ENERGY & SUSTAINABILITY STATEMENT

36 REDINGTON ROAD, LONDON NW3 7RT

Irvineering LTD

ASSESSMENT INFORMATION

Prepared for: Archetype Associates Ltd Prepared by: Ondrej Gajdos, Irvineering Ltd

Date: 21 December 2018

DISCLAIMER

The findings, conclusions and recommendations of this report are based on the information supplied. OG Energy Ltd disclaims responsibility in respect of incorrect information imparted to them or for the actual performance of any of the building services installations. This Report is prepared for the use of 36 Redington Road; a duty of care is not owed to other parties.

CONTENT

Executive summary	2
Introduction	6
PLANNING FRAMEWORK	7
ELINE ENERGY CONSUMPTION & CO2 EMISSIONS	11
BASELINE ENERGY CONSUMPTION AND CO2 EMISSIONS	11
BE LEAN : PASSIVE DESIGN MURES AND EFFICIENT SERVICES	12
BE CLEAN: COMBINED HEAT AND POWER	13
BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - SOLAR HOT WATER	14
BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - AIR SOURCE HEAT PUMP	15
BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - SOLAR PHOTOVOLTAICS	17
BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - GROUND SOURCE HEAT PUMP	18
BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - BIOMASS / BIOFUELS	20
BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - WIND ENERGY	21
SUSTAINABILITY PRINCIPLES	22

EXECUTIVE SUMMARY

36 REDINGTON ROAD, LONDON NW3 7RT

ABOUT THE ENERGY STATEMENT

Irvineering Ltd have been appointed to provide an Energy Statement for the proposed development.

This statement covers possible active and passive measures including renewable energy sources to make this development sustainable and environmentally friendly.

The target is to comply fully with the Camden Council and London Plan Policies and ensure, that the "Energy Hierarchy" is followed. This document has been prepared in line with the GLA Energy Team Guidance on Planning Energy Assessments.

Baseline and all estimated energy consumptions have been calculated using full SAP 2012 assessment of the development in accordance with Part L procedures.

The tables below show a summary of energy requirements for baseline scheme and reduction proposed to be achieved by passive measures, efficient services and on-site renewable energy sources. 36 REDINGTON ROAD, LONDON NW3 7RT

			•				
	Carbon dioxide emissions (Tonnes CO2 per annum)						
	Regulated Unregulated Total						
Building Regulations 2013 Part L Compliant Development	7.12	3.66	10.78				
After energy demand reduction	6.57	3.66	10.23				
After PV	4.43	3.66	8.09				

 Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

Table 2: Carbon Dioxide Savings from each stage of the Energy Hierarchy

	Carbon dioxide (Tonnes CO2 per	savings annum)	Carbon dioxide savings (%)		
	Regulated	Total	Regulated	Total	
Savings from energy demand					
reduction	0.55	0.55	7.7%	5.1%	
Savings from PV	2.14	2.14	32.5%	20.9%	
Total Cumulative Savings	2.69	2.69	37.7%	24.9%	



EXECUTIVE SUMMARY

36 REDINGTON ROAD, LONDON NW3 7RT

Number of passive design measures and energy efficiency measures to reduce CO2 emissions before applying the renewable sources has been included in the design. The table below shows the specification for each stage of the energy hierarchy:

Table 3: SAP calculation specification for each stage of the energy hierarchy

Specification	Notional Baseline	Efficient Baseline (Be Lean)	Proposed Development (Be Green)	
External Wall & basement wall U-value	0.18	0.18	0.18	
Basement floor & ground floor U-value	0.12	0.12	0.12	
Exposed floor (soffit) U-value	0.13	0.20	0.20	
Roofs and terraces U-value	0.13	0.14	0.14	
Windows, doors and rooflights U-value	1.40	0.80	0.80	
Thermal bridging	Accredited construction details throughout	Accredited construction details throughout	Accredited construction details throughout	
Air Permeability	5	5	5	
Space Heating System	Condensing boiler SEDBUK 2009 efficiency 89.5%, radiators, time and temperature zone control, weather compensator	Remeha Quinta Pro 65 (or equivalent, approved by SAP assesor), underfloor heating, time and temperature zone control, delayed start thermostat	Remeha Quinta Pro 65 (or equivalent, approved by SAP assesor), underfloor heating, time and temperature zone control, delayed start thermostat	
Secondary Space Heating System	-	Flueless gas fires	Flueless gas fires	
DHW System	150 L indirect DHW cylinder	Indirect Cylinder Mikrofill Rapide Extreme 200	Indirect Cylinder Mikrofill Rapide Extreme 200	
Ventilation System	Natural with intermittent mechanical extracts	Natural with intermittent mechanical extracts	Natural with intermittent mechanical extracts	
Energy Efficient Lighting	100%	100%	100%	
Renewable energy sources			PV system with total peak output of 5 kWp with panels facing SE/SW at 15-35 degree pitch	
% Improvement in CO2 over Building regulations compliant baseline	0.0%	7.7%	37.7%	

Proposed renewable systems include PV system with total peak output of 5 kWp



36 REDINGTON ROAD, LONDON NW3 7RT

Table + . OAT Tesult summary of the proposed development
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Resider	Residential			Energy Consumption Breakdown					P	/s	SAP 20:	12	
Unit	Floor area (m2)	FEE (kWh/m2/yr)	Space Heating (kWh/an)	DHW (kWh/an)	Cooling (kWh/a)	Lighting (kWh/an)	Aux (kWh/an)	Un-Reg (kWh/an)	PVs output (kWp)	PVs Energy Offset (kWh/a)	DER	TER	% Improvement DER over TER
Proposed House	469.1	52	22,654	2,686	31	954	75	7,054	5.000	-4,117	9.45	15.17	37.7%

The proposed development will achieve:

37.7% overall site regulated CO2 reduction against 2013 Part L compliant baseline.

32.5% reduction in regulated CO2 by renewable sources

20.9% reduction in total CO2 (regulated and un-regulated) by renewable sources

INTRODUCTION

ERROR! REFERENCE SOURCE NOT FOUND.

BACKGROUND Irvineering Ltd have been appointed to provide an Energy Statement for the proposed development. This statement covers possible active and passive measures including renewable energy sources to make this development sustainable and environmentally friendly. **DESCRIPTION OF THE SITE** It is proposed to demolish the existing building on the site to make way for a new Erection of a four storey single family dwelling including basement level, ground, first

and 2nd floor with solar panels at roof level and associated landscaping.



36 REDINGTON ROAD, LONDON NW3 7RT

2.1 NATIONAL POLICY	 DCLG sets out basis for local policies in section 14 of National Planning Policy Framework. It requires new development to be planned in ways that can help to reduce greenhouse gas emissions, such as through its location, orientation and design. To help increase the use and supply of renewable and lowcarbon energy and heat, plans are encouraged to: a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts); b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.
2.2 THE LONDON PLAN	 The London Plan is the name given to the Mayor's spatial development strategy. The current version of London Plan was published in 2011 with Further Alterations to the London Plan published in March 2015. The aim is to develop London as an exemplary sustainable world city, based on three interwoven themes. Strong, diverse long term economic growth Social inclusivity to give all Londoners the opportunity to share in London's future success Fundamental improvements in London's environment and use of resources. Specific requirements on development sustainability are set out in the following policies:
Policy 5.2 Minimising CO2 Emissions	Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy: 1. Be lean: use less energy
	 Be clean: supply energy efficiently Be green: use renewable energy 7

36 REDINGTON ROAD, LONDON NW3 7RT

Major developments	are required to meet the following
targets for CO2 reduct	ion against building regulations Target
Emission Rate (TER):	
Residential buildings:	
Year	Improvement on 2010 Building
Regulations	
2010 - 2013	25 per cent
	(Code for Sustainable Homes level 4)
2013 – 2016	40 per cent
2016 – 2031	Zero carbon
Non-domestic building	S
Year	Improvement on 2010 Building
Regulations	
2010 - 2013	25 per cent
2013 – 2016	40 per cent
2016 - 2019	As per building regulations
requirements	
2019 – 2031	Zero carbon

As this is not a major application according to London Plan definition, policy 5.2 does not apply.

IMPLEMENTATION OF 2013 BUILDING REGULATIONS

Policy 5.2 of the London Plan states that from 2013 to 2016 energy assessments should be produced to meet a target of 40 per cent carbon reduction beyond Part L 2010 of the Building Regulations. The draft SPG on Sustainable Design and Construction confirmed that this requirement would apply for Stage 1 applications received by the Mayor on or after 1 October 2013.

From 6 April 2014 the 2013 changes to Part L of the Building Regulations came into effect. Part L 2013 delivers an overall reduction in CO2 emissions for new residential and new nondomestic buildings, with the targets for individual buildings being differentiated according to building type. This reduction in CO2 emissions affects the percentage reduction necessary above the new Part L 2013 regulations to meet the Mayor's targets in the London Plan.

As outlined in the Sustainable, Design and Construction SPG a 35 per cent carbon reduction target beyond Part L 2013 of the Building Regulations is currently applied – this is deemed to be broadly equivalent to the 40 per cent target beyond Part L 2010 of the Building Regulations, as specified in Policy 5.2 of the London Plan for 2013–2016.

36 REDINGTON ROAD, LONDON NW3 7RT

ZERO CARBON POLICY

As outlined in the Housing SPG, from 1 October 2016 the Mayor applies a zero carbon standard to new residential development. The Housing SPG defines 'Zero carbon' homes as homes forming part of major development applications where the residential element of the application achieves at least a 35 per cent reduction in regulated carbon dioxide emissions (beyond Part L 2013) on-site . The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere (in line with policy 5.2E). This payment is currently fixed (in most boroughs) at £60/tonne of CO_2 per year for 30 years.

As this is not a major application according to London Plan definition, this policy does not apply.

Policy 5.6 - Decentralised Energy in Development Proposals

> Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites. Major development proposals should select energy systems in accordance with the following hierarchy:

- 1. Connection to existing heating or cooling networks
- 2. Site wide CHP network
- **3**. Communal heating and cooling

Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

POLICY 5.7 - RENEWABLE ENERGY

> The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

36 REDINGTON ROAD, LONDON NW3 7RT

There is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20 per cent through the use of on-site renewable energy generation wherever feasible.

As this is not a major application according to London Plan definition, policy 5.7 does not apply.

POLICY 5.9 – OVERHEATING AND COOLING

Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

- 1. minimise internal heat generation through energy efficient design
- 2. reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
- **3.** manage the heat within the building through exposed internal thermal mass and high ceilings
- 4. passive ventilation
- 5. mechanical ventilation
- **6.** active cooling systems (ensuring they are the lowest carbon options)

As this is not a major application according to London Plan definition, policy 5.9 does not apply.

BASELINE ENERGY CONSUMPTION AND CO2 EMISSION

36 REDINGTON ROAD, LONDON NW3 7RT

BASELINE ENERGY CONSUMPTION AND CO2 EMISSIONS

An energy assessment using SAP 2012 has been carried out on the actual proposed dwellings using notional baseline specification achieving compliance with 2012 Part L The specification is set out in Table 3 above.

As a result of the baseline energy calculation, the following values of energy and CO_2 emissions have been obtained. SAP 2012 carbon emission factors have been used for the CO_2 emissions calculation.

Table 5:

Residential Energy Consumption Breakdown					SAP 2	012			
Unit	Floor area (m2)	Space Heating (Main 1) (kWh/an)	DHW (kWh/an)	Cooling(kWh/a)	Lighting(kWh/an)	Aux (kWh/an)	Un-Reg(kWh/an)	DER	TER
Proposed House	882	51,419	3,641		1,328	75	10,042	14.31	14.31

BE LEAN: PASSIVE DESIGN MEASURES AND EFFICIENT SERVICES

36 REDINGTON ROAD, LONDON NW3 7RT

Number of passive design measures and measures improving energy efficiency of building services have been included in the design to help to reduce the CO2 emissions. Full specification of the efficient baseline is described in Table 3. The following table shows results obtained with the improvements over the notional baseline

Table 6:

Residentia	I	Energy Consumption Breakdown					Energy Consumption Breakdown SAP 2012			%
Unit	Floor area (m2)	Space Heating (kWh/an)	DHW (kWh/an)	Cooling (kWh/a)	Lighting (kWh/an)	Aux (kWh/an)	Un-Reg (kWh/an)	DER	TER	Improve ment DER over TER
Proposed Hous	469.1	22,654	2,686	31	954	75	7,054	14.00	15.17	7.7%

OVERHEATING AND COOLING

The house modelled in SAP has also been assessed against overheating criteria set out in SAP Appendix P.

The proposed house complies with the criteria using passive measures – openable windows and light coloured internal blinds. The house achieves "slight" risk of overheating.

BE CLEAN: COMBINED HEAT AND POWER

36 REDINGTON ROAD, LONDON NW3 7RT

GENERAL INFORMATION

Although not using any renewable energy source, gas CHP helps to reduce CO2 emissions by delivering heat and electricity locally and reducing the losses that normally occur by conventional power plants. Produced electricity can be exported to grid if the on-site demand is lower than production.



RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

Heat demand of the proposed development is considered too low to make a CHP installation feasible.

BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - SOLAR HOT WATER (SHW)

36 REDINGTON ROAD, LONDON NW3 7RT

GENERAL INFORMATION

Solar hot water systems for dwellings use collector which provides a separate heating circuit for hot water cylinder. This is usually backed up by electric immersion heater or other source of heat.

- Two types of collectors are available:
- Flat Plate less expensive, less efficient
- Evacuated Tube more expensive and more efficient





RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

Solar hot water system may be feasible, however, photovoltaic panels are preferable due to higher CO2 emission offset, lower installation and maintenance cost.

BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - AIR SOURCE HEAT PUMP (ASHP)

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GENERAL INFORMATION

An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can extract heat from the air even when the outside temperature is as low as minus 15° C.

On 17 December 2008, the European Parliament adopted the EU Directive on promoting the use of energy from renewable sources. For the first time however, in addition to geothermal energy, aerothermal and hydrothermal energy are also recognised as renewable energy sources.

There are two main types of ASHP:

AIR-TO-WATER SYSTEM

Air-to-water system uses the heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system would, so they are more suitable for underfloor heating systems than radiator systems. Although some ASHP systems are capable of heating the water to the higher temperature, the efficiency is higher when using low temperature underfloor heating or low temperature fan convectors.





BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - AIR SOURCE HEAT PUMP (ASHP)

36 REDINGTON ROAD, LONDON NW3 7RT

AIR-TO-AIRSYSTEM

Air-to-air system uses the heat to warm the indoor air. The air is heated through individual fan-coils or centrally and then distributed to rooms via ductwork.



RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

> Air source heat pumps are not proposed due to higher installation, maintenance and running cost compared to gas boilers. Noise from outdoor condensing units could also represent a potential problem.

BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - SOLAR PHOTOVOLTAICS (PV)

36 REDINGTON ROAD, LONDON NW3 7RT

GENERAL INFORMATION

This system uses semi-conductor cells to convert solar energy into electricity. Two main types of PV panels are available:

- Monocrystalline More expensive and more efficient
- Polycrystalline Less expensive and less efficient

Depending on type, the output of 1 kWp (kilowatt peak) can be achieved by panels with area between 8 and 20 m2.

The use of PV panels generally requires relatively large unshaded roof area where they can be mounted facing south, ideally having between 30° and 40° inclination.

The cost per tonne of CO2 saved would be between £550 and £1,100,



RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

> A PV system with total peak output of 5 kWp is proposed for roof installation. The panels are proposed to be installed at a 15-35 degree angle facing South-East or South-West to alighn with the building orientation. The proposed PV system will produce 4,117 kWh of electricity per year, which represents an offset of 2.13 tonnes of CO2.

BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - GROUND SOURCE HEAT PUMP (GSHP)

36 REDINGTON ROAD, LONDON NW3 7RT

GENERAL INFORMATION

Ground source heat pumps use a buried ground loop which transfers heat from the ground into the building through heating distribution system. GSHP technology can be used both for heating and cooling. Two main types of GSHP are available:

- Horizontal loop is suitable for applications where sufficient area is available to accommodate horizontally buried pipes



BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - GROUND SOURCE HEAT PUMP (GSHP)

36 REDINGTON ROAD, LONDON NW3 7RT

- Vertical loop system can be used where ground space is limited, but will require boreholes typically 15–150m deep, and is consequently more expensive to install than horizontal systems.



RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

> Ground source heat pumps have been ruled out due to high capital cost and relatively small savings in CO2 emissions compared to other recommended technologies.

BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - BIOMASS / BIOFUELS

36 REDINGTON ROAD, LONDON NW3 7RT

GENERAL INFORMATION

Producing energy from biomass has both environmental and economic advantages. It is a carbon neutral process as the CO2 released when energy is generated from biomass is balanced by that absorbed during the fuel's production. There are two main ways of using biomass to heat a domestic property:

- Standalone stoves providing space heating for a room. These can be fuelled by logs or pellets but only pellets are suitable for automatic feed. Generally they are 6-12 kW in output, and some models can be fitted with a back boiler to provide water heating.

- Boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW.

RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

> Biofuels are ruled out due to negative impact on air quality and environmental issues surrounding liquid biofuels as currently there are no established standards relating to the sustainability of biofuels.

BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - WIND ENERGY

36 REDINGTON ROAD, LONDON NW3 7RT

GENERAL INFORMATION

Wind power is a clean, renewable source of energy which produces no carbon dioxide emissions or waste products. The turbines can have horizontal or vertical axis (Darrieus type). Wind turbines use the wind's lift forces to rotate aerodynamic blades that turn a rotor which creates electricity. Most small wind turbines generate direct current (DC) electricity and are not connected to the national grid. A special inverter and controller is required to convert DC electricity to AC at a quality and standard acceptable to the grid if the turbine is to be connected to national grid.



RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

Wind energy systems will not be considered due to negative visual effects, interference, flicker and noise risk. Exposure to wind would be limited by surrounding buildings.

SUSTAINABILITY PRINCIPLES

36 REDINGTON ROAD, LONDON NW3 7RT

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VV ATER	Internal water consumption will be reduced to 105 litres/person/daybyspecificationofwaterefficientfittings:
	Dual flush WC with 4/6 l flush volume Kitchen tap: 8 litres/min Other taps: 6 litres/min Showers: 8 litres/min Bath capacity to overflow: 140 litres Washing machines: 6 litres/kg dry load Dishwashers: 1.3 litres pre place setting
MATERIALS	Environmental impact of construction materials will be taken into account. Where possible, construction materials will be sourced from local producers and suppliers with environmental impact certification. All timber will be FSC (or equivalent) certified.
	Besides the energy efficiency measures relating to regulated energy, which are described in the energy statement, there will be additional energy saving measures implemented in the development:
	- Energy efficient white goods will be used
	- Low energy external lighting
	Adequate internal and external storage of recycled and non- recycled waste will be ensured. The external storage will be sized according to the frequency of collection, based on guidance from the recycling scheme operator.
	Construction waste will be minimised by implementing a site waste management plan containing procedures to minimise and divert waste from landfill

APPENDIX A

SAP CALCULATION OF THE PROPOSED HOUSE

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16 *Printed on 21 December 2018 at 09:26:50*

Project Information	n:			
Assessed By:	Ondrej Gajdos (STF	RO006629)	Building Type:	Semi-detached House
Dwelling Details:				
NEW DWELLING D	DESIGN STAGE		Total Floor Area: 4	69.14m²
Site Reference :	36 Redington Road		Plot Reference:	Proposed House
Address :	36 Redington Road	, London, NW3 7RT		
Client Details:				
Name:				
Address :				
This report covers It is not a complete	items included with report of regulatio	hin the SAP calculations. ns compliance.		
1a TER and DER				
Fuel for main heatin	ng system: Mains gas	3		
Fuel factor: 1.00 (m	ains gas) ido Emission Poto ($15.17 kg/m^2$	
Dwelling Carbon Div	oxide Emission Rate ((DFR)	9 44 kg/m²	ОК
1b TFEE and DFE	E		of the tegrit	
Target Fabric Energ	y Efficiency (TFEE)		68.9 kWh/m²	
Dwelling Fabric Ene	ergy Efficiency (DFEI	Ξ)	52.0 kWh/m ²	
				OK
2 Fabric U-values		•		
Element Extornal w		Average	Highest	OK
Floor	all	0.12 (max. 0.25)	0.10 (max, 0.70) 0.20 (max, 0.70)	OK
Roof		0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings		0.80 (max. 2.00)	0.80 (max. 3.30)	ОК
2a Thermal bridgi	ing			
Thermal bi	ridging calculated fro	m linear thermal transmittan	ces for each junction	
3 Air permeability	1			
Air permeabi	lity at 50 pascals		5.00 (design valu	ne)
waximum			10.0	UK
4 Heating efficien	су	-		
Main Heating	g system:	Database: (rev 436, product Boiler systems with radiator Brand name: Remeha Model: Quinta Pro 45 Model qualifier: (Regular) Efficiency 88.7 % SEDBUK Minimum 88.0 %	t Index 016567): s or underfloor heating - ma 2009	ains gas OK
Secondary h	eating system:	Room heaters - gas Flueless gas fire, secondary	/ heating only	

Regulations Compliance Report

5 Cy	linder insulation			
	Hot water Storage:	Measured cylinder loss: 1.20 kW Permitted by DBSCG: 2.24 kWh/	h/day /day	ОК
	Primary pipework insulated:	Yes		ОК
6 Cc	ontrols			
	Space heating controls Hot water controls:	TTZC by plumbing and electrical Cylinderstat Independent timer for DHW	services	ОК ОК ОК
	Boiler interlock:	Yes		OK
710	w energy lights			UN
	Boreentage of fixed lights with low	w operav fittinge	100.0%	
	Minimum	w-energy mungs	75.0%	OK
0.14			13.078	ON
8 116	echanical ventilation			
	Not applicable			
9 Su	immertime temperature			
	Overheating risk (Thames valley)	:	Slight	OK
Based	d on:			
	Overshading:		Average or unknown	
	Windows facing: South West		4.16m ²	
	Windows facing: South West		3.41m ²	
	Windows facing: South West		6.81m ²	
	Windows facing: South West		2.3m ²	
	Windows facing: South West		4.26m ²	
	Windows facing: South West		8.1m ²	
	Windows facing: South West		4.05m ²	
	Windows facing: South East		2.16m ²	
	Windows facing: North East		5.24m ²	
	Windows facing: North East		6.34m ²	
	Windows facing: North East		4.45m ²	
	Windows facing: North East		13.06m ²	
	Windows facing: North East		12.7m ²	
	Windows facing: North East		11.02m ²	
	Windows facing: North West		4.59m ²	
	Roof windows facing: Unspecified	d	3.49m ²	
	Roof windows facing: Unspecifie	d	4.33m ²	
	Ventilation rate:		3.00	
	Blinds/curtains:		Light-coloured curtain or roller blind	
			Closed 100 % of daylight hours	
10 V	an factures			
-10 K	Windows II volue		0.8 \//m2k	
			$0.0 \text{ VV/III}^{\text{T}}$	
			$0.0 \text{ W/m}^2 \text{K}$	
			0.12 W/m²k	
	FIGUIS U-Value		0.12 W/III-A	
	Fillowollaic array			
	Secondary nearing (mains gas)			

Regulations Compliance Report

					User D	etails:									
Assessor Name:	On	drej Gaj	jdos			Strom	a Num	ber:		STRC	006629				
Software Name:	Stro	oma FS	AP 201	2		Softwa	are Ver	sion:		Versio	on: 1.0.4.16				
				Р	roperty	Address	: Propos	ed Hous	е						
Address :	36 I	Redingto	on Road	, London	n, NW37	7RT									
1. Overall dwelling dim	nension	S:				()			• • • •						
Crown of floor					Area	a(m ²)		Av. Hei	ght(m)	- 	Volume(m ³	[•])			
Ground floor					1	50.84	(1a) x	2	.6	(2a) =	392.18	(3a)			
First floor					1	25.3	(1b) x	3	.3	(2b) =	413.49	(3b)			
Second floor					1	21.9	(1c) x		3	(2c) =	365.7	(3c)			
Third floor						71.1	(1d) x		3	(2d) =	213.3	(3d)			
Total floor area TFA = ((1a)+(1b	o)+(1c)+((1d)+(1e	e)+(1r	n)4	69.14	(4)			_		_			
Dwelling volume	Dwelling volume $3a + (3b) + (3c) + (3d) + (3e) + \dots + (3n) = 1384.67$ (5)2. Ventilation rate:main secondary heatingothertotalm³ per hour heatingNumber of chimneys0+0+0=0x ⁴ 0 = 0(6a)														
2. Ventilation rate: Number of chimneys $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$															
Mumber of chimneys 0 + 0 + 0 = 0 x^40 m^3 per hourNumber of open flues 0 + 0 + 0 = 0 x^40 0 (6a)															
Number of chimneys	L	0	+	0	+	0	=	0	x	⁴ 0 =	0	(6a)			
Number of open flues		0	+	0	+	0	=	0	x	² 0 =	0	(6b)			
Number of intermittent	fans							7	x	10 =	70	(7a)			
Number of passive vent	ts						Г	0	x	10 =	0	(7b)			
Number of flueless gas	fires						Γ	0	X	40 =	0	(7c)			
										Air cl	nanges per ho	our			
Tumber of passive vents Tumber of passive vents Tumber of flueless gas fires $0 x^{10} = 0 (7b)$ $0 x^{40} = 0 (7c)$ Air changes per hour filtration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 70 ÷ (5) = 0.05 (8)$															
If a pressurisation test has	been car	ried out or	is intende	d, proceed	d to (17), c	otherwise c	ontinue fro	om (9) to (1	6)	. (0) –	0.05	(0)			
Number of storeys in	the dwe	elling (ne	6)								0	(9)			
Additional infiltration									[(9)	-1]x0.1 =	0	(10)			
Structural infiltration:	0.25 for	r steel or	timber i	frame or	0.35 fo	r masoni	ry constr	uction			0	(11)			
If both types of wall are deducting areas of oper	present, i nings); if e	use the va equal user	lue corres 0.35	ponding to	the great	er wall area	a (after								
If suspended wooder	n floor, e	enter 0.2	(unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	(12)			
If no draught lobby, e	nter 0.0)5, else e	enter 0								0	(13)			
Percentage of window	ws and	doors dr	aught 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	e, q50, e	expresse	ed in cub	oic metre	s per ho	our per s	quare m	etre of e	nvelope	area	5	(17)			
If based on air permeat	oility val	ue, then	(18) = [(1	$7) \div 20]+(8)$	B), otherwi	ise (18) = ((16) moobility i	a haing up	od		0.3	(18)			
Number of sides shelter	red	essunsauc	n test nas	s been don		nee an per	Ποαρπιτγ Ι	s being us	u		1	(19)			
Shelter factor						(20) = 1 -	[0.075 x (1	9)] =			0.92	(10)			
Infiltration rate incorpora	ating sh	elter fac	tor			(21) = (18) x (20) =				0.28	(21)			
Infiltration rate modified	for mo	nthly wir	nd speed	k											
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					

Monthl	y avera	ge wind	speed fi	rom Tab	le 7									
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjuste	ed infiltr	ation rat	e (allowi	ing for sł	nelter an	d wind s	speed) =	(21a) x	(22a)m					
_	0.35	0.35	0.34	0.31	0.3	0.26	0.26	0.26	0.28	0.3	0.31	0.33		
Calcula If me	ate effe echanica	ctive air al ventila	<i>change</i> ation:	rate for t	he appli	cable ca	se						0	(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	23b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If bala	anced with	h heat reco	overy: effic	iency in %	allowing	for in-use f	actor (fron	n Table 4h) =				0	(23c)
a) If	balance	ed mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22	2b)m + (23b) × [′	1 – (23c)	÷ 100]	
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	ed mech	anical ve	entilation	without	heat red	covery (N	MV) (24b	o)m = (22	2b)m + (23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If i	whole h f (22b)r	iouse ex n < 0.5 >	tract ver < (23b), 1	ntilation o then (24	or positiv c) = (23t	/e input o); other	ventilatio wise (24	on from c c) = (22b	outside o) m + 0.	.5 × (23t	b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf i	natural f (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (221	se positiv c)m othe	ve input erwise (2	ventilatio 24d)m =	on from 0.5 + [(2	loft 2b)m² x	0.5]				
(24d)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	o) or (24	c) or (24	d) in box	x (25)					
(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²⋅K	A X k kJ/K
Doors			4.08	×	0.8	=	3.264		(26)
Windows Type 1			4.16	x1/[1	/(0.8)+ 0.04	4] =	3.22		(27)
Windows Type 2	2		3.41	x1/[1	/(0.8)+ 0.04	4] =	2.64		(27)
Windows Type 3	3		6.81	x1/[1	/(0.8)+ 0.04	4] =	5.28		(27)
Windows Type 4	ŀ		2.3	x1/[1	/(0.8)+ 0.04	4] =	1.78		(27)
Windows Type 5	5		4.26	x1/[1	/(0.8)+ 0.04	4] =	3.3		(27)
Windows Type 6	5		8.1	x1/[1	/(0.8)+ 0.04	4] =	6.28		(27)
Windows Type 7	7		4 05	x1/[1	/(0.8)+ 0.04	4] =	3 14		(27)
Windows Type 8	3		2 16	x1/[1	/(0.8)+ 0.04	4] =	1.67		(27)
Windows Type 9)		5.24	x1/[1	/(0.8)+ 0.04	4] =	4.06		(27)
Windows Type 1	0		6 34	x1/[1	/(0.8)+ 0.04	4] =	4.00		(27)
Windows Type 1	1		4 45	x1/[1	/(0.8)+ 0.04	4] =	3.45		(27)
Windows Type 1	2		6.53	x1/[1	/(0.8)+ 0.04	4] =	5.06		(27)
Windows Type 1	3		6 35	x1/[1	/(0.8)+ 0.04	4] =	4.92		(27)

Floor 7	Гуре 1					15	50.84	x	0.12	_=[18.1	800				(28
Floor 7	Гуре 2					;	3.6	x	0.2	_=	0.	72				(28
Floor 7	Гуре З					1	6.5	x	0.12	- =	1.9	98				(28
Walls ⁻	Type1	419.	64	9	6.73	32	22.91	x	0.18	_ = _	58	.12				(29
Walls	Type2	147.	94		0	14	17.94	x	0.18	[26	.63				(29
Roof -	Type1	71.	1		7.82	6	3.28	x	0.14	[8.8	36				(30
Roof -	Type2	7			0		7	x	0.14	[0.9	98				(30
Roof -	ТуреЗ	50.	8		0	5	50.8	x	0.14	= _	7.	11				(30
Roof -	Type4	39.	6		0	3	39.6	x	0.14	_=	5.	54				(30
Total a	area of e	lements	, m²			907.0)2	•				I				(31)
* for win ** incluc	dows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	indow U-va Is and par	alue calcul titions	lated using	g formula	a 1/[(1/U-	valu	e)+0.04] a	s given in	paragraph	n 3.2		
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30) + (32	2) =				20	9.2	(33)
Heat c	apacity	Cm = S	(A x k)						((28)	.(30) + (3	2) + (32a).	(32e) =		0	(34)
Therm	al mass	parame	eter (TM	P = Cm ·	÷ TFA) i	n kJ/m²K	K		Ir	ndica	tive Value	: Low		1	00	(35)
For desi	ign assess used inste	ments wh	ere the de	etails of the	construct	ion are no	t known pr	recisely	the indica	ative	values of	TMP in Ta	ble 1f			
Therm	al bridae	es : S (L	x Y) cal	culated	usina Ar	ppendix	К							6	93	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	81)										
Total f	abric he	at loss							(3	33) +	(36) =			27	9.13	(37)
Ventila	ation hea	at loss c	alculated	d monthl	у				(3	38)m	= 0.33 × ((25)m x (5))	-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g So	ер	Oct	Nov	Dec			
(38)m=	257.18	256.06	254.97	249.84	248.88	244.41	244.41	243.5	8 246	.13	248.88	250.82	252.85			(38)
Heat tr	ransfer c	coefficie	nt, W/K	-	-			-	(3	39)m	= (37) + (38)m	-	-		
(39)m=	536.3	535.19	534.1	528.96	528	523.53	523.53	522.7	1 525	.26	528	529.95	531.98			
Heatle	see nara	motor (l	-11 D) \\/	/m2k					(/	, 10)m	Average = - (39)m -	Sum(39)₁ . (4)	12 /12=	52	8.96	(39)
(40)m=	1.14	1.14	1.14	1.13	1.13	1.12	1.12	1.11	1.1	2	1.13	1.13	1.13	1		
(,										-	Average =	Sum(40)1	12 /12=	1.	.13	(40)
Numbe	er of day	/s in mo	nth (Tab	ole 1a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g So	ер	Oct	Nov	Dec			
(41)m=	31	28	31	30	31	30	31	31	30	0	31	30	31			(41)
4. Wa	ater heat	ting ene	rgy requ	irement:									kWh/y	/ear:		
Assum if TF if TF	ned occu A > 13.9 A £ 13.9	ipancy, 9, N = 1 9, N = 1	N + 1.76 >	([1 - exp)(-0.000	349 x (Tl	FA -13.9	9)2)] +	0.0013	x (⁻	FFA -13	<u>3</u> 9)	.35]		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usa hot water person pe	ge in litre usage by r day (all w	es per da 5% if the c vater use, 1	ay Vd,av dwelling is hot and co	verage = designed hld)	(25 x to achie	N) + 36 ve a wate) er us	e target o	, <u>11</u>	3.81]		(43)
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Au	a S	ер	Oct	Nov	Dec]		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Stri¢ ™a I	SAB. 291	2 1/2£015663 n:	110.64.086 (SAIP195 9 2)	-1016p.9/8/vv	w i.02 1.04120a.	c 00 2.42	106.98	111.53	116.08	120.63	125.19	Page 3	of 13
									-	Fotal = Su	m(44) =	-	1365.67	(44)

Energy	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,n	n x nm x D)Tm / 3600) kWh/mon	th (see Ta	bles 1b, 1c	:, 1d)		
(45)m=	185.65	162.37	167.55	146.07	140.16	120.95	112.08	128.61	130.15	151.67	165.56	179.79		
lf instan	ntaneous v	/ater heati	na at point	of use (no	hot water	r storage).	enter 0 in	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	=	1790.6	(45)
(46)m=	27.85	24.36	25.13	21.91	21.02	18.14	16.81	19.29	19.52	22.75	24.83	26.97	1	(46)
Water	storage	loss:											ł	
Storag	ge volum	e (litres)) includir	ng any s	olar or V	WHRS	storage	within s	ame ves	sel		200]	(47)
If com	munity ł	neating a	and no ta	ank in dv	velling, e	enter 110) litres in	ı (47)						
Other	wise if no	o stored	hot wate	er (this ir	ncludes i	instantar	neous co	ombi boi	lers) ente	er '0' in (47)			
vvater	storage	10SS: Turer's di	eclared I	oss fact	or is kno	wn (kW)	h/dav).				1	2	1	(48)
Temp	erature f	actor fro	m Table	2h			n/day).					.2	1	(40)
Energ	v lost fro	m water	storade	· 20 	oor			(48) v (40)) —		0.	05	1	(43)
b) If n	nanufac	urer's de	eclared	cylinder	loss fact	or is not	known:	(+0) X (+0	,,		0.	60	i	(50)
Hot wa	ater stor	age loss	factor f	rom Tab	le 2 (kW	h/litre/da	ay)					0]	(51)
If com	munity h	eating s	ee secti	on 4.3									-	
Volum	e factor	from Ta	ble 2a	26								0	-	(52)
- Tempe				20				(0]	(53)
Energ	y lost fro	m water	r storage	e, kWh/y	ear			(47) x (51) x (52) x (53) =		0	-	(54)
Wotor	(50) OI		oulotod :	for oach	month			((56)m -	(55) ~ (41)	m	0.	.65]	(55)
vvaler	storage	1055 Cal						((50)))) =	(33) × (41)				1	(50)
(56)m=	20.09	18.14	20.09	19.44	20.09	19.44	20.09	20.09	19.44	20.09	19.44	20.09	liv L1	(56)
псуппа	er contain	suedicate	u solar sid	nage, (57)	m = (oc)m	x [(00) – ((חוח) - [(ווח	ou), eise (o	(00) = (10)	m where (m Append		
(57)m=	20.09	18.14	20.09	19.44	20.09	19.44	20.09	20.09	19.44	20.09	19.44	20.09	İ	(57)
Prima	ry circuit	loss (ar	nnual) fro	om Table	e 3							0]	(58)
Prima	ry circuit	loss cal	culated	for each	month ((59)m =	(58) ÷ 36	65 × (41))m					
(mo	dified by	factor f	rom Tab	le H5 if f	there is s	solar wa	ter heati	ng and a	a cylinde	r thermo	stat)		1	(50)
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	i	(59)
Comb	i loss ca	lculated	for each	month	(61)m =	(60) ÷ 3	65 × (41)m	-					
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total ł	neat req	uired for	water h	eating ca	alculated	d for eac	h month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	229	201.52	210.9	188.03	183.51	162.9	155.43	171.96	172.1	195.02	207.51	223.14		(62)
Solar D	HW input	calculated	using App	endix G o	r Appendix	k H (negati	ve quantit	y) (enter '()' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies 3	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter										_	
(64)m=	229	201.52	210.9	188.03	183.51	162.9	155.43	171.96	172.1	195.02	207.51	223.14		
								Out	put from w	ater heate	r (annual)₁	12	2301.02	(64)
Heat g	gains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)n	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	96.41	85.31	90.39	82.13	81.28	73.78	71.95	77.44	76.83	85.11	88.61	94.46		(65)
inclu	ude (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. <u>In</u>	terna <u>l g</u> a	ains (<u>se</u> e	e Tab <u>le 5</u>	5 and <u>5a</u>):									
Metab	olic dair	is (Table	e 5). Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 54.03 47.99 39.03 29.55 22.09 18.65 20.15 26.19 35.15 44.64 52.1 55.54 (67) Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 584.18 590.24 574.96 542.44 501.39 462.81 437.03 430.97 446.25 478.77 519.82 558.4 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 39.76 39.76 39.76 39.76 39.76 39.76 39.76 39.76 39.76 39.76 39.76 39.76 (39.76 39.76 39.76 39.76 (39.76 39.76 39.76 39.76 39.76 39.76 (39.76 39.76 39.76 39.76 39.76 (39.76 39.76 39.76 39.76 39.76 39.76 (39.76 39	(66)m=	167.59	167.59	167.59	167.59	167.59	167.59	167.59	167.59	167.59	167.59	167.59	167.59	(66)	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68) $(68)m=$ 584.18 590.24 574.96 542.44 501.39 462.81 437.03 430.97 446.25 478.77 519.82 558.4 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69) (69) 39.76 <td>(67)m=</td> <td>54.03</td> <td>47.99</td> <td>39.03</td> <td>29.55</td> <td>22.09</td> <td>18.65</td> <td>20.15</td> <td>26.19</td> <td>35.15</td> <td>44.64</td> <td>52.1</td> <td>55.54</td> <td>(67)</td> <td></td>	(67)m=	54.03	47.99	39.03	29.55	22.09	18.65	20.15	26.19	35.15	44.64	52.1	55.54	(67)	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Applia	nces gai	ins (calc	ulated in	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ole 5				
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 39.76 3	(68)m=	584.18	590.24	574.96	542.44	501.39	462.81	437.03	430.97	446.25	478.77	519.82	558.4	(68)	
(69)m= 39.76 <t< td=""><td>Cookin</td><td>ig gains</td><td>(calcula</td><td>ted in A</td><td>ppendix</td><td>L, equat</td><td>tion L15</td><td>or L15a)</td><td>), also se</td><td>ee Table</td><td>5</td><td></td><td></td><td></td><td></td></t<>	Cookin	ig gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)), also se	ee Table	5				
Pumps and fans gains (Table 5a) $(70)m =$ 3 3<	(69)m=	39.76	39.76	39.76	39.76	39.76	39.76	39.76	39.76	39.76	39.76	39.76	39.76	(69)	
(70)m= 3 <td>Pumps</td> <td>and far</td> <td>ns gains</td> <td>(Table §</td> <td>ōa)</td> <td></td>	Pumps	and far	ns gains	(Table §	ōa)										
Losses e.g. evaporation (negative values) (Table 5) (71)m = -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 (71) Water heating gains (Table 5) $(72)m = 129.58 126.95 121.49 114.07 109.25 102.47 96.7 104.09 106.72 114.4 123.07 126.96 (72)$	(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)	
(71)m= -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 -134.07 (71) Water heating gains (Table 5) (72)m= 129.58 126.95 121.49 114.07 109.25 102.47 96.7 104.09 106.72 114.4 123.07 126.96 (72)	Losses	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	ole 5)								
Water heating gains (Table 5) (72)m= 129.58 126.95 121.49 114.07 109.25 102.47 96.7 104.09 106.72 114.4 123.07 126.96 (72)	(71)m=	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	(71)	
(72)m= 129.58 126.95 121.49 114.07 109.25 102.47 96.7 104.09 106.72 114.4 123.07 126.96 (72	Water	heating	gains (T	able 5)											
	(72)m=	129.58	126.95	121.49	114.07	109.25	102.47	96.7	104.09	106.72	114.4	123.07	126.96	(72)	
Total internal gains = $(66)m + (67)m + (68)m + (70)m + (71)m + (72)m$	Total i	nternal	gains =				(66))m + (67)m	n + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m	_	
(73)m= 844.07 841.46 811.76 762.34 709.01 660.2 630.16 637.53 664.39 714.08 771.26 817.18 (73)	(73)m=	844.07	841.46	811.76	762.34	709.01	660.2	630.16	637.53	664.39	714.08	771.26	817.18	(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 Table 6d	•	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	5.24	x	11.28	×	0.63	×	0.7	=	12.67	(75)
Northeast 0.9x	0.54	x	6.34	x	11.28	x	0.63	x	0.7	=	15.33	(75)
Northeast 0.9x	0.54	x	4.45	x	11.28	x	0.63	×	0.7	=	10.76	(75)
Northeast 0.9x	0.54	x	6.53	x	11.28	x	0.63	×	0.7	=	31.58	(75)
Northeast 0.9x	0.54	x	6.35	x	11.28	x	0.63	×	0.7	=	30.71	(75)
Northeast 0.9x	0.54	x	11.02	x	11.28	x	0.63	×	0.7	=	26.65	(75)
Northeast 0.9x	0.54	x	5.24	x	22.97	x	0.63	×	0.7	=	25.79	(75)
Northeast 0.9x	0.54	x	6.34	x	22.97	x	0.63	×	0.7	=	31.21	(75)
Northeast 0.9x	0.54	x	4.45	x	22.97	x	0.63	x	0.7	=	21.9	(75)
Northeast 0.9x	0.54	x	6.53	x	22.97	x	0.63	×	0.7	=	64.29	(75)
Northeast 0.9x	0.54	x	6.35	x	22.97	x	0.63	×	0.7	=	62.51	(75)
Northeast 0.9x	0.54	x	11.02	x	22.97	x	0.63	×	0.7	=	54.24	(75)
Northeast 0.9x	0.54	x	5.24	x	41.38	x	0.63	×	0.7	=	46.47	(75)
Northeast 0.9x	0.54	x	6.34	x	41.38	x	0.63	×	0.7	=	56.23	(75)
Northeast 0.9x	0.54	x	4.45	x	41.38	x	0.63	×	0.7	=	39.47	(75)
Northeast 0.9x	0.54	x	6.53	x	41.38	x	0.63	×	0.7	=	115.82	(75)
Northeast 0.9x	0.54	x	6.35	x	41.38	x	0.63	×	0.7	=	112.63	(75)
Northeast 0.9x	0.54	x	11.02	x	41.38	x	0.63	×	0.7	=	97.73	(75)
Northeast 0.9x	0.54	x	5.24	x	67.96	x	0.63	×	0.7	=	76.32	(75)
Northeast 0.9x	0.54	x	6.34	x	67.96	x	0.63	×	0.7	=	92.34	(75)
Northeast 0.9x	0.54	x	4.45	x	67.96	x	0.63	×	0.7	=	64.81	(75)

Northeast 0.9x	0.54	x	6.53	x	67.96	x	0.63	x	0.7	=	190.21	(75)
Northeast 0.9x	0.54	x	6.35	×	67.96	x	0.63	x	0.7	=	184.97	(75)
Northeast 0.9x	0.54	x	11.02	×	67.96	x	0.63	x	0.7] =	160.5	(75)
Northeast 0.9x	0.54	x	5.24	x	91.35	x	0.63	x	0.7	=	102.59	(75)
Northeast 0.9x	0.54	x	6.34	×	91.35	x	0.63	x	0.7] =	124.12	(75)
Northeast 0.9x	0.54	x	4.45	×	91.35	x	0.63	x	0.7	=	87.12	(75)
Northeast 0.9x	0.54	x	6.53	×	91.35	x	0.63	x	0.7] =	255.69	(75)
Northeast 0.9x	0.54	x	6.35	×	91.35	x	0.63	x	0.7	=	248.64	(75)
Northeast 0.9x	0.54	x	11.02	×	91.35	x	0.63	x	0.7	=	215.75	(75)
Northeast 0.9x	0.54	x	5.24	×	97.38	x	0.63	x	0.7	=	109.37	(75)
Northeast 0.9x	0.54	x	6.34	×	97.38	x	0.63	x	0.7	=	132.33	(75)
Northeast 0.9x	0.54	x	4.45	x	97.38	x	0.63	x	0.7	=	92.88	(75)
Northeast 0.9x	0.54	x	6.53	x	97.38	x	0.63	x	0.7	=	272.59	(75)
Northeast 0.9x	0.54	x	6.35	x	97.38	x	0.63	x	0.7	=	265.07	(75)
Northeast 0.9x	0.54	x	11.02	x	97.38	x	0.63	x	0.7	=	230.01	(75)
Northeast 0.9x	0.54	x	5.24	x	91.1	x	0.63	x	0.7	=	102.31	(75)
Northeast 0.9x	0.54	x	6.34	×	91.1	x	0.63	x	0.7	=	123.79	(75)
Northeast 0.9x	0.54	x	4.45	x	91.1	x	0.63	x	0.7	=	86.89	(75)
Northeast 0.9x	0.54	x	6.53	x	91.1	x	0.63	x	0.7	=	255	(75)
Northeast 0.9x	0.54	x	6.35	×	91.1	x	0.63	x	0.7	=	247.97	(75)
Northeast 0.9x	0.54	x	11.02	×	91.1	x	0.63	x	0.7	=	215.17	(75)
Northeast 0.9x	0.54	x	5.24	×	72.63	x	0.63	x	0.7] =	81.56	(75)
Northeast 0.9x	0.54	x	6.34	×	72.63	x	0.63	x	0.7	=	98.69	(75)
Northeast 0.9x	0.54	x	4.45	x	72.63	x	0.63	x	0.7	=	69.27	(75)
Northeast 0.9x	0.54	x	6.53	×	72.63	×	0.63	x	0.7	=	203.29	(75)
Northeast 0.9x	0.54	x	6.35	×	72.63	x	0.63	x	0.7	=	197.69	(75)
Northeast 0.9x	0.54	x	11.02	×	72.63	×	0.63	x	0.7	=	171.54	(75)
Northeast 0.9x	0.54	x	5.24	×	50.42	×	0.63	x	0.7	=	56.63	(75)
Northeast 0.9x	0.54	x	6.34	×	50.42	×	0.63	x	0.7	=	68.51	(75)
Northeast 0.9x	0.54	x	4.45	×	50.42	×	0.63	x	0.7	=	48.09	(75)
Northeast 0.9x	0.54	x	6.53	×	50.42	x	0.63	x	0.7	=	141.13	(75)
Northeast 0.9x	0.54	x	6.35	×	50.42	x	0.63	x	0.7	=	137.24	(75)
Northeast 0.9x	0.54	x	11.02	×	50.42	×	0.63	x	0.7	=	119.09	(75)
Northeast 0.9x	0.54	x	5.24	×	28.07	x	0.63	x	0.7	=	31.52	(75)
Northeast 0.9x	0.54	x	6.34	×	28.07	x	0.63	x	0.7	=	38.14	(75)
Northeast 0.9x	0.54	x	4.45	×	28.07	×	0.63	x	0.7	=	26.77	(75)
Northeast 0.9x	0.54	x	6.53	×	28.07	×	0.63	x	0.7	=	78.56	(75)
Northeast 0.9x	0.54	x	6.35	×	28.07	×	0.63	x	0.7	=	76.4	(75)
Northeast 0.9x	0.54	x	11.02	×	28.07	×	0.63	x	0.7	=	66.29	(75)
Northeast 0.9x	0.54	x	5.24	×	14.2	×	0.63	x	0.7	=	15.94	(75)
Northeast 0.9x	0.54	x	6.34	×	14.2	×	0.63	×	0.7	=	19.29	(75)

Northeast 0.9x	0.54	x	4.45	x	14.2	x	0.63	x	0.7	=	13.54	(75)
Northeast 0.9x	0.54	x	6.53	x	14.2	x	0.63	x	0.7	=	39.74	(75)
Northeast 0.9x	0.54	x	6.35	x	14.2	x	0.63	x	0.7	=	38.64	(75)
Northeast 0.9x	0.54	x	11.02	×	14.2	x	0.63	x	0.7	=	33.53	(75)
Northeast 0.9x	0.54	x	5.24	x	9.21	x	0.63	x	0.7	=	10.35	(75)
Northeast 0.9x	0.54	x	6.34	x	9.21	x	0.63	x	0.7	=	12.52	(75)
Northeast 0.9x	0.54	x	4.45	×	9.21	x	0.63	x	0.7] =	8.79	(75)
Northeast 0.9x	0.54	x	6.53	×	9.21	x	0.63	x	0.7	=	25.79	(75)
Northeast 0.9x	0.54	x	6.35	x	9.21	x	0.63	x	0.7	=	25.08	(75)
Northeast 0.9x	0.54	x	11.02	x	9.21	x	0.63	x	0.7	=	21.76	(75)
Southeast 0.9x	0.54	x	2.16	×	36.79	x	0.63	x	0.7	=	17.03	(77)
Southeast 0.9x	0.54	x	2.16	×	62.67	x	0.63	x	0.7	=	29.01	(77)
Southeast 0.9x	0.54	x	2.16	×	85.75	x	0.63	x	0.7	=	39.7	(77)
Southeast 0.9x	0.54	x	2.16	×	106.25	x	0.63	x	0.7	=	49.19	(77)
Southeast 0.9x	0.54	x	2.16	×	119.01	x	0.63	x	0.7	=	55.1	(77)
Southeast 0.9x	0.54	x	2.16	×	118.15	x	0.63	x	0.7	=	54.7	(77)
Southeast 0.9x	0.54	x	2.16	x	113.91	x	0.63	x	0.7	=	52.73	(77)
Southeast 0.9x	0.54	x	2.16	×	104.39	x	0.63	x	0.7	=	48.33	(77)
Southeast 0.9x	0.54	x	2.16	×	92.85	x	0.63	x	0.7	=	42.99	(77)
Southeast 0.9x	0.54	x	2.16	×	69.27	x	0.63	x	0.7	=	32.07	(77)
Southeast 0.9x	0.54	x	2.16	×	44.07	x	0.63	x	0.7	=	20.4	(77)
Southeast 0.9x	0.54	x	2.16	x	31.49	x	0.63	x	0.7	=	14.58	(77)
Southwest0.9x	0.54	x	4.16	x	36.79]	0.63	x	0.7	=	32.81	(79)
Southwest0.9x	0.54	x	3.41	×	36.79]	0.63	x	0.7	=	26.89	(79)
Southwest0.9x	0.54	x	6.81	×	36.79]	0.63	x	0.7	=	53.7	(79)
Southwest0.9x	0.54	x	2.3	×	36.79]	0.63	x	0.7	=	18.14	(79)
Southwest0.9x	0.54	x	4.26	×	36.79]	0.63	x	0.7	=	33.59	(79)
Southwest0.9x	0.54	x	8.1	×	36.79]	0.63	x	0.7	=	63.88	(79)
Southwest0.9x	0.54	x	4.05	×	36.79]	0.63	x	0.7	=	31.94	(79)
Southwest0.9x	0.54	x	4.16	×	62.67]	0.63	x	0.7	=	55.88	(79)
Southwest0.9x	0.54	x	3.41	×	62.67]	0.63	x	0.7	=	45.81	(79)
Southwest0.9x	0.54	x	6.81	×	62.67]	0.63	x	0.7	=	91.48	(79)
Southwest0.9x	0.54	x	2.3	×	62.67]	0.63	x	0.7	=	30.89	(79)
Southwest0.9x	0.54	x	4.26	×	62.67]	0.63	x	0.7	=	57.22	(79)
Southwest0.9x	0.54	x	8.1	×	62.67]	0.63	x	0.7	=	108.8	(79)
Southwest0.9x	0.54	x	4.05	×	62.67]	0.63	x	0.7	=	54.4	(79)
Southwest0.9x	0.54	x	4.16	×	85.75]	0.63	x	0.7	=	76.46	(79)
Southwest0.9x	0.54	x	3.41	×	85.75]	0.63	x	0.7	=	62.67	(79)
Southwest0.9x	0.54	x	6.81	×	85.75]	0.63	x	0.7] =	125.16	(79)
Southwest0.9x	0.54	x	2.3	×	85.75]	0.63	x	0.7	=	42.27	(79)
Southwest0.9x	0.54	×	4.26	×	85.75]	0.63	×	0.7	=	78.29	(79)

Southwest0.9x	0.54	x	8.1	x	85.75		0.63	x	0.7	=	148.87	(79)
Southwest0.9x	0.54	x	4.05	x	85.75		0.63	x	0.7	=	74.44	(79)
Southwest0.9x	0.54	x	4.16	×	106.25		0.63	x	0.7	=	94.73	(79)
Southwest0.9x	0.54	x	3.41	x	106.25		0.63	x	0.7	=	77.65	(79)
Southwest0.9x	0.54	x	6.81	×	106.25		0.63	x	0.7	=	155.08	(79)
Southwest0.9x	0.54	x	2.3	x	106.25		0.63	x	0.7	=	52.38	(79)
Southwest0.9x	0.54	x	4.26	x	106.25		0.63	x	0.7	=	97.01	(79)
Southwest0.9x	0.54	x	8.1	x	106.25		0.63	x	0.7	=	184.46	(79)
Southwest0.9x	0.54	x	4.05	x	106.25		0.63	x	0.7	=	92.23	(79)
Southwest0.9x	0.54	x	4.16	×	119.01		0.63	x	0.7	=	106.11	(79)
Southwest0.9x	0.54	x	3.41	x	119.01		0.63	x	0.7	=	86.98	(79)
Southwest0.9x	0.54	x	6.81	x	119.01		0.63	x	0.7	=	173.7	(79)
Southwest0.9x	0.54	x	2.3	x	119.01		0.63	x	0.7	=	58.67	(79)
Southwest0.9x	0.54	x	4.26	x	119.01		0.63	x	0.7	=	108.66	(79)
Southwest0.9x	0.54	x	8.1	x	119.01		0.63	x	0.7	=	206.61	(79)
Southwest0.9x	0.54	x	4.05	x	119.01		0.63	x	0.7	=	103.3	(79)
Southwest0.9x	0.54	x	4.16	x	118.15		0.63	x	0.7	=	105.34	(79)
Southwest0.9x	0.54	x	3.41	x	118.15		0.63	x	0.7	=	86.35	(79)
Southwest0.9x	0.54	x	6.81	×	118.15		0.63	x	0.7	=	172.45	(79)
Southwest0.9x	0.54	x	2.3	x	118.15		0.63	x	0.7	=	58.24	(79)
Southwest0.9x	0.54	x	4.26	x	118.15		0.63	x	0.7	=	107.87	(79)
Southwest0.9x	0.54	x	8.1	x	118.15		0.63	x	0.7	=	205.11	(79)
Southwest0.9x	0.54	x	4.05	x	118.15		0.63	x	0.7	=	102.56	(79)
Southwest0.9x	0.54	x	4.16	×	113.91		0.63	x	0.7	=	101.56	(79)
Southwest0.9x	0.54	x	3.41	×	113.91		0.63	x	0.7	=	83.25	(79)
Southwest0.9x	0.54	x	6.81	x	113.91		0.63	x	0.7	=	166.26	(79)
Southwest0.9x	0.54	x	2.3	×	113.91]	0.63	x	0.7	=	56.15	(79)
Southwest0.9x	0.54	x	4.26	×	113.91]	0.63	x	0.7	=	104	(79)
Southwest0.9x	0.54	x	8.1	×	113.91]	0.63	x	0.7	=	197.75	(79)
Southwest0.9x	0.54	x	4.05	×	113.91]	0.63	x	0.7	=	98.88	(79)
Southwest0.9x	0.54	x	4.16	x	104.39		0.63	x	0.7	=	93.07	(79)
Southwest0.9x	0.54	x	3.41	x	104.39		0.63	x	0.7	=	76.29	(79)
Southwest0.9x	0.54	x	6.81	×	104.39]	0.63	x	0.7	=	152.36	(79)
Southwest0.9x	0.54	x	2.3	×	104.39]	0.63	x	0.7	=	51.46	(79)
Southwest0.9x	0.54	x	4.26	×	104.39]	0.63	x	0.7	=	95.31	(79)
Southwest0.9x	0.54	x	8.1	×	104.39]	0.63	x	0.7	=	181.23	(79)
Southwest0.9x	0.54	x	4.05	×	104.39]	0.63	x	0.7	=	90.61	(79)
Southwest0.9x	0.54	x	4.16	×	92.85		0.63	x	0.7	=	82.79	(79)
Southwest <mark>0.9x</mark>	0.54	x	3.41	×	92.85]	0.63	x	0.7	=	67.86	(79)
Southwest <mark>0.9x</mark>	0.54	x	6.81	×	92.85]	0.63	x	0.7	=	135.52	(79)
Southwest <mark>0.9x</mark>	0.54	x	2.3	×	92.85]	0.63	x	0.7	=	45.77	(79)

Southwest0.9x	0.54	x	4.26	x	92.85		0.63	x	0.7	=	84.78	(79)
Southwest0.9x	0.54	x	8.1	×	92.85	1	0.63	x	0.7	=	161.19	(79)
Southwest0.9x	0.54	×	4.05	×	92.85	1	0.63	x	0.7	=	80.6	(79)
Southwest0.9x	0.54	x	4.16	×	69.27	1	0.63	x	0.7] =	61.76	(79)
Southwest0.9x	0.54	x	3.41	x	69.27	1	0.63	x	0.7	=	50.62	(79)
Southwest0.9x	0.54	x	6.81	×	69.27]	0.63	x	0.7] =	101.1	(79)
Southwest0.9x	0.54	x	2.3	×	69.27]	0.63	x	0.7	=	34.15	(79)
Southwest0.9x	0.54	x	4.26	×	69.27]	0.63	x	0.7	=	63.24	(79)
Southwest0.9x	0.54	x	8.1	x	69.27]	0.63	x	0.7	=	120.25	(79)
Southwest0.9x	0.54	x	4.05	x	69.27]	0.63	x	0.7	=	60.13	(79)
Southwest0.9x	0.54	x	4.16	x	44.07]	0.63	x	0.7	=	39.29	(79)
Southwest0.9x	0.54	x	3.41	x	44.07]	0.63	x	0.7	=	32.21	(79)
Southwest0.9x	0.54	x	6.81	x	44.07]	0.63	x	0.7	=	64.32	(79)
Southwest0.9x	0.54	x	2.3	x	44.07]	0.63	x	0.7	=	21.72	(79)
Southwest0.9x	0.54	x	4.26	x	44.07]	0.63	x	0.7	=	40.24	(79)
Southwest0.9x	0.54	x	8.1	x	44.07]	0.63	x	0.7	=	76.51	(79)
Southwest0.9x	0.54	x	4.05	×	44.07]	0.63	x	0.7	=	38.25	(79)
Southwest0.9x	0.54	x	4.16	x	31.49]	0.63	x	0.7	=	28.07	(79)
Southwest0.9x	0.54	x	3.41	x	31.49]	0.63	x	0.7	=	23.01	(79)
Southwest0.9x	0.54	x	6.81	x	31.49]	0.63	x	0.7	=	45.96	(79)
Southwest0.9x	0.54	x	2.3	×	31.49]	0.63	x	0.7	=	15.52	(79)
Southwest0.9x	0.54	x	4.26	×	31.49]	0.63	x	0.7] =	28.75	(79)
Southwest0.9x	0.54	x	8.1	×	31.49]	0.63	x	0.7	=	54.66	(79)
Southwest0.9x	0.54	x	4.05	x	31.49]	0.63	x	0.7	=	27.33	(79)
Northwest 0.9x	0.54	x	4.59	×	11.28	x	0.63	x	0.7	=	11.1	(81)
Northwest 0.9x	0.54	x	4.59	×	22.97	x	0.63	x	0.7	=	22.59	(81)
Northwest 0.9x	0.54	x	4.59	×	41.38	x	0.63	x	0.7	=	40.71	(81)
Northwest 0.9x	0.54	x	4.59	×	67.96	x	0.63	x	0.7	=	66.85	(81)
Northwest 0.9x	0.54	x	4.59	×	91.35	x	0.63	x	0.7	=	89.86	(81)
Northwest 0.9x	0.54	x	4.59	×	97.38	x	0.63	x	0.7	=	95.8	(81)
Northwest 0.9x	0.54	x	4.59	×	91.1	x	0.63	x	0.7	=	89.62	(81)
Northwest 0.9x	0.54	x	4.59	×	72.63	x	0.63	x	0.7	=	71.45	(81)
Northwest 0.9x	0.54	x	4.59	x	50.42	x	0.63	x	0.7	=	49.6	(81)
Northwest 0.9x	0.54	x	4.59	×	28.07	x	0.63	x	0.7	=	27.61	(81)
Northwest 0.9x	0.54	x	4.59	x	14.2	x	0.63	x	0.7	=	13.97	(81)
Northwest 0.9x	0.54	x	4.59	x	9.21	x	0.63	x	0.7	=	9.06	(81)
Rooflights 0.9x	1	x	3.49	×	26	x	0	x	0.8	=	0	(82)
Rooflights 0.9x	1	x	4.33	x	26	x	0	x	0.8	=	0	(82)
Rooflights 0.9x	1	x	3.49	×	54	x	0	x	0.8	=	0	(82)
Rooflights 0.9x	1	x	4.33	×	54	x	0	x	0.8] =	0	(82)
Rooflights 0.9x	1	x	3.49	×	96	x	0	x	0.8	=	0	(82)

Rooflig	hts 0.9x	1	×	4	33	x		96	×	0	x	0.8	3	=	0	(82)
Rooflig	hts 0.9x	1	x	3	49	x		150	x	0	×	0.8	3	=	0	(82)
Rooflig	hts 0.9x	1	×	4	33	x		150	x	0	×	0.8	3	1 =	0	(82)
Rooflig	hts 0.9x	1	x	3	49	x		192	x	0	×	0.8	3	1 = 1	0	(82)
Rooflig	hts 0.9x	1	x	4	33	x		192	x	0	×	0.8	3	1 = 1	0	(82)
Rooflig	hts 0.9x	1	x	3	49	x		200	x	0	×	0.8	3		0	(82)
Rooflig	hts 0.9x	1	x	4	33	x		200	x	0	×	0.8	3	- =	0	(82)
Rooflig	hts 0.9x	1	x	3	49	x		189	x	0	×	0.8	3	- =	0	(82)
Rooflig	hts 0.9x	1	x	4	33	x		189	x	0	x	0.8	3	=	0	(82)
Rooflig	hts 0.9x	1	x	3	49	x		157	x	0	x	0.8	3	=	0	(82)
Rooflig	hts 0.9x	1	x	4	33	x		157	x	0	x	0.8	3	=	0	(82)
Rooflig	hts 0.9x	1	x	3	49	x		115	x	0	x	0.8	3	=	0	(82)
Rooflig	hts 0.9x	1	x	4	33	x		115	x	0	x	0.8	3	=	0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	49	x		66	x	0	×	0.8	3	=	0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	33	x		66	x	0	×	0.8	3	1 = 1	0	(82)
Rooflig	hts 0.9x	1	x	3	49	x		33	x	0	×	0.8	3	1 = 1	0	(82)
Rooflig	hts 0.9x	1	x	4	33	x		33	x	0	×	0.8	3	1 = 1	0	(82)
Rooflig	hts 0.9x	1	x	3	49	×		21	x	0	×	0.8	3	i = i	0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	33	×		21	x	0	×	0.8	3	i = i	0	(82)
									-							
Solar g	ains in	watts, ca	alculated	d for ea	ch mon	th			(83)m	n = Sum(74)r	m(82)r	n				
(83)m=	416.78	756.04	1156.91	1638.74	2022.8	9 20	090.68	1981.34	1682	2.15 1321.7	' 9 868.	61 507.6	51 35	51.25		(83)
Total g	ains – i	nternal a	ind sola	r (84)m	= (73)n	n + (83)m	, watts	1							
(84)m=	1260.85	1597.5	1968.68	2401.08	2731.9	9 2	750.88	2611.5	2319	9.68 1986.1	8 1582	.68 1278.	87 11	68.42		(84)
7. Me	an inter	nal temp	oerature	(heatin	g seaso	on)										
Temp	erature	during h	eating p	periods	in the li	ving	area	from Ta	ble 9	, Th1 (°C)					21	(85)
Utilisa	ation fac	tor for g	ains for	living a	ea, h1,	m (s	see Ta	ble 9a)	T							
	Jan	Feb	Mar	Apr	May	/	Jun	Jul	A	ug Sep	00	t No	v I	Dec		
(86)m=	0.99	0.99	0.98	0.95	0.89		0.79	0.68	0.7	0.9	0.9	7 0.99		1		(86)
Mean	interna	l temper	ature in	living a	rea T1	(follo	ow ste	ps 3 to 7	7 in T	able 9c)						
(87)m=	18.69	18.88	19.23	19.71	20.19	2	20.56	20.75	20	.7 20.37	19.7	′6 19.1 _′	4 18	8.67		(87)
Temp	erature	during h	eating p	periods	in rest o	of dv	velling	from Ta	able 9	9, Th2 (°C))					
(88)m=	19.97	19.97	19.97	19.98	19.98		19.99	19.99	19.	99 19.98	19.9	19.9	B 19	9.97		(88)
Utilisa	ation fac	tor for g	ains for	rest of	dwelling	ı. h2	.m (se	e Table	9a)	-						
(89)m=	0.99	0.99	0.98	0.94	0.87		0.74	0.58	0.6	0.86	0.9	7 0.99		1		(89)
Mean	interna	l temper	ature in	the res	t of dwe	llinc	1 T2 (f	ollow ste	ens 3	to 7 in Ta	uble 9c)					
(90)m=	16.82	17.1	17.61	18.31	18.99		19.5	19.73	19.	68 19.25	18.3	9 17.4	9 10	6.78		(90)
				1	1				1	1	fLA = l	iving area	÷ (4) =		0.07	(91)
Mean	interna	l temper	ature (fr	or the w	hole du	ollin	nu) – ti	Δ 🗸 Τ1	+ (1	_ fl Δ) √ ⊤	2			I		I
(92)m=	16.95	17.22	17.72	18.41	19.07		19.58	19.8	19.	75 19.33	- 18.4	9 17.6	1 1	6.92		(92)
· /	-					1		-								

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

(93)m=	16.8	17.07	17.57	18.26	18.92	19.43	19.65	19.6	19.18	18.34	17.46	16.77	1	(93)
8. Sp	ace hea	ting requ	uiremen	t										
Set T	i to the i	mean int	ternal te	mperatu using Ta	re obtair able 9a	ned at st	ep 11 of	Table 9	b, so tha	ıt Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	<u>י</u> ו:	,	L		5			L	1		
(94)m=	0.99	0.98	0.96	0.92	0.83	0.7	0.53	0.6	0.82	0.95	0.98	0.99		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (8	4)m						•			
(95)m=	1247.98	1567.14	1894.23	2204.4	2276.29	1912.86	1395.7	1394.18	1635.17	1501.17	1257.77	1158.65		(95)
Month	nly aver	age exte	ernal terr	nperature	e from T	able 8							1	(2.2)
(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	ļ	(96)
Heat	1055 rate	e for mea	an interr	1052 66	erature,	LM , VV :	=[(39)m	x [(93)m	- (96)m	1084.38	5497 7	6685.00		(97)
(97)III=	orus.24		amont fo	4952.00	5014.05	2527.99 Wh/mon	1590.49 th – 0.02	1075.14	2070.2	3ml x (1)	1)m	0000.99		(37)
(98)m=	4060.21	3325.35	2990.17	1978.75	1144.09	0	0.02	0)iii — (33 0	1921.91	3045.55	4112.35		
								Tota	al per year	(kWh/yea	r) = Sum(9)8) _{15.912} =	22578.38	(98)
Snac	a haatin	a requir	omont in	k/M/b/m	2/voor						, ,		19.12	
Opaci	eneatin	grequit	ementin		/year								40.13	(00)
		oling rec	quiremer											
Calcu	llated to	r June, . Feb	July and Mar	August.	See Ta		Jul	Αμα	Sen	Oct	Nov	Dec		
Heat	loss rate	e Lm (ca	lculated	using 2	5°C inter	rnal tem	oerature	and ext	ernal ter	nperatur	e from T	able 10)	1	
(100)m=	0	0	0	0	0	4921.23	3874.16	3972.57	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	oss hm											
(101)m=	0	0	0	0	0	0.61	0.69	0.63	0	0	0	0		(101)
Usefu	ıl loss, h	mLm (V	Vatts) =	(100)m >	k (101)m									
(102)m=	0	0	0	0	0	3023.2	2665.99	2519.97	0	0	0	0		(102)
Gains	s (solar g	gains ca	lculated	for appli	icable w	eather re	egion, se	e Table	10)				1	(100)
(103)m=	0	0	0	0	0	3675.48	3493.26	3118.87		0	0	0	(11)	(103)
set (1	e <i>coolin</i> 04)m to	g require zero if (<i>ement to</i> (104)m <	r montn, < 3 × (98	, <i>whole c</i> 3)m	iweiling,	continuo	DUS (KVV	n) = 0.02	24 X [(10	13)m – (1	102)m] X	(41)M	
(104)m=	0	0	0	0	0	0	615.5	445.58	0	0	0	0		
					!				Tota	l = Sum((104)	=	1061.08	(104)
Cooled	d fractio	n							f C =	cooled	area ÷ (4	4) =	0.51	(105)
Interm	ittency f	actor (Ta	able 10b)		0.05	0.05	0.05					I	
(106)m=	0	0	0	0	0	0.25	0.25	0.25			(104)	0	0	
Space	cooling	requirer	ment for	month =	= (104)m	× (105)	× (106)r	n	TOLA	i = Suiri	1.04)	=	0	(106)
(107)m=	0	0	0	0	0	0	78.72	56.99	0	0	0	0		
									Total	l = Sum(107)	=	135.71	(107)
Space	cooling	requirer	ment in l	/Wh/m²	vear				(107) ÷ (4) =			0.29	(108)
9a. En	erav rea	uiremer	nts – Ind	ividual h	eating s	vstems i	ncluding	micro-C	CHP)	, , ,				
Spac	e heatir	ng:												
Fracti	on of sp	ace hea	at from s	econdar	y/supple	ementary	v system						0.1	(201)
Fracti	on of sp	bace hea	at from n	nain syst	tem(s)			(202) = 1	- (201) =				0.9	(202)
Fracti	on of to	tal heati	ng from	main sy	stem 1			(204) = (2	02) × [1 –	(203)] =			0.9	(204)
														_

Effici	ency of	main spa	ace heat	ting syste	em 1							[89.7	(206)
Efficie	ency of	seconda	ry/suppl	lementar	y heating	g syster	n, %					ľ	90	(208)
Cooli	ng Syst	em Ener	gy Effici	ency Ra	tio							Ī	4.32	(209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Spac	e heatin	g require	ement (o	calculate	d above)		1							
	4060.21	3325.35	2990.17	1978.75	1144.09	0	0	0	0	1921.91	3045.55	4112.35		
(211)n	ו = {[(98	8)m x (20)4)] } x ′	100 ÷ (20)6) 									(211)
	4073.79	3336.47	3000.17	1985.37	1147.92	0	0	0 Tota		1928.34	3055.73	4126.1	00050.00	(211)
Casa	o hootim	a fuel (a			/ma a with			TOLO		ar) =Sum(2) 15,101	2-	22653.89	(211)
Spac = {[(98	e neatin)m x (20	ig tuel (s 01)] } x 1	econdai 00 ÷ (20	ry), kvvn/)8)	month									
– ([(30 (215)m=	451.13	369.48	332.24	219.86	127.12	0	0	0	0	213.55	338.39	456.93		
								Tota	al (kWh/ye	ar) =Sum(215) _{15,101}	2=	2508.71	(215)
Water	heating	3										L		
Output	from w	ater hea	ter (calc	ulated a	bove)									
	229	201.52	210.9	188.03	183.51	162.9	155.43	171.96	172.1	195.02	207.51	223.14		٦
Efficie	tcy of w	ater hea	ter	I									79	(216)
(217)m= 	88.99	88.94	88.83	88.55	87.9	79	79	79	79	88.49	88.85	89.01		(217)
Fuel fo (219)n	or water $n = (64)$	heating,	kWh/m) ∸ (217	onth)m										
(219)m=	257.33	226.58	237.43	212.33	208.78	206.2	196.74	217.67	217.84	220.4	233.55	250.68		
		-						Tota	al = Sum(2	19a) ₁₁₂ =	•		2685.54	(219)
Space	coolin	g fuel, k	Wh/moi	nth.								-		
(221)n	า = (107	′)m÷ (209	9)		0	0	10.00	12 10	0	0		0		
(221)m=	0	0	0	0	0	0	18.22	13.19 Tota	0	21) -	0	0	21.44	(221)
_								1010		2 1/ ₆₈ —		L	31.41	(221)
Annua Space	heatinc	; i fuel use	ed main	system	1					K	wh/yeai	r [22653 89	r T
Space	hooting	, fuel uer	od 0000	ndon	•							Ĺ	0500.74	
Space	neating		u, seco	nuary								l	2508.71	
vvater	heating	fuel use	d									l	2685.54	_
Space	cooling	fuel use	ed										31.41	
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatir	ng pump	:									30		(2300
boiler	with a	fan-assis	sted flue									45		(230)
Total e	electricit	y for the	above,	kWh/yea	ar			sum	of (230a)	(230g) =	:		75	(231)
Electri	city for I	iahtina	·									Ĺ	054.07	(232)
Electri	citv aen	erated b	v PVs									1 -	954.27	(233)
12a.	CO2 err	nissions -	– Individ	lual heat	ing syste	ems incl	uding mi	cro-CHF	þ				-4116.75	
						с.	oray			Emico	ion fac	tor	Emission	
						kV	Vh/year			kg CO	2/kWh		kg CO2/ye	ar
Space	heating) (main s	ystem 1)		(21	1) x			0.2	16	=	4893.24	(261)
												L		

Space heating (secondary)	(215) x	0.216	=	541.88	(263)
Water heating	(219) x	0.216	=	580.08	(264)
Space and water heating	(261) + (262) + (263) +	- (264) =		6015.2	(265)
Space cooling	(221) x	0.519	=	16.2	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	495.27	(268)
Energy saving/generation technologies					-
Item 1		0.519	=	-2136.59	(269)
Total CO2, kg/year		sum of (265)(271) =		4429.1	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		9.44	(273)
El rating (section 14)				88	(274)

36 Redington Road London NW3 7RT Dwelling type: Date of assessment: Produced by: Total floor area: Semi-detached House 21 December 2018 Ondrej Gajdos 469.14 m²

Environmental Impact (CO₂) Rating

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be. The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.



				User D	Details:						
Assessor Name:	Ondrej Ga	ijdos			Stron	na Nun	nber:		STRC	0006629	
Software Name:	Stroma FS	SAP 2012	2		Softw	vare Ve	ersion:		Versio	on: 1.0.4.16	
			Р	roperty	Address	s: Propo	sed Hous	se			
Address :	36 Redingt	on Road,	London	, NW3 7	7RT						
1. Overall dwelling dimer	nsions:			•	(0)						
Cround floor				Are	a(m²)		AV. He		-	volume(m ^s	~) (2=)
				1	50.84	(1a) x		2.6	(2a) =	392.18	(3a)
First floor				1	125.3	(1b) x	3	3.3	(2b) =	413.49	(3b)
Second floor				1	121.9	(1c) x		3	(2c) =	365.7	(3c)
Third floor					71.1	(1d) x		3	(2d) =	213.3	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+	(1d)+(1e)	+(1n) 4	69.14	(4)			-	-	
Dwelling volume						(3a +(3)	b)+(3c)+(3c	l)+(3e)+	.(3n) =	1384.67	(5)
2. Ventilation rate:					oth or		totol			m3 nor hou	
	heating	se	condar eating	у	other		total			m ³ per nou	r
Number of chimneys	0	+	0	+	0	=	0	x	⁴ 0 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x	20 =	0	(6b)
Number of intermittent far	IS						7	x	10 =	70	(7a)
Number of passive vents							0	x	10 =	0	(7b)
Number of flueless gas fir	es						0	X 4	40 =	0	(7c)
									Air cl	hanges per ho	our
Infiltration due to chimney	s, flues and f	fans = <mark>(6</mark> a)+(6b)+(7	a)+(7b)+((7c) =		70		÷ (5) =	0.05	(8)
If a pressurisation test has be	en carried out o	r is intendec	l, proceec	l to (17), c	otherwise	continue	from (9) to (*	16)]
Number of storeys in th	e dwelling (n	s)								0	(9)
Additional infiltration				0.05 ([(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel o	r timber fi	rame or onding to	0.35 to	r masor or wall ar	nry cons	truction			0	(11)
deducting areas of opening	gs); if equal use	r 0.35	onung to	line great	er wan are	ea (allei					
If suspended wooden fl	oor, enter 0.2	2 (unseale	ed) or 0.	1 (seale	ed), else	e enter C)			0	(12)
If no draught lobby, ente	er 0.05, else	enter 0								0	(13)
Percentage of windows	and doors d	raught str	ipped							0	(14)
Window infiltration					0.25 - [0.	2 x (14) ÷	100] =			0	(15)
Infiltration rate					(8) + (10) + (11) +	(12) + (13) -	+ (15) =		0	(16)
Air permeability value, o	50, express	ed in cubi	c metre	s per ho	our per s	square r	netre of e	nvelope	area	5	(17)
If based on air permeabilit	y value, ther	ן (18) = [(17 ion tost has	') ÷ 20]+(8	8), otherw	ise (18) =	(16) srmoobiliti	, is boing us	od		0.3	(18)
Number of sides sheltered	" a pressuiisali	Un test lids		୍ଦ ତା ବ ପଟ୍	y ee all pe	ann c aoinily	, is being us			1	(10)
Shelter factor	A				(20) = 1	- [0.075 x	(19)] =			0.92	(10)
Infiltration rate incorporati	ng shelter fa	ctor			(21) = (1	8) x (20) =	=			0.28	(21)
Infiltration rate modified for	r monthly wi	nd speed									
Jan Feb M	vlar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	

Monthl	y avera	ge wind	speed f	rom Tab	le 7									
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind F	actor (2	22a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjuste	ed infiltr	ation rat	te (allow	ing for sl	helter an	d wind s	speed) =	(21a) x	(22a)m					
	0.35	0.35	0.34	0.31	0.3	0.26	0.26	0.26	0.28	0.3	0.31	0.33		
Calcula	ate ette	ctive air	change	rate for t	he appli	cable ca	se							
II me	echanic	al ventila	ation:			/							0	(23a)
lf exh	aust air h	eat pump	using App	endix N, (2	23b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0	(23b)
lf bala	anced wit	h heat reco	overy: effic	ciency in %	allowing f	for in-use f	actor (fron	n Table 4h	ı) =				0	(23c)
a) If	balance	ed mech	anical ve	entilation	with he	at recov	ery (MV	HR) (24a	a)m = (2	2b)m + (23b) × [⁻	1 – (23c)	÷ 100]	
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	ed mech	anical ve	entilation	without	heat red	covery (I	MV) (24t	o)m = (22	2b)m + (23b)	-		
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	/e input v	ventilatio	on from o	outside					
i	f (22b)r	n < 0.5 >	< (23b), †	then (24	c) = (23b	o); other	wise (24	c) = (22	b) m + 0.	.5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf i	natural f (22b)r	ventilation n = 1, th	on or wh en (24d)	ole hous m = (22	se positiv b)m othe	ve input erwise (2	ventilatio 24d)m =	on from 0.5 + [(2	loft 2b)m² x	0.5]				
(24d)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(24d)
Effe	ctive air	change	rate - er	nter (24a	a) or (24	o) or (24	c) or (24	d) in bo	x (25)	-	-	-		
(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(25)
					-	-	-			-	-	-		

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²⋅K	A X k kJ/K
Doors			4.08	x	0.8	= -	3.264		(26)
Windows Type 1			4.16	x1/[1/	/(0.8)+ 0.04	.] = -	3.22		(27)
Windows Type 2			3.41	x1/[1/	/(0.8)+ 0.04] = -	2.64		(27)
Windows Type 3			6.81	x1/[1/	/(0.8)+ 0.04] = -	5.28		(27)
Windows Type 4			2.3	x1/[1/	/(0.8)+ 0.04] = -	1.78		(27)
Windows Type 5			4.26	x1/[1/	/(0.8)+ 0.04] = [3.3		(27)
Windows Type 6			8.1	x1/[1/	/(0.8)+ 0.04] = [6.28		(27)
Windows Type 7			4.05	x1/[1/	/(0.8)+ 0.04] = [3.14		(27)
Windows Type 8			2.16	x1/[1/	/(0.8)+ 0.04] = [1.67		(27)
Windows Type 9			5.24	x1/[1/	/(0.8)+ 0.04] = [4.06		(27)
Windows Type 1	0		6.34	x1/[1/	/(0.8)+ 0.04	-] = -	4.91		(27)
Windows Type 1	1		4.45	x1/[1/	/(0.8)+ 0.04	-] =	3.45		(27)
Windows Type 1	2		6.53	x1/[1/	/(0.8)+ 0.04	•] = -	5.06		(27)
Windows Type 1	3		6.35	x1/[1/	/(0.8)+ 0.04] =	4.92		(27)

Floor 7	Гуре 1					15	50.84	x	0.12	2 =	18.	1008			(28)
Floor 7	Гуре 2					;	3.6	x	0.2	=	0.	72			(28)
Floor 7	Гуре З					1	6.5	x	0.12	2 =	1.	98			(28)
Walls ⁻	Type1	419.	64	9	6.73	32	22.91	x	0.18	3 =	58	.12			(29)
Walls -	Type2	147.	94		0	14	7.94	x	0.18	3 =	26	.63			(29)
Roof -	Туре1	71.	1		7.82	6	3.28	x	0.14	4 =	8.	86			(30)
Roof -	Гуре2	7			0		7	x	0.14	4 =	0.	98			(30)
Roof -	ГуреЗ	50.	8		0	5	6.8	x	0.14	4 =	7.	11			(30)
Roof -	Гуре4	39.	6		0	3	9.6	×	0.14	4 =	5.	54			(30)
Total a	area of e	elements	s, m²			907.0)2	-				-			(31)
* for win ** incluc	dows and le the area	roof wind as on both	ows, use e sides of ir	effective wi nternal wal	indow U-va Is and par	alue calcul titions	ated using	g formul	la 1/[(1/U-valu	e)+0.04] a	as given in j	paragraph	3.2	
Fabric	heat los	ss, W/K	= S (A x	U)				(26)	.(30) +	+ (32) =				209.2	(33)
Heat c	apacity	Cm = S	(A x k)							((28).	(30) + (3	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	eter (TMI	P = Cm ·	÷ TFA) ii	n kJ/m²K	ζ.			Indica	tive Value	: Low		100	(35)
For desi can be ι	ign assess Ised inste	sments wh ad of a de	nere the de tailed calc	etails of the ulation.	construct	ion are no	t known pr	ecisely	the in	ndicative	values of	TMP in Ta	ble 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	opendix	K							69.93	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)					<i>(</i>)				
I otal f	abric he	at loss	.1. 1.4.	1						(33) +	· (36) =	(0.5) (5)		279.13	(37)
ventila	ation nea				y Max	l. un	1.1			(38)m	$= 0.33 \times$	(25)m x (5)	Dee	1	
(38)m=	257.18	256.06	254.97	249.84	248.88	244.41	244.41	243.	19 58	246.13	248.88	250.82	252.85		(38)
Hoat t	ancfor		nt W/K							(30)m	- (37) + ((38)m]	. ,
(39)m=	536.3	535.19	534.1	528.96	528	523.53	523.53	522	71	525.26	528	529.95	531.98	1	
(<u> </u>		Average =	= Sum(39)1	12 /12=	528.96	(39)
Heat lo	oss para	imeter (l	HLP), W	/m²K						(40)m	= (39)m -	÷ (4)			
(40)m=	1.14	1.14	1.14	1.13	1.13	1.12	1.12	1.1	1	1.12	1.13	1.13	1.13		
Numbe	er of day	/s in mo	nth (Tah	le 1a)							Average =	= Sum(40)₁	12 /12=	1.13	(40)
Numbe	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	ıa	Sep	Oct	Nov	Dec]	
(41)m=	31	28	31	30	31	30	31	31	~9	30	31	30	31		(41)
									J					1	
4. Wa	ater hea	tina ene	rav reau	irement:									kWh/v	ear:	
														-	
Assum if TF	ied occu A > 13. A = 13.	upancy, 9, N = 1 9 N = 1	N + 1.76 x	(1 - exp	o(-0.0003	349 x (TI	FA -13.9))2)] +	0.00)13 x (TFA -13	.9)	.35	J	(42)
Annua	l averag	je hot wa	ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x	: N) +	- 36		11	3.81]	(43)
Reduce	the annua	al average	hot water	usage by	5% if the c	welling is	designed	to achie	eve a	water us	se target o	f		J	
	- unat 125	illes per		uay (all N				<u> </u>				.	_	1	
	Jan	⊦eb	Mar	Apr	May	Jun	Jul	Au	ıg	Sep	Oct	Nov	Dec		

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Stri¢ ™a I	S&B. 291	2 1/2£015663 n:	110.64.0186 (5 A1 P195 9 2)	-1016p.9/8/vv	w 1.62 1.0102a.	c 00 2.42	106.98	111.53	116.08	120.63	125.19	Page 3	3 of 14
									-	Fotal = Su	m(44) =		1365.67	(44)

Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,n	n x nm x D	0Tm / 3600	kWh/mon	th (see Tal	bles 1b, 1c	:, 1d)		
(45)m=	185.65	162.37	167.55	146.07	140.16	120.95	112.08	128.61	130.15	151.67	165.56	179.79		
lf instan	taneous v	vater heati	ng at point	of use (no	o hot water	r storage),	enter 0 in l	boxes (46) to (61)	Total = Su	m(45) ₁₁₂ =	=	1790.6	(45)
(46)m=	27.85	24.36	25.13	21.91	21.02	18.14	16.81	19.29	19.52	22.75	24.83	26.97		(46)
Storac		i 1055. Na (litras)) includir	na anv s	olar or M	WHRS	storane	within s	ame ves	مما		200	1	(47)
If com	munity k	neating a	and no ta	ank in du	vellina e	onter 110) litres in	(47)		501		200	J	(47)
Otherv	vise if n	o stored	hot wate	er (this in	ncludes i	instantar	neous co	ombi boi	lers) ente	er '0' in (47)			
Water	storage	loss:											1	
a) If m _	nanufac	turer's de	eclared I	oss fact	or is kno	wn (kWl	n/day):				1	.2		(48)
Tempe	erature f	actor fro	m Table	2b							0.	54		(49)
Energy	y lost fro	om water turer's d	storage	e, kWh/y cylinder	ear loss fact	or is not	known:	(48) x (49) =		0.	65		(50)
Hot wa	ater stor	age loss	factor f	rom Tab	le 2 (kW	h/litre/da	ay)					0	1	(51)
If com	munity ł	neating s	ee secti	on 4.3	,		• /					-	1	
Volum	e factor	from Ta	ble 2a									0]	(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energ	y lost fro	om water	storage	e, kWh/y	ear			(47) x (51) x (52) x (53) =		0		(54)
Enter	(50) or	(54) in (5	55)						·		0.	65	J	(55)
Water	storage	loss cal	culated	for each	month			((56)m =	(55) × (41)	m				
(56)m=	20.09	18.14	20.09	19.44	20.09	19.44	20.09	20.09	19.44	20.09	19.44	20.09		(56)
If cylind	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=	20.09	18.14	20.09	19.44	20.09	19.44	20.09	20.09	19.44	20.09	19.44	20.09		(57)
Prima	ry circuit	loss (ar	nnual) fro	om Table	e 3							0]	(58)
Prima	ry 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	there is a	solar wa	ter heati	ng and a	a cylinde	r thermo	stat)		1	(50)
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	i loss ca	lculated	for each	month	(61)m =	(60) ÷ 3	65 × (41)m					1	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat req	uired for	water h	eating ca	alculated	d for eac	h month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	229	201.52	210.9	188.03	183.51	162.9	155.43	171.96	172.1	195.02	207.51	223.14		(62)
Solar D	HW input	calculated	using App	endix G o	r Appendix	k H (negati	ve quantit	y) (enter '()' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	I lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)				1	()
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter	1	1	-	1						1	
(64)m=	229	201.52	210.9	188.03	183.51	162.9	155.43	171.96	172.1	195.02	207.51	223.14		۰
								Out	put from w	ater heate	r (annual)₁	12	2301.02	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)n	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	96.41	85.31	90.39	82.13	81.28	73.78	71.95	77.44	76.83	85.11	88.61	94.46		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. In	ternal ga	ains (see	e Table S	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=	201.11	201.11	201.11	201.11	201.11	201.11	201.11	201.11	201.11	201.11	201.11	201.11	(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equati	ion L9 o	r L9a), a	lso see	Table 5				
(67)m=	135.09	119.98	97.58	73.87	55.22	46.62	50.37	65.48	87.88	111.59	130.24	138.84	(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, equ	uation L	13 or L1	3a), also	see Ta	ble 5			
(68)m=	871.91	880.95	858.15	809.62	748.34	690.76	652.29	643.24	666.04	714.58	775.85	833.43	(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5			
(69)m=	58.46	58.46	58.46	58.46	58.46	58.46	58.46	58.46	58.46	58.46	58.46	58.46	(69)
Pumps	s and fai	ns gains	(Table §	ōa)									
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses	s e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)							
(71)m=	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	-134.07	(71)
Water	heating	gains (T	able 5)										
(72)m=	129.58	126.95	121.49	114.07	109.25	102.47	96.7	104.09	106.72	114.4	123.07	126.96	(72)
Total i	nternal	gains =				(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72)	m	
(73)m=	1265.07	1256.39	1205.72	1126.06	1041.32	968.35	927.86	941.31	989.14	1069.06	1157.66	1227.74	(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 Table 6d	•	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	5.24	x	11.28	×	0.63	×	0.7	=	12.67	(75)
Northeast 0.9x	0.54	x	6.34	x	11.28	x	0.63	x	0.7	=	15.33	(75)
Northeast 0.9x	0.54	x	4.45	x	11.28	x	0.63	x	0.7	=	10.76	(75)
Northeast 0.9x	0.54	x	6.53	x	11.28	x	0.63	×	0.7	=	31.58	(75)
Northeast 0.9x	0.54	x	6.35	x	11.28	x	0.63	×	0.7	=	30.71	(75)
Northeast 0.9x	0.54	x	11.02	x	11.28	x	0.63	x	0.7	=	26.65	(75)
Northeast 0.9x	0.54	x	5.24	x	22.97	x	0.63	×	0.7	=	25.79	(75)
Northeast 0.9x	0.54	x	6.34	x	22.97	x	0.63	×	0.7	=	31.21	(75)
Northeast 0.9x	0.54	x	4.45	x	22.97	x	0.63	x	0.7	=	21.9	(75)
Northeast 0.9x	0.54	x	6.53	x	22.97	x	0.63	x	0.7	=	64.29	(75)
Northeast 0.9x	0.54	x	6.35	x	22.97	x	0.63	×	0.7	=	62.51	(75)
Northeast 0.9x	0.54	x	11.02	x	22.97	x	0.63	×	0.7	=	54.24	(75)
Northeast 0.9x	0.54	x	5.24	x	41.38	x	0.63	×	0.7	=	46.47	(75)
Northeast 0.9x	0.54	x	6.34	x	41.38	x	0.63	×	0.7	=	56.23	(75)
Northeast 0.9x	0.54	x	4.45	x	41.38	x	0.63	×	0.7	=	39.47	(75)
Northeast 0.9x	0.54	x	6.53	x	41.38	x	0.63	×	0.7	=	115.82	(75)
Northeast 0.9x	0.54	x	6.35	x	41.38	x	0.63	x	0.7	=	112.63	(75)
Northeast 0.9x	0.54	x	11.02	x	41.38	x	0.63	×	0.7	=	97.73	(75)
Northeast 0.9x	0.54	x	5.24	x	67.96	x	0.63	×	0.7	=	76.32	(75)
Northeast 0.9x	0.54	x	6.34	x	67.96	x	0.63	×	0.7	=	92.34	(75)
Northeast 0.9x	0.54	x	4.45	x	67.96	x	0.63	x	0.7	=	64.81	(75)

Northeast 0.9x	0.54	×	6.53	x	67.96	x	0.63	x	0.7	=	190.21	(75)
Northeast 0.9x	0.54	x	6.35	x	67.96	x	0.63	x	0.7	=	184.97	(75)
Northeast 0.9x	0.54	x	11.02	×	67.96	x	0.63	×	0.7	=	160.5	(75)
Northeast 0.9x	0.54	×	5.24	x	91.35	x	0.63	x	0.7	=	102.59	(75)
Northeast 0.9x	0.54	x	6.34	×	91.35	x	0.63	×	0.7	=	124.12	(75)
Northeast 0.9x	0.54	x	4.45	×	91.35	x	0.63	×	0.7	=	87.12	(75)
Northeast 0.9x	0.54	x	6.53	x	91.35	x	0.63	x	0.7	=	255.69	(75)
Northeast 0.9x	0.54	x	6.35	x	91.35	x	0.63	x	0.7	=	248.64	(75)
Northeast 0.9x	0.54	x	11.02	x	91.35	x	0.63	x	0.7	=	215.75	(75)
Northeast 0.9x	0.54	x	5.24	x	97.38	x	0.63	×	0.7	=	109.37	(75)
Northeast 0.9x	0.54	x	6.34	x	97.38	x	0.63	x	0.7] =	132.33	(75)
Northeast 0.9x	0.54	x	4.45	×	97.38	x	0.63	×	0.7	=	92.88	(75)
Northeast 0.9x	0.54	x	6.53	×	97.38	x	0.63	×	0.7	=	272.59	(75)
Northeast 0.9x	0.54	x	6.35	×	97.38	x	0.63	×	0.7	=	265.07	(75)
Northeast 0.9x	0.54	x	11.02	x	97.38	x	0.63	×	0.7	=	230.01	(75)
Northeast 0.9x	0.54	x	5.24	×	91.1	x	0.63	×	0.7] =	102.31	(75)
Northeast 0.9x	0.54	x	6.34	x	91.1	x	0.63	x	0.7	=	123.79	(75)
Northeast 0.9x	0.54	x	4.45	x	91.1	x	0.63	×	0.7	=	86.89	(75)
Northeast 0.9x	0.54	x	6.53	×	91.1	x	0.63	×	0.7	=	255	(75)
Northeast 0.9x	0.54	x	6.35	x	91.1	x	0.63	×	0.7	=	247.97	(75)
Northeast 0.9x	0.54	x	11.02	×	91.1	x	0.63	×	0.7] =	215.17	(75)
Northeast 0.9x	0.54	x	5.24	×	72.63	x	0.63	×	0.7] =	81.56	(75)
Northeast 0.9x	0.54	x	6.34	×	72.63	x	0.63	×	0.7	=	98.69	(75)
Northeast 0.9x	0.54	x	4.45	x	72.63	x	0.63	x	0.7	=	69.27	(75)
Northeast 0.9x	0.54	x	6.53	×	72.63	x	0.63	×	0.7	=	203.29	(75)
Northeast 0.9x	0.54	x	6.35	x	72.63	x	0.63	x	0.7	=	197.69	(75)
Northeast 0.9x	0.54	x	11.02	x	72.63	x	0.63	x	0.7	=	171.54	(75)
Northeast 0.9x	0.54	x	5.24	×	50.42	x	0.63	×	0.7	=	56.63	(75)
Northeast 0.9x	0.54	x	6.34	x	50.42	x	0.63	x	0.7	=	68.51	(75)
Northeast 0.9x	0.54	x	4.45	×	50.42	x	0.63	×	0.7	=	48.09	(75)
Northeast 0.9x	0.54	x	6.53	×	50.42	x	0.63	×	0.7	=	141.13	(75)
Northeast 0.9x	0.54	x	6.35	×	50.42	x	0.63	×	0.7	=	137.24	(75)
Northeast 0.9x	0.54	x	11.02	×	50.42	x	0.63	×	0.7	=	119.09	(75)
Northeast 0.9x	0.54	x	5.24	×	28.07	x	0.63	×	0.7	=	31.52	(75)
Northeast 0.9x	0.54	x	6.34	×	28.07	x	0.63	×	0.7	=	38.14	(75)
Northeast 0.9x	0.54	x	4.45	×	28.07	x	0.63	×	0.7	=	26.77	(75)
Northeast 0.9x	0.54	x	6.53	×	28.07	x	0.63	×	0.7	=	78.56	(75)
Northeast 0.9x	0.54	x	6.35	×	28.07	x	0.63	×	0.7	=	76.4	(75)
Northeast 0.9x	0.54	x	11.02	×	28.07	x	0.63	×	0.7	=	66.29	(75)
Northeast 0.9x	0.54	x	5.24	×	14.2	x	0.63	×	0.7	=	15.94	(75)
Northeast 0.9x	0.54	x	6.34	×	14.2	×	0.63	×	0.7	=	19.29	(75)

Northeast 0.9x	0.54	x	4.45	x	14.2	x	0.63	x	0.7	=	13.54	(75)
Northeast 0.9x	0.54	x	6.53	×	14.2	x	0.63	x	0.7	=	39.74	(75)
Northeast 0.9x	0.54	x	6.35	x	14.2	x	0.63	x	0.7	=	38.64	(75)
Northeast 0.9x	0.54	x	11.02	×	14.2	x	0.63	x	0.7] =	33.53	(75)
Northeast 0.9x	0.54	x	5.24	x	9.21	x	0.63	x	0.7	=	10.35	(75)
Northeast 0.9x	0.54	x	6.34	×	9.21	x	0.63	x	0.7] =	12.52	(75)
Northeast 0.9x	0.54	x	4.45	×	9.21	x	0.63	x	0.7] =	8.79	(75)
Northeast 0.9x	0.54	x	6.53	x	9.21	x	0.63	x	0.7	=	25.79	(75)
Northeast 0.9x	0.54	x	6.35	×	9.21	x	0.63	x	0.7	=	25.08	(75)
Northeast 0.9x	0.54	x	11.02	×	9.21	x	0.63	x	0.7	=	21.76	(75)
Southeast 0.9x	0.54	x	2.16	x	36.79	x	0.63	x	0.7	=	17.03	(77)
Southeast 0.9x	0.54	x	2.16	×	62.67	x	0.63	x	0.7	=	29.01	(77)
Southeast 0.9x	0.54	x	2.16	×	85.75	x	0.63	x	0.7] =	39.7	(77)
Southeast 0.9x	0.54	x	2.16	×	106.25	x	0.63	x	0.7	=	49.19	(77)
Southeast 0.9x	0.54	x	2.16	×	119.01	x	0.63	x	0.7] =	55.1	(77)
Southeast 0.9x	0.54	x	2.16	×	118.15	x	0.63	x	0.7	=	54.7	(77)
Southeast 0.9x	0.54	x	2.16	×	113.91	x	0.63	x	0.7	=	52.73	(77)
Southeast 0.9x	0.54	x	2.16	x	104.39	x	0.63	x	0.7	=	48.33	(77)
Southeast 0.9x	0.54	x	2.16	x	92.85	x	0.63	x	0.7	=	42.99	(77)
Southeast 0.9x	0.54	x	2.16	×	69.27	x	0.63	x	0.7	=	32.07	(77)
Southeast 0.9x	0.54	x	2.16	×	44.07	x	0.63	x	0.7	=	20.4	(77)
Southeast 0.9x	0.54	x	2.16	×	31.49	x	0.63	x	0.7] =	14.58	(77)
Southwest0.9x	0.54	x	4.16	×	36.79]	0.63	x	0.7	=	32.81	(79)
Southwest0.9x	0.54	x	3.41	×	36.79]	0.63	x	0.7] =	26.89	(79)
Southwest0.9x	0.54	x	6.81	×	36.79]	0.63	x	0.7] =	53.7	(79)
Southwest0.9x	0.54	x	2.3	×	36.79]	0.63	x	0.7	=	18.14	(79)
Southwest0.9x	0.54	x	4.26	×	36.79]	0.63	x	0.7	=	33.59	(79)
Southwest0.9x	0.54	x	8.1	×	36.79]	0.63	x	0.7] =	63.88	(79)
Southwest0.9x	0.54	x	4.05	×	36.79]	0.63	x	0.7	=	31.94	(79)
Southwest0.9x	0.54	x	4.16	x	62.67]	0.63	x	0.7	=	55.88	(79)
Southwest0.9x	0.54	x	3.41	×	62.67]	0.63	x	0.7	=	45.81	(79)
Southwest0.9x	0.54	x	6.81	×	62.67]	0.63	x	0.7	=	91.48	(79)
Southwest0.9x	0.54	x	2.3	×	62.67]	0.63	x	0.7] =	30.89	(79)
Southwest0.9x	0.54	x	4.26	×	62.67]	0.63	x	0.7	=	57.22	(79)
Southwest0.9x	0.54	x	8.1	×	62.67]	0.63	x	0.7] =	108.8	(79)
Southwest0.9x	0.54	x	4.05	×	62.67]	0.63	x	0.7] =	54.4	(79)
Southwest0.9x	0.54	x	4.16	×	85.75]	0.63	×	0.7	=	76.46	(79)
Southwest0.9x	0.54	x	3.41	×	85.75]	0.63	x	0.7] =	62.67	(79)
Southwest0.9x	0.54	x	6.81	×	85.75]	0.63	x	0.7	=	125.16	(79)
Southwest0.9x	0.54	x	2.3	×	85.75]	0.63	x	0.7	=	42.27	(79)
Southwest0.9x	0.54	x	4.26	×	85.75]	0.63	×	0.7	=	78.29	(79)

Southwest0.9x	0.54	x	8.1	x	85.75		0.63	x	0.7	=	148.87	(79)
Southwest0.9x	0.54	x	4.05	x	85.75]	0.63	x	0.7	=	74.44	(79)
Southwest0.9x	0.54	x	4.16	×	106.25	1	0.63	x	0.7	=	94.73	(79)
Southwest0.9x	0.54	x	3.41	×	106.25	1	0.63	x	0.7	=	77.65	(79)
Southwest0.9x	0.54	x	6.81	×	106.25	1	0.63	x	0.7	=	155.08	(79)
Southwest0.9x	0.54	×	2.3	×	106.25]	0.63	x	0.7] =	52.38	(79)
Southwest0.9x	0.54	x	4.26	×	106.25]	0.63	x	0.7] =	97.01	(79)
Southwest0.9x	0.54	x	8.1	×	106.25]	0.63	x	0.7] =	184.46	(79)
Southwest0.9x	0.54	x	4.05	x	106.25]	0.63	x	0.7	=	92.23	(79)
Southwest0.9x	0.54	x	4.16	x	119.01]	0.63	x	0.7	=	106.11	(79)
Southwest0.9x	0.54	x	3.41	x	119.01]	0.63	x	0.7	=	86.98	(79)
Southwest0.9x	0.54	x	6.81	×	119.01]	0.63	x	0.7	=	173.7	(79)
Southwest0.9x	0.54	x	2.3	×	119.01]	0.63	x	0.7	=	58.67	(79)
Southwest0.9x	0.54	x	4.26	×	119.01]	0.63	x	0.7	=	108.66	(79)
Southwest0.9x	0.54	x	8.1	×	119.01]	0.63	x	0.7	=	206.61	(79)
Southwest0.9x	0.54	x	4.05	×	119.01]	0.63	x	0.7	=	103.3	(79)
Southwest0.9x	0.54	x	4.16	x	118.15]	0.63	x	0.7	=	105.34	(79)
Southwest0.9x	0.54	x	3.41	×	118.15]	0.63	x	0.7	=	86.35	(79)
Southwest0.9x	0.54	x	6.81	×	118.15]	0.63	x	0.7	=	172.45	(79)
Southwest0.9x	0.54	x	2.3	×	118.15]	0.63	x	0.7	=	58.24	(79)
Southwest0.9x	0.54	x	4.26	x	118.15]	0.63	x	0.7	=	107.87	(79)
Southwest0.9x	0.54	x	8.1	×	118.15]	0.63	x	0.7	=	205.11	(79)
Southwest0.9x	0.54	x	4.05	x	118.15]	0.63	x	0.7	=	102.56	(79)
Southwest0.9x	0.54	x	4.16	x	113.91]	0.63	x	0.7	=	101.56	(79)
Southwest0.9x	0.54	x	3.41	x	113.91]	0.63	x	0.7	=	83.25	(79)
Southwest0.9x	0.54	x	6.81	x	113.91]	0.63	x	0.7	=	166.26	(79)
Southwest0.9x	0.54	x	2.3	x	113.91]	0.63	x	0.7	=	56.15	(79)
Southwest0.9x	0.54	x	4.26	x	113.91]	0.63	x	0.7	=	104	(79)
Southwest0.9x	0.54	x	8.1	x	113.91]	0.63	x	0.7	=	197.75	(79)
Southwest0.9x	0.54	x	4.05	x	113.91]	0.63	x	0.7	=	98.88	(79)
Southwest0.9x	0.54	x	4.16	x	104.39]	0.63	x	0.7	=	93.07	(79)
Southwest0.9x	0.54	x	3.41	×	104.39]	0.63	x	0.7	=	76.29	(79)
Southwest0.9x	0.54	x	6.81	×	104.39]	0.63	x	0.7	=	152.36	(79)
Southwest0.9x	0.54	x	2.3	×	104.39]	0.63	x	0.7	=	51.46	(79)
Southwest0.9x	0.54	x	4.26	×	104.39]	0.63	x	0.7	=	95.31	(79)
Southwest0.9x	0.54	x	8.1	×	104.39]	0.63	x	0.7	=	181.23	(79)
Southwest0.9x	0.54	×	4.05	×	104.39]	0.63	x	0.7	=	90.61	(79)
Southwest0.9x	0.54	×	4.16	×	92.85]	0.63	x	0.7	=	82.79	(79)
Southwest0.9x	0.54	×	3.41	×	92.85]	0.63	×	0.7	=	67.86	(79)
Southwest0.9x	0.54	×	6.81	×	92.85		0.63	x	0.7	=	135.52	(79)
Southwest0.9x	0.54	x	2.3	×	92.85]	0.63	x	0.7	=	45.77	(79)

Southwest0.9x	0.54	×	4.26	x	92.85		0.63	x	0.7	=	84.78	(79)
Southwest0.9x	0.54	x	8.1	x	92.85	1	0.63	x	0.7	=	161.19	(79)
Southwest0.9x	0.54	x	4.05	×	92.85	1	0.63	×	0.7] =	80.6	(79)
Southwest0.9x	0.54	x	4.16	x	69.27	1	0.63	x	0.7	=	61.76	(79)
Southwest0.9x	0.54	x	3.41	x	69.27	1	0.63	x	0.7	=	50.62	(79)
Southwest0.9x	0.54	x	6.81	x	69.27	1	0.63	x	0.7	=	101.1	(79)
Southwest0.9x	0.54	x	2.3	×	69.27	1	0.63	×	0.7] =	34.15	(79)
Southwest0.9x	0.54	x	4.26	×	69.27]	0.63	×	0.7] =	63.24	(79)
Southwest0.9x	0.54	x	8.1	×	69.27]	0.63	×	0.7] =	120.25	(79)
Southwest0.9x	0.54	x	4.05	×	69.27	1	0.63	×	0.7	=	60.13	(79)
Southwest0.9x	0.54	x	4.16	×	44.07]	0.63	×	0.7] =	39.29	(79)
Southwest0.9x	0.54	x	3.41	×	44.07]	0.63	×	0.7] =	32.21	(79)
Southwest0.9x	0.54	x	6.81	×	44.07	1	0.63	×	0.7	=	64.32	(79)
Southwest0.9x	0.54	x	2.3	×	44.07	1	0.63	×	0.7] =	21.72	(79)
Southwest0.9x	0.54	x	4.26	x	44.07	1	0.63	x	0.7	=	40.24	(79)
Southwest0.9x	0.54	x	8.1	x	44.07	1	0.63	x	0.7	=	76.51	(79)
Southwest0.9x	0.54	x	4.05	×	44.07	1	0.63	x	0.7] =	38.25	(79)
Southwest0.9x	0.54	x	4.16	x	31.49	1	0.63	x	0.7	=	28.07	(79)
Southwest0.9x	0.54	x	3.41	×	31.49	1	0.63	×	0.7] =	23.01	(79)
Southwest0.9x	0.54	x	6.81	x	31.49	1	0.63	x	0.7	=	45.96	(79)
Southwest0.9x	0.54	x	2.3	x	31.49	1	0.63	x	0.7	=	15.52	(79)
Southwest0.9x	0.54	x	4.26	x	31.49	1	0.63	x	0.7	=	28.75	(79)
Southwest0.9x	0.54	x	8.1	×	31.49	1	0.63	x	0.7] =	54.66	(79)
Southwest0.9x	0.54	x	4.05	x	31.49	1	0.63	x	0.7	=	27.33	(79)
Northwest 0.9x	0.54	x	4.59	x	11.28	x	0.63	x	0.7] =	11.1	(81)
Northwest 0.9x	0.54	x	4.59	x	22.97	x	0.63	x	0.7	=	22.59	(81)
Northwest 0.9x	0.54	x	4.59	×	41.38	x	0.63	×	0.7	=	40.71	(81)
Northwest 0.9x	0.54	x	4.59	×	67.96	×	0.63	×	0.7	=	66.85	(81)
Northwest 0.9x	0.54	x	4.59	×	91.35	x	0.63	×	0.7] =	89.86	(81)
Northwest 0.9x	0.54	x	4.59	×	97.38	x	0.63	×	0.7] =	95.8	(81)
Northwest 0.9x	0.54	x	4.59	×	91.1	x	0.63	×	0.7] =	89.62	(81)
Northwest 0.9x	0.54	x	4.59	×	72.63	x	0.63	×	0.7] =	71.45	(81)
Northwest 0.9x	0.54	x	4.59	x	50.42	x	0.63	x	0.7] =	49.6	(81)
Northwest 0.9x	0.54	x	4.59	x	28.07	x	0.63	x	0.7	=	27.61	(81)
Northwest 0.9x	0.54	x	4.59	x	14.2	x	0.63	x	0.7	=	13.97	(81)
Northwest 0.9x	0.54	x	4.59	x	9.21	x	0.63	×	0.7] =	9.06	(81)
Rooflights 0.9x	1	x	3.49	×	26	x	0	×	0.8	=	0	(82)
Rooflights 0.9x	1	x	4.33	×	26	x	0	×	0.8	=	0	(82)
Rooflights 0.9x	1	x	3.49	×	54	x	0	×	0.8] =	0	(82)
Rooflights 0.9x	1	x	4.33	×	54	×	0	×	0.8] =	0	(82)
Rooflights 0.9x	1	x	3.49	×	96	x	0	×	0.8] =	0	(82)
		-				-				-		

Rooflig	hts <mark>0.9x</mark>	1	х	4	.33	×		96	x	0		x	0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	.49	×		150	x	0		x	0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	.33	x		150	x	0		x [0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	.49	×		192	x	0		x	0.8	-	= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	.33	×		192	x	0		x [0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	.49	x		200	x	0		x [0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	.33	×		200	x	0		x	0.8	-	= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	.49	×		189	x	0		x [0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	.33	×		189	x	0		x	0.8	-	= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	.49	×		157	x	0		x [0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	.33	×		157	x	0		x [0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	.49	×		115	x	0		x	0.8		- [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	.33	×		115	x	0		x	0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	.49	×		66	x	0		x [0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	.33	×		66	x	0		x	0.8		- [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	.49	×		33	x	0		x	0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	.33	×		33	x	0		x	0.8	:	= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	3	.49	×		21	x	0		x	0.8		= [0	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	4	.33	×		21	x	0		x	0.8		= [0	(82)
(83)m= Total <u>g</u> (84)m=	416.78 jains – i 1681.86	756.04 nternal a 2012.43	1156.91 and sola 2362.64	1638.74 r (84)m 2764.8	2022.8 = (73)r 3064.2	n + (21 3	090.68 (83)m 059.02	1981.34 , watts 2909.2	(00)n 1682 2623	2.15 1321.7 3.46 2310.9	79 868 13 193	7.6	507.61 7 1665.27	351.2 1578.9	5 99		(83) (84)
7. Me	an inter	nal temp	perature	(heatir	a seaso	on)			•								
Temp Utilisa	erature ation fac	during h tor for a	neating p ains for	periods living a	in the li rea, h1,	ving m (s	area see Ta	from Tal able 9a)	ble 9	, Th1 (°C)					[21	(85)
	Jan	Feb	Mar	Apr	Ma	y È	Jun	Jul	A	ug Sep)ct	Nov	Dec	2		
(86)m=	0.99	0.98	0.97	0.94	0.87		0.76	0.64	0.6	69 0.86	0.9	96	0.98	0.99			(86)
Mean	interna	l temper	ature in	living a	rea T1	(follo	ow ste	ps 3 to 7	7 in T	able 9c)							
(87)m=	18.81	19	19.33	19.8	20.25	5	20.6	20.77	20.	73 20.43	19.	.85	19.25	18.78	3		(87)
Temr	erature	durina h	neating r	heriods	in rest (of dy	velling	from Ta	ahle (9 Th2 (°C))						
(88)m=	19.97	19.97	19.97	19.98	19.98		19.99	19.99	19.	99 19.98	/	.98	19.98	19.97	,		(88)
l Itilie:	ation fac	tor for a	ains for	rest of	dwelling	n h2	2 m (se	n Do Tablo	(02)								
(89)m=	0.99	0.98	0.96	0.92	0.84	<i>,</i> 112	0.7	0.53	0.0	6 0.82	0.9	95	0.98	0.99			(89)
Moon	intorna	ltompor	atura in	the rec	t of dwg		л ТЭ (f	ollow sta		to 7 in To		••					
(90)m=	16.99	17.26	17.75	18.43	19.07	, ,	19.55	19.75	19. ⁻	71 19.33	18	,) .52	17.64	16.95	5		(90)
· / "									L		fLA =	Liv	ving area ÷ (4	·) =	\neg	0.07	(91)
Moor	intorna	Itompor	aturo (f	or the v	iholo du	ر الم) – t	I A 🗸 T4	⊥ /1	fl ለነ 🗤 ተ	· 2				L		
(92)m=	17.12	17.39	17.87	18.53	19.16		19.62	19.82	+ (1 19.	78 19.41	<u>~</u> 18.	.61	17.76	17.08	3		(92)
· · · · ·								-					-				

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

(93)m=	16.97	17.24	17.72	18.38	19.01	19.47	19.67	19.63	19.26	18.46	17.61	16.93		(93)
8. Sp	ace hea	ting req	uiremen	t										
Set T the ut	i to the ilisation	mean int	ternal te or gains	mperatu using Ta	re obtair able 9a	ned at ste	ep 11 of	Table 9	b, so tha	ıt Ti,m=(76)m an	d re-calc	culate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	jains, hr	<u>י</u> ו:					·					
(94)m=	0.98	0.97	0.95	0.89	0.8	0.66	0.49	0.56	0.78	0.92	0.97	0.98		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (8	4)m	-	-	-		-				
(95)m=	1649.02	1949.59	2234.03	2474.49	2460.87	2012.9	1439.47	1457.07	1805.91	1790.87	1616.41	1552.68		(95)
Mont	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		(96)
Heat	loss rat	e for me	an interr	nal temp	erature,	Lm,W:	=[(39)m	x [(93)m	– (96)m]			1	
(97)m=	6795.04	6601.97	5991.22	5015.71	3857.77	2551.5	1606.94	1690.22	2711.06	4151.24	5568.1	6773.57		(97)
Space	e heatin	g requir	ement fo	or each r	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95	5)m] x (4	1)m		1	
(98)m=	3828.64	3126.4	2795.35	1829.68	1039.29	0	0	0	0	1756.11	2845.22	3884.34		-
								Tota	al per year	(kWh/yea	r) = Sum(9	98) _{15,912} =	21105.03	(98)
Space	e heatin	g requir	ement ir	kWh/m ²	²/year								44.99	(99)
8c. S	pace co	oling rea	quiremer	nt										_
Calcu	lated fo	r June, .	July and	August.	See Ta	ble 10b								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rat	e Lm (ca	alculated	using 2	5°C inter	rnal tem	oerature	and ext	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	4921.23	3874.16	3972.57	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	oss hm								1			
(101)m=	0	0	0	0	0	0.61	0.69	0.63	0	0	0	0		(101)
Usefu	ul loss, h	nmLm (V	Vatts) =	(100)m >	k (101)m			1		1			1	
(102)m=	0	0	0	0	0	3023.2	2665.99	2519.97	0	0	0	0		(102)
Gains	s (solar	gains ca	lculated	for appl	icable w	eather re	egion, se	e Table	10)		1		l	(1.0.0)
(103)m=	0	0	0	0	0	3675.48	3493.26	3118.87	0	0	0	0		(103)
Space	e coolin 04)m to	g require zero if (<i>ement fo</i> (104)m ≼	or month, < 3 × (98	, <i>whole c</i> .)m	lwelling,	continue	ous (kW	(h) = 0.02	24 x [(10)3)m – (1	102)m]x	r (41)m	
(104)m=	0		0	0	0	0	615.5	445.58	0	0	0	0		
			I	I	I			I	I Tota	I I = Sumi	(104)	I	1061.08	(104)
Cooled	d fractio	n							f C =	cooled	area ÷ (4) =	0.51	(105)
Interm	ittency f	actor (T	able 10b)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
									Tota	l = Sum	(104)	=	0	(106)
Space	cooling	require	ment for	month =	= (104)m	× (105)	× (106)r	n	T	I.		1	I	_
(107)m=	0	0	0	0	0	0	78.72	56.99	0	0	0	0		-
									Tota	I = Sum((107)	=	135.71	(107)
Space	cooling	require	ment in I	×Wh/m²/	year				(107) ÷ (4) =			0.29	(108)
9a. En	ergy rea	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatiı	ng:												_
Fract	ion of s	bace hea	at from s	econdar	y/supple	mentary	y system						0.1	(201)
Fract	ion of s	bace hea	at from n	nain syst	tem(s)			(202) = 1	– (201) =				0.9	(202)
Fract	ion of to	tal heati	ng from	main sy	stem 1			(204) = (2	02) × [1 –	(203)] =			0.9	(204)

Effici	ency of	main spa	ace heat	ting syste	em 1								89.7	(206)
Effici	ency of	seconda	ry/suppl	ementar	ry heating	g syster	n, %						90	(208)
Cooli	ng Syste	em Ener	gy Effici	ency Ra	tio								4.32	(209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Spac	e heatin	g require	ement (o	calculate	d above))				4750.44	00.45.00	000404		
()	3828.64	3126.4	2795.35	1829.68	1039.29	0	0	0	0	1756.11	2845.22	3884.34		
(211)n	$n = \{[(98)] 3841.45\}$)m x (20)4)] } X ^	100 ÷ (20	J6) 1042 77	0	0	0	0	1761 00	2854 73	3807 33		(211)
	5041.45	5150.05	2004.7	1000.0	1042.77	0	0	Tota	al (kWh/yea	ar) =Sum(2004.73 211) _{1.510,11}	=	21175 62	(211)
Spac	e heatin	a fuel (s	econdar	v). kWh	/month					, ,	,		21110.02	
= {[(98	s)m x (20	01)] } x 1	00 ÷ (20)))))8)										
(215)m=	425.4	347.38	310.59	203.3	115.48	0	0	0	0	195.12	316.14	431.59		_
								Tota	al (kWh/yea	ar) =Sum(215) _{15,101}	2=	2345	(215)
Water	heating]												
Outpu	t from w	ater hea	ter (calc	ulated a	bove) 183.51	162.9	155 43	171 96	172 1	195 02	207 51	223 14		
Efficie	1CV of w	ater hea	ter	100.00	100.01	102.0	100.10			100.02	201.01	220.11	79	(216)
(217)m=	88.95	88.9	88.77	88.47	87.75	79	79	79	79	88.39	88.8	88.98	-	(217)
Fuel fo	or water	heating,	kWh/m	onth					L			11		
(219)n	<u>n = (64)</u>	<u>m x 10</u>) <u>÷ (217</u>)m	000.40		400 74	047.07		000.05		050 70		
(219)m=	257.45	226.7	237.58	212.53	209.13	206.2	196.74	217.67 Tota	217.84	220.65	233.69	250.78	0000 07	(210)
Snace	coolin	a fuol k	Wh/mor	ath				1010		1500) ₁₁₂ –			2080.97	(219)
(221)n	n = (107))m÷ (20	9)											
(221)m=	0	0	0	0	0	0	18.22	13.19	0	0	0	0		_
								Tota	al = Sum(2	21) ₆₈ =			31.41	(221)
Annua	al totals									k	Wh/yea	r	kWh/year	-
Space	heating	fuel use	ed, main	system	1								21175.62	ļ
Space	heating	fuel use	ed, seco	ndary									2345	
Water	heating	fuel use	ed										2686.97	
Space	cooling	fuel use	ed										31.41]
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								
centr	al heatir	ng pump	:									30		(230c)
boile	r with a f	an-assis	sted flue									45		(230e)
Total e	electricit	y for the	above,	kWh/yea	ar			sum	of (230a)	(230g) =			75	(231)
Electri	city for I	ighting											954.27	 (232)
Electri	city gen	erated b	y PVs										-4116.75	(233)
10a.	Fuel cos	sts - indiv	vidual he	eating sy	vstems:									
						E.	ol			Eucl B	Prico		Eucl Cost	
						kV	Vh/year			(Table	12)		£/year	
Space	heating	- main s	system ?	1		(21	1) x			3.4	48	x 0.01 =	736.91	(240)
										۱ <u>ـــــ</u>				- ·

Space heating - main system 2	(213) x	0 × 0.01 =	0	(241)
Space heating - secondary	(215) x	3.48 × 0.01 =	81.61	(242)
Water heating cost (other fuel)	(219)	3.48 × 0.01 =	93.51	(247)
Space cooling	(221)	13.19 × 0.01 =	4.14	(248)
Pumps, fans and electric keep-hot	(231)	13.19 × 0.01 =	9.89	(249)
(if off-peak tariff, list each of (230a) to (23 Energy for lighting	0g) separately as applicable and (232)	apply fuel price according to 13.19 × 0.01 =	Table 12a 125.87	(250)
Additional standing charges (Table 12)			120	(251)
	one of (233) to (235) x)	13.19 × 0.01 =	-543	(252)
Appendix Q items: repeat lines (253) and	(254) as needed			J, ,
Total energy cost	(245)(247) + (250)(254) =		628.93	(255)
11a. SAP rating - individual heating syste	ms			
Energy cost deflator (Table 12)			0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =		0.51	(257)
SAP rating (Section 12)			92.83	(258)
12a. CO2 emissions – Individual heating	systems including micro-CHP			
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.216 =	4573.93	(261)
Space heating (secondary)	(215) x	0.216 =	506.52	(263)
Water heating	(219) x	0.216 =	580.39	(264)
Space and water heating	(261) + (262) + (263) + (264	4) =	5660.84	(265)
Space cooling	(221) x	0.519 =	16.2	(266)
Electricity for pumps, fans and electric ke	ep-hot (231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	495.27	(268)
Energy saving/generation technologies Item 1		0.519 =	-2136.59	(269)
Total CO2, kg/year		sum of (265)(271) =	4074.75	(272)
CO2 emissions per m ²		(272) ÷ (4) =	8.69	(273)
El rating (section 14)			89	(274)
13a. Primary Energy				
	Energy	Primary	P. Energy	
	kvvn/year	factor	kvvn/year	
Space heating (main system 1)	(211) x	factor =	kWh/year 25834.26	(261)

(219) x

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Energy for water heating

(264)

3278.1

1.22

Space and water heating	(261) + (262) + (263) + (26	4) =	[31973.26	(265)
Space cooling	(221) x	3.07 =	- [96.44	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07 =	- [230.25	(267)
Electricity for lighting	(232) x	0 =	- [2929.62	(268)
Energy saving/generation technologies Item 1		3.07 =	= [-12638.41	(269)
'Total Primary Energy		sum of (265)(271) =	[22591.16	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =	[48.15	(273)