

Energy Strategy Report



217 Kingston Road Teddington TW11 9JN

November 2019



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Revision	Rev A	Rev B	Rev C	Rev D
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1. Executive Summary

This Energy Statement demonstrates the predicted energy performance and carbon dioxide emissions of the proposed development at **217 Kingston Road, Teddington, TW11 9JN**, based on the information provided by the design team. The development will comprise of **new construction of 7no. flats and a detached house in the London Borough of Richmond upon Thames.**

1.1. Policy Requirements

The Council requires new developments to incorporate sustainable design and construction measures. The table below summarises the local policy requirements for the proposed development.

Policies	Requirements	Notes
London Plan 5.2 and 5.7 & Local Policy LP22	An overall 35% reduction of carbon emissions over the Building Regulation Part L 2013, incorporating on-site renewable technologies	The proposed development achieved an overall 36.46% carbon reduction via energy efficient measures and PV panels.
London Plan 5.15 and Local Policy LP22	Water use of 110 litres/person/day or less (including an allowance of 5litres or less) is required for the new dwellings.	Water consumption of 110 litres/person/day or less achieved using energy efficient fittings. Design stage calculations are in section 6.1 of this report.
LBRUT Sustainable Construction Checklist	Complete the Checklist and meet the required score.	The Checklist has been attached under separate cover, confirming the required score has been met.

Table 1 Policy Requirements

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1.2. Methodology and Strategies

The methodology used to determine the CO_2 emissions is in accordance with the London Plan's threestep Energy Hierarchy (Policy 5.2). The below table shows the Energy Hierarchy and suggested strategies for the proposed development.

Stages	Strategies
BE LEAN Energy efficient design	 U-values and air permeability better than Building Regulations Part L. Accredited Construction Details for all junctions Efficient individual gas boilers for heating and hot water demand. Natural ventilation with extract fans in wet rooms Low energy lights Low water consumption
BE CLEAN District heat networks or communal heating systems	• Not feasible on the site. Details are in section 7.
BE GREEN On-site renewable technologies	 PV panels of 7.875kWp for the 7 flats (18 panels on South-West roof and 7 panels on South-East roof – 315 watts per panel) PV panels of 1.89kWp for the detached house (6 panels on the flat roof - 315 watt per panel) Details are in section 7.2.

Table 2 Energy Hierarchy and suggested strategies

1.3. Assessment Results

After the application of all strategies based on the Energy Hierarchy, the regulated carbon dioxide emissions have been reduced as follows;

	Energy Hierarchy	Regulated Carbon Emissions (Tonnes CO ₂ /yr)
BASELINE	TER set by Building Regulations 2013 Part L	12.29
BE LEAN	After energy demand reduction	12.23
BE CLEAN	After CHP/ Communal Heating	12.23
BE GREEN	After renewable energy	8.12

Table 3 Carbon Emissions after each stage of the proposed strategy













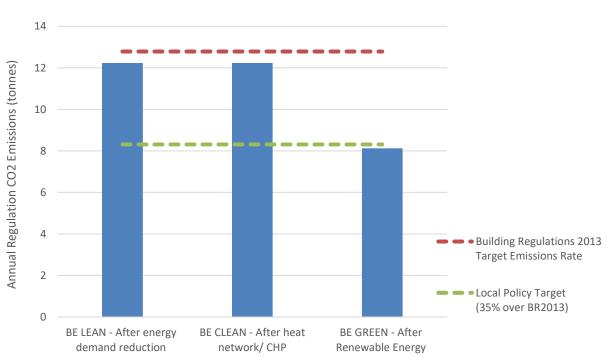




This carbon savings from each stage can be calculated based on the results above. The chart below summarises the total cumulative savings:

Energy Hierarchy		Regulated Carbon Savings	
	,,,		%
BE LEAN	After energy demand reduction	0.55	4.30 %
BE CLEAN	After heat network/ CHP	0	0 %
BE GREEN	After renewable energy	4.11	33.61 %
Total Cumulative Savings		4.66	36.46 %
Total Target Savings		4.47	35 %

Table 4 Carbon dioxide Emissions after each stage of the Energy Hierarchy



The Energy Hierarchy

Figure 1 The Energy Hierarchy

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2. Introduction

This Energy Statement will be included as part of the planning application that addresses the environmental impact of the development. This report focuses on the energy strategy for the proposed scheme and how energy consumption and carbon emissions will be minimised and to meet the targeted carbon emissions in accordance with the London Plan and Local planning policy.

The development is to be located in the London Borough of Richmond Upon Thames and it is in close proximity to Teddington Station (approximately 0.7 miles West) and Hampton Wick Station (approximately 0.6 miles South East). The proposal is new construction of 7no. flats and a detached house at 217 Kingston Road, Teddington, TW11 9JN

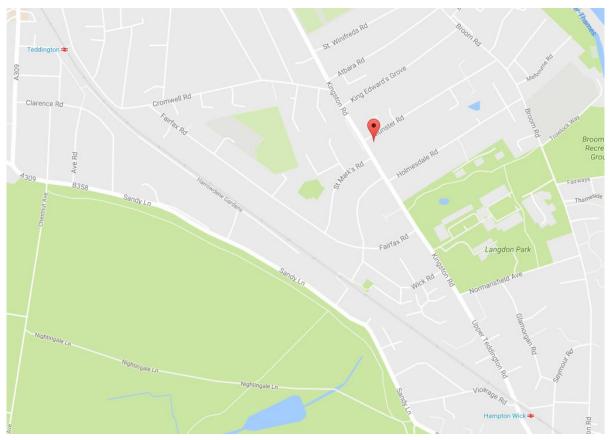


Figure 2 Site Location

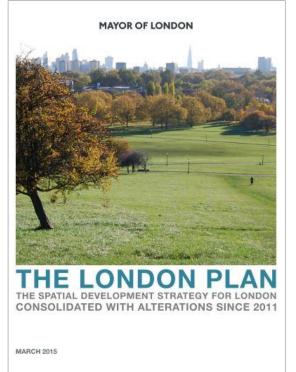


3. Planning Policy

3.1. National Planning Policy Framework (March 2019)

The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

3.2. The London Plan (March 2016)



Policy 5.2, 5.4, 5.5, 5.6, & 5.7

According to Policy 5.2 all major new developments should show carbon emissions reduction through the Mayor's energy hierarchy (Be Lean, Be Clean and Be Green), unless it can be demonstrated that such provision is not feasible. From October 2016 Zero Carbon Standard apply to all new major residential development (10 or more units). This means that at least 35% of carbon reductions against a Building Regulations Part L 2013 must be achieved on-site, with the remaining emissions, up to 100%, to be offset through a contribution to the Council's Carbon Offset Fund. For the non-residential development must achieve a 35% reduction in CO₂ emissions against a Building Regulations Part L 2013 baseline.

For retrofitting developments, it will be a challenge to meet these target. However, available reductions in carbon emissions should be demonstrated along

with water saving measures as per Policy 5.4.

Furthermore, intent must be shown for connecting to a Decentralised Energy Network and utilizing a Combined Heat & Power according to Policy 5.5 and 5.6. The Mayor and boroughs should in their DPDs adopt a presumption that developments will achieve a reduction in carbon dioxide emissions of 20% from onsite renewable energy generation according to paragraph 5.42 of Policy 5.7 Renewable Energy.

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Local Plan (Adopted in July 2018)

Policy LP22

Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following;

1. Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed checklist has to be submitted as part of the planning application.

2. Development that results in a new residential dwelling, including conversion, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).

3. New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.

4. Proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible)

Reducing Carbon Dioxide Emissions

B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and lo carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

1. All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.

2. All other new residential buildings should achieve a 35% reduction.





3. All non-residential buildings should achieve zero carbon standards in line with London Plan policy.

Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.

- C. This should be achieved by following the Energy Hierarchy:
 - 1. Be lean: use less energy
 - 2. Be clean: supply energy efficiently
 - 3. Be green: use renewable energy

Decentralised Energy Networks

D. The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localized decentralized energy (DE) systems by 2025. The following will be required:

1. All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.

2. Development proposals of 50 units or more, or new non-residential development of 1000sqm or more, will need to provide an assessment of the provision of on-site decentralized energy (DE) networks and combined heat and power (CHP).

3. Where feasible, new development of 50 units or more, or new non-residential development of 1000sqm or more, as well as schemes for the Proposal Sites identified in this Plan, will need to provide on-site DE and CHP; this is particularly necessary within the clusters identified for DE opportunities in the borough-wide Heat Mapping Study. Where on-site provision is not feasible, provision should be made for future connection to local DE network should one become available.

Applicants are required to consider the installation of low, or preferably ultra-low, NOx boilers to reduce the amount of NOx emitted in the borough.

Local opportunities to contribute towards decentralised energy supply from renewable and lowcarbon technologies will be encouraged where appropriate.

Retrofitting

E. High standards of energy and water efficiency in existing developments will be supported wherever possible through retrofitting. Householder extensions and other development proposals that do not meet the thresholds set out in this policy are encouraged to complete and submit the Sustainable Construction Checklist SPD as far as possible, and opportunities for micro-generation of renewable energy will be supported in line with other policies in this Plan.

















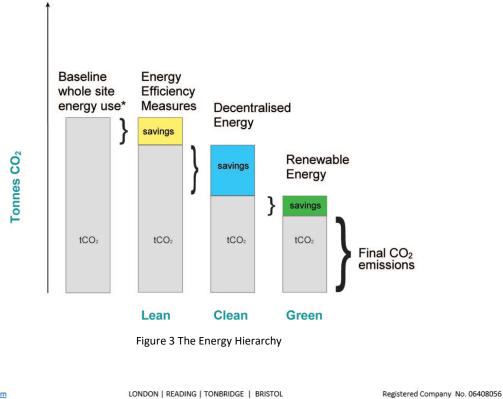
4. Assessment Methodology

4.1. Mayor's Energy Hierarchy

The energy hierarchy is a classification of different methods to improve energy performance in a parallel sequence. This includes primarily a focus on reducing energy use by avoiding unnecessary use, to then improving the efficiency of energy systems to minimise loss, this is followed by exploiting renewable energy sources and then low carbon energy solutions for energy needs and finally, any remaining demand can be catered for by conventional fuel sources.

The Mayor's Energy Strategy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. These guiding principles have been reordered since the publication of the Mayor's Energy Strategy in Feb 2004 and the adopted replacement London Plan 2011 with further alterations in 2015 stating that the following hierarchy should be used to assess applications:

- **BE LEAN** By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.
- **BE CLEAN** By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.
- **BE GREEN** By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.





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4.2. Software and Input data

The Government approved software, i.e. **FSAP 2012**, have been utilised to carry out **Standard Assessment Procedure (SAP)** calculations for the residential units.

Syntegra received the architectural drawings and relevant documents, and they were used to undertake the energy assessments. The document references are listed in the table below.

No.	Document Name	Format	Received Date
1	240 2 PL10 P00-I	dwg	01-10-2019
2	240 PL20 E02-G	dwg	01-10-2019
3	240 PL20 P00-I	dwg	01-10-2019
4	240 PL20 P01-H	dwg	01-10-2019
5	240 PL20 P-1-I	dwg	01-10-2019
6	240 PL20 P02-I	dwg	01-10-2019
7	240 PL20 P03-E	dwg	01-10-2019
8	240 2 PL20 E01-C	dwg	23-05-2018
9	240 2 PL20 E02-C	dwg	23-05-2018
10	240 2 PL20 E03-B	dwg	23-05-2018
11	240 2 PL20 P00-D	dwg	23-05-2018
12	240 2 PL20 P01-C	dwg	23-05-2018
13	240 2 PL20 P-1-C	dwg	23-05-2018
14	240 2 PL20 S01-B	dwg	23-05-2018

Table 5 The document list

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5. **Baseline – Target Emission Rate**

The baseline (known as Target Emission Rate), as calculated in line with the Building Regulation 2013, is the maximum amount of carbon dioxide a dwelling or non-residential unit is allowed to emit. The Target Emission Rate (TER) includes carbon dioxide emissions which are covered by Part L of the Building Regulations, known as regulated emissions (space and water heating, ventilation, lighting, pumps, fans & controls). The baseline energy uses and resulting CO2 emissions rates of the development have been assessed using the Government approved software.

The baseline regulated CO₂ emissions for the development as a whole are presented in the tables below:

BASELINE: TER	Regulated CO ₂ Emissions (Tonnes CO ₂ /yr)
Flat Unit 1	1.52
Flat Unit 1	1.54
Flat Unit 1	1.26
Flat Unit 1	1.35
Flat Unit 1	1.33
Flat Unit 1	1.39
Flat Unit 1	1.33
Detached House	3.07
TOTAL	12.79

📥 BASELINE

Table 6 Regulated Energy Use and Carbon Emissions at Baseline

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6. BE LEAN – Energy Efficient Design

This section outlines the energy efficient measures taken in order to minimise the building's energy demand and therefore reduce energy use and CO₂ emissions further than the Baseline requirements (Building Regulations 2013 Part L compliance).

6.1. Passive Design Measures

• Enhanced Building Elements

At the 'BE LEAN' stage of the energy hierarchy, energy efficient building elements have been incorporated into the build. The heat loss of different building element is dependent upon their U-value, air tightness, and thermal bridging y-values. Therefore, better U-values and air permeability than the minimum values set in the Part L 2013 have been suggested in this development. And, Accredited Construction Detail for Part L was also applied for all thermal bridging junctions to reduce the heat loss from the thermal bridging. Please see below more specifically:

		Part L1A 2013 min. required values	Proposed building values
	Wall	0.30	0.15
	Window	2.00	1.2
U-value (W/m ² K)	Floor	0.25	0.13
	Roof	0.20	0.13
	Door	1.0 (notional)	1.2
Air Permea (m ³ /h.m ² at	•	10	4.0
Use of Accr Construction		-	Yes

Table 7 Proposed Building Elements

• Orientation & Natural Daylighting

Passive solar gain reduces the amount of energy required for space heating during the winter months. Dwellings have enough windows and roof lights which can maximise the passive solar gains into the building throughout the day. Moreover, the internal layout of the development has been designed to improve daylighting in all habitable spaces, as a way of improving the health and wellbeing of occupants.



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• Efficient Use of Water

In accordance with London Plan Policy 5.15 and Local Plan, the development will be based upon the specification of water efficient fittings including low volume dual flush WCs, and low flow taps/ showers/bath. These measures will result in the total water consumption rate of 110 litres/person/day or less including the external water use. Design stage calculations are below.

Installation Type	Unit of Measure	Capacity/ flow rate (1)	Use factor (2)	Fixed use (litres/head/ day) (3)	Total Consumption Litres/head/day [(1)x(2)]+(3) =(4)
wc	Full Flush Volume (litres)	6	1.46	0	8.76
(dual flush)	Part flush Volume (litres)	4	2.96	0	11.85
Taps (excluding kitchen/ utility room taps)	Flow rate (litres/minute)	6.5	1.58	1.58	11.85
Bath (where shower also present)	Capacity to overflow (litres)	120	0.11	0	13.20
Shower (where bath also present)	Flow rate (litres/minute)	7.5	4.37	0	32.78
Kitchen / utility room sink taps	Flow rate (litres/minute)	6.5	0.44	10.36	13.22
Washing machine	Litres/kg dry load	9	2.1	0	18.90
Dishwasher	Litres/place setting	1.2	3.6	0	4.32
Waste disposal unit	Litres/use	If present = 1 If absent = 0	3.08	0.00	0
Water Softener	Litres/person/day	-	1.00	0.00	-
(5)	Total calculated us				114.9
(6)	Contribution from			-	0
(7)	Contribution from	-	s/person/d	ay)	0
(8)	Normalisation Fact	-			0.91
(9)	Total internal wate	•	= (5) X (8)		104.5
(10)	External water use				5
Total	water consumption	(litres/person/d	lay) = (9) +	(10)	109.5

Table 8 Water Use Calculations



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• Solar Shading

The proposed design does not show risk of overheating allowing for natural ventilation through openable windows thus reducing the need for mechanical cooling systems.

• Natural Ventilation

A natural ventilation strategy will be adopted in all residential units with extract fans in wet rooms; toilets, kitchen, and utility rooms. Therefore, higher energy consumption and CO₂ emissions due to mechanical ventilation is avoided.

6.2. Active Design Measures

• Heating and Hot Water System

The space heating and hot water are provided by energy efficient systems as summarised in the table below. At the 'BE LEAN' stage efficiency individual combi boilers have been examined for space heating and hot water demand.

Systems	General Specification	Controls
Heating	Individual Combi Boilers (efficiency of 89.5%)	Time and temperature zone control by suitable arrangement of plumbing and electrical services
Hot water	Same as space heating	-

Table 9 Heating and Hot water systems

All suggested specifications above are provisional, and have to be reviewed with mechanical engineers and contractors at detailed design stage.

• High Efficiency Lighting

The proposed light fittings will be low energy efficient fittings. These can be **T5 fluorescent fittings** with high frequency ballasts, or LED fittings for residential units. The suggested specifications should be reviewed at detailed design stage with electric engineers.

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The following tables demonstrate the reduction in CO_2 emissions from the energy efficiency measures mentioned above. It can be seen that the overall CO₂ reduction at Be Lean stage is <u>4.3%</u> for the total regulated emissions.

📥 BE LEAN STAGE

	Regulated CO ₂ Emiss	ions (Tonnes CO ₂ /yr)	Carbon Reduction
	BASELINE	BE LEAN	(%)
Flat Unit 1	1.52	1.46	3.82 %
Flat Unit 1	1.54	1.50	2.75 %
Flat Unit 1	1.26	1.28	0.00 %
Flat Unit 1	1.35	1.36	0.00 %
Flat Unit 1	1.33	1.29	2.75 %
Flat Unit 1	1.39	1.37	1.35 %
Flat Unit 1	1.33	1.28	4.01 %
Detached House	3.07	2.70	12.06 %
TOTAL	12.79	12.23	4.30 %

Table 10 Regulated Energy Use and Carbon Emissions at Be Lean Stage

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7. BE CLEAN – CHP & Decentralised Energy Networks

The Energy Hierarchy encourages the use of a CHP system and the connection to District Heating system to reduce CO_2 emissions further.

7.1. Decentralised Energy Network

The Mayor's Energy Strategy favours community heating systems because they offer:

- Potential economies of scale in respect of efficiency and therefore reduced carbon emissions; and
- Greater potential for future replacement with Low or Zero Carbon (LZC) technologies.

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed alongside the **London Heat Map Study for the London Borough of Richmond Upon Thames** as part of this assessment. The study identifies that the site is not located near the existing district heating networks. This is demonstrated clearly from the London Heat Map (http://www.londonheatmap.org.uk) snapshot below.

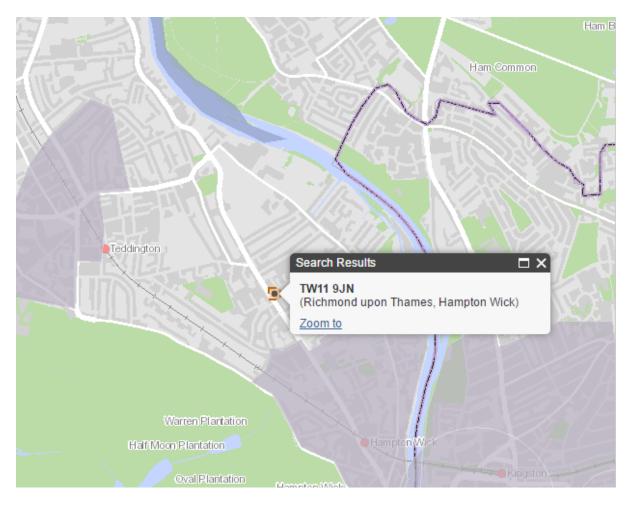


Figure 4 London Heat Map near the site



















Moreover, the London heat map below identifies existing and potential DH networks in more broaden area, and it could not find any existing DH networks (in yellow) and potential networks (in red) within 1km radius from the property. The costs involved in extending the existing DH network would outweigh the advantages in this development. Therefore, utilisation of the DH network has not been a feasible option for this development.



Figure 5 Existing and Potential DH Networks



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7.2. **CHP**

The Energy Hierarchy identifies the combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP. The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

- Development with high heating load for the majority of the year.
- CHP operation based on maximum heat load for minimum 10 hours per day.
- CHP operation at maximum capacity of 90% of its operating period.

To ensure that CHP is financially viable it is essential that the unit is selected to meet the base heat load and that this load is maintained over a large proportion of the day (a figure of 14 - 17 hours per day is often quoted subject to the load profiles and gas and electricity prices) to ensure that the additional costs (maintenance) associated with running a CHP unit can be recovered. This need to run the CHP plant, as far as possible continuously makes the building load profile of prime importance when reviewing the viability of such solutions and in particular the summer time heat load profile. To enable the CHP plant to run continuously when it is operating, a thermal store is often used so that excess CHP capacity can be used to generate hot water for use at a later time.

Since this development consists of only 8 dwellings that do not require high heating loads, installing the CHP system would not be beneficial given the cost. According to the Local Plan Policy LP22, developments of 50 units or more will need to provide an assessment of the provision of CHP. Hence the CHP system has not been considered for this development at BE CLEAN stage.

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8. BE GREEN – Renewable Energy

In this section the viable renewable energy technologies that could reduce the development's CO₂ emissions are examined. In determining the appropriate renewable technology for the site, the following factors were considered;

- Renewable energy resource or fuel availability of the LZC technology on the site.
- Space limitations due to building design and urban location of the site.
- Capital, operating and maintenance cost.
- Planning Permission
- Implementation with regards the overall M&E design strategy for building type
- Available Grants

The table below summarises the various low zero carbon technologies considered for the projects, and we have identified that **Photovoltaic (PV)** would be the most appropriate option in this development.

Technology	Local Planning Requirements	Carbon Payback	Grants/ Funding	Feasibility
Air Source Heat Pumps (ASHP)	Noise Issues from External units	Medium	Renewable Heat Incentive (RHI)	MEDIUM
Photovoltaic (PV)	Spatial and Shadowing	High	High -	
Solar Thermal	Spatial and Shadowing	Low	Renewable Heat Incentive (RHI)	MEDIUM
Ground Source Heat Pumps (GSHP)	Spatial issues for Bore Holes and noise	Medium	Renewable Heat Incentive (RHI)	MEDIUM
Biomass	Spatial requirement for fuel storage and biomass odour	High	Renewable Heat Incentive (RHI)	LOW
Wind Power	Extensive planning requirements for noise and local biodiversity	Low	-	LOW
Hydro Power	Extensive planning requirements for noise and water quality	None	-	ZERO

Table 11 Feasibility Study of LZC Technologies



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8.1. Non-feasible Technology

Air Source Heat Pumps (ASHP)

ASHP can meet the space heating demands on site efficiently in comparison with gas boilers. Although this low carbon technology consumes electricity to operate due to higher efficiency the heat output is much greater. However, the efficiency of heat pumps is very much dependent on the temperature difference between the heat source and the space required to be heated. As a result, ASHPs tend to have a lower COP than GSHPs. This is due to the varying levels of air temperature throughout the year when compared to the relatively stable ground temperature. Moreover, any noise associated with the external units could potentially be an issue at night due to the proximity of the neighboring residential buildings. Therefore, the use of ASHP is not a suitable option for this development.

Ground Source Heat Pumps (GSHP)

Ground source heat pump would be a feasible option to meet the space heating requirements, however, it requires ground space for bore holes to extract the ground heat to be utilised for space heating requirements. In this case there is no available ground space for a borehole or trench system, the ground source loop would have to be incorporated within the foundation piles of the structure, which would result in additional cost. Hence, this option is not suitable for this development.

Solar Thermal

The use of solar thermal for this development would be limited to domestic hot water only. The use of solar thermal for space heating would not be practical as it is not required when solar thermal is at its most effective during the summer months. Therefore, this system would require additional plumbing and space for hot water storage, incurring additional financial cost. Moreover, the amount of carbon offset from the system is generally lower than other technologies. Therefore, this technology is deemed to be unsuitable for this development.

Hydro power

There is no river or lake within the development site boundaries. Therefore, small scale hydro-electric will not be studied any further because of the location and the spatial limitations of the development.

Biomass •

A biomass system designed for this development would be fueled by wood pellets which have a high energy content. However, a biomass system would not be an appropriate technology for the site for the following reasons:

- i. The burning of wood pellets releases substantially more NOx emissions when compared to similar gas boilers. As the development is situated within an urban area, the installation of a biomass boiler would further impact on the air quality in this area.
- ii. the lack of spaces for pellet boiler and storage on the site.
- iii. Pellets would need to be transported from local pellet suppliers, which causes carbon emissions to the air.



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However, if the biomass system is considered at detailed design stage, local suppliers can be found near the site as shown in the map below (http://biomass-suppliers-list.service.gov.uk .

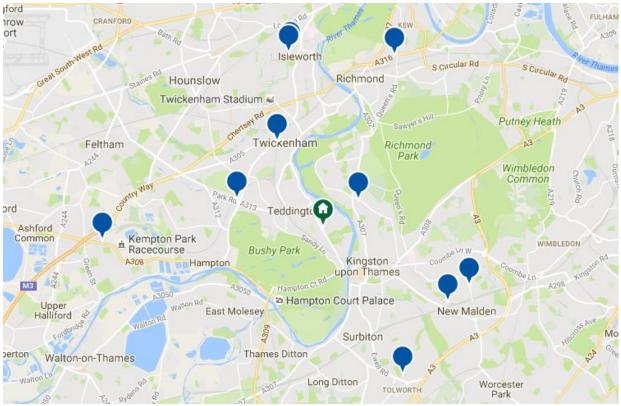


Figure 6 Map showing local suppliers to proposed development

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Registered Company No. 06408056



Company Name	Contact	Fuel Supplied	Telephone
Wolseley UK Ltd	www.plumbcenter.co.uk DBD.Kingston@wolseley.co.uk	Pellets	0208 546 9287
City Plumping Suppliers (CPS) part of the Travis Perkins Group	www.cityplumbing.co.uk mark.glazier@cityplumbing.co.uk	Briquettes, Pellets	0208 941 3999
Wolseley UK Ltd	www.plumbcenter.co.uk YW.Twickenham@wolseley.co.uk	Pellets	0208 891 2381
Plumbing Trade Supplies (PTS) part of the Travis Perkins Group	www.ptsplumbing.co.uk james.newman@ptsplumbing.co.uk	Pellets	0208 329 0004
Travis Perkins Trading Co. Ltd.	www.travisperkins.co.uk tony.scott@travisperkins.co.uk	Pellets	0208 942 9498
Travis Perkins Trading Co. Ltd.	www.travisperkins.co.uk Andrew.bullen@travisperkins.co.uk	Pellets	0208 399 1307
Travis Perkins Trading Co. Ltd.	www.travisperkins.co.uk steve.burns@travisperkins.co.uk	Pellets	0208 465 2900
Wolseley UK Ltd	www.plumbcenter.co.uk EK.Isleworth@wolseley.co.uk	Pellets	0208 560 2794
Travis Perkins Trading Co. Ltd.	www.travisperkins.co.uk jack.hewitt@travisperkins.co.uk	Pellets	0208 332 9689
Travis Perkins Trading Co. Ltd.	www.travisperkins.co.uk ian.barnes@travisperkins.co.uk	Pellets	01932 782 612

Table 12 List of suppliers in the vicinity of the proposed development

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Wind Power

Wind turbines need extensive planning requirements and they are only feasible at consistent wind speed. Moreover, since the development is located in an urban area, the site does not have sufficient wind speed to operate wind turbine at the height of 10 meters as shown below (http://www.renew-reuse-recycle.com/noabl.pl?n=503). Hence this option has been discounted.

Wind speed at above ground (m/s)			Wind speed at 25m above ground level (m/s)			speed at e ground (m/s)		
4.6	4.6	4.7	5.3	5.4	5.4	5.8	5.9	Γ
4.7	4.8	4.8	5.5	5.5	5.6	5.9	6	
4.8	4.8	4.9	5.6	5.6	5.6	6	6.1	

Estimated average windspeeds around SW11 1..

Squares surrounding the central square correspond to wind speeds for surrounding grid squares. Power generated is related to windspeed by a cubic ratio. That means if you halve the windspeed, the power goes down by a factor of 8 (which is 2 x 2 x 2). A quarter of the windspeed gives you a 64th of the power (4 x 4 x 4). As a rough guide, if your turbine is rated at producing 1KW at 12m/s then it will produce 125W at 6m/s and 15W at 3m/s.

Please note that bear in mind that the NOABL windspeed dataset used here is a model of windspeeds across the country, assuming completely flat terrain. It isn't a database of measured windspeeds. Other factors such as hills, houses, trees and other obstructions in your vicinity need to be considered as well as they can have a significant effect. If you're thinking about installing a wind turbine, you should perform your own windspeed measurements using an anemometer to determine what the actual figures are.

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8.2. Proposed Technology

• Photovoltaic (PV)

Based on the feasibility study above, PV would be the most suitable renewable Technology for the following reasons:

- i. The installation of PV is much simpler when compared to other renewable technologies
- ii. There is sufficient roof space available to install enough PV modules to have a significant impact on carbon emissions of the development
- iii. PV panels sited on the roof within an urban area are less visually intrusive when compared to wind turbines

The PV system capacity for the whole development depends upon the heating system selected. Therefore, the amount of PV relating to the proposed heating system option is outlined below:

- Flats Individual Combi Gas Boilers + 5.67 kWp PV on South West + 2.205 kWp PV on South East
- Detached House Combi Boiler + 1.89 kWp PV

The tables below illustrate the indicative PV panel's detail, should it be feasible to implement:

Orientation	 Flats - South West and South East Detached House – South West 	Number of Panels	 Flats – 18 panels on South- West roof and 7 panels on South-East roof Detached house – 6 panels on the flat roof 			
Panel Tilt	Flats - 30°Detached house - 10°	Power Output	315 watt per panel			
Overshading	None or very little	PV Area	1.65 m ² per panel			
Annual Ouput		Flats - approx 6,484 kWh Detached House – approx 1,437 kWh				

Table 13 Suggested PV details

The proposed PV panels are subject to further consideration at detailed design stage. In order to qualify both the installer and the equipment, the system must be certified under the Microgeneration Certification Scheme (MCS).

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Given the proposed LZC technologies on the site (**PVs**), the overall CO_2 reduction at BE GREEN stage can be calculated as shown below. And, it can be seen that the overall CO_2 reduction via on-site renewables is <u>**33.61**</u>[%] for the total emissions.

	Regulated CO ₂ Emiss	Carbon Reduction	
	BE LEAN	BE GREEN	(%)
Flat Unit 1	1.46	0.88	39.49 %
Flat Unit 1	1.50	0.94	37.13 %
Flat Unit 1	1.28	0.81	36.31 %
Flat Unit 1	1.36	0.90	33.65 %
Flat Unit 1	1.29	0.84	35.25 %
Flat Unit 1	1.37	0.91	33.45 %
Flat Unit 1	1.28	0.88	31.07 %
Detached House	2.70	1.95	27.67 %
TOTAL	12.23	8.12	33.61 %

4 BE GREEN stage

Table 14 Regulated Energy Use and Carbon Reduction at Be Green Stage

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9. Conclusion

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at **217 Kingston Road, Teddington TW11 9JN**, based on the information provided by the design team.

In line with the London Plan's three step energy hierarchy the regulated CO₂ emissions for this development have been reduced by **36.46%** over Building Regulation 2013, once all measures in the table below are taken into account.

Stages	Strategies
BE LEAN Energy efficient design	 U-values and air permeability better than Building Regulations Part L. Accredited Construction Details for all junctions Efficient individual gas boilers for heating and hot water demand. Natural ventilation with extract fans in wet rooms Low energy lights Low water consumption
BE CLEAN District heat networks or communal heating systems	• Not feasible on the site. Details are in section 7.
BE GREEN On-site renewable technologies	 PV panels of 7.875kWp for the 7 flats (18 panels on South-West roof and 7 panels on South-East roof – 315 watt per panel) PV panels of 1.89kWp for the detached house (6 panels on the flat roof - 315 watt per panel) Details are in section 7.2.

Table 16 Energy Hierarchy and suggested strategies

The chart below summarises the total cumulative savings. As shown in the table the proposed scheme achieves a 35% carbon reduction.

	Energy Hierarchy		Regulated Carbon Savings		
			%		
BE LEAN	After energy demand reduction	0.55	4.30 %		
BE CLEAN	BE CLEAN After heat network/ CHP		0.00 %		
BE GREEN	After renewable energy	4.11	33.61 %		
Total Cumul	ative Savings	4.66	36.46 %		
Total Target	Savings	4.47	35 %		

Table 15 Carbon dioxide Emissions after each stage of the Energy Hierarchy

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10. Appendix A – SAP Reports

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Block Compliance WorkSheet: 217 Kingston Road - BE LEAN

	ι	Jser Details				
Assessor Name: Software Name: S	Stroma Number:Stroma FSAPSoftware Version:Version: 1.0.4.18			4.18		
	Cald	culation Detail	S			
Dwelling		DER	TER	DFEE	TFEE	TFA
Front - Unit 1		18.61	19.35	45.4	56.7	78.333
Front - Unit 2		19.82	20.38	49.7	61	75.469
Front - Unit 3		20.27	20.1	48.4	55.2	62.935
Front - Unit 4		21.84	21.55	54.2	62.2	62.425
Front - Unit 5		20.88	21.47	52.1	62.2	61.99
Front - Unit 6		22	22.3	54.5	66.6	62.204
Front - Unit 7		23.69	24.68	57.7	73.2	53.984
Rear House		16.12	18.33	50.9	70.6	167.515

Calculation Summary

Total Floor Area	624.86
Average TER	20.46
Average DER	19.58
Average DFEE	51.21
Average TFEE	64.30
Compliance	Pass
% Improvement DER TER	4.3
% Improvement DFEE TFEE	20.36

Block Compliance WorkSheet: 217 Kingston Road - BE GREEN

		User Details				
Assessor Name: Software Name:	Stroma FSAP	Softw	a Number: are Versior		/ersion: 1.0.4	4.18
	Ca	Iculation Detail	S			
Dwelling		DER	TER	DFEE	TFEE	TFA
Front - Unit 1		11.26	19.35	45.4	56.7	78.333
Front - Unit 2		12.46	20.38	49.7	61	75.469
Front - Unit 3		12.91	20.1	48.4	55.2	62.935
Front - Unit 4		14.49	21.55	54.2	62.2	62.425
Front - Unit 5		13.52	21.47	52.1	62.2	61.99
Front - Unit 6		14.64	22.3	54.5	66.6	62.204
Front - Unit 7		16.33	24.68	57.7	73.2	53.984
Rear House		11.66	18.33	50.9	70.6	167.515

Calculation Summary

(
Total Floor Area	624.86
Average TER	20.46
Average DER	13.00
Average DFEE	51.21
Average TFEE	64.30
Compliance	Pass
% Improvement DER TER	36.46
% Improvement DFEE TFEE	20.36

Regulations Compliance Report

Printed on 05 November	-	by Stroma FSAP 2012 program, Vers	sion: 1.0.4.18
Project Information:			-
-	Lee (STRO031315)	Building Type:	Flat
Dwelling Details:			
NEW DWELLING DESI		Total Floor Area: 78	8.33m²
Site Reference : 217	Kingston Road	Plot Reference:	Front - Unit 1
Address :			
Client Details:			
Name: Address :			
-	ns included within the SAP calcul port of regulations compliance.	lations.	
1a TER and DER			
Fuel for main heating sy Fuel factor: 1.00 (mains Target Carbon Dioxide E Dwelling Carbon Dioxide 1b TFEE and DFEE	gas) Emission Rate (TER)	19.35 kg/m² 11.26 kg/m²	ок
Target Fabric Energy Ef	ficiency (TEEE)	56.7 kWh/m²	
Dwelling Fabric Energy		45.4 kWh/m²	
5 5,			ОК
2 Fabric U-values			
Element	Average	Highest	
External wall	0.15 (max. 0.30)	· · · · · · · · · · · · · · · · · · ·	OK
Party wall	0.00 (max. 0.20)		OK
Floor Roof	0.13 (max. 0.25) 0.13 (max. 0.20)		OK OK
Openings	1.20 (max. 2.00)		OK
2a Thermal bridging	1120 (maxi 2100)	1120 (11034 0100)	•m
	ng calculated from linear thermal tra	insmittances for each junction	
3 Air permeability		,	
Air permeability a Maximum	t 50 pascals	4.00 (design value 10.0	е) ОК
4 Heating efficiency			
Main Heating sys	tem: Boiler systems with Data from manufac Combi boiler Efficiency 89.5 % S Minimum 88.0 %		ns gas OK
Secondary heatin	ig system: None		
5 Cylinder insulation			
Hot water Storage	e: No cylinder		N/A

Regulations Compliance Report

ontrols			
Space heating controls Hot water controls:	TTZC by plumbing and el No cylinder thermostat	ectrical services	Ok
	No cylinder		
Boiler interlock:	Yes		Ok
ow energy lights			
Percentage of fixed lights with	low-energy fittings	100.0%	
Minimum		75.0%	OK
echanical ventilation			
Not applicable			
ummertime temperature			
Overheating risk (Thames val	ley):	Slight	OK
d on:			
Overshading:		Average or unknown	
Windows facing: South West		5.34m ²	
Windows facing: South East		3.5m ²	
Windows facing: South East		1.69m ²	
Windows facing: South East		0.77m ²	
Windows facing: North East		0.84m ²	
Windows facing: South West		3.79m ²	
Windows facing: South East		1.04m ²	
Windows facing: North West		1.04m ²	
Ventilation rate:		4.00	
Blinds/curtains:		None	
Key features			
External Walls U-value		0.13 W/m²K	
Party Walls U-value		0 W/m²K	
Photovoltaic array		••••••	

DER WorkSheet: New dwelling design stage

				User D	Details:						
Assessor Name: Software Name:	Su Lee Stroma F	SAP 2012 Software Version:						STRO031315 Version: 1.0.4.18			
			Pi	operty	Address	: Front -	Unit 1				
Address :											
1. Overall dwelling dim	iensions.			Aro	o(m²)		Av. Hei	abt(m)		Volumo(m ³)	
Basement				-	a(m²) 11.01	(1a) x		.6	(2a) =	Volume(m ³)	(3a)
Ground floor						(1b) x]](3b)
	4 -) · (4 +) · (4 -)	. (4 -1) . (4 -			37.33		2.	81	(2b) =	104.89	
Total floor area TFA = (1a)+(1b)+(1c)·	+(10)+(16	e)+(1n)	78.33	(4)					_
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	211.5	(5)
2. Ventilation rate:											
	main heating		econdary neating	y	other		total			m ³ per hour	
Number of chimneys	0	+	0	+	0] = [0	x 4	40 =	0	(6a)
Number of open flues	0	+	0] + [0	_] = [0	x 2	20 =	0	(6b)
Number of intermittent f	ans					- T	3	x ^	10 =	30	(7a)
Number of passive vent	S					Г	0	x ^	10 =	0	(7b)
Number of flueless gas	fires					Г	0	x 4	40 =	0	(7c)
						L					1
									Air ch	anges per ho	ır
Infiltration due to chimn	eys, flues and	fans = (6	a)+(6b)+(7	a)+(7b)+((7c) =	Г	30		÷ (5) =	0.14	(8)
If a pressurisation test has			ed, proceed	l to (17),	otherwise o	continue fr	om (9) to (16)			-
Number of storeys in	the dwelling (I	าร)								0	(9)
Additional infiltration								[(9)-	-1]x0.1 =	0	(10)
Structural infiltration:							uction			0	(11)
if both types of wall are deducting areas of oper			ponuing to	uie grea	lei wali ale	a (allel					
If suspended wooder	floor, enter 0.	2 (unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
lf no draught lobby, e	nter 0.05, else	enter 0								0	(13)
Percentage of window	ws and doors o	draught st	ripped							0	(14)
Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	- (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area									area	4	(17)
If based on air permeat	-									0.34	(18)
Air permeability value app		tion test has	s been don	e or a de	gree air pe	rmeability	is being us	sed			
Number of sides shelter Shelter factor	red				(20) = 1 -	[0.075 x (1	9)] =			2	(19) (20)
Infiltration rate incorpora	ating shelter fa	octor			(21) = (18	0.85					
Infiltration rate modified	•		4		, , (. .	,				0.29	(21)
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	·	1 *		501	1 , , , , , , , , , , , , , , , , , , ,			1101	200	l	
Monthly average wind s (22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
	7.3 4.4	4.3	5.0	5.0	3.7	4	4.0	4.0	4.1		

DER WorkSheet: New dwelling design stage

Wind Fa	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 sł	nelter ar	d wind s	peed) =	(21a) x	(22a)m					
	0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34		
	chanica		-	rate for t	ne appil	cable ca	se					[0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , other	wise (23b) = (23a)		Ĺ	0	(23b)
If bala	nced with	heat reco	overy: effic	iency in %	allowing	or in-use f	actor (fron	n Table 4h)	=			L L	0	(23c)
a) If b	balance	d mecha	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a)m = (2	2b)m + (23b) × [ˈ	۱ (23c) – ۱	÷ 100]	(
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If b	balance	d mecha	anical ve	entilation	without	heat red	covery (N	MV) (24b)m = (22	2b)m + (2	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If v	whole ho	ouse ex	tract ver	tilation of	or positiv	e input	ventilatio	on from c	utside		_			
if	f (22b)m	ו < 0.5 ×	(23b), t	hen (240	c) = (23t	o); other	wise (24	c) = (22b) m + 0	.5 × (23b)	·		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
								on from l 0.5 + [(2		0.51				
(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.5 + [(2.	0.54	0.55	0.55	0.56		(24d)
` ´ L								d) in box		0.00	0.00	0.00		(_ · · ·)
(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
· · L	I		I		I			1		1				
				Daramet										
ELEM	ENI	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I	<)	k-value kJ/m²⋅k		A X k kJ/K
Doors						1.86	x	1.2	=	2.232				(26)
Windov	vs Type	1				5.336	; x1	/[1/(1.2)+	0.04] =	6.11				(27)
Windov	vs Type	2				3.496	3 x1	/[1/(1.2)+	0.04] =	4				(27)
Windov	vs Type	3				1.689	x1	/[1/(1.2)+	0.04] =	1.93	=			(27)
Windov	vs Type	4				0.773	3	/[1/(1.2)+	0.04] =	0.89				(27)
Windov	Vindows Type 5			$0.84 x^{1/[1/(1.2)+0.04]} = 0.96$							(27)			
Windov	vs Type	6				1.263	 	/[1/(1.2)+	0.041	4 45				(27)
Window						1.200			0.04] =	1.45				
vvindov	vs Type	7				1.04		/[1/(1.2)+		1.45 1.19				(27)
	vs Type vs Type					1.04	x1	/[1/(1.2)+	0.04] =	1.19				(27) (27)
	vs Type vs Type					1.04	x1	/[1/(1.2)+ /[1/(1.2)+	0.04] = 0.04] =	1.19 1.19				(27)
Windov Floor	vs Type	8		0		1.04 ² 1.04 ² 41.00	x1 x1 5 x	/[1/(1.2)+ /[1/(1.2)+ 0.13	0.04] =	1.19 1.19 5.33065				(27)
Windov Floor Walls T	vs Type ype1	8		0		1.04 ⁴ 1.04 ⁴ 41.00	x1 x1 5 x x	/[1/(1.2)+ /[1/(1.2)+ 0.13 0.15	0.04] = 0.04] = =	1.19 1.19 5.33065 2.55				(27) (28) (29)
Windov Floor Walls T Walls T	vs Type ype1 ype2	8	3	8.83		1.04 ⁻ 1.04 ⁻ 41.00 17 12.75	x1 x1 5 x x x	/[1/(1.2)+ /[1/(1.2)+ 0.13 0.15 0.15	0.04] = 0.04] = = = =	1.19 1.19 5.33065 2.55 1.92				(27) (28) (29) (29)
Windov Floor Walls T Walls T Walls T	vs Type ype1 ype2 ype3	8 17 21.6 45.4	53 14	8.83		1.04 ⁻ 1.04 ⁻ 41.00 17 12.75 34.4	x1 x1 5 x x 2 x x x x x x x x x	/[1/(1.2)+ /[1/(1.2)+ 0.13 0.15 0.15 0.15	0.04] = 0.04] = = = = = =	1.19 1.19 5.33065 2.55 1.92 5.16				(27) (28) (29) (29) (29)
Window Floor Walls T Walls T Walls T Walls T	vs Type ype1 ype2 ype3 ype4	8 17 21.6 45.4 14.6	3 14 34	8.83 11.03		1.04 ⁻ 1.04 ⁻ 41.00 17 12.75 34.4 14.6 ⁻	x1 x1 5 x x x x x x x x x x x x x x x x x	/[1/(1.2)+ /[1/(1.2)+ 0.13 0.15 0.15 0.15 0.15	0.04] = 0.04] =	1.19 1.19 5.33068 2.55 1.92 5.16 2.1				(27) (28) (29) (29) (29) (29)
Windov Floor Walls T Walls T Walls T	vs Type ype1 ype2 ype3 ype4 ype5	8 17 21.6 45.4	33 14 34 9	8.83		1.04 ⁻ 1.04 ⁻ 41.00 17 12.75 34.4	x1 x1 5 x x x x x x x x x x x x x x x x x x x	/[1/(1.2)+ /[1/(1.2)+ 0.13 0.15 0.15 0.15	0.04] = 0.04] = = = = = =	1.19 1.19 5.33065 2.55 1.92 5.16				(27) (28) (29) (29) (29)

Total a	rea of e	lements	, m²			154.7	2							(31)
Party v	vall					32.39) X	0	=	0				(32)
Party v	vall					13.17	7 X	0	=	0			\neg	(32)
					indow U-va Is and part		ated usin	g formula 1	/[(1/U-valı	ie)+0.04] a	as given in	paragraph	3.2	
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)) + (32) =				41.87	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF	P = Cm -	÷ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
	•				construct	ion are not	t known p	recisely the	e indicative	e values of	TMP in Ta	able 1f		
			tailed calcu x Y) calu		using Ap	nendix k	<						16.77	(36)
	0		,		= 0.05 x (3	•	`						10.77	(30)
	abric he			- ()		,			(33) +	(36) =			58.65	(37)
Ventila	tion hea	at loss ca	alculated	monthl	у				(38)m	= 0.33 × ((25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	39.69	39.5	39.32	38.46	38.3	37.56	37.56	37.42	37.84	38.3	38.63	38.97		(38)
Heat tr	ansfer o	coefficier	nt, W/K					-	(39)m	= (37) + (38)m			
(39)m=	98.33	98.15	97.97	97.11	96.95	96.2	96.2	96.06	96.49	96.95	97.27	97.61		
								•		Average =	Sum(39)1.	12 /12=	97.11	(39)
	· · ·		HLP), W/	1	1		1		r	= (39)m ÷	r		I	
(40)m=	1.26	1.25	1.25	1.24	1.24	1.23	1.23	1.23	1.23	1.24	1.24	1.25		
Numbe	er of day	/s in moi	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. Wa	ater heat	ting ene	rgy requi	irement:								kWh/y	ear:	
if TF				[1 - exp	(-0.0003	849 x (TF	-13.9	9)2)] + 0.0	0013 x (⁻	TFA -13		43		(42)
Annua	l averag	e hot wa						: (25 x N)			91	.92		(43)
					5% if the a vater use, l			to achieve	a water us	se target o	f			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	<i>(</i> (43)						
(44)m=	101.12	97.44	93.76	90.09	86.41	82.73	82.73	86.41	90.09	93.76	97.44	101.12		
Energy	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	m x nm x	DTm / 3600			m(44) ₁₁₂ = ables 1b, 1		1103.08	(44)
(45)m=	149.95	131.15	135.33	117.99	113.21	97.69	90.53	103.88	105.12	122.51	133.73	145.22		
lf instan	taneous w	vater heatii	ng at point	of use (no	o hot water	· storage),	enter 0 ir	n boxes (46		Total = Su	m(45) ₁₁₂ =	-	1446.32	(45)
(46)m=	22.49	19.67	20.3	17.7	16.98	14.65	13.58	15.58	15.77	18.38	20.06	21.78		(46)
· · · ·	storage			I	1		1	Į	1	1	I	1	I	
Storag	e volum	e (litres)	includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	•	-			velling, e			. ,						
Otherv	vise if no	o stored	hot wate	er (this ir	ncludes i	nstantar	neous c	ombi boil	ers) ente	er '0' in (47)			

Water	storage	loss:												
a) If m	nanufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	e 2b								0		(49)
Energy	y lost fro	m water	r storage	, kWh/ye	ear			(48) x (49) =			0		(50)
,				cylinder										
		-		rom Tabl	le 2 (kW	h/litre/da	ay)					0		(51)
	•	-	see secti	on 4.3									i i	()
		from Ta	bie ∠a om Table	. 2h								0		(52)
									(50) (0]	(53)
	•		•	e, kWh/ye	ear			(47) x (51) x (52) x (53) =		0		(54)
	. ,	(54) in (5		f				((50))				0	l	(55)
vvater	storage	loss cai	culated	for each	month	1	1	((56)m = (55) × (41)	n	1			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	loss (ar	nual) fro	om Table	e 3	-	-	-	-	_		0		(58)
	•	•	,	for each		59)m = ((58) ÷ 36	65 × (41)	m					
	•			le H5 if t		,	. ,	. ,		r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi		lculated	for each	n month ((61)m –	(60) - 30	65 v (41))m						
(61)m=	50.96	44.85	47.78	44.43	44.03	40.8	42.16	44.03	44.43	47.78	48.05	50.96	1	(61)
													(50)	
	· · · ·	· · · · · ·	1	·	· · · · · ·	· · · · · ·		<u>, ,</u>			<u> </u>	<u> </u>	(59)m + (61)m I	
(62)m=	200.91	176	183.11	162.41	157.24	138.49	132.69	147.91	149.55	170.29	181.78	196.18	l	(62)
				endix G o						r contribut	ion to wate	er heating)		
	r	· · · · · ·	i	and/or \	r	<u> </u>	· ·	i – – –	<u>,</u>				I	(00)
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	l	(63)
Output	t from w	ater hea	iter											
(64)m=	200.91	176	183.11	162.41	157.24	138.49	132.69	147.91	149.55	170.29	181.78	196.18		_
								Out	out from w	ater heate	r (annual)₁	12	1996.57	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	62.6	54.82	56.94	50.34	48.65	42.68	40.64	45.55	46.06	52.68	56.48	61.03		(65)
inclu	ude (57)	m in cale	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal da	ains (see	e Table f	5 and 5a):	-		-				•	-	
			e 5), Wat		/-									
Melab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	121.52	121.52	121.52	121.52	121.52	121.52	121.52	121.52	121.52	121.52	121.52	121.52		(66)
										121.02	121.02	121.02	I	(00)
-	<u> </u>	i –	1	opendix	· · ·	· · · · · ·	, 	r	r	45.00	40.00	40.05	l	(67)
(67)m=	19.32	17.16	13.95	10.56	7.9	6.67	7.2	9.36	12.57	15.96	18.62	19.85	ł	(67)
• •		· · · · · · · · · · · · · · · · · · ·	1	n Append	· · · ·		r	<u>,</u>			1		i i	
(68)m=	215.92	218.16	212.52	200.5	185.32	171.06	161.53	159.29	164.94	176.96	192.13	206.39		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)), also se	ee Table	5				
(69)m=	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15		(69)
Pumps	s and fa	ns 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= -97.22 -97.22 -97.22	-97.22 -97.22	-97.22 -97.22	-97.22	-97.22	-97.22 -	97.22 -97.2	2	(71)					
Water heating gains (Table 5)		•	•			•							
(72)m= 84.14 81.58 76.54	69.91 65.39	59.28 54.62	61.22	63.97	70.81	78.44 82.02	2	(72)					
Total internal gains =	· · · · · ·	(66)m + (67)n	n + (68)m +	+ (69)m + (7	70)m + (71)n	n + (72)m							
(73)m= 381.83 379.35 365.46	343.43 321.07	299.47 285.82	292.33	303.93	326.18 3	51.65 370.7	' 3	(73)					
6. Solar gains:													
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.													
Orientation: Access Factor Area Flux g_ FF Gains Table 6d m ² Table 6a Table 6b Table 6c (W)													
Northeast 0.9x 0.77 x	0.84	× 11.28	×	0.76	_ ×	0.7	= 3.49	(75)					
Northeast 0.9x 0.77 x	0.84	× 22.97	×	0.76	_ ×	0.7	= 7.11	(75)					
Northeast 0.9x 0.77 x	0.84	× 41.38	_ ×	0.76	_ ×	0.7	= 12.81	(75)					
Northeast 0.9x 0.77 x	0.84	K 67.96	x	0.76	×	0.7	= 21.05	(75)					
Northeast 0.9x 0.77 x	0.84	× 91.35	x	0.76	×	0.7	= 28.29	(75)					
Northeast 0.9x 0.77 x	0.84	× 97.38	x	0.76	X	0.7	= 30.16	(75)					
Northeast 0.9x 0.77 x	0.84	× 91.1	x	0.76	×	0.7	= 28.21	(75)					
Northeast 0.9x 0.77 x	0.84	72.63	x	0.76	×	0.7	= 22.49	(75)					
Northeast 0.9x 0.77 x	0.84	\$ 50.42	×	0.76	x	0.7	= 15.61	(75)					
Northeast 0.9x 0.77 x	0.84	× 28.07	x	0.76	x	0.7	= 8.69	(75)					
Northeast 0.9x 0.77 x	0.84	× 14.2	x	0.76	x	0.7	= 4.4	(75)					
Northeast 0.9x 0.77 x	0.84	× 9.21	x	0.76	x	0.7	= 2.85	(75)					
Southeast 0.9x 0.54 x	3.5	x 36.79	x	0.76	x	0.7	= 33.26	(77)					
Southeast 0.9x 0.77 x	1.69	x 36.79	x	0.76	x	0.7	= 22.91	(77)					
Southeast 0.9x 0.77 x	0.77	x 36.79	×	0.76	x	0.7	= 10.49	(77)					
Southeast 0.9x 0.77 x	1.04	x 36.79	x	0.76	x	0.7	= 14.12	(77)					
Southeast 0.9x 0.54 x	3.5	62.67	x	0.76	x	0.7	= 56.65	(77)					
Southeast 0.9x 0.77 x	1.69	62.67	x	0.76	x	0.7	= 39.03	(77)					
Southeast 0.9x 0.77 x	0.77	6 2.67	x	0.76	x	0.7	= 17.86	(77)					
Southeast 0.9x 0.77 x	1.04	62.67	x	0.76	x	0.7	= 24.05	(77)					
Southeast 0.9x 0.54 x	3.5	× 85.75	x	0.76	x 🗌	0.7	= 77.51	(77)					
Southeast 0.9x 0.77 x	1.69	× 85.75) x [0.76	x	0.7	= 53.4	(77)					
Southeast 0.9x 0.77 x	0.77	× 85.75	x	0.76	x	0.7	= 24.44	(77)					
Southeast 0.9x 0.77 x	1.04	× 85.75	×	0.76	x	0.7	= 32.91	(77)					
Southeast 0.9x 0.54 x	3.5	× 106.25	x	0.76	x	0.7	= 96.04	(77)					
Southeast 0.9x 0.77 x	1.69	106.25	x	0.76	×	0.7	= 66.16	(77)					
Southeast 0.9x 0.77 x	0.77	× 106.25] x [0.76	_ × _	0.7	= 30.28	(77)					
Southeast 0.9x 0.77 x	1.04	× 106.25		0.76		0.7	= 40.78	(77)					
Southeast 0.9x 0.54 x	3.5	× 119.01) x [0.76	_ x _	0.7	= 107.57	(77)					
Southeast 0.9x 0.77 x	1.69	× 119.01	x	0.76	x	0.7	= 74.11	(77)					

Southeast 0.9x	0.77] ×	0.77	×	119.01	×	0.76	x	0.7] =	33.92	(77)
Southeast 0.9x	0.77	」 ^] x	1.04	x	119.01	x x	0.76	x	0.7] -] =	45.68	_(<i>TT</i>)
Southeast 0.9x	0.54	」 ^] ×	3.5	x	118.15	x	0.76	x	0.7	- _	106.8	_(<i>TT</i>)
Southeast 0.9x	0.34	」 ^] ×	1.69	x	118.15	x x	0.76	x	0.7	- _	73.57	_(<i>''')</i> _(77)
Southeast 0.9x	0.77	」 ^] x	0.77	x	118.15	x x	0.76	x	0.7	- _	33.67](<i>TT</i>)
Southeast 0.9x	0.77	」^] x	1.04	×	118.15	x	0.76	x	0.7	- _	45.35	_(<i>TT</i>)
Southeast 0.9x	0.54	」 ^] x	3.5	x	113.91	x x	0.76	x	0.7] -] =	102.96	_(<i>'''</i>) _(77)
Southeast 0.9x	0.77	」 ^ 】 ×	1.69	x	113.91	x x	0.76	x	0.7] _] _	70.93](**)](77)
Southeast 0.9x	0.77] ^] x	0.77	x	113.91	x	0.76	x	0.7] =	32.46	(77)
Southeast 0.9x	0.77] ×	1.04	x	113.91	x	0.76	x	0.7]] =	43.72](77)
Southeast 0.9x	0.54	」 】 ×	3.5	x	104.39	x	0.76	x	0.7	 =	94.36](77)
Southeast 0.9x	0.77	」 】 ×	1.69	x	104.39	x	0.76	x	0.7	=	65](77)
Southeast 0.9x	0.77	」 】 ×	0.77	x	104.39	x	0.76	x	0.7	=	29.75](77)
Southeast 0.9x	0.77	」 】 x	1.04	x	104.39	x	0.76	x	0.7	=	40.06](77)
Southeast 0.9x	0.54] x	3.5	x	92.85	×	0.76	x	0.7	=	83.93	(77)
Southeast 0.9x	0.77] x	1.69	x	92.85	×	0.76	x	0.7	=	57.82	(77)
Southeast 0.9x	0.77] x	0.77	x	92.85	x	0.76	x	0.7	=	26.46	(77)
Southeast 0.9x	0.77	×	1.04	×	92.85	×	0.76	x	0.7	=	35.64	(77)
Southeast 0.9x	0.54	x	3.5	x	69.27	×	0.76	x	0.7	i =	62.61	(77)
Southeast 0.9x	0.77	x	1.69	x	69.27	x	0.76	x	0.7	=	43.13	(77)
Southeast 0.9x	0.77	x	0.77	x	69.27	×	0.76	x	0.7	=	19.74	(77)
Southeast 0.9x	0.77	x	1.04	x	69.27	×	0.76	x	0.7	=	26.58	(77)
Southeast 0.9x	0.54	x	3.5	x	44.07	×	0.76	x	0.7	=	39.84	(77)
Southeast 0.9x	0.77	x	1.69	x	44.07	x	0.76	x	0.7	=	27.44	(77)
Southeast 0.9x	0.77	x	0.77	x	44.07	×	0.76	x	0.7	=	12.56	(77)
Southeast 0.9x	0.77	x	1.04	×	44.07	×	0.76	x	0.7	=	16.91	(77)
Southeast 0.9x	0.54	x	3.5	x	31.49	×	0.76	x	0.7	=	28.46	(77)
Southeast 0.9x	0.77	x	1.69	x	31.49	×	0.76	x	0.7	=	19.61	(77)
Southeast 0.9x	0.77	x	0.77	×	31.49	×	0.76	x	0.7	=	8.97	(77)
Southeast 0.9x	0.77	x	1.04	x	31.49	x	0.76	x	0.7	=	12.08	(77)
Southwest _{0.9x}	0.54	x	5.34	x	36.79		0.76	x	0.7	=	50.76	(79)
Southwest _{0.9x}	0.77	x	1.26	x	36.79		0.76	x	0.7	=	51.4	(79)
Southwest0.9x	0.54	x	5.34	×	62.67		0.76	x	0.7	=	86.47	(79)
Southwest _{0.9x}	0.77	x	1.26	x	62.67		0.76	x	0.7	=	87.55	(79)
Southwest _{0.9x}	0.54	x	5.34	×	85.75		0.76	x	0.7	=	118.31	(79)
Southwest _{0.9x}	0.77	x	1.26	x	85.75		0.76	x	0.7	=	119.79	(79)
Southwest _{0.9x}	0.54	×	5.34	×	106.25	ļ	0.76	x	0.7] =	146.59	(79)
Southwest _{0.9x}	0.77	×	1.26	×	106.25		0.76	x	0.7	=	148.42	(79)
Southwest _{0.9x}	0.54	×	5.34	×	119.01		0.76	x	0.7	=	164.19	(79)
Southwest _{0.9x}	0.77	×	1.26	×	119.01		0.76	x	0.7	=	166.25	(79)
Southwest _{0.9x}	0.54	×	5.34	X	118.15		0.76	x	0.7	=	163	(79)

Southwest _{0.9x}	0.77	x	1.2	26	x	1	18.15		0.76	6	x	0.7	=	- [165.05	(79)
Southwest _{0.9x}	0.54	x	5.3	34	x	1	13.91]	0.76	6] x [0.7	=	- [157.15	(79)
Southwest _{0.9x}	0.77	x	1.2	26	x	1	13.91]	0.76	6	x [0.7	=	- [159.12	(79)
Southwest _{0.9x}	0.54	x	5.3	34	x	10	04.39]	0.76	6	x [0.7	=	- [144.02	(79)
Southwest _{0.9x}	0.77	x	1.2	26	x	10	04.39]	0.76	6] x [0.7	=	- [145.82	(79)
Southwest _{0.9x}	0.54	x	5.3	34	x	9	2.85]	0.76	6	x [0.7	=	- [128.1	(79)
Southwest <mark>0.9x</mark>	0.77	x	1.2	26	x	9	2.85]	0.76	6] x [0.7	=	• [129.71	(79)
Southwest _{0.9x}	0.54	x	5.3	34	x	6	9.27	1	0.76	3] x [0.7		- [95.56	(79)
Southwest _{0.9x}	0.77	x	1.2	26	x	6	9.27	Ī	0.76	6] x [0.7	= -	Ē	96.76	(79)
Southwest _{0.9x}	0.54	x	5.3	34	x	4	4.07	Ī	0.76	6] x [0.7	=	- [60.8	(79)
Southwest _{0.9x}	0.77	x	1.2	26	x	4	4.07	İ	0.76	3] x [0.7		ן י	61.56	(79)
Southwest _{0.9x}	0.54	x	5.3	34	x	3	1.49	İ	0.76	3] x [0.7		ן י	43.44	(79)
Southwest _{0.9x}	0.77	x	1.2	26	x	3	1.49	ĺ	0.76	3	İ x İ	0.7	=	ן י	43.99	(79)
Northwest 0.9x	0.77	x	1.0)4	x	1	1.28	x	0.76	6] × [0.7	=	ן י	4.33	(81)
Northwest 0.9x	0.77	x	1.0)4	x	2	2.97	x	0.76	6] × [0.7	=	ן י	8.81	(81)
Northwest 0.9x	0.77	x	1.0)4	x	4	1.38	x	0.76	3	İ x İ	0.7	╡ -	ן י	15.88	(81)
Northwest 0.9x	0.77	x	1.0)4	x	6	7.96	x	0.76	6] × [0.7	=	ן י	26.08	(81)
Northwest 0.9x	0.77	x	1.0)4	x	9	1.35	x	0.76	6] × [0.7	=	ן י	35.06	(81)
Northwest 0.9x	0.77	x	1.0)4	x	9	7.38	x	0.76		İ x İ	0.7		- [37.38	(81)
Northwest 0.9x	0.77	x	1.0)4	x		91.1	x	0.76	6] × [0.7	=	ן י	34.96	(81)
Northwest 0.9x	0.77	x	1.0)4	x	7	2.63	x	0.76	6] × [0.7	=	ן י	27.87	(81)
Northwest 0.9x	0.77	x	1.0)4	x	5	0.42	x	0.76	3] × [0.7	=	ן י	19.35	(81)
Northwest 0.9x	0.77	x	1.0)4	x	2	8.07	x	0.76	6] x [0.7	=	ן י	10.77	(81)
Northwest 0.9x	0.77	x	1.0)4	x		14.2	x	0.76	6] × [0.7	=	ן י	5.45	(81)
Northwest 0.9x	0.77	x	1.0)4	x		9.21	×	0.76	3] × [0.7	=	ן י	3.54	(81)
-								•						-		-
Solar gains in	watts, ca	alculated	for eac	h month	ו			(83)m	n = Sum(74	4)m((82)m					
(83)m= 190.76	327.53	455.05	575.4	655.06	6	54.97	629.52	569	.39 496	.62	363.86	228.96	162.94	4		(83)
Total gains – i	nternal a	and solar	(84)m =	= (73)m	+ (83)m	, watts	_								
(84)m= 572.59	706.89	820.51	918.83	976.12	9	54.43	915.34	861	.72 800	.55	690.03	580.61	533.67	7		(84)
7. Mean inter	rnal temp	perature	(heating	seasor	า)											
Temperature						area	from Tab	ole 9	, Th1 (°C))				Γ	21	(85)
Utilisation fac	ctor for g	ains for I	iving are	ea, h1,n	n (s	ee Ta	ble 9a)							L		_
Jan	Feb	Mar	Apr	May	Ť	Jun	Jul	A	ug Se	ер	Oct	Nov	Dec	;		
(86)m= 1	0.99	0.97	0.91	0.79		0.61	0.46	0.	5 0.7	'4	0.94	0.99	1			(86)
Mean interna	l temper	ature in	living ar	ea T1 (f		w ste	ns 3 to 7	r 7 in T	able 9c)			-				
(87)m= 19.74	19.96	20.26	20.6	20.85	-	20.97	20.99	20.	- <u> </u>	ī	20.58	20.08	19.69			(87)
			oriodo ir		-L	olling	from To					<u> </u>				
Temperature (88)m= 19.88	19.88	19.88	19.89	19.89	-	7eiiing 19.9	19.9	19	`	<u> </u>	19.89	19.89	19.88			(88)
					_						. 5.50					. /
Utilisation fac	<u> </u>	i			-			r Ó		- T	0.00	0.00	4	٦		(80)
(89)m= 0.99	0.98	0.96	0.88	0.73		0.52	0.35	0.3	39 0.6	co	0.92	0.99	1			(89)

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

(90)m=	18.22	18.54	18.97	19.44	19.75	19.88	19.9	19.89	19.83	19.43	18.73	18.16		(90)
									f	fLA = Livin	g area ÷ (4	4) =	0.45	(91)
Maan	interne		atura (fa	ماريم ماريم		lline or) fl	ΔΤ4	. (4 4	A) T O			I		
(92)m=	18.91	19.18	19.55	or the wh	20.25	20.37	20.39	+ (1 – 1L 20.39	20.32	19.95	19.34	18.85		(92)
											19.34	10.05		(32)
(93)m=	18.91	19.18	19.55	19.97	20.25	20.37	20.39	20.39	20.32	19.95	19.34	18.85		(93)
. ,			uirement	I	20.25	20.37	20.39	20.39	20.52	19.95	19.04	10.00		(00)
				mperatu	o obtair	od at st	on 11 of		a co tha	t Ti m_(76)m an	d ro, colo	sulato	
				using Ta		ieu al si	эрттог	Table 9	J, SU IIIA	u 11,111=(<i>i</i> 0)111 atr	u re-caic	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm					g						
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.4	0.44	0.69	0.92	0.98	0.99		(94)
Usefu	I gains,	hmGm	, W = (94	4)m x (84	4)m	1								
(95)m=	567.95	692.52	780.86	811.77	734.14	536.66	362.02	378.78	553.26	632.82	570.48	530.46		(95)
Month	nly avera	age exte	rnal tem	perature	e from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	- =[(39)m :	x [(93)m	– (96)m]				
(97)m=	1436.16	1401.9	1278.89	1074.65	828.62	554.95	364.75	383.26	600.46	906.04	1190.59	1430.26		(97)
Space	e heatin	g require	ement fo	r each n	honth, k	Wh/mon	th = 0.02	4 x [(97))m – (95	5)m] x (4 ⁻	1)m			
(98)m=	645.95	476.7	370.53	189.27	70.29	0	0	0	0	203.28	446.48	669.45		
								Tota	l per year	(kWh/year	·) = Sum(9	8)15,912 =	3071.96	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								39.22	(99)
9a Fn	erav rec	uiremer	nts – Ind	ividual h	eating s	vstems i	ncludina	micro-C	HP)			l		
	e heatir			i i i di di li i	outing o	yotorno i	nordanig		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
•		•	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sc	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
				main sys	. ,			(204) = (2	02) × [1 –	(203)] =		-	1	(204)
			•	ing syste				. , .	<i>,</i>			·		(206)
	•			• •								·	90.3	4
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	ז, %				-		0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space		g require	i`	alculate	d above)				1			1	
	645.95	476.7	370.53	189.27	70.29	0	0	0	0	203.28	446.48	669.45	I	
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)									(211)
	715.34	527.91	410.33	209.6	77.84	0	0	0	0	225.12	494.44	741.37		
			-	-				Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	3401.95	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									_
	onoaan													
= {[(98			00 ÷ (20	8)		-				-	-			
= {[(98 (215)m=)m x (20		00 ÷ (20 0	8) 0	0	0	0	0	0	0	0	0	I	
)m x (20	01)] } x 1	<u> </u>	r -	0	0	0				0 215) _{15,1012}		0	(215)
(215)m=)m x (20	01)] } x 1 0	<u> </u>	r -	0	0	0						0	(215)
(215)m= Water)m x (20 0 heating	01)] } x 1 0	0	r -		0	0	Tota				=	0	(215)
(215)m= Water Output)m x (20 heating t from wa 200.91	01)] } x 1 0	0 ter (calc 183.11	0		0	0 132.69						0	(215)

_													_		
(217)m=	87.91	87.59	87	85.75	83.66	81	81	81	81	85.81	87.4	88.01		(217)	
		•	kWh/mo												
(219)m (219)m=		<u>m x 100</u> 200.94) ÷ (217) 210.48	m 189.4	187.95	170.98	163.81	182.61	184.63	198.45	208	222.91	1		
` ´									I = Sum(2	19a) ₁₁₂ =			2348.7	(219)	
Annua	l totals									k\	Wh/year		kWh/yea] ,	
Space	heating	fuel use	ed, main	system	1								3401.95		
Water I	heating	fuel use	d										2348.7		
Electric	city for p	oumps, f	ans and	electric l	keep-ho	t									
centra	al heatin	g pump	:									30]	(230c)	
boiler	with a f	an-assis	ted flue									45	ĺ	(230e)	
Total e	lectricity	/ for the	above, k	(Wh/yea	r			sum	of (230a).	(230g) =			75	(231)	
Electric	city for li	ghting											341.11	(232)	
Electric	city gene	erated b	y PVs										-1110.56	(233)	
								0115							
12a. (12a. CO2 emissions – Individual heating systems including micro-CHP														
12a. (CO2 em	issions -	– Individ	ual heati	ng syste			cro-CHF	,	Fmiss	ion fac	tor	Emissions		
12a. (CO2 em	issions -	– Individ	ual heati	ng syste	En	ergy /h/year	cro-CHF		Emiss kg CO2	ion fac 2/kWh	tor	Emissions kg CO2/ye		
			- Individ ystem 1)		ng syste	En kW	ergy	CIO-CHF			2/kWh	tor =			
Space	heating		ystem 1)		ng syste	En kW (211	ergy /h/year	Cro-CHF		kg CO	2/kWh		kg CO2/ye	ar ¬	
Space Space	heating	(main s	ystem 1)		ng syste	En kW (211 (215	ergy /h/year I) x	Cro-CHF		kg CO2	2/kWh 16 19	=	kg CO2/ye	ar](261)	
Space Space Water I	heating heating heating	(main s	ystem 1) dary)		ng syste	En kW (211 (215	ergy /h/year) x 5) x 9) x	cro-CHF + (263) + (kg CO2	2/kWh 16 19	=	kg CO2/ye	ar (261) (263)	
Space Space Water Space	heating heating heating and wa	(main s (second ter heati	ystem 1) dary) ng			En kW (211 (215 (215 (261	ergy /h/year) x 5) x 9) x			kg CO2	2/kWh 16 19 16	=	kg CO2/ye 734.82 0 507.32	ar (261) (263) (264)	
Space Space Water I Space Electric	heating heating heating and wa	(main s (second ter heati bumps, fa	ystem 1) dary) ng)		En kW (211 (215 (215 (261 (231	ergy /h/year 1) x 5) x 9) x 1) + (262)			kg CO2	2/kWh 16 19 16	-	kg CO2/ye 734.82 0 507.32 1242.14	ar (261) (263) (264) (265)	
Space Space Water I Space Electric Electric	heating heating heating and wa city for p city for li	(main s (second ter heati bumps, fa ghting	ystem 1) dary) ng ans and)	keep-hot	En kW (211 (215 (215 (261 (231	ergy /h/year 1) x 5) x 2) x 1) + (262) +			kg CO2 0.2 0.5	2/kWh 16 19 16 19 19	= = =	kg CO2/ye 734.82 0 507.32 1242.14 38.93	ar (261) (263) (264) (265) (267)	
Space Space Water I Space Electric Electric Energy Item 1	heating heating and wa city for p city for li	(main s (second ter heati bumps, fa ghting /generat	ystem 1) dary) ng ans and) electric I	keep-hot	En kW (211 (215 (215 (261 (231	ergy /h/year 1) x 5) x 2) x 1) + (262) +		264) =	kg CO2 0.2 0.5 0.2	2/kWh 16 19 16 19 19 19	-	kg CO2/ye 734.82 0 507.32 1242.14 38.93 177.04 -576.38	ar (261) (263) (264) (265) (267) (268) (269)	
Space Space Water I Space Electric Energy Item 1 Total C	heating heating and wa city for p city for li saving.	(main s (second ter heati bumps, fa ghting /generat	ystem 1) dary) ng ans and ion tech) electric l nologies	keep-hot	En kW (211 (215 (215 (261 (231	ergy /h/year 1) x 5) x 2) x 1) + (262) +		264) = sum o	kg CO2 0.2 0.5 0.5	2/kWh 16 19 16 19 19 19	-	kg CO2/ye 734.82 0 507.32 1242.14 38.93 177.04 -576.38 881.72	ar (261) (263) (264) (265) (267) (268) (269) (272)	
Space Space Water I Space Electric Electric Energy Item 1 Total C Dwellin	heating heating and wa city for p city for li saving.	(main s (second ter heati bumps, fa ghting /generat year Emissi	ystem 1) dary) ng ans and) electric l nologies	keep-hot	En kW (211 (215 (215 (261 (231	ergy /h/year 1) x 5) x 2) x 1) + (262) +		264) = sum o	kg CO2 0.2 0.5 0.2 0.5 0.5 (0.5) (265)(2	2/kWh 16 19 16 19 19 19	-	kg CO2/ye 734.82 0 507.32 1242.14 38.93 177.04 -576.38	ar (261) (263) (264) (265) (267) (268) (269)	

Regulations Compliance Report

Approved Document Printed on 05 Noverr Project Information:	nber 2019 at 13:23	•	roma FSAP 2012 program, Ve	rsion: 1.0.4.18	
Assessed By:	Su Lee (STRO031	315)	Building Type:	Flat	
Dwelling Details:					
NEW DWELLING DE	ESIGN STAGE		Total Floor Area: 7	75.47m²	
Site Reference : 2	217 Kingston Road		Plot Reference:	Front - Unit 2	
Address :					
Client Details:					
Name:					
Address :					
This report covers i It is not a complete		thin the SAP calculatior ons compliance.	IS.		
1a TER and DER					
Fuel for main heating Fuel factor: 1.00 (ma Target Carbon Dioxid Dwelling Carbon Diox 1b TFEE and DFEE	ins gas) de Emission Rate (xide Emission Rate	TER)	20.38 kg/m² 12.46 kg/m²		ок
Target Fabric Energy			61.0 kWh/m²		
Dwelling Fabric Ener	• • •		49.7 kWh/m ²		
					ОК
2 Fabric U-values					
Element External wa	п	Average	Highest		ок
Party wall	11	0.15 (max. 0.30) 0.00 (max. 0.20)	0.15 (max. 0.70) -		OK
Floor		0.13 (max. 0.25)	0.13 (max. 0.70)		ОК
Roof		0.13 (max. 0.20)	0.13 (max. 0.35)		ОК
Openings		1.20 (max. 2.00)	1.20 (max. 3.30)		ОК
2a Thermal bridgin					
	dging calculated fro	om linear thermal transmi	ttances for each junction		
3 Air permeability	ty of EQ popoolo		4.00 (design val	uo)	
Maximum	ty at 50 pascals		4.00 (design vai 10.0	ue)	ок
4 Heating efficienc	W				
Main Heating		Boiler systems with radi Data from manufacturer Combi boiler Efficiency 89.5 % SEDE Minimum 88.0 %		ains gas	ок
Secondary he	ating system:	None			
5 Cylinder insulation					
Hot water Stor	rage:	No cylinder			N/A

Regulations Compliance Report

ontrols			
Space heating controls Hot water controls:	TTZC by plumbing and el No cylinder thermostat	lectrical services	OI
Boiler interlock:	No cylinder Yes		O
ow energy lights			-
Percentage of fixed lights wi	th low-energy fittings	100.0%	
Minimum	6, 6	75.0%	O
lechanical ventilation			
Not applicable			
ummertime temperature			
Overheating risk (Thames va	alley):	Slight	0
ed on:			
Overshading:		Average or unknown	
Windows facing: South Wes	t	3.91m ²	
Windows facing: North West		3.5m ²	
Windows facing: North West		1.69m ²	
Windows facing: North West		0.77m ²	
Windows facing: North East		1.57m ²	
Windows facing: South Wes	t	2.89m ²	
Windows facing: South East		0.67m ²	
Windows facing: North West		0.67m ²	
Windows facing: West		0.87m ²	
Windows facing: South		0.87m ²	
Ventilation rate:		4.00	
Blinds/curtains:		None	
Key features			
External Walls U-value		0.13 W/m²K	
Party Walls U-value		0 W/m²K	
Dharta altaba anna			

Photovoltaic array

				User D	etails:						
Assessor Name: Software Name:	Su Lee Stroma FS	AP 2012			Strom Softwa	are Ver	rsion:			031315 n: 1.0.4.18	
			Pr	operty ,	Address	Front -	Unit 2				
Address :											
1. Overall dwelling dime	ensions:			•	(0)						
Basement					a(m²)	(10) X	Av. Hei	,	(2a) =	Volume(m ³)	
				4		(1a) x	2	.6] 	106.4	(3a)
Ground floor				3	4.54	(1b) x	2.	81	(2b) =	97.07	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+	(1n)) 7	5.47	(4)					
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	203.47	(5)
2. Ventilation rate:											
	main heating		ondary ating	/	other		total			m ³ per hour	
Number of chimneys	0] + [0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0] + [0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ins					- L	3	x 1	10 =	30	(7a)
Number of passive vents							0	x 1	10 =	0	(7b)
Number of flueless gas fi	res						0	x 4	40 =	0	(7c)
									Air ch	anges per ho	ır
Infiltration due to chimne	ys, flues and fa	ans = (6a)-	+(6b)+(7a	a)+(7b)+(7c) =		30		÷ (5) =	0.15	(8)
If a pressurisation test has b			proceed	to (17), d	otherwise o	continue fr	om (9) to (16)			_
Number of storeys in the	he dwelling (ns)								0	(9)
Additional infiltration								[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0						•	uction			0	(11)
if both types of wall are p deducting areas of openi			nding to	the great	er wall are	a (atter					
If suspended wooden			d) or 0.′	1 (seale	d), else	enter 0				0	(12)
lf no draught lobby, en	ter 0.05, else e	enter 0								0	(13)
Percentage of window	s and doors dra	aught strip	oped							0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	- (15) =		0	(16)
Air permeability value,	q50, expresse	d in cubic	metres	s per ho	our per s	quare m	etre of e	nvelope	area	4	(17)
If based on air permeabil	lity value, then	(18) = [(17)	÷ 20]+(8), otherwi	se (18) = (16)				0.35	(18)
Air permeability value applie		n test has b	een done	e or a deg	gree air pe	rmeability	is being us	sed			-
Number of sides sheltere	ed				(20) - 1	[0 075 v (1	0)1			2	(19)
Shelter factor	la sa ka ka ƙasa ƙasa				(20) = 1 -		[9]]=		-	0.85	(20)
Infiltration rate incorporat	-				(21) = (18) x (20) =				0.3	(21)
Infiltration rate modified f	<u> </u>		luu:	1. 1	Δ.	0		NJ -		l	
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp					i		,		,	I	
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind 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					
	0.38	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.3	0.32	0.33	0.35		
	ate effec		-	rate for t	he appli	cable ca	ise	•		•			·	
	echanica aust air he			undiv NL (O	2h) (00	а) Г ари (и	acuation (nuida (DOk	x) (00a)			0	
		• •	0 11		, (, (,, ,	`)) = (23a)			0	(23b)
	anced with				•					~ ` `		(00)	0	(23c)
			1				<u> </u>	1	ŕ	2b)m + ()	r <u>, -</u>	i , ,	÷ 100] I	(24a)
(24a)m=		0	0	0	0	0	0	0	0		0	0		(24a)
	r					r		1	ŕ	2b)m + (2	, 		I	(24b)
(24b)m=		0	0	0	0	0	0	0	0	0	0	0		(24b)
,	whole ho if (22b)m				•	•				.5 × (23b))			
(24c)m=	r`´r	0	0	0	0	0	0	0	0	0	0	0		(24c)
,	natural v if (22b)m				•					0.5]	<u> </u>			
(24d)m=	r í r	0.57	0.57	0.55	, 0.55	0.54	0.54	0.54	, 0.54	0.55	0.56	0.56		(24d)
Effe	ctive air o	change	rate - en	iter (24a) or (24) or (24	L c) or (24	d) in boy	(25)					
(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56		(25)
2 1 10	otioooor				- #1	1	1	•	1			1		
ELEN	at losses	Gros		Openin		Net Ar	222	U-valı		AXU		k-value	2	AXk
		area		m	-	A,r		W/m2		(W/I	<)	kJ/m²·l		kJ/K
Doors						1.86	x	1.2	=	2.232				(26)
Window	ws Type	1				3.908	3 x1	/[1/(1.2)+	0.04] =	4.47				(27)
Windo	ws Type	2				3.496	3 x1	/[1/(1.2)+	0.04] =	4				(27)
Windo	ws Type	3				1.689		/[1/(1.2)+	0.04] =	1.93				(27)
Window	ws Type	4				0.773	3	/[1/(1.2)+	0.04] =	0.89				(27)
Windo	ws Type	5				1.57		/[1/(1.2)+	0.04] =	1.8				(27)
	ws Type					0.963		/[1/(1.2)+		1.1				(27)
	ws Type					0.665		/[1/(1.2)+		0.76				(27)
Windov	ws Type	8				0.665	5 x1	/[1/(1.2)+	0.04] =	0.76				(27)
Windov	ws Type	9				0.87		/[1/(1.2)+	0.04] =	1				(27)
Window	ws Type	10				0.87	x1	/[1/(1.2)+	0.04] =	1				(27)
Floor						40.92	5 X	0.13	=	5.3202	 5			(28)
Walls ⁻	Гуре1	17.0	3	0		17.03	3 X	0.15	=	2.56	F F		\dashv	(29)
Walls ⁻	Гуре2	20.3		7.4		12.98	3 X	0.15	=	1.95	ה ה		\exists	(29)
Walls ⁻	ГуреЗ	45.5	54	11.8	5	33.69	э х	0.15	=	5.05	ה ה		ĪĒ	(29)
Walls ⁻	Гуре4	10.9	3	0		10.93	3 X	0.14	=	1.57	ז ד		ĪĒ	(29)
	Гуре5	7.4		0		7.45	x	0.13	=	0.98	=		\dashv	(29)

Roof		8.0	7	0		8.07)	0.13	=	1.05				(30)
Total a	rea of el	ements	, m²			150.3	4							(31)
Party v	vall					32.39))	0	=	0				(32)
Party v	vall					9.04	,	(0		0	i T		i —	(32)
			ows, use e sides of in				ated usi	ng formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	3.2	
			= S (A x		is and par	uuons		(26)(30) + (32) =				40.63	(33)
	apacity (- /					((28).	(30) + (32	2) + (32a).	(32e) =	0	(34)
			ter (TMF	P = Cm -	+ TFA) ir	ר kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi	gn assess	ments wh		tails of the				precisely the	e indicative	e values of	TMP in Ta	able 1f		(```/
			x Y) cal		usina Ar	pendix l	<						17.64	(36)
	-	•	are not kn		• •	•	·						17.04	(00)
	abric hea			()	,	,			(33) +	(36) =			58.27	(37)
Ventila	tion hea	t loss ca	alculated	I monthly	у				(38)m	= 0.33 × (25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	38.33	38.15	37.97	37.12	36.96	36.22	36.22	36.08	36.5	36.96	37.28	37.62		(38)
Heat tr	ansfer c	oefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	96.6	96.42	96.24	95.39	95.23	94.49	94.49	94.35	94.77	95.23	95.55	95.89		
Heat lo		meter (H	HLP), W/	m²K		•	•			Average = = (39)m ÷		12 /12=	95.38	(39)
(40)m=	1.28	1.28	1.28	1.26	1.26	1.25	1.25	1.25	1.26	1.26	1.27	1.27		
(-)					_	_		_		Average =			1.26	(40)
Numbe	er of day	s in mo	nth (Tab	le 1a)	-	_	_		_	_				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Δeeum	ned occu	nancv	N									27	I	(42)
				[1 - exp	(-0.0003	349 x (TF	FA -13.	9)2)] + 0.	0013 x (TFA -13.		.37	ł	(42)
	A £ 13.9							(1	
								= (25 x N) d to achieve		se target o		0.52		(43)
		-	person per			-	-			-				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage in	litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c	x (43)	-				I	
(44)m=	99.57	95.95	92.33	88.71	85.09	81.47	81.47	85.09	88.71	92.33	95.95	99.57		
_										Total = Su	· · ·		1086.21	(44)
Energy	content of	hot water	used - cal	culated me	onthly = 4.	190 x Vd,r	m x nm x	DTm / 360	0 kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	1	
(45)m=	147.66	129.14	133.26	116.18	111.48	96.2	89.14	102.29	103.51	120.64	131.68	143		—].
lf instan	taneous w	ater heati	ng at point	of use (no	o hot wate	r storage),	enter 0	in boxes (46		Total = Su	m(45) ₁₁₂ =	=	1424.2	(45)
(46)m=	22.15	19.37	19.99	17.43	16.72	14.43	13.37	15.34	15.53	18.1	19.75	21.45		(46)
	storage							-1	•		·		•	
Storag	e volum	e (litres)	includin	ig any se	olar or W	WHRS	storage	e within s	ame ves	sel		0	l	(47)

Otherw	•	o stored	ind no ta hot wate		-			• •	ers) ente	ər '0' in (47)			
a) If m	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
			storage					(48) x (49)) =			0		(50)
			eclared of factor fr	•								0		(51)
		-	ee secti			1/1110/00	iy)					0		(51)
	•	from Ta										0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	· storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	55)									0		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m	-			
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3		-					0		(58)
Primar	y circuit	loss cal	culated f	for each	month (. ,	• • •		r thermo	ostat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	culated	for each	month ((61)m =	(60) ÷ 36	55 x (41))m			•			
(61)m=	50.74	44.16	47.05	43.75	43.36	40.18	41.51	43.36	43.75	47.05	47.32	50.74		(61)
	eat reg	uired for	l water he	eating ca		for eac	L h month		0.85 x ((45)m +	I (46)m +		(59)m + (61)	m
(62)m=	198.4	173.31	180.31	159.93	154.84	136.37	130.66	145.65	147.26	167.69	179	193.74		(62)
			using App											
			FGHRS									5,		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	198.4	173.31	180.31	159.93	154.84	136.37	130.66	145.65	147.26	167.69	179	193.74		
								Outp	out from w	ater heate	r (annual)₁	12	1967.16	(64)
Heat g	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m	1	
(65)m=	61.78	53.98	56.07	49.57	47.91	42.03	40.02	44.85	45.35	51.87	55.61	60.23	-	(65)
inclu	de (57)	m in calo	culation of	of (65)m	only if c	ylinder is	s in the c	dwelling	or hot w	ater is fr	om com	munity h	eating	
	, ,		e Table 5	. ,		,		U				,	U	
			e 5), Wat											
metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56	118.56		(66)
Liahtin	a aains	(calcula	ted in Ap	pendix	L. equat	ion L9 oi	r L9a). a	lso see ⁻	L Table 5	1				
(67)m=	18.74	16.64	13.53	10.25	7.66	6.47	6.99	9.08	12.19	15.48	18.07	19.26		(67)
	nces da	ins (calc	ulated in		dix L. ea	uation L	13 or L1	u 3a), also	see Ta	ble 5	1	1	l	
(68)m=	209.71	211.89	206.4	194.73	179.99	166.14	156.89	154.71	160.2	171.87	186.61	200.46		(68)
		(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5	!		I	

(69)m= 34.86	34.86	34.86	;]	34.86 34.8	36	34.	.86 34.86	34.	.86	34.86	34.86	34.86	34.	86		(69)
Pumps and fa	ans gains	(Table	5a)	I			I					1				
(70)m= 3	3	3	Ť	3 3		3	3 3		3	3	3	3	3	}		(70)
Losses e.g. e	vaporatio	n (nega	tiv	ve values) (1	Fabl	e 5))			I						
(71)m= -94.85	1	-94.85	-	-94.85 -94.8	-		.85 -94.85	-94	.85	-94.85	-94.85	5 -94.85	-94	.85		(71)
Water heating	g gains (T	able 5)														
(72)m= 83.04	80.33	75.37		68.84 64.3	39	58.	.37 53.79	60.	.29	62.99	69.72	77.24	80.	96		(72)
Total interna	l gains =						(66)m + (67)m	n + (6	8)m +	- (69)m + (7	70)m +	(71)m + (72)	m			
(73)m= 373.06	370.43	356.87	3	335.39 313.	61	292	2.55 279.23	285	5.65	296.95	318.64	4 343.48	362	.24		(73)
6. Solar gair																
Solar gains are		-	ar fl		6a a	ind a		tions	to co	nvert to the	e applic		ion.			
Orientation:Access FactorAreaFluxg_FFGainTable 6dm²Table 6aTable 6bTable 6c(W													Gains			
													-			
	•		⊢	1.57	4	⊢	11.28] 1			4	0.7		=	6.53	(75)
Northeast 0.9x	••••	×	F	1.57	4	׼	22.97	X		0.76	×	0.7		=	13.29	(75)
Northeast 0.9x	•	×	F	1.57	4	×L	41.38	×		0.76	×	0.7		=	23.95	(75)
Northeast 0.9x	•	×	님	1.57	4	׼	67.96	X		0.76	×	0.7		=	39.33	(75)
Northeast 0.9x	0.77	×	F	1.57	_	×L	91.35	X		0.76	×	0.7		=	52.87	(75)
Northeast 0.9x	0.77	×	Ļ	1.57	_	׼	97.38	X		0.76	×	0.7		=	56.37	(75)
Northeast 0.9x		×	Ļ	1.57	_	׼	91.1	X		0.76	_ ×	0.7		=	52.73	(75)
Northeast 0.9x	•	×	Ļ	1.57	_	׼	72.63	X		0.76	×	0.7		=	42.04	(75)
Northeast 0.9x	0	×	Ļ	1.57	_	׼	50.42	X		0.76	×	0.7		=	29.18	(75)
Northeast 0.9x	0	×	Ļ	1.57	_	×L	28.07	×		0.76	×	0.7		=	16.25	(75)
Northeast 0.9x	0.77	×	Ļ	1.57	_	׼	14.2	×		0.76	×	0.7		=	8.22	(75)
Northeast 0.9x	0.77	×	Ļ	1.57	_	×L	9.21	×		0.76	×	0.7		=	5.33	(75)
Southeast 0.9x	•	×	Ļ	0.67	_	×L	36.79	×		0.76	×	0.7		=	9.02	(77)
Southeast 0.9x	-	×	Ļ	0.67	_	׼	62.67	×		0.76	×	0.7		=	15.37	(77)
Southeast 0.9x		×	Ļ	0.67	'	׼	85.75	×		0.76	×	0.7		=	21.02	(77)
Southeast 0.9x		×	Ļ	0.67	_	×L	106.25	×		0.76	×	0.7		=	26.05	(77)
Southeast 0.9x	-	×	Ļ	0.67	_	×L	119.01	×		0.76	×	0.7		=	29.18	(77)
Southeast 0.9x		×	Ļ	0.67	_	׼	118.15	X		0.76	×	0.7		=	28.97	(77)
Southeast 0.9x	-	×	Ļ	0.67	_	×L	113.91	×		0.76	×	0.7		=	27.93	(77)
Southeast 0.9x	_	×	Ļ	0.67	_	׼	104.39	×		0.76	×	0.7		=	25.59	(77)
Southeast 0.9x	•	X	Ļ	0.67	_	׼	92.85	×		0.76	×	0.7		=	22.76	(77)
Southeast 0.9x		×	Ļ	0.67	_	׼	69.27	×		0.76	×	0.7		=	16.98	(77)
	outheast 0.9x 0.77 x 0.67						44.07	×		0.76	×	0.7		=	10.8	(77)
Southeast 0.9x	•	0.67	_	׼	31.49	×		0.76	×	0.7		=	7.72	(77)		
South 0.9x		0.87	,	×L	46.75	×		0.76	×	0.7		=	15	(78)		
							76.57	×		0.76	×	0.7		=	24.56	(78)
							97.53	×		0.76	×	0.7		=	31.28	(78)
South 0.9x	0.77	×		0.87	,	×	110.23	×		0.76	x	0.7		=	35.36	(78)

South 0.9x	0.77		0.07		444.07		0.70		0.7		00.04	(78)
	0.77	x	0.87	×	114.87	x	0.76	x	0.7	=	36.84	4
	0.77	x	0.87	x	110.55	x	0.76	x	0.7	=	35.46	(78)
	0.77	x	0.87	x	108.01	x	0.76	x	0.7	=	34.64	(78)
	0.77	x	0.87	×	104.89	x	0.76	x	0.7	=	33.64	(78)
	0.77	x	0.87	×	101.89	x	0.76	x	0.7	=	32.68	(78)
	0.77	x	0.87	x	82.59	x	0.76	x	0.7	=	26.49	(78)
	0.77	x	0.87	x	55.42	x	0.76	x	0.7	=	17.77	(78)
South 0.9x	0.77	x	0.87	×	40.4	x	0.76	x	0.7	=	12.96	(78)
Southwest0.9x	0.54	x	3.91	×	36.79		0.76	x	0.7	=	37.18	(79)
Southwest _{0.9x}	0.77	x	0.96	×	36.79		0.76	x	0.7	=	39.19	(79)
Southwest _{0.9x}	0.54	x	3.91	×	62.67		0.76	x	0.7	=	63.33	(79)
	0.77	x	0.96	x	62.67		0.76	x	0.7	=	66.75	(79)
Southwesto a	0.54	x	3.91	x	85.75		0.76	x	0.7	=	86.65	(79)
Southwesto.9x	0.77	x	0.96	x	85.75		0.76	x	0.7	=	91.34	(79)
Southwest _{0.9x}	0.54	x	3.91	x	106.25		0.76	x	0.7	=	107.36	(79)
Southwest _{0.9x}	0.77	X	0.96	X	106.25		0.76	x	0.7	=	113.17	(79)
Southwest _{0.9x}	0.54	x	3.91	X	119.01		0.76	x	0.7	=	120.25	(79)
Southwest _{0.9x}	0.77	x	0.96	X	119.01		0.76	x	0.7	=	126.76	(79)
Southwest _{0.9x}	0.54	x	3.91	x	118.15		0.76	x	0.7	=	119.38	(79)
Southwest _{0.9x}	0.77	x	0.96	x	118.15		0.76	x	0.7	=	125.84	(79)
Southwest _{0.9x}	0.54	x	3.91	x	113.91		0.76	x	0.7	=	115.1	(79)
Southwest _{0.9x}	0.77	x	0.96	x	113.91		0.76	x	0.7	=	121.33	(79)
Southwest _{0.9x}	0.54	x	3.91	x	104.39		0.76	x	0.7	=	105.48	(79)
Southwest _{0.9x}	0.77	x	0.96	x	104.39		0.76	x	0.7	=	111.19	(79)
Southwest _{0.9x}	0.54	x	3.91	x	92.85		0.76	x	0.7	=	93.82	(79)
Southwest _{0.9x}	0.77	x	0.96	x	92.85		0.76	x	0.7	=	98.9	(79)
Southwest _{0.9x}	0.54	x	3.91	x	69.27		0.76	x	0.7	=	69.99	(79)
Southwest _{0.9x}	0.77	x	0.96	x	69.27		0.76	x	0.7	=	73.78	(79)
Southwest _{0.9x}	0.54	x	3.91	x	44.07		0.76	x	0.7	=	44.53	(79)
Southwest _{0.9x}	0.77	x	0.96	x	44.07		0.76	x	0.7	=	46.94	(79)
Southwest _{0.9x}	0.54	x	3.91	x	31.49		0.76	x	0.7	=	31.82	(79)
Southwest _{0.9x}	0.77	x	0.96	x	31.49		0.76	x	0.7	=	33.54	(79)
West 0.9x	0.77	x	0.87	x	19.64	x	0.76	x	0.7	=	6.3	(80)
West 0.9x	0.77	x	0.87	x	38.42	x	0.76	x	0.7	=	12.32	(80)
West 0.9x	0.77	x	0.87	x	63.27	x	0.76	x	0.7	=	20.29	(80)
West 0.9x	0.77	x	0.87	x	92.28	x	0.76	x	0.7	=	29.6	(80)
West 0.9x	0.77	x	0.87	x	113.09	x	0.76	x	0.7	=	36.27	(80)
West 0.9x	0.77	x	0.87	x	115.77	x	0.76	x	0.7	=	37.13	(80)
West 0.9x	0.77	x	0.87	x	110.22	x	0.76	x	0.7	=	35.35	(80)
West 0.9x	0.77	x	0.87	x	94.68	x	0.76	x	0.7	=	30.37	(80)
West 0.9x	0.77	x	0.87	x	73.59	x	0.76	x	0.7	=	23.6	(80)

West 0.9x	0.77] ×	0.87	×	45.59) ×	0.76	x	0.7	=	14.62	(80)
West 0.9x	0.77	」 】 x	0.87	x	24.49	 x	0.76	x	0.7	=	7.85	(80)
West 0.9x	0.77	x	0.87	x	16.15	x	0.76	x	0.7	=	5.18	(80)
Northwest 0.9x	0.54	x	3.5	x	11.28	x	0.76	x	0.7	=	10.2	(81)
Northwest 0.9x	0.77] x	1.69	x	11.28	x	0.76	x	0.7	=	7.03	(81)
Northwest 0.9x	0.77	x	0.77	x	11.28	×	0.76	x	0.7	=	3.22	(81)
Northwest 0.9x	0.77	x	0.67	x	11.28	x	0.76	x	0.7	=	2.77	(81)
Northwest 0.9x	0.54	x	3.5	x	22.97	×	0.76	x	0.7	=	20.76	(81)
Northwest 0.9x	0.77	x	1.69	x	22.97	×	0.76	x	0.7	=	14.3	(81)
Northwest 0.9x	0.77	x	0.77	x	22.97	×	0.76	x	0.7	=	6.55	(81)
Northwest 0.9x	0.77	x	0.67	x	22.97	×	0.76	x	0.7	=	5.63	(81)
Northwest 0.9x	0.54	x	3.5	x	41.38	x	0.76	x	0.7	=	37.4	(81)
Northwest 0.9x	0.77	x	1.69	x	41.38	x	0.76	x	0.7	=	25.77	(81)
Northwest 0.9x	0.77	x	0.77	×	41.38	×	0.76	x	0.7	=	11.79	(81)
Northwest 0.9x	0.77	x	0.67	x	41.38	×	0.76	x	0.7	=	10.14	(81)
Northwest 0.9x	0.54	x	3.5	x	67.96	×	0.76	x	0.7	=	61.43	(81)
Northwest 0.9x	0.77	x	1.69	x	67.96	x	0.76	x	0.7	=	42.32	(81)
Northwest 0.9x	0.77	x	0.77	x	67.96	x	0.76	x	0.7	=	19.37	(81)
Northwest 0.9x	0.77	x	0.67	×	67.96	×	0.76	x	0.7	=	16.66	(81)
Northwest 0.9x	0.54	x	3.5	x	91.35	×	0.76	x	0.7	=	82.57	(81)
Northwest 0.9x	0.77	x	1.69	x	91.35	x	0.76	x	0.7	=	56.88	(81)
Northwest 0.9x	0.77	x	0.77	x	91.35	×	0.76	x	0.7	=	26.03	(81)
Northwest 0.9x	0.77	x	0.67	x	91.35	×	0.76	x	0.7	=	22.4	(81)
Northwest 0.9x	0.54	x	3.5	x	97.38	x	0.76	x	0.7	=	88.03	(81)
Northwest 0.9x	0.77	x	1.69	x	97.38	x	0.76	x	0.7	=	60.64	(81)
Northwest 0.9x	0.77	x	0.77	x	97.38	x	0.76	x	0.7	=	27.75	(81)
Northwest 0.9x	0.77	x	0.67	x	97.38	x	0.76	x	0.7	=	23.88	(81)
Northwest 0.9x	0.54	x	3.5	x	91.1	x	0.76	x	0.7	=	82.35	(81)
Northwest 0.9x	0.77	x	1.69	×	91.1	x	0.76	x	0.7	=	56.73	(81)
Northwest 0.9x	0.77	x	0.77	×	91.1	×	0.76	x	0.7	=	25.96	(81)
Northwest 0.9x	0.77	x	0.67	x	91.1	x	0.76	x	0.7	=	22.34	(81)
Northwest 0.9x	0.54	x	3.5	×	72.63	×	0.76	x	0.7	=	65.65	(81)
Northwest 0.9x	0.77	x	1.69	x	72.63	×	0.76	x	0.7	=	45.22	(81)
Northwest 0.9x	0.77	x	0.77	x	72.63	×	0.76	x	0.7	=	20.7	(81)
Northwest 0.9x	0.77	x	0.67	x	72.63	×	0.76	x	0.7	=	17.81	(81)
Northwest 0.9x	0.54	×	3.5	×	50.42	×	0.76	x	0.7	=	45.58	(81)
Northwest 0.9x	0.77	×	1.69	×	50.42	×	0.76	x	0.7	=	31.4	(81)
Northwest 0.9x	0.77	×	0.77	×	50.42	×	0.76	x	0.7	=	14.37	(81)
Northwest 0.9x	0.77	×	0.67	×	50.42	×	0.76	x	0.7	=	12.36	(81)
Northwest 0.9x	0.54	×	3.5	×	28.07	×	0.76	x	0.7	=	25.37	(81)
Northwest 0.9x	0.77	x	1.69	x	28.07	x	0.76	x	0.7	=	17.48	(81)

					Г									
Northwest 0.9x	0.77	×	0.7		×L	28.0			0.76		0.7	=	8	(81)
Northwest 0.9x	0.77	×	0.6	57	×L	28.0)7	×	0.76		0.7	=	6.88	(81)
Northwest 0.9x	0.54	x	3.	5	×L	14.2	2	×	0.76	×	0.7	=	12.83	(81)
Northwest 0.9x	0.77	x	1.6	9	×	14.2	2	×	0.76	×	0.7	=	8.84	(81)
Northwest 0.9x	0.77	x	0.7	7	×	14.2	2	x	0.76	×	0.7	=	4.05	(81)
Northwest 0.9x	0.77	x	0.6	57	x	14.2	2	x	0.76	x	0.7	=	3.48	(81)
Northwest 0.9x	0.54	x	3.	5	×	9.21	1	x	0.76	x	0.7	=	8.33	(81)
Northwest 0.9x	0.77	x	1.6	9	×	9.21	1	x	0.76	×	0.7	=	5.74	(81)
Northwest 0.9x	0.77	x	0.7	7	×	9.21	1	x	0.76	x	0.7	=	2.63	(81)
Northwest 0.9x	0.77	x	0.6	57	×	9.21	1	x	0.76	×	0.7	=	2.26	(81)
					_									
Solar gains in v	vatts, ca	lculated	l for eac	h month				(83)m =	Sum(74)m .	(82)m				
(83)m= 136.42	242.86	359.64	490.64	590.06	603	3.44 5	74.45	497.68	3 404.65	275.83	165.32	115.5		(83)
Total gains – in	iternal a	nd solar	(84)m =	= (73)m	+ (8	3)m , w	vatts			•				
(84)m= 509.48	613.29	716.52	826.02	903.67	8	96 8	53.68	783.3	3 701.6	594.47	508.81	477.74		(84)
7. Mean interr	nal temp	erature	(heating	season)							-	-	
Temperature of			` U		<i>′</i>	rea fro	m Tab	ole 9. T	h1 (°C)				21	(85)
Utilisation fact	-	• •			-				(-)					
Jan	Feb	Mar	Apr	May	<u> </u>		Jul	Auç	Sep	Oct	Nov	Dec]	
(86)m= 1	0.99	0.98	0.93	0.82		-	0.48	0.54	0.79	0.96	0.99	1		(86)
]	
Mean internal	19.85				1	1	3 to 7			00.40		19.62	1	(87)
(87)m= 19.66	19.85	20.15	20.53	20.82	20	.96 2	20.99	20.98	20.88	20.49	20	19.62		(07)
Temperature	T	eating p		[1	<u> </u>	om Ta	ble 9,					1	
(88)m= 19.86	19.86	19.86	19.87	19.87	19	.88 1	9.88	19.88	19.88	19.87	19.87	19.86		(88)
Utilisation fact	tor for ga	ains for I	rest of d	welling,	h2,r	n (see	Table	9a)					_	
(89)m= 1	0.99	0.97	0.91	0.76	0.	54 (0.36	0.42	0.71	0.94	0.99	1		(89)
Mean internal	tempera	ature in	the rest	of dwell	ing T	Γ2 (follo	ow ste	eps 3 to	7 in Tabl	le 9c)				
(90)m= 18.08	18.37	18.81	19.34	19.7	Ť	<u> </u>	9.88	19.87	- T	19.29	18.59	18.03		(90)
L									1	fLA = Livi	ng area ÷ (4) =	0.47	(91)
Mean internal	tompor	oturo (fo	r tho wh	olo dwo	Illing) _ fl A	<u>у</u> Т1	. /1	fl A) y To					
(92)m= 18.82	19.06	19.44	19.89	20.23	Ť	<u> </u>	20.4	20.39		19.85	19.25	18.78	1	(92)
Apply adjustm													J	
(93)m= 18.82	19.06	19.44	19.89	20.23	ī —		20.4	20.39		19.85	19.25	18.78]	(93)
8. Space heat	ina reau	irement			1									
Set Ti to the m				e obtair	ned a	at step	11 of	Table	9b, so tha	t Ti,m=	(76)m an	d re-calo	culate	
the utilisation			•						,	,		-	_	
Jan	Feb	Mar	Apr	May	J	un	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fact	tor for ga	ains, hm	:								-			
(94)m= 0.99	0.99	0.97	0.91	0.78	0.	58 (0.42	0.47	0.74	0.94	0.99	1		(94)
Useful gains,	hmGm ,	W = (94	4)m x (84	4)m									1	
(95)m= 506.44	604.85	691.87	748.27	701.96			55.26	370.48	3 522.07	559.98	502.61	475.58	J	(95)
Monthly avera	<u> </u>				1					1	1	1	1	
(96)m= 4.3	4.9	6.5	8.9	11.7	14	4.6	16.6	16.4	14.1	10.6	7.1	4.2	J	(96)

Heat	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	-	-		
(97)m=	1402.65	1365.61	1245.06	1048.72	811.81	545.16	358.83	376.84	587.51	881.19	1160.74	1397.63		(97)
-	r		· · · · · · · · · · · · · · · · · · ·	i		Wh/mont	h = 0.02	24 x [(97))m – (95	r - ·	r			
(98)m=	666.78	511.23	411.57	216.32	81.73	0	0	0	0	238.98	473.86	686		-
								Tota	l per year	(kWh/year	⁻) = Sum(9	8)15,912 =	3286.47	(98)
Spac	e heatin	g require	ement in	kWh/m ²	/year								43.55	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
•	e heatir ion of sp	-	at from s	econdar	y/supple	mentary	system					[0	(201)
Fract	ion of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
			•	ing syste									90.3	(206)
	-			• •		g system	ı, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ur
Spac	e heatin	g require	ement (c	alculate	d above)						J	·	
	666.78	511.23	411.57	216.32	81.73	0	0	0	0	238.98	473.86	686		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20	6)									(211)
	738.41	566.14	455.78	239.56	90.51	0	0	0	0	264.65	524.76	759.69		_
								Tota	ll (kWh/yea	ar) =Sum(2	2 11) _{15,1012}	=	3639.51	(211)
•				y), kWh/	month									
	· · · ·		00 ÷ (20	· ·								· · · · · ·		
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		1 /2 / 2
								Tota	ll (kWh/yea	ar) =5um(2	210) _{15,1012}	=	0	(215)
	heating	•	tor (calc	ulated a										
Outpu	198.4	173.31	180.31	159.93	154.84	136.37	130.66	145.65	147.26	167.69	179	193.74		
Efficie	ncy of w	ater hea	iter										81	(216)
(217)m=	87.98	87.75	87.25	86.1	83.99	81	81	81	81	86.22	87.54	88.07		(217)
		-	kWh/m											
(219)m (219)m=		<u>m x 10(</u> 197.5) ÷ (217) 206.67	m 185.75	184.36	168.36	161.3	179.82	181.8	194.49	204.47	219.98		
(219)11-	223.49	197.5	200.07	165.75	104.30	100.30	101.5		l = Sum(2		204.47	219.90	2310	(219)
Δnnua	al totals										Wh/year	. l	kWh/year	
		fuel use	ed, main	system	1					ĸ	Will y Cal		3639.51]
Water	heating	fuel use	d										2310	Ī
Electri	city for p	oumps, f	ans and	electric	keep-ho	t						•		-
centra	al heatir	ig pump	:									30		(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Total e	electricity	/ for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =		[75	(231)
Electri	city for li	ghting										[330.91	(232)
Electri	city gen	erated b	y PVs									[-1069.95	(233)
												•		-

12a. CO2 emissions - Individual heating systems including micro-CHP Energy **Emission factor Emissions** kg CO2/kWh kg CO2/year kWh/year (211) x Space heating (main system 1) 0.216 = 786.13 (261) Space heating (secondary) (215) x = (263)0.519 0 (219) x Water heating = (264) 0.216 498.96 (261) + (262) + (263) + (264) = Space and water heating 1285.09 (265) Electricity for pumps, fans and electric keep-hot (231) x (267) 0.519 38.93 Electricity for lighting (232) x = (268) 0.519 171.74 Energy saving/generation technologies Item 1 0.519 = -555.3 (269) sum of (265)...(271) = Total CO2, kg/year 940.46 (272) **Dwelling CO2 Emission Rate** $(272) \div (4) =$ 12.46 (273)EI rating (section 14) (274) 90

Regulations Compliance Report

Approved Documer Printed on 05 Nove Project Information	mber 2019 at 13:23		roma FSAP 2012 program, Ver	rsion: 1.0.4.18	
Assessed By:	Su Lee (STRO031	315)	Building Type:	Flat	
Dwelling Details:	Υ.	,	0 /1		
NEW DWELLING	DESIGN STAGE		Total Floor Area: 6	2 93m ²	
Site Reference :	217 Kingston Road	ł	Plot Reference:	Front - Unit 3	
Address :		-			
Client Details:					
Name:					
Address :					
	tems included wi	thin the SAP calculation	s		
It is not a complete			5.		
1a TER and DER		•			
Fuel for main heatir	ng system: Mains ga	IS			
Fuel factor: 1.00 (m	• /				
Target Carbon Diox			20.1 kg/m ²		
Dwelling Carbon Di 1b TFEE and DFE		e (DER)	12.91 kg/m ²		OK
Target Fabric Energ			55.2 kWh/m ²		
Dwelling Fabric Energy			48.4 kWh/m²		
D froming r dono En)			ок
2 Fabric U-values	5				
Element		Average	Highest		
External w	vall	0.15 (max. 0.30)	0.15 (max. 0.70)		ОК
Party wall		0.00 (max. 0.20)	-		OK
Floor		0.13 (max. 0.25)	0.13 (max. 0.70)		OK
Roof Openings		0.13 (max. 0.20) 1.20 (max. 2.00)	0.13 (max. 0.35) 1.20 (max. 3.30)		OK OK
2a Thermal bridg	ina	1.20 (max. 2.00)	1.20 (max. 5.50)		UK
		om linear thermal transmit	tances for each junction		
3 Air permeability					
	ility at 50 pascals		4.00 (design val	ue)	
Maximum	, i		10.0	,	ОК
4 Heating efficien	ncy				
Main Heating		Boiler systems with radia Data from manufacturer Combi boiler Efficiency 89.5 % SEDB Minimum 88.0 %		ains gas	ок
Secondary h	eating system:	None			
5 Cylinder insula	tion				
Hot water St	orage:	No cylinder			N/A

Regulations Compliance Report

6 Controls			
Space heating controls	TTZC by plumbing and e	electrical services	ОК
Hot water controls:	No cylinder thermostat No cylinder		
Boiler interlock:	Yes		ОК
7 Low energy lights			
Percentage of fixed lights wit	h low-energy fittings	100.0%	
Minimum		75.0%	ОК
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames va	lley):	Medium	ОК
Based on:			
Overshading:		Average or unknown	
Windows facing: North East		6.9m ²	
Windows facing: South East		3.41m ²	
Windows facing: South East		0.97m ²	
Windows facing: South East		2.41m ²	
Windows facing: North East		6.7m ²	
Ventilation rate:		4.00	
Blinds/curtains:		None	
10 Key features			
Party Walls U-value		0 W/m²K	
Photovoltaic array			

				User D	Details:						
Assessor Name: Software Name:	Su Lee Stroma FS	SAP 201			Strom Softwa	are Vei	rsion:			031315 n: 1.0.4.18	
A daha a a			PI	operty	Address	: Front -	Unit 3				
Address : 1. Overall dwelling dim	ensions:										
	cholono.			Δre	a(m²)		Av. Hei	aht(m)		Volume(m ³)	
Basement				-	. ,	(1a) x		.6	(2a) =	86.45	(3a)
Ground floor						(1b) x	2	81	(2b) =	83.41](3b)
Total floor area TFA = (1a)+(1b)+(1c)+	(1d)+(1e)+ (1n		52.93	(4)				00.11	
Dwelling volume		(10) (10	,	′	52.95)+(3c)+(3d)+(3e)+	.(3n) =	169.86	(5)
2. Ventilation rate:											_]
2. Vontilation rate.	main heating		econdarg	y	other		total			m ³ per hour	
Number of chimneys	0	_ + [0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0	_ + _	0	ī + [0	- -	0	x 2	20 =	0	(6b)
Number of intermittent f	ans					- T	3	x ^	0 =	30	(7a)
Number of passive vent	S					Γ	0	x	0 =	0	(7b)
Number of flueless gas	fires					Г	0	x 4	40 =	0	(7c)
									A :		_
Infiltration due to object	ere flere erel	(c)	-).(Ch).(7	-).(7 -).(7.0	-			1	anges per hou	-
Infiltration due to chimne If a pressurisation test has	•					continue fr	30 om (9) to (÷ (5) =	0.18	(8)
Number of storeys in			,							0	(9)
Additional infiltration	U V	,						[(9)-	1]x0.1 =	0	(10)
Structural infiltration:	0.25 for steel c	r timber f	rame or	0.35 fo	r masoni	ry constr	uction		-	0	(11)
if both types of wall are deducting areas of open			ponding to	the grea	ter wall are	a (after					_
If suspended wooden	floor, enter 0.2	2 (unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, e	nter 0.05, else	enter 0								0	(13)
Percentage of windov	vs and doors d	raught st	ripped							0	(14)
Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	- (15) =		0	(16)
Air permeability value				•	•	•	etre of e	nvelope	area	4	(17)
If based on air permeab	-									0.38	(18)
Air permeability value appl		ion test has	s been don	e or a de	gree air pe	rmeability	is being us	sed	1		-
Number of sides shelter Shelter factor	ed				(20) = 1 -	[0 075 x (1	9)1 -			2	(19)
	ting chalter fo	otor					[0]] =			0.85	(20)
Infiltration rate incorpora	•		1		(21) = (18	, x (20) =				0.32	(21)
Infiltration rate modified		<u> </u>		11	A~	See	Oct	Nev	Dee		
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s		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 (2	22a)m =	(22)m ÷	4										
<mark>(22a)m=</mark> 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 rat	e (allowi	ing for sl	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.3	0.32	0.34	0.36	0.38		
Calculate effect		-	rate for t	he appli	cable ca	ise		<u>.</u>		<u>.</u>	<u>.</u>		
If mechanica			andix N (2	(23b) - (23c	a) x Emv (equation (N5)) othe	nuise (23)	(232)) (23a)
If balanced with) – (200)) (23b)
a) If balance		•		Ū				,	2h)m + (23h) y [1 – (23c)	(∸ 1001) (23c)
(24a)m= 0			0	0	0			0	0		0	. 100]	(24a)
b) If balance	ed mech	ı anical ve	ntilation	u without	heat red	L Coverv (I	u MV) (24t	m = (2)	1 2b)m + (23b)			
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h	iouse ex	tract ver	ntilation of	r positiv	/e input [,]	ventilatio	on from a	outside		<u>.</u>			
if (22b)n	n < 0.5 >	(23b), t	then (24	c) = (23k	o); other	wise (24	-c) = (22t	b) m + 0	.5 × (23k	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural									0.51				
If (22b)n (24d)m= 0.58	n = 1, tn 0.58	en (24a) 0.58	m = (221	0.56	0.55	(40)m = 0.55	0.5 + [(2	2D)m ² X	0.5	0.56	0.57		(24d)
Effective air									0.50	0.50	0.07		(210)
(25)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57		(25)
	I	I											
3. Heat losse					Not Ar								
3. Heat losse	s and he Gros area	SS	parameto Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/		k-value kJ/m²·I		A X k kJ/K
ELEMENT	Gros	SS	Openin	gs		m²				K)			
ELEMENT Doors	Gros area	SS	Openin	gs	A ,r	m²	W/m2	2K =	(W/	K)			kJ/K
ELEMENT Doors Windows Type	Gros area	SS	Openin	gs	A ,r 2.09	m ² x	W/m2	2K = • 0.04] =	(W/ 2.5116	K)			kJ/K (26)
ELEMENT Doors Windows Type Windows Type	Gros area e 1 e 2	SS	Openin	gs	A ,r 2.09 6.9	m ² x x 3 x ¹ 3 x ¹	W/m2 1.2 /[1/(1.2)+	2K = = • 0.04] = • 0.04] =	(W/ 2.5116 7.9	K)			kJ/K (26) (27)
	Gros area e 1 e 2 e 3	SS	Openin	gs	A ,r 2.09 6.9 3.400	m ² x x1 3 x1 7 x1	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+	2K = • 0.04] = • 0.04] = • 0.04] =	(W/ 2.5116 7.9 3.9	K)			kJ/K (26) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type	Gros area 4 2 3 4 4	SS	Openin	gs	A,r 2.09 6.9 3.400 0.967	m ² x x1 5 x1 7 x1 3 x1	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	$\frac{2K}{2} = \frac{2}{2} = 2$	(W/ 2.5116 7.9 3.9 1.11	K)			kJ/K (26) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type	Gros area 4 2 3 4 4	SS	Openin	gs	A ,r 2.09 6.9 3.400 0.967 2.408	m ² x x1 5 x1 7 x1 3 x1 3 x1 x1 x1	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	$\frac{2}{2} = \frac{2}{2}	(W/ 2.5116 7.9 3.9 1.11 2.76	к))) 			kJ/K (26) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type	Gros area 4 2 3 4 4	ss (m²)	Openin	gs	A ,r 2.09 6.9 3.400 0.967 2.408 6.7	m ² x x1 5 x1 7 x1 3 x1 5 x1 5 x	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	$\frac{2}{2} = \frac{2}{2}	(W/ 2.5116 7.9 3.9 1.11 2.76 7.67	к))) 			kJ/K (26) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Floor	Gros area 4 5	ss (m²)	Openin rr	gs 1 ²	A,r 2.09 6.9 3.400 2.400 6.7 33.25	m ² x x1 3 x1 3 x1 3 x1 3 x1 5 x 3 x1 5 x	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	$\frac{2}{2} = \frac{2}{2}	(W/ 2.5116 7.9 3.9 1.11 2.76 7.67 4.3225	к))) 			kJ/K (26) (27) (27) (27) (27) (27) (28)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Floor Walls Type1	Gros area 2 2 3 4 5 12.1	I3	Openin m	gs 1 ²	A ,r 2.09 6.9 3.406 2.408 6.7 33.25 12.13	$ m^{2} \\ $	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ (1/(1.2)+ 0.13 0.15	$\frac{2}{2} = \frac{2}{2}$	(W/ 2.5116 7.9 3.9 1.11 2.76 7.67 4.3225 1.82	к))) 			kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (29)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2	Gros area 2 2 3 4 5 12.1 21.1	I3 I3 I8	Openin m 0 10.3	gs 1 ²	A,r 2.09 6.9 3.400 2.400 6.7 33.25 12.13 10.83	$ m^{2} \\ $	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.13 0.15 0.15	$\frac{2}{2} = \frac{2}{2}$	(W/ 2.5116 7.9 3.9 1.11 2.76 7.67 4.3225 1.82 1.62	к))) 			kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (29) (29)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3	Gros area = 1 = 2 = 3 = 4 = 5 12.1 21.1 31.1	3 (m ²) 3 13 18	Openin m 0 10.3 12.1	gs 1 ²	A,r 2.09 6.9 3.400 0.967 2.400 6.7 33.25 12.13 10.83	m ² x x1 5 x1 7 x1 3 x1 5 x x1 5 x x3 3 x x2 2 x x	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ (1/(1.2)+ 0.13 0.15 0.15	$\frac{2}{2} \frac{1}{2} = \frac{1}{2} $	(W/ 2.5116 7.9 3.9 1.11 2.76 7.67 4.3225 1.82 1.62 2.85	к))) 			kJ/K (26) (27) (27) (27) (27) (27) (28) (29) (29) (29)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Roof Type1	Gros area = 1 = 2 = 3 = 4 = 5 12.1 21.1 31.1 1.8 5.2	ISS (m ²) IS IS IS IS IS IS IS IS IS IS IS IS IS	Openin m 0 10.3 12.1 0	gs 1 ²	A,r 2.09 6.9 3.400 0.967 2.408 6.7 33.25 12.13 10.83 19.02 1.8	$ m^{2} \\ $	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.13 0.15 0.15 0.15 0.13	$\frac{2}{2} \frac{1}{2} = \frac{1}{2} $	(W/ 2.5116 7.9 3.9 1.11 2.76 7.67 4.3225 1.82 1.62 2.85 0.23	к))) 			kJ/K (26) (27) (27) (27) (27) (27) (28) (29) (29) (29) (29) (30)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Roof Type1 Roof Type2	Gros area = 1 = 2 = 3 = 4 = 5 12.1 21.1 31.1 1.8 5.2	ISS (m ²) IS IS IS IS IS IS IS IS IS IS IS IS IS	Openin m 0 10.3 12.1 0	gs 1 ²	A ,r 2.09 6.9 3.400 2.408 6.7 33.29 12.13 10.83 19.02 1.8 5.26	$ m^{2} \\ $	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.13 0.15 0.15 0.15 0.13	$\frac{2}{2} \frac{1}{2} = \frac{1}{2} $	(W/ 2.5116 7.9 3.9 1.11 2.76 7.67 4.3225 1.82 1.62 2.85 0.23	к))) 			kJ/K (26) (27) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (30)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Roof Type1 Roof Type2 Total area of e	Gros area = 1 = 2 = 3 = 4 = 5 12.1 21.1 31.1 1.8 5.2	ISS (m ²) IS IS IS IS IS IS IS IS IS IS IS IS IS	Openin m 0 10.3 12.1 0	gs 1 ²	A,r 2.09 6.9 3.400 0.967 2.400 6.7 33.25 12.13 10.83 19.02 1.8 5.26	$ m^{2} \\ $	W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ 0.13 0.15 0.15 0.15 0.13 0.13	$\frac{2}{2} = \frac{2}{2}	(W/ 2.5116 7.9 3.9 1.11 2.76 7.67 4.3225 1.82 1.62 2.85 0.23 0.68	к))) 			kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (29) (29) (29) (29) (30) (30) (31)

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

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

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

^{37.38 (33)}

Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm -	÷ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
	-	sments wh ad of a de			e constructi	ion are noi	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	<						12.72	(36)
if details	of therma	al bridging	are not kr	nown (36) :	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			50.1	(37)
Ventila	ation hea	at loss ca	alculated	d monthl	у				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.7	32.52	32.34	31.5	31.35	30.62	30.62	30.49	30.9	31.35	31.66	31.99		(38)
Heat tr	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m		•	
(39)m=	82.8	82.62	82.44	81.61	81.45	80.72	80.72	80.59	81	81.45	81.77	82.1	1	
Heat lo	oss para	ımeter (H	HLP), W	/m²K			1			Average = = (39)m ÷	Sum(39)1. (4)	12 /12=	81.61	(39)
(40)m=	1.32	1.31	1.31	1.3	1.29	1.28	1.28	1.28	1.29	1.29	1.3	1.3		
N I I			1	I					/	Average =	Sum(40)1.	₁₂ /12=	1.3	(40)
NUMDE	-	/s in moi Feb	, 	, <u> </u>	May	lup	lul	Δυα	Son	Oct	Nov	Doc	1	
(41)m -	Jan		Mar	Apr 20	May 21	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(41)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	J	(41)
4. Wa	ater hea	ting enei	rgy requ	irement:								kWh/y	ear:	
		upancy, l 9, N = 1		: [1 - exp	o(-0.0003	849 x (TF	- A -13.9)2)] + 0.0)013 x (1	ΓFA -13.		06]	(42)
	A £ 13.	,											•	
								(25 x N) to achieve		se target o		3.2		(43)
		-			/ater use, l	-	-			J				
	Jan	Feb	Mar	Apr	May		1							
Hot wate	er usage i	n litres per	day for ea	ach month		Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(44)m=	91.52	88.2	I		Vd,m = fa			Aug (43)	Sep	Oct	Nov	Dec]	
			84.87	81.54	, <u>,</u>				Sep 81.54	Oct 84.87	Nov 88.2	Dec 91.52]	
Enorm			84.87		Vd,m = fa	ctor from	Table 1c x	(43)	81.54	84.87		91.52	998.44	(44)
Energy	content of	hot water		81.54	Vd,m = fa 78.21	ctor from 7 74.88	Table 1c x 74.88	(43)	81.54	84.87 Total = Su	88.2 m(44) ₁₁₂ =	91.52	998.44	(44)
	content of 135.73	hot water 118.71		81.54	Vd,m = fa 78.21	ctor from 7 74.88	Table 1c x 74.88	(43) 78.21	81.54	84.87 Total = Su	88.2 m(44) ₁₁₂ =	91.52	998.44	(44)
(45)m=			used - cai	81.54	Vd,m = fa 78.21 onthly = 4.	ctor from 7 74.88 190 x Vd,r	Table 1c x 74.88 n x nm x D	(43) 78.21 0Tm / 3600	81.54 kWh/mon 95.15	84.87 Total = Su th (see Ta 110.89	88.2 m(44) ₁₁₂ = ables 1b, 1	91.52 c, 1d) 131.44	998.44	(44)
(45)m=	135.73	118.71	used - cal 122.5	81.54 Iculated mi 106.79	Vd,m = fa 78.21 onthly = 4.	ctor from 7 74.88 190 x Vd,r 88.43	Table 1c x 74.88 n x nm x L 81.94	(43) 78.21 0Tm / 3600	81.54 kWh/mon 95.15	84.87 Total = Su th (see Ta 110.89	88.2 m(44) ₁₁₂ = ables 1b, 1 121.04	91.52 c, 1d) 131.44]	_
(45)m= <i>If instan</i> (46)m=	135.73 taneous w 20.36	118.71 vater heatii 17.81	used - cal 122.5	81.54 Iculated mi 106.79	Vd,m = fa 78.21 onthly = 4.	ctor from 7 74.88 190 x Vd,r 88.43	Table 1c x 74.88 n x nm x L 81.94	(43) 78.21 07 <i>m / 3600</i> 94.03	81.54 kWh/mon 95.15	84.87 Total = Su th (see Ta 110.89	88.2 m(44) ₁₁₂ = ables 1b, 1 121.04	91.52 c, 1d) 131.44]	_
(45)m= <i>If instan</i> (46)m= Water	135.73 taneous w 20.36 storage	118.71 vater heatii 17.81 IOSS:	used - cai 122.5 ng at point 18.37	81.54 Iculated me 106.79 t of use (no 16.02	Vd,m = fa 78.21 0nthly = 4. 102.47 0 hot water 15.37	ctor from 7 74.88 190 x Vd,r 88.43 • storage), 13.26	Fable 1c x 74.88 n x nm x E 81.94 enter 0 in 12.29	(43) 78.21 DTm / 3600 94.03 boxes (46) 14.1	81.54 9 <i>kWh/mon</i> 95.15 9 <i>to</i> (61) 14.27	84.87 Fotal = Su <i>ith (see Ta</i> 110.89 Fotal = Su 16.63	88.2 m(44) ₁₁₂ = ables 1b, 1 121.04 m(45) ₁₁₂ = 18.16	91.52 c, 1d) 131.44 19.72]	(45) (46)
(45)m= <i>If instan</i> (46)m= Water Storag	135.73 taneous w 20.36 storage ye volum	118.71 vater heatii 17.81 loss: ne (litres)	used - cai 122.5 ng at point 18.37) includir	81.54 Iculated m 106.79 t of use (no 16.02	Vd,m = fa 78.21 102.47 $b hot water$ 15.37 $colar or W$	ctor from 7 74.88 190 x Vd,r 88.43 storage), 13.26 /WHRS	Table 1c x 74.88 n x nm x E 81.94 enter 0 in 12.29 storage	(43) 78.21 0 <i>Tm / 3600</i> 94.03 <i>boxes (46)</i> 14.1 within sa	81.54 9 <i>kWh/mon</i> 95.15 9 <i>to</i> (61) 14.27	84.87 Fotal = Su <i>ith (see Ta</i> 110.89 Fotal = Su 16.63	88.2 m(44) ₁₁₂ = ables 1b, 1 121.04 m(45) ₁₁₂ = 18.16	91.52 c, 1d) 131.44]	(45)
(45)m= If instan (46)m= Water Storag If comi Otherv	135.73 taneous w 20.36 storage je volum munity h vise if no	118.71 vater heatin 17.81 loss: ne (litres) neating a postored	used - cai 122.5 ng at point 18.37) includir	81.54 Iculated mile 106.79 t of use (no 16.02 ng any se ank in dw	Vd,m = fa 78.21 0nthly = 4. 102.47 0 hot water 15.37 0lar or W velling, e	ctor from 7 74.88 190 x Vd,r 88.43 storage), 13.26 /WHRS nter 110	Table 1c x 74.88 n x nm x L 81.94 enter 0 in 12.29 storage litres in	(43) 78.21 0 <i>Tm / 3600</i> 94.03 <i>boxes (46)</i> 14.1 within sa	81.54 9 <i>kWh/mon</i> 95.15 9 <i>to</i> (61) 14.27	84.87 Total = Su <i>ith (see Ta</i> 110.89 Total = Su 16.63 sel	88.2 m(44) ₁₁₂ = ables 1b, 1 121.04 m(45) ₁₁₂ = 18.16	91.52 c, 1d) 131.44 19.72]	(45) (46)
(45)m= If instan (46)m= Water Storag If comi Otherv Water	135.73 taneous w 20.36 storage ye volum munity h vise if no storage	118.71 vater heatin 17.81 loss: ne (litres) neating a p stored loss:	used - cai 122.5 ng at point 18.37) includir ind no ta hot wate	81.54 Iculated mi 106.79 t of use (no 16.02 ng any so ank in dw er (this ir	Vd,m = fa 78.21 000000000000000000000000000000000000	ctor from 7 74.88 190 x Vd,r 88.43 storage), 13.26 /WHRS nter 110 nstantar	Table 1c x 74.88 n x nm x L 81.94 enter 0 in 12.29 storage litres in neous co	(43) 78.21 07m / 3600 94.03 boxes (46) 14.1 within sa (47)	81.54 9 <i>kWh/mon</i> 95.15 9 <i>to</i> (61) 14.27	84.87 Total = Su <i>ith (see Ta</i> 110.89 Total = Su 16.63 sel	88.2 m(44) ₁₁₂ = ables 1b, 1 121.04 m(45) ₁₁₂ = 18.16	91.52 c, 1d) 131.44 19.72]	(45) (46) (47)
(45)m= <i>If instan</i> (46)m= Water Storag If comi Otherv Water a) If m	135.73 taneous w 20.36 storage je volum munity h vise if no storage nanufact	118.71 vater heatin 17.81 loss: he (litres) heating a postored loss: surer's de	used - cal 122.5 ng at point 18.37) includir ind no ta hot wate eclared l	81.54 Iculated mi 106.79 t of use (no 16.02 ng any si ank in dw er (this ir	Vd,m = fa 78.21 0nthly = 4. 102.47 0 hot water 15.37 0lar or W velling, e	ctor from 7 74.88 190 x Vd,r 88.43 storage), 13.26 /WHRS nter 110 nstantar	Table 1c x 74.88 n x nm x L 81.94 enter 0 in 12.29 storage litres in neous co	(43) 78.21 07m / 3600 94.03 boxes (46) 14.1 within sa (47)	81.54 9 <i>kWh/mon</i> 95.15 9 <i>to</i> (61) 14.27	84.87 Total = Su <i>ith (see Ta</i> 110.89 Total = Su 16.63 sel	88.2 m(44) ₁₁₂ = ables 1b, 1 121.04 m(45) ₁₁₂ = 18.16	91.52 c, 1d) 131.44 19.72 0]	(45) (46) (47) (48)
(45)m= <i>If instan</i> (46)m= Water Storag If com Otherv Water a) If m Tempe	135.73 taneous w 20.36 storage ye volum munity h vise if no storage nanufact erature f	118.71 vater heatin 17.81 loss: ne (litres) neating a postored loss: curer's de actor fro	used - cai 122.5 ng at point 18.37 includir ind no ta hot wate eclared I m Table	81.54 Iculated mi 106.79 t of use (no 16.02 ng any si ank in dw er (this ir	Vd,m = fa 78.21 000000000000000000000000000000000000	ctor from 7 74.88 190 x Vd,r 88.43 storage), 13.26 /WHRS nter 110 nstantar	Table 1c x 74.88 n x nm x L 81.94 enter 0 in 12.29 storage litres in neous conditional conditions h/day):	(43) 78.21 07m / 3600 94.03 boxes (46) 14.1 within sa (47)	81.54 9 <i>kWh/mon</i> 95.15 9 <i>to</i> (61) 14.27 ame vess ers) ente	84.87 Total = Su <i>ith (see Ta</i> 110.89 Total = Su 16.63 sel	88.2 m(44) ₁₁₂ = ables 1b, 1 121.04 m(45) ₁₁₂ = 18.16	91.52 c, 1d) 131.44 19.72]	(45) (46) (47)

If com	munity ł	age loss neating s from Tal	ee secti		le 2 (kW	h/litre/da	ay)				г	0		(51)
		actor fro		2b								0		(53)
Enera	/ lost fro	om water	storage	. kWh/ve	ear			(47) x (51)) x (52) x (53) =		0		(54)
•••		(54) in (5	-	, ,						,		0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m			I	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	ĺ	(56)
If cylinde	er contain	s dedicate	d solar sto	l orage, (57)	I m = (56)m	x [(50) – (I H11)] ÷ (5	0), else (5	1 7)m = (56)	m where (H11) is fro	m Append	l lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
												0		(58)
		t loss (an t loss cal	,			59)m – ((58) ÷ 36	5 v (11)	m			0	i	(00)
	•	/ factor fi			,	,	. ,	· · /		r thermo	stat)			
、 (59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi		lculated	for each	month	(61)m –	ا (60) – 3(65 x (41))m						
(61)m=	46.64	40.59	43.25	40.21	39.86	36.93	38.16	39.86	40.21	43.25	43.49	46.64	1	(61)
] (59)m + (61)m	
(62)m=	182.37	159.3	165.74	147.01	142.33	125.35	120.1	133.88	135.36	154.13	164.54	178.08	(59)11 + (61)11	(62)
													l	(02)
		calculated								r contribut	on to wate	er neating)		
(auu a (63)m=									0	0	0	0	1	(63)
			-	0	0	0	0	0	0	0	0	0	l	(00)
(64)m=	182.37	ater hea 159.3	165.74	147.01	142.33	125.35	120.1	133.88	135.36	154.13	164.54	178.08	I	
(04)11=	102.37	159.5	103.74	147.01	142.55	120.00	120.1		out from wa				1808.19	(64)
	aina fra		haatina		anth 0.0		(45)							
	r	m water	1	r	r	1	r	r				I]	(65)
(65)m=	56.79	49.62	51.54	45.56	44.04	38.63	36.78	41.23	41.69	47.68	51.12	55.36	1	(03)
		m in calo		. ,	-	ylinder i	s in the d	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab		ns (Table		ts		i							I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	103.16	103.16	103.16	103.16	103.16	103.16	103.16	103.16	103.16	103.16	103.16	103.16		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	16.07	14.28	11.61	8.79	6.57	5.55	5.99	7.79	10.46	13.28	15.5	16.52		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5		-		
(68)m=	180.28	182.15	177.44	167.4	154.74	142.83	134.87	133	137.72	147.75	160.42	172.33		(68)
Cookir	ng gains	(calcula	ited in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5				
(69)m=	33.32	33.32	33.32	33.32	33.32	33.32	33.32	33.32	33.32	33.32	33.32	33.32		(69)
Pumps	and fa	ns gains	(Table !	5a)		-			-				'	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. e\	, aporatio	n (nega	tive valu	es) (Tab	le 5)	•	•					1	
(71)m=	-82.53	-82.53	-82.53	-82.53	-82.53	-82.53	-82.53	-82.53	-82.53	-82.53	-82.53	-82.53		(71)
Water	heating	gains (T	able 5)	1	1	1				L	L		1	
(72)m=	76.33	73.84	, 69.28	63.28	59.19	53.66	49.44	55.41	57.9	64.09	71	74.42		(72)
	L												i	

Total internal gain	s =			(6	6)m + (67)n	n + (6 8	3)m + (69)m +	(70)m +	(71)m + (72))m		
(73)m= 329.63 327.	22 315.28	296.42	277.44	258.98	3 247.26	253	.16 263.03	282.0	7 303.87	320.21		(73)
6. Solar gains:												
Solar gains are calcula	ted using sola	ar flux from	Table 6a	and asso	ciated equa	ations	to convert to t	he applic		tion.		
Orientation: Acces Table		Area m²	l		lux able 6a		g_ Table 6b		FF Table 6c		Gains	
	ou			·	able oa	-					(W)	_
	.54 ×	6	.9	×	11.28	X	0.76	×	0.7	=	20.13	(75)
	.77 ×	6	.7	×	11.28	×	0.76	×	0.7	=	27.87	(75)
	.54 ×	6	.9	x	22.97	x	0.76	x	0.7	=	40.97	(75)
Northeast 0.9x (.77 ×	6	.7	x	22.97	x	0.76	x	0.7	=	56.73	(75)
	0.54 ×	6	.9	x	41.38	x	0.76	x	0.7	=	73.82	(75)
).77 ×	6	.7	x	41.38	x	0.76	x	0.7	=	102.21	(75)
Northeast 0.9x (0.54 ×	6	.9	x	67.96	x	0.76	x	0.7	=	121.23	(75)
Northeast 0.9x ().77 ×	6	.7	x	67.96	x	0.76	x	0.7	=	167.86	(75)
Northeast 0.9x	.54 ×	6	.9	x	91.35	x	0.76	x	0.7	=	162.96	(75)
Northeast 0.9x ().77 ×	6	.7	x	91.35	x	0.76	x	0.7	=	225.64	(75)
Northeast 0.9x (0.54 ×	6	.9	x	97.38	x	0.76	x	0.7	=	173.73	(75)
Northeast 0.9x ().77 ×	6	.7	x	97.38	x	0.76	x	0.7	=	240.55	(75)
Northeast 0.9x (.54 ×	6	.9	x	91.1	x	0.76	x	0.7	=	162.53	(75)
Northeast 0.9x ().77 ×	6	.7	x	91.1	x	0.76	x	0.7	=	225.03	(75)
Northeast 0.9x (.54 ×	6	.9	x	72.63	x	0.76	x	0.7	=	129.57	(75)
Northeast 0.9x ().77 ×	6	.7	x	72.63	x	0.76	x	0.7	=	179.4	(75)
Northeast 0.9x (.54 ×	6	.9	x	50.42	x	0.76	x	0.7	=	89.95	(75)
Northeast 0.9x ().77 ×	6	.7	x	50.42	x	0.76	x	0.7	=	124.55	(75)
Northeast 0.9x (.54 ×	6	.9	x	28.07	x	0.76	x	0.7	=	50.07	(75)
Northeast 0.9x ().77 ×	6	.7	x	28.07	×	0.76	x	0.7	=	69.33	(75)
Northeast 0.9x (.54 ×	6	.9	x	14.2	x	0.76	x	0.7	=	25.33	(75)
Northeast 0.9x ().77 ×	6	.7	x	14.2	x	0.76	x	0.7	=	35.07	(75)
Northeast 0.9x (0.54 ×	6	.9	x	9.21	×	0.76	x	0.7	=	16.44	(75)
Northeast 0.9x ().77 ×	6	.7	x	9.21	x	0.76	x	0.7	=	22.76	(75)
Southeast 0.9x (.54 ×	3.4	41	x	36.79] ×	0.76	x	0.7	=	32.4	(77)
Southeast 0.9x ().77 ×	0.	97	×	36.79] x	0.76	×	0.7	=	13.12	(77)
Southeast 0.9x ().77 ×	2.	41	x	36.79] x	0.76	x	0.7	=	32.66	(77)
Southeast 0.9x (0.54 ×	3.4	41	x	62.67] ×	0.76	×	0.7		55.19	(77)
).77 ×	0.	97	x	62.67] x	0.76	x	0.7	=	22.34	(77)
).77 ×	2.4	41	x	62.67] x	0.76	×	0.7	=	55.64	(77)
	0.54 ×			×	85.75] x	0.76	×	0.7	=	75.52	(77)
	0.77 ×		97	x	85.75	」 】 ×	0.76	×	0.7	=	30.57	(77)
).77 ×			×	85.75] ×	0.76	×	0.7	=	76.13	(77)
	0.54 ×		41	×	106.25] ×	0.76	×	0.7	=	93.57	(77)
	^	<u>, , , , , , , , , , , , , , , , , </u>				<u>ن</u> ۱	L		L			

		_						•			_						_
Southeast 0.9x	0.77	×	0.9	07	x	10	06.25	x		0.76	×		0.7		=	37.88	(77)
Southeast 0.9x	0.77	x	2.4	1	x	10	06.25	x		0.76	x		0.7		=	94.33	(77)
Southeast 0.9x	0.54	x	3.4	1	x	11	19.01	x		0.76	x		0.7		=	104.8	(77)
Southeast 0.9x	0.77	x	0.9)7	x	1	19.01	x		0.76	x		0.7		=	42.43	(77)
Southeast 0.9x	0.77	x	2.4	1	x	1'	19.01	x		0.76	x		0.7		=	105.65	(77)
Southeast 0.9x	0.54	x	3.4	1	x	1'	18.15	x		0.76	x		0.7		=	104.05	(77)
Southeast 0.9x	0.77	x	0.9	17	x	1	18.15	x		0.76	x		0.7		=	42.12	(77)
Southeast 0.9x	0.77	x	2.4	1	x	1	18.15	x		0.76	x		0.7		=	104.89	(77)
Southeast 0.9x	0.54	x	3.4	1	x	1	13.91	x		0.76	x		0.7		=	100.31	(77)
Southeast 0.9x	0.77	x	0.9	17	x	1'	13.91	x		0.76	x		0.7		=	40.61	(77)
Southeast 0.9x	0.77	x	2.4	1	x	1	13.91	x		0.76	x		0.7		=	101.13	(77)
Southeast 0.9x	0.54	x	3.4	1	x	10	04.39	x		0.76	x		0.7		=	91.93	(77)
Southeast 0.9x	0.77	×	0.9	07	x	10	04.39	x		0.76	x		0.7		=	37.22	(77)
Southeast 0.9x	0.77	x	2.4	1	x	10	04.39	x		0.76	x		0.7		=	92.67	(77)
Southeast 0.9x	0.54	x	3.4	1	x	9	2.85	x		0.76	x		0.7		=	81.77	(77)
Southeast 0.9x	0.77	×	0.9	07	x	9	2.85	x		0.76	x		0.7		=	33.1	(77)
Southeast 0.9x	0.77	×	2.4	1	x	9	2.85	x		0.76	×		0.7		=	82.43	(77)
Southeast 0.9x	0.54	×	3.4	1	x	6	9.27	x		0.76	×		0.7		=	61	(77)
Southeast 0.9x	0.77	×	0.9	07	x	6	9.27	x		0.76	×		0.7		=	24.69	(77)
Southeast 0.9x	0.77	×	2.4	1	x	6	9.27	x		0.76	x		0.7		=	61.49	(77)
Southeast 0.9x	0.54	×	3.4	1	x	4	4.07	x		0.76	x		0.7		=	38.81	(77)
Southeast 0.9x	0.77	× آ	0.9	07	x	4	4.07	İ x		0.76	×		0.7		=	15.71	(77)
Southeast 0.9x	0.77	×	2.4	1	x	4	4.07	x		0.76	×		0.7		=	39.12	(77)
Southeast 0.9x	0.54	×	3.4	1	x	3	1.49	x		0.76	×		0.7		=	27.73	(77)
Southeast 0.9x	0.77	× آ	0.9	07	x	3	1.49	x		0.76	۲ ×		0.7		=	11.23	(77)
Southeast 0.9x	0.77	×	2.4	1	x	3	1.49	x		0.76	×		0.7	=	=	27.95	(77)
ľ								1									
Solar gains in	watts. calc	ulated	for eac	n mont	h			(83)m	า = Su	ım(74)m	(82)n	า					
(83)m= 126.18		58.25	514.87	641.49	_	65.35	629.6	530		411.8	266.5	_	154.04	106	.11		(83)
Total gains – i	internal and	l solar	(84)m =	= (73)m	+ (8	83)m	, watts										
(84)m= 455.82	558.1 6	73.52	811.29	918.93	9	24.33	876.86	783	.94	674.82	548.6	66	457.91	426	.32		(84)
7. Mean inte	rnal temper	ature	(heating	seaso	n)			•	!	ı							
Temperature			` °		<i>.</i>	area f	rom Tał	ole 9	Th1	(°C)						21	(85)
Utilisation fac	-	• •			-			510 0	,	(0)						21	(00)
Jan	Feb	Mar	Apr	May	ТÌ	Jun	Jul	Δ	ug	Sep	Oc	t I	Nov	D	ес		
(86)m= 1		0.97	0.89	0.73		0.54	0.4	0.4	-	0.74	0.95		0.99	1			(86)
					_												
Mean interna (87)m= 19.65	<u> </u>	20.21	20.62	ea 11 (1 20.88	_	20.98	21 ps 3 to 1	20.	-	9C) 20.91	20.5	2	20.01	19.	81		(87)
	I				_						20.5	2	20.01	19.	51		(07)
Temperature		<u> </u>			_			1	· ·	` ´ 1						I	()
(88)m= 19.83	19.83 1	9.83	19.84	19.85	1	9.85	19.85	19.	86	19.85	19.8	5	19.84	19.8	84		(88)
Utilisation fac	ctor for gair	ns for r	est of d	welling	, h2	,m (se	e Table	9a)								L	
(89)m= 0.99	0.98	0.95	0.86	0.67		0.45	0.3	0.3	35	0.65	0.92	2	0.99	1			(89)

Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to 3	7 in Tabl	e 9c)				
(90)m=	18.06	18.38	18.86	19.42	19.74	19.84	19.85	19.85	19.79	19.32	18.59	18.01		(90)
I						1		1	f	LA = Livin	g area ÷ (4	4) =	0.45	(91)
							· ^	. (4 (1						_
1		· · ·	r ·	î	i		r	+(1-fL)	<u> </u>	10.00	40.00	40.70		(02)
(92)m=	18.78	19.05	19.47	19.96	20.25	20.35	20.37	20.37	20.29	19.86	19.23	18.73		(92)
	-		1	1	· · ·	1	1	4e, whe	· · ·	·	40.00	40.70		(02)
(93)m=	18.78	19.05	19.47	19.96	20.25	20.35	20.37	20.37	20.29	19.86	19.23	18.73		(93)
			uirement					T 1 1 0		· - · · · ·			н	
				mperatu using Ta		ied at ste	ep 11 of	l able 9	o, so tha	t II,m=(76)m an	d re-calc	ulate	
ine ui	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
l Itilies			ains, hm	· ·	Iviay	Jun	Jui	Aug	Seb	001		Dec		
(94)m=	0.99	0.98	0.95	0.86	0.69	0.49	0.35	0.4	0.68	0.92	0.98	0.99		(94)
				1 4)m x (8-		0.40	0.00	0.4	0.00	0.02	0.00	0.00		(0.)
(95)m=	452.23	547.66	, VV = (94 640.31	698.77	636.36	454.5	302.66	316.59	461	506.74	450.56	423.77		(95)
							302.00	510.53	401	500.74	430.30	423.11		(00)
(96)m=	4.3	4.9	6.5	perature 8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		-									7.1	4.2		(30)
		1169.23		· · ·	696.68	464.39	304.17	x [(93)m 319.62			991.59	1193.19		(97)
(97)m=									501.68	754.47		1193.19		(97)
			1	1	i	í –	í –	24 x [(97			· · · · · · · · · · · · · · · · · · ·	570.44		
(98)m=	555.56	417.69	319.23	146.78	44.88	0	0	0	0	184.32	389.54	572.44		
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	2630.44	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								41.8	(99)
9a. En	erav rec	uiremer	nts – Ind	ividual h	eating s	vstems i	ncludinc	micro-C	CHP)					_
	e heatir				Ŭ.	5			,					
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 ·	- (201) =				1	(202)
				main sys	. ,			(204) = (2	02) × [1 –	(203)] =			1	(204)
			•						<i>,</i> .					<u> </u>
	-			ing syste									90.3	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	ז, %					-	0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above))	-	-			-			
	555.56	417.69	319.23	146.78	44.88	0	0	0	0	184.32	389.54	572.44		
(211)m	ı = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)									(211)
· /	615.24	462.56	353.52	162.55	, 49.7	0	0	0	0	204.12	431.39	633.93		
								Tota	l (kWh/yea	ar) =Sum(2	L 211) _{1 510 11}	=	2913	(211)
Snace	hoatin	a fuol (c	ocondor	y), kWh/	month									
•		•	econdar 00 ÷ (20		monun									
(215)m=	0	0		0	0	0	0	0	0	0	0	0		
(210)11-	Ū	0	Ů	Ů	Ű	Ű	Ů		l (kWh/yea	-			0	(215)
								1010			- • • /15,1012		0	(215)
	heating	•	ton (!-	- امدم	have									
Output	182.37	ater hea 159.3	ter (calc 165.74	ulated a	bove) 142.33	125.35	120.1	133.88	135.36	154.13	164.54	178.08		
Efficier				147.01	142.00	120.00	120.1	133.00	130.30	104.10	104.04	170.00	04	
Enicier	ICY OF W	ater hea	ILEI										81	(216)

(217)m=	87.81	87.53	86.89	85.39	83.05	81	81	81	81	85.81	87.32	87.91]	(217)
			kWh/mc										-	
` ´ г	= (64) 207.69	m x 100 182.01) ÷ (217) 190.75	m 172.15	171.37	154.76	148.27	165.29	167.11	179.62	188.42	202.59	1	
(L									l = Sum(2				2130.01	(219)
Annual	l totals									k	Wh/year		kWh/yea	
Space I	heating	fuel use	ed, main	system	1								2913	
Water h	neating	fuel use	d										2130.01	
Electric	ity for p	oumps, fa	ans and	electric	keep-hot	t								
centra	l heatin	g pump:	:									30]	(230c)
boiler	with a f	an-assis	ted flue									45	1	(230e)
Total el	ectricity	/ for the	above, k	(Wh/yea	r			sum	of (230a).	(230g) =			75	(231)
Electric	ity for li	ghting											283.84	(232)
Electric	ity gene	erated by	y PVs										-892.25	(233)
								0.115						
12a. C	CO2 em	issions -	- Individ	ual heati	ng syste	ems inclu	uding mi	cro-CHP	,					
12a. C	CO2 em	issions -	- Individi	ual heati	ng syste	En	ergy	cro-CHP			ion fac 2/kWb	tor	Emissions	
					ng syste	En kW		CIO-CHP		kg CO	2/kWh	tor =	kg CO2/ye	ar
Space I	heating	(main s	ystem 1)		ng syste	En kW (211	ergy /h/year	Cro-CHF		kg CO	2/kWh		kg CO2/ye	ar (261)
Space I Space I	heating		ystem 1)		ng syste	En kW (211 (215	ergy /h/year 1) x	Cro-CHF		kg CO	2/kWh 16 19	=	kg CO2/ye	ar (261) (263)
Space I Space I Water h	heating heating neating	(main s (secono	ystem 1) Jary)		ng syste	En kW (211 (215	ergy /h/year 1) x 5) x 9) x	+ (263) + (kg CO	2/kWh 16 19	=	kg CO2/ye	ar (261) (263) (264)
Space I Space I Water F Space a	heating heating neating and wat	(main s (secono ter heati	ystem 1) Jary) ng)		En kW (211 (211 (211) (211) (261)	ergy /h/year 1) x 5) x 9) x			kg CO.	2/kWh 16 19 16	=	kg CO2/ye	ar (261) (263) (264) (265)
Space I Space I Water F Space a Electric	heating heating neating and wat ity for p	(main s (second ter heati bumps, fa	ystem 1) Jary) ng			En kW (211 (215 (215 (261 (261)	ergy /h/year 1) x 5) x 9) x 1) + (262)			kg CO. 0.2 0.5 0.2	2/kWh 16 19 16 19	-	kg CO2/ye	ar (261) (263) (264) (265) (265) (267)
Space I Space I Water I Space a Electric Electric	heating heating neating and wat ity for p ity for li	(main s (second ter heati pumps, fa ghting	ystem 1) dary) ng ans and)	keep-hot	En kW (211 (215 (215 (261 (261)	ergy /h/year 1) x 5) x 9) x 1) + (262) + 1) x			kg CO. 0.2 0.5 0.2	2/kWh 16 19 16 19 19	= = =	kg CO2/ye	ar (261) (263) (264) (265) (265) (267) (268)
Space I Space I Water h Space a Electric Electric Energy Item 1	heating heating and wat ity for p ity for li saving	(main s (second ter heati pumps, fa ghting /generat	ystem 1) dary) ng ans and) electric	keep-hot	En kW (211 (215 (215 (261 (261)	ergy /h/year 1) x 5) x 9) x 1) + (262) + 1) x		264) =	kg CO. 0.2 0.5 0.2	2/kWh 16 19 16 19 19 19	-	kg CO2/ye 629.21 0 460.08 1089.29 38.93 147.32 -463.08	ar (261) (263) (264) (265) (267) (268) (268)
Space I Space I Water h Space a Electric Electric Energy Item 1 Total C	heating heating and wat ity for p ity for li saving/ O2, kg/	(main s (second ter heati pumps, fa ghting /generat	ystem 1) dary) ng ans and ion tech) electric I nologies	keep-hot	En kW (211 (215 (215 (261 (261)	ergy /h/year 1) x 5) x 9) x 1) + (262) + 1) x		264) = sum o	kg CO. 0.2 0.5 0.5 0.5	2/kWh 16 19 16 19 19 19	-	kg CO2/ye 629.21 0 460.08 1089.29 38.93 147.32 -463.08 812.45	ar (261) (263) (264) (265) (265) (267) (268) (269) (272)
Space I Space I Water h Space a Electric Electric Energy Item 1 Total C	heating heating and wat ity for p ity for li saving, O2, kg/ ng CO2	(main s (second ter heati bumps, fa ghting /generat year Emissi	ystem 1) dary) ng ans and) electric I nologies	keep-hot	En kW (211 (215 (215 (261 (261)	ergy /h/year 1) x 5) x 9) x 1) + (262) + 1) x		264) = sum o	kg CO. 0.2 0.5 0.2 0.5 0.5 (265)(2)	2/kWh 16 19 16 19 19 19	-	kg CO2/ye 629.21 0 460.08 1089.29 38.93 147.32 -463.08	ar (261) (263) (264) (265) (267) (268) (268)

Regulations Compliance Report

Approved Document L1A, Printed on 05 November 2 Project Information:		Stroma FSAP 2012 program, Version: 1.0.4.1	8
Assessed By: Su Le	e (STRO031315)	Building Type: Flat	
Dwelling Details:			
NEW DWELLING DESIGN	N STAGE	Total Floor Area: 62.42m ²	
Site Reference : 217 K	ingston Road	Plot Reference: Front - Uni	t 4
Address :			
Client Details:			
Name:			
Address :			
-	included within the SAP calculati rt of regulations compliance.	ions.	
1a TER and DER			
Fuel for main heating syste Fuel factor: 1.00 (mains ga Target Carbon Dioxide Em	as)	21.55 kg/m²	
Dwelling Carbon Dioxide En	· · · · · ·	14.49 kg/m ²	ок
1b TFEE and DFEE			
Target Fabric Energy Effic		62.2 kWh/m ²	
Dwelling Fabric Energy Eff	iiciency (DFEE)	54.2 kWh/m²	ОК
2 Fabric U-values			UK
Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	ОК
Party wall	0.00 (max. 0.20)	-	OK
Floor Roof	0.13 (max. 0.25) 0.13 (max. 0.20)	0.13 (max. 0.70) 0.13 (max. 0.35)	OK OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
	calculated from linear thermal trans	mittances for each junction	
3 Air permeability			
Air permeability at 5	50 pascals	4.00 (design value)	.
Maximum		10.0	OK
4 Heating efficiency			
Main Heating syste	m: Boiler systems with ra Data from manufactur Combi boiler Efficiency 89.5 % SEI Minimum 88.0 %		ок
Secondary heating	system: None		
5 Cylinder insulation			
Hot water Storage:	No cylinder		N/A

Regulations Compliance Report

6 Controls			
Space heating controls	TTZC by plumbing and	electrical services	ок
Hot water controls:	No cylinder thermostat		UN
	No cylinder		
Boiler interlock:	Yes		ок
7 Low energy lights			
Percentage of fixed lights wit	h low-energy fittings	100.0%	
Minimum	6, 6	75.0%	ОК
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames va	lley):	Slight	ОК
Based on:			
Overshading:		Average or unknown	
Windows facing: North East		6.9m ²	
Windows facing: North West		3.41m ²	
Windows facing: North West		0.97m ²	
Windows facing: North East		6.9m ²	
Ventilation rate:		4.00	
Blinds/curtains:		None	
10 Key features			
External Walls U-value		0.13 W/m²K	
Party Walls U-value		0 W/m²K	
Photovoltaic array			

User Details:	
Assessor Name:Su LeeStroma Number:STRO031315Software Name:Stroma FSAP 2012Software Version:Version: 1.0.4.18	
Property Address: Front - Unit 4	
Address :	
1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m²)	3)
Area(m²)Av. Height(m)Volume(m²)Basement 35.14 $(1a) \times$ 2.6 $(2a) =$ 91.37) (3a)
	(3b)
	(30)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 62.42 (4)	_
Dwelling volume $(3a)+(3c)+(3d)+(3e)+(3n) = 168.03$	(5)
2. Ventilation rate:	
main secondary other total m ³ per hou heating heating	Ir
Number of chimneys $0 + 0 + 0 = 0 $ x 40 = 0	(6a)
Number of open flues 0 + 0 = 0 $\times 20$ = 0	(6b)
Number of intermittent fans 3 × 10 = 30	(7a)
Number of passive vents $0 \times 10 = 0$	(7b)
Number of flueless gas fires $0 \times 40 = 0$	(7c)
Air changes per h	our
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c) = 30$ \div (5) = 0.18	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)	_
Number of storeys in the dwelling (ns)	(9)
Additional infiltration $[(9)-1] \times 0.1 = 0$	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 if both types of wall are present, use the value corresponding to the greater wall area (after	(11)
deducting areas of openings); if equal user 0.35	
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	(12)
If no draught lobby, enter 0.05, else enter 0	(13)
Percentage of windows and doors draught stripped 0	(14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0	(15)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	(17)
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$, otherwise $(18) = (16)$	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered 2	
Number of sides sheltered2Shelter factor $(20) = 1 - [0.075 \times (19)] =$ 0.85	(19) (20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ 0.32	(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	

Wind Factor (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		
Adjusted infiltra	ation rat	e (allowii	ng for sh	nelter an	d wind s	speed) :	= (21a) x	(22a)m					
0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38		
Calculate effec		-	ate for t	he appli	cable ca	ise	•						
If mechanica If exhaust air he			ndix N (2	3h) - (23a) × Fmv (a	aquation	(N5)) othe	wise (23t	n) – (23a)			0	
If balanced with) – (20d)			0	
a) If balance				0					2h)m + (23h) v [1 – (23c)	0 	(230)
(24a)m= 0	0		0	0	0			0	0		0		(24a)
b) If balance	d mecha	anical ve	ntilation	without	heat red	covery (MV) (24b)m = (2	1 2b)m + (23b)		I	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole ho	ouse ex	tract ven	tilation c	or positiv	e input	ventilat	on from o	outside		<u>.</u>	Į	1	
if (22b)m	ı < 0.5 ×	(23b), t	hen (240	c) = (23b); other	wise (24	4c) = (22b	o) m + 0	.5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural v							ion from l 0.5 + [(2		0.51				
(24d)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.5 + [(2	0.55	0.5	0.57	0.57]	(24d)
Effective air												J	· · · ·
(25)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57		(25)
	ond he		oromoto	- ri		•	•			•	1	1	
3. Heat losses		at 1055 p	alamete	91.									
FIFMENT	Gros	ss	Openin	as	Net Ar	ea	U-valı	le	AXU		k-value	ė	AXk
ELEMENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/		k-value kJ/m²₊l		A X k kJ/K
ELEMENT Doors						m²	W/m2			K)			
Doors	area				A ,r	m²	W/m2	K =	(W/	K)			kJ/K
Doors Windows Type	area 1				A ,r 2.09	m ² x	W/m2	K = 0.04] =	(W/ 2.5116	K)			kJ/K (26)
Doors Windows Type Windows Type	area 1 2				A ,r 2.09 6.9	m ² x	W/m2 1.2 1/[1/(1.2)+	K 0.04] = 0.04] =	(W/ 2.5116 7.9	K)			kJ/K (26) (27)
Doors Windows Type Windows Type Windows Type	area 1 2 3				A ,r 2.09 6.9 3.400	m ² x x 3 x 3 x	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+	K 0.04] = 0.04] = 0.04] =	(W/ 2.5116 7.9 3.9	K)			kJ/K (26) (27) (27)
Doors Windows Type Windows Type Windows Type	area 1 2 3				A ,r 2.09 6.9 3.406 0.966	m ² x x 5 x 5 x	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+	K 0.04] = 0.04] = 0.04] =	(W/ 2.5116 7.9 3.9 1.11	K)			kJ/K (26) (27) (27) (27)
Doors Windows Type Windows Type Windows Type Windows Type	area 1 2 3	(m²)			A ,r 2.09 6.9 3.406 0.966 6.9	m ² x x 5 x 5 x 5 x 1 x	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+	K 0.04] = 0.04] = 0.04] = 0.04] =	(W/ 2.5116 7.9 3.9 1.11 7.9	K)			kJ/K (26) (27) (27) (27) (27)
Doors Windows Type Windows Type Windows Type Windows Type Floor	area 1 2 3 4	(m²) 4	. m	2	A ,r 2.09 6.9 3.406 0.966 6.9 35.14	m ² x 5 x 5 x 1 x 4 x	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 0.13 0.15	K = 0.04] = 0.04] = 0.04] = 0.04] = = =	(W/ 2.5116 7.9 3.9 1.11 7.9 4.5683	K)			kJ/K (26) (27) (27) (27) (27) (28)
Doors Windows Type Windows Type Windows Type Windows Type Floor Walls Type1	area 1 2 3 4	(m ²)	0	1	A ,r 2.09 6.9 3.406 0.966 6.9 35.14 12.14	m ² x 5 x 5 x 1 x 4 x	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 0.13 0.15	K = 0.04] = 0.04] = 0.04] = 0.04] = = = =	(W/ 2.5116 7.9 3.9 1.11 7.9 4.5683 1.82	K)			kJ/K (26) (27) (27) (27) (27) (27) (28) (29)
Doors Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2	area 1 2 3 4 <u>12.1</u> <u>21.1</u>	4 4 22	0 10.3 ²	1	A ,r 2.09 6.9 3.406 0.966 6.9 35.14 12.14 10.83	m ² x 5 x 5 x 5 x 5 x 5 x 5 x 1 x 4 x 3 x 5 x	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 0.13 0.15 0.15 0.15	K 0.04] = 0.04] = 0.04] = 0.04] = = = = = =	(W/ 2.5116 7.9 3.9 1.11 7.9 4.5683 1.82 1.62	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (29)
Doors Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3	area 1 2 3 4 12.1 21.1 30.2	4 4 22 6	0 10.3 ⁻ 9.96	1	A ,r 2.09 6.9 3.406 0.966 6.9 35.14 12.12 10.83 20.26	m ² x 5 x 5 x 5 x 5 x 5 x 5 x 1 x 4 x 3 x 5 x	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 0.13 0.15 0.15 0.15	K 0.04] = 0.04] = 0.04] = 0.04] = 1 = 1 = 1 = 1 =	(W/ 2.5116 7.9 3.9 1.11 7.9 4.5683 1.82 1.62 3.04	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29)
Doors Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Walls Type4	area 1 2 3 4 <u>12.1</u> 21.1 <u>30.2</u> <u>3.10</u>	4 4 22 6	0 10.3 ⁴ 9.96	1	A ,r 2.09 6.9 3.406 0.966 6.9 35.14 12.14 10.83 20.26 3.16	m ² x 5 x 5 x 1 x 4 x 5 x 4 x 5 x 4 x 5 x 4 x 5 x 4 x 5 x 4 x 5 x 4 x 5 x 5 x 5 x 4 x 5 x 5 x 5 x 5 x 5 x 5 x 5 x 5	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 0.13 0.15 0.15 0.15 0.13 0.13	K 0.04] = 0.04] = 0.04] = 0.04] = 1 = 1 = 1 = 1 = 1 = 1 =	(W/ 2.5116 7.9 3.9 1.11 7.9 4.5683 1.82 1.62 3.04 0.42	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29)
Doors Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Walls Type4 Roof Type1	area 1 2 3 4 12.1 21.1 30.2 3.10 6.5 4.82	4 4 22 6 2	0 10.3 ⁻ 9.96 0	1	A ,r 2.09 6.9 3.406 0.966 6.9 35.14 12.14 10.83 20.26 3.16 6.5	m ² x 3 x 5 x 5 x 6 x 1 x 4 x 3 x 5 x 1 x 4 x 5 x 1 x 4 x 5 x 1 x 4 x 5 x 5 x 1 x 4 x 5 x 5 x 5 x 5 x 5 x 5 x 5 x 5	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 0.13 0.15 0.15 0.15 0.13 0.13	K 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = =	(W/ 2.5116 7.9 3.9 1.11 7.9 4.5683 1.82 1.62 3.04 0.42 0.85	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (29) (29) (29
Doors Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type3 Walls Type3 Walls Type4 Roof Type1 Roof Type2	area 1 2 3 4 12.1 21.1 30.2 3.10 6.5 4.82	4 4 22 6 2	0 10.3 ⁻ 9.96 0	1	A ,r 2.09 6.9 3.406 0.966 6.9 35.14 12.14 10.83 20.26 3.16 6.5 4.82	m ² x 5 x 5 x 6 x 6 x 1 x 4 x 5 x 6 x 4 x 5 x 4 x 5 x 4 x 7 x 7 x 7 x 7 x 7 x 7 x 7 x 7	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 0.13 0.15 0.15 0.15 0.13 0.13	K 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = =	(W/ 2.5116 7.9 3.9 1.11 7.9 4.5683 1.82 1.62 3.04 0.42 0.85	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (29) (30) (30)
Doors Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Walls Type4 Roof Type1 Roof Type2 Total area of el	area 1 2 3 4 12.1 21.1 30.2 3.10 6.5 4.82	4 4 22 6 2	0 10.3 ⁻ 9.96 0	1	A ,r 2.09 6.9 3.406 0.966 6.9 35.14 12.12 10.83 20.26 3.16 6.5 4.82 113.1	m ² x 5 x 5 x 1 x 4 x 3 x 2 x 2 x 3 x 2 x 3 x 2 x 3 x 4 x 4 x 5 x 4 x 5 x 5 x 5 x 5 x 5 x 5 x 5 x 5	W/m2 1.2 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 1/[1/(1.2)+ 0.13 0.15 0.15 0.15 0.15 0.13 0.13 0.13	K 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = =	(W/ 2.5116 7.9 3.9 1.11 7.9 4.5683 1.82 1.62 3.04 0.42 0.85 0.63	K)			kJ/K (26) (27) (27) (27) (27) (28) (29) (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
 ** include the areas on both sides of internal walls and partitions

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

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

36.26 (33)

Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF	- = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
	-	sments wh ad of a de			construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix I	<						14.06	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			50.32	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y		-		(38)m	= 0.33 × (25)m x (5)		_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.39	32.21	32.03	31.2	31.04	30.32	30.32	30.18	30.6	31.04	31.36	31.69		(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	82.71	82.53	82.35	81.52	81.36	80.63	80.63	80.5	80.91	81.36	81.68	82.01		
Heat lo	oss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷	Sum(39)1. (4)	12 /12=	81.52	(39)
(40)m=	1.32	1.32	1.32	1.31	1.3	1.29	1.29	1.29	1.3	1.3	1.31	1.31		
Numbe	er of day	/s in moi	nth (Tab	le 1a)					/	Average =	Sum(40) _{1.}	12 /12=	1.31	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4 \\/;	ater heat	ting enei	rav reau	irement:								kWh/y	ear:	
-1. VVC		ang ener	gy requ	irement.								1		
		ipancy, l		F 4	(40 (T						05]	(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	49 X (11	-A -13.9)2)] + 0.0	0013 x (IFA -13.	9)			
			ater usag	ge in litre	es per da	iy Vd,av	erage =	(25 x N)	+ 36		82	.87]	(43)
Reduce	the annua	al average	hot water	usage by a	5% if the a	welling is	designed t	to achieve		se target o			1	
not mor	e that 125	litres per j	berson pei	r day (all w	ater use, r	not and co	la)						1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					•	
(44)m=	91.16	87.84	84.53	81.21	77.9	74.58	74.58	77.9	81.21	84.53	87.84	91.16		_
Francis	contant of	botwator	used col	a data d ma	anthly 1	100 v Vd -		Tm / 2600			$m(44)_{112} =$		994.45	(44)
								0Tm / 3600				·	1	
(45)m=	135.18	118.23	122.01	106.37	102.06	88.07	81.61	93.65	94.77	110.44	120.56	130.92		
lf instan	taneous w	vater heati	na at point	of use (no	o hot water	storage).	enter 0 in	boxes (46,		Total = Su	m(45) ₁₁₂ =	=	1303.88	(45)
		i		·			i	· · ·	. ,	40.57	40.00	40.04	1	(46)
(46)m= Water	20.28 storage	17.74 loss:	18.3	15.96	15.31	13.21	12.24	14.05	14.22	16.57	18.08	19.64	J	(40)
	-		includir	na anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0	1	(47)
-		. ,		ink in dw			-					0	1	()
		-			-			ombi boil	ers) ente	er '0' in (47)			
	storage			,					,	,	,			
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0]	(48)
Tempe	erature f	actor fro	m Table	2b								0]	(49)
Energy	y lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=			0]	(50)
b) If m	nanufact	urer's de	eclared o	cylinder l	oss fact	or is not	known:						-	

lf com Volum	munity h e factor	age loss neating s from Ta actor fro	ee secti ble 2a	on 4.3	le 2 (kW	h/litre/da	ау)					0		(51) (52) (53)
•		om water			ear			(47) x (51)	x (52) x (53) =		-		(54)
0.		(54) in (5	•	,, , , , , , , , , , , , , , , , ,	cai			(47) X (01)	(v (oz) x (00) –		0 0		(55)
	. ,	loss cal		for each	month			((56)m = (55) × (41)ı	m		•		(/
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	-	-	-	-		-		-	-	-		m Append	ix H	(/
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
	_					Ů	Ů	Ů	Ū	Ů				
Primar	y circuit	: loss (ar : loss cal / factor fi	culated	for each	month (,	. ,	• •		r thermo		0		(58)
(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=	46.45	40.43	43.07	40.05	39.7	36.78	38.01	39.7	40.05	43.07	43.32	46.45		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	181.64	158.67	165.08	146.42	141.76	124.85	119.62	133.35	134.82	153.52	163.88	177.37		(62)
Solar DI	-W input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	on to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix C	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter	-	-									
(64)m=	181.64	158.67	165.08	146.42	141.76	124.85	119.62	133.35	134.82	153.52	163.88	177.37		
								Outp	out from wa	ater heate	r (annual)₁	12	1800.97	(64)
Heat g	ains fro	m 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=	56.56	49.42	51.34	45.38	43.86	38.48	36.64	41.06	41.52	47.49	50.92	55.14		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gain	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47	102.47		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	15.96	14.18	11.53	8.73	6.52	5.51	5.95	7.74	10.38	13.18	15.39	16.4		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5				
(68)m=	179.02	180.88	176.2	166.23	153.65	141.83	133.93	132.07	136.75	146.72	159.3	171.12		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5				
(69)m=	33.25	33.25	33.25	33.25	33.25	33.25	33.25	33.25	33.25	33.25	33.25	33.25		(69)
Pumps	and fai	ns gains	(Table (5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	se.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)				1				
(71)m=	-81.97	-81.97	-81.97	-81.97	-81.97	-81.97	-81.97	-81.97	-81.97	-81.97	-81.97	-81.97		(71)
Water	heatina	ı gains (T	able 5)	!	!	<u>I</u>	I	<u> </u>		<u>I</u>	<u> </u>			
(72)m=	76.02	73.54	69	63.03	58.95	53.44	49.24	55.19	57.67	63.83	70.72	74.12		(72)
	L		I			I	!			I				

6. Solar gains Construction Constructio	Total i	nternal	gains =					(66)	m + (67)m	n + (68	8)m +	- (69)m + (1	70)m +	(71)m + (72)	m		
Solar guine unit solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor nable 6d Area m ² Flux Table 6a Q_ FF Gains (%) Northeast 0.9x 0.54 × 6.9 × 11.28 × 0.76 × 0.77 = 20.13 (75) Northeast 0.9x 0.77 × 6.9 × 11.28 × 0.76 × 0.77 = 20.13 (75) Northeast 0.9x 0.77 × 6.9 × 11.28 × 0.76 × 0.77 = 28.7 (75) Northeast 0.9x 0.77 × 6.9 × 41.38 × 0.76 × 0.77 = 105.26 (75) Northeast 0.9x 0.54 × 6.9 × 67.98 × 0.76 × 0.77 = 122.3 (75) Northeast 0.9x 0.77 × 6.9 × 67.98 × 0.76 × 0.77 = 122.3 (75) Northeast	(73)m=	327.74	325.33	313.46	294.72	275.86	25	57.52	245.86	251	.74	261.54	280.4	7 302.14	318.38		(73)
Orientation: Access Factor Table 6d Area m ² Flux Table 6a g_n Table 6b FF Table 6c Cains (W) Northeast 0.4% 0.54 × 6.59 × 11.28 × 0.76 × 0.77 = 20.13 (75) Northeast 0.4% 0.77 × 6.59 × 12.23 0.76 × 0.77 = 28.7 (75) Northeast 0.4% 0.54 × 6.59 × 141.38 × 0.76 × 0.77 = 58.42 (75) Northeast 0.4% 0.54 × 6.59 × 41.38 0.76 × 0.77 = 105.28 (75) Northeast 0.4% 0.54 × 6.59 × 0.76 × 0.77 = 122.3 (75) Northeast 0.4% 0.54 × 6.59 × 91.35 0.76 × 0.77 = 122.37 (75) Northeast 0.4% 0.54 × 6.	6. Sol	lar gains	S:														
Table 6d m² Table 6a Table 6b Table 6c (W) Nortneast 0.x 0.54 x 6.9 x 11.28 x 0.76 x 0.77 z 20.13 (%) Nortneast 0.x 0.77 x 6.9 x 22.97 x 0.76 x 0.77 z 20.13 (%) Nortneast 0.x 0.57 x 6.9 x 22.97 x 0.76 x 0.77 z 6.9 x 41.38 x 0.76 x 0.77 z 6.9 x 6.76 x 0.77 x 6.9 x 0.76 x 0.77 z 0.77 x 6.9 x 0.76 x 0.77 z 0.77 x 6.9 x 0.76 <td>-</td> <td></td> <td></td> <td>-</td> <td>r flux fron</td> <td>n Table 6a</td> <td>and</td> <td></td> <td></td> <td>tions</td> <td>to co</td> <td>nvert to the</td> <td>e applic</td> <td></td> <td>ion.</td> <td></td> <td></td>	-			-	r flux fron	n Table 6a	and			tions	to co	nvert to the	e applic		ion.		
Northeast 0.sx 0.5.4 × 6.9 × 11.28 × 0.76 × 0.77 = 20.13 (75) Northeast 0.sx 0.77 × 6.9 × 11.28 × 0.76 × 0.77 = 22.7 (75) Northeast 0.sx 0.54 × 6.9 × 41.38 × 0.76 × 0.77 = 78.82 (75) Northeast 0.sx 0.54 × 6.9 × 41.38 × 0.76 × 0.77 = 121.23 (75) Northeast 0.sx 0.77 × 6.9 × 67.96 × 0.77 = 121.23 (75) Northeast 0.sx 0.77 × 6.9 × 97.38 0.76 × 0.77 = 122.27 (75) Northeast 0.sx 0.77 × 6.9 × 97.38 0.76 × 0.77 = 122.77 (75)	Orienta			actor		a					т						
Northeast 0, x 0.77 x 6.9 x 11.28 x 0.76 x 0.77 z 28.7 (75) Northeast 0, x 0.77 x 6.9 x 22.97 x 0.76 x 0.7 = 40.97 (75) Northeast 0, x 0.77 x 6.9 x 41.38 x 0.76 x 0.77 = 73.842 (75) Northeast 0, x 0.77 x 6.9 x 41.38 x 0.76 x 0.7 = 112.23 (75) Northeast 0, x 0.77 x 6.9 x 67.96 x 0.77 = 112.23 (75) Northeast 0, x 0.77 x 6.9 x 67.96 x 0.77 = 122.23 (75) Northeast 0, x 0.77 x 6.9 x 97.38 x 0.76 x 0.7 223.7 (75) Northeast 0, x <td></td> <td>_</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Id</td> <td>Jie da</td> <td></td> <td>1</td> <td></td> <td>_</td> <td></td> <td></td> <td>(vv)</td> <td></td>		_						Id	Jie da		1		_			(vv)	
Northeast 0.9x 0.54 x 6.9 x 22.97 x 0.76 x 0.77 = 40.97 (75) Northeast 0.9x 0.77 x 6.9 x 22.97 x 0.76 x 0.77 = 58.42 (75) Northeast 0.9x 0.54 x 6.9 x 41.38 x 0.76 x 0.77 = 105.26 (75) Northeast 0.9x 0.54 x 6.9 x 67.96 x 0.76 x 0.77 = 112.23 (75) Northeast 0.9x 0.77 x 6.9 x 91.35 x 0.76 x 0.77 = 122.87 (75) Northeast 0.9x 0.77 x 6.9 x 91.35 x 0.76 x 0.77 = 221.77 (75) Northeast 0.9x 0.77 x 6.9 x 91.1 x 0.76 x 0.77		L	0.54	X	6	.9	x	1	1.28	X		0.76	×	0.7	=	20.13	(75)
Northeast 0.77 × 6.9 × 22.27 × 0.76 × 0.77 = 56.42 (75) Northeast 0.3x 0.77 × 6.9 × 41.38 × 0.76 × 0.77 = 105.26 (75) Northeast 0.3x 0.77 × 6.9 × 67.96 × 0.76 × 0.77 = 112.23 (75) Northeast 0.3x 0.54 × 6.9 × 91.35 × 0.76 × 0.77 = 122.37 (75) Northeast 0.4x 6.9 × 91.35 × 0.76 × 0.77 = 122.37 (75) Northeast 0.4x 6.9 × 97.38 × 0.76 × 0.77 = 122.37 (75) Northeast 0.4x 6.9 × 97.263 × 0.76 × 0.77 =		Ļ	0.77	X	6	.9	x	1	1.28	X		0.76	×	0.7	=	28.7	(75)
Northeast 0.5.4 x 6.9 x 41.38 x 0.7.6 x 0.7.7 = 7.3.2 (7.5) Northeast 0.9x 0.7.7 x 6.9 x 41.38 x 0.7.6 x 0.7.7 = 105.26 (7.5) Northeast 0.9x 0.5.4 x 6.9 x 67.96 x 0.7.6 x 0.7.7 = 112.23 (75) Northeast 0.9x 0.5.4 x 6.9 x 91.35 x 0.7.6 x 0.7.7 = 162.96 (75) Northeast 0.9x 0.7.7 x 6.9 x 97.38 x 0.7.6 x 0.7.7 = 162.93 (75) Northeast 0.9x 0.7.7 x 6.9 x 97.38 x 0.7.6 x 0.7.7 = 162.53 (75) Northeast 0.9x 0.77 x 6.9 7		Ļ	0.54	x	6	.9	x	2	2.97	x		0.76	x	0.7	=	40.97	(75)
Northeast 0.9x 0.77 x 6.9 x 41.38 x 0.76 x 0.77 = 105.26 (75) Northeast 0.9x 0.54 x 6.9 x 67.96 x 0.76 x 0.77 = 121.23 (76) Northeast 0.9x 0.54 x 6.9 x 91.35 x 0.76 x 0.77 = 122.23 (75) Northeast 0.9x 0.54 x 6.9 x 91.35 x 0.76 x 0.77 = 122.23.77 (75) Northeast 0.9x 0.54 x 6.9 x 91.35 x 0.76 x 0.77 = 122.97 (75) Northeast 0.9x 0.54 x 6.9 x 91.1 x 0.76 x 0.77 = 122.57 (75) Northeast 0.9x 0.54 x 6.9 x 72.63 x 0.76 x 0.77 = 129.57 (75) Northeast 0.9x 0.54 x 6.9		L	0.77	x	6	.9	x	2	2.97	x		0.76	×	0.7	=	58.42	(75)
Northeast 0.54 x 6.9 x 67.96 x 0.76 x 0.77 = 121.23 (75) Northeast 0.9x 0.77 x 6.9 x 67.96 x 0.76 x 0.77 = 121.23 (75) Northeast 0.9x 0.54 x 6.9 x 91.35 x 0.76 x 0.77 = 122.23 (75) Northeast 0.9x 0.77 x 6.9 x 97.38 x 0.76 x 0.77 = 122.37 (75) Northeast 0.9x 0.77 x 6.9 x 97.38 x 0.76 x 0.77 = 224.773 (75) Northeast 0.9x 0.54 x 6.9 x 72.63 x 0.76 x 0.77 = 129.57 (75) Northeast 0.9x 0.54 x 6.9 x		L	0.54	x	6	.9	x	4	1.38	x		0.76	x	0.7	=	73.82	(75)
Northeast 0.9x 0.77 x 6.9 x 67.66 x 0.76 x 0.77 = 112.87 (75) Northeast 0.9x 0.54 x 6.9 x 91.35 x 0.76 x 0.77 = 122.87 (75) Northeast 0.9x 0.54 x 6.9 x 97.38 x 0.76 x 0.77 = 122.37 (75) Northeast 0.9x 0.54 x 6.9 x 97.38 x 0.76 x 0.77 = 122.57 (75) Northeast 0.9x 0.54 x 6.9 x 97.38 x 0.76 x 0.77 = 122.57 (75) Northeast 0.9x 0.54 x 6.9 x 72.63 x 0.76 x 0.77 = 129.57 (75) Northeast 0.9x 0.54 x 6.9 x 0.76 x 0.77 = 128.26 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 <		L	0.77	x	6	.9	x	4	1.38	x		0.76	×	0.7	=	105.26	(75)
Northeast 0.9x 0.54 x 6.9 y 91.35 x 0.76 x 0.77 = 162.66 (%) Northeast 0.9x 0.54 x 6.9 x 91.35 x 0.76 x 0.77 = 232.37 (%) Northeast 0.9x 0.54 x 6.9 x 97.38 x 0.76 x 0.77 = 247.73 (%) Northeast 0.9x 0.54 x 6.9 x 91.1 x 0.76 x 0.77 = 247.73 (%) Northeast 0.9x 0.54 x 6.9 x 91.1 x 0.76 x 0.77 = 231.75 (%) Northeast 0.9x 0.54 x 6.9 x 72.63 x 0.76 x 0.77 = 89.95 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.77 =	Northea	ast <mark>0.9x</mark>	0.54	x	6	.9	x	6	57.96	x		0.76	x	0.7	=	121.23	(75)
Northeast 0.9x 0.77 x 6.9 x 91.35 x 0.76 x 0.77 = 223.37 (75) Northeast 0.9x 0.54 x 6.9 x 97.38 x 0.76 x 0.77 = 173.73 (75) Northeast 0.9x 0.54 x 6.9 x 97.38 x 0.76 x 0.77 = 223.77 (75) Northeast 0.9x 0.54 x 6.9 x 97.38 x 0.76 x 0.77 = 124.773 (75) Northeast 0.9x 0.54 x 6.9 x 72.63 x 0.76 x 0.77 = 129.57 (75) Northeast 0.9x 0.54 x 6.9 x 56.42 x 0.76 x 0.77 = 128.26 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.7	Northea	ast <mark>0.9x</mark>	0.77	x	6	.9	x	6	57.96	x		0.76	x	0.7	=	172.87	(75)
Northeast 0.54 \times 6.9 \times 97.38 \times 0.76 \times 0.77 $=$ 173.73 (75) Northeast 0.9 0.77 \times 6.9 \times 97.38 \times 0.76 \times 0.77 $=$ 247.73 (75) Northeast 0.9 0.54 \times 6.9 \times 91.1 \times 0.76 \times 0.77 $=$ 247.73 (75) Northeast 0.9 0.54 \times 6.9 \times 91.1 \times 0.76 \times 0.77 $=$ 247.73 (75) Northeast 0.9 0.54 \times 6.9 \times 72.63 \times 0.76 \times 0.77 $=$ 29.57 (75) Northeast 0.9 0.54 \times 6.9 \times 50.42 \times 0.76 \times 0.77 $=$ 184.75 (75) Northeast 0.9 0.54 \times 6.9 \times 28.07 \times 0.77 $=$ 50.07 (75)	Northea	ast <mark>0.9x</mark>	0.54	x	6	.9	x	ç	1.35	x		0.76	x	0.7	=	162.96	(75)
Northeast $0.9x$ 0.77 × 6.9 × 97.38 × 0.76 × 0.77 = 247.73 (75) Northeast $0.9x$ 0.54 × 6.9 × 91.1 × 0.76 × 0.77 = 223.175 (75) Northeast $0.9x$ 0.54 × 6.9 × 91.1 × 0.76 × 0.77 = 223.175 (75) Northeast $0.9x$ 0.54 × 6.9 × 72.63 × 0.76 × 0.77 = 129.57 (75) Northeast $0.9x$ 0.54 × 6.9 × 50.42 × 0.76 × 0.77 = 129.57 (75) Northeast $0.9x$ 0.54 × 6.9 × 50.42 × 0.76 × 0.77 = 128.26 (75) Northeast $0.9x$ 0.54 × 6.9 × 28.07 × 0.76 × 0.77 = 50.07 (75) Northeast $0.9x$ 0.54 ×	Northea	ast <mark>0.9x</mark>	0.77	x	6	.9	x	ç	1.35	x		0.76	x	0.7	=	232.37	(75)
Northeast 0.9x 0.54 × 6.9 × 91.1 × 0.76 × 0.77 = 162.53 (75) Northeast 0.9x 0.54 × 6.9 × 91.1 × 0.76 × 0.77 = 1231.75 (75) Northeast 0.9x 0.54 × 6.9 × 72.63 × 0.76 × 0.77 = 129.57 (75) Northeast 0.9x 0.54 × 6.9 × 50.42 × 0.76 × 0.77 = 184.75 (75) Northeast 0.9x 0.54 × 6.9 × 50.42 × 0.76 × 0.77 = 89.95 (75) Northeast 0.9x 0.54 × 6.9 × 28.07 × 0.76 × 0.77 = 50.07 (75) Northeast 0.9x 0.54 × 6.9 × 14.2 × 0.76 × 0.77 <	Northea	ast <mark>0.9x</mark>	0.54	x	6	.9	x	g	7.38	x		0.76	×	0.7	=	173.73	(75)
Northeast 0.9x 0.77 x 6.9 x 91.1 x 0.76 x 0.77 = 231.75 (75) Northeast 0.9x 0.54 x 6.9 x 72.63 x 0.76 x 0.77 = 129.57 (75) Northeast 0.9x 0.77 x 6.9 x 72.63 x 0.76 x 0.77 = 148.75 (75) Northeast 0.9x 0.54 x 6.9 x 50.42 x 0.76 x 0.77 = 188.26 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.77 = 50.07 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.77 = 25.33 (75) Northeast 0.9x 0.54 x 6.9 x 9.21 x 0.76 x 0.77 <t< td=""><td>Northea</td><td>ast <mark>0.9x</mark></td><td>0.77</td><td>x</td><td>6</td><td>.9</td><td>x</td><td>ç</td><td>7.38</td><td>x</td><td></td><td>0.76</td><td>x</td><td>0.7</td><td>=</td><td>247.73</td><td>(75)</td></t<>	Northea	ast <mark>0.9x</mark>	0.77	x	6	.9	x	ç	7.38	x		0.76	x	0.7	=	247.73	(75)
Northeast 0.9x 0.54 x 6.9 x 72.63 x 0.76 x 0.7 = 129.57 (75) Northeast 0.9x 0.77 x 6.9 x 72.63 x 0.76 x 0.7 = 149.57 (75) Northeast 0.9x 0.54 x 6.9 x 50.42 x 0.76 x 0.7 = 184.75 (75) Northeast 0.9x 0.54 x 6.9 x 50.42 x 0.76 x 0.7 = 89.95 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.7 = 50.07 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.7 = 25.33 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.7 = 23.44 (75) Northeast 0.9x 0.54 x 6.9 x	Northea	ast <mark>0.9x</mark>	0.54	x	6	.9	x	9	91.1	x		0.76	x	0.7	=	162.53	(75)
Northeast 0.9x 0.77 x 6.9 x 72.63 x 0.76 x 0.77 = 184.75 (75) Northeast 0.9x 0.54 x 6.9 x 50.42 x 0.76 x 0.7 = 89.95 (75) Northeast 0.9x 0.77 x 6.9 x 50.42 x 0.76 x 0.7 = 184.75 (75) Northeast 0.9x 0.77 x 6.9 x 50.42 x 0.76 x 0.7 = 128.26 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.7 = 71.4 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.7 = 25.33 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.7 = 23.44 (75) Northeast 0.9x 0.54 x 3.41 11.28 <td>Northea</td> <td>ast <mark>0.9x</mark></td> <td>0.77</td> <td>x</td> <td>6</td> <td>.9</td> <td>x</td> <td></td> <td>91.1</td> <td>x</td> <td></td> <td>0.76</td> <td>×</td> <td>0.7</td> <td>=</td> <td>231.75</td> <td>(75)</td>	Northea	ast <mark>0.9x</mark>	0.77	x	6	.9	x		91.1	x		0.76	×	0.7	=	231.75	(75)
Northeast 0.9x 0.54 x 6.9 x 50.42 x 0.76 x 0.7 = 89.95 (75) Northeast 0.9x 0.77 x 6.9 x 50.42 x 0.76 x 0.7 = 89.95 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.7 = 128.26 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.7 = 50.07 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.7 = 71.4 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.7 = 16.44 (75) Northeast 0.9x 0.54 x 3.41 x 11.28 x 0.76 x 0.7 = 9.94 (81) Northwest 0.9x 0.77 x 0.97 x	Northea	ast <mark>0.9x</mark>	0.54	x	6	.9	x	7	2.63	x		0.76	x	0.7	=	129.57	(75)
Northeast $0.9x$ 0.77 x 6.9 x 50.42 x 0.76 x 0.77 $=$ 128.26 (75) Northeast $0.9x$ 0.54 x 6.9 x 28.07 x 0.76 x 0.7 $=$ 50.07 (75) Northeast $0.9x$ 0.77 x 6.9 x 28.07 x 0.76 x 0.7 $=$ 50.07 (75) Northeast $0.9x$ 0.54 x 6.9 x 14.2 x 0.76 x 0.7 $=$ 25.33 (75) Northeast $0.9x$ 0.54 x 6.9 x 14.2 x 0.76 x 0.7 $=$ 25.33 (75) Northeast $0.9x$ 0.54 x 6.9 x 9.21 x 0.76 x 0.7 $=$ 16.44 (75) Northeast $0.9x$ 0.54 x 3.41 x 11.28 x 0.76 x 0.7 $=$ 9.94 (81) Northwest $0.9x$ 0.54 x 3.41 x 11.28 x 0.76 x 0.7 $=$ 9.94 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 $=$ 8.18 (81) Northwest $0.9x$ 0.54 <td< td=""><td>Northea</td><td>ast <mark>0.9x</mark></td><td>0.77</td><td>x</td><td>6</td><td>.9</td><td>x</td><td>7</td><td>2.63</td><td>x</td><td></td><td>0.76</td><td>x</td><td>0.7</td><td>=</td><td>184.75</td><td>(75)</td></td<>	Northea	ast <mark>0.9x</mark>	0.77	x	6	.9	x	7	2.63	x		0.76	x	0.7	=	184.75	(75)
Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.7 = 50.07 (75) Northeast 0.9x 0.77 x 6.9 x 28.07 x 0.76 x 0.7 = 50.07 (75) Northeast 0.9x 0.54 x 6.9 x 28.07 x 0.76 x 0.7 = 71.4 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.7 = 25.33 (75) Northeast 0.9x 0.77 x 6.9 x 14.2 x 0.76 x 0.7 = 26.11 (75) Northeast 0.9x 0.54 x 6.9 x 9.21 x 0.76 x 0.7 = 23.44 (75) Northwest 0.9x 0.54 x 3.41 x 11.28 x 0.76 x 0.7 = 9.94 (81) Northwest 0.9x 0.54 x 3.41 x <	Northea	ast <mark>0.9x</mark>	0.54	x	6	.9	x	5	0.42	x		0.76	x	0.7	=	89.95	(75)
Northeast 0.9x 0.77 x 6.9 x 28.07 x 0.76 x 0.7 = 71.4 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.7 = 71.4 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.7 = 25.33 (75) Northeast 0.9x 0.54 x 6.9 x 14.2 x 0.76 x 0.7 = 25.33 (75) Northeast 0.9x 0.54 x 6.9 x 9.21 x 0.76 x 0.7 = 16.44 (75) Northeast 0.9x 0.54 x 3.41 x 11.28 x 0.76 x 0.7 = 9.94 (81) Northwest 0.9x 0.54 x 3.41 x 11.28 x 0.76 x 0.7 = 20.23 (81) Northwest 0.9x 0.54 x 3.41 22.97	Northea	ast <mark>0.9x</mark>	0.77	x	6	.9	x	5	60.42	x		0.76	x	0.7	=	128.26	(75)
Northeast $0.9x$ 0.54 x 6.9 x 14.2 x 0.76 x 0.7 $=$ 25.33 (75) Northeast $0.9x$ 0.77 x 6.9 x 14.2 x 0.76 x 0.7 $=$ 36.11 (75) Northeast $0.9x$ 0.54 x 6.9 x 9.21 x 0.76 x 0.7 $=$ 16.44 (75) Northeast $0.9x$ 0.77 x 6.9 x 9.21 x 0.76 x 0.7 $=$ 23.44 (75) Northwest $0.9x$ 0.54 x 3.41 x 11.28 x 0.76 x 0.7 $=$ 9.94 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 8.18 (81) Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 $=$ 36.44 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54	Northea	ast <mark>0.9x</mark>	0.54	x	6	.9	x	2	8.07	x		0.76	x	0.7	=	50.07	(75)
Northeast $0.9x$ 0.77 x 6.9 x 14.2 x 0.76 x 0.7 $=$ 36.11 (75) Northeast $0.9x$ 0.54 x 6.9 x 9.21 x 0.76 x 0.7 $=$ 16.44 (75) Northeast $0.9x$ 0.77 x 6.9 x 9.21 x 0.76 x 0.7 $=$ 23.44 (75) Northwest $0.9x$ 0.54 x 3.41 x 11.28 x 0.76 x 0.7 $=$ 9.94 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.77 x 0.97 x 41.38 x 0.76 x 0.7 $=$ 36.44 (81) Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 $=$ 14.74 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 <	Northea	ast <mark>0.9x</mark>	0.77	x	6	.9	x	2	8.07	x		0.76	x	0.7	=	71.4	(75)
Northeast $0.9\times$ 0.54 \times 6.9 \times 9.21 \times 0.76 \times 0.7 $=$ 16.44 (75) Northeast $0.9\times$ 0.77 \times 6.9 \times 9.21 \times 0.76 \times 0.7 $=$ 23.44 (75) Northwest $0.9\times$ 0.54 \times 3.41 \times 11.28 \times 0.76 \times 0.7 $=$ 9.94 (81) Northwest $0.9\times$ 0.54 \times 3.41 \times 11.28 \times 0.76 \times 0.7 $=$ 4.02 (81) Northwest $0.9\times$ 0.54 \times 3.41 \times 22.97 \times 0.76 \times 0.7 $=$ 4.02 (81) Northwest $0.9\times$ 0.54 \times 3.41 \times 22.97 \times 0.76 \times 0.7 $=$ 8.18 (81) Northwest $0.9\times$ 0.54 \times 3.41 \times 22.97 \times 0.76 \times 0.7 $=$ 8.18 (81) Northwest $0.9\times$ 0.54 \times 3.41 \times 41.38 \times 0.76 \times 0.7 $=$ 14.74 (81) Northwest $0.9\times$ 0.54 \times 3.41 \times 67.96 \times 0.76 \times 0.7 $=$ 59.84 (81) Northwest $0.9\times$ 0.54 \times 3.41 \times 67.96 \times 0.76 \times 0.7 $=$ 24.2 (81) Northwest $0.9\times$ 0.54 <td< td=""><td>Northea</td><td>ast <mark>0.9x</mark></td><td>0.54</td><td>x</td><td>6</td><td>.9</td><td>x</td><td></td><td>14.2</td><td>x</td><td></td><td>0.76</td><td>x</td><td>0.7</td><td>=</td><td>25.33</td><td>(75)</td></td<>	Northea	ast <mark>0.9x</mark>	0.54	x	6	.9	x		14.2	x		0.76	x	0.7	=	25.33	(75)
Northeast $0.9x$ 0.77 x 6.9 x 9.21 x 0.76 x 0.7 $=$ 23.44 (75) Northwest $0.9x$ 0.54 x 3.41 x 11.28 x 0.76 x 0.7 $=$ 9.94 (81) Northwest $0.9x$ 0.77 x 0.97 x 11.28 x 0.76 x 0.7 $=$ 4.02 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 8.18 (81) Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 $=$ 36.44 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 59.84 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 59.84 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 24.2 (81)	Northea	ast <mark>0.9x</mark>	0.77	x	6	.9	x		14.2	x		0.76	×	0.7	=	36.11	(75)
Northwest $0.9x$ 0.54 x 3.41 x 11.28 x 0.76 x 0.7 $=$ 9.94 (81) Northwest $0.9x$ 0.77 x 0.97 x 11.28 x 0.76 x 0.7 $=$ 4.02 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 $=$ 36.44 (81) Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 $=$ 14.74 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 59.84 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 80.44 (81)	Northea	ast <mark>0.9x</mark>	0.54	x	6	.9	x		9.21	x		0.76	×	0.7	=	16.44	(75)
Northwest $0.9x$ 0.77 x 0.97 x 11.28 x 0.76 x 0.7 $=$ 4.02 (81) Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.77 x 0.97 x 22.97 x 0.76 x 0.7 $=$ 20.23 (81) Northwest $0.9x$ 0.77 x 0.97 x 22.97 x 0.76 x 0.7 $=$ 8.18 (81) Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 $=$ 14.74 (81) Northwest $0.9x$ 0.77 x 0.97 x 41.38 x 0.76 x 0.7 $=$ 14.74 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 80.44 (81)	Northea	ast <mark>0.9x</mark>	0.77	x	6	.9	x		9.21	x		0.76	×	0.7	=	23.44	(75)
Northwest $0.9x$ 0.54 x 3.41 x 22.97 x 0.76 x 0.7 = 20.23 (81) Northwest $0.9x$ 0.77 x 0.97 x 22.97 x 0.76 x 0.7 = 8.18 (81) Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 = 36.44 (81) Northwest $0.9x$ 0.77 x 0.97 x 41.38 x 0.76 x 0.7 = 14.74 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 = 59.84 (81) Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 = 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 = 80.44 (81)	Northwe	est <mark>0.9x</mark>	0.54	x	3.	41	x	1	1.28	x		0.76	×	0.7	=	9.94	(81)
Northwest $0.9x$ 0.77 x 0.97 x 22.97 x 0.76 x 0.7 $=$ 8.18 (81) Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 $=$ 36.44 (81) Northwest $0.9x$ 0.77 x 0.97 x 41.38 x 0.76 x 0.7 $=$ 14.74 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 59.84 (81) Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 $=$ 59.84 (81) Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 80.44 (81)	Northwe	est <mark>0.9x</mark>	0.77	x	0.	97	x	1	1.28	x		0.76	×	0.7	=	4.02	(81)
Northwest $0.9x$ 0.54 x 3.41 x 41.38 x 0.76 x 0.7 $=$ 36.44 (81) Northwest $0.9x$ 0.77 x 0.97 x 41.38 x 0.76 x 0.7 $=$ 14.74 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 59.84 (81) Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 $=$ 59.84 (81) Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 80.44 (81)	Northwe	est 0.9x	0.54	×	3.	41	x	2	2.97	x		0.76	×	0.7	=	20.23	(81)
Northwest $0.9x$ 0.77 x 0.97 x 41.38 x 0.76 x 0.7 = 14.74 (81)Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 = 59.84 (81)Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 = 59.84 (81)Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 = 24.2 (81)Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 = 80.44 (81)	Northw	est 0.9x	0.77	×	0.	97	x	2	2.97	x		0.76	×	0.7	= =	8.18	(81)
Northwest $0.9x$ 0.77 x 0.97 x 41.38 x 0.76 x 0.7 $=$ 14.74 (81) Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 $=$ 59.84 (81) Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 $=$ 80.44 (81)	Northw	est 0.9x		×			x			x			×		=	r	(81)
Northwest $0.9x$ 0.54 x 3.41 x 67.96 x 0.76 x 0.7 = 59.84 (81) Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 = 59.84 (81) Northwest $0.9x$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 = 24.2 (81) Northwest $0.9x$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 = 80.44 (81)	Northw	est 0.9x		×			x			x			×		=		(81)
Northwest $_{0.9x}$ 0.77 x 0.97 x 67.96 x 0.76 x 0.7 = 24.2 (81) Northwest $_{0.9x}$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 = 80.44 (81)	Northwe	est <mark>0.9x</mark>		x			x			1 1			۲ × آ		=		(81)
Northwest $_{0.9x}$ 0.54 x 3.41 x 91.35 x 0.76 x 0.7 = 80.44 (81)		L								1 1			4			r	(81)
		L								1 1			4				(81)
Northwest 0.9x 0.77 x 0.97 x 91.35 x 0.76 x 0.7 = 32.53 (81)		Ľ	0.77				x			1 I 1 I		0.76	4	0.7		32.53	(81)

Northwest 0.9x	0.54	x	3.41	1	x	9	7.38	×	0.76	x	0.7	=	85.76	(81)
Northwest 0.9x	0.77	×	0.97	,	x	9	7.38	x	0.76	_ × [0.7	=	34.68	(81)
Northwest 0.9x	0.54	x	3.41		x	ę	91.1	x	0.76	× [0.7	=	80.23	(81)
Northwest 0.9x	0.77	×	0.97	7	x	ę	91.1	x	0.76	_ × [0.7	= =	32.44	(81)
Northwest 0.9x	0.54	×	3.41	ı	x	7	2.63	x	0.76	_ × [0.7	=	63.96	(81)
Northwest 0.9x	0.77	x	0.97	7	x	7	2.63	x	0.76	_ × [0.7	=	25.87	(81)
Northwest 0.9x	0.54	×	3.41	1	x	5	0.42	x	0.76	_ × [0.7	=	44.4	(81)
Northwest 0.9x	0.77	×	0.97	7	x	5	0.42	x	0.76	_ × [0.7	=	17.96	(81)
Northwest 0.9x	0.54	x	3.41		x	2	8.07	x	0.76	_ × [0.7	=	24.72	(81)
Northwest 0.9x	0.77	x	0.97	,	x	2	8.07	x	0.76	×	0.7	=	10	(81)
Northwest 0.9x	0.54	×	3.41		x		14.2	x	0.76	_ × [0.7	=	12.5	(81)
Northwest 0.9x	0.77	×	0.97	7	x		14.2	x	0.76	_ × [0.7	=	5.06	(81)
Northwest 0.9x	0.54	x	3.41	1	x	ę	9.21	x	0.76	× [0.7	=	8.11	(81)
Northwest 0.9x	0.77	×	0.97	7	x	ç	9.21	x	0.76	_ × [0.7	=	3.28	(81)
-		-												
Solar gains in	watts, calcul	ated	for each	month	ר			(83)m	= Sum(74)m .	(82)m			_	
(83)m= 62.79	127.8 230).26	378.15	508.31	54	41.91	506.95	404.	14 280.57	156.18	79	51.27]	(83)
Total gains – i	nternal and	solar	(84)m =	(73)m	+ (8	33)m	, watts							
(84)m= 390.53	453.14 543	3.72	672.87	784.17	79	99.43	752.81	655.	88 542.12	436.66	381.14	369.65]	(84)
7. Mean inter	nal tempera	ture (heating	seasor	า)				-				-	
Temperature			Ŭ		<i>.</i>	area f	rom Tab	ole 9.	Th1 (°C)				21	(85)
Utilisation fac	-	• ·			-				(-)					
Jan		1ar	Apr	May	T	Jun	Jul	Au	ig Sep	Oct	Nov	Dec]	
(86)m= 1		98	0.94	0.8		D.61	0.46	0.5		0.98	1	1	-	(86)
	<u> </u>		I	- T A (1				.					1	
Mean interna (87)m= 19.55	i <u>i</u>	- 1			-				able 9c)	00.00	10.00			
(87)m= 19.55	19.72 20	.04	20.48	20.82	1 4	0.96	20.99					40 50	1	(97)
Temperature	during heati		L		-			20.9	8 20.84	20.39	19.89	19.53]	(87)
	<u> </u>	<u> </u>	eriods in	rest of	f dw	elling	from Ta			20.39	19.89	19.53]	
(88)m= 19.82	<u> </u>	ng pe .83	eriods in 19.84	rest of 19.84	-	elling 9.85	from Ta 19.85		, Th2 (°C)	19.84	19.89	19.53 19.83]]	(87) (88)
(88)m= 19.82 Utilisation fac	19.82 19	.83	19.84	19.84	1	9.85	19.85	ble 9 19.8	, Th2 (°C)	1	I]]	
	19.82 19	.83	19.84	19.84	1 h2,	9.85	19.85	ble 9 19.8	, Th2 (°C) 5 19.84	1	I]]]	
Utilisation fac (89)m= 1	19.82 19 ctor for gains 0.99 0.	.83 for r 98	19.84 est of dw 0.91	19.84 velling, 0.74	1 h2,	9.85 m (se 0.52	19.85 ee Table 0.35	ble 9 19.8 9a) 0.4:	, Th2 (°C) 5 19.84 2 0.75	19.84 0.96	19.83	19.83]]]	(88)
Utilisation fac	19.8219ctor for gains0.990.l temperatur	.83 for r 98	19.84 est of dw 0.91	19.84 velling, 0.74	1 h2, (9.85 m (se 0.52	19.85 ee Table 0.35	ble 9 19.8 9a) 0.4:	, Th2 (°C) 19.84 2 0.75 to 7 in Tabl	19.84 0.96	19.83	19.83]]]	(88)
Utilisation fac (89)m= 1 Mean interna	19.8219ctor for gains0.990.l temperatur	.83 for r 98 e in t	19.84 est of dw 0.91 he rest o	19.84 velling, 0.74 of dwell	1 h2, (9.85 m (se 0.52 T2 (fo	19.85 ee Table 0.35 ollow ste	ble 9 19.8 9a) 0.4 ps 3	, Th2 (°C) 19.84 2 0.75 to 7 in Tabl 4 19.72	19.84 0.96 e 9c) 19.13	0.99	19.83 1 17.88]]] 	(88)
Utilisation fac (89)m= 1 Mean interna (90)m= 17.91	19.82 19 ctor for gains 0.99 0. l temperatur 18.15 18	62	19.84 est of dw 0.91 he rest o 19.24	19.84 velling, 0.74 of dwell 19.67	1 h2, 0 ling 1	9.85 m (se 0.52 T2 (fo 9.82	19.85 ee Table 0.35 ollow ste 19.84	ble 9 19.8 9a) 0.4 ps 3 19.8	, Th2 (°C) 5 19.84 2 0.75 to 7 in Tabl 4 19.72	19.84 0.96 e 9c) 19.13	19.83 0.99 18.42	19.83 1 17.88]]] 	(88) (89) (90)
Utilisation fac (89)m= 1 Mean interna (90)m= 17.91 Mean interna	19.8219ctor for gains0.990.I temperatur18.1518I temperatur	607 r 98 e in t .62 e (foi	19.84 est of dw 0.91 he rest o 19.24 r the who	19.84 velling, 0.74 of dwell 19.67 ble dwe	1 h2, (ling 1	9.85 m (se 0.52 T2 (fo 9.82 g) = fl	19.85 ee Table 0.35 ollow ste 19.84 _A × T1	ble 9 19.8 9a) 0.4 19.8 19.8	, Th2 (°C) 19.84 2 0.75 to 7 in Tabl 4 19.72 1 - fLA) × T2	19.84 0.96 le 9c) 19.13 fLA = Livi	19.83 0.99 18.42 ng area ÷ (4	19.83 1 17.88 +) =]] 	(88) (89) (90) (91)
Utilisation fac (89)m= 1 Mean interna (90)m= 17.91 Mean interna (92)m= 18.71	19.82 19 ctor for gains 0.99 0. l temperatur 18.15 18 l temperatur 18.91 19	.83 for r 98 e in t .62 e (for .31	19.84 est of dw 0.91 he rest o 19.24 r the who 19.84	19.84 velling, 0.74 of dwell 19.67 ble dwe 20.23	1 h2, (ling 1 elling 2	9.85 m (se 0.52 T2 (fo 9.82 g) = fl	19.85 e Table 0.35 ollow ste 19.84 _A × T1 20.4	ble 9 19.8 9a) 0.4 :ps 3 19.8 + (1 - 20.4	, Th2 (°C) 19.84 2 0.75 to 7 in Tabl 4 19.72 1 - fLA) × T2 4 20.27	19.84 0.96 le 9c) 19.13 fLA = Livi 19.74	19.83 0.99 18.42	19.83 1 17.88]]] 0.48]	(88) (89) (90)
Utilisation fac (89)m= 1 Mean interna (90)m= 17.91 Mean interna (92)m= 18.71 Apply adjustr	19.82 19 ctor for gains 0.99 0. l temperatur 18.15 18 l temperatur 18.91 19 ment to the n 19 19	.83 for r 98 e in t .62 e (for .31	19.84 est of dw 0.91 he rest o 19.24 r the who 19.84 internal 1	19.84 velling, 0.74 of dwell 19.67 ble dwe 20.23 tempe	1 h2, (ling 1 elling 2 ratu	9.85 m (se 0.52 T2 (fo 9.82 g) = fl 0.37 ire fro	19.85 ee Table 0.35 ollow ste 19.84 _A × T1 20.4 m Table	ble 9 19.8 9a) 0.4 ps 3 19.8 + (1 - 20.4 4e, v	, Th2 (°C) 19.84 2 0.75 to 7 in Table 4 19.72 - fLA) × T2 4 20.27 where approx	19.84 0.96 e 9c) 19.13 fLA = Livi 19.74 opriate	19.83 0.99 18.42 ng area ÷ (4 19.13	19.83 1 17.88 +) = 18.68]] 	(88) (89) (90) (91) (92)
Utilisation fac (89)m= 1 Mean interna (90)m= 17.91 Mean interna (92)m= 18.71 Apply adjustr (93)m= 18.71	19.82 19 ctor for gains 0.99 0. 1 temperatur 18.15 18 I temperatur 18.91 19 nent to the n 18.91 19	.83 for r 98 e in t .62 e (for .31 nean .31	19.84 est of dw 0.91 he rest o 19.24 r the who 19.84	19.84 velling, 0.74 of dwell 19.67 ble dwe 20.23	1 h2, (ling 1 elling 2 ratu	9.85 m (se 0.52 T2 (fo 9.82 g) = fl	19.85 e Table 0.35 ollow ste 19.84 _A × T1 20.4	ble 9 19.8 9a) 0.4 :ps 3 19.8 + (1 - 20.4	, Th2 (°C) 19.84 2 0.75 to 7 in Table 4 19.72 1 - fLA) × T2 4 20.27 where approx	19.84 0.96 le 9c) 19.13 fLA = Livi 19.74	19.83 0.99 18.42 ng area ÷ (4	19.83 1 17.88 +) =]]] 0.48]]	(88) (89) (90) (91)
Utilisation fac (89)m= 1 Mean interna (90)m= 17.91 Mean interna (92)m= 18.71 Apply adjustr (93)m= 18.71 8. Space heat	19.8219tor for gains0.990.1 temperatur18.15181 temperatur18.9119nent to the n18.9119nent to the n18.9119nent to the n18.9119	83 for n 98 e in t 62 62 98 e in t 62 1 1 1 1 1 1 1 1 1 1 1	19.84 est of dw 0.91 he rest o 19.24 r the who 19.84 internal t 19.84	19.84 velling, 0.74 of dwell 19.67 ble dwe 20.23 tempe 20.23	1 h2, (ling 1 elling 2 ratu 2	9.85 m (se 0.52 T2 (fo 9.82 g) = fl 0.37 ire fro 0.37	19.85 ee Table 0.35 ollow ste 19.84 _A × T1 20.4 m Table 20.4	ble 9 19.8 9a) 0.4 ps 3 19.8 + (1 - 20.4 4e, V 20.4	, Th2 (°C) 19.84 2 0.75 to 7 in Table 4 19.72 1 - fLA) × T2 4 20.27 vhere approx 4 20.27	19.84 0.96 e 9c) 19.13 fLA = Livi 19.74 opriate 19.74	19.83 0.99 18.42 ng area ÷ (4 19.13	19.83 1 17.88 +) = 18.68 18.68]	(88) (89) (90) (91) (92)
Utilisation fac (89)m= 1 Mean interna (90)m= 17.91 Mean interna (92)m= 18.71 Apply adjustr (93)m= 18.71 8. Space heat Set Ti to the	19.82192tor for gains0.990.0.990.1 temperatur18.15181 temperatur18.9119nent to the n18.911918.9119ting requirermean interna	for r 98 e in t 62 e (for 31 nean 31 nent	19.84 est of dw 0.91 he rest o 19.24 r the who 19.84 internal f 19.84	19.84 velling, 0.74 of dwell 19.67 ble dwe 20.23 temper 20.23 e obtain	1 h2, (ling 1 elling 2 ratu 2	9.85 m (se 0.52 T2 (fo 9.82 g) = fl 0.37 ire fro 0.37	19.85 ee Table 0.35 ollow ste 19.84 _A × T1 20.4 m Table 20.4	ble 9 19.8 9a) 0.4 ps 3 19.8 + (1 - 20.4 4e, V 20.4	, Th2 (°C) 19.84 2 0.75 to 7 in Table 4 19.72 1 - fLA) × T2 4 20.27 vhere approx 4 20.27	19.84 0.96 e 9c) 19.13 fLA = Livi 19.74 opriate 19.74	19.83 0.99 18.42 ng area ÷ (4 19.13	19.83 1 17.88 +) = 18.68 18.68]	(88) (89) (90) (91) (92)
Utilisation fac (89)m= 1 Mean interna (90)m= 17.91 Mean interna (92)m= 18.71 Apply adjustr (93)m= 18.71 8. Space heat Set Ti to the the utilisation	19.8219tor for gains0.990.0.990.1 temperatur18.15181 temperatur18.9119nent to the n18.9119ting requirermean internalfactor for ga	for r fo	19.84 est of dw 0.91 he rest o 19.24 r the who 19.84 internal t 19.84 using Tab	19.84 velling, 0.74 of dwell 19.67 ole dwe 20.23 tempe 20.23 tempe 20.23	1 h2, (ling 1 ellinț 2 ratu 2 ratu	9.85 m (se 0.52 T2 (fc 9.82 g) = fl 0.37 ire fro 0.37 at ste	19.85 ee Table 0.35 ollow ste 19.84 -A × T1 20.4 m Table 20.4 ep 11 of	ble 9 19.8 9a) 0.4 ps 3 19.8 + (1 - 20.4 4e, V 20.4 Table	, Th2 (°C) 19.84 2 0.75 to 7 in Table 4 19.72 - fLA) × T2 4 20.27 where approved 4 20.27 where approved 4 20.27 • here approved • approved	19.84 0.96 19.13 fLA = Livi 19.74 0priate 19.74 t Ti,m=	19.83 0.99 18.42 ng area ÷ (4 19.13 19.13 (76)m and	19.83 1 17.88 1) = 18.68 18.68 d re-calo]	(88) (89) (90) (91) (92)
Utilisation fac (89)m= 1 Mean interna (90)m= 17.91 Mean interna (92)m= 18.71 Apply adjustr (93)m= 18.71 8. Space heat Set Ti to the	19.82 19 2tor for gains 0.99 0. 0.99 0. 0. I temperatur 18.15 18 I temperatur 18.91 19 I temperatur 18.91 19 Interperatur 18.91 19 I temperatur 19.91 19 I temperatur 19 19 I temperatur 19 19 I temperatur 19 19 I temperatur 19 19 I temperatur 19 19 I temperatur 19 19 I tempe	for r 98 e in t 62 e (for 31 nean 31 nent al ten ins t 1ar	19.84 est of dw 0.91 he rest o 19.24 r the who 19.84 internal f 19.84 nperature using Tab	19.84 velling, 0.74 of dwell 19.67 ble dwe 20.23 temper 20.23 e obtain	1 h2, (ling 1 ellinț 2 ratu 2 ratu	9.85 m (se 0.52 T2 (fo 9.82 g) = fl 0.37 ire fro 0.37	19.85 ee Table 0.35 ollow ste 19.84 _A × T1 20.4 m Table 20.4	ble 9 19.8 9a) 0.4 ps 3 19.8 + (1 - 20.4 4e, V 20.4	, Th2 (°C) 19.84 2 0.75 to 7 in Table 4 19.72 - fLA) × T2 4 20.27 where approved 4 20.27 where approved 4 20.27 • here approved • approved	19.84 0.96 e 9c) 19.13 fLA = Livi 19.74 opriate 19.74	19.83 0.99 18.42 ng area ÷ (4 19.13	19.83 1 17.88 +) = 18.68 18.68]	(88) (89) (90) (91) (92)

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0.77

0.56

0.4

0.48

0.78

0.96

0.99

1

(94)m=

1

0.99

0.97

0.91

(94)

Usefu	ul gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	388.78	449.05	530.09	614.82	600.91	448.49	303.48	315.26	425.47	419.79	377.95	368.35		(95)
Mont	hly aver	age exte	rnal tem	perature	e from Ta	able 8	-							
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	nal tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1191.67	1156.46	1054.6	891.99	693.69	465.65	306.45	321.6	498.87	743.45	982.88	1187.17		(97)
Spac	e heatin	g require	ement fo	or each n	nonth, k	Wh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	597.35	475.38	390.24	199.57	69.02	0	0	0	0	240.8	435.54	609.2		_
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	3017.1	(98)
Spac	e heatin	g require	ement in	ı kWh/m²	?/year								48.33	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:												
Fract	ion of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fract	ion of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (20	02) × [1 – ((203)] =			1	(204)
			•	ing syste									90.3	(206)
Efficie	ency of a	seconda	ry/suppl	ementar	y heatin	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Spac	e heatin	g require	ement (c	alculate	d above)								
	597.35	475.38	390.24	199.57	69.02	0	0	0	0	240.8	435.54	609.2		
(211)m	า = {[(98)m x (20	4)]}x1	100 ÷ (20)6)									(211)
. ,	661.52	526.44	432.16	221	76.44	0	0	0	0	266.67	482.33	674.64		
				!				Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	3341.2	(211)
Spac	e heatin	g fuel (s	econdar	y), kWh/	month									1
•		01)] } x 1		• •										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
				-				Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	=	0	(215)
Water	heating	9												-
Output	t from w		ter (calc	ulated a	bove)								1	
	181.64	158.67	165.08	146.42	141.76	124.85	119.62	133.35	134.82	153.52	163.88	177.37		_
Efficie	ncy of w	ater hea	iter										81	(216)
(217)m=	87.95	87.78	87.32	86.12	83.83	81	81	81	81	86.44	87.55	88.02		(217)
		heating,												
(219)n <mark>(219)</mark> m=		<u>m x 100</u> 180.76) ÷ (217) 189.05)m 170.03	169.11	154.14	147.68	164.63	166.44	177.61	187.18	201.51		
(219)11=	200.55	100.70	109.00	170.03	109.11	134.14	147.00		l = Sum(2		107.10	201.31	0444.07	
A								Tota			All. 4		2114.67	(219)
	al totals		ad main	system	1					K	Wh/year		kWh/year 3341.2	1
•				System	•]
	-	fuel use											2114.67	
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatir	ng 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				281.85	(232)
Electricity generated by PVs				-885.02	(233)
12a. CO2 emissions – Individual heating systems	including micro-	CHP			
	Energy kWh/year	Emission fact kg CO2/kWh	or	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	=	721.7	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	456.77	(264)
Space and water heating	(261) + (262) + (26	3) + (264) =		1178.47	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	146.28	(268)
Energy saving/generation technologies Item 1		0.519	=	-459.33	(269)
Total CO2, kg/year		sum of (265)(271) =		904.35	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		14.49	(273)
EI rating (section 14)				89	(274)

Regulations Compliance Report

Approved Document Printed on 05 Novem Project Information:	nber 2019 at 13:23	•	roma FSAP 2012 program, Ver	sion: 1.0.4.18	
Assessed By:	Su Lee (STRO031	315)	Building Type:	Flat	
Dwelling Details:					
NEW DWELLING DE	ESIGN STAGE		Total Floor Area: 6	1.99m²	
Site Reference : 2	217 Kingston Road		Plot Reference:	Front - Unit 5	
Address :					
Client Details:					
Name:					
Address :					
This report covers i It is not a complete		thin the SAP calculation ons compliance.	s.		
1a TER and DER					
Fuel for main heating Fuel factor: 1.00 (ma Target Carbon Dioxic Dwelling Carbon Diox 1b TFEE and DFEE	ins gas) de Emission Rate (xide Emission Rate	TER)	21.47 kg/m² 13.52 kg/m²		ок
Target Fabric Energy			62.2 kWh/m²		
Dwelling Fabric Energy	• • •		52.1 kWh/m ²		
		,			ОК
2 Fabric U-values					
Element		Average	Highest		
External wa	II	0.15 (max. 0.30)	0.15 (max. 0.70)		OK
Party wall Floor		0.00 (max. 0.20) 0.13 (max. 0.25)	- 0.13 (max. 0.70)		OK OK
Roof		0.13 (max. 0.20)	0.13 (max. 0.35)		OK
Openings		1.20 (max. 2.00)	1.20 (max. 3.30)		ОК
2a Thermal bridgin	ng				
Thermal brid	dging calculated fro	om linear thermal transmit	tances for each junction		
3 Air permeability					
	ty at 50 pascals		4.00 (design valu	le)	01/
Maximum			10.0		ОК
4 Heating efficienc		_			
Main Heating	system:	Boiler systems with radia Data from manufacturer Combi boiler Efficiency 89.5 % SEDB Minimum 88.0 %		ains gas	ОК
Secondary he		None			
5 Cylinder insulation					
Hot water Stor	rage:	No cylinder			N/A

Regulations Compliance Report

6 Controls									
Space heating controls Hot water controls:									
Boiler interlock:	Yes		ок						
7 Low energy lights									
Percentage of fixed lights with	h low-energy fittings	100.0%							
Minimum	5, 5	75.0%	ОК						
8 Mechanical ventilation									
Not applicable									
9 Summertime temperature									
Overheating risk (Thames va	lley):	High	Fail						
Based on:		5							
Overshading:		Average or unknown							
Windows facing: North East		8.8m ²							
Windows facing: South East		4.63m ²							
Windows facing: South East		0.97m ²							
Windows facing: South East		0.77m ²							
Windows facing: North East		0.85m ²							
Windows facing: South East		1.69m ²							
Windows facing: South East		0.97m ²							
Windows facing: North West		0.97m ²							
Windows facing: South West		3.55m ²							
Windows facing: South		1.08m ²							
Windows facing: West		1.08m ²							
Ventilation rate:		3.00							
Blinds/curtains:		None							
10 Key features									
External Walls U-value		0.13 W/m²K							
Party Walls U-value		0 W/m²K							
Photovoltaic array									

			User D	etails:						
Assessor Name:	Su Lee			Strom	a Num	ber:		STRO	031315	
Software Name:	Stroma FSAP 20	12		Softwa	are Ver	sion:		Versic	on: 1.0.4.18	
		Р	roperty <i>i</i>	Address:	Front -	Unit 5				
Address :										
1. Overall dwelling dime	nsions:									
Ground floor			-	a(m²) 1.99	(1a) x	Av. He	i ght(m) .56	(2a) =	Volume(m ³) 158.38	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1	e)+(1r	I) 6	1.99	(4)					
Dwelling volume			L		(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	158.38	(5)
2. Ventilation rate:	-									
Number of chimneys	main heating 0 +	secondar heating 0	у] + [_	0 0] = [total	X 4	40 =	m³ per hour	(6a)
Number of open flues	0 +	0	+	0	=	0	x 2	20 =	0	(6b)
Number of intermittent fai	าร					3	x ′	10 =	30	(7a)
Number of passive vents						0	x	10 =	0	(7b)
Number of flueless gas fi	res				Ē	0	x 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney	/s. flues and fans =	(6a)+(6b)+(7	a)+(7b)+(1	7c) =	Г	30	<u> </u>	÷ (5) =	0.19	(8)
lf a pressurisation test has be					continue fro				0.10	
Number of storeys in th	e dwelling (ns)								0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0. if both types of wall are pr deducting areas of openin	esent, use the value corre				•	uction			0	(11)
If suspended wooden f	- · · ·	aled) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else enter 0								0	(13)
Percentage of windows	and doors draught	stripped							0	(14)
Window infiltration				0.25 - [0.2		· ·			0	(15)
Infiltration rate				(8) + (10) ·		<i>·</i> · · <i>·</i>			0	(16)
Air permeability value,			•	•	•	etre of e	nvelope	area	4	(17)
If based on air permeabili	•					:			0.39	(18)
Air permeability value applies Number of sides sheltere		as been don	e or a deg	ree air pei	meability	is being us	sea		1	(19)
Shelter factor	u .			(20) = 1 - [[0.075 x (1	9)] =			1 0.92	(10)
Infiltration rate incorporati	ing shelter factor			(21) = (18)) x (20) =				0.36	(21)
Infiltration rate modified for	or monthly wind spee	ed								
Jan Feb	Mar Apr May	/ Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7									
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltra	tion rate ((allowir	ng for she	elter an	d wind sp	peed) =	(21a) x ((22a)m					
	0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42		
		<i>tive air ch</i> I ventilatio	-	ate for th	ie appli	cable cas	se							(22.5)
		at pump usi		ndix N (23	h) - (23a) x Fmv (er	nuation (N	N5)) other	wise (23h	(23a)		l	0	(23a)
		heat recove	• • •		, ,	, ,) = (200)		l	0	(23b)
		d mechan		-	-					2b)m i <i>(t</i>	22h) v [/	1 (22a)	0	(23c)
(24a)m=				0			0		$\frac{1}{0}$		230) × [1 - (230)	÷ 100]	(24a)
		d mechan	-	-	-	,	-		-	-	, e	Ů		
(24b)m=				0	0		0		0		0	0		(24b)
i i l	whole ho	ouse extra			rpositiv				utside	-		_		
,		< 0.5 × (2			•	•				.5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If i	natural v	entilation	or who	ole house	e positiv	ve input v	rentilatio	on from l	oft					
r	<u> </u>	= 1, then	(24d)r	<u> </u>		<u> </u>	1d)m =		2b)m² x	0.5]				
(24d)m=		0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59		(24d)
r	ctive air c	change ra	te - en	í		<u> </u>	, (d) in box	: (25)			,		
(25)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59		(25)
3. Hea	at losses	and heat	loss p	aramete	r:									
ELEN	IENT	Gross area (n		Opening m ²		Net Are A ,m		U-valu W/m2		A X U (W/ł	<)	k-value kJ/m²₊ł		A X k kJ/K
Doors						1.86	x	1.2	=	2.232				(26)
Window	ws Type	1				8.8	x1.	/[1/(1.2)+	0.04] =	10.08				(27)
Window	ws Type	2				4.627	x1.	/[1/(1.2)+	0.04] =	5.3				(27)
Window	ws Type	3				0.966	x1.	/[1/(1.2)+	0.04] =	1.11				(27)
Window	ws Type	4				0.773	x1.	/[1/(1.2)+	0.04] =	0.89				(27)
Window	ws Type	5				0.85	x1.	/[1/(1.2)+	0.04] =	0.97				(27)
Window	ws Type	6				1.689		/[1/(1.2)+	0.04] =	1.93				(27)
Window	ws Type	7				0.967		/[1/(1.2)+	0.04] =	1.11				(27)
Window	ws Type	8				0.967		/[1/(1.2)+	0.04] =	1.11				(27)
Window	ws Type	9				1.182	x1.	/[1/(1.2)+	0.04] =	1.35				(27)
Window	ws Type	10				1.08		/[1/(1.2)+	0.04] =	1.24				(27)
Window	ws Type	11				1.08		/[1/(1.2)+	0.04] =	1.24				(27)
Floor T														
	ype 1					0.777	x	0.13	=	0.10101			\neg	(28)
Floor T						0.777	x x	0.13	=	0.10101	=			(28)
Floor T Walls T	ype 2	71.85	7	25.35			=	r			=			(28)
	ype 2 ype1	71.85		25.35		3.701	×	0.13	=	0.48113	=			(28)
Walls T	ype 2 ype1 ype2	3.8		1.86		3.701 46.51 1.94	x x	0.13 0.15 0.14	=	0.48113 6.98 0.27	=			(28) (29) (29)
Walls T Walls T	ype 2 Type1 Type2 Type3					3.701 46.51	x x x	0.13		0.48113	=			(28)

Roof -	Гуре3	15.3	32	0		15.32	<u>2</u> X	0.13	=	1.99				(30)
Total a	area of e	lements	s, m²			128.1	4							(31)
Party v	wall					30.05	5 X	0	=	0				(32)
			ows, use e sides of in				lated using	g formula 1	/[(1/U-valı	ıe)+0.04] a	as given in	paragrapl	n 3.2	
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)) + (32) =				45.35	(33)
Heat c	apacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	eter (TMF	P = Cm -	÷ TFA) ir	n kJ/m²K			Indica	itive Value	: Medium		250	(35)
	•		nere the de tailed calcu		e construct	ion are noi	t known p	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix l	K						16.97	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								
	abric he								(33) +	(36) =			62.32	(37)
Ventila	ation hea	at loss ca	alculated	l monthl	y		1		(38)m	= 0.33 × (25)m x (5))	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	31.65	31.43	31.22	30.24	30.05	29.19	29.19	29.03	29.52	30.05	30.42	30.81	J	(38)
Heat ti	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		_	
(39)m=	93.96	93.75	93.54	92.55	92.37	91.51	91.51	91.35	91.84	92.37	92.74	93.13		
Heat lo	oss para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷	Sum(39)1 · (4)	12 /12=	92.55	(39)
(40)m=	1.52	1.51	1.51	1.49	1.49	1.48	1.48	1.47	1.48	1.49	1.5	1.5		
Numb	ar of day	in mo	nth (Tabl	la 12)	•		•			Average =	Sum(40)1	12 /12=	1.49	(40)
Numbe	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		(41)
						I		I					1	
4. Wa	ater heat	ting ene	rgy requi	rement:								kWh/y	ear:	
													1	
if TF			N + 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (TFA -13.		.04	J	(42)
			ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		82	2.59]	(43)
		-	hot water person per			-	-	to achieve	a water u	se target o	f		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)		-			-	
(44)m=	90.84	87.54	84.24	80.93	77.63	74.33	74.33	77.63	80.93	84.24	87.54	90.84		
F a a a a a a a a a a		hat water		a data dua	and here a	400 ··· \/					m(44) ₁₁₂ =		991.03	(44)
			used - cal		-	r	. <u> </u>	1			i	· ·	1	
(45)m=	134.72	117.83	121.59	106	101.71	87.77	81.33	93.33	94.44	110.06	120.14	130.47		
lf instan	taneous w	ater heati	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	1299.4	(45)
(46)m=	20.21	17.67	18.24	15.9	15.26	13.17	12.2	14	14.17	16.51	18.02	19.57]	(46)
	storage						-4						1	
-		. ,) includin				-		ame ves	sei		0	J	(47)
	•	-	and no ta		-			. ,	ore) ont	or '()' in ((17)			
Junery	vi2G II I)(2 SIDIED	hot wate	זו כנוווצ וו	iciuues l	กอเลกเสเ	IGOUS CO	ווטמ ומווול	eis) ente	- IUIII (H()			

Water	storage	loss:												
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	y lost fro	m water	⁻ storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
,				cylinder l										
		-		rom Tabl	e 2 (kW	h/litre/da	ay)					0	I	(51)
	•	leating s	ee secti	on 4.3										(50)
			m Table	2h								0 0		(52) (53)
								(47) × (54)	x (52) x (5 2) _		-	l	
0.		(54) in (5	•	e, kWh/ye	ear			(47) x (51))	55) =		0 0		(54) (55)
	. ,	. , .		for each	month			((56)m = (55) 🗙 (41)	m		0		(00)
								. , .	, , ,	r				(50)
(56)m=			0	0	0 = (56)m	0		0	0		0	0 m Append	iv Ll	(56)
				naye, (57)i	n = (56)m	x [(50) – ((11)] ÷ (5 1	0), eise (5	7)m = (56)					
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	I	(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	93							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 30	65 × (41))m						
(61)m=	46.29	40.29	42.93	39.91	39.56	36.65	37.88	39.56	39.91	42.93	43.17	46.29		(61)
Total h	neat regi	uired for	water h	eating ca	alculated	l for eac	ı h month	(62)m =	0.85 x ((45)m +	i (46)m +	(57)m +	(59)m + (61)m	
(62)m=	181.01	158.12	164.51	145.92	141.27	124.42	119.21	132.89	134.36	152.99	163.32	176.76		(62)
				endix G or										
				and/or \						i oontinbut		, nouting)		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
		ı ater hea	l tor											
-	181.01	158.12	164.51	145.92	141.27	124.42	119.21	132.89	134.36	152.99	163.32	176.76		
(04)11-	101.01	150.12	104.51	143.92	141.27	124.42	113.21				r (annual)		1794.78	(64)
	aina fra		h o o tino n		anth 0.0		(45)					•		
-			<u> </u>	45.22		<u> </u>	<u>, ,</u>	· · · ·		<u> </u>	<u> </u>	+ (59)m]	(65)
(65)m=	56.37	49.25	51.16	_	43.71	38.35	36.51	40.92	41.38	47.33	50.74	54.95	1	(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gain	s (Table	e 5), Wat	ts		•	•				•			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	101.87	101.87	101.87	101.87	101.87	101.87	101.87	101.87	101.87	101.87	101.87	101.87		(66)
Lightin	ig gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	15.86	14.09	11.46	8.67	6.48	5.47	5.92	7.69	10.32	13.1	15.29	16.3		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	177.94	179.78	175.13	165.22	152.72	140.97	133.12	131.27	135.92	145.83	158.33	170.09		(68)
				ı ppendix					e Table					
(69)m=	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19		(69)
			(Table (/
(70)m=		is gains		3	3	3	3	3	3	3	3	3		(70)
		1 3	<u>ا</u> ا	I 2	1 3	<u>ا</u> ا	I 2	I 2	1 3	1 1	I 2			$(\cdot \circ)$

(71)== 431.40	Losses e.g. evaporation (negative values) (Table 5)																
(72)m 75.76 73.29 68.76 62.81 59.76 53.26 48.07 55 57.47 63.61 70.47 73.86 (72) Total internal gains = (60m + (67)m + (20)m + (70)m + (71)m + (72)m (73)m 53.212 232.372 311.81 293.27 274.51 258.28 244.67 250.29 209.28 279.11 300.68 316.81 (73)m Star gains are calculated using solar flux from Table 6a and associated equators to convert to the applicable orientation. Orientation: Area Flux 9 F Gains Northeast 0.5% 0.76 × 0.7 25.57 75) Northeast 0.5% 0.77 × 0.88 × 11.28 × 0.76 × 0.7 25.57 75) Northeast 0.5% 0.77 × 0.88 × 11.28 × 0.76 × 0.7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	(71)m= -81.49	9 -81.49	-81.49	-81.49	-81.49		81.49	-81.49	-81	.49 -81.49	-81	1.49	-81.49	-81.49)		(71)
Total internal gains = (66/m + (67/m + (68/m + (70/m + (71/m +	Water heatin	g gains (T	able 5)							•							
(73)ms 328.12 321.72 311.91 293.27 274.51 256.26 244.67 250.52 280.28 279.11 300.66 316.81 (73) Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Orien	(72)m= 75.76	73.29	68.76	62.81	58.75	5	53.26	49.07	5	5 57.47	63	.61	70.47	73.86			(72)
6. Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Area Table 6a F Gains Table 6b FF Gains (W) Northeast 0.% 0.54 × 0.88 × 11.28 × 0.76 × 0.7 = 25.67 (75) Northeast 0.% 0.77 × 0.88 × 11.28 × 0.76 × 0.7 = 25.67 (75) Northeast 0.% 0.77 × 0.85 × 21.297 × 0.76 × 0.7 = 52.67 (75) Northeast 0.% 0.77 × 0.85 × 22.97 × 0.76 × 0.7 = 94.15 (75) Northeast 0.% 0.77 × 0.85 × 0.76 × 0.7 = 21.97 (75) Northeast 0.% 0.77 × 0.85 × 0.76	Total interna	al gains =					(66)	m + (67)m	1 + (68	3)m + (69)m +	⊦ (70)n	n + (71)m + (72)ı	n			
<th< td=""><td>(73)m= 326.12</td><td>2 323.72</td><td>311.91</td><td>293.27</td><td>274.51</td><td>2</td><td>56.26</td><td>244.67</td><td>250</td><td>.52 260.28</td><td>279</td><td>9.11</td><td>300.66</td><td>316.8</td><td>1</td><td></td><td>(73)</td></th<>	(73)m= 326.12	2 323.72	311.91	293.27	274.51	2	56.26	244.67	250	.52 260.28	279	9.11	300.66	316.8	1		(73)
Orientation: Access Factor Table 6d Area m ² Flux Table 6a g Table 6b FF Table 6c Gains (W) Northeast 0.9x 0.54 x 8.8 11.28 x 0.76 x 0.7 = 25.67 (75) Northeast 0.9x 0.77 x 0.85 x 11.28 x 0.76 x 0.7 = 3.54 (75) Northeast 0.9x 0.54 x 8.8 22.97 x 0.76 x 0.7 = 52.26 (75) Northeast 0.9x 0.54 x 8.8 41.38 x 0.76 x 0.7 = 94.15 (75) Northeast 0.9x 0.77 x 0.85 x 0.76 x 0.7 = 21.297 75) Northeast 0.9x 0.77 x 0.85 x 91.35 0.76 x 0.7 = 21.3 (75) Northeast 0.9x 0.77 x 0.85 91.35	6. Solar gai	ns:			-												
Table 6d m² Table 6a Table 6b Table 6c (W) Northeast 0.sk 0.54 x 8.8 x 11.28 x 0.76 x 0.77 = 25.67 (75) Northeast 0.sk 0.77 x 0.85 x 11.28 x 0.76 x 0.77 = 0.52.67 (75) Northeast 0.sk 0.77 x 0.85 x 22.97 x 0.76 x 0.77 = 0.52.67 (75) Northeast 0.sk 0.77 x 0.85 x 41.38 x 0.76 x 0.77 = 12.97 (75) Northeast 0.sk 0.77 x 0.85 x 0.76 x 0.77 = 12.97 (75) Northeast 0.sk 0.77 x 0.85 x 97.84 176) x 0.77 z 0.85 x 97.84 176) x 0.77 z 0.85 1	Solar gains are	e calculated	using solar	flux from	Table 6a	a and	associa	ated equa	tions	to convert to	the ap	plica	able orientati	on.			
Northeast 0.9 0.54 × 8.8 × 11.28 × 0.76 × 0.77 = 25.67 (75) Northeast 0.9 0.54 × 0.85 × 11.28 × 0.76 × 0.77 = 5.22.67 (75) Northeast 0.9 0.77 × 0.85 × 22.97 × 0.76 × 0.77 = 5.22.67 (75) Northeast 0.9 0.77 × 0.85 × 22.97 × 0.76 × 0.77 = 94.15 (75) Northeast 0.9 0.77 × 0.85 × 41.38 × 0.76 × 0.77 = 12.97 (75) Northeast 0.9 0.77 × 0.85 × 97.38 × 0.76 × 0.77 = 207.84 (75) Northeast 0.9 0.77 × 0.85	Orientation:		actor								_	_					
Northeast 0.9 0.77 × 0.85 × 11.28 × 0.76 × 0.77 = 3.54 (75) Northeast 0.9 0.54 × 8.8 × 22.97 × 0.76 × 0.77 = 52.26 (75) Northeast 0.9 0.54 × 8.8 × 22.97 × 0.76 × 0.77 = 64.15 (75) Northeast 0.9 0.54 × 8.8 × 41.38 × 0.76 × 0.77 = 64.15 (75) Northeast 0.9 0.77 × 0.85 × 61.76 × 0.77 = 12.97 (75) Northeast 0.9 0.77 × 0.85 × 61.76 × 0.77 = 21.3 (75) Northeast 0.9 0.77 × 0.85 × 91.35 × 0.76 × 0.77 = 22.63 (75) Nor								ne oa	,		, 	-			-	(VV)	_
Northeast 0.9x 0.54 x 8.8 x 22.97 x 0.76 x 0.77 = 52.26 (75) Northeast 0.9x 0.54 x 8.8 x 1.13 x 0.76 x 0.77 = 52.26 (75) Northeast 0.9x 0.54 x 8.8 x 41.38 x 0.76 x 0.77 = 94.15 (75) Northeast 0.9x 0.54 x 8.8 x 67.96 x 0.76 x 0.77 = 12.97 (75) Northeast 0.9x 0.54 x 8.8 x 91.35 x 0.76 x 0.77 = 21.3 (75) Northeast 0.9x 0.54 x 8.8 x 97.38 x 0.76 x 0.77 = 22.157 (75) Northeast 0.9x 0.54 x 8.8 x 97.38 x 0.76 x 0.77			x	8.	8	x	1	1.28	x	0.76		×Ĺ	0.7	=	Ľ	25.67	(75)
Northeast 0.9x 0.77 x 0.86 x 22.97 x 0.76 x 0.77 = 7.2 (75) Northeast 0.9x 0.54 x 8.8 x 41.38 x 0.76 x 0.77 = 94.15 (75) Northeast 0.9x 0.54 x 8.8 x 67.96 x 0.76 x 0.77 = 12.97 (75) Northeast 0.9x 0.54 x 8.8 x 67.96 x 0.76 x 0.77 = 207.84 (75) Northeast 0.9x 0.54 x 8.8 x 91.35 x 0.76 x 0.7 = 207.84 (75) Northeast 0.9x 0.54 x 8.8 x 91.35 x 0.76 x 0.7 = 207.28 (75) Northeast 0.9x 0.54 x 8.8 x 91.1 x 0.76 x 0.7 =		0	x	0.8	35	x	1.	1.28	x	0.76		×Ĺ	0.7	=	Ľ	3.54	(75)
Northeast 0.54 × 8.8 × 41.38 × 0.76 × 0.77 = 94.15 (75) Northeast 0.9x 0.77 × 0.85 × 41.38 × 0.76 × 0.77 = 12.97 (75) Northeast 0.9x 0.54 × 8.8 × 67.96 × 0.76 × 0.77 = 12.97 (75) Northeast 0.9x 0.54 × 8.8 × 67.96 × 0.76 × 0.77 = 21.3 (75) Northeast 0.9x 0.54 × 8.8 91.35 × 0.76 × 0.77 = 28.63 (75) Northeast 0.9x 0.54 × 8.8 97.38 × 0.76 × 0.77 = 28.55 (75) Northeast 0.9x 0.77 × 0.85 × 77.63 × 0.		0.01	×	8.	8	x	22	2.97	x	0.76		×Ĺ	0.7	=	Ľ	52.26	(75)
Northeast 0.9x 0.77 × 0.85 × 41.38 × 0.76 × 0.77 = 11.297 (75) Northeast 0.9x 0.54 × 8.8 × 67.96 × 0.76 × 0.77 = 112.97 (75) Northeast 0.9x 0.77 × 0.85 × 67.96 × 0.76 × 0.77 = 21.3 (75) Northeast 0.9x 0.54 × 8.8 91.35 × 0.76 × 0.77 = 221.57 (75) Northeast 0.9x 0.77 × 0.85 × 97.38 × 0.76 × 0.77 = 221.57 (75) Northeast 0.9x 0.77 × 0.85 × 97.38 × 0.76 × 0.77 = 221.57 (75) Northeast 0.9x 0.54 × 8.8 91.1			x	0.8	35	x	22	2.97	×	0.76		×Ĺ	0.7	=	Ľ	7.2	(75)
Northeast 0.5x 0.54 x 8.8 x 67.96 x 0.76 x 0.7 = 154.62 (7) Northeast 0.9x 0.77 x 0.86 x 67.96 x 0.76 x 0.7 = 21.3 (7) Northeast 0.9x 0.54 x 8.8 x 91.35 x 0.76 x 0.77 = 221.3 (7) Northeast 0.9x 0.77 x 0.85 x 91.35 x 0.76 x 0.77 = 221.57 (7) Northeast 0.9x 0.77 x 0.85 x 97.38 x 0.76 x 0.77 = 221.57 (7) Northeast 0.9x 0.54 x 8.8 x 91.1 x 0.76 x 0.77 = 28.55 (7) Northeast 0.9x 0.77 x 0.85 x 91.1 x 0.76 x 0.77 = </td <td></td> <td></td> <td>x</td> <td>8.</td> <td>8</td> <td>x</td> <td>4</td> <td>1.38</td> <td>×</td> <td>0.76</td> <td></td> <td>×Ĺ</td> <td>0.7</td> <td> =</td> <td>Ľ</td> <td>94.15</td> <td>(75)</td>			x	8.	8	x	4	1.38	×	0.76		×Ĺ	0.7	=	Ľ	94.15	(75)
Northeast 0.97 × 0.85 × 67.96 × 0.76 × 0.77 = 21.3 (75) Northeast 0.9x 0.54 × 8.8 × 91.35 × 0.76 × 0.77 = 207.84 (75) Northeast 0.9x 0.77 × 0.85 × 91.35 × 0.76 × 0.77 = 221.57 (75) Northeast 0.9x 0.54 × 8.8 × 97.38 × 0.76 × 0.77 = 221.57 (75) Northeast 0.9x 0.77 × 0.85 × 91.1 × 0.76 × 0.77 = 207.28 (75) Northeast 0.9x 0.77 × 0.85 × 72.63 × 0.76 × 0.77 = 28.55 (75) Northeast 0.9x 0.77 × 0.85 ×			x	0.8	35	x	4	1.38	×	0.76		×Ĺ	0.7	=	Ľ	12.97	(75)
Northeast 0.9x 0.54 x 8.8 x 91.35 x 0.76 x 0.77 = 207.84 (75) Northeast 0.9x 0.77 x 0.85 x 91.35 x 0.76 x 0.77 = 2207.84 (75) Northeast 0.9x 0.54 x 8.8 x 97.38 x 0.76 x 0.77 = 221.57 (75) Northeast 0.9x 0.77 x 0.85 x 97.38 x 0.76 x 0.77 = 221.57 (75) Northeast 0.9x 0.54 x 8.8 x 11.1 x 0.76 x 0.77 = 28.55 (75) Northeast 0.9x 0.54 x 8.8 x 72.63 x 0.76 x 0.77 = 145.24 (75) Northeast 0.9x 0.54 x 8.8 x 50.42 x 0.76 x 0.77	Northeast 0.9x	0.54	X	8.	8	x	6	7.96	x	0.76		×	0.7	=	Ľ	154.62	(75)
Northeast 0.9x 0.77 x 0.85 x 91.35 x 0.76 x 0.7 = 28.63 (75) Northeast 0.9x 0.54 x 8.8 x 97.38 x 0.76 x 0.7 = 221.57 (75) Northeast 0.9x 0.77 x 0.85 x 97.38 x 0.76 x 0.7 = 221.57 (75) Northeast 0.9x 0.54 x 8.8 x 91.1 x 0.76 x 0.7 = 207.28 (75) Northeast 0.9x 0.54 x 8.8 x 72.63 x 0.76 x 0.7 = 28.55 (75) Northeast 0.9x 0.54 x 8.8 x 72.63 x 0.76 x 0.7 = 21.76 (75) Northeast 0.9x 0.77 x 0.85 x <td>Northeast 0.9x</td> <td>0.77</td> <td>x</td> <td>3.0</td> <td>35</td> <td>x</td> <td>6</td> <td>7.96</td> <td>x</td> <td>0.76</td> <td></td> <td>×</td> <td>0.7</td> <td>=</td> <td>-</td> <td>21.3</td> <td>(75)</td>	Northeast 0.9x	0.77	x	3.0	35	x	6	7.96	x	0.76		×	0.7	=	-	21.3	(75)
Northeast 0.54 × 8.8 × 97.38 × 0.76 × 0.77 = 221.57 (75) Northeast 0.9x 0.77 × 0.85 × 97.38 × 0.76 × 0.77 = 30.52 (75) Northeast 0.9x 0.54 × 8.8 × 111 × 0.76 × 0.77 = 207.28 (75) Northeast 0.9x 0.77 × 0.85 × 111 × 0.76 × 0.77 = 207.28 (75) Northeast 0.9x 0.77 × 0.85 × 72.63 × 0.76 × 0.77 = 28.55 (75) Northeast 0.9x 0.77 × 0.85 × 72.63 × 0.76 × 0.77 = 28.55 (75) Northeast 0.9x 0.77 × 0.85 50.42 <td< td=""><td>Northeast 0.9x</td><td>0.54</td><td>x</td><td>8.</td><td>8</td><td>x</td><td>9</td><td>1.35</td><td>×</td><td>0.76</td><td></td><td>×</td><td>0.7</td><td>=</td><td>-</td><td>207.84</td><td>(75)</td></td<>	Northeast 0.9x	0.54	x	8.	8	x	9	1.35	×	0.76		×	0.7	=	-	207.84	(75)
Northeast 0.9x 0.77 × 0.85 × 97.38 × 0.76 × 0.77 = 30.52 (75) Northeast 0.9x 0.54 × 8.8 × 91.1 × 0.76 × 0.77 = 207.28 (75) Northeast 0.9x 0.77 × 0.85 × 91.1 × 0.76 × 0.77 = 207.28 (75) Northeast 0.9x 0.77 × 0.85 × 72.63 × 0.76 × 0.77 = 28.55 (75) Northeast 0.9x 0.77 × 0.85 × 72.63 × 0.76 × 0.77 = 22.76 (75) Northeast 0.9x 0.54 × 8.8 × 50.42 × 0.76 × 0.77 = 114.72 (75) Northeast 0.9x 0.77 × 0.85 <t< td=""><td>Northeast 0.9x</td><td>0.77</td><td>x</td><td>0.8</td><td>35</td><td>x</td><td>9</td><td>1.35</td><td>x</td><td>0.76</td><td></td><td>×</td><td>0.7</td><td>=</td><td>• [</td><td>28.63</td><td>(75)</td></t<>	Northeast 0.9x	0.77	x	0.8	35	x	9	1.35	x	0.76		×	0.7	=	• [28.63	(75)
Northeast 0.54 × 8.8 × 91.1 × 0.76 × 0.77 = 207.28 (75) Northeast 0.9x 0.77 × 0.85 × 91.1 × 0.76 × 0.77 = 28.55 (75) Northeast 0.9x 0.54 × 8.8 × 72.63 × 0.76 × 0.77 = 28.55 (75) Northeast 0.9x 0.54 × 8.8 × 72.63 × 0.76 × 0.77 = 22.76 (75) Northeast 0.9x 0.54 × 8.8 × 50.42 × 0.76 × 0.77 = 114.72 (75) Northeast 0.9x 0.54 × 8.8 28.07 × 0.76 × 0.77 = 63.86 (75) Northeast 0.9x 0.54 × 8.8 14.2 × 0.7	Northeast 0.9x	0.54	x	8.	8	x	9	7.38	×	0.76		× [0.7	=	-	221.57	(75)
Northeast 0.9x 0.77 × 0.85 × 91.1 × 0.76 × 0.77 = 28.55 (75) Northeast 0.9x 0.54 × 8.8 × 72.63 × 0.76 × 0.77 = 165.24 (75) Northeast 0.9x 0.77 × 0.85 × 72.63 × 0.76 × 0.77 = 22.76 (75) Northeast 0.9x 0.77 × 0.85 × 72.63 × 0.76 × 0.77 = 22.76 (75) Northeast 0.9x 0.54 × 8.8 × 50.42 × 0.76 × 0.77 = 114.72 (75) Northeast 0.9x 0.54 × 8.8 × 28.07 × 0.76 × 0.77 = 63.86 (75) Northeast 0.9x 0.54 × 8.8 × 14.2 × 0.76 × 0.77 = 4.45 (75) Northeast 0.9x 0.77 × 0.85 ×	Northeast 0.9x	0.77	x	0.8	35	x	9	7.38	×	0.76		×	0.7	=	- [30.52	(75)
Northeast 0.9x 0.54 x 8.8 x 72.63 x 0.76 x 0.7 = 165.24 (75) Northeast 0.9x 0.77 x 0.85 x 72.63 x 0.76 x 0.7 = 165.24 (75) Northeast 0.9x 0.77 x 0.85 x 72.63 x 0.76 x 0.7 = 122.76 (75) Northeast 0.9x 0.54 x 8.8 x 50.42 x 0.76 x 0.7 = 114.72 (75) Northeast 0.9x 0.77 x 0.85 x 50.42 x 0.76 x 0.7 = 114.72 (75) Northeast 0.9x 0.54 x 8.8 x 28.07 x 0.76 x 0.7 = 8.8 (75) Northeast 0.9x 0.54 x 8.8 x 14.2 x 0.76 x 0.7 = 23.3 (75) Northeast 0.9x 0.77 x 0.85 x	Northeast 0.9x	0.54	X	8.	8	x	9	1.1	x	0.76		×	0.7	=	- [207.28	(75)
Northeast $0.9x$ 0.77 x 0.85 x 72.63 x 0.76 x 0.7 z 22.76 (75) Northeast $0.9x$ 0.54 x 8.8 x 50.42 x 0.76 x 0.7 z 114.72 (75) Northeast $0.9x$ 0.77 x 0.85 x 50.42 x 0.76 x 0.7 z 114.72 (75) Northeast $0.9x$ 0.77 x 0.85 x 50.42 x 0.76 x 0.7 z 114.72 (75) Northeast $0.9x$ 0.54 x 8.8 x 28.07 x 0.76 x 0.7 z 63.86 (75) Northeast $0.9x$ 0.77 x 0.85 x 28.07 x 0.76 x 0.7 z 8.8 (75) Northeast $0.9x$ 0.54 x 8.8 x 14.2 x 0.76 x 0.7 z 23.3 (75) Northeast $0.9x$ 0.77 x 0.85 x 14.2 x 0.76 x 0.7 z 28.9 (75) Northeast $0.9x$ 0.54 x 8.8 x 9.21 x 0.76 x 0.7 z 2.89 (75) Southeast $0.9x$ 0.77 x 0.85 y 9.76 x 0.7 z 2.89 (75)	Northeast 0.9x	0.77	X	0.8	35	x	9	1.1	×	0.76		× [0.7	=	- [28.55	(75)
Northeast $0.9x$ 0.54 x 8.8 x 50.42 x 0.76 x 0.77 $=$ 114.72 (75) Northeast $0.9x$ 0.77 x 0.85 x 50.42 x 0.76 x 0.7 $=$ 114.72 (75) Northeast $0.9x$ 0.77 x 0.85 x 50.42 x 0.76 x 0.7 $=$ 114.72 (75) Northeast $0.9x$ 0.54 x 8.8 x 28.07 x 0.76 x 0.7 $=$ 63.86 (75) Northeast $0.9x$ 0.77 x 0.85 x 28.07 x 0.76 x 0.7 $=$ 8.8 (75) Northeast $0.9x$ 0.54 x 8.8 x 14.2 x 0.76 x 0.7 $=$ 32.3 (75) Northeast $0.9x$ 0.54 x 8.8 x 14.2 x 0.76 x 0.7 $=$ 20.96 (75) Northeast $0.9x$ 0.54 x 8.8 9.21 x 0.76 x 0.7 $=$ 28.9 (75) Southeast $0.9x$ 0.54 x 4.63 x 36.79 x 0.76 x 0.7 $=$ 28.9 (75) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 13.12 (77) Southeast $0.9x$ 0.77 x <t< td=""><td>Northeast 0.9x</td><td>0.54</td><td>X</td><td>8.</td><td>8</td><td>x</td><td>72</td><td>2.63</td><td>×</td><td>0.76</td><td></td><td>× [</td><td>0.7</td><td>=</td><td>- [</td><td>165.24</td><td>(75)</td></t<>	Northeast 0.9x	0.54	X	8.	8	x	72	2.63	×	0.76		× [0.7	=	- [165.24	(75)
Northeast $0.9x$ 0.77 x 0.85 x 50.42 x 0.76 x 0.7 $=$ 15.8 (75) Northeast $0.9x$ 0.54 x 8.8 x 28.07 x 0.76 x 0.7 $=$ 63.86 (75) Northeast $0.9x$ 0.77 x 0.85 x 28.07 x 0.76 x 0.7 $=$ 63.86 (75) Northeast $0.9x$ 0.77 x 0.85 x 28.07 x 0.76 x 0.7 $=$ 8.8 (75) Northeast $0.9x$ 0.54 x 8.8 x 14.2 x 0.76 x 0.7 $=$ 4.45 (75) Northeast $0.9x$ 0.54 x 8.8 x 9.21 x 0.76 x 0.7 $=$ 20.96 (75) Northeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 2.89 (75) Northeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 24.02 (77) Southeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 24.02 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 13.12 (77) Southeast $0.9x$ 0.77 x	Northeast 0.9x	0.77	x	0.8	35	x	72	2.63	×	0.76		× [0.7	=	- [22.76	(75)
Northeast $0.9x$ 0.54 x 8.8 x 28.07 x 0.76 x 0.7 = 63.86 (75) Northeast $0.9x$ 0.77 x 0.85 x 28.07 x 0.76 x 0.7 = 8.8 (75) Northeast $0.9x$ 0.54 x 8.8 x 14.2 x 0.76 x 0.7 = 32.3 (75) Northeast $0.9x$ 0.54 x 8.8 x 14.2 x 0.76 x 0.7 = 4.45 (75) Northeast $0.9x$ 0.77 x 0.85 x 14.2 x 0.76 x 0.7 = 4.45 (75) Northeast $0.9x$ 0.54 x 8.8 x 9.21 x 0.76 x 0.7 = 20.96 (75) Northeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 = 24.02 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 = 13.1 (77) Southeast $0.9x$ 0.77 x 0.77 x 36.79 x 0.76 x 0.7 = 12.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 = 13.12 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 = <td>Northeast 0.9x</td> <td>0.54</td> <td>x</td> <td>8.</td> <td>8</td> <td>x</td> <td>50</td> <td>0.42</td> <td>x</td> <td>0.76</td> <td></td> <td>× [</td> <td>0.7</td> <td>=</td> <td>- [</td> <td>114.72</td> <td>(75)</td>	Northeast 0.9x	0.54	x	8.	8	x	50	0.42	x	0.76		× [0.7	=	- [114.72	(75)
Northeast $0.9x$ 0.77 x 0.85 x 28.07 x 0.76 x 0.7 $=$ 8.8 (75) Northeast $0.9x$ 0.54 x 8.8 x 14.2 x 0.76 x 0.7 $=$ 32.3 (75) Northeast $0.9x$ 0.77 x 0.85 x 14.2 x 0.76 x 0.7 $=$ 4.45 (75) Northeast $0.9x$ 0.77 x 0.85 x 14.2 x 0.76 x 0.7 $=$ 20.96 (75) Northeast $0.9x$ 0.54 x 8.8 x 9.21 x 0.76 x 0.7 $=$ 2.89 (75) Southeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 2.89 (75) Southeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 2.89 (75) Southeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 2.89 (75) Southeast $0.9x$ 0.77 x 0.85 x 36.79 x 0.76 x 0.7 $=$ 13.1 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 22.91 (77) Southeast $0.9x$ 0.77 x <td>Northeast 0.9x</td> <td>0.77</td> <td>x</td> <td>0.8</td> <td>35</td> <td>x</td> <td>50</td> <td>0.42</td> <td>×</td> <td>0.76</td> <td></td> <td>× [</td> <td>0.7</td> <td>=</td> <td>- [</td> <td>15.8</td> <td>(75)</td>	Northeast 0.9x	0.77	x	0.8	35	x	50	0.42	×	0.76		× [0.7	=	- [15.8	(75)
Northeast $0.9x$ 0.54 x 8.8 x 14.2 x 0.76 x 0.7 $=$ 32.3 (75) Northeast $0.9x$ 0.77 x 0.85 x 14.2 x 0.76 x 0.7 $=$ 4.45 (75) Northeast $0.9x$ 0.54 x 8.8 x 9.21 x 0.76 x 0.7 $=$ 20.96 (75) Northeast $0.9x$ 0.54 x 8.8 x 9.21 x 0.76 x 0.7 $=$ 20.96 (75) Northeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 2.89 (75) Southeast $0.9x$ 0.54 x 4.63 x 36.79 x 0.76 x 0.7 $=$ 44.02 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 10.49 (77) Southeast $0.9x$ 0.77 x 0.77 x 36.79 x 0.76 x 0.7 $=$ 10.49 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 12.291 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 12.291 (77) Southeast $0.9x$ 0.77 <t< td=""><td>Northeast 0.9x</td><td>0.54</td><td>x</td><td>8.</td><td>8</td><td>x</td><td>28</td><td>8.07</td><td>x</td><td>0.76</td><td></td><td>× [</td><td>0.7</td><td>=</td><td>- [</td><td>63.86</td><td>(75)</td></t<>	Northeast 0.9x	0.54	x	8.	8	x	28	8.07	x	0.76		× [0.7	=	- [63.86	(75)
Northeast $0.9x$ 0.77 x 0.85 x 14.2 x 0.76 x 0.7 $=$ 4.45 (75) Northeast $0.9x$ 0.54 x 8.8 x 9.21 x 0.76 x 0.7 $=$ 20.96 (75) Northeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 20.96 (75) Northeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 2.89 (75) Southeast $0.9x$ 0.54 x 4.63 x 36.79 x 0.76 x 0.7 $=$ 44.02 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 13.1 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 13.12 (77)	Northeast 0.9x	0.77	x	0.8	35	x	28	8.07	x	0.76		× [0.7	=	- [8.8	(75)
Northeast $0.9x$ 0.54 x 8.8 x 9.21 x 0.76 x 0.7 $=$ 20.96 (75) Northeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 2.89 (75) Southeast $0.9x$ 0.54 x 4.63 x 36.79 x 0.76 x 0.7 $=$ 44.02 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 13.1 (77) Southeast $0.9x$ 0.77 x 0.77 x 36.79 x 0.76 x 0.7 $=$ 10.49 (77) Southeast $0.9x$ 0.77 x 1.69 x 36.79 x 0.76 x 0.7 $=$ 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 13.12 (77)	Northeast 0.9x	0.54	x	8.	8	x	1	4.2	×	0.76		× [0.7	=	- [32.3	(75)
Northeast $0.9x$ 0.77 x 0.85 x 9.21 x 0.76 x 0.7 $=$ 2.89 (75) Southeast $0.9x$ 0.54 x 4.63 x 36.79 x 0.76 x 0.7 $=$ 44.02 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 13.1 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 10.49 (77) Southeast $0.9x$ 0.77 x 1.69 x 36.79 x 0.76 x 0.7 $=$ 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 $=$ 22.91 (77)	Northeast 0.9x	0.77	x	0.8	35	x	1	4.2	x	0.76		× [0.7	=	- [4.45	(75)
Southeast $0.9x$ 0.54 x 4.63 x 36.79 x 0.76 x 0.7 = 44.02 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 = 13.1 (77) Southeast $0.9x$ 0.77 x 0.77 x 36.79 x 0.76 x 0.7 = 13.1 (77) Southeast $0.9x$ 0.77 x 0.77 x 36.79 x 0.76 x 0.7 = 10.49 (77) Southeast $0.9x$ 0.77 x 1.69 x 36.79 x 0.76 x 0.7 = 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 = 13.12 (77)	Northeast 0.9x	0.54	x	8.	8	x	9	.21	x	0.76		×	0.7	=	• [20.96	(75)
Southeast $0.9x$ 0.77x0.97x36.79x0.76x0.77=13.1(77)Southeast $0.9x$ 0.77x0.77x36.79x0.76x0.7=10.49(77)Southeast $0.9x$ 0.77x1.69x36.79x0.76x0.7=10.49(77)Southeast $0.9x$ 0.77x1.69x36.79x0.76x0.7=22.91(77)Southeast $0.9x$ 0.77x0.97x36.79x0.76x0.7=13.12(77)	Northeast 0.9x	0.77	x	3.0	35	x	9	.21	x	0.76		×	0.7	=	• [2.89	(75)
Southeast $0.9x$ 0.77 x 0.77 x 36.79 x 0.76 x 0.7 = 10.49 (77) Southeast $0.9x$ 0.77 x 1.69 x 36.79 x 0.76 x 0.7 = 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 = 22.91 (77) Southeast $0.9x$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 = 13.12 (77)	Southeast 0.9x	0.54	x	4.6	63	x	30	6.79	x	0.76		×	0.7	=	• [44.02	(77)
Southeast $_{0.9x}$ 0.77 x 1.69 x 36.79 x 0.76 x 0.7 = 22.91 (77) Southeast $_{0.9x}$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 = 22.91 (77)	Southeast 0.9x	0.77	X	0.9)7	x	30	6.79	×	0.76		×Ī	0.7	=	- [13.1	(77)
Southeast $_{0.9x}$ 0.77 x 0.97 x 36.79 x 0.76 x 0.7 = 13.12 (77)	Southeast 0.9x	0.77	x	0.7	77	x	30	6.79	x	0.76		×Ī	0.7		- [10.49	(77)
	Southeast 0.9x	0.77	x	1.6	69	x	30	6.79	x	0.76		×Ī	0.7	_	Ē	22.91	(77)
Southeast 0.9x 0.54 x 4.63 x 62.67 x 0.76 x 0.7 = 74.98 (77)	Southeast 0.9x	0.77	x	0.9	97	x	30	6.79	×	0.76		×Ī	0.7		Ē	13.12	(77)
	Southeast 0.9x	0.54	x	4.6	63	x	62	2.67	×	0.76		×Ē	0.7		- [74.98	(77)

Southeast 0.9x	0.77] ×	0.97	×	62.67	x	0.76	x	0.7	=	22.32	(77)
Southeast 0.9x	0.77	l x	0.97	x	62.67	x	0.76	x	0.7	=	17.86	_(<i>```)</i> _(77)
Southeast 0.9x	0.77] ^] x	1.69	x	62.67	x	0.76	x	0.7	=	39.03	(<i>11)</i>
Southeast 0.9x	0.77] ^] x	0.97	x	62.67	x	0.76	x	0.7	=	22.34	(77)
Southeast 0.9x	0.54] ^] x	4.63	x	85.75	x	0.76	x	0.7	=	102.59	(77)
Southeast 0.9x	0.77] x	0.97	x	85.75	x	0.76	x	0.7	=	30.54	(77)
Southeast 0.9x	0.77	」 】 x	0.77	x	85.75	x	0.76	x	0.7	=	24.44](77)
Southeast 0.9x	0.77] x	1.69	x	85.75	x	0.76	x	0.7	=	53.4	(77)
Southeast 0.9x	0.77	x	0.97	x	85.75	x	0.76	x	0.7	=	30.57	(77)
Southeast 0.9x	0.54	×	4.63	×	106.25	x	0.76	x	0.7	=	127.11	(77)
Southeast 0.9x	0.77	x	0.97	x	106.25	x	0.76	x	0.7	=	37.84	(77)
Southeast 0.9x	0.77	x	0.77	x	106.25	x	0.76	x	0.7	=	30.28	(77)
Southeast 0.9x	0.77	x	1.69	x	106.25	x	0.76	x	0.7	=	66.16	(77)
Southeast 0.9x	0.77	x	0.97	×	106.25	x	0.76	x	0.7	=	37.88	(77)
Southeast 0.9x	0.54	x	4.63	x	119.01	x	0.76	x	0.7	=	142.37	(77)
Southeast 0.9x	0.77	x	0.97	x	119.01	x	0.76	x	0.7	=	42.38	(77)
Southeast 0.9x	0.77	x	0.77	x	119.01	x	0.76	x	0.7	=	33.92	(77)
Southeast 0.9x	0.77	x	1.69	x	119.01	x	0.76	x	0.7	=	74.11	(77)
Southeast 0.9x	0.77	x	0.97	x	119.01	x	0.76	x	0.7	=	42.43	(77)
Southeast 0.9x	0.54	x	4.63	x	118.15	x	0.76	x	0.7	=	141.35	(77)
Southeast 0.9x	0.77	x	0.97	x	118.15	x	0.76	x	0.7	=	42.08	(77)
Southeast 0.9x	0.77	x	0.77	x	118.15	x	0.76	x	0.7	=	33.67	(77)
Southeast 0.9x	0.77	x	1.69	x	118.15	x	0.76	x	0.7	=	73.57	(77)
Southeast 0.9x	0.77	x	0.97	x	118.15	x	0.76	x	0.7	=	42.12	(77)
Southeast 0.9x	0.54	x	4.63	x	113.91	x	0.76	x	0.7	=	136.27	(77)
Southeast 0.9x	0.77	x	0.97	x	113.91	x	0.76	x	0.7	=	40.57	(77)
Southeast 0.9x	0.77	x	0.77	×	113.91	x	0.76	x	0.7	=	32.46	(77)
Southeast 0.9x	0.77	x	1.69	x	113.91	x	0.76	x	0.7	=	70.93	(77)
Southeast 0.9x	0.77	x	0.97	x	113.91	x	0.76	x	0.7	=	40.61	(77)
Southeast 0.9x	0.54	x	4.63	x	104.39	x	0.76	x	0.7	=	124.88	(77)
Southeast 0.9x	0.77	x	0.97	x	104.39	x	0.76	X	0.7	=	37.18	(77)
Southeast 0.9x	0.77	x	0.77	x	104.39	x	0.76	x	0.7	=	29.75	(77)
Southeast 0.9x	0.77	x	1.69	x	104.39	x	0.76	x	0.7	=	65	(77)
Southeast 0.9x	0.77	x	0.97	x	104.39	x	0.76	x	0.7	=	37.22	(77)
Southeast 0.9x	0.54	×	4.63	x	92.85	x	0.76	x	0.7	=	111.08	(77)
Southeast 0.9x	0.77	x	0.97	x	92.85	X	0.76	X	0.7	=	33.07	(77)
Southeast 0.9x	0.77	×	0.77	×	92.85	x	0.76	x	0.7	=	26.46	(77)
Southeast 0.9x	0.77	×	1.69	×	92.85	x	0.76	x	0.7	=	57.82	(77)
Southeast 0.9x	0.77	×	0.97	×	92.85	x	0.76	x	0.7	=	33.1	(77)
Southeast 0.9x	0.54	×	4.63	×	69.27	x	0.76	x	0.7	=	82.87	(77)
Southeast 0.9x	0.77	×	0.97	X	69.27	x	0.76	x	0.7	=	24.67	(77)

0		1		,		1		I	[٦
Southeast 0.9x	0.77	X	0.77	X	69.27	X	0.76	X	0.7	=	19.74	(77)
Southeast 0.9x	0.77	x	1.69	x	69.27	x	0.76	X	0.7	=	43.13	(77)
Southeast 0.9x	0.77	x	0.97	x	69.27	x	0.76	x	0.7	=	24.69	(77)
Southeast 0.9x	0.54	x	4.63	x	44.07	x	0.76	x	0.7	=	52.72	(77)
Southeast 0.9x	0.77	x	0.97	x	44.07	x	0.76	x	0.7	=	15.7	(77)
Southeast 0.9x	0.77	x	0.77	x	44.07	x	0.76	x	0.7	=	12.56	(77)
Southeast 0.9x	0.77	x	1.69	x	44.07	x	0.76	x	0.7	=	27.44	(77)
Southeast 0.9x	0.77	x	0.97	x	44.07	x	0.76	x	0.7	=	15.71	(77)
Southeast 0.9x	0.54	x	4.63	x	31.49	x	0.76	x	0.7	=	37.67	(77)
Southeast 0.9x	0.77	x	0.97	x	31.49	x	0.76	x	0.7	=	11.21	(77)
Southeast 0.9x	0.77	x	0.77	x	31.49	x	0.76	x	0.7	=	8.97	(77)
Southeast 0.9x	0.77	x	1.69	x	31.49	x	0.76	x	0.7	=	19.61	(77)
Southeast 0.9x	0.77	x	0.97	x	31.49	x	0.76	x	0.7	=	11.23	(77)
South 0.9x	0.77	x	1.08	x	46.75	x	0.76	x	0.7	=	18.62	(78)
South 0.9x	0.77	x	1.08	x	76.57	x	0.76	x	0.7	=	30.49	(78)
South 0.9x	0.77	x	1.08	x	97.53	x	0.76	x	0.7	=	38.84	(78)
South 0.9x	0.77	x	1.08	x	110.23	x	0.76	x	0.7	=	43.89	(78)
South 0.9x	0.77	x	1.08	x	114.87	x	0.76	x	0.7	=	45.74	(78)
South 0.9x	0.77	x	1.08	x	110.55	x	0.76	x	0.7	=	44.02	(78)
South 0.9x	0.77	x	1.08	x	108.01	x	0.76	x	0.7	=	43.01	(78)
South 0.9x	0.77	x	1.08	x	104.89	x	0.76	x	0.7	=	41.77	(78)
South 0.9x	0.77	x	1.08	x	101.89	x	0.76	x	0.7	=	40.57	(78)
South 0.9x	0.77	x	1.08	x	82.59	x	0.76	x	0.7	=	32.88	(78)
South 0.9x	0.77	x	1.08	x	55.42	x	0.76	x	0.7	=	22.07	(78)
South 0.9x	0.77	x	1.08	x	40.4	x	0.76	x	0.7	=	16.09	(78)
Southwest _{0.9x}	0.77	x	1.18	x	36.79]	0.76	x	0.7	=	48.1	(79)
Southwest _{0.9x}	0.77	x	1.18	x	62.67]	0.76	x	0.7	=	81.93	(79)
Southwest _{0.9x}	0.77	x	1.18	x	85.75]	0.76	x	0.7	=	112.11	(79)
Southwest _{0.9x}	0.77	x	1.18	x	106.25]	0.76	x	0.7	=	138.91	(79)
Southwest0.9x	0.77	x	1.18	x	119.01]	0.76	x	0.7	=	155.59	(79)
Southwest _{0.9x}	0.77	x	1.18	x	118.15]	0.76	x	0.7	=	154.46	(79)
Southwest _{0.9x}	0.77	x	1.18	x	113.91]	0.76	x	0.7	=	148.92	(79)
Southwest0.9x	0.77	x	1.18	x	104.39]	0.76	x	0.7	=	136.47	(79)
Southwest _{0.9x}	0.77	x	1.18	x	92.85]	0.76	x	0.7	=	121.39	(79)
Southwest _{0.9x}	0.77	x	1.18	x	69.27]	0.76	x	0.7	=	90.56	(79)
Southwest _{0.9x}	0.77	x	1.18	×	44.07]	0.76	x	0.7	=	57.61	(79)
Southwest _{0.9x}	0.77	×	1.18	×	31.49]	0.76	x	0.7	=	41.16	(79)
West 0.9x	0.77	x	1.08	x	19.64	x	0.76	x	0.7	=	7.82	(80)
West 0.9x	0.77	x	1.08	×	38.42	x	0.76	x	0.7	=	15.3	(80)
West 0.9x	0.77	×	1.08	×	63.27	×	0.76	x	0.7	=	25.19	(80)
West 0.9x	0.77	×	1.08	x	92.28	×	0.76	x	0.7	=	36.74	(80)

West	0.9x	0.77	x	1.08	×		113.09	x	0.76	×	0.7	=	45.03	(80)
West	0.9x	0.77	x	1.08	×		115.77	×	0.76	x	0.7	=	46.1	(80)
West	0.9x	0.77	x	1.08	×		110.22	x	0.76	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	1.08	×		94.68	×	0.76	×	0.7	=	37.7	(80)
West	0.9x	0.77	x	1.08	×		73.59	x	0.76	×	0.7	=	29.3	(80)
West	0.9x	0.77	x	1.08	×		45.59	- x	0.76	×	0.7	=	18.15	(80)
West	0.9x	0.77	x	1.08	×		24.49	Ī×Ī	0.76	- x	0.7	=	9.75	(80)
West	0.9x	0.77	x	1.08	×		16.15	x	0.76	- x	0.7	=	6.43	(80)
Northwe	st 0.9x	0.77	x	0.97	×		11.28	Ī×Ī	0.76	×	0.7	=	4.02	(81)
Northwe	st 0.9x	0.77	x	0.97	×		22.97	Ī×Ī	0.76	- x	0.7	=	8.19	(81)
Northwe	st 0.9x	0.77	×	0.97	×		41.38	- x	0.76	- ×	0.7	=	14.75	(81)
Northwe	st 0.9x	0.77	×	0.97	×		67.96		0.76	- x	0.7	= =	24.23	(81)
Northwe	st 0.9x	0.77	×	0.97	×		91.35	i x i	0.76	ا × آ	0.7	=	32.57	(81)
Northwe	st <u>0.9x</u>	0.77	x	0.97	×		97.38] x	0.76	ا × آ	0.7	=	34.72	(81)
Northwe	st 0.9x	0.77	×	0.97	×		91.1	i x i	0.76	ا_ ×	0.7	=	32.48	(81)
Northwe	st 0.9x	0.77	×	0.97	×		72.63] x [0.76	- ×	0.7	=	25.89	(81)
Northwe	st 0.9x	0.77	x	0.97	×		50.42] x	0.76	- x	0.7	=	17.98	(81)
Northwe	st 0.9x	0.77	×	0.97	×		28.07	x	0.76	- x	0.7	=	10.01	(81)
Northwe	st <mark>0.9x</mark>	0.77	_ x	0.97	≓,		14.2	ı x	0.76	ا × ا	0.7	=	5.06	(81)
Northwe	st <mark>0.9x</mark>	0.77	×	0.97	≓,		9.21	」 」] x]	0.76	ا_ ×	0.7	=	3.28	(81)
	L			L										
Solar da	ains in s	watts cale	culated	for each m	onth			(83)m	= Sum(74)m	.(82)m				
(83)m=	211.4	· · · ·	539.54		50.59	864.1	7 824.96	723.		419.35	5 255.37	179.51	1	(83)
Total ga	ains – ir	nternal and	d solar	(84)m = (7	3)m +	(83)r	n , watts	1					1	
(84)m=	537.52	695.61 8	351.45	1012.22 11	25.11	1120.4	3 1069.62	974.	39 861.56	698.46	556.03	496.32]	(84)
7 Mea	an inter	nal tempe	rature	(heating se	ason)		•						•	
				eriods in th		a area	a from Ta	ble 9.	Th1 (°C)				21	(85)
		-	• •	iving area,		-		,	(-)					
Γ	Jan	Feb	Mar		May	Jun		A	lg Sep	Oct	Nov	Dec]	
(86)m=	0.99	0.98	0.94).68	0.51	0.37	0.4		0.91	0.98	0.99		(86)
L Mean i	• •			I				1					1	
INCALL	intorna	i tamnarat	uro in l	ivina area	T1 (fol		tons 3 to .	7 in T	ahla Qc)					
- г		<u> </u>		iving area	<u> </u>			1		20.53	19.94	19.47	1	(87)
(87)m=	19.53	19.82	20.21	20.62 2	0.87	20.97	20.99	20.9	99 20.91	20.53	19.94	19.47]	(87)
(87)m= Tempe	19.53 erature	19.82 during hea	20.21 ating p	20.62 2 eriods in re	0.87 est of d	20.97 Iwellir	20.99	20.9 able 9	99 20.91), Th2 (°C)]	
(87)m= [Tempe (88)m= [19.53 erature 19.68	19.82 during hea 19.68	20.21 ating p 19.68	20.62 2 eriods in re 19.69 1	0.87 est of d 9.69	20.97 Iwellir 19.71	20.99 ng from Ta 19.71	20.9 able 9 19.7	99 20.91), Th2 (°C)	20.53 19.69		19.47 19.69]	(87) (88)
(87)m= [Tempe (88)m= [Utilisat	19.53 erature 19.68 tion fac	19.82 during hea 19.68 tor for gain	20.21 ating p 19.68 ns for r	20.62 2 eriods in re 19.69 1 est of dwe	0.87 est of d 9.69 ling, h	20.97 Iwellir 19.71 2,m (1	20.99 ng from Ta 19.71 see Table	20.9 able 9 19.7 9a)	20.91 20.91 0, Th2 (°C) 71 19.7	19.69	19.69	19.69]]	(88)
(87)m= [Tempe (88)m= [19.53 erature 19.68	19.82 during hea 19.68	20.21 ating p 19.68	20.62 2 eriods in re 19.69 1 est of dwe	0.87 est of d 9.69	20.97 Iwellir 19.71	20.99 ng from Ta 19.71	20.9 able 9 19.7	20.91 20.91 0, Th2 (°C) 71 19.7]]]	
(87)m= [Tempe (88)m= [Utilisat (89)m= [19.53 erature 19.68 tion fac 0.99	19.82 during hea 19.68 tor for gain 0.97	20.21 ating p 19.68 ns for r 0.92	20.62 2 eriods in re 19.69 1 est of dwel 0.8 (0.87 est of d 9.69 ling, h	20.97 Iwellir 19.71 2,m (0.41	20.99 ng from Ta 19.71 see Table 0.26	20.9 able 9 19.7 9a) 0.3	20.91 20.91 0, Th2 (°C) 71 19.7	19.69 0.87	19.69	19.69]]	(88)
(87)m= [Tempe (88)m= [Utilisat (89)m= [19.53 erature 19.68 tion fac 0.99	19.82 during hea 19.68 tor for gain 0.97 I temperat	20.21 ating p 19.68 ns for r 0.92	20.62 2 eriods in re 19.69 1 est of dwel 0.8 0 the rest of d	0.87 est of d 9.69 ling, h	20.97 Iwellir 19.71 2,m (0.41	20.99 ng from Ta 19.71 see Table 0.26 (follow ste	20.9 able 9 19.7 9a) 0.3	20.91 20.91 0, Th2 (°C) 71 19.7 1 0.57 to 7 in Table 7 19.65	19.69 0.87 e 9c) 19.21	19.69 0.97 18.38	19.69 0.99 17.7]]]	(88)
(87)m= [Tempe (88)m= [Utilisat (89)m= [Mean i	19.53 erature 19.68 tion fac 0.99 interna	19.82 during hea 19.68 tor for gain 0.97 I temperat	20.21 ating p 19.68 ns for r 0.92 ure in t	20.62 2 eriods in re 19.69 1 est of dwel 0.8 0 the rest of d	0.87 9.69 ling, h 0.61 dwellin	20.97 wellir 19.71 2,m (0.41	20.99 ng from Ta 19.71 see Table 0.26 (follow ste	20.9 able 9 19.7 9a) 0.3 eps 3	20.91 20.91 0, Th2 (°C) 71 19.7 1 0.57 to 7 in Table 7 19.65	19.69 0.87 e 9c) 19.21	19.69 0.97	19.69 0.99 17.7]] 0.4	(88) (89)
(87)m= [Tempe (88)m= [Utilisat (89)m= [Mean i (90)m= [19.53 erature 19.68 tion fac 0.99 interna 17.78	19.82 during hea 19.68 tor for gain 0.97 l temperat 18.2	20.21 ating p 19.68 ns for r 0.92 ure in t 18.74	20.62 2 eriods in re 1 19.69 1 est of dwel 0.8 0.8 0 the rest of of 19.29 19.29 1	0.87 9.69 Iling, h 0.61 dwellin 9.59	20.97 lwellir 19.71 2,m (0.41 ng T2 19.69	20.99 ng from Ta 19.71 see Table 0.26 (follow sta 19.7	20.9 able 9 19.7 9a) 0.3 eps 3 19.	20.91 20.91 0, Th2 (°C) 71 19.7 1 0.57 to 7 in Table 7 19.65	19.69 0.87 e 9c) 19.21	19.69 0.97 18.38	19.69 0.99 17.7]] 0.4	(88) (89) (90)
(87)m= [Tempe (88)m= [Utilisat (89)m= [Mean i (90)m= [19.53 erature 19.68 tion fac 0.99 interna 17.78	19.82 during hea 19.68 tor for gain 0.97 I temperat 18.2	20.21 ating p 19.68 ns for r 0.92 ure in t 18.74	20.62 2 eriods in re 1 19.69 1 est of dwel 0.8 0.8 0 the rest of 0 1 19.29 1 r the whole 1	0.87 9.69 Iling, h 0.61 dwellin 9.59	20.97 lwellir 19.71 2,m (0.41 ng T2 19.69	20.99 ng from Ta 19.71 see Table 0.26 (follow sta 19.7	20.9 able 9 19.7 9a) 0.3 eps 3 19.	20.91 20.910	19.69 0.87 e 9c) 19.21	19.69 0.97 18.38 ting area ÷ (4	19.69 0.99 17.7]] 0.4	(88) (89) (90)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.48	18.85	19.33	19.83	20.1	20.2	20.22	20.22	20.15	19.74	19.01	18.41		(93)
8. Spa	ace hea	iting requ	uiremen	t										
				mperatui using Ta		ied at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	n:										
(94)m=	0.98	0.96	0.91	0.8	0.64	0.45	0.31	0.35	0.6	0.87	0.97	0.99		(94)
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m									
(95)m=	529.35	669.46	777.18	813.39	714.56	501.67	329.58	345.74	519.86	609.23	538.89	490.62		(95)
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8							1	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	I	(96)
		1	i	nal tempe		ì	- ,		· ,	- 1			1	
(97)m=	1332.29				776.23	512.85	331.38	348.94	556.1	844.41	1104.43	1323.87	I	(97)
· ·		ř	1	or each n		1		<u> </u>	<u>``</u>	<u> </u>	ŕ			
(98)m=	597.38	428.86	314.68	142.47	45.89	0	0	0	0	174.98	407.19	619.94	<u> </u>	٦
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	2731.39	(98)
Space	e heatin	g requir	ement in	1 kWh/m²	/year								44.06	(99)
9a. En	ergy rea	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heati	ng:												_
Fracti	on of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =		ĺ	1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								90.3	(206)
	•	-		ementar		n system	n %					l	0	(208)
2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea]```
Space			1	alculate				, tag	000	000		200		
	597.38	428.86	314.68	142.47	45.89	0	0	0	0	174.98	407.19	619.94		
(211)m	n = {[(98)m x (20	1)4)] } x 1	1 00 ÷ (20)6)	1								(211)
()	661.55	474.93	348.48	157.77	50.82	0	0	0	0	193.77	450.93	686.53		· · ·
								Tota	l (kWh/yea	ar) =Sum(2	2 11) _{15,1012}	=	3024.79	(211)
Space	e heatin	a fuel (s	econdar	y), kWh/	month							l].
•)] } x 1		• •										
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
I			!					Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	=	0	(215)
Water	heating	a										l		J
			ter (calc	ulated a	bove)			-		-				
-	181.01	158.12	164.51	145.92	141.27	124.42	119.21	132.89	134.36	152.99	163.32	176.76		
Efficier	ncy of w	ater hea	ater	-				-					81	(216)
(217)m=	87.95	87.59	86.88	85.34	83.1	81	81	81	81	85.71	87.43	88.06		(217)
		heating,				-				-				
. ,		m x 100			(-					4=-				
(219)m=	205.81	180.52	189.37	170.98	170.01	153.61	147.17	164.06	165.87	178.5	186.8	200.74		٦.
_	_							lota	I = Sum(2 ⁻				2113.43	(219)
	l totals		nd main	ovete	1					k	Wh/year	I	kWh/year	1
Space	neating	iuei use	eu, main	system	I								3024.79]

Water heating fuel used				2113.43]
Electricity for pumps, fans and electric keep-hot					
central heating pump:			30]	(230c)
boiler with a fan-assisted flue			45]	(230e)
Total electricity for the above, kWh/year	sum of (230	a)(230g) =		75	(231)
Electricity for lighting				280.15	(232)
Electricity generated by PVs				-878.85	(233)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy kWh/year	Emission fa kg CO2/kWh		Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.216	=	653.35	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	456.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1109.86	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	145.4	(268)
Energy saving/generation technologies Item 1		0.519	=	-456.13	(269)
Total CO2, kg/year	sun	n of (265)(271) =		838.05	(272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =		13.52	(273)
EI rating (section 14)				90	(274)

Regulations Compliance Report

Printed on 05 November	-	by Stroma FSAP 2012 program, Version: 1.0.4.1	8
Project Information:			
Assessed By: Su L	_ee (STRO031315)	Building Type: Flat	
Dwelling Details:			
NEW DWELLING DESIG	GN STAGE	Total Floor Area: 62.2m ²	
Site Reference : 217	Kingston Road	Plot Reference: Front - Uni	t 6
Address :			
Client Details:			
Name:			
Address :			
This report covers item	is included within the SAP calcula	ations	
-	ort of regulations compliance.		
1a TER and DER			
Fuel for main heating sys	stem: Mains gas		
Fuel factor: 1.00 (mains g	0		
Target Carbon Dioxide E		22.3 kg/m²	
Dwelling Carbon Dioxide	Emission Rate (DER)	14.64 kg/m²	OK
1b TFEE and DFEE			
Target Fabric Energy Eff		66.6 kWh/m²	
Dwelling Fabric Energy E		54.5 kWh/m²	ок
2 Fabric U-values			UN
Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	ОК
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	ОК
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	ОК
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK
2a Thermal bridging			
	g calculated from linear thermal trar	nsmittances for each junction	
3 Air permeability			
Air permeability at	t 50 pascals	4.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main Heating syst	tem: Boiler systems with Data from manufact Combi boiler Efficiency 89.5 % S Minimum 88.0 %		ок
Secondary heating	g system: None		
5 Cylinder insulation			
Hot water Storage	e: No cylinder		N/A

Regulations Compliance Report

ontrols			
Space heating controls Hot water controls:	TTZC by plumbing and e No cylinder thermostat No cylinder	ectrical services	OI
Boiler interlock:	Yes		OI
ow energy lights			
Percentage of fixed lights with	th low-energy fittings	100.0%	
Minimum		75.0%	0
lechanical ventilation			
Not applicable			
ummertime temperature			
Overheating risk (Thames va	alley):	Medium	0
ed on:			
Overshading:		Average or unknown	
Windows facing: North East		4.6m ²	
Windows facing: North West		0.97m ²	
Windows facing: North West		0.77m ²	
Windows facing: North East		1.73m ²	
Windows facing: North West		1.69m ²	
Windows facing: South East		0.62m ²	
Windows facing: North West		0.62m ²	
Windows facing: North East		2.68m ²	
Windows facing: South		0.81m ²	
Windows facing: West		0.81m ²	
Ventilation rate:		3.00	
Blinds/curtains:		None	
Key features			
External Walls U-value		0.13 W/m²K	
Party Walls U-value		0 W/m²K	

Photovoltaic array

			User D	etails:						
Assessor Name:	Su Lee			Strom	a Num	ber:		STRO	031315	
Software Name:	Stroma FSAP 20	12		Softwa	are Ver	sion:		Versio	on: 1.0.4.18	
		Pr	operty A	Address:	Front -	Unit 6				
Address :										
1. Overall dwelling dimer	nsions:									
Ground floor			Area 6		(1a) x	Av. Hei	56	(2a) =	Volume(m ³) 158.93	(3a)
Total floor area TFA = (1a	ı)+(1b)+(1c)+(1d)+(1	e)+(1n) 6	62.2	(4)			-		
Dwelling volume			L]	(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	158.93	(5)
2. Ventilation rate:	_									
Number of chimneys		econdary heating 0	/] + [other] = [total	x 4	40 =	m ³ per hour	(6a)
Number of open flues	0 +	0	」] + ᄃ	0	」] = [0	x2	20 =	0	 (6b)
Number of intermittent far						3	x ^	10 =	30	(7a)
Number of passive vents						0	x^	10 =	0	(7b)
Number of flueless gas fir	es				Г	0	x 4	40 =	0	(7c)
					L			Air ch	anges per ho	_ ur
Infiltration due to chimney	s flues and fans – (6a)+(6b)+(7;	a)+(7b)+(7	7c) =	Г	20	_	÷ (5) =		(8)
If a pressurisation test has be					continue fro	30 om (9) to (÷ (0) –	0.19	
Number of storeys in th	e dwelling (ns)								0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2					•	uction			0	(11)
if both types of wall are pre deducting areas of opening		sponding to	the greate	er wall area	a (atter					
If suspended wooden fl	- · · ·	aled) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter 0								0	(13)
Percentage of windows	and doors draught s	stripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, o	•		•	•	•	etre of e	nvelope	area	4	(17)
If based on air permeabilit	•								0.39	(18)
Air permeability value applies		as been don	e or a deg	iree air pei	rmeability i	is being us	sed		[٦
Number of sides sheltered Shelter factor				(20) = 1 - [0.075 x (1	9)] =			1	(19) (20)
Infiltration rate incorporati	na shelter factor			(21) = (18)		-/1			0.92	(20)
Infiltration rate modified for	-	d		() ()	, (=0)				0.36	(21)
	Mar Apr May	<u> </u>	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe		I			·				ı	
· · · · · · · · · · · · · · · · · · ·	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22		· 1								
	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
	•								-	

	u minua	tion rate	(allowir	ig ior sne	eller an	d wind sp	peed) =	(21a) x (2	22a)m					
	0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.4	0.42		
		<i>tive air ch</i> I ventilatio	-	ate for th	e appli	cable cas	se					ſ	0	(23a)
				ndix N, (23	b) = (23a) × Fmv (ed	quation (N	N5)), otherw	vise (23b) = (23a)		L [0	(23b)
								n Table 4h) :				Ĺ	0	(23c)
a) If t	balanced	d mechar	nical ve	ntilation v	with hea	at recove	rv (MVI	HR) (24a)	m = (2	2b)m + (:	23b) × [′	۱ (23c) – ۱	-	(
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	-	(24a)
b) If t	balanced	d mechar	nical ve	ntilation v	without	heat reco	overy (N	иV) (24b)	m = (22	2b)m + (2	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If v	whole ho	ouse extra	act ven	tilation or	positiv	e input v	entilatic	on from ou	utside					
if	f (22b)m	< 0.5 × (23b), tł	nen (24c)	= (23b); otherw	vise (24	c) = (22b)	m + 0.	5 × (23b)	·		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,								on from lo 0.5 + [(22		0.5]				
(24d)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59		(24d)
Effec	tive air c	change ra	ate - en	ter (24a)	or (24b	o) or (24c) or (24	d) in box	(25)	_				
(25)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59		(25)
3. Hea	at losses	and hea	t loss p	arametei	r:									
ELEM		Gross area (r		Opening m²	S	Net Are A ,m		U-value W/m2K		A X U (W/ł	<)	k-value kJ/m²⋅k		A X k kJ/K
Doors		,	,			1.86	x	1.2] = [2.232				(26)
Windov	vs Type	1				4.6		/[1/(1.2)+ 0	041	5.07	=			(27)
Windov						4.0	· · ·	/[I/(I.Z)+ 0	.04] =	5.27				
	vs Type	2				0.966		/[1/(1.2)+ 0		5.27				(27)
	vs Type vs Type						x1,		0.04] =					(27) (27)
Windov		3				0.966	x1,	/[1/(1.2)+ 0	0.04] = 0.04] =	1.11				
Windov Windov	vs Type	3 4				0.966	x1, x1, x1,	/[1/(1.2)+ 0 /[1/(1.2)+ 0	0.04] = 0.04] = 0.04] =	1.11 0.89				(27)
Windov Windov Windov	vs Type vs Type	3 4 5				0.966 0.773 1.73	x1, x1, x1, x1, x1, x1,	/[1/(1.2)+ 0 /[1/(1.2)+ 0 /[1/(1.2)+ 0	0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98				(27) (27)
Windov Windov Windov Windov	vs Type vs Type vs Type	3 4 5 6				0.966 0.773 1.73 1.689	x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.2)+ 0 /[1/(1.2)+ 0 /[1/(1.2)+ 0 /[1/(1.2)+ 0	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98 1.93				(27) (27) (27)
Windov Windov Windov Windov	vs Type vs Type vs Type vs Type	3 4 5 6 7				0.966 0.773 1.73 1.689 0.617	x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.2)+ 0 /[1/(1.2)+ 0 /[1/(1.2)+ 0 /[1/(1.2)+ 0 /[1/(1.2)+ 0	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98 1.93 0.71				(27) (27) (27) (27)
Windov Windov Windov Windov Windov	vs Type vs Type vs Type vs Type vs Type vs Type	3 4 5 6 7 8				0.966 0.773 1.73 1.689 0.617 0.617	x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98 1.93 0.71 0.71				(27) (27) (27) (27) (27)
Windov Windov Windov Windov Windov Windov	vs Type vs Type vs Type vs Type vs Type vs Type vs Type	3 4 5 6 7 8 9				0.966 0.773 1.73 1.689 0.617 0.617 0.895	x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98 1.93 0.71 0.71 1.02				 (27) (27) (27) (27) (27) (27) (27)
Windov Windov Windov Windov Windov Windov	vs Type vs Type vs Type vs Type vs Type vs Type vs Type vs Type	3 4 5 6 7 8 9				0.966 0.773 1.73 1.689 0.617 0.617 0.895 0.81	x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98 1.93 0.71 0.71 1.02 0.93				 (27) (27) (27) (27) (27) (27) (27) (27)
Windov Windov Windov Windov Windov Windov	vs Type vs Type vs Type vs Type vs Type vs Type vs Type vs Type ype 1	3 4 5 6 7 8 9				0.966 0.773 1.73 1.689 0.617 0.617 0.895 0.81	$ \begin{array}{c} $		0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98 1.93 0.71 0.71 1.02 0.93 0.93	=			(27) (27) (27) (27) (27) (27) (27) (27)
Windov Windov Windov Windov Windov Windov Floor T	vs Type vs Type vs Type vs Type vs Type vs Type vs Type vs Type ype 1 ype 2	3 4 5 6 7 8 9		15.3		0.966 0.773 1.73 1.689 0.617 0.617 0.895 0.81 0.81 1.027	$ \begin{array}{c} $	<pre>/[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0</pre>	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98 1.93 0.71 0.71 1.02 0.93 0.93 0.1335	=			(27) (27) (27) (27) (27) (27) (27) (27)
Window Window Window Window Window Window Floor T Floor T	vs Type vs Type vs Type vs Type vs Type vs Type vs Type vs Type ype 1 ype 2 ype1	3 4 5 6 7 8 9 10 <u>63.66</u>		15.3		0.966 0.773 1.73 1.689 0.617 0.617 0.895 0.81 0.81 1.027 4.089	x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 0.13 0.13	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98 1.93 0.71 0.71 1.02 0.93 0.93 0.1335 ⁴ 0.53157	=			(27) (27) (27) (27) (27) (27) (27) (27)
Window Window Window Window Window Window Floor T Floor T Walls T	vs Type vs Type vs Type vs Type vs Type vs Type vs Type vs Type ype 1 ype 2 ype1 ype1	3 4 5 6 7 8 9 10				0.966 0.773 1.73 1.689 0.617 0.617 0.895 0.81 0.81 1.027 4.089 48.36	x1, x	/[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 0.13 0.13 0.15	0.04] = 0.04	1.11 0.89 1.98 1.93 0.71 0.71 1.02 0.93 0.93 0.13357 0.53157 7.25 1.16	=			(27) (27) (27) (27) (27) (27) (27) (27)
Windov Windov Windov Windov Windov Windov Floor T Floor T Walls T Walls T	vs Type vs Type vs Type vs Type vs Type vs Type vs Type vs Type ype 1 ype 2 ype 1 ype 2 ype 1 ype 2	3 4 5 6 7 8 9 10 63.66 10.05		1.86		0.966 0.773 1.73 1.689 0.617 0.617 0.895 0.81 0.81 1.027 4.089 48.36 8.19	x1, x	<pre>/[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 0.13 0.13 0.13 0.15 0.14</pre>	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	1.11 0.89 1.98 1.93 0.71 0.71 1.02 0.93 0.93 0.1335 0.53157 7.25	=			(27) (27) (27) (27) (27) (27) (27) (27)
Windov Windov Windov Windov Windov Windov Floor T Floor T Walls T Walls T	vs Type vs Type vs Type vs Type vs Type vs Type vs Type vs Type ype 1 ype 2 ype 1 ype 2 ype 3 ype3 ype1	3 4 5 6 7 8 9 10 63.66 10.05 10.74		1.86		0.966 0.773 1.73 1.689 0.617 0.617 0.895 0.81 1.027 4.089 48.36 8.19 10.74	x1, x	/[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 /[1/(1.2)+0 0.13 0.13 0.15 0.14 0.13	0.04] = 0.04	1.11 0.89 1.98 1.93 0.71 0.71 1.02 0.93 0.93 0.13357 7.25 1.16 1.42	=			(27) (27) (27) (27) (27) (27) (27) (27)

Total a	rea of e	lements	, m²			124.1	6							(31)
Party v	vall					30.05	5 X	0] = [0				(32)
			ows, use e sides of ir				ated using	g formula 1	/[(1/U-valu	ie)+0.04] a	ns given in	paragraph	3.2	
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				34.74	(33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF	- Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
	•		ere the de tailed calci		constructi	ion are noi	t known pi	recisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix l	<						18.68	(36)
			are not kn	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			53.42	(37)
Ventila	tion hea	at loss ca	alculated	monthl	У				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	31.74	31.52	31.31	30.33	30.14	29.28	29.28	29.13	29.61	30.14	30.52	30.91		(38)
Heat tr	ansfer c	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	85.16	84.94	84.73	83.75	83.56	82.71	82.71	82.55	83.04	83.56	83.94	84.33		
Heat lo	oss para	imeter (H	HLP), W/	/m²K				-		Average = = (39)m ÷	Sum(39)1. (4)	12 /12=	83.75	(39)
(40)m=	1.37	1.37	1.36	1.35	1.34	1.33	1.33	1.33	1.33	1.34	1.35	1.36		
								•		Average =	Sum(40)1.	12 /12=	1.35	(40)
Numbe	er of day	/s in moi	nth (Tab	le 1a)	i	i	i	i		i	i	i	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ting enei	rgy requi	irement:								kWh/y	ear:	
Accum		ipancy, I	N										1	(40)
if TF		9, N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.(0013 x (1	TFA -13.		04		(42)
								(25 x N)				.73		(43)
		-	hot water berson pei	• •		-	-	to achieve	a water us	se target o	f			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Hot wate			day for ea	Apr ach month	,				Seb		NOV	Dec		
(44)m=	91	87.69	84.38	81.07	77.76	74.45	74.45	77.76	81.07	84.38	87.69	91]	
()	01	01.00	01.00	01.01	11.10	11.10	1 1.10				m(44) ₁₁₂ =		992.72	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x L	OTm / 3600					002.112	
(45)m-		-	1		404.00	87.92	81.47	93.49	94.6	110.25	120.35	130.69		
(45)m=	134.95	118.03	121.79	106.18	101.88	07.92			01.0					
(45)11=	134.95	118.03	121.79	106.18	101.88	07.92					l m(45) ₁₁₂ =	 =	1301.61	(45)
								boxes (46	-		m(45) ₁₁₂ =	=	1301.61	(45)
If instant (46)m=	taneous w 20.24	vater heatii 17.7						1	-		m(45) ₁₁₂ = 18.05	19.6	1301.61	(45) (46)
If instant (46)m= Water	taneous w 20.24 storage	/ater heatii 17.7 IOSS:	ng at point 18.27	of use (no	o hot water 15.28	<i>storage),</i> 13.19	enter 0 in 12.22	boxes (46)) to (61) 14.19	Total = Su 16.54	18.05	19.6	1301.61	(46)
<i>If instant</i> (46)m= Water Storag	taneous w 20.24 storage e volum	ater heatin 17.7 Ioss: ne (litres)	ng at point 18.27) includir	of use (no 15.93 ng any so	o hot water 15.28 Dlar or W	storage), 13.19 /WHRS	enter 0 in 12.22 storage	boxes (46)) to (61) 14.19	Total = Su 16.54	18.05		1301.61	
If instant (46)m= Water Storag If comr	taneous w 20.24 storage e volum munity h	/ater heatin 17.7 Toss: ne (litres) neating a	ng at point 18.27) includir and no ta	of use (no 15.93 ng any so nk in dw	o hot water 15.28 Dlar or W velling, e	r storage), 13.19 /WHRS nter 110	enter 0 in 12.22 storage	boxes (46)) <i>to (61)</i> 14.19 ame vess	Total = Su 16.54 sel	18.05	19.6	1301.61	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):												0		(48)
Tempe	erature f	actor fro	m Table	2b			0		(49)					
Energy	y lost fro	om water	r storage	e, kWh/y	ear			(48) x (49) =			0		(50)
'			eclared of	•									l	
		-	factor fr		ie 2 (kvv	n/litre/da	ay)					0		(51)
	•	from Ta		011 4.5								0		(52)
			m Table	2b								0		(53)
Energy	y lost fro	om water	r storage	, kWh/y	ear			(47) x (51) x (52) x (53) =		0		(54)
Enter	(50) or	(54) in (5	55)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m =	(55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	loss (ar	nnual) fro	om Table	3							0		(58)
	•		lculated			59)m = ((58) ÷ 36	65 × (41)	m			-		
	-		rom Tab							r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	Iculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)m						
(61)m=	46.37	40.36	43	39.98	39.63	36.72	37.94	39.63	39.98	43	43.24	46.37		(61)
Total h	neat reg	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × 0	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	181.32	158.39	164.79	146.16	141.51	124.64	119.41	133.11	134.58	153.25	163.59	177.06	. , . ,	(62)
Solar DI	HW input	L calculated	using App	endix G o	I r Appendix	I H (negati	I ve quantity) (enter 'C	l if no sola	r contribut	ion to wate	r heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	iter	•	•	•	•	•	•					
(64)m=	181.32	158.39	164.79	146.16	141.51	124.64	119.41	133.11	134.58	153.25	163.59	177.06		
	·		!					Out	out from w	ater heate	r (annual)₁	12	1797.83	(64)
Heat g	ains fro	m water	heating,	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)n	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	56.46	49.33	51.25	45.3	43.78	38.41	36.57	40.99	41.45	47.41	50.83	55.05		(65)
inclu	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gair	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	102.16	102.16	102.16	102.16	102.16	102.16	102.16	102.16	102.16	102.16	102.16	102.16		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	15.91	14.13	11.49	8.7	6.5	5.49	5.93	7.71	10.35	13.14	15.34	16.35		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also	o see Ta	ble 5	•			
(68)m=	178.47	180.32	175.65	165.72	153.18	141.39	133.52	131.66	136.33	146.27	158.81	170.59		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a), also s	ee Table	5			1	
(69)m=	33.22	33.22	33.22	33.22	33.22	33.22	33.22	33.22	33.22	33.22	33.22	33.22		(69)
Pumps	s and fa	ns gains	(Table	5a)						•	•			
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)

Losses e.g.	Losses e.g. evaporation (negative values) (Table 5)													
(71)m= -81.	73 -81.73	-81.73	-81.73	-81.73	-8	31.73 -81.73	3	-81.	73 -81.73	-81.7	3 -81.73	-81.73		(71)
Water heati	ng gains (T	able 5)				ł								
(72)m= 75.8	9 73.41	68.88	62.92	58.85	5	3.35 49.16	3	55.	1 57.57	63.72	70.59	73.99		(72)
Total interr	nal gains =					(66)m + (67	')m +	- (68)m + (69)m + (70)m +	(71)m + (72)	m		
(73)m= 326.	92 324.52	312.67	293.99	275.18	2	56.88 245.20	6	251.	12 260.9	279.7	8 301.39	317.58		(73)
6. Solar ga	ins:													
Solar gains a	re calculated	using sola	flux from	Table 6a	and	associated eq	luatio	ons t	o convert to the	e applio	able orientat	ion.		
Orientation:		actor	Area			Flux			g_ Tabla Ch		FF Table Ca		Gains	
	Table 6d		m²			Table 6a	_		Table 6b	_	Table 6c		(W)	_
Northeast 0.9		x	4.	6	x	11.28		x	0.76	×	0.7	=	13.42	(75)
Northeast 0.9	•	X	1.7	'3	x	11.28		x	0.76	×	0.7	=	7.2	(75)
Northeast 0.9		X	0.8	39	x	11.28		x	0.76	×	0.7	=	11.17	(75)
Northeast 0.9		x	4.	6	x	22.97		x	0.76	×	0.7	=	27.32	(75)
Northeast 0.9	•	x	1.7	'3	x	22.97		x	0.76	×	0.7	=	14.65	(75)
Northeast 0.9	0.77	x	0.8	39	x	22.97		x	0.76	x	0.7	=	22.73	(75)
Northeast 0.9		x	4.	6	x	41.38		x	0.76	x	0.7	=	49.21	(75)
Northeast 0.9		X	1.7	′3	x	41.38		x	0.76	x	0.7	=	26.39	(75)
Northeast 0.9	x 0.77	x	0.8	39	x	41.38		x	0.76	x	0.7	=	40.96	(75)
Northeast 0.9		x	4.	6	x	67.96		x	0.76	x	0.7	=	80.82	(75)
Northeast 0.9		x	1.7	'3	x	67.96		x	0.76	×	0.7	=	43.34	(75)
Northeast 0.9	0.77 x	x	0.8	39	x	67.96		x	0.76	×	0.7	=	67.27	(75)
Northeast 0.9		x	4.	6	x	91.35		x	0.76	×	0.7	=	108.64	(75)
Northeast 0.9	0.77	X	1.7	73	x	91.35		x	0.76	x	0.7	=	58.26	(75)
Northeast 0.9	0.77 x	x	0.8	39	x	91.35		x	0.76	×	0.7	=	90.42	(75)
Northeast 0.9	0.54	X	4.	6	x	97.38		x	0.76	x	0.7	=	115.82	(75)
Northeast 0.9	0.77 x	x	1.7	'3	x	97.38		x	0.76	x	0.7	=	62.11	(75)
Northeast 0.9	0.77	X	0.8	39	x	97.38		x	0.76	x	0.7	=	96.4	(75)
Northeast 0.9	0.54	x	4.	6	x	91.1		x	0.76	x	0.7	=	108.35	(75)
Northeast 0.9	0.77 x	x	1.7	'3	x	91.1		x	0.76	x	0.7	=	58.11	(75)
Northeast 0.9	0.77 x	x	0.8	39	x	91.1		x	0.76	x	0.7	=	90.18	(75)
Northeast 0.9	0.54	x	4.	6	x	72.63		x	0.76	x	0.7	=	86.38	(75)
Northeast 0.9	x 0.77	x	1.7	'3	x	72.63		x	0.76	×	0.7	=	46.32	(75)
Northeast 0.9	x 0.77	x	0.8	39	x	72.63		x	0.76	×	0.7	=	71.89	(75)
Northeast 0.9	0.54	x	4.	6	x	50.42		x	0.76	x	0.7	=	59.97	(75)
Northeast 0.9	x 0.77	x	1.7	'3	x	50.42		x	0.76	x	0.7	=	32.16	(75)
Northeast 0.9	0.77 x	x	0.8	39	x	50.42		x [0.76	x	0.7	=	49.91	(75)
Northeast 0.9	0.54	x	4.	6	x	28.07		x	0.76	x	0.7	=	33.38	(75)
Northeast 0.9	0.77 x	x	1.7	73	x	28.07		x [0.76	x	0.7	=	17.9	(75)
Northeast 0.9	0.77	x	0.8	39	x	28.07		x [0.76	x	0.7	=	27.78	(75)

Northeast 0.9x	0.54	×	4.6	×	14.2	×	0.76	x	0.7	=	16.88	(75)
Northeast 0.9x	0.77	x	1.73	x	14.2	×	0.76	x	0.7	=	9.05	(75)
Northeast 0.9x	0.77	x	0.89	x	14.2	×	0.76	x	0.7	=	14.05	(75)
Northeast 0.9x	0.54	x	4.6	x	9.21	×	0.76	x	0.7	=	10.96	(75)
Northeast 0.9x	0.77	x	1.73	x	9.21	x	0.76	x	0.7	=	5.88	(75)
Northeast 0.9x	0.77	x	0.89	x	9.21	×	0.76	x	0.7	=	9.12	(75)
Southeast 0.9x	0.77	x	0.62	x	36.79	×	0.76	x	0.7	=	8.37	(77)
Southeast 0.9x	0.77	x	0.62	x	62.67	x	0.76	x	0.7	=	14.26	(77)
Southeast 0.9x	0.77	x	0.62	x	85.75	×	0.76	x	0.7	=	19.51	(77)
Southeast 0.9x	0.77	x	0.62	x	106.25	x	0.76	x	0.7	=	24.17	(77)
Southeast 0.9x	0.77	x	0.62	x	119.01	x	0.76	x	0.7	=	27.07	(77)
Southeast 0.9x	0.77	x	0.62	x	118.15	x	0.76	x	0.7	=	26.88	(77)
Southeast 0.9x	0.77	x	0.62	x	113.91	x	0.76	x	0.7	=	25.91	(77)
Southeast 0.9x	0.77	x	0.62	×	104.39	×	0.76	x	0.7	=	23.75	(77)
Southeast 0.9x	0.77	x	0.62	x	92.85	×	0.76	x	0.7	=	21.12	(77)
Southeast 0.9x	0.77	x	0.62	x	69.27	×	0.76	x	0.7	=	15.76	(77)
Southeast 0.9x	0.77	x	0.62	x	44.07	x	0.76	x	0.7	=	10.02	(77)
Southeast 0.9x	0.77	x	0.62	x	31.49	x	0.76	x	0.7	=	7.16	(77)
South 0.9x	0.77	x	0.81	x	46.75	x	0.76	x	0.7	=	13.96	(78)
South 0.9x	0.77	x	0.81	x	76.57	x	0.76	x	0.7	=	22.87	(78)
South 0.9x	0.77	x	0.81	x	97.53	×	0.76	x	0.7	=	29.13	(78)
South 0.9x	0.77	x	0.81	x	110.23	x	0.76	x	0.7	=	32.92	(78)
South 0.9x	0.77	x	0.81	x	114.87	×	0.76	x	0.7	=	34.3	(78)
South 0.9x	0.77	x	0.81	x	110.55	x	0.76	x	0.7	=	33.01	(78)
South 0.9x	0.77	x	0.81	x	108.01	x	0.76	x	0.7	=	32.26	(78)
South 0.9x	0.77	x	0.81	x	104.89	x	0.76	x	0.7	=	31.32	(78)
South 0.9x		x	0.81	x	101.89	×	0.76	x	0.7	=	30.43	(78)
South 0.9x		x	0.81	x	82.59	×	0.76	x	0.7	=	24.66	(78)
South 0.9x		×	0.81	x	55.42	×	0.76	x	0.7	=	16.55	(78)
South 0.9x		x	0.81	X	40.4	×	0.76	x	0.7	=	12.06	(78)
West 0.9x		x	0.81	X	19.64	×	0.76	x	0.7	=	5.87	(80)
West 0.9x		x	0.81	×	38.42	×	0.76	x	0.7	=	11.47	(80)
West 0.9x		X	0.81	X	63.27	×	0.76	X	0.7	=	18.9	(80)
West 0.9x		X	0.81	X	92.28	×	0.76	X	0.7	=	27.56	(80)
West 0.9x		X	0.81	X	113.09	X	0.76	X	0.7	=	33.77	(80)
West 0.9x		X	0.81	X	115.77	×	0.76	X	0.7	=	34.57	(80)
West 0.9x		×	0.81	×	110.22	×	0.76	X	0.7	=	32.91	(80)
West 0.9x		×	0.81	×	94.68	X	0.76	x	0.7	=	28.27	(80)
West 0.9x		×	0.81	X	73.59	X	0.76	x	0.7	=	21.98	(80)
West 0.9x		×	0.81	X	45.59	X	0.76	x	0.7	=	13.61	(80)
West 0.9x	0.77	x	0.81	×	24.49	×	0.76	x	0.7	=	7.31	(80)

West 0.9x	0.77) ×	0.81	x	16.15	×	0.76	x	0.7	=	4.82	(80)
Northwest 0.9x	0.77	x	0.97	x	11.28	x	0.76	x	0.7	=	4.02	(81)
Northwest 0.9x	0.77	x	0.77	x	11.28	×	0.76	x	0.7	=	3.22	(81)
Northwest 0.9x	0.77	x	1.69	x	11.28	×	0.76	x	0.7	=	7.03	(81)
Northwest 0.9x	0.77	x	0.62	x	11.28	×	0.76	x	0.7	=	2.57	(81)
Northwest 0.9x	0.77	x	0.97	x	22.97	x	0.76	x	0.7	=	8.18	(81)
Northwest 0.9x	0.77	x	0.77	x	22.97	×	0.76	x	0.7	=	6.55	(81)
Northwest 0.9x	0.77	x	1.69	x	22.97	×	0.76	x	0.7	=	14.3	(81)
Northwest 0.9x	0.77	x	0.62	x	22.97	×	0.76	x	0.7	=	5.22	(81)
Northwest 0.9x	0.77	x	0.97	x	41.38	×	0.76	x	0.7	=	14.74	(81)
Northwest 0.9x	0.77	x	0.77	x	41.38	×	0.76	x	0.7	=	11.79	(81)
Northwest 0.9x	0.77	x	1.69	x	41.38	×	0.76	x	0.7	=	25.77	(81)
Northwest 0.9x	0.77	x	0.62	x	41.38	×	0.76	x	0.7	=	9.41	(81)
Northwest 0.9x	0.77	x	0.97	x	67.96	×	0.76	x	0.7	=	24.2	(81)
Northwest 0.9x	0.77	x	0.77	x	67.96	x	0.76	x	0.7	=	19.37	(81)
Northwest 0.9x	0.77	x	1.69	x	67.96	×	0.76	x	0.7	=	42.32	(81)
Northwest 0.9x	0.77	x	0.62	x	67.96	x	0.76	x	0.7	=	15.46	(81)
Northwest 0.9x	0.77	x	0.97	x	91.35	×	0.76	x	0.7	=	32.53	(81)
Northwest 0.9x	0.77	x	0.77	x	91.35	x	0.76	x	0.7	=	26.03	(81)
Northwest 0.9x	0.77	x	1.69	x	91.35	×	0.76	x	0.7	=	56.88	(81)
Northwest 0.9x	0.77	x	0.62	x	91.35	×	0.76	x	0.7	=	20.78	(81)
Northwest 0.9x	0.77	x	0.97	x	97.38	x	0.76	x	0.7	=	34.68	(81)
Northwest 0.9x	0.77	x	0.77	x	97.38	×	0.76	x	0.7	=	27.75	(81)
Northwest 0.9x	0.77	x	1.69	x	97.38	x	0.76	x	0.7	=	60.64	(81)
Northwest 0.9x	0.77	x	0.62	x	97.38	×	0.76	x	0.7	=	22.15	(81)
Northwest 0.9x	0.77	x	0.97	x	91.1	×	0.76	x	0.7	=	32.44	(81)
Northwest 0.9x	0.77	x	0.77	x	91.1	x	0.76	x	0.7	=	25.96	(81)
Northwest 0.9x	0.77	x	1.69	x	91.1	×	0.76	x	0.7	=	56.73	(81)
Northwest 0.9x	0.77	x	0.62	x	91.1	×	0.76	x	0.7	=	20.72	(81)
Northwest 0.9x	0.77	x	0.97	x	72.63	×	0.76	x	0.7	=	25.87	(81)
Northwest 0.9x	0.77	x	0.77	x	72.63	x	0.76	x	0.7	=	20.7	(81)
Northwest 0.9x	0.77	×	1.69	x	72.63	×	0.76	x	0.7	=	45.22	(81)
Northwest 0.9x	0.77	×	0.62	x	72.63	×	0.76	x	0.7	=	16.52	(81)
Northwest 0.9x	0.77	×	0.97	x	50.42	×	0.76	x	0.7	=	17.96	(81)
Northwest 0.9x	0.77	×	0.77	x	50.42	×	0.76	x	0.7	=	14.37	(81)
Northwest 0.9x	0.77	×	1.69	x	50.42	×	0.76	x	0.7	=	31.4	(81)
Northwest 0.9x	0.77	×	0.62	x	50.42	×	0.76	x	0.7	=	11.47	(81)
Northwest 0.9x	0.77	×	0.97	x	28.07	×	0.76	x	0.7	=	10	(81)
Northwest 0.9x	0.77	×	0.77	x	28.07	×	0.76	x	0.7	=	8	(81)
Northwest 0.9x	0.77	×	1.69	x	28.07	×	0.76	x	0.7	=	17.48	(81)
Northwest 0.9x	0.77	x	0.62	x	28.07	x	0.76	x	0.7	=	6.38	(81)

Northwest 0.9x	0.77	x	0.9	7	x	1	4.2	x	0.76	x	0.7	=	5.06	(81)
Northwest 0.9x	0.77	x	0.7	7	x [1	4.2	x	0.76	×	0.7	=	4.05	(81)
Northwest 0.9x	0.77	x	1.6	9	x [1	4.2	x	0.76	×	0.7	=	8.84	(81)
Northwest 0.9x	0.77	x	0.6	2	× [1	4.2	x	0.76	×	0.7	=	3.23	(81)
Northwest 0.9x	0.77	x	0.9	7	x [g	9.21	x	0.76	×	0.7	=	3.28	(81)
Northwest 0.9x	0.77	x	0.7	7	× [g	9.21	x	0.76	×	0.7	=	2.63	(81)
Northwest 0.9x	0.77	x	1.6	9	x [g	9.21	x	0.76	×	0.7	=	5.74	(81)
Northwest 0.9x	0.77	x	0.6	2	× [ç	9.21	x	0.76	×	0.7	=	2.1	(81)
_					_									
Solar gains in	watts, calc	ulated	for eacl	n month				(83)m = 5	Sum(74)m .	(82)m				
(83)m= 76.81	147.54	245.8	377.42	488.7	51	4.03	483.58	396.24	290.75	174.96	95.05	63.75		(83)
Total gains – i	nternal and	d solar	(84)m =	- (73)m ·	+ (8	33)m ,	watts		•		•			
(84)m= 403.73	472.06 5	58.48	671.41	763.88	77	0.91	728.83	647.36	551.65	454.73	396.44	381.33		(84)
7. Mean inter	nal temper	rature ('heating	season)				•		•		•	
Temperature			Ŭ		<i>′</i>	aroa f	rom Tak		1 (°C)				21	(85)
-	•	• •			-			ле <u>э</u> , п	II (C)				21	(00)
Utilisation fac	т т				r`-			A	Car	Oct	Nov	Dee	1	
Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00)
(86)m= 1	0.99	0.98	0.94	0.82	0	.64	0.49	0.56	0.83	0.97	0.99	1	J	(86)
Mean interna	l temperati	ure in li	iving are	ea T1 (fo	ollo	w ster	os 3 to 7	' in Tab	e 9c)					
(87)m= 19.52	19.69	20.01	20.44	20.78	20	0.95	20.99	20.98	20.83	20.38	19.87	19.49		(87)
Temperature	during hea	ating pe	eriods ir	rest of	dw	elling	from Ta	ble 9, T	ĥ2 (°C)					
(88)m= 19.79	<u> </u>	19.79	19.8	19.81	-	9.82	19.82	19.82	19.81	19.81	19.8	19.8]	(88)
Utilisation fac	tor for gair	ns for r	est of d	vellina	h2	m (se	e Table	9a)	•					
(89)m= 1	I I I	0.98	0.92	0.76	-	0.54	0.36	0.43	0.75	0.96	0.99	1]	(89)
	L tomporati	uro in t	ha raat	of dwall	<u> </u>	TO (fe		no 2 to	Tin Tahl		1		1	
Mean interna					<u> </u>	<u> </u>		-	1		10.07	17.0	1	(90)
(90)m= 17.84	18.09	18.56	19.17	19.61	1	9.79	19.81	19.81	19.68	19.09	18.37	17.8		
									1	LA = LIVI	ng area ÷ (4	+) =	0.4	(91)
Mean interna	l temperati	ure (for	the wh	ole dwe	lling	g) = fL	_A × T1	+ (1 – fl	_A) × T2				_	
(92)m= 18.51	18.74 ⁻	19.14	19.68	20.08	2	0.25	20.29	20.28	20.15	19.61	18.97	18.48		(92)
Apply adjustr	nent to the	mean	internal	temper	atu	re fro	m Table	4e, wh	ere appro	priate				
(93)m= 18.51	18.74	19.14	19.68	20.08	2	0.25	20.29	20.28	20.15	19.61	18.97	18.48		(93)
8. Space hea	ting require	ement												
Set Ti to the	mean inter	nal terr	nperatur	e obtair	ned	at ste	ep 11 of	Table 9	b, so tha	t Ti,m=	(76)m an	d re-calo	culate	
the utilisation	factor for	gains u	ising Ta	ble 9a										
Jan	Feb	Mar	Apr	May	,	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	tor for gair	ns, hm:											,	
(94)m= 0.99	0.99	0.97	0.91	0.78	0).58	0.41	0.48	0.78	0.96	0.99	1		(94)
Useful gains,	r	<u> </u>	, ,										1	
(95)m= 401.53	466.87 5	542.77	613.66	595.25	44	6.67	301.25	313.3	428.48	434.29	392.4	379.7		(95)
Monthly aver	age extern	ŕ			<u> </u>				,				1	
(96)m= 4.3	4.9	6.5	8.9	11.7		4.6	16.6	16.4	14.1	10.6	7.1	4.2	J	(96)
Heat loss rat	· · · ·		· · ·		<u> </u>		- ,	- ,	1	-			1	
(97)m= 1210.45	1175.47 1	071.13	902.89	700.29	46	67.59	304.85	320.32	502.1	752.94	996.58	1204.45	J	(97)

Space	e heatin	g requir	ement fo	or each n	honth, k	Wh/mon	th = 0.02	24 x [(97])m – (95)m] x (4	1)m			
(98)m=	601.84	476.17	393.1	208.25	78.15	0	0	0	0	237.07	435.02	613.61		_
								Tota	l per year	(kWh/yeai	r) = Sum(9	8)15,912 =	3043.21	(98)
Space	e heatin	g requir	ement in	n kWh/m²	/year							[48.92	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heatii	-			, .							г		
				econdar	,	mentary	-		(201) -			l	0	(201)
	-			nain syst	. ,			(202) = 1 - (204) =	- (201) = 02) × [1 -	(203)1 -		l	1	(202)
			0	main sys				(204) - (2	02) × [1 –	(200)] –		l	1	(204)
	-			ementar		a sveton	o %					l	90.3	(208)
LIICK	-	i	1	1				A	Can	Ort	Nev			
Space	Jan e heatin	Feb a require	Mar ement (c	Apr calculate	May d above	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Opuo	601.84	476.17	393.1	208.25	78.15	0	0	0	0	237.07	435.02	613.61		
(211)m	n = {[(98)m x (20)4)] } x 1	100 ÷ (20)6)							<u> </u>		(211)
、 ,	666.48	527.32	435.33	230.62	86.55	0	0	0	0	262.54	481.75	679.52		
			-	-		-		Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	3370.11	(211)
•				y), kWh/	month							-		_
		l l	00 ÷ (20	T										
(215)m=	0	0	0	0	0	0	0	0 Tota	0 l (kWh/yea	0	0 215) _{15,10} 12	0	0	(215)
Wator	heating							, ota			- • • • • • • • • • • • • • • • • • • •		0	(210)
			iter (calc	ulated a	bove)									
•	181.32	158.39	164.79	146.16	141.51	124.64	119.41	133.11	134.58	153.25	163.59	177.06		
Efficier	ncy of w	ater hea	ater										81	(216)
(217)m=	87.96	87.78	87.34	86.22	84.08	81	81	81	81	86.4	87.55	88.04		(217)
			, kWh/m) ÷ (217)											
(219)m=		180.43	188.68	169.53	168.3	153.87	147.42	164.34	166.15	177.36	186.85	201.12		
								Tota	I = Sum(2	19a) ₁₁₂ =		·	2110.21	(219)
	I totals									k	Wh/year		kWh/yea	r
Space	heating	fuel use	ed, main	system	1								3370.11	
Water	heating	fuel use	ed										2110.21	
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatir	ig pump	:									30		(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Total e	lectricit	v for the	above,	kWh/yea	r			sum	of (230a).	(230g) =	:		75	(231)
	city for l		,	,								[280.99	(232)
		erated b	v PVs									l ſ	-881.89	(233)
			-	lual boot	ing evet	me indu	Idina mi)			l		
Tza. (SOZ em	15510115		lual heati	ng syste		Jaing Mi							

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	727.94 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	455.8 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1183.75 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	145.83 (268)
Energy saving/generation technologies			
Item 1		0.519 =	-457.7 (269)
Total CO2, kg/year	sum	of (265)(271) =	910.8 (272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =	14.64 (273)
El rating (section 14)			89 (274)

Regulations Compliance Report

	ent L1A, 2013 Editior /ember 2019 at 13:23		ma FSAP 2012 program, Vers	sion: 1.0.4.18
Project Informati				
Assessed By:	Su Lee (STRO031	315)	Building Type:	Flat
Dwelling Details:				
NEW DWELLING	DESIGN STAGE		Total Floor Area: 53	3.98m²
Site Reference :	217 Kingston Road	d	Plot Reference:	Front - Unit 7
Address :				
Client Details:				
Name:				
Address :				
-	rs items included w ete report of regulat	ithin the SAP calculations.		
1a TER and DEF				
	ting system: Mains ga	as		
Fuel factor: 1.00 (• • •			
•	oxide Emission Rate		24.68 kg/m ²	
-	Dioxide Emission Rat	e (DER)	16.33 kg/m²	OK
1b TFEE and DF		\ \	70.0 k/M/b/m2	
-	ergy Efficiency (TFEE nergy Efficiency (DFE		73.2 kWh/m² 57.7 kWh/m²	
	nergy Enciency (Di E		57.7 KWII/III-	ОК
2 Fabric U-value	es			
Element		Average	Highest	
External	wall	0.14 (max. 0.30)	0.15 (max. 0.70)	OK
Floor		0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof Opening	6	0.13 (max. 0.20) 1.20 (max. 2.00)	0.13 (max. 0.35) 1.20 (max. 3.30)	OK OK
2a Thermal brid		1.20 (IIIax. 2.00)	1.20 (IIIax. 5.50)	UK
		om linear thermal transmitta	nces for each junction	
3 Air permeabili				
-	bility at 50 pascals		4.00 (design valu	e)
Maximum			10.0	OK
4 Heating efficie	ency			
Main Heati	ng system:	Boiler systems with radiate Data from manufacturer Combi boiler Efficiency 89.5 % SEDBU Minimum 88.0 %	ors or underfloor heating - ma K2009	ins gas OK
Secondary	heating system:	None		
5 Cylinder insul	ation			
Hot water S		No cylinder		
	- 0 -			N/A

Regulations Compliance Report

6 Controls			
Space heating controls Hot water controls:	TTZC by plumbing and e No cylinder thermostat	electrical services	ОК
Boiler interlock:	No cylinder Yes		ок
7 Low energy lights	103		UN
Percentage of fixed lights with Minimum	low-energy fittings	100.0% 75.0%	ок
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (Thames val	ley):	Slight	OK
Based on: Overshading: Windows facing: North East Windows facing: North West Windows facing: North East Windows facing: South East Ventilation rate: Blinds/curtains:		Average or unknown 1.98m ² 1.49m ² 1.49m ² 3.00 None	
10 Key features			
External Walls U-value Photovoltaic array		0.13 W/m²K	

			User D	etails:						
Assessor Name:		STRO	031315							
Software Name:	Stroma FSAP 20	012		Softwa	are Ver	sion:		Versic	on: 1.0.4.18	
		P	roperty /	Address:	Front -	Unit 7				
Address :										
1. Overall dwelling dime	nsions:									
Ground floor			-	a(m²) 3.98	(1a) x	Av. He i	i ght(m) 4	(2a) =	Volume(m ³) 129.56	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1r	n)5	3.98	(4)			_		_
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	129.56	(5)
2. Ventilation rate:	-									
Number of chimneys	main heating 0 +	secondar heating	у] + [0 0] = [total 0		40 =	m ³ per hour	(6a)
Number of open flues	0 +	0	+	0	=	0		20 =	0	(6b)
Number of intermittent far	าร					2	x ′	10 =	20	(7a)
Number of passive vents						0	x ′	10 =	0	(7b)
Number of flueless gas fir	res				Ē	0	× 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney	s, flues and fans =	(6a)+(6b)+(7	′a)+(7b)+(7c) =	Г	20	<u> </u>	÷ (5) =	0.15	(8)
If a pressurisation test has be	een carried out or is inter	ided, procee	d to (17), c	otherwise o	continue fro	om (9) to (16)			_
Number of storeys in th	e dwelling (ns)								0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0. if both types of wall are pro- deducting areas of openin	esent, use the value con				•	uction			0	(11)
If suspended wooden fl	oor, enter 0.2 (unse	aled) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else enter ()							0	(13)
Percentage of windows	and doors draught	stripped							0	(14)
Window infiltration				0.25 - [0.2		· ·			0	(15)
Infiltration rate				(8) + (10)		<i>·</i> · · <i>·</i>			0	(16)
Air permeability value,			•	•	•	etre of e	nvelope	area	4	(17)
If based on air permeabili Air permeability value applies	•					ia haina w	ad		0.35	(18)
Number of sides sheltere		las been uur	ie oi a ueg	jiee ali pei	Πεαρπικγ	is being us	seu		0	(19)
Shelter factor	-			(20) = 1 -	[0.075 x (1	9)] =			1	(20)
Infiltration rate incorporati	ng shelter factor			(21) = (18)) x (20) =				0.35	(21)
Infiltration rate modified for	or monthly wind spe	ed								
Jan Feb	Mar Apr Ma	y Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7									
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	

Adjust	ed infiltra	ation rat	e (allowi	ng for sł	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		
	ate effec echanica		-	rate for t	he appli	cable ca	ise						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (N5)) , othe	rwise (23b) = (23a)			0	(23b)
								m Table 4h		, , ,			0	(23c)
a) If	balance	d mecha	anical ve	entilation	with he	at recove	erv (MV	HR) (24a	a)m = (2)	2b)m + (2	23b) × [′	1 – (23c)	-	()
, (24a)m=		0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	covery (MV) (24t)m = (22	2b)m + (2	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole he	ouse ex	tract ver	ntilation of	or positiv	e input v	ventilati	on from o	outside			-		
	if (22b)m	ı < 0.5 ×	(23b), t	hen (240	c) = (23k); other	wise (24	lc) = (22l	b) m + 0.	5 × (23b)	1		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,					•			on from 0.5 + [(2		0.51				
(24d)m=	r í í	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	1 4d) in bo	x (25)			<u> </u>		
(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 Ho	at losses	and he	at loss i	aramet	or:									
	IENT	Gros		Openin		Net Ar	62	U-val		AXU		k-value	2	AXk
		area		m	-	A ,r		W/m2		(W/ł	<)	kJ/m²·l		kJ/K
Doors						1.86	x	1.2	=	2.232				(26)
Windo	ws Type	1				1.979) x1	I/[1/(1.2)+	0.04] =	2.27				(27)
Windo	ws Type	2				1.492	2 x1	I/[1/(1.2)+	0.04] =	1.71				(27)
Windo	ws Type	3				1.979) x1	I/[1/(1.2)+	0.04] =	2.27				(27)
Windo	ws Type	4				1.488	3 x1	I/[1/(1.2)+	0.04] =	1.7				(27)
Floor						1.48	x	0.13	=	0.1924				(28)
Walls	Type1	62.3	32	6.94	Ļ	55.38	3 X	0.15	=	8.31				(29)
Walls	Type2	10.8	35	1.86	;	8.99	x	0.14	=	1.27				(29)
Walls	ТуреЗ	18.1	2	0		18.12	<u>2</u> x	0.13	=	2.42				(29)
Roof ⁻	Type1	60.7	76	0		60.76	6 X	0.13	=	7.9				(30)
Roof ⁻	Type2	4.5	9	0		4.59	x	0.13	=	0.6				(30)
Total a	area of el	lements	, m²			158.1	2							(31)
	dows and le the area		-				ated using	g formula 1	l/[(1/U-valı	ıe)+0.04] a	s given in	paragraph	3.2	
	heat los							(26)(30) + (32) =				30.86	(33)
Heat c	apacity (Cm = S((Axk)						((28).	(30) + (32	?) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TM		- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
	-				construct	ion are noi	t known p	recisely the	e indicative	values of	TMP in Ta	able 1f		
	used instea						/							.
	al bridge s of therma		,		• •		n						15.05	(36)
ii uciails		, onuging	are not KI		- 0.00 X (3	'/								

Total fa	abric hea	at loss						(33) + (36) =					45.91	(37)
Ventila	tion hea	at loss ca	alculated	I monthly	y	-			(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	25.74	25.57	25.41	24.63	24.48	23.8	23.8	23.67	24.06	24.48	24.78	25.08		(38)
Heat tr	ansfer c	coefficier	nt, W/K						(39)m	= (37) + (3	38)m		_	
(39)m=	71.66	71.49	71.32	70.54	70.39	69.71	69.71	69.59	69.98	70.39	70.69	71		
Heat Ic	ss para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷		12 /12=	70.54	(39)
(40)m=	1.33	1.32	1.32	1.31	1.3	1.29	1.29	1.29	1.3	1.3	1.31	1.32]	
Nharaka			i (Tak					11	,	Average =	Sum(40)1.	₁₂ /12=	1.31	(40)
Numbe	er of day Jan	rs in moi Feb	nth (Tab Mar	le 1a) Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ן	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	-	_	-		-					-		-]	
1 \//2	tor hoat	ing one	rgy requi	rement.								kWh/ye	oor.	
T. V U			igy icqu	i cinent.										
		ipancy, l		[1 ovp	(0 0002		- 120)2)] + 0.0	012 v /	TEA 12		81		(42)
	A 2 13.8 A £ 13.9		+ 1.70 X	[i - exp	(-0.0003	949 X (11	-A -13.9)2)] + 0.0	JU 15 X (IFA - 13.	9)			
								(25 x N)				.13		(43)
		-			5% if the a rater use, l	-	-	to achieve	a water us	se target o	f		-	
					i	i	· · · · ·	A	Can	Ort	Nov	Dee	1	
Hot wate	Jan er usage in	Feb n litres per	Mar day for ea	Apr ach month	May Vd,m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec	J	
(44)m=	84.84	, 81.76	78.67	75.59	72.5	69.42	69.42	72.5	75.59	78.67	81.76	84.84	1	
(01.01	01110	10.01	10.00	12.0	00.12	00.12	72.0		Total = Su			925.55	(44)
Energy o	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600			· · ·			
(45)m=	125.82	110.04	113.55	99	94.99	81.97	75.96	87.16	88.2	102.79	112.21	121.85		
lf instant	aneous w	ator hoatii	na at noint	of use (no	hot water	r storage)	enter 0 in	boxes (46)		Total = Su	m(45) ₁₁₂ =	-	1213.54	(45)
i							-			15 40	16.00	10.00	1	(46)
(46)m= Water	18.87 storage	16.51 IOSS:	17.03	14.85	14.25	12.3	11.39	13.07	13.23	15.42	16.83	18.28		(40)
	-		includir	ig any so	olar or W	/WHRS	storage	within sa	me ves	sel		0]	(47)
If comr	nunity h	eating a	ind no ta	nk in dw	velling, e	nter 110	litres in	(47)					1	
			hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boile	ers) ente	er '0' in (47)			
	storage					. /1 \ \ /1	(1-)						1	
					or is kno	wn (kvvr	n/day):					0]	(48)
			m Table					(0		(49)
			storage	-	ear loss fact	or is not		(48) x (49)	=			0		(50)
				-	e 2 (kW							0]	(51)
If comr	nunity h	eating s	ee secti	on 4.3									1	
		from Ta										0		(52)
•			m Table									0	ļ	(53)
			storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter	(50) or ((54) in (5	5)									0	J	(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where ((H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
	•	•	culated			59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	ostat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	n month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	43.23	37.63	40.09	37.28	36.95	34.23	35.37	36.95	37.28	40.09	40.32	43.23		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	169.05	147.67	153.64	136.27	131.94	116.2	111.33	124.11	125.48	142.88	152.52	165.08		(62)
Solar DI	HW input	calculated	using App	endix G o	Appendix	H (negativ	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	G)	-	-	-		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter											
(64)m=	169.05	147.67	153.64	136.27	131.94	116.2	111.33	124.11	125.48	142.88	152.52	165.08		_
								Outp	out from w	ater heate	r (annual)₁	12	1676.18	(64)
Heat g	ains fro	m water	heating,	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	52.64	46	47.78	42.24	40.82	35.81	34.1	38.22	38.65	44.2	47.39	51.32		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fi	rom com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gain	ns (Table	e 5), Wat	tts										
	Jan	Feb	Mar	Apr	Мау	Jun								
(66)m=	90.38	90.38	90.38	00.00			Jul	Aug	Sep	Oct	Nov	Dec		
Lightin	a aains			90.38	90.38	90.38	Jul 90.38	Aug 90.38	Sep 90.38	Oct 90.38	Nov 90.38	Dec 90.38		(66)
(67)m=	9 9	(calcula	ted in Ap				90.38	90.38	90.38					(66)
A 1'	15.55	ì					90.38	90.38	90.38					(66) (67)
Applia	15.55	13.81	ted in Ap	opendix 8.5	L, equat 6.36	ion L9 oi 5.37	90.38 r L9a), a 5.8	90.38 Iso see 7.54	90.38 Table 5 10.12	90.38 12.85	90.38	90.38		
	15.55	13.81	ted in Ap 11.23	opendix 8.5	L, equat 6.36	ion L9 oi 5.37	90.38 r L9a), a 5.8	90.38 Iso see 7.54	90.38 Table 5 10.12	90.38 12.85	90.38	90.38		
(68)m=	15.55 nces ga 157.56	13.81 ins (calc 159.2	ted in Ap 11.23 culated in	8.5 Appendix Append 146.31	L, equati 6.36 dix L, eq 135.23	ion L9 oi 5.37 uation L ⁻ 124.83	90.38 r L9a), a 5.8 13 or L1 117.88	90.38 Iso see 7.54 3a), also 116.24	90.38 Table 5 10.12 see Ta 120.36	90.38 12.85 ble 5 129.13	90.38	90.38 15.98		(67)
(68)m=	15.55 nces ga 157.56	13.81 ins (calc 159.2	ted in Ap 11.23 culated in 155.08	8.5 Appendix Append 146.31	L, equati 6.36 dix L, eq 135.23	ion L9 oi 5.37 uation L ⁻ 124.83	90.38 r L9a), a 5.8 13 or L1 117.88	90.38 Iso see 7.54 3a), also 116.24	90.38 Table 5 10.12 see Ta 120.36	90.38 12.85 ble 5 129.13	90.38	90.38 15.98		(67)
(68)m= Cookir (69)m=	15.55 nces ga 157.56 ng gains 32.04	13.81 ins (calc 159.2 (calcula 32.04	ted in Ap 11.23 culated in 155.08 ated in A	Appendix 8.5 Append 146.31 ppendix 32.04	L, equati 6.36 dix L, eq 135.23 L, equat	ion L9 or 5.37 uation L ⁻ 124.83 ion L15	90.38 r L9a), a 5.8 13 or L1 117.88 or L15a)	90.38 Iso see 7.54 3a), also 116.24), also se	90.38 Table 5 10.12 9 see Ta 120.36 ee Table	90.38 12.85 ble 5 129.13 5	90.38 14.99 140.2	90.38 15.98 150.61		(67)
(68)m= Cookir (69)m=	15.55 nces ga 157.56 ng gains 32.04	13.81 ins (calc 159.2 (calcula 32.04	ted in Ap 11.23 culated ir 155.08 ated in A 32.04	Appendix 8.5 Append 146.31 ppendix 32.04	L, equati 6.36 dix L, eq 135.23 L, equat	ion L9 or 5.37 uation L ⁻ 124.83 ion L15	90.38 r L9a), a 5.8 13 or L1 117.88 or L15a)	90.38 Iso see 7.54 3a), also 116.24), also se	90.38 Table 5 10.12 9 see Ta 120.36 ee Table	90.38 12.85 ble 5 129.13 5	90.38 14.99 140.2	90.38 15.98 150.61		(67)
(68)m= Cookir (69)m= Pumps (70)m=	15.55 nces ga 157.56 ng gains 32.04 s and fat 3	13.81 ins (calc 159.2 (calcula 32.04 ns gains 3	ted in Ap 11.23 culated ir 155.08 ated in A 32.04 c (Table \$	opendix 8.5 Appendix 146.31 ppendix 32.04 5a) 3	L, equati 6.36 dix L, eq 135.23 L, equat 32.04	ion L9 or 5.37 uation L 124.83 ion L15 32.04	90.38 r L9a), a 5.8 13 or L1 117.88 or L15a) 32.04	90.38 Iso see 7.54 3a), also 116.24), also se 32.04	90.38 Table 5 10.12 see Ta 120.36 ee Table 32.04	90.38 12.85 ble 5 129.13 5 32.04	90.38 14.99 140.2 32.04	90.38 15.98 150.61 32.04		(67) (68) (69)
(68)m= Cookir (69)m= Pumps (70)m=	15.55 nces ga 157.56 ng gains 32.04 s and fat 3	13.81 ins (calc 159.2 (calcula 32.04 ns gains 3	ted in Ap 11.23 culated in 155.08 ated in A 32.04 c (Table 8 3	opendix 8.5 Appendix 146.31 ppendix 32.04 5a) 3	L, equati 6.36 dix L, eq 135.23 L, equat 32.04	ion L9 or 5.37 uation L 124.83 ion L15 32.04	90.38 r L9a), a 5.8 13 or L1 117.88 or L15a) 32.04	90.38 Iso see 7.54 3a), also 116.24), also se 32.04	90.38 Table 5 10.12 see Ta 120.36 ee Table 32.04	90.38 12.85 ble 5 129.13 5 32.04	90.38 14.99 140.2 32.04	90.38 15.98 150.61 32.04		(67) (68) (69)
(68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	15.55 nces ga 157.56 ng gains 32.04 s and fat 3 s e.g. ev -72.3	13.81 ins (calc 159.2 (calcula 32.04 ns gains 3 vaporatic	ted in Ap 11.23 culated ir 155.08 ated in A 32.04 (Table \$ 3 on (nega -72.3	Appendix 8.5 Appendix 146.31 ppendix 32.04 5a) 3 tive valu	L, equati 6.36 dix L, eq 135.23 L, equat 32.04 3 aes) (Tab	ion L9 or 5.37 uation L7 124.83 ion L15 32.04 3 le 5)	90.38 r L9a), a 5.8 13 or L1 117.88 or L15a) 32.04 3	90.38 Iso see ⁻ 7.54 3a), also 116.24), also se 32.04 3	90.38 Table 5 10.12 see Ta 120.36 ee Table 32.04	90.38 12.85 ble 5 129.13 5 32.04 3	90.38 14.99 140.2 32.04 3	90.38 15.98 150.61 32.04 3		(67) (68) (69) (70)
(68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	15.55 nces ga 157.56 ng gains 32.04 s and fat 3 s e.g. ev -72.3	13.81 ins (calc 159.2 (calcula 32.04 ns gains 3 vaporatic -72.3	ted in Ap 11.23 culated ir 155.08 ated in A 32.04 (Table \$ 3 on (nega -72.3	Appendix 8.5 Appendix 146.31 ppendix 32.04 5a) 3 tive valu	L, equati 6.36 dix L, eq 135.23 L, equat 32.04 3 aes) (Tab	ion L9 or 5.37 uation L7 124.83 ion L15 32.04 3 le 5)	90.38 r L9a), a 5.8 13 or L1 117.88 or L15a) 32.04 3	90.38 Iso see ⁻ 7.54 3a), also 116.24), also se 32.04 3	90.38 Table 5 10.12 see Ta 120.36 ee Table 32.04	90.38 12.85 ble 5 129.13 5 32.04 3	90.38 14.99 140.2 32.04 3	90.38 15.98 150.61 32.04 3		(67) (68) (69) (70)
(68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	15.55 nces ga 157.56 ng gains 32.04 s and fai 3 s e.g. ev -72.3 heating 70.76	13.81 ins (calc 159.2 (calcula 32.04 ns gains 3 /aporatic -72.3 gains (T	ted in Ap 11.23 culated ir 155.08 ated in A 32.04 (Table 5 ated in A -72.3 Fable 5) 64.22	opendix 8.5 Appendix 146.31 ppendix 32.04 5a) 3 tive valu -72.3	L, equati 6.36 dix L, eq 135.23 L, equat 32.04 3 es) (Tab -72.3	ion L9 or 5.37 uation L 124.83 ion L15 32.04 3 le 5) -72.3 49.74	90.38 r L9a), a 5.8 13 or L1 117.88 or L15a) 32.04 3 -72.3 45.83	90.38 Iso see - 7.54 3a), also 116.24), also se 32.04 3 -72.3 51.37	90.38 Table 5 10.12 9 see Ta 120.36 9 Table 32.04 3 -72.3 53.68	90.38 12.85 ble 5 129.13 5 32.04 3 -72.3 59.41	90.38 14.99 140.2 32.04 3 -72.3	90.38 15.98 150.61 32.04 3 -72.3 68.98		(67)(68)(69)(70)(71)
(68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	15.55 nces ga 157.56 ng gains 32.04 s and fai 3 s e.g. ev -72.3 heating 70.76	13.81 ins (calc 159.2 (calcula 32.04 ns gains 3 /aporatic -72.3 gains (T 68.45	ted in Ap 11.23 culated ir 155.08 ated in A 32.04 (Table 5 ated in A -72.3 Fable 5) 64.22	opendix 8.5 Appendix 146.31 ppendix 32.04 5a) 3 tive valu -72.3	L, equati 6.36 dix L, eq 135.23 L, equat 32.04 3 es) (Tab -72.3	ion L9 or 5.37 uation L 124.83 ion L15 32.04 3 le 5) -72.3 49.74	90.38 r L9a), a 5.8 13 or L1 117.88 or L15a) 32.04 3 -72.3 45.83	90.38 Iso see - 7.54 3a), also 116.24), also se 32.04 3 -72.3 51.37	90.38 Table 5 10.12 9 see Ta 120.36 9 Table 32.04 3 -72.3 53.68	90.38 12.85 ble 5 129.13 5 32.04 3 -72.3 59.41	90.38 14.99 140.2 32.04 3 -72.3 65.82	90.38 15.98 150.61 32.04 3 -72.3 68.98		(67)(68)(69)(70)(71)

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	1.98	×	11.28	×	0.76	x	0.7	=	5.77	(75)
Northeast 0.9x	0.77	x	1.98	x	11.28	x	0.76	x	0.7	=	8.23	(75)
Northeast 0.9x	0.54	x	1.98	x	22.97	x	0.76	x	0.7	=	11.75	(75)
Northeast 0.9x	0.77	x	1.98	x	22.97	x	0.76	x	0.7	=	16.76	(75)
Northeast 0.9x	0.54	x	1.98	x	41.38	x	0.76	x	0.7	=	21.17	(75)
Northeast 0.9x	0.77	x	1.98	x	41.38	x	0.76	x	0.7	=	30.19	(75)
Northeast 0.9x	0.54	x	1.98	x	67.96	x	0.76	x	0.7	=	34.77	(75)
Northeast 0.9x	0.77	x	1.98	x	67.96	x	0.76	x	0.7	=	49.58	(75)
Northeast 0.9x	0.54	x	1.98	x	91.35	x	0.76	x	0.7	=	46.74	(75)
Northeast 0.9x	0.77	x	1.98	x	91.35	x	0.76	x	0.7	=	66.65	(75)
Northeast 0.9x	0.54	x	1.98	x	97.38	x	0.76	x	0.7	=	49.83	(75)
Northeast 0.9x	0.77	x	1.98	x	97.38	x	0.76	x	0.7	=	71.05	(75)
Northeast 0.9x	0.54	x	1.98	x	91.1	x	0.76	x	0.7	=	46.61	(75)
Northeast 0.9x	0.77	x	1.98	×	91.1	x	0.76	x	0.7	=	66.47	(75)
Northeast 0.9x	0.54	x	1.98	x	72.63	x	0.76	x	0.7	=	37.16	(75)
Northeast 0.9x	0.77	x	1.98	x	72.63	x	0.76	x	0.7	=	52.99	(75)
Northeast 0.9x	0.54	x	1.98	×	50.42	x	0.76	x	0.7	=	25.8	(75)
Northeast 0.9x	0.77	x	1.98	x	50.42	x	0.76	x	0.7	=	36.79	(75)
Northeast 0.9x	0.54	x	1.98	x	28.07	x	0.76	x	0.7	=	14.36	(75)
Northeast 0.9x	0.77	x	1.98	x	28.07	x	0.76	x	0.7	=	20.48	(75)
Northeast 0.9x	0.54	x	1.98	x	14.2	x	0.76	x	0.7	=	7.26	(75)
Northeast 0.9x	0.77	x	1.98	x	14.2	x	0.76	x	0.7	=	10.36	(75)
Northeast 0.9x	0.54	x	1.98	×	9.21	×	0.76	x	0.7	=	4.71	(75)
Northeast 0.9x	0.77	x	1.98	x	9.21	×	0.76	x	0.7	=	6.72	(75)
Southeast 0.9x	0.77	x	1.49	x	36.79	x	0.76	x	0.7	=	20.18	(77)
Southeast 0.9x	0.77	x	1.49	x	62.67	x	0.76	x	0.7	=	34.38	(77)
Southeast 0.9x	0.77	x	1.49	×	85.75	×	0.76	x	0.7	=	47.04	(77)
Southeast 0.9x	0.77	x	1.49	x	106.25	x	0.76	x	0.7	=	58.29	(77)
Southeast 0.9x	0.77	x	1.49	×	119.01	×	0.76	x	0.7	=	65.29	(77)
Southeast 0.9x	0.77	x	1.49	x	118.15	x	0.76	x	0.7	=	64.82	(77)
Southeast 0.9x	0.77	x	1.49	x	113.91	x	0.76	x	0.7	=	62.49	(77)
Southeast 0.9x	0.77	x	1.49	×	104.39	×	0.76	x	0.7	=	57.27	(77)
Southeast 0.9x	0.77	x	1.49	x	92.85	×	0.76	x	0.7	=	50.94	(77)
Southeast 0.9x	0.77	x	1.49	x	69.27	x	0.76	x	0.7	=	38	(77)
Southeast 0.9x	0.77	x	1.49	x	44.07	x	0.76	x	0.7	=	24.18	(77)
Southeast 0.9x	0	x	1.49	×	31.49	×	0.76	×	0.7	=	17.27	(77)
Northwest 0.9x	0.77	x	1.49	×	11.28	×	0.76	x	0.7	=	6.21	(81)
Northwest 0.9x		x	1.49	×	22.97	×	0.76	x	0.7	=	12.63	(81)
Northwest 0.9x	0.77	x	1.49	x	41.38	×	0.76	x	0.7	=	22.76	(81)

Northwest 0.9		×	1.4	19	×	67.96	×	0.76		0.7	=	37.38	(81)
Northwest 0.9		x	1.4	49	x	91.35	×	0.76	×	0.7	=	50.25	(81)
Northwest 0.9	× 0.77	x	1.4	19	x	97.38	×	0.76	×	0.7	=	53.57	(81)
Northwest 0.9	× 0.77	x	1.4	19	x	91.1] × [0.76	×	0.7	=	50.11	(81)
Northwest 0.9	× 0.77	X	1.4	19	x	72.63	x	0.76	x	0.7	=	39.95	(81)
Northwest 0.9	x 0.77	x	1.4	19	x	50.42	x	0.76	x	0.7	=	27.73	(81)
Northwest 0.9	× 0.77	x	1.4	19	x	28.07	x	0.76	x	0.7	=	15.44	(81)
Northwest 0.9	× 0.77	x	1.4	19	x	14.2	x	0.76	x	0.7	=	7.81	(81)
Northwest 0.9	× 0.77	x	1.4	19	x	9.21	×	0.76	x	0.7	=	5.07	(81)
Solar gains i	in watts, c	alculated	for eac	h month	-	_	(83)m	= Sum(74)m	(82)m	_			
(83)m= 40.4	75.52	121.17	180.02	228.92	239.27	225.68	187.	.37 141.26	88.28	49.61	33.78		(83)
Total gains -	- internal a	and solar	: (84)m =	= (73)m	+ (83)m	n, watts							
(84)m= 337.3	370.09	404.81	446.61	478.49	472.31	448.3	415.	.63 378.52	342.78	323.73	322.47		(84)
7. Mean int	ernal tem	perature	(heating	season)								
Temperatu	re during h	neating p	eriods ir	n the livi	ng area	from Ta	ble 9,	Th1 (°C)				21	(85)
Utilisation f	actor for g	ains for l	living are	ea, h1,m	i (see T	able 9a)							
Jar	n Feb	Mar	Apr	May	Jun	Jul	Αι	ug Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.97	0.92	0.8	0.64	0.7	7 0.9	0.98	1	1		(86)
Mean inter	nal temper	rature in	living ar	ea T1 (fo	ollow st	eps 3 to	7 in T	able 9c)		-	-		
(87)m= 19.5		19.93	20.29	20.64	20.88	20.97	20.9		20.33	19.88	19.53		(87)
Temperatu	re during h	neating n	eriods in	n rest of	dwellin	a from T	ahla 0	Th2 (°C)					
(88)m= 19.82		19.82	19.84	19.84	19.85	19.85	19.8		19.84	19.83	19.83		(88)
Utilisation f	0.99	0.99	0.96	weiling, 0.89	n2,m (s	0.49	9a) 0.5	6 0.84	0.97	0.99	1		(89)
										0.99			(00)
Mean inter		-			<u> </u>	<u> </u>	ri		<u> </u>	· · · · ·	i	I	(2.2)
(90)m= 17.9	18.1	18.46	18.99	19.47	19.76	19.84	19.8		19.05	18.4	17.88		(90)
									TLA = LIVI	ng area ÷ (4) =	0.5	(91)
Mean inter	nal temper	rature (fo	or the wh	ole dwe	lling) =	$fLA \times T1$	+ (1 -	– fLA) × T2	2				
(92)m= 18.72	2 18.89	19.2	19.64	20.05	20.32	20.4	20.3	39 20.2	19.69	19.14	18.7		(92)
Apply adjus		1	i	<u> </u>	r	-	e 4e, v	where appr	opriate		,	1	
(93)m= 18.72		19.2	19.64	20.05	20.32	20.4	20.3	39 20.2	19.69	19.14	18.7		(93)
8. Space h													
Set Ti to the the utilisation			•		ned at s	tep 11 of	Table	e 9b, so tha	at Ti,m=	(76)m an	d re-calc	culate	
Jar		Mar	Apr	May	Jun	Jul	Αι	ug Sep	Oct	Nov	Dec		
Utilisation f			· · ·	Iviay	Jun								
(94)m= 1	0.99	0.99	0.96	0.89	0.75	0.57	0.6	3 0.87	0.97	0.99	1		(94)
Useful gain	is, hmGm	, W = (94	1 4)m x (8-	1 4)m		_							
(95)m= 335.8		398.78	429.04	427.26	352.06	254.61	261.	.37 327.79	333.18	321.22	321.3		(95)
Monthly av	erage exte	ernal tem	perature	e from T	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	ate for me	an intern	al temp	erature,	Lm , W	=[(39)m	x [(93	3)m– (96)m]				
(97)m= 1033.	.6 999.78	905.44	757.51	587.85	398.82	264.85	277.	48 426.75	639.87	851.08	1029.57		(97)

Space	e heating	g require	ement fo	r each n	nonth, k\	Wh/mont	th = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	519.1	424.96	376.95	236.5	119.48	0	0	0	0	228.18	381.5	526.95		_
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	2813.62	(98)
Space	e heating	g require	ement in	kWh/m ²	²/year								52.12	(99)
9a. Ene	ergy req	luiremer	nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heatir	-			, .									
	-				y/supple	mentary	-	(000) 4	(004)				0	(201)
	-		at from m	-	. ,			(202) = 1 -		(000)]			1	(202)
			ng from	-				(204) = (2	02) × [1 –	(203)] =			1	(204)
		-	ace heat	• •									90.3	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space		g require 424.96	ement (c 376.95	i	d above)		0	0	0	000.40	201 5	526.95		
	519.1			236.5	119.48	0	0	0	0	228.18	381.5	526.95		
(211)m	$1 = \{[(98)]$ 574.86)m x (20 470.6	4)] } x 1 417.45	00 ÷ (20 261.9	132.31	0	0	0	0	252.69	422.48	583.56		(211)
	574.00	470.0		201.0	102.01	0	0			ar) =Sum(2			3115.85	(211)
Space	e heatin	a fuel (s	econdar	v). kWh/	month					· · ·	· 1		0110100	
•		•	00 ÷ (20											
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
						-		Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,1012}	-	0	(215)
Water	heating	I												
Output	from wa	ater hea 147.67	ter (calc 153.64	ulated a	bove) 131.94	116.2	111.33	124.11	125.48	142.88	152.52	165.08		
 Efficier		ater hea		130.27	131.94	110.2	111.55	124.11	125.40	142.00	152.52	105.08	81	(216)
(217)m=		87.7	87.39	86.66	85.17	81	81	81	81	86.48	87.43	87.89	01	(217)
· · I			kWh/mo											~ /
(219)m	i = (64)) ÷ (217)											
(219)m=	192.49	168.38	175.8	157.25	154.91	143.46	137.45	153.22	154.91	165.23	174.45	187.82		-
_								Tota	I = Sum(2				1965.36	(219)
	l i totals beating	fuel use	ed, main	system	1					k\	Wh/year		kWh/year 3115.85	٦
	•			System	1							l		
	-	fuel use										l	1965.36	
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t								
centra	al heatin	g pump:	:									30		(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Total e	lectricity	for the	above, l	kWh/yea	ır			sum	of (230a).	(230g) =			75	(231)
Electric	city for li	ghting											274.62	(232)
Electric	city gene	erated by	y PVs										-765.35	(233)
	, go.n		,					0115				l		

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 =	673.02 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	424.52 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1097.54 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	142.53 (268)
Energy saving/generation technologies			
Item 1		0.519 =	-397.22 (269)
Total CO2, kg/year	sum	of (265)(271) =	881.78 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =	16.33 (273)
El rating (section 14)			88 (274)

Regulations Compliance Report

	mber 2019 at 13:22	2:49		sion: 1.0.4.18	
Project Information	h:				
Assessed By:	Su Lee (STRO031	315)	Building Type:	Detached House	
Dwelling Details:					
NEW DWELLING D	DESIGN STAGE		Total Floor Area: 16	37.51m²	
Site Reference :	217 Kingston Road	d	Plot Reference:	Rear House	
Address :					
Client Details:					
lame:					
ddress :					
his report covers	items included w	ithin the SAP calculations.			
•	e report of regulat				
1a TER and DER					
	ng system: Mains ga	as			
Fuel factor: 1.00 (m	• /	(
-	kide Emission Rate		18.33 kg/m ²		ok
1b TFEE and DFE	oxide Emission Rat	e (DER)	11.66 kg/m²		OK
	gy Efficiency (TFEE)	70.6 kWh/m ²		
	ergy Efficiency (DFE		50.9 kWh/m ²		
5	3	,			ОК
2 Fabric U-values					
Element		Average	Highest		
External w	all	0.15 (max. 0.30)	0.15 (max. 0.70)		OK
Floor		0.13 (max. 0.25)	0.13 (max. 0.70)		OK
Roof Openings		0.13 (max. 0.20) 1.20 (max. 2.00)	0.13 (max. 0.35) 1.20 (max. 3.30)		OK OK
· · ·		1.20 (IIIax: 2.00)	1.20 (IIIax: 5.50)		
2a Thermal bridg	ing				
		om linear thermal transmittanc	es for each junction		
Thermal br	ridging calculated fr	om linear thermal transmittanc	es for each junction		
Thermal bi 3 Air permeability	ridging calculated fr	om linear thermal transmittanc	es for each junction 4.00 (design valu	e)	
Thermal bi 3 Air permeability	ridging calculated fr	om linear thermal transmittanc		e)	OK
Thermal bu 3 Air permeability Air permeabi Maximum	ridging calculated fr y ility at 50 pascals	om linear thermal transmittanc	4.00 (design valu	e)	
Thermal bu 3 Air permeability Air permeabi Maximum	ridging calculated fr v ility at 50 pascals	om linear thermal transmittanc Boiler systems with radiators Data from manufacturer	4.00 (design valu 10.0	·	
Thermal bi 3 Air permeability Air permeabi Maximum 4 Heating efficien	ridging calculated fr v ility at 50 pascals	Boiler systems with radiators	4.00 (design valu 10.0	·	
Thermal bi 3 Air permeability Air permeabi Maximum 4 Heating efficien	ridging calculated fr v ility at 50 pascals	Boiler systems with radiators Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2	4.00 (design valu 10.0 or underfloor heating - ma	·	ок
 3 Air permeability Air permeabi Maximum 4 Heating efficien 	ridging calculated fr v ility at 50 pascals	Boiler systems with radiators Data from manufacturer Combi boiler	4.00 (design valu 10.0 or underfloor heating - ma	·	
Thermal br 3 Air permeability Air permeabi Maximum 4 Heating efficien Main Heating	ridging calculated fr v ility at 50 pascals	Boiler systems with radiators Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2	4.00 (design valu 10.0 or underfloor heating - ma	·	ок
Thermal bi 3 Air permeability Air permeability Maximum 4 Heating efficien Main Heating Secondary h	ridging calculated fr ility at 50 pascals ncy g system:	Boiler systems with radiators Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2 Minimum 88.0 %	4.00 (design valu 10.0 or underfloor heating - ma	·	ок
Thermal bi 3 Air permeability Air permeabi Maximum 4 Heating efficien Main Heating	ridging calculated fr v ility at 50 pascals ncy g system: heating system:	Boiler systems with radiators Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2 Minimum 88.0 %	4.00 (design valu 10.0 or underfloor heating - ma	·	ок

Regulations Compliance Report

Space besting controls	TT70 by plumbing and a	lastrical convision	C
Space heating controls Hot water controls:	TTZC by plumbing and e	lectrical services	, c
Hot water controls.	No cylinder thermostat		
Boiler interlock:	No cylinder Yes		c
w energy lights	165		
Percentage of fixed lights wi	th low-operav fittings	100.0%	
Minimum	throw-energy mangs	75.0%	C
chanical ventilation		10.070	
Not applicable			
mmertime temperature			
Overheating risk (Thames va	alley):	Slight	C
l on:			
Overshading:		Average or unknown	
Windows facing: South Wes	t	15.76m ²	
Windows facing: North East		7.02m ²	
Windows facing: South Wes	t	1.98m ²	
Windows facing: North East		1.99m ²	
Windows facing: South Wes	t	3.93m ²	
Roof windows facing: South		4.04m ²	
Roof windows facing: North		4.04m ²	
Ventilation rate:		4.00	
Blinds/curtains:		None	

Photovoltaic array

User Details:													
Assessor Name: Software Name:	Su Lee Stroma FS	AP 201				a Num are Vei	rsion:			STRO031315 /ersion: 1.0.4.18			
A dala e e e													
Address : 1. Overall dwelling dimensions:													
	13013.			Δre	a(m²)		Av. Hei	aht(m)		Volume(m ³)			
Basement						(1a) x		.7	(2a) =	274.43	(3a)		
Ground floor					65.88	(1b) x	2	76	(2b) =	182.08] (3b)		
Total floor area TFA = (1)	a)+(1b)+(1c)+	(1d)+(1e	e)+(1n		67.51	(4)]` ´	.02.00]```		
Dwelling volume	((().(,(′ <u> </u>	07.01)+(3c)+(3d)+(3e)+	.(3n) =	456.51	(5)		
2. Ventilation rate:											-1		
	main heating		econdary leating	V	other		total			m ³ per hour			
Number of chimneys	0] + [["]	0] + [0] = [0	x 4	40 =	0	(6a)		
Number of open flues	0	<u> </u> + [0] + [0		0	x 2	20 =	0	(6b)		
Number of intermittent fa	ns					Γ	4	x ′	10 =	40	(7a)		
Number of passive vents						Γ	0	x	10 =	0	(7b)		
Number of flueless gas fi	res					Г	0	x 4	40 =	0	(7c)		
									A := = =		_		
Lefflore d'activité de la constitución			-) · (Ch) · (7	-).(7-).		F			1	anges per ho	-		
Infiltration due to chimne If a pressurisation test has b						continue fr	40 om (9) to (÷ (5) =	0.09	(8)		
Number of storeys in the			,							0	(9)		
Additional infiltration	Ū (,						[(9)-	-1]x0.1 =	0	(10)		
Structural infiltration: 0	.25 for steel or	r timber f	frame or	0.35 fo	r masoni	ry constr	uction		-	0	(11)		
if both types of wall are p deducting areas of openii			ponding to	the grea	ter wall are	a (after					_		
If suspended wooden f	loor, enter 0.2	(unseal	ed) or 0.	1 (seal	ed), else	enter 0				0	(12)		
If no draught lobby, en	ter 0.05, else e	enter 0								0	(13)		
Percentage of windows	s and doors dr	aught st	ripped							0	(14)		
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)		
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	- (15) =		0	(16)		
Air permeability value,	q50, expresse	ed in cub	oic metres	s per h	our per s	quare m	etre of e	nvelope	area	4	(17)		
If based on air permeabil	ity value, then	(18) = [(1	7) ÷ 20]+(8), otherw	vise (18) = ((16)				0.29	(18)		
Air permeability value applie	s if a pressurisation	on test has	s been don	e or a de	gree air pe	rmeability	is being us	sed					
Number of sides sheltere	ed									0	(19)		
Shelter factor						[0.075 x (1	[9)] =			1	(20)		
Infiltration rate incorporat	-				(21) = (18) x (20) =				0.29	(21)		
Infiltration rate modified f		· ·			1.					l			
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Monthly average wind sp	eed from Tabl	e 7	·							I			
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7				

(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18	_
Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m	
0.37 0.36 0.35 0.32 0.31 0.27 0.27 0.27 0.29 0.31 0.32 0.34	
Calculate effective air change rate for the applicable case	
If mechanical ventilation: If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	0 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0 (23b)
	0 (23c)
a) If balanced mechanical ventilation with heat recovery (MVHR) $(24a)m = (22b)m + (23b) \times [1 - (23c) (24a)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 $	(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 0	(24b)
c) If whole house extract ventilation or positive input ventilation from outside	
if $(22b)m < 0.5 \times (23b)$, then $(24c) = (23b)$; otherwise $(24c) = (22b)m + 0.5 \times (23b)$	
(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(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)m² x 0.5] 	1
(24d)m= 0.57 0.56 0.56 0.55 0.55 0.54 0.54 0.54 0.54 0.54 0.55 0.55 0.56	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	
(25)m = 0.57 0.56 0.56 0.55 0.55 0.54 0.54 0.54 0.54 0.55 0.55 0.56	(25)
3. Heat losses and heat loss parameter:	
ELEMENT Gross Openings Net Area U-value A X U k-value area (m ²) m ² A ,m ² W/m2K (W/K) kJ/m ² ·k	
ELEMENT Gross Openings Net Area U-value A X U k-value	
ELEMENT Gross area (m²) Openings m² Net Area A ,m² U-value A X U k-value W/m2K (W/K) m² kJ/m²·k	K kJ/K
ELEMENTGross area (m^2) Openings m^2 Net Area A, m^2 U-value W/m2KA X U (W/K)k-value kJ/m²-kDoors 2.15 x 1.2 = 2.586	K kJ/K (26)
ELEMENTGross area (m^2) Openings m^2 Net Area A,m^2U-value 	K kJ/K (26) (27)
ELEMENTGross area (m^2) Openings m^2 Net Area A, m^2 U-value W/m2KA X U (W/K)k-value kJ/m²-kDoors 2.15 x 1.2 = 2.586 Windows Type 1 15.756 $x1/[1/(1.2)+0.04]$ = 18.04 Windows Type 2 7.02 $x1/[1/(1.2)+0.04]$ = 8.04	K kJ/K (26) (27) (27)
ELEMENT Gross area (m²) Openings m² Net Area A,m² U-value W/m2K A X U (W/K) k-value kJ/m²-k Doors 2.15 x 1.2 = 2.586 Windows Type 1 15.756 $x1/[1/(1.2)+0.04]$ = 18.04 Windows Type 2 7.02 $x1/[1/(1.2)+0.04]$ = 8.04 Windows Type 3 0.991 $x1/[1/(1.2)+0.04]$ = 1.13	K kJ/K (26) (27) (27) (27)
ELEMENT Gross area (m²) Openings m² Net Area A,m^2 U-value $W/m2K$ A X U (W/K) k-value kJ/m^2 . Doors 2.15 x 1.2 = 2.586 Windows Type 1 15.756 x1/[1/(1.2)+0.04] = 18.04 Windows Type 2 7.02 x1/[1/(1.2)+0.04] = 8.04 Windows Type 3 0.991 x1/[1/(1.2)+0.04] = 1.13 Windows Type 4 0.996 x1/[1/(1.2)+0.04] = 1.14	K kJ/K (26) (27) (27) (27) (27) (27)
ELEMENT Gross area (m²) Openings m² Net Area $A, m²$ U-value $W/m2K$ A X U (W/K) k-value $kJ/m²-k$ Doors 2.15 × 1.2 = 2.586 Windows Type 1 15.756 x1/[1/(1.2)+0.04] = 18.04 Windows Type 2 7.02 x1/[1/(1.2)+0.04] = 8.04 Windows Type 3 0.991 x1/[1/(1.2)+0.04] = 1.13 Windows Type 5 3.929 x1/[1/(1.2)+0.04] = 4.5	K kJ/K (26) (27) (27) (27) (27) (27) (27)
ELEMENTGross area (m^2) Openings m^2 Net Area A, m^2 U-value W/m2KA X U (W/K)k-value kJ/m2·HDoors 2.15 x 1.2 $=$ 2.586 Windows Type 1 15.756 $x1/[1/(1.2)+0.04] =$ 18.04 Windows Type 2 7.02 $x1/[1/(1.2)+0.04] =$ 8.04 Windows Type 3 0.991 $x1/[1/(1.2)+0.04] =$ 1.13 Windows Type 4 0.996 $x1/[1/(1.2)+0.04] =$ 1.14 Windows Type 5 3.929 $x1/[1/(1.2)+0.04] =$ 4.5 Rooflights Type 1 2.02 $x1/[1/(1.2)+0.04] =$ 2.424	K kJ/K (26) (27) (27) (27) (27) (27) (27) (27)
ELEMENTGross area (m²)Openings m²Net Area A,m²U-value W/m2KA X U (W/K)k-value kJ/m²-kDoors 2.15 x 1.2 = 2.586 Windows Type 1 15.756 $x1/[1/(1.2)+0.04]$ = 18.04 Windows Type 2 7.02 $x1/[1/(1.2)+0.04]$ = 1.13 Windows Type 3 0.991 $x1/[1/(1.2)+0.04]$ = 1.13 Windows Type 4 0.996 $x1/[1/(1.2)+0.04]$ = 1.14 Windows Type 5 3.929 $x1/[1/(1.2)+0.04]$ = 4.5 Rooflights Type 1 2.02 $x1/[1/(1.2)+0.04]$ = 2.424 Rooflights Type 2 2.02 $x1/[1/(1.2)+0.04]$ = 2.424	K kJ/K (26) (27) (27) (27) (27) (27) (27) (27b) (27b)
ELEMENT Gross area (m²) Openings m² Net Area A,m² U-value W/m2K A X U (W/K) k-value kJ/m²·k Doors 2.15 x 1.2 = 2.586 Windows Type 1 15.756 $x1/[1/(1.2)+0.04]$ = 18.04 Windows Type 2 7.02 $x1/[1/(1.2)+0.04]$ = 8.04 Windows Type 3 0.991 $x1/[1/(1.2)+0.04]$ = 1.13 Windows Type 4 0.996 $x1/[1/(1.2)+0.04]$ = 4.5 Rooflights Type 1 2.02 $x1/[1/(1.2)+0.04]$ = 2.424 Rooflights Type 2 2.02 $x1/[1/(1.2)+0.04]$ = 2.424 Floor 101.64 x 0.13 = 13.2132	K kJ/K (26) (27) (27) (27) (27) (27) (27) (27b) (27b)
ELEMENT Gross area (m ²) Openings m ² Net Area A, m ² U-value W/m2K A X U (W/K) k-value kJ/m ² .H Doors 2.15 x 1.2 $=$ 2.586 Windows Type 1 15.756 $x1/[1/(1.2) + 0.04] =$ 18.04 Windows Type 2 7.02 $x1/[1/(1.2) + 0.04] =$ 8.04 Windows Type 3 0.991 $x1/[1/(1.2) + 0.04] =$ 1.13 Windows Type 4 0.996 $x1/[1/(1.2) + 0.04] =$ 1.14 Windows Type 5 3.929 $x1/[1/(1.2) + 0.04] =$ 4.5 Rooflights Type 1 2.02 $x1/[1/(1.2) + 0.04] =$ 2.424 Floor 101.64 x 0.13 $=$ 13.2132 Walls Type 1 45.8 0 45.8 x 0.15 6.87	K kJ/K (26) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b)
ELEMENT Gross area (m²) Openings m² Net Area A, m² U-value W/m2K A X U (W/K) k-value kJ/m²-k Doors 2.15 x 1.2 = 2.586 Windows Type 1 15.756 $x1/[1/(1.2)+0.04]$ 18.04 Windows Type 2 7.02 $x1/[1/(1.2)+0.04]$ 8.04 Windows Type 3 0.991 $x1/[1/(1.2)+0.04]$ 1.13 Windows Type 4 0.996 $x1/[1/(1.2)+0.04]$ 4.5 Rooflights Type 5 3.929 $x1/[1/(1.2)+0.04]$ 4.5 Rooflights Type 1 2.02 $x1/[1/(1.2)+0.04]$ 2.424 Floor 101.64 x 0.13 $=$ 13.2132 Walls Type1 45.8 0 45.8 0.15 6.87 0.986 Walls Type2 74.79 24.93 49.86 0.15 $=$ 7.48 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.15 <t< td=""><td>K kJ/K (26) (27) (27) (27) (27) (27) (27b)(27b) (27b)(27b)(27b)(27b)(27b)(27b)(27b)(27b)</td></t<>	K kJ/K (26) (27) (27) (27) (27) (27) (27b)(27b) (27b)(27b)(27b)(27b)(27b)(27b)(27b)(27b)
ELEMENT Gross area (m ²) Openings m ² Net Area A, m ² U-value W/m2K A X U (W/K) k-value kJ/m ² -k Doors 2.15 x 1.2 = 2.586 Windows Type 1 15.756 $x1/[1/(1.2)+0.04]$ = 18.04 Windows Type 2 7.02 $x1/[1/(1.2)+0.04]$ = 8.04 Windows Type 3 0.991 $x1/[1/(1.2)+0.04]$ = 1.13 Windows Type 4 0.996 $x1/[1/(1.2)+0.04]$ = 4.5 Rooflights Type 1 2.02 $x1/[1/(1.2)+0.04]$ = 2.424 Rooflights Type 1 2.02 $x1/[1/(1.2)+0.04]$ = 2.424 Floor 101.64 0.13 = 13.2132 0.94 Walls Type1 45.8 0.15 6.87 0.94 0.15	K kJ/K (26) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (29)
ELEMENT Gross area (m²) Openings m² Net Area $A, m²$ U-value $W/m2K$ A X U (W/K) k-value $kJ/m²-k$ Doors 2.15 × 1.2 = 2.586 Windows Type 1 15.756 x1/[1/(1.2)+0.04] = 18.04 Windows Type 2 7.02 x1/[1/(1.2)+0.04] = 8.04 Windows Type 3 0.991 x1/[1/(1.2)+0.04] = 1.13 Windows Type 4 0.996 x1/[1/(1.2)+0.04] = 4.5 Rooflights Type 5 3.929 x1/[1/(1.2)+0.04] = 4.5 Rooflights Type 1 2.02 x1/[1/(1.2)+0.04] = 2.424 Floor 101.64 0.13 = 13.2132 Walls Type 2 74.79 24.93 49.86 0.15 = 7.48 Walls Type 3 76.94 7.9 69.04 0.13 = 10.36	K kJ/K (26) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (29) (29) (29) (29) (29)
ELEMENT Gross area (m²) Openings m² Net Area A,m² U-value W/m2K A X U (W/K) k-value kJ/m²-k Doors 2.15 \times 1.2 $=$ 2.586 18.04 Windows Type 1 15.756 $\times 1/[1/(1.2) + 0.04] =$ 18.04 18.04 Windows Type 2 7.02 $\times 1/[1/(1.2) + 0.04] =$ 8.04 Windows Type 3 0.991 $\times 1/[1/(1.2) + 0.04] =$ 1.13 Windows Type 4 0.996 $\times 1/[1/(1.2) + 0.04] =$ 1.14 Windows Type 5 3.929 $\times 1/[1/(1.2) + 0.04] =$ 2.424 Rooflights Type 1 2.02 $\times 1/[1/(1.2) + 0.04] =$ 2.424 Floor 101.64 \times 0.13 $=$ 13.2132 Walls Type 1 45.8 0 45.8 0.15 $=$ 6.87 Walls Type 3 76.94 7.9 69.04 \times 0.15 $=$ 10.36 $=$ Roof Type 1 33.77 0 33.77 \times 0.13 $=$ 4.39 $=$ Walls Type 2 4.35 0 4.35 \times 0.1	K kJ/K (26) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (29) (29) (29) (29) (29) (29) (29) (30)

				effective wi nternal wal			lated using	formula 1,	/[(1/U-valu	ıe)+0.04] a	as given in	paragrapi	h 3.2	
Fabric	heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				98.65	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF		: TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
	0		ere the de tailed calc		construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix	K						33.72	(36)
			are not kn	own (36) =	= 0.05 x (3	1)								_
	abric he								(33) +	(36) =			132.36	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)		7	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	85.45	85.06	84.67	82.86	82.52	80.95	80.95	80.66	81.55	82.52	83.21	83.93		(38)
Heat t	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	217.82	217.42	217.04	215.23	214.89	213.31	213.31	213.02	213.92	214.89	215.57	216.29]	
										-	Sum(39)1	12 /12=	215.23	(39)
	<u> </u>	, ,	HLP), W/	r	1	1		1		= (39)m ÷	r		1	
(40)m=	1.3	1.3	1.3	1.28	1.28	1.27	1.27	1.27	1.28	1.28	1.29	1.29		-
Numb	or of day	in moi	nth (Tab	la 12)					,	Average =	Sum(40)1	12 /12=	1.28	(40)
Numb	Jan	Feb	Mar	,	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
(41)m=	31	28	31	Apr 30	31	30	31	Aug 31	30	31	30	31		(41)
(+1)11-	51	20						51	50	51	50		J	()
4. Wa	ater heat	ting ener	rgy requ	irement:								kWh/y	ear:	
		ıpancy, I 9, N = 1		: [1 - exp	(-0.0003	349 x (TI	FA -13.9)2)] + 0.()013 x (⁻	TFA -13		96]	(42)
	A £ 13.9												-	
								(25 x N) to achieve		se tarnet o		4.48		(43)
		-		r day (all w		-	-		a water ut	se iarger o	,			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Hot wat					,		Table 1c x	-	000	000	1.00	000	1	
(44)m=	114.93	110.75	106.57	102.39	98.21	94.03	94.03	98.21	102.39	106.57	110.75	114.93	1	
()						0.100	0.000				m(44) ₁₁₂ =		1253.78	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,i	m x nm x E	0Tm / 3600						
(45)m=	170.44	149.07	153.82	134.11	128.68	111.04	102.89	118.07	119.48	139.25	152	165.06]	
				1	1	I	1			Total = Su	m(45) ₁₁₂ =	=	1643.91	(45)
lf instan	taneous w	ater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)					
(46)m=	25.57	22.36	23.07	20.12	19.3	16.66	15.43	17.71	17.92	20.89	22.8	24.76]	(46)
	storage						-				·		-	
-		. ,					-	within sa	ame ves	sel		0		(47)
	-	-			-) litres in							
	vise if no		hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
vvaler	otoroac	1000								(,			
	storage nanufact		eclared I	oss facto	or is kno	wn (k\\/l	n/dav).			(0	1	(48)
a) If m	nanufact	urer's de	eclared I m Table	oss facto	or is kno	wn (kWl	n/day):					0]	(48) (49)

			storage		ear loss fact	or is not		(48) x (49)) =			0		(50)
Hot wa	ater stor	age loss	factor fr	om Tab	le 2 (kW							0		(51)
	•	-	ee secti	on 4.3									I	
		from Ta actor fro	ble 2a m Table	2h								0 0		(52) (53)
•			storage		ear			(47) x (51) x (52) x (53) =		0		(54)
		(54) in (5	-									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m			I	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	loss (ar	nual) fro	om Table	e 3		•	•				0		(58)
	•	•	,		month (59)m = ((58) ÷ 36	65 × (41)	m				I	
(mo	dified by	factor f	rom 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 ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41))m						
(61)m=	50.96	46.03	50.96	49.32	50.05	46.37	47.92	50.05	49.32	50.96	49.32	50.96		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	, (59)m + (61)m	
(62)m=	221.4	195.09	204.78	183.42	178.73	157.41	150.81	168.12	168.8	190.2	201.31	216.02		(62)
Solar DI	-W input of	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)]	
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter	-	-		-			-	-	-	'	
(64)m=	221.4	195.09	204.78	183.42	178.73	157.41	150.81	168.12	168.8	190.2	201.31	216.02		
			-				-	Outp	out from w	ater heate	r (annual)₁	12	2236.1	(64)
Heat g	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	69.41	61.07	63.89	56.92	55.3	48.51	46.19	51.77	52.06	59.04	62.87	67.62		(65)
inclu	ide (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gain	s (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	147.96	147.96	147.96	147.96	147.96	147.96	147.96	147.96	147.96	147.96	147.96	147.96		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	-	-	-	'	
(67)m=	30.22	26.84	21.83	16.53	12.35	10.43	11.27	14.65	19.66	24.97	29.14	31.06		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	-			
(68)m=	339.01	342.52	333.66	314.79	290.96	268.57	253.62	250.1	258.96	277.84	301.66	324.05		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	e 5			I	
(69)m=	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8		(69)
Pumps	and fai	ns gains	(Table	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	le 5)		-		-			'	
(71)m=	-118.37	-118.37	-118.37	-118.37	-118.37	-118.37	-118.37	-118.37	-118.37	-118.37	-118.37	-118.37		(71)

(72)me 93.29 93.88 85.87 79.05 74.32 67.38 62.09 69.59 72.3 79.36 87.32 90.89 (72)m <th cols<="" th=""><th>Water heating</th><th>gains (Ta</th><th>able 5)</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th>	<th>Water heating</th> <th>gains (Ta</th> <th>able 5)</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	Water heating	gains (Ta	able 5)												
(73)me 532.91 530.64 611.75 440.02 448.03 416.77 397.36 404.72 421.32 432.64 488.6 516.39 (73) Solar geins are calculated using solar flux from Table 6a ad associated equations to convert to the applicable orientation. Orientation: Access Factor Area m² Flux 0.76 × 0.7 = 29.2 (75) Northeast 0.9x 0.77 × 1 × 11.28 × 0.76 × 0.7 = 29.2 (75) Northeast 0.9x 0.77 × 1 × 22.07 × 0.76 × 0.7 = 29.2 (75) Northeast 0.9x 0.77 × 1 × 22.07 × 0.76 × 0.7 = 107.09 75) Northeast 0.9x 0.77 × 1 × 41.38 × 0.76 × 0.7 = 49.41 75) Northeast 0.9x 0.77 × 1 × 67.86 × 0.76 × 0	(72)m= 93.29	90.88	85.87	79.05	74.32	6	7.38 62.09	69	.59	72.3	79.35	87.32	90.89]	(72)	
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Table 6a Flux from Table 6a Table 6b FF Gains (W) Northeast 0.9x 0.77 x 11.28 x 0.76 x 0.77 s 0.77 x 11.28 x 0.76 x 0.76 x 0.77 x 11.28 x 0.76 x 0.77 x 10.76 x 0.76 x 0.77 x <t< td=""><td>Total interna</td><td>l gains =</td><td></td><td></td><td></td><td></td><td>(66)m + (67)</td><td>m + (6</td><td>8)m +</td><td>(69)m + (7</td><td>70)m +</td><td>(71)m + (72)</td><td>m</td><td>-</td><td></td></t<>	Total interna	l gains =					(66)m + (67)	m + (6	8)m +	(69)m + (7	70)m +	(71)m + (72)	m	-		
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable ortentation: Access Factor Area Flux g Table 6b FF Gains Northeast 0.sx 0.77 × 7.02 × 11.28 × 0.76 × 0.77 = 2.8.29 (%) Northeast 0.sx 0.77 × 1 × 11.28 × 0.76 × 0.77 = 2.8.29 (%) Northeast 0.sx 0.77 × 1 × 2.2.97 × 0.76 × 0.77 = 1.6.70 (%) Northeast 0.sx 0.77 × 1 × 2.2.97 × 0.76 × 0.77 = 1.6.70 (%) (%) (%) 0.77 = 1.6.70 (%) (%) 0.77 = 1.6.70 (%) (%) (%) 0.77 = 1.6.70 (%) 0.77 = 1.75.88 (%) 0.76 × 0.77 = 1.75.88 (%) 0.77 (%) 1.75.2 (%) 0.76 × </td <td>(73)m= 532.91</td> <td>530.64</td> <td>511.75</td> <td>480.76</td> <td>448.03</td> <td>4</td> <td>16.77 397.36</td> <td>6 404</td> <td>4.72</td> <td>421.32</td> <td>452.5</td> <td>4 488.5</td> <td>516.39</td> <td>]</td> <td>(73)</td>	(73)m= 532.91	530.64	511.75	480.76	448.03	4	16.77 397.36	6 404	4.72	421.32	452.5	4 488.5	516.39]	(73)	
Orientation: Access Factor Table 60 Area m ² Flux Table 60 g_ FF Table 60 Gains (W) Northeast 0.ax Oxtheast 0.ax 0.07 0.77 × 11.28 × 0.76 × 0.77 = 2.9.2 (75) Northeast 0.ax 0.07 × 7.02 × 2.297 × 0.76 × 0.77 = 2.9.2 (75) Northeast 0.ax 0.07 × 1 × 2.297 × 0.76 × 0.77 = 9.9.44 (75) Northeast 0.ax 0.77 × 1 × 2.297 × 0.76 × 0.77 = 10.709 (75) Northeast 0.ax 0.77 × 7.02 × 41.38 × 0.76 × 0.77 = 49.91 (75) Northeast 0.ax 0.77 × 7.02 × 91.35 × 0.76 × 0.77 = 226.41 (75) Northeast 0.ax 0.77 × 7.02 × 9	6. Solar gain	s:						1						4		
Table 6d m² Table 6a Table 6b Table 6c (W) Northeast 0.9x 0.77 × 7.02 × 11.28 × 0.76 × 0.77 = 2.9.2 7.61 Northeast 0.9x 0.77 × 1 × 2.2.97 × 0.76 × 0.77 = 0.8044 (75) Northeast 0.9x 0.77 × 1.02 × 0.76 × 0.77 = 0.8044 (75) Northeast 0.9x 0.77 × 1.02 × 41.38 × 0.76 × 0.77 = 107.00 (75) Northeast 0.9x 0.77 × 7.02 × 67.96 × 0.76 × 0.77 = 175.88 (75) Northeast 0.9x 0.77 × 7.02 × 91.35 × 0.76 × 0.77 = 175.2 (75) Northeast 0.9x 0.77 × 7.02	Solar gains are	calculated u	ising sola	r flux from	Table 6a	and	associated equ	uations	to co	nvert to the	e applic	able orientat	ion.			
Northeast 0.9k 0.77 × 7.02 × 11.28 × 0.76 × 0.77 = 2.9.2 (75) Northeast 0.9k 0.77 × 7.02 × 22.97 × 0.76 × 0.77 = 5.9.44 (75) Northeast 0.9k 0.77 × 1 × 22.97 × 0.76 × 0.77 = 5.9.44 (75) Northeast 0.9k 0.77 × 1.02 × 41.38 × 0.76 × 0.77 = 107.09 (75) Northeast 0.9k 0.77 × 7.02 × 67.96 × 0.76 × 0.77 = 175.88 (75) Northeast 0.9k 0.77 × 1 × 97.38 × 0.76 × 0.77 = 232.04 (75) Northeast 0.9k 0.777 × 1 × 97.38 × 0.76 × 0.77			actor						-							
Northeast 0.4k 0.77 × 11.28 × 0.76 × 0.77 = 6.2.9 (75) Northeast 0.9k 0.77 × 1 × 22.97 × 0.76 × 0.77 = 6.9.44 (75) Northeast 0.9k 0.77 × 1 × 22.97 × 0.76 × 0.77 = 16.87 (75) Northeast 0.9k 0.77 × 1 × 41.38 × 0.76 × 0.77 = 107.09 (75) Northeast 0.9k 0.77 × 1 × 67.96 × 0.76 × 0.77 = 175.88 (75) Northeast 0.9k 0.77 × 1 97.98 × 0.76 × 0.77 = 236.41 (75) Northeast 0.9k 0.77 × 1 × 97.38 × 0.76 × 0.77 = 235.74 (75) N		Table 6d		m²			Table 6a		Ta	able 6b		Table 6c		(VV)		
Northeast 0.9k 0.77 x 7.02 x 22.97 x 0.76 x 0.77 = 59.44 (75) Northeast 0.9k 0.77 x 1 x 22.97 x 0.76 x 0.77 = 16.87 (75) Northeast 0.9k 0.77 x 1 x 41.38 x 0.76 x 0.77 = 107.09 (75) Northeast 0.9k 0.77 x 1 x 67.96 x 0.76 x 0.77 = 30.39 (75) Northeast 0.9k 0.77 x 1 x 67.96 x 0.76 x 0.77 = 49.91 (75) Northeast 0.9k 0.77 x 1 x 91.35 x 0.76 x 0.77 = 252.04 (75) Northeast 0.9k 0.77 x 1 x 97.38 x 0.76 x 0.77 =		0.77	x	7.0)2	x	11.28	x		0.76	x	0.7	=	29.2	(75)	
Northeast 0.9x 0.77 × 1 × 22.97 × 0.76 × 0.77 = 16.87 (75) Northeast 0.9x 0.77 × 7.02 × 41.38 × 0.76 × 0.77 = 107.09 (75) Northeast 0.9x 0.77 × 7.02 × 67.96 × 0.76 × 0.77 = 107.09 (75) Northeast 0.9x 0.77 × 7.02 × 67.96 × 0.76 × 0.77 = 44.941 (75) Northeast 0.9x 0.77 × 7.02 × 91.35 × 0.76 × 0.77 = 67.08 (75) Northeast 0.9x 0.77 × 1 × 91.35 × 0.76 × 0.77 = 67.08 (75) Northeast 0.9x 0.77 × 1 × 97.38 × 0.76 × 0.77 <t< td=""><td></td><td>0.77</td><td>x</td><td>1</td><td></td><td>x</td><td>11.28</td><td>×</td><td></td><td>0.76</td><td>×</td><td>0.7</td><td>=</td><td>8.29</td><td>(75)</td></t<>		0.77	x	1		x	11.28	×		0.76	×	0.7	=	8.29	(75)	
Northeast 0.9x 0.77 x 7.02 x 41.38 x 0.76 x 0.77 = 107.09 (75) Northeast 0.9x 0.77 x 1 x 41.38 x 0.76 x 0.77 = 30.39 (75) Northeast 0.9x 0.77 x 7.02 x 67.96 x 0.76 x 0.77 = 49.91 (75) Northeast 0.9x 0.77 x 7.02 x 91.35 x 0.76 x 0.7 = 236.41 (75) Northeast 0.9x 0.77 x 1 x 91.35 x 0.76 x 0.7 = 236.41 (75) Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.7 = 235.78 (75) Northeast 0.9x 0.77 x 1 x 97.43 x 0.76 x 0.7 = <td></td> <td>0.77</td> <td>x</td> <td>7.(</td> <td>)2</td> <td>x</td> <td>22.97</td> <td>x</td> <td></td> <td>0.76</td> <td>×</td> <td>0.7</td> <td>=</td> <td>59.44</td> <td>(75)</td>		0.77	x	7.()2	x	22.97	x		0.76	×	0.7	=	59.44	(75)	
Northeast 0.9x 0.77 x 1 x 41.38 x 0.76 x 0.77 = 30.39 (75) Northeast 0.9x 0.77 x 1 x 67.96 x 0.76 x 0.77 = 30.39 (75) Northeast 0.9x 0.77 x 1 x 67.96 x 0.76 x 0.77 = 49.91 (75) Northeast 0.9x 0.77 x 1 x 91.35 x 0.76 x 0.77 = 236.41 (75) Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.7 = 235.78 (75) Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.7 = 235.78 (75) Northeast 0.9x 0.77 x 1 x 72.63 x 0.76 x 0.7 =	Northeast 0.9x	0.77	x	1		x	22.97	×		0.76	x	0.7	=	16.87	(75)	
Northeast 0.sx 0.77 x 7.02 x 67.96 x 0.76 x 0.77 = 175.88 (75) Northeast 0.sx 0.77 x 1 x 67.96 x 0.76 x 0.77 = 49.91 (75) Northeast 0.sx 0.77 x 7.02 x 91.35 x 0.76 x 0.77 = 236.41 (75) Northeast 0.sx 0.77 x 1 x 91.36 x 0.76 x 0.77 = 236.41 (75) Northeast 0.sx 0.77 x 1 x 97.38 x 0.76 x 0.77 = 71.52 (75) Northeast 0.sx 0.77 x 1 x 97.38 x 0.76 x 0.77 = 71.52 (75) Northeast 0.sx 0.77 x 7.02 x 72.63 x 0.76 x 0.77 =	Northeast 0.9x	0.77	x	7.0)2	x	41.38	x		0.76	x	0.7	=	107.09	(75)	
Northeast 0,sx 0.77 x 1 x 67.96 x 0.76 x 0.77 = 49.91 (75) Northeast 0,sx 0.77 x 7.02 x 91.35 x 0.76 x 0.77 = 236.41 (75) Northeast 0,sx 0.77 x 1 x 91.35 x 0.76 x 0.77 = 236.41 (75) Northeast 0,sx 0.77 x 7.02 x 97.38 x 0.76 x 0.77 = 252.04 (75) Northeast 0,sx 0.77 x 7.02 x 91.1 x 0.76 x 0.77 = 235.78 (75) Northeast 0,sx 0.77 x 1 x 726.3 x 0.76 x 0.77 = 187.97 (75) Northeast 0,sx 0.77 x 1 x 726.3 x 0.76 x 0.77	Northeast 0.9x	0.77	x	1		x	41.38	x		0.76	×	0.7	=	30.39	(75)	
Northeast 0.9x 0.77 x 7.02 x 91.35 x 0.76 x 0.77 = 236.41 (75) Northeast 0.9x 0.77 x 1 x 91.35 x 0.76 x 0.77 = 67.08 (75) Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.77 = 67.08 (75) Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.77 = 71.52 (75) Northeast 0.9x 0.77 x 7.02 x 91.1 x 0.76 x 0.77 = 66.9 (75) Northeast 0.9x 0.77 x 1 x 72.63 x 0.76 x 0.77 = 187.97 (75) Northeast 0.9x 0.77 x 1 x	Northeast 0.9x	0.77	x	7.()2	x	67.96	x		0.76	×	0.7	=	175.88	(75)	
Northeast 0.9x 0.77 x 1 x 91.35 x 0.76 x 0.77 = 67.08 (75) Northeast 0.9x 0.77 x 7.02 x 97.38 x 0.76 x 0.7 = 252.04 (75) Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.7 = 252.04 (75) Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.7 = 252.04 (75) Northeast 0.9x 0.77 x 1 x 91.1 x 0.76 x 0.7 = 66.9 (75) Northeast 0.9x 0.77 x 1 x 72.63 x 0.76 x 0.7 = 187.97 (75) Northeast 0.9x 0.77 x 1 x <td< td=""><td>Northeast 0.9x</td><td>0.77</td><td>x</td><td>1</td><td></td><td>x</td><td>67.96</td><td>×</td><td></td><td>0.76</td><td>×</td><td>0.7</td><td>=</td><td>49.91</td><td>(75)</td></td<>	Northeast 0.9x	0.77	x	1		x	67.96	×		0.76	×	0.7	=	49.91	(75)	
Northeast 0.9x 0.77 x 7.02 x 97.38 x 0.76 x 0.77 z 11 x 97.38 x 0.76 x 0.77 z 11 x 97.38 x 0.76 x 0.77 z 11 x 97.38 x 0.76 x 0.77 z 11.52 (75) Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.77 = 225.04 (75) Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.77 = 235.78 (75) Northeast 0.9x 0.77 x 1 x 72.63 x 0.76 x 0.77 = 187.97 (75) Northeast 0.9x 0.77 x 1 x 50.42 x 0.76 x 0.77 = 137.03	Northeast 0.9x	0.77	x	7.0)2	x	91.35	x		0.76	x	0.7	=	236.41	(75)	
Northeast 0.9x 0.77 x 1 x 97.38 x 0.76 x 0.77 = 71.52 (75) Northeast 0.9x 0.77 x 7.02 x 91.1 x 0.76 x 0.77 = 235.78 (75) Northeast 0.9x 0.77 x 1 x 91.1 x 0.76 x 0.77 = 235.78 (75) Northeast 0.9x 0.77 x 1 x 91.1 x 0.76 x 0.77 = 66.9 (75) Northeast 0.9x 0.77 x 1 x 50.42 x 0.76 x 0.77 = 53.34 (75) Northeast 0.9x 0.77 x 7.02 x 28.07 x 0.76 x 0.77 = 72.64 (75) Northeast 0.9x 0.77 x 1.42 x	Northeast 0.9x	0.77	x	1		x	91.35	x		0.76	x	0.7	=	67.08	(75)	
Northeast 0.9 0.77 × 7.02 × 91.1 × 0.76 × 0.77 = 235.78 (75) Northeast 0.9 0.77 × 1 × 91.1 × 0.76 × 0.77 = 66.9 (75) Northeast 0.9 0.77 × 1 × 72.63 × 0.76 × 0.77 = 187.97 (75) Northeast 0.9 0.77 × 1 × 72.63 × 0.76 × 0.77 = 187.97 (75) Northeast 0.9 0.77 × 7.02 × 50.42 × 0.76 × 0.77 = 130.49 (75) Northeast 0.9 0.77 × 1 × 50.42 × 0.76 × 0.77 = 37.03 (75) Northeast 0.9 0.77 × 1 × <td< td=""><td>Northeast 0.9x</td><td>0.77</td><td>x</td><td>7.0</td><td>)2</td><td>x</td><td>97.38</td><td>x</td><td></td><td>0.76</td><td>x</td><td>0.7</td><td>=</td><td>252.04</td><td>(75)</td></td<>	Northeast 0.9x	0.77	x	7.0)2	x	97.38	x		0.76	x	0.7	=	252.04	(75)	
Northeast 0.9x 0.77 x 1 x 91.1 x 0.76 x 0.7 = 66.9 (75) Northeast 0.9x 0.77 x 7.02 x 72.63 x 0.76 x 0.7 = 187.97 (75) Northeast 0.9x 0.77 x 1 x 72.63 x 0.76 x 0.7 = 187.97 (75) Northeast 0.9x 0.77 x 1 x 50.42 x 0.76 x 0.7 = 53.34 (75) Northeast 0.9x 0.77 x 1 x 50.42 x 0.76 x 0.7 = 37.03 (75) Northeast 0.9x 0.77 x 1 x 28.07 x 0.76 x 0.7 = 20.61 (75) Northeast 0.9x 0.77 x 1.42 x <td< td=""><td>Northeast 0.9x</td><td>0.77</td><td>x</td><td>1</td><td></td><td>x</td><td>97.38</td><td>×</td><td></td><td>0.76</td><td>×</td><td>0.7</td><td>=</td><td>71.52</td><td>(75)</td></td<>	Northeast 0.9x	0.77	x	1		x	97.38	×		0.76	×	0.7	=	71.52	(75)	
Northeast $0.9\times$ 0.77 \times 7.02 \times 72.63 \times 0.76 \times 0.77 $=$ 187.97 (75) Northeast $0.9\times$ 0.77 \times 1 \times 72.63 \times 0.76 \times 0.77 $=$ 53.34 (75) Northeast $0.9\times$ 0.77 \times 7.02 \times 50.42 \times 0.76 \times 0.77 $=$ 130.49 (75) Northeast $0.9\times$ 0.77 \times 1 \times 50.42 \times 0.76 \times 0.77 $=$ 37.03 (75) Northeast $0.9\times$ 0.77 \times 1 \times 50.42 \times 0.76 \times 0.77 $=$ 37.03 (75) Northeast $0.9\times$ 0.77 \times 7.02 \times 28.07 \times 0.76 \times 0.77 $=$ 22.64 (75) Northeast $0.9\times$ 0.77 \times 1 \times 28.07 \times 0.76 \times 0.7 $=$ 22.64 (75) Northeast $0.9\times$ 0.77 \times 7.02 \times 14.2 \times 0.76 \times 0.7 $=$ 20.61 (75) Northeast $0.9\times$ 0.77 \times 7.02 \times 14.2 \times 0.76 \times 0.7 $=$ 23.85 (75) Northeast $0.9\times$ 0.77 \times 1 \times 9.21 \times 0.76 \times 0.7 $=$ 23.85 (75) Northeast $0.9\times$ 0.77 <td< td=""><td>Northeast 0.9x</td><td>0.77</td><td>x</td><td>7.(</td><td>)2</td><td>x</td><td>91.1</td><td>x</td><td></td><td>0.76</td><td>×</td><td>0.7</td><td>=</td><td>235.78</td><td>(75)</td></td<>	Northeast 0.9x	0.77	x	7.()2	x	91.1	x		0.76	×	0.7	=	235.78	(75)	
Northeast 0.9x 0.77 x 1 x 72.63 x 0.76 x 0.77 = 53.34 (75) Northeast 0.9x 0.77 x 7.02 x 50.42 x 0.76 x 0.77 = 130.49 (75) Northeast 0.9x 0.77 x 1 x 50.42 x 0.76 x 0.77 = 130.49 (75) Northeast 0.9x 0.77 x 1 x 50.42 x 0.76 x 0.77 = 37.03 (75) Northeast 0.9x 0.77 x 7.02 x 28.07 x 0.76 x 0.77 = 72.64 (75) Northeast 0.9x 0.77 x 1 x 28.07 x 0.76 x 0.77 = 20.61 (75) Northeast 0.9x 0.77 x 7.02 x 14.2 x 0.76 x 0.77 = 10.43 (75) Northeast 0.9x 0.77 x 1 x	Northeast 0.9x	0.77	x	1		x	91.1	×		0.76	×	0.7	=	66.9	(75)	
Northeast 0.9x 0.77 × 7.02 × 50.42 × 0.76 × 0.77 = 130.49 (75) Northeast 0.9x 0.77 × 1 × 50.42 × 0.76 × 0.77 = 130.49 (75) Northeast 0.9x 0.77 × 1 × 50.42 × 0.76 × 0.77 = 37.03 (75) Northeast 0.9x 0.77 × 7.02 × 28.07 × 0.76 × 0.77 = 72.64 (75) Northeast 0.9x 0.77 × 1 × 28.07 × 0.76 × 0.77 = 20.61 (75) Northeast 0.9x 0.77 × 1 × 28.07 × 0.76 × 0.77 = 36.74 (75) Northeast 0.9x 0.77 × 1 × 14.2 × 0.76 × 0.77 = 10.43 (75) Northeast 0.9x 0.77 × 1 ×	Northeast 0.9x	0.77	x	7.0)2	x	72.63	×		0.76	×	0.7	=	187.97	(75)	
Northeast $0.9x$ 0.77 x 1 x 50.42 x 0.76 x 0.7 z 37.03 (75) Northeast $0.9x$ 0.77 x 7.02 x 28.07 x 0.76 x 0.7 z 72.64 (75) Northeast $0.9x$ 0.77 x 1 x 28.07 x 0.76 x 0.7 z 72.64 (75) Northeast $0.9x$ 0.77 x 1 x 28.07 x 0.76 x 0.7 z 20.61 (75) Northeast $0.9x$ 0.77 x 1 x 28.07 x 0.76 x 0.7 z 20.61 (75) Northeast $0.9x$ 0.77 x 1 x 28.07 x 0.76 x 0.7 z 10.43 (75) Northeast $0.9x$ 0.77 x 1 x 14.2 x 0.76 x 0.7 z 23.85 (75) Northeast $0.9x$ 0.77 x 1 x 9.21 x 0.76 x 0.7 z z z 0.76 x 0.7 z z z z 0.76 x 0.7 z	Northeast 0.9x	0.77	x	1		x	72.63	x		0.76	×	0.7	=	53.34	(75)	
Northeast $0.9x$ 0.77 x 7.02 x 28.07 x 0.76 x 0.7 $=$ 72.64 (75) Northeast $0.9x$ 0.77 x 1 x 28.07 x 0.76 x 0.7 $=$ 20.61 (75) Northeast $0.9x$ 0.77 x 7.02 x 14.2 x 0.76 x 0.7 $=$ 20.61 (75) Northeast $0.9x$ 0.77 x 7.02 x 14.2 x 0.76 x 0.7 $=$ 36.74 (75) Northeast $0.9x$ 0.77 x 1 x 14.2 x 0.76 x 0.7 $=$ 10.43 (75) Northeast $0.9x$ 0.77 x 7.02 x 9.21 x 0.76 x 0.7 $=$ 23.85 (75) Northeast $0.9x$ 0.77 x 15.76 x 36.79 0.76 x 0.7 $=$ 213.73 (79) Southwest $0.9x$ 0.77 x 15.76 x 62.67 0.76 x 0.7 $=$ 26.89 (79) Southwest $0.9x$ 0.77 x 15.76 x 62.67 0.76 x 0.7 $=$ 53.3 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 $=$ 53.3 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67	Northeast 0.9x	0.77	x	7.0)2	x	50.42	×		0.76	×	0.7	=	130.49	(75)	
Northeast $0.9x$ 0.77 x 1 x 28.07 x 0.76 x 0.7 $=$ 20.61 (75) Northeast $0.9x$ 0.77 x 7.02 x 14.2 x 0.76 x 0.7 $=$ 36.74 (75) Northeast $0.9x$ 0.77 x 1 x 14.2 x 0.76 x 0.7 $=$ 10.43 (75) Northeast $0.9x$ 0.77 x 1 x 14.2 x 0.76 x 0.7 $=$ 23.85 (75) Northeast $0.9x$ 0.77 x 7.02 x 9.21 x 0.76 x 0.7 $=$ 23.85 (75) Northeast $0.9x$ 0.77 x 1 x 9.21 x 0.76 x 0.7 $=$ 23.85 (75) Southwest $0.9x$ 0.77 x 15.76 x 36.79 0.76 x 0.7 $=$ 213.73 (79) Southwest $0.9x$ 0.77 x 3.93 x 36.79 0.76 x 0.7 $=$ 53.3 (79) Southwest $0.9x$ 0.77 x 15.76 x 62.67 0.76 x 0.7 $=$ 53.3 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 $=$ 45.8 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67 <td< td=""><td>Northeast 0.9x</td><td>0.77</td><td>x</td><td>1</td><td></td><td>x</td><td>50.42</td><td>×</td><td></td><td>0.76</td><td>×</td><td>0.7</td><td>=</td><td>37.03</td><td>(75)</td></td<>	Northeast 0.9x	0.77	x	1		x	50.42	×		0.76	×	0.7	=	37.03	(75)	
Northeast $0.9x$ 0.77 x 7.02 x 14.2 x 0.76 x 0.7 = 36.74 (75) Northeast $0.9x$ 0.77 x 1 x 14.2 x 0.76 x 0.7 = 10.43 (75) Northeast $0.9x$ 0.77 x 7.02 x 9.21 x 0.76 x 0.7 = 23.85 (75) Northeast $0.9x$ 0.77 x 1 x 9.21 x 0.76 x 0.7 = 6.77 (75) Southwest $0.9x$ 0.77 x 15.76 x 36.79 0.76 x 0.7 = 213.73 (79) Southwest $0.9x$ 0.77 x 0.99 x 36.79 0.76 x 0.7 = 26.89 (79) Southwest $0.9x$ 0.77 x 3.93 x 36.79 0.76 x 0.7 = 26.89 (79) Southwest $0.9x$ 0.77 x 3.93 x 36.79 0.76 x 0.7 = 53.3 (79) Southwest $0.9x$ 0.77 x 15.76 x 62.67 0.76 x 0.7 = 45.8 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 = 45.8 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 = 498.12 (79) Southwest $0.9x$ <td>Northeast 0.9x</td> <td>0.77</td> <td>x</td> <td>7.0</td> <td>)2</td> <td>x</td> <td>28.07</td> <td>x</td> <td></td> <td>0.76</td> <td>×</td> <td>0.7</td> <td>=</td> <td>72.64</td> <td>(75)</td>	Northeast 0.9x	0.77	x	7.0)2	x	28.07	x		0.76	×	0.7	=	72.64	(75)	
Northeast $0.9x$ 0.77 x1x14.2x 0.76 x 0.7 =10.43(75)Northeast $0.9x$ 0.77 x 7.02 x 9.21 x 0.76 x 0.7 = 23.85 (75)Northeast $0.9x$ 0.77 x1x 9.21 x 0.76 x 0.7 = 6.77 (75)Southwest $0.9x$ 0.77 x15.76x 36.79 0.76 x 0.7 = 213.73 (79)Southwest $0.9x$ 0.77 x 0.99 x 36.79 0.76 x 0.7 = 26.89 (79)Southwest $0.9x$ 0.77 x 3.93 x 36.79 0.76 x 0.7 = 53.3 (79)Southwest $0.9x$ 0.77 x 15.76 x 62.67 0.76 x 0.7 = 53.3 (79)Southwest $0.9x$ 0.77 x 0.99 x 62.67 0.76 x 0.7 = 45.8 (79)Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 = 45.8 (79)Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 = 45.8 (79)Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 = 498.12 (79)Southwest $0.9x$ 0.77 x 3.93 <	Northeast 0.9x	0.77	x	1		x	28.07	×		0.76	×	0.7	=	20.61	(75)	
Northeast $0.9x$ 0.77 x 7.02 x 9.21 x 0.76 x 0.7 $=$ 23.85 (75) Northeast $0.9x$ 0.77 x 1 x 9.21 x 0.76 x 0.7 $=$ 6.77 (75) Southwest $0.9x$ 0.77 x 15.76 x 36.79 0.76 x 0.7 $=$ 213.73 (79) Southwest $0.9x$ 0.77 x 0.99 x 36.79 0.76 x 0.7 $=$ 26.89 (79) Southwest $0.9x$ 0.77 x 3.93 x 36.79 0.76 x 0.7 $=$ 53.3 (79) Southwest $0.9x$ 0.77 x 15.76 x 62.67 0.76 x 0.7 $=$ 364.06 (79) Southwest $0.9x$ 0.77 x 0.99 x 62.67 0.76 x 0.7 $=$ 45.8 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 $=$ 498.12 (79) Southwest $0.9x$ 0.77 x 15.76 x 85.75 0.76 x 0.7 $=$ 498.12 (79)	Northeast 0.9x	0.77	x	7.0)2	x	14.2	×		0.76	×	0.7	=	36.74	(75)	
Northeast $0.9x$ 0.77 x 1 x 9.21 x 0.76 x 0.7 $=$ 6.77 (75) Southwest $0.9x$ 0.77 x 15.76 x 36.79 0.76 x 0.7 $=$ 213.73 (79) Southwest $0.9x$ 0.77 x 0.99 x 36.79 0.76 x 0.7 $=$ 26.89 (79) Southwest $0.9x$ 0.77 x 3.93 x 36.79 0.76 x 0.7 $=$ 53.3 (79) Southwest $0.9x$ 0.77 x 15.76 x 62.67 0.76 x 0.7 $=$ 364.06 (79) Southwest $0.9x$ 0.77 x 0.99 x 62.67 0.76 x 0.7 $=$ 364.06 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 $=$ 45.8 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 $=$ 498.12 (79) Southwest $0.9x$ 0.77 x 3.93 x 62.67 0.76 x 0.7 $=$ 498.12 (79)	Northeast 0.9x	0.77	x	1		x	14.2	×		0.76	×	0.7	=	10.43	(75)	
Southwest 0.9x 0.77 x 15.76 x 36.79 0.76 x 0.7 = 213.73 (79) Southwest 0.9x 0.77 x 0.99 x 36.79 0.76 x 0.7 = 26.89 (79) Southwest 0.9x 0.77 x 3.93 x 36.79 0.76 x 0.7 = 26.89 (79) Southwest 0.9x 0.77 x 3.93 x 36.79 0.76 x 0.7 = 53.3 (79) Southwest 0.9x 0.77 x 15.76 x 62.67 0.76 x 0.7 = 364.06 (79) Southwest 0.9x 0.77 x 0.99 x 62.67 0.76 x 0.7 = 45.8 (79) Southwest 0.9x 0.77 x 3.93 x 62.67 0.76 x 0.7 = 45.8 (79) Southwest 0.9x 0.77 x 3.93 x 62.67 0.76 x 0.7 = 90.78 (79) Southwest 0.9x 0.77 x 15.76 x 85.75 0.76 x 0.7 = 498.12 (79)	Northeast 0.9x	0.77	x	7.0)2	x	9.21	×		0.76	×	0.7	=	23.85	(75)	
Southwest 0.9x 0.77 x 0.99 x 36.79 0.76 x 0.7 = 26.89 (79) Southwest 0.9x 0.77 x 3.93 x 36.79 0.76 x 0.7 = 23.3 (79) Southwest 0.9x 0.77 x 15.76 x 62.67 0.76 x 0.7 = 364.06 (79) Southwest 0.9x 0.77 x 0.99 x 62.67 0.76 x 0.7 = 45.8 (79) Southwest 0.9x 0.77 x 3.93 x 62.67 0.76 x 0.7 = 45.8 (79) Southwest 0.9x 0.77 x 3.93 x 62.67 0.76 x 0.7 = 90.78 (79) Southwest 0.9x 0.77 x 15.76 x 85.75 0.76 x 0.7 = 498.12 (79)	Northeast 0.9x	0.77	x	1		x	9.21	×		0.76	×	0.7	=	6.77	(75)	
Southwest 0.9x 0.77 x 3.93 x 36.79 0.76 x 0.77 = 53.3 (79) Southwest 0.9x 0.77 x 15.76 x 62.67 0.76 x 0.7 = 364.06 (79) Southwest 0.9x 0.77 x 0.99 x 62.67 0.76 x 0.7 = 364.06 (79) Southwest 0.9x 0.77 x 0.99 x 62.67 0.76 x 0.7 = 45.8 (79) Southwest 0.9x 0.77 x 3.93 x 62.67 0.76 x 0.7 = 90.78 (79) Southwest 0.9x 0.77 x 15.76 x 85.75 0.76 x 0.7 = 498.12 (79)	Southwest _{0.9x}	0.77	x	15.	76	x	36.79	Ē		0.76	×	0.7	=	213.73	(79)	
Southwest 0.9x 0.77 x 15.76 x 62.67 0.76 x 0.7 = 364.06 (79) Southwest 0.9x 0.77 x 0.99 x 62.67 0.76 x 0.7 = 45.8 (79) Southwest 0.9x 0.77 x 3.93 x 62.67 0.76 x 0.7 = 45.8 (79) Southwest 0.9x 0.77 x 3.93 x 62.67 0.76 x 0.7 = 90.78 (79) Southwest 0.9x 0.77 x 15.76 x 85.75 0.76 x 0.7 = 498.12 (79)	Southwest0.9x	0.77	×	0.9	99	x	36.79	Ī		0.76	- ×	0.7	= =	26.89	(79)	
Southwest 0.9x 0.77 x 0.99 x 62.67 0.76 x 0.77 = 45.8 (79) Southwest 0.9x 0.77 x 3.93 x 62.67 0.76 x 0.7 = 90.78 (79) Southwest 0.9x 0.77 x 15.76 x 85.75 0.76 x 0.7 = 90.78 (79)	Southwest _{0.9x}	0.77	x	3.9	93	x	36.79	Ī		0.76	×	0.7	=	53.3	(79)	
Southwest 0.9x0.77x3.93x62.670.76x0.7=90.78(79)Southwest 0.9x0.77x15.76x85.750.76x0.7=498.12(79)	Southwest _{0.9x}	0.77	x	15.	76	x	62.67	Ē		0.76	×	0.7	=	364.06	(79)	
Southwest 0.77 x 3.93 x 62.67 0.76 x 0.7 = 90.78 (79) Southwest 0.77 x 15.76 x 85.75 0.76 x 0.7 = 498.12 (79)	Southwest _{0.9x}		×			x	62.67	Ĩ		0.76	۲ x		=		(79)	
Southwest _{0.9x} 0.77 x 15.76 x 85.75 0.76 x 0.7 = 498.12 (79)	Southwest _{0.9x}	0.77	×	3.9	93	x	62.67	f		0.76	۲ × آ	0.7		90.78	=	
	Southwest _{0.9x}		×			x		f			۲ × آ		=			
0.001 0.10 1° 0.00 1° 0.10 1° 0.11 1° 0.10 1° 0.11 1° 0.200 $1(10)$	Southwest _{0.9x}		x			x	85.75	f		0.76	۲ × آ	0.7	=	62.66	(79)	

Southwest0.9x	0.77] ×	3.93	×	85.75		0.76	x	0.7	=	124.22	(79)
Southwest _{0.9x}	0.77	」 】 ×	15.76	x	106.25		0.76	x	0.7	=	617.2](79)
Southwest _{0.9x}	0.77] x	0.99	×	106.25		0.76	x	0.7	=	77.64	(79)
Southwest _{0.9x}	0.77	x	3.93	x	106.25		0.76	x	0.7	=	153.91](79)
Southwest _{0.9x}	0.77] x	15.76	x	119.01		0.76	x	0.7	=	691.32](79)
Southwest _{0.9x}	0.77	x	0.99	x	119.01		0.76	x	0.7	=	86.96	(79)
Southwest0.9x	0.77	x	3.93	x	119.01		0.76	x	0.7	=	172.39	(79)
Southwest _{0.9x}	0.77	x	15.76	x	118.15		0.76	x	0.7	=	686.32	(79)
Southwest _{0.9x}	0.77	x	0.99	x	118.15		0.76	x	0.7	=	86.33	(79)
Southwest0.9x	0.77	x	3.93	x	118.15		0.76	x	0.7	=	171.14	(79)
Southwest _{0.9x}	0.77	x	15.76	x	113.91		0.76	x	0.7	=	661.68	(79)
Southwest _{0.9x}	0.77	x	0.99	x	113.91		0.76	x	0.7	=	83.24	(79)
Southwest _{0.9x}	0.77	x	3.93	x	113.91		0.76	x	0.7	=	165	(79)
Southwest _{0.9x}	0.77	x	15.76	x	104.39		0.76	x	0.7	=	606.39	(79)
Southwest _{0.9x}	0.77	x	0.99	x	104.39		0.76	x	0.7	=	76.28	(79)
Southwest _{0.9x}	0.77	x	3.93	×	104.39		0.76	x	0.7	=	151.21	(79)
Southwest _{0.9x}	0.77	x	15.76	x	92.85		0.76	x	0.7	=	539.36	(79)
Southwest _{0.9x}	0.77	x	0.99	x	92.85		0.76	x	0.7	=	67.85	(79)
Southwest _{0.9x}	0.77	x	3.93	x	92.85		0.76	x	0.7	=	134.5	(79)
Southwest _{0.9x}	0.77	x	15.76	×	69.27		0.76	x	0.7	=	402.37	(79)
Southwest _{0.9x}	0.77	x	0.99	×	69.27		0.76	x	0.7	=	50.61	(79)
Southwest _{0.9x}	0.77	x	3.93	x	69.27		0.76	x	0.7	=	100.34	(79)
Southwest _{0.9x}	0.77	x	15.76	×	44.07		0.76	x	0.7	=	256	(79)
Southwest _{0.9x}	0.77	x	0.99	×	44.07		0.76	x	0.7	=	32.2	(79)
Southwest _{0.9x}	0.77	x	3.93	x	44.07		0.76	x	0.7	=	63.84	(79)
Southwest _{0.9x}	0.77	x	15.76	x	31.49		0.76	x	0.7	=	182.91	(79)
Southwest _{0.9x}	0.77	x	0.99	x	31.49		0.76	x	0.7	=	23.01	(79)
Southwest _{0.9x}	0.77	x	3.93	x	31.49		0.76	x	0.7	=	45.61	(79)
Rooflights 0.9x	1	x	2.02	x	40.32	x	0.76	x	0.7	=	77.99	(82)
Rooflights 0.9x	1	x	2.02	x	16.09	x	0.76	x	0.7	=	31.13	(82)
Rooflights 0.9x	1	x	2.02	x	73.69	x	0.76	x	0.7	=	142.54	(82)
Rooflights 0.9x	1	x	2.02	x	32.97	x	0.76	x	0.7	=	63.77	(82)
Rooflights 0.9x	1	×	2.02	x	111.54	x	0.76	x	0.7	=	215.77	(82)
Rooflights 0.9x	1	x	2.02	x	60.54	x	0.76	x	0.7	=	117.1	(82)
Rooflights 0.9x	1	×	2.02	x	151.96	x	0.76	x	0.7	=	293.94	(82)
Rooflights 0.9x	1	x	2.02	x	101.95	X	0.76	X	0.7	=	197.21	(82)
Rooflights 0.9x	1	×	2.02	×	179.7	x	0.76	x	0.7	=	347.6	(82)
Rooflights 0.9x	1	×	2.02	×	139.58	x	0.76	x	0.7	=	270.01	(82)
Rooflights 0.9x	1	×	2.02	×	181.76	x	0.76	x	0.7	=	351.58	(82)
Rooflights 0.9x	1	×	2.02	×	149.95	x	0.76	x	0.7	=	290.06	(82)
Rooflights 0.9x	1	×	2.02	×	173.9	x	0.76	x	0.7	=	336.37	(82)

Rooflights 0.9x	1	x	2.0)2	x	1	39.82	x		0.76	×	0.7	=	270.46	(82)
Rooflights 0.9x	1	x	2.0)2	x	1	53.23	x		0.76	×	0.7	=	296.39	(82)
Rooflights 0.9x	1	x	2.0)2	x	1	09.87	x		0.76	x	0.7	=	212.52	(82)
Rooflights 0.9x	1	x	2.0)2	x	1:	25.83	x		0.76	x	0.7	=	243.4	(82)
Rooflights 0.9x	1	x	2.0)2	x	7	4.51	x		0.76	×	0.7	=	144.13	(82)
Rooflights 0.9x	1	x	2.0)2	x	8	4.58	x		0.76	_ × [0.7	=	163.61	(82)
Rooflights 0.9x	1	x	2.0)2	x	4	0.53	×		0.76	_ × [0.7	=	78.4	(82)
Rooflights 0.9x	1	x	2.0)2	x	4	9.27	x		0.76	_ × [0.7	=	95.3	(82)
Rooflights 0.9x	1	x	2.0)2	x	2	0.27	x		0.76	_ × [0.7	=	39.21	(82)
Rooflights 0.9x	1	x	2.0)2	x	3	3.84	x		0.76	×	0.7	=	65.46	(82)
Rooflights 0.9x	1	x	2.0)2	x	1	3.14	x		0.76	×	0.7	=	25.41	(82)
Solar gains in	1	1	1		-		i	(83)m	1 = St	um(74)m .	(82)m			1	
(83)m= 440.52		1155.34				1909	1819.44	158	4.1	1296.75	888.58	533.72	373.01		(83)
Total gains –	1		r.,	· <i>,</i>	<u>`</u>	,	r					1		1	
(84)m= 973.43	1313.9	1667.09	2046.44	2319.8	23	325.77	2216.8	1988	3.82	1718.07	1341.13	1022.23	889.4]	(84)
7. Mean inte	rnal tem	perature	(heating	seasor	n)										
Temperature	e during h	neating p	periods ir	n the livi	ng	area	from Tab	ole 9	, Th′	1 (°C)				21	(85)
Utilisation fac	T	ains for	living are	1	ı (s	ee Ta	, 							1	
Jan	Feb	Mar	Apr	May	-	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.97	0.9	0.76	(0.57	0.42	0.4	18	0.75	0.96	1	1]	(86)
Mean interna	al temper	rature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	7 in T	able	e 9c)		-			
(87)m= 19.55	19.8	20.17	20.59	20.87	2	20.97	20.99	20.	99	20.9	20.48	19.92	19.5		(87)
Temperature	e during h	neating p	periods ir	n rest of	dw	elling	from Ta	able 9	9, Tł	n2 (°C)					
(88)m= 19.84	19.84	19.84	19.85	19.85	1	9.86	19.86	19.	86	19.86	19.85	19.85	19.85		(88)
Utilisation fac	ctor for a	ains for	rest of d	welling,	h2,	m (se	e Table	9a)							
(89)m= 1	0.99	0.96	0.87	0.69	-	0.47	0.31	0.3	37	0.67	0.94	0.99	1]	(89)
Mean interna	al temper	rature in	the rest	of dwell	ina	T2 (f	nllow ste	ens 3	to 7	in Tabl	e 9c)			1	
(90)m= 17.91	18.29	18.81	19.4	19.74	<u> </u>	9.85	19.86	19.		19.79	19.27	18.46	17.85]	(90)
		1			1					f	LA = Livii	ng area ÷ (4	1) =	0.49	(91)
Maan interne	al tompo	roturo (fo	r tho wh	olo duo	Illin	a) – fl		. (1	fI	A) To					
Mean interna (92)m= 18.7	19.02	19.47	19.98	20.28	1	<u>y) = 11</u> 20.39	20.41	+ (1	- 1	20.33	19.86	19.17	18.65	1	(92)
Apply adjust														J	
(93)m= 18.7	19.02	19.47	19.98	20.28	-	20.39	20.41	20.		20.33	19.86	19.17	18.65]	(93)
8. Space hea	ating req	uirement	t												
Set Ti to the			•		ned	at ste	ep 11 of	Tabl	le 9b	, so that	t Ti,m=	(76)m an	d re-calo	culate	
the utilisation	1	T T	<u> </u>		-							1		1	
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac		1	î .	0.70		0.50	0.20		12	07	0.04	0.00	4	1	(04)
(94)m= 1	0.99	0.96	0.88	0.72		0.52	0.36	0.4	+2	0.7	0.94	0.99	1	J	(94)
Useful gains (95)m= 970.2	, nmGm 1298.18	i – – – – – – – – – – – – – – – – – – –	4)m x (84 1796.81	·	1	203.9	807.97	844	12	1211.12	1261.43	1013.72	887.4	ו	(95)
Monthly ave							007.97	044	. 12	1211.12	1201.43	1013.72	007.4]	
(96)m= 4.3	4.9	6.5	8.9	11.7	T	ео 14.6	16.6	16	.4	14.1	10.6	7.1	4.2	1	(96)
				L,										J	(- - /

Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	-			
(97)m=	3137.61	3070.33	2815.24	2383.78	1844.65	1235.68	812.91	853.83	1332.46	1989.61	2601.77	3125.53		(97)
Space		<u> </u>		or each m	honth, k	Nh/mont	th = 0.02	24 x [(97))m – (95	<u> </u>	<u>,</u>			
(98)m=	1612.55	1190.88	902.91	422.62	135.1	0	0	0	0	541.77	1143.39	1665.17		1
								Tota	l per year	(kWh/year	') = Sum(9	8)15,912 =	7614.4	(98)
Spac	e heatin	g require	ement in	kWh/m ²	/year								45.46	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatir ion of sp	0	t from s	econdar	y/supple	mentary	system					[0	(201)
Fract	ion of sp	ace hea	it from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								90.3	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ı r
Space				alculate					1				,	
	1612.55	1190.88	902.91	422.62	135.1	0	0	0	0	541.77	1143.39	1665.17		
(211)m	า = {[(98)m x (20	4)]	00 ÷ (20)6)									(211)
	1785.77	1318.81	999.9	468.02	149.62	0	0	0	0	599.96		1844.04		_
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	Ē	8432.34	(211)
•				y), kWh/	month									
)1)]}x1		· · · ·										
(215)m=	0	0	0	0	0	0	0	0 Tota	0 I (kWh/yea	0	0	0		(215)
Watar	haating							Tota	i (kwii/yoo	ur) =0urri(2	10) _{15,1012}	-	0	(215)
	heating	•	ter (calc	ulated al	hove)									
e arp ar	221.4	195.09	204.78	183.42	178.73	157.41	150.81	168.12	168.8	190.2	201.31	216.02		
Efficie	ncy of w	ater hea	ter										81	(216)
(217)m=	89.07	88.86	88.42	87.27	84.76	81	81	81	81	87.68	88.77	89.12		(217)
		heating, m x 100												
(219)m=		219.54	231.59	210.18	210.87	194.34	186.19	207.56	208.39	216.92	226.77	242.38		
				•				Tota	I = Sum(2	19a) ₁₁₂ =			2603.31	(219)
	al totals									k	Wh/year		kWh/year	-
Space	heating	fuel use	ed, main	system	1								8432.34	
	-	fuel use											2603.31]
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatir	ig pump										30		(230c)
boiler	[.] with a f	an-assis	ted flue									45		(230e)
Total e	electricity	/ for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
Electri	city for li	ghting											533.74	(232)
Electri	city gen	erated b	y PVs										-1437.33	(233)

12a. CO2 emissions - Individual heating systems including micro-CHP Energy **Emission factor Emissions** kg CO2/year kWh/year kg CO2/kWh (211) x Space heating (main system 1) 0.216 = 1821.38 (261) Space heating (secondary) (215) x = (263)0.519 0 (219) x Water heating = (264) 0.216 562.31 (261) + (262) + (263) + (264) = Space and water heating 2383.7 (265) Electricity for pumps, fans and electric keep-hot (231) x (267) 0.519 38.93 Electricity for lighting (232) x = (268) 0.519 277.01 Energy saving/generation technologies Item 1 0.519 = -745.97 (269) sum of (265)...(271) = Total CO2, kg/year 1953.66 (272) **Dwelling CO2 Emission Rate** $(272) \div (4) =$ 11.66 (273)EI rating (section 14) (274) 88