

# **ENERGY STATEMENT ADDENDUM**

NEW HOUSE, 68-70 BOVILL ROAD, LONDON, SE23 1EJ

CONSULT JA LTD

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**ASSESSMENT INFORMATION** 

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This report is prepared for the use of 68-70 Bovill Road, a duty of care is not owed to other parties.

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#### NEW HOUSE, 68-70 BOVILL ROAD, LONDON, SE23 1EJ

This report is an addendum to previously submitted energy statement, following changes in the proposed heating strategy for newly constructed house from heat pump to gas boiler. The London Plan approach of "Be lean" – "Be clean" – "Be green" is fully adopted by implementing:

- Passive measures (low U-values, air permeability, avoidance of thermal bridging by accredited details)
- High efficiency services, i.e., high efficiency ventilation with heat recovery, high efficiency lighting
- Renewable sources: solar PV

Excluded renewable sources are:

- Solar hot water
- Biomass
- Wind turbines
- Heat pumps

The proposed development will achieve:

- 41% domestic regulated CO2 reduction against 2013 Part L compliant baseline
- 23% domestic regulated CO2 reduction by renewable sources
- 18% domestic regulated CO2 reduction by efficiency measures ("Be Lean" stage of the energy hierarchy)

About the energy statement

Consult JA 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.

Specific requirements of London Plan on Energy Efficiency and Renewable Energy will be met through a combination of passive design features, energy efficient building services and renewable energy sources. This is to comply fully with the London Plan Policies and ensure they are following the "Energy Hierarchy". This document has been prepared in line with the GLA Energy Team Guidance on Planning Energy Assessments.

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Baseline and all estimated energy consumptions have been calculated using a SAP 2012 assessment, with 10.2 carbon factors applied to calculate the CO2 reductions.

The table below shows 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.

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO <sub>2</sub> per annum)								
	Regulated	Unregulated							
Baseline: Part L 2013 of the Building Regulations Compliant Development	1.6	0.4							
After energy demand reduction (be lean)	1.3	0.4							
After renewable energy (be green)	1.0	0.4							

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings								
	(Tonnes CO <sub>2</sub> per annum)	(%)							
Be lean: Savings from energy demand reduction	0.3	18%							
Be green: Savings from renewable energy	0.4	23%							
Cumulative on site savings	0.7	41%							

#### SAP results summary of the proposed development

DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS												
Unit identifier (e.a. plot	Model total floor area (m²)	REGULATED EN	ERGY CONSUMF GREEN' SAP DE	TION PER UNIT R WORKSHEET	(kWh p.a.) - 'BE	SAP 10.2 REGULATED CO2 EMISSIONS PER UNIT						
number, dwelling		Space Heating (Heat Source 1)	Domestic Hot Water	Lighting	Auxiliary	Space Heating	Domestic Hot Water	SAP 10.2 CO <sub>2</sub> emissions	Calculated DER SAP 10.0			
.,,			(Heat Source 1) (kgCO <sub>2</sub> p.a.) (kgCO <sub>2</sub> /									
House	98.9	3307	2635	401	331	694	553	972	9.8			

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

Specification	Notional Baseline	Efficient Baseline (Be Lean)	Proposed Development (Be Green)			
Ground floor U-value	0.13	0.	13			
External Wall U-value	0.18	0.	18			
Flat Roof U-value	0.13	0.	11			
Pitched roof with insulation at rafter level U-value	0.13	0.	11			
Windows and glazed doors U-value	1.4	1	.2			
Air Permeability (m3/h.m2)	5		5			
Thermal bridging	Accredited construction details Generally in line with Recognised Construction Details					
Ventilation System	Natural ventilation with intermittent mechanical extracts MVHR Nuaire MRXBOXAB-Eco3 or equivalent approved by SAP asso Supply and extract duct to and from exterior has to be insulated with 25mm i than 2m long or 50mm thickness for ducts over 2m long					
Space Heating System and hot water	Gas boiler, SEDBUK efficiency 89.5%, ratdiators, time and temperature zone control, weather compensator	Gas boiler Vaillant EcoTec Plus 418 or equivalent approved by SAP assessor, radiators, time and temperature zone control, delayed start thermostat; Indirect cylinder	Gas boiler Vaillant EcoTec Plus 418 or equivalent approved by SAP assessor, radiators, time and temperature zone control, delayed start thermostat; Indirect cylinder			
Renewable	-	-	Solar PV system with total peak output of 3.2 kWp (e.g. 8 panels @ 0.4 kWp each), installed on the south facing pitched roof			
Low energy lights	100%	100%	100%			
% Improvement in CO2 over Building regulations compliant baseline	0.0%	18.2%	41%			

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# **PLANNING FRAMEWORK**

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	m
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 low carbon 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.
THE NEW LONDON PLAN	<ul> <li>The London Plan is the name given to the Mayor's spatial development strategy. The current version of London Plan was adopted in March 2021. The aim is to develop London as an exemplary sustainable world city, based on three interwoven themes.</li> <li>Strong, diverse long term economic growth</li> <li>Social inclusivity to give all Londoners the opportunity to share in London's future success</li> <li>Fundamental improvements in London's environment and use of resources.</li> </ul>
	Specific requirements on development sustainability are set out in the following policies:

Policy SI 2 Minimising CO2 emissions

A. Major development should be net zero-carbon.151 This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:
1) be lean: use less energy and manage demand during

1) be lean: use less energy and manage demand during operation

# **PLANNING FRAMEWORK**

#### NEW HOUSE, 68-70 BOVILL ROAD, LONDON, SE23 1EJ

2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly3) be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site4) be seen: monitor, verify and report on energy performance.

- B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.
- C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations 152 is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
  - 1) through a cash in lieu contribution to the borough's carbon offset fund, or

2) off-site provided that an alternative proposal is identified and delivery is certain.

D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.

Policy SI 3 D – Energy Infrastructure

> Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system:

- 1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
  - a) connect to local existing or planned heat networks
  - b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
  - c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)

# **PLANNING FRAMEWORK**

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- d) use ultra-low NOx gas boilers
- 2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality
- 3) where a heat network is planned but not yet in existence the development should be designed to allow for the costeffective connection at a later date.

#### Policy SI 4 – Managing heat Risk

- A. Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.
- B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure

2) minimise internal heat generation through energy efficient design

3) manage the heat within the building through exposed internal thermal mass and high ceilings

- 4) provide passive ventilation
- 5) provide mechanical ventilation
- 6) provide active cooling systems.

# BE LEAN: PASSIVE DESIGN MEASURES AND EFFICIENT SERVICES

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Number of passive design measures and measures improving energy efficiency of building services have been included in the design to underline the "Passive first" approach in the scheme design. Implemented measures are summarised in Table 3 of this report and include:

#### LOW U-VALUES OF BUILDING FABRIC



Thermal performance of fabric is the most important aspect of passive measures mosaic. Low U-values ensure, that the amount of heat transmitted through building external elements is minimised. This is achieved by using highly insulated building materials with low thermal conductivity.

Notional dwelling U-values as set out in 2021 Part L1 are generally followed with small variations in the proposed scheme. The current notional building U-values are already challenging in real world and making significant improvements over them is usually not practical from payback and technical point of view.

#### AVOIDANCE OF THERMAL BRIDGING



Thermal bridges occur at all junctions between building thermal elements, typically at junctions between wall/floor, wall/roof etc. Recent changes in the building regulations have emphasized the significance of thermal bridging in building design.

Continuity of insulation has to be maximised in order to minimise thermal bridging. Calculations presented in this energy statement and current proposal are based on thermal bridging Psi-values from Recognised Construction Details. Psi-values of all applicable junctions will be assessed by a suitably qualified assessor at the detailed design stage by either:

- Custom Psi-value calculation by 2D thermal modelling
- Psi value from database of approved details

# BE LEAN: PASSIVE DESIGN MEASURES AND EFFICIENT SERVICES

#### NEW HOUSE, 68-70 BOVILL ROAD, LONDON, SE23 1EJ

#### AIR TIGHTNESS



Air tight buildings minimise their heat loss through infiltration of cold air through gaps and cracks in building envelope. Air tightness of buildings is expressed as air permeability rate. Air permeability rate of 5.0 m3/h.m2 is set out as a reference value for the current building regulations notional dwelling. This value has to be confirmed by postconstruction air tightness testing.

#### MECHANICAL VENTILATION WITH HEAT RECOVERY



Building regulations Part F recommends mechanical ventilation for dwellings with design air permeability of 5 or less. The most efficient form of mechanical ventilation is the heat recovery ventilation, where warm air extracted from bathrooms and kitchen passes the heat on to the supply air in heat exchanger. Supply air is then distributed to habitable rooms (bedrooms, living rooms).

To meet a good practice for MVHR efficiency, the installed units have to have hight heat recovery efficiency and low specific fan power. Such performance can be verified by choosing units from SAP Product Characteristics Database. Ductwork between the unit and exterior (supply and extract) has to be insulated to "Level 1" standard, i.e. 25mm insulation if less than 2m long or 50mm thickness for ducts over 2m long.

#### HIGH EFFICIENCY LIGHTING



While previous versions of Part L1 recognised low energy lighting to certain degree, the impact of low energy lighting is more accurate and more significant in the new 2021 Part L. All installed light fittings need to be included in detail in the assessment. To meet the efficiency level of notional reference dwelling, the installed power density shouldn't exceed 2.3 W/m2 and all light fittings should achieve a luminaire efficacy of at least 80 lm/W

# BE LEAN: PASSIVE DESIGN MEASURES AND EFFICIENT SERVICES

### NEW HOUSE, 68-70 BOVILL ROAD, LONDON, SE23 1EJ

#### WATER EFFICIENCY



Reducing general water consumption in dwellings also reduces amount of energy needed to provide hot water. New Part L1 notional building therefore allows for overall water consumption of 125 l/person.day and more specifically, showers with flow rate of 8 l/min.

# BE CLEAN: DISTRICT HEATING AND CHP

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#### **COMBINED HEAT AND POWER**

Although gas CHP's used to help to reduce CO2 emissions by delivering heat and electricity locally and reducing the losses that normally occur by conventional power plants. This is no longer true, after significant grid electricity de-carbonisation in recent years. Any local electricity generation using fossil fuels (e.g. mains gas) will deliver electricity with higher carbon footprint than grid electricity. Combined heat and power is therefore no longer considered a low carbon technology.

DISTRICT HEATING CONNECTION

District heating connection is not feasible due to the size and nature of this development (single house).

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#### BE GREEN: ON-SITE RENEWABLE ENERGY SOURCES - SOLAR HOT WATER

#### **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 has been ruled out as a less suitable system compared to the proposed solar PV. Solar photovoltaic is preferred due to longer life span and higher CO2 savings.

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#### **BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - AIR SOURCE HEAT PUMPS**

#### **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  $15^{\circ}$  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.





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#### AIR-TO-AIR SYSTEM

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 pump has been ruled out due to the negative impact upon the usability of amenity space especially once the plant is enclosed to prevent disturbance to residents/neighbours.

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#### **BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - SOLAR PHOTOVOLTAICS**

#### **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 6 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  $30^{\circ}$  and  $40^{\circ}$  inclination.



RECOMMENDATIONS SPECIFIC TO THIS DEVELOPMENT

It is proposed to install a PV system on the south facing pitched roof, as indicated on architect roof plan, with total peak output of 3.2 kWp (e.g. 8 panels @ 0.4 kWp each). This is considered as a maximum PV system that can fit on the roof.

#### NEW HOUSE, 68-70 BOVILL ROAD, LONDON, SE23 1EJ

#### BE GREEN: ON-SITE RENEWABLE ENERGY SOURCE - GROUND SOURCE HEAT PUMP

#### **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



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- 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 higher installation cost maintenance and running cost compared to the proposed heating solution.

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

#### **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.

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

**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.

# CONCLUSION

#### NEW HOUSE, 68-70 BOVILL ROAD, LONDON, SE23 1EJ

The London Plan approach of "Be lean" – "Be clean" – "Be green" is fully adopted by implementing:

- Passive measures (low U-values, air permeability, avoidance of thermal bridging by accredited details)
- High efficiency services, i.e., high efficiency ventilation with heat recovery, high efficiency lighting
- Renewable sources: solar PV

Excluded renewable sources are:

- Solar hot water
- Biomass
- Wind turbines
- Heat pumps

The proposed development will achieve:

- 41% domestic regulated CO2 reduction against 2013 Part L compliant baseline
- 23% domestic regulated CO2 reduction by renewable sources
- 18% domestic regulated CO2 reduction by efficiency measures ("Be Lean" stage of the energy hierarchy)

User Details:											
Assessor Name:	Ondrej Ga	jdos			Strom	a Num	ber:		STRO	006629	
Software Name:	Stroma FS	SAP 201	2		Softwa	are Vei	rsion:		Versio	n: 1.0.5.60	
			Р	roperty	Address	: Be Lea	n				
Address :	Be Lean, 68	3-70 Bov	ill Road,	LONDO	ON, SE2	3 1EJ					
1. Overall dwelling dimen	sions:										
Cround floor				Area	a(m²)		Av. Hei	ght(m)		Volume(m <sup>3</sup> )	
					37.5	(1a) x	2.	.4	(2a) =	90	(3a)
First floor				:	30.7	(1b) x	2.0	65	(2b) =	81.36	(3b)
Second floor				;	30.7	(1c) x	2.	.3	(2c) =	70.61	(3c)
Total floor area TFA = (1a)	)+(1b)+(1c)+	(1d)+(1e	)+(1r	ı) <u> </u>	98.9	(4)					
Dwelling volume						(3a)+(3b	)+(3c)+(3d)	+(3e)+	.(3n) =	241.97	(5)
2. Ventilation rate:											
	main heating	se h	econdar leating	у	other		total			m <sup>3</sup> per hour	
Number of chimneys	0	+	0	+	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0	+	0	] + [	0	] = [	0	x 2	20 =	0	(6b)
Number of intermittent fan	s					Ē	3	x ′	10 =	30	(7a)
Number of passive vents						Г	0	x ^	10 =	0	(7b)
Number of flueless gas fire	es					Г	0	x 4	40 =	0	(7c)
									Air ch	anges per ho	ur
Infiltration due to chimneys	s, flues and f	ans = (6	a)+(6b)+(7	a)+(7b)+(	7c) =		30		÷ (5) =	0.12	(8)
If a pressurisation test has be	en carried out o	r is intende c)	ed, procee	d to (17), o	otherwise (	continue fr	om (9) to (1	16)		0	
Additional infiltration	e dwenning (n.	5)						[(9)-	-11x0.1 =	0	(3)
Structural infiltration: 0.2	5 for steel o	r timber f	frame or	0.35 fo	r masoni	y constr	uction		1	0	(11)
if both types of wall are pre	sent, use the va	alue corres	ponding to	the great	er wall are	a (after					
If suspended wooden flo	s); if equal user oor. enter 0.2	<sup>- 0.35</sup> ? (unseal	ed) or 0.	1 (seale	ed), else	enter 0				0	<b>]</b> (12)
If no draught lobby, ente	er 0.05, else	enter 0		. (000	,					0	(13)
Percentage of windows	and doors dr	raught st	ripped							0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	(15) =		0	(16)
Air permeability value, q	50, expresse	ed in cub	ic metre	s per ho	our per s	quare m	etre of er	nvelope	area	5	(17)
If based on air permeabilit	y value, then	(18) = [(1	7) ÷ 20]+(8	3), otherw	ise (18) = (	16)				0.37	(18)
Air permeability value applies	if a pressurisati	on test has	s been dor	e or a de	gree air pe	rmeability	is being us	ed		-	
Shelter factor					(20) = 1 -	[0.075 x (1	9)] =			3 0.78	(19)
Infiltration rate incorporatir	ng shelter fac	ctor			(21) = (18	) x (20) =				0.29	(21)
Infiltration rate modified fo	r monthly wir	nd speed	1								<b>_</b> 1` ´
Jan Feb M	/lar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from 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 Fa	actor (2	2a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjuste	d infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
Γ	0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34		
Calcula	te effec	ctive air	change	rate for t	he appli	cable ca	se						·	
If me	chanica		tion:	andix NL (2	2h) (00	) <b>F</b> ront (a	austion (N		nuiae (02h	) (22a)			0	(23a)
li exna				ionovin (Z	3D) = (238	a) × FIIIV (e	equation (r	NO)), Other	iwise (230	) = (23a)			0	(23b)
			ivery. enic		allowing i				) =		001.) [4	(00)	0	(23c)
a) if t						at recove	ery (MVF	HR) (24a T	m = (22)	2b)m + (i L	23b) × [1	– (23C)	÷100]	(245)
(24a)m=	0	U al ana ala	0	0	0		0					0		(24a)
					without			VIV) (240 1	o)m = (22	20)m + (. 	23D)	0	I	(24b)
(240)11=		0	0		0		0			0	0	0		(240)
C) If V if	vhole h (22h)m	ouse ex n < 0 5 v	(23b) t	itilation ( hen (24)	or positiv	ve input v	ventilatio	on from ( c) - (22k	hot the muther hot the muther hot the hot th	5 v (23h	))			
(24c)m=	0	0	0		0 = (201)			0 = (22x)			0	0		(24c)
d) If r	natural y	ventilatio	n or wh		e nositiv		ventilatio	n from l	oft					
if	(22b)m	r = 1, the	en (24d)	m = (221)	o)m othe	erwise (2	(4d)m = 0	0.5 + [(2	2b)m <sup>2</sup> x	0.5]				
(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(24d)
Effec	tive air	change	rate - er	nter (24a	) or (24t	o) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
3 Hea	at losses	s and he	at loss i	naramete	⊃r.									
FI FM	FNT	Gros	S	Openin	as	Net Ar	ea	U-valı	Je	AXU		k-value	9	AXk
		area	(m²)	'n	2	A ,r	m²	W/m2	K	(W/I	K)	kJ/m²∙l	<	kJ/K
Doors										2.484				(26)
Window						2.07	X	1.2		=				
VIIIGOV	vs Type	e 1				2.07 1.34	x x	1.2 /[1/( 1.4 )+	0.04] =	1.78				(27)
Window	vs Type vs Type	e 1 e 2				2.07 1.34 1.34	x x1/ x1/	1.2 /[1/( 1.4 )+ /[1/( 1.4 )+	0.04] = [ 0.04] =	1.78				(27) (27)
Window Window Window	vs Type vs Type vs Type	e 1 e 2 e 3				2.07 1.34 1.34 7.24	x1/ x1/ x1/ x1/ x1/	<u> </u>	0.04] = [ 0.04] = [ 0.04] = [	1.78 1.78 9.6				(27) (27) (27)
Window Window Window	vs Type vs Type vs Type vs Type	e 1 e 2 e 3 e 4				2.07 1.34 1.34 7.24 2.34	x1/ x1/ x1/ x1/ x1/ x1/ x1/	<u> </u>	$0.04] = \begin{bmatrix} 0.04] \\ 0.04] = \begin{bmatrix} 0.04] \\ 0.04] = \begin{bmatrix} 0.04] \\ 0.04] = \end{bmatrix}$	1.78 1.78 9.6 3.1				(27) (27) (27) (27)
Window Window Window Window	vs Type vs Type vs Type vs Type vs Type	e 1 e 2 e 3 e 4 e 5				2.07 1.34 1.34 7.24 2.34 2.34	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	<u>    1.2</u> /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \end{array}$	1.78 1.78 9.6 3.1 3.1				(27) (27) (27) (27) (27)
Window Window Window Window Window	vs Type vs Type vs Type vs Type vs Type vs Type	2 2 3 4 5 6				2.07 1.34 1.34 7.24 2.34 2.34 2.57	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	<u>    1.2</u> /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \end{array}$	1.78 1.78 9.6 3.1 3.1 3.41				(27) (27) (27) (27) (27) (27)
Window Window Window Window Window Window	vs Type vs Type vs Type vs Type vs Type vs Type vs Type	e 1 e 2 e 3 e 4 e 5 e 6 e 7				2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88	x 1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x	<u>    1.2</u> /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+ /[1/( 1.4 )+	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \end{array}$	1.78 1.78 9.6 3.1 3.1 3.41 2.49				(27) (27) (27) (27) (27) (27) (27) (27)
Window Window Window Window Window Window	vs Type vs Type vs Type vs Type vs Type vs Type vs Type vs Type	e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8				2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88 1.13	x x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/		$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \end{array}$	1.78 1.78 9.6 3.1 3.1 3.41 2.49 1.5				<ul> <li>(27)</li> </ul>
Window Window Window Window Window Window Roofligh	vs Type vs Type vs Type vs Type vs Type vs Type vs Type hts Type	e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 1				2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88 1.13 1.8843	x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	$\frac{1.2}{(1/(1.4)+)/(1/(1.4)+)/(1/(1.4)+)/(1/(1.4)+)/(1/(1.4)+)/(1/(1.4)+)/(1/(1.4)+)/(1/(1.4)+)/(1/(1.4)+)/(1/(1.4)+)/(1/(1.7)+)/(1/(1.7)+))$	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \end{array}$	1.78 1.78 9.6 3.1 3.1 2.49 1.5 3.20339				<ul> <li>(27)</li> </ul>
Window Window Window Window Window Window Roofligh Roofligh	vs Type vs Type vs Type vs Type vs Type vs Type hts Type hts Type	e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 1 e 2				2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88 1.13 1.8843 0.58243	x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/		$\begin{array}{c} 0.04] = \\ 0.04] = \\ \\ 0.04] = \\ \\ 0.04] = \\ \\ 0.04] = \\ \\ 0.04] = \\ \\ 0.04] = \\ \\ 0.04] = \\ \\ 0.04] = \\ \end{array}$	1.78 1.78 9.6 3.1 3.1 3.41 2.49 1.5 3.20339 0.990138				<ul> <li>(27)</li> </ul>
Window Window Window Window Window Window Roofligh Roofligh	vs Type vs Type vs Type vs Type vs Type vs Type hts Type hts Type	e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 1 e 2				2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88 1.13 1.8843 0.58243 37 5	x x x x x x x x x x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x 48 x x 1 / x 47 x x 1 / x 48 x x 1 / x x x 1 / x x x 1 / x x 1 / x x 1 / x x x 1 / x x x 1 / x x 1	$\begin{array}{c} 1.2 \\ 1.2 \\ 1.2 \\ 1.4 \\$	$\begin{array}{c} 0.04\\ 0.04\\ =\\ \end{array} \begin{bmatrix} \\ \\ 0.04\\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ 0.04\\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ 0.04\\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ 0.04\\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ 0.04\\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \end{bmatrix}$	1.78 1.78 9.6 3.1 3.1 3.41 2.49 1.5 3.20339 0.990139 4.875				<ul> <li>(27)</li> <li>(27)</li> <li>(27)</li> <li>(27)</li> <li>(27)</li> <li>(27)</li> <li>(27)</li> <li>(27)</li> <li>(27)</li> <li>(27b)</li> <li>(27b)</li> <li>(28)</li> </ul>
Window Window Window Window Window Window Roofligh Roofligh Floor Walls	vs Type vs Type vs Type vs Type vs Type vs Type hts Type hts Type	e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 1 e 2	58	22.20		2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88 1.13 1.8843 0.58243 37.5 120.2	x x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	$\begin{array}{c} 1.2 \\ 1.2 \\ 1.4 \\$	$\begin{array}{c} & - & - & - & - & - & - & - & - & - & $	1.78 1.78 9.6 3.1 3.1 3.41 2.49 1.5 3.20339 0.990138 4.875 25.08				(27) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (28)
Window Window Window Window Window Window Roofligh Roofligh Floor Walls	vs Type vs Type vs Type vs Type vs Type vs Type hts Type hts Type	a 1 a 2 a 3 a 4 a 5 a 6 a 7 a 8 a 1 a e 2 161.3	58	22.2	5	2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88 1.13 1.8843 0.58243 37.5 139.3	x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/ x 1/	$\begin{array}{c} 1.2 \\ 1.2 \\ 1.4 \\$	$\begin{array}{c} 0.04\\ 0.04\\ =\\ \end{array} \begin{bmatrix} \\ 0.04\\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ 0.04\\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \end{bmatrix} \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} \begin{bmatrix} \\ \\ \\ \\$	1.78 1.78 9.6 3.1 3.1 3.41 2.49 1.5 3.20339 0.990139 4.875 25.08 0.71				(27) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (28) (29) (30)
Window Window Window Window Window Window Roofligh Roofligh Floor Walls Roof T Roof T	vs Type vs Type vs Type vs Type vs Type vs Type hts Type hts Type	a = 1 a = 2 a = 3 a = 4 a = 5 a = 6 a = 7 a = 8 a = 1 a = 2 a = 2 a = 1 a = 2 a = 1 a = 2 a = 2 a = 1 a = 2 a = 2 a = 1 a = 2 a	58	22.24 0	5	2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88 1.13 1.8843 0.58243 37.5 139.3 5.5	x x x x x x x x x x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x x x	$\begin{array}{c} 1.2 \\ 1.2 \\ 1.2 \\ 1.2 \\ 1.4 \\$	$\begin{array}{c} & - & - & - & - & - & - & - & - & - & $	1.78 1.78 9.6 3.1 3.1 3.41 2.49 1.5 3.20339 0.990138 4.875 25.08 0.71				(27) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27) (27) (27) (27) (27) (27) (27) (27
Window Window Window Window Window Window Roofligh Roofligh Floor Walls Roof T Roof T	vs Type vs Type vs Type vs Type vs Type vs Type vs Type hts Type hts Type ype1 ype2	a = 1 a = 2 a = 3 a = 4 a = 5 a = 6 a = 7 a = 8 a = 1 a = 2 a = 1 a = 3 a = 1 a = 3 a = 3 a = 1 a = 3 a = 3 a = 1 a = 3 a = 3 a = 1 a = 3 a = 3 a = 3 a = 1 a = 3 a	58	22.24 0 2.47	5	2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88 1.13 1.8843 0.58243 37.5 139.3 5.5 35.03 212.2	x x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/	$\begin{array}{c} 1.2 \\ 1.2 \\ 1.2 \\ 1.2 \\ 1.4 \\$	$\begin{array}{c} & - & - & - & - & - & - & - & - & - & $	1.78 1.78 9.6 3.1 3.1 3.41 2.49 1.5 3.20339 0.990138 4.875 25.08 0.71 4.55				(27) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27) (27) (27) (27) (27) (27) (27) (27
Window Window Window Window Window Window Roofligh Roofligh Floor Walls Roof T Roof T Total an	vs Type vs Type vs Type vs Type vs Type vs Type vs Type hts Type hts Type ype1 ype2 rea of e	a 1 a 2 a 3 a 4 a 5 a 6 a 7 a 8 a 1 a 2 a 1 a 2 a 1 a 2 a 1 a 2 a 1 a 2 a 1 a 2 a 3 a 3 a 4 a 5 a 6 a 7 a 8 a 1 a 2 a 1 a 2 a 3 a 3	58 5	22.24 0 2.47	5	2.07 1.34 1.34 7.24 2.34 2.34 2.57 1.88 1.13 1.8843 0.58243 37.5 139.3 5.5 35.03 242.0	x x x x x x x x x x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x 1 / x x x x	$\begin{array}{c} 1.2 \\ 1.2 \\ 1.2 \\ 1.2 \\ 1.4 \\$	$\begin{array}{c} 0.04\\ 0.04\\ =\\ \end{array} \begin{bmatrix} \\ 0.04\\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ 0.04\\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \end{bmatrix} =\\ \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	1.78 1.78 9.6 3.1 3.1 3.41 2.49 1.5 3.20339 0.990139 4.875 25.08 0.71 4.55				(27) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (28) (29) (30) (30) (31)

Interna	al floor					61.4					Г		<b>¬</b> г		(32d)
Interna	al ceiling					61.4					Ī		Ξ F		(32e)
* for win ** incluc	dows and le the area	roof winde as on both	ows, use e sides of ir	effective wi nternal wal	indow U-va Is and part	alue calcul itions	lated using	g formula 1	/[(1/U-valu	ie)+0.04] a	L as given in	paragraph	L 1 3.2		
Fabric	heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				68.	.39	(33)
Heat c	apacity	Cm = S(	(Axk)			((28)(30) + (32) + (32a)(32e) =								0.61	(34)
Therm	al mass	parame	ter (TMF		÷ TFA) in	ı kJ/m²K			Indica	tive Value	: Medium		25	50	(35)
For des	ign assess	ments wh	ere the de	tails of the	constructi	on are no	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f			
can be ι	used inste	ad of a de	tailed calc	ulation.											_
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix I	K						16	.3	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)			(00)	(00)					<b>-</b>
I OTAL TADRIC NEAT LOSS $(33) + (36) =$												84.	68	(37)	
Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)												1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ĺ		(00)
(38)m=	45.38	45.16	44.96	43.98	43.8	42.95	42.95	42.79	43.28	43.8	44.17	44.55			(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m				
(39)m=	130.06	129.85	129.64	128.67	128.48	127.64	127.64	127.48	127.96	128.48	128.85	129.24			_
									(10)	Average =	Sum(39)1.	12 /12=	128	.67	(39)
Heat Id	oss para		1LP), W/	m²K		4.00		1 4 9 9	(40)m	= (39)m ÷	• (4)		I		
(40)m=	1.32	1.31	1.31	1.3	1.3	1.29	1.29	1.29	1.29	1.3	1.3	1.31	<u> </u>		
Numbe	er of dav	rs in mor	nth (Tab	le 1a)					,	Average =	Sum(40)1.	12 /12=	<u> </u>	3	(40)
	Jan	Feb	Mar	Anr	May	Jun	. hul	Aug	Sen	Oct	Nov	Dec	I		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31			(41)
()			<u> </u>		0.							0.	i		
4 . 3. 4 (															
4. VVa	ater heat	ing ener	rgy requi	irement:								kWh/ye	ear:		
Assum	ned occu	ipancy, l	N								2.	73			(42)
if TF	A > 13.9	9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	49 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.	.9)		I		
	A £ 13.9	$\theta$ , N = 1 A bot we	ator usar	no in litre	e nor da	ve hV vi	orano -	(25 v N)	+ 36		00	00	I		(12)
Reduce	the annua	al average	hot water	usage by	5% if the d	welling is	designed	(20 x N) to achieve	a water us	se target o	f 99	.02	i		(43)
not mor	e that 125	litres per p	person pei	<sup>r</sup> day (all w	vater use, h	not and co	ld)								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot wat	er usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)					I		
(44)m=	108.92	104.96	101	97.04	93.08	89.11	89.11	93.08	97.04	101	104.96	108.92			
										Total = Su	m(44) <sub>112</sub> =	=	118	8.2	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)			
(45)m=	161.52	141.27	145.78	127.09	121.95	105.23	97.51	111.9	113.23	131.96	144.05	156.43			
										Total = Su	m(45) <sub>112</sub> =	=	155	7.91	(45)
lf instan	taneous w	ater heatii	ng at point	of use (no	o hot water	storage),	enter 0 in	boxes (46	) to (61)						
(46)m=	24.23	21.19	21.87	19.06	18.29	15.78	14.63	16.78	16.98	19.79	21.61	23.46	l		(46)
vvater	storage	IOSS:		0.001.5	olor or \^		otoroar	within	maxes				I		(
Siorag	ie voium	e (illes)		iy any so			Surage		ame ves	501		150	İ		(47)
Other	nunity fi vise if pr	eaung a stored	nu no ta hot wate	u ik if) UW ar (thie in	renny, e Indudee in	nstantar		(47) mhi hoil	ers) entr	^r '()' in (	47)				
			not wate		isiaacs I	istantal									

Water storage loss:

a) If m	nanufact	urer's de	eclared I	oss fact		1	.7	(48					
Tempe	erature f	actor fro	m Table	2b							0.	54	(49
Energy	y lost fro	m watei	r storage	e, kWh/y	ear			(48) x (49	) =		0.	92	(50
b) If m Hot wa If com	nanufact ater stor munity h	urer's de age loss leating s	eclared of factor fi see secti	cylinder rom Tab on 4.3	loss fact le 2 (kW	or is not h/litre/da	known: ay)					0	(51
Volum	e factor	from Ta	ble 2a								0		(52
Tempe	erature f	actor fro	m Table	2b								0	(53
Energy	y lost fro	m water	r storage	e, kWh/y	ear			(47) x (51) x (52) x (53) =				0	(54
Enter	(50) Or	(54) IN (8	05) Isulata du	(				((50))			0.	92	(55
vvater	storage	loss cai	culated T	for each	montn	r	· · · · ·	((56)m = (	55) × (41)	m r	r	· · · · ·	
(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(56
If cylinde	er contain:	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	
(57)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(57
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0	(58
Primar	y circuit	loss cal	culated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m				
(mo	dified by	factor f	rom Tab	le H5 if t T	there is s	solar wat	ter heatii	ng and a	a cylinde T	r thermo	stat)		l (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	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)	)m					
(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	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m
(62)m=	213.27	188.01	197.52	177.17	173.69	155.31	149.26	163.64	163.31	183.71	194.12	208.17	(62
Solar DI	HW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (	G)				
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63
Output	t from w	ater hea	ter			-		-					
(64)m=	213.27	188.01	197.52	177.17	173.69	155.31	149.26	163.64	163.31	183.71	194.12	208.17	
								Out	out from w	ater heate	r (annual)₁	12	2167.19 (64
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 >	(46)m	+ (57)m	+ (59)m	]
(65)m=	95.1	84.36	89.87	82.32	81.94	75.05	73.82	78.6	77.71	85.27	87.96	93.41	(65
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating
5. Int	ternal ga	ains (see	e Table 5	5 and 5a	):								
Metab	olic gain	s (Table	e 5), Wat	ts									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	(66
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				
(67)m=	22.69	20.15	16.39	12.41	9.28	7.83	8.46	11	14.76	18.74	21.88	23.32	(67
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5			
(68)m=	254.54	257.18	250.52	236.35	218.47	201.65	190.42	187.78	194.44	208.61	226.5	243.31	(68
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)	), also se	ee Table	5			1
(69)m=	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	(69
Pumps	s and fai	ns gains	(Table (	5a)	•		•	•	•				I
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70

Losse	s e.g. ev	/aporatio	n (negat	tive valu	ies) (Ta	ble	5)									
(71)m=	-109.16	-109.16	-109.16	-109.16	-109.16	6 -1	09.16	-109.16	-109	.16 -109.	.16 -10	9.16	-109.16	-109.16		(71)
Water	heating	gains (T	able 5)						-		-					
(72)m=	127.83	125.54	120.79	114.33	110.14	1	04.24	99.22	105	.65 107.	93 11	4.62	122.16	125.55		(72)
Total	internal	gains =					(66)	m + (67)m	n + (68	3)m + (69)n	n + (70)r	n + (	71)m + (72)	m		
(73)m=	471.99	469.81	454.64	430.03	404.82	2 3	80.66	365.04	371	.37 384.	07 40	8.91	437.47	459.12		(73)
6. Sc	lar gain:	s:														
Solar	gains are o	calculated u	using sola	r flux fron	n Table 6a	a and	assoc	ated equa	tions	to convert t	to the ap	plica	able orientati	on.		
Orient	ation: /	Access F	actor	Area	ì		Flu	X			0	_	FF		Gains	
	-	able 6d		m²			Tai	ble 6a				-	able 6C		(VV)	_
North	0.9x	0.77	x	1.	34	x	1	0.63	X	0.63		×	0.7	=	4.35	(74)
North	0.9x	0.77	x	1.	34	x	1	0.63	x	0.63		×	0.7	=	4.35	(74)
North	0.9x	0.77	x	2.	57	x	1	0.63	x	0.63		×	0.7	=	8.35	(74)
North	0.9x	0.77	x	1.	88	x	1	0.63	x	0.63		x	0.7	=	6.11	(74)
North	0.9x	0.77	x	1.	13	x	1	0.63	x	0.63		x	0.7	=	3.67	(74)
North	0.9x	0.77	x	1.	34	x	2	0.32	x	0.63		x	0.7	=	8.32	(74)
North	0.9x	0.77	x	1.	34	x	2	0.32	x	0.63		x	0.7	=	8.32	(74)
North	0.9x	0.77	x	2.	57	x	2	0.32	x	0.63		x	0.7	=	15.96	(74)
North	0.9x	0.77	x	1.	88	x	2	0.32	x	0.63		x	0.7	=	11.68	(74)
North	0.9x	0.77	x	1.	13	x	2	0.32	x	0.63		x	0.7	=	7.02	(74)
North	0.9x	0.77	x	1.	34	x	3	4.53	x	0.63		x	0.7	=	14.14	(74)
North	0.9x	0.77	x	1.	34	x	3	4.53	x	0.63		x	0.7	=	14.14	(74)
North	0.9x	0.77	x	2.	57	x	3	4.53	x	0.63		x [	0.7	=	27.12	(74)
North	0.9x	0.77	x	1.	88	x	3	4.53	x	0.63		x	0.7	=	19.84	(74)
North	0.9x	0.77	x	1.	13	x	3	4.53	x	0.63		x	0.7	=	11.92	(74)
North	0.9x	0.77	x	1.	34	x	5	5.46	x	0.63		x [	0.7	=	22.71	(74)
North	0.9x	0.77	x	1.	34	x	5	5.46	x	0.63		x [	0.7	=	22.71	(74)
North	0.9x	0.77	x	2.	57	x	5	5.46	x	0.63		x	0.7	=	43.56	(74)
North	0.9x	0.77	x	1.	88	x	5	5.46	x	0.63		x [	0.7	=	31.87	(74)
North	0.9x	0.77	x	1.	13	x	5	5.46	x	0.63		x [	0.7	=	19.15	(74)
North	0.9x	0.77	x	1.	34	x	7	4.72	x	0.63		x [	0.7	=	30.6	(74)
North	0.9x	0.77	x	1.	34	x	7	4.72	x	0.63		x [	0.7	=	30.6	(74)
North	0.9x	0.77	x	2.	57	x	7	4.72	x	0.63		x [	0.7	=	58.68	(74)
North	0.9x	0.77	x	1.	88	x	7	4.72	x	0.63		x [	0.7	=	42.93	(74)
North	0.9x	0.77	x	1.	13	x	7	4.72	x	0.63		x [	0.7	=	25.8	(74)
North	0.9x	0.77	x	1.	34	x	7	9.99	×	0.63		x	0.7	=	32.76	(74)
North	0.9x	0.77	x	1.	34	x	7	9.99	x	0.63		x [	0.7	=	32.76	(74)
North	0.9x	0.77	x	2.	57	x	7	9.99	x	0.63		x	0.7	=	62.82	(74)
North	0.9x	0.77	x	1.	88	x	7	9.99	x	0.63		x	0.7	=	45.96	(74)
North	0.9x	0.77	x	1.	13	x	7	9.99	×	0.63		хГ	0.7	=	27.62	(74)

North	0.9x	0.77	x	1.34	x	74.68	x	0.63	x	0.7	=	30.58	(74)
North	0.9x	0.77	x	1.34	x	74.68	×	0.63	x	0.7	i =	30.58	(74)
North	0.9x	0.77	x	2.57	×	74.68	×	0.63	x	0.7	=	58.65	(74)
North	0.9x	0.77	x	1.88	×	74.68	×	0.63	x	0.7	=	42.91	(74)
North	0.9x	0.77	x	1.13	×	74.68	×	0.63	x	0.7	=	25.79	(74)
North	0.9x	0.77	x	1.34	×	59.25	×	0.63	x	0.7	] =	24.26	(74)
North	0.9x	0.77	x	1.34	×	59.25	×	0.63	x	0.7	] =	24.26	(74)
North	0.9x	0.77	x	2.57	x	59.25	×	0.63	x	0.7	=	46.53	(74)
North	0.9x	0.77	x	1.88	x	59.25	×	0.63	x	0.7	=	34.04	(74)
North	0.9x	0.77	x	1.13	x	59.25	x	0.63	x	0.7	=	20.46	(74)
North	0.9x	0.77	x	1.34	x	41.52	×	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	2.57	x	41.52	x	0.63	x	0.7	] =	32.61	(74)
North	0.9x	0.77	x	1.88	x	41.52	x	0.63	x	0.7	=	23.85	(74)
North	0.9x	0.77	x	1.13	×	41.52	×	0.63	x	0.7	=	14.34	(74)
North	0.9x	0.77	x	1.34	×	24.19	×	0.63	x	0.7	] =	9.91	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.63	x	0.7	] =	9.91	(74)
North	0.9x	0.77	x	2.57	×	24.19	×	0.63	x	0.7	=	19	(74)
North	0.9x	0.77	x	1.88	x	24.19	×	0.63	x	0.7	=	13.9	(74)
North	0.9x	0.77	x	1.13	x	24.19	x	0.63	x	0.7	=	8.35	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.63	x	0.7	=	5.37	(74)
North	0.9x	0.77	x	1.34	x	13.12	×	0.63	x	0.7	=	5.37	(74)
North	0.9x	0.77	x	2.57	x	13.12	x	0.63	x	0.7	=	10.3	(74)
North	0.9x	0.77	x	1.88	x	13.12	x	0.63	x	0.7	=	7.54	(74)
North	0.9x	0.77	x	1.13	x	13.12	x	0.63	x	0.7	=	4.53	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.63	x	0.7	=	3.63	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.63	x	0.7	=	3.63	(74)
North	0.9x	0.77	x	2.57	x	8.86	x	0.63	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	1.88	x	8.86	x	0.63	x	0.7	=	5.09	(74)
North	0.9x	0.77	x	1.13	x	8.86	x	0.63	x	0.7	=	3.06	(74)
East	0.9x	0.77	x	7.24	x	19.64	x	0.63	x	0.7	=	43.46	(76)
East	0.9x	0.77	x	2.34	x	19.64	x	0.63	x	0.7	=	14.05	(76)
East	0.9x	0.77	x	2.34	x	19.64	x	0.63	x	0.7	=	14.05	(76)
East	0.9x	0.77	x	7.24	x	38.42	x	0.63	x	0.7	=	85.01	(76)
East	0.9x	0.77	x	2.34	×	38.42	x	0.63	x	0.7	] =	27.48	(76)
East	0.9x	0.77	x	2.34	x	38.42	x	0.63	x	0.7	=	27.48	(76)
East	0.9x	0.77	x	7.24	×	63.27	×	0.63	x	0.7	] =	140	(76)
East	0.9x	0.77	x	2.34	×	63.27	x	0.63	x	0.7	] =	45.25	(76)
East	0.9x	0.77	x	2.34	×	63.27	×	0.63	x	0.7	=	45.25	(76)
East	0.9x	0.77	x	7.24	×	92.28	×	0.63	x	0.7	=	204.18	(76)
East	0.9x	0.77	x	2.34	×	92.28	×	0.63	x	0.7	=	65.99	(76)

East	0.9x	0.77	x	2.34	x	92.28	x	0.63	x	0.7	] =	65.99	(76)
East	0.9x	0.77	x	7.24	×	113.09	×	0.63	x	0.7	i =	250.23	- (76)
East	0.9x	0.77	x	2.34	×	113.09	×	0.63	x	0.7	i =	80.88	(76)
East	0.9x	0.77	x	2.34	×	113.09	x	0.63	x	0.7	=	80.88	- (76)
East	0.9x	0.77	x	7.24	×	115.77	×	0.63	x	0.7	=	256.16	- (76)
East	0.9x	0.77	x	2.34	x	115.77	x	0.63	x	0.7	=	82.79	(76)
East	0.9x	0.77	x	2.34	×	115.77	×	0.63	x	0.7	] =	82.79	(76)
East	0.9x	0.77	x	7.24	x	110.22	x	0.63	x	0.7	] =	243.87	(76)
East	0.9x	0.77	x	2.34	×	110.22	×	0.63	x	0.7	=	78.82	(76)
East	0.9x	0.77	x	2.34	x	110.22	x	0.63	x	0.7	=	78.82	(76)
East	0.9x	0.77	x	7.24	×	94.68	x	0.63	x	0.7	=	209.48	(76)
East	0.9x	0.77	x	2.34	×	94.68	x	0.63	x	0.7	=	67.71	(76)
East	0.9x	0.77	x	2.34	×	94.68	x	0.63	x	0.7	=	67.71	(76)
East	0.9x	0.77	x	7.24	×	73.59	x	0.63	x	0.7	=	162.83	(76)
East	0.9x	0.77	x	2.34	x	73.59	x	0.63	x	0.7	=	52.63	(76)
East	0.9x	0.77	x	2.34	×	73.59	x	0.63	x	0.7	] =	52.63	(76)
East	0.9x	0.77	x	7.24	×	45.59	x	0.63	x	0.7	=	100.87	(76)
East	0.9x	0.77	x	2.34	×	45.59	x	0.63	x	0.7	] =	32.6	(76)
East	0.9x	0.77	x	2.34	×	45.59	x	0.63	x	0.7	] =	32.6	(76)
East	0.9x	0.77	x	7.24	×	24.49	x	0.63	x	0.7	=	54.19	(76)
East	0.9x	0.77	x	2.34	x	24.49	x	0.63	x	0.7	=	17.51	(76)
East	0.9x	0.77	x	2.34	×	24.49	x	0.63	x	0.7	=	17.51	(76)
East	0.9x	0.77	x	7.24	×	16.15	x	0.63	x	0.7	=	35.74	(76)
East	0.9x	0.77	x	2.34	×	16.15	x	0.63	x	0.7	] =	11.55	(76)
East	0.9x	0.77	x	2.34	×	16.15	×	0.63	x	0.7	=	11.55	(76)
Roofligh	ts <mark>0.9x</mark>	1	x	1.88	x	16.18	x	0.63	x	0.7	=	12.1	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.58	×	43.99	x	0.63	x	0.7	=	10.17	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	1.88	x	30.63	x	0.63	x	0.7	] =	22.91	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.58	x	80.27	x	0.63	x	0.7	] =	18.56	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	1.88	×	55.7	x	0.63	x	0.7	] =	41.66	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.58	x	121.32	x	0.63	x	0.7	=	28.04	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	1.88	x	101.28	x	0.63	x	0.7	] =	75.75	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.58	x	165.18	x	0.63	x	0.7	] =	38.18	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	1.88	×	149.52	x	0.63	x	0.7	=	111.83	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.58	×	195.41	x	0.63	x	0.7	] =	45.17	(82)
Roofligh	ts <mark>0.9</mark> x	1	x	1.88	×	166.08	x	0.63	x	0.7	=	124.21	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.58	×	197.72	x	0.63	x	0.7	=	45.71	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	1.88	×	152.65	x	0.63	x	0.7	=	114.16	(82)
Roofligh	ts <mark>0.9</mark> x	1	x	0.58	×	189.14	x	0.63	x	0.7	=	43.72	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	1.88	×	112.79	×	0.63	x	0.7	=	84.36	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.58	×	166.58	×	0.63	x	0.7	=	38.51	(82)

Rooflig	hts 0.9x	1	x	1.8	38	x	7	0.26	<b>x</b> [		0.63	x	0.7	=	52.55	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	0.5	58	x	1	36.8	x [		0.63		0.7		31.62	(82)
Rooflig	hts 0.9x	1	x	1.8	38	x	3	37.03	x		0.63		0.7		27.7	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	0.5	58	x	g	2.07	İ×「		0.63	آ × آ	0.7		21.28	(82)
Rooflig	hts 0.9x	1	x	1.8	38	x	· ·	19.8	×		0.63		0.7		14.81	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	0.5	58	x	5	3.73	x		0.63	_ × [	0.7		12.42	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	1.8	38	x	1	3.64	x		0.63	_ × [	0.7	=	10.2	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	0.5	58	x	3	6.94	x		0.63	] × [	0.7	=	8.54	(82)
	-						-		_			_				
Solar g	pains in	watts, ca	alculated	d for eac	h month	<u>۱</u>			(83)m	= Su	ım(74)m .	(82)m			_	
(83)m=	120.66	232.73	387.37	590.12	757.59	7	93.57	747.91	617.3	32	457.05	276.12	149.55	99.96		(83)
Total g	jains – i	nternal a	and sola	r (84)m =	= (73)m	+ (	83)m	, watts	1						-	
(84)m=	592.65	702.54	842.01	1020.15	1162.41	11	174.23	1112.95	988.6	69	841.13	685.03	587.03	559.07	/	(84)
7. Me	an inter	nal temp	perature	(heating	seasor	า)										
Temp	erature	during h	neating p	periods i	n the liv	ing	area	from Tab	ole 9,	Th1	(°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living ar	ea, h1,n	n (s	ee Ta	ble 9a)	-							_
	Jan	Feb	Mar	Apr	May		Jun	Jul	Au	ıg	Sep	Oct	Nov	Dec	;	
(86)m=	1	1	0.99	0.94	0.83		0.65	0.49	0.57	7	0.84	0.98	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	in Ta	able	e 9c)					
(87)m=	19.54	19.72	20.03	20.45	20.79	2	20.95	20.99	20.9	8	20.84	20.38	19.89	19.51	7	(87)
Temp	erature	durina h	neating r	Deriods i	n rest of	dv	/ellina	from Ta	ble 9	Th			•		-	
(88)m=	19.83	19.83	19.83	19.84	19.84	1	19.85	19.85	19.8	35	19.85	19.84	19.84	19.84	7	(88)
l Itilie:	L	tor for a	ains for	rest of d	welling	h2	m (se	a Tabla	(a)		I		1	Į		
(89)m=	1	0.99	0.98	0.92	0.77		0.55	0.37	0.44	4	0.76	0.96	0.99	1	7	(89)
Maan	interne	l l tompor	lin	the rest	l of dwol		TO /f				in Tobl	o () o)				
		1 temper				IING	12 (10				10 72	10 13	18/11	17.86	7	(90)
(30)11-	17.5	10.15	10.01	19.21	19.04		19.02	19.04	13.0	,4	13.72 f	A = 1 ivi	ng area $\div$ (4	4) =		
														-/	0.5	
Mean	interna	l temper	ature (fo	or the wh	ole dwe	ellin	g) = fl	LA × T1	+ (1 -	- fL/	A) × T2		1		-	
(92)m=	18.39	18.62	19.04	19.58	19.99		20.16	20.19	20.1	8	20.05	19.5	18.85	18.35		(92)
Apply	adjustr	10.60	he mear			ratu	are fro	m lable	4e, v	whe	re appro	opriate	10.05	10.05	7	(03)
(95)III=	10.39	ting rogu	liromon	19.56	19.99		20.16	20.19	20.1	°	20.05	19.5	18.05	10.55		(33)
Sot T	i to the	mean int	inement	n Mooratu	ro obtai	nod	l at et	on 11 of	Table		so that	t Ti m-	(76)m an	d ro-co		
the ut	tilisation	factor fo	or gains	using Ta	able 9a	neu	1 21 31	50 11 01	Table	5 30	, 30 114		(70)11 an		iculate	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Au	ıg	Sep	Oct	Nov	Dec	;]	
Utilisa	ation fac	tor for g	ains, hr	ו:									•		_	
(94)m=	1	0.99	0.97	0.92	0.78		0.58	0.41	0.48	8	0.78	0.96	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (9	4)m x (8	4)m										_	
(95)m=	590.21	696.2	820.84	936.62	909.51	6	79.49	453.06	472.6	67	654.13	656.93	582.19	557.29	1	(95)
Month	nly aver	age exte	ernal terr	nperature	e from T	abl	e 8		r						-	
(96)m=	4.3	4.9	6.5	8.9	11.7	Ļ	14.6	16.6	16.4	4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	hal temp	erature,	Lm	1, W =	=[(39)m :	x [(93	)m-	- (96)m	1449.5	4540-5	4005 5	7	(07)
(97)m=	1832.55	1781.62	1625.07	1374.24	1064.56	7	09.02	457.66	481.9	95	761.53	1143.8	1513.77	1828.8	<u> </u>	(97)

Space	e heatin	g requir	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
(98)m=	924.31	729.4	598.35	315.09	115.36	0	0	0	0	362.23	670.74	946.01		_
								Tota	al per year	(kWh/yeai	r) = Sum(9	8)15,912 =	4661.49	(98)
Space	e heatin	g requir	ement in	kWh/m²	²/year							[	47.13	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:			, .							г		
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system	(202) - 1	(201) -				0	
Fracti	on of sp	ace nea	at from n	nain syst	em(s)			$(202) = 1^{-1}$	-(201) =	(203)1 -		ľ	1	$\begin{bmatrix} (202) \\ (204) \end{bmatrix}$
Efficie				ina ovet	stern i			(204) - (2	02) <b>x</b> [1 -	(200)] –			1	(204)
Efficie				amontar	v boatin	a cyctor	o 0/					l	93.5	
EIIICIE							1, 70		0					(208)
Space	Jan beatin		Mar ement (c	Apr Apr	d above	Jun	Jui	Aug	Sep	Oct	NOV	Dec	Kvvn/yea	ar
Opaci	924.31	729.4	598.35	315.09	115.36	0	0	0	0	362.23	670.74	946.01		
(211)m	n = {[(98	)m x (20	1 )4)] } x 1	1 00 ÷ (20		1	1	1	Į	1	Į	J		(211)
( )	988.56	780.11	639.94	336.99	123.38	0	0	0	0	387.41	717.37	1011.78		. ,
				•				Tota	l (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	=	4985.55	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month							_		_
= {[(98	)m x (20	)1)]}x 1	00 ÷ (20	)8)										
(215)m=	0	0	0	0	0	0	0			0	0	0		
Motor	haatina							TOLO			213) <sub>15,10</sub> 12		0	(215)
	from w	l ater hea	ter (calc	ulated a	bove)									
•p	213.27	188.01	197.52	177.17	173.69	155.31	149.26	163.64	163.31	183.71	194.12	208.17		
Efficier	ncy of w	ater hea	ater	_					_	-	_		79.8	(216)
(217)m=	88.28	88.08	87.59	86.33	83.75	79.8	79.8	79.8	79.8	86.59	87.86	88.36		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)II (219)m=	241.58	213.45	225.52	205.21	207.39	194.62	187.04	205.07	204.65	212.15	220.96	235.59		
					1			Tota	l = Sum(2)	19a) <sub>112</sub> =			2553.23	(219)
Annua	I totals									k	Wh/year		kWh/year	-
Space	heating	fuel use	ed, main	system	1								4985.55	
Water	heating	fuel use	ed										2553.23	
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatin	g pump	:									30		(230c)
boiler	with a f	an-assis	sted flue									45		(230e
Total e	lectricity	/ for the	above, l	kWh/yea	ır			sum	of (230a).	(230g) =			75	(231)
Electric	city for li	ahtina	,	<b>,</b>								L [	400.75	 ](232)
Total d	elivered	enerav	for all u	ses (211	)(221)	+ (231)	+ (232)	(237h)	=			L [	8014 53	] (338)
122 -		icciono					Idina mi		)			L		
Tza. (	Joz em	15510115		uarneat	nig syste		ading mi							

	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	1076.88 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	551.5 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1628.38 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	207.99 (268)
Total CO2, kg/year	sum	n of (265)(271) =	1875.29 (272)

TER =

18.96 (273)

				User D	etails:						
Assessor Name:	Ondrej Ga	jdos			Strom	a Num	ber:		STRO	006629	
Software Name:	Stroma FS	AP 201	2		Softwa	are Vei	rsion:		Versic	on: 1.0.5.60	
			Р	roperty ,	Address	: Be Lea	n				
Address :	Be Lean, 68	8-70 Bov	ill Road,	LONDO	DN, SE2	3 1EJ					
1. Overall dwelling dimer	isions:			<b>A</b>	- (		A 11a			) / a la una a (una 2)	
Ground floor				Area	a(m²) 87.5	(1a) x			(2a) =		<b>1</b> (3a)
First floor					0.7	(10) x			(20) =	04.00	
Second floor					50.7	(10) X		.co.	(20) =	01.30	
Total floor area $TEA = (1a)$	)+(1b)+(1c)+	(1d)+(1o	)⊥ (1r		30.7	(TC) X	2	2.3	(20) =	70.61	(30)
	)+(10)+(10)+	(10)+(16	/+(11	"	98.9	(4)	) . (20) . (2d		(2n) =		٦
Dweiling volume						(38)+(30	)+(30)+(30	I)+(3e)+	.(31) =	241.97	(5)
2. Ventilation rate:	main	Se	econdar	'V	other		total			m <sup>3</sup> per hour	
Number of chimneys	heating	h 	eating	, _ +				x 4	10 =		
Number of open flues	0	╡ᆠ┝	0	⊣ └ └	0	」 [ 」 _ [	0		20 =	0	
Number of intermittent fan			0		0		0		10 =	0	
Number of passive vents	13						0		10 =	0	(7a)
Number of flueloss gas fir	00						0		10 –	0	
Number of nucless gas in	55						0	× -		0	(7C)
									Air ch	anges per hou	ır
Infiltration due to chimney	s, flues and f	ans = <mark>(6</mark>	a)+(6b)+(7	′a)+(7b)+(	7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has be	en carried out o	r is intende	d, procee	d to (17), d	otherwise o	continue fr	om (9) to (	(16)			-
Number of storeys in the	e dwelling (n	s)								0	(9)
Additional infiltration		. e		0.05 (				[(9)-	-1]x0.1 =	0	(10)
structural inflitration: 0.2	25 TOT STEEL O	r timber i due corres	rame or	0.35 IOI	r masoni er wall are	'Y CONStr a (after	uction			0	(11)
deducting areas of opening	gs); if equal user	0.35		, the great		a (anoi					_
If suspended wooden flo	oor, enter 0.2	(unseal	ed) or 0.	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else	enter 0								0	(13)
Percentage of windows	and doors di	aught st	ripped		0.05 10.0		0.01			0	(14)
Window infiltration					0.25 - [0.2	X (14) ÷ 1	00] =	(45)		0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value, o	150, expresse		ic metre	s per ho	our per s	quare m	etre of e	nvelope	area	5	(17)
If based on air permeability	y value, then	(18) = [(1	7) ÷ 20]+(8	b), otherwi	se (18) = ( pree air pe	(16) rmeehility	is heina us	ed		0.25	(18)
Number of sides sheltered		on test nas	been uur		giee all pe	inicability	is being us	seu		3	7(19)
Shelter factor	•				(20) = 1 -	[0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporation	ng shelter fac	ctor			(21) = (18	) x (20) =				0.19	(21)
Infiltration rate modified fo	r monthly wir	nd speed									
Jan Feb I	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Tab	e 7									
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind 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 infiltra	ation rat	e (allowi	ing for sl	nelter an	nd wind s	speed) =	: (21a) x	(22a)m					
	0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23		
Calcula	ate effec	ctive air	change	rate for t	he appli	cable ca	se	•				ـــــــــــــــــــــــــــــــــــــ		<b>-</b>
If me	echanica	al ventila	ation:							) (00-)		l	0.5	(23a)
If exh	aust air he	eat pump		endix N, (2	(23a) = (23a	a) × Fmv (e	equation (I	N5)), other	rwise (23b	o) = (23a)		ļ	0.5	(23b)
If bala	anced with	heat reco	overy: effic	ency in %	allowing	for in-use f	actor (fron	n Table 4h	) =			l	75.65	(23c)
a) If	balance	d mecha	anical ve	entilation	with he	at recove	ery (MVI 1	HR) (24a 1	a)m = (2: I	2b)m + () 1	23b) × [′	1 – (23c)	÷ 100]	(5.4.)
(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35		(24a)
b) If	balance	d mech	anical ve	entilation	without	heat rec	covery (N	MV) (24b 1	o)m = (22	2b)m + (2 1	23b)			(5.4.)
(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	ve input v	ventilatio	on from c	outside	- (00)	<b>、</b>			
	f (22b)n	n < 0.5 ×	(23b), 1	then (24)	c) = (23t)	o); otherv	wise (24	c) = (220)	b) m + 0	.5 × (23b	)) 			(24a)
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(240)
d) lf i	natural <sup>v</sup> f (22h)m	ventilation – 1 th	on or wh en (24d)	iole hous m = (22)	se positiv	ve input <sup>v</sup> erwise (2	ventilatio	on from I 0 5 + [(2	Oft 2h)m² x	0 51				
(24d)m=	0	0									0	0		(24d)
Effor	 ctive air	change	rato - or	ter (2/1a	$\int \frac{1}{24}$	$\int_{-\infty}^{\infty} dr (24)$	$r = \frac{1}{2}$	ld) in hoy	(25)	Ů	Ĵ			· · ·
(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31		0.32	0.33	0.34	0.35		(25)
(20)	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.0	0.02	0.00	0.01	0.00		()
3 He	at losse	s and he	ant loce i	naramet	or:									
0.110			at 1055	paramet	51.									
ELEN	IENT	Gros	SS (m <sup>2</sup> )	Openin rr	gs 1 <sup>2</sup>	Net Ar A ,r	rea m²	U-valı W/m2	ue K	A X U (W/I	K)	k-value kJ/m²-ŀ	A Å	X k /K
ELEN Doors	IENT	Gros area	ss (m <sup>2</sup> )	Openin rr	gs 1 <sup>2</sup>	Net Ar A ,r 2.07	rea m²	U-valı W/m2	ue K	A X U (W/I 2.07	K)	k-value kJ/m²⋅k	A A K kJ	X k /K (26)
ELEN Doors Windov	<b>IENT</b> ws Type	Gros area	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07	rea m² x x1	U-valu W/m2 1 /[1/( 1.2 )+	ue K =   0.04] =	A X U (W/I 2.07 1.8	K)	k-value kJ/m²·ŀ	A ( K kJ	X k /K (26) (27)
ELEN Doors Window Window	<b>IENT</b> ws Type ws Type	Gros area	SS (m <sup>2</sup> )	Openin r	gs <sub>1</sub> 2	Net Ar A ,r 2.07 1.57	rea m <sup>2</sup> x x x1 x1	U-valu W/m2 [	ue K 0.04] = 0 0.04] = 0	A X U (W/I 2.07 1.8 1.8	K)	k-value kJ/m²·ŀ	a A∶ K kJ	X k /K (26) (27) (27)
ELEN Doors Window Window	<b>IENT</b> ws Type ws Type ws Type	Gros area e 1 e 2 e 3	ss (m <sup>2</sup> )	Openin m	gs <sub>J<sup>2</sup></sub>	Net Ar A ,r 2.07 1.57 1.57 8.45	rea m <sup>2</sup> x x x1 x1 x1 x1	U-valu W/m2 [	ue K 0.04] =   0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68	K)	k-value kJ/m²⋅ł	A ( K kJ	X k /K (26) (27) (27) (27)
ELEN Doors Window Window Window	IENT ws Type ws Type ws Type ws Type	Gros area e 1 e 2 e 3 e 4	ss (m <sup>2</sup> )	Openin r	gs <sub>12</sub>	Net Ar A ,r 2.07 1.57 1.57 8.45 2.73	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1	U-valı W/m2 [	LIE K 0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13	<)	k-value kJ/m²⋅k	A X	X k /K (26) (27) (27) (27) (27)
ELEN Doors Window Window Window Window	<b>IENT</b> ws Type ws Type ws Type ws Type ws Type	Gros area e 1 e 2 e 3 e 4 e 5	ss (m <sup>2</sup> )	Openin r	gs <sub>1</sub> 2	Net Ar A ,r 2.07 1.57 1.57 8.45 2.73 2.73	rea m <sup>2</sup> x x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup>	U-valı W/m2 [	ue K 0.04] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13	<>	k-value kJ/m²-ŀ	ά Α΄ Κ kJ	X k /K (26) (27) (27) (27) (27) (27)
ELEN Doors Window Window Window Window Window	IENT ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 9 1 9 2 9 3 9 4 9 5 9 6	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 8.45 2.73 2.73 3	rea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-valu W/m2 1 /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+	LLE K 0.04] =   0.04] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13	$\diamond$	k-value kJ/m²·ŀ	A ( K kJ	X k /K (26) (27) (27) (27) (27) (27) (27)
ELEN Doors Window Window Window Window Window	IENT ws Type ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 2 1 2 2 2 3 2 4 2 5 2 6 2 7	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 3 2.22	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vala W/m2 1 /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+	LE 	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.44 2.52	$\sim$	k-value kJ/m²⋅k	A (	X k /K (26) (27) (27) (27) (27) (27) (27) (27)
ELEN Doors Window Window Window Window Window Window	IENT ws Type ws Type ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 2 2 3 4 5 5 6 7 2 8	ss (m <sup>2</sup> )	Openin m	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 3 2.2 1.32	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vala W/m2 1 /[1/( 1.2 )+ /[1/( 1.2 )+	LIE K 0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.44 2.52 1.51	$\diamond$	k-value kJ/m²·ŀ	A (	X k /K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Window Window Window Window Window Window Rooflig	MENT ws Type ws Type ws Type ws Type ws Type ws Type ws Type us Type	Gros area 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 8 9 1	ss (m <sup>2</sup> )	Openin m	gs <sub>12</sub>	Net Ar A ,r 2.07 1.57 1.57 8.45 2.73 2.73 3 2.2 1.32 2.2	ea m <sup>2</sup> x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vala W/m2 [1] /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	Le K 0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.14 2.52 1.51 2.64	$\diamond$	k-value kJ/m²·ŀ	K KJ	X k /K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig	<b>TYPE</b> ws Type ws Type ws Type ws Type ws Type ws Type ws Type jhts Typ	Gros area 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 7 9 8 9 1 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 3 2.2 1.32 2.2 1.32 2.2	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vala W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	LE K 0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816	$\diamond$	k-value kJ/m²-ŀ	A (	X k /K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig Floor	<b>TYPE</b> ws Type ws Type ws Type ws Type ws Type ws Type ws Type hts Typ	Gros area 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 1 9 2 9 7 9 8 9 7 9 8 9 7 9 8 9 7 9 8 9 7 9 8 9 7 9 8 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 2.73 2.73 2.2 1.32 2.2 0.68 37.5	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vala W/m2	LE 	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875	$\langle \rangle$	k-value kJ/m²·ŀ	A (kJ	X k /K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig Floor Walls	<b>TYPE</b> ws Type ws Type ws Type ws Type ws Type ws Type ws Type hts Typ hts Typ	Gros area 2 1 2 2 3 3 4 4 5 5 6 6 7 8 8 e 1 e 2 161.	58	Openin m	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 2.73 3 2.73 2.73 2.73 3 2.22 1.32 2.2 0.68 37.5 135.9	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	$\begin{array}{c} \text{U-value} \\ \text{W/m2} \\ \hline 1 \\ 1 \\$	Le K 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 1 0.04] = 0.04] = 1 0.04] = 1 0 0.04] = 1 0 0 0 0 0 0 0 0 0 0 0 0 0	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875 24.47	$\diamond$	k-value kJ/m²-ŀ	A (kJ)	X k /K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig Floor Walls Roof	Type ws Type ws Type ws Type ws Type ws Type ws Type ws Type yhts Typ yhts Typ	Gros area 2 1 2 2 3 3 4 4 5 5 6 6 2 7 2 8 e 1 e 2 161. 5.5	58 558 578	Openin           m           25.6           0	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 2.73 2.73 2.73 2.73 2.2 1.32 2.2 0.68 37.5 135.9 5.5	ea m <sup>2</sup> x x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>2</sup>	$\begin{array}{c} \text{U-valu}\\ \text{W/m2} \end{array}$	LE K 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 1 0.04] = 1 0 0.04] = 1 0 0 0 0 0 0 0 0 0 0 0 0 0	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875 24.47 0.6		k-value kJ/m²-ŀ	A (kJ)	X k (26) (27) (28) (29) (30) (30)
ELEN Doors Window Window Window Window Window Window Rooflig Floor Walls Roof T Roof T	<b>Type</b> ws Type ws Type ws Type ws Type ws Type ws Type yhts Typ yhts Typ	Gros area $a^{2}$ 1 $a^{2}$ 2 $a^{3}$ 4 $a^{5}$ 5 $a^{6}$ 6 $a^{7}$ 7 $a^{8}$ 8 $e^{1}$ 1 $e^{2}$ 2 $a^{5}$ 5 $a^{6}$ 7 $a^{8}$ 8 $e^{1}$ 1 $e^{2}$ 2 $a^{7}$ 3 $a^{7}$ 3	58 55	Openin           m           25.6           0           2.88	4	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 3 2.2 1.32 2.2 0.68 37.5 135.9 5.5 34.62	ea m <sup>2</sup> x x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x	$\begin{array}{c} \text{U-valu}\\ \text{W/m2} \end{array}$	Le K 0.04] =   0.04]	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875 24.47 0.6 3.81		k-value kJ/m²-ŀ	A ( kJ ( kJ ( kJ ( kJ ( kJ ( kJ ( kJ ( kJ	X k /K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig Floor Walls Roof 1 Roof 1 Roof 1 Roof 1 Roof 1 Total a	<b>Type</b> ws Type ws Type ws Type ws Type ws Type ws Type yhts Typ yhts Typ fype1 Type2 urea of e	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 1 e 2 161. 5.5 37.3 Hements	58 55 57 57 57	Openin           m           25.6           0           2.88	4	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 2.73 2.73 3 2.2 1.32 2.2 1.32 2.2 0.68 37.5 135.9 5.5 34.62 242.0	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-value W/m2 $ \begin{bmatrix} 1 \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ 0.13 \\ \hline 0.11 \\ 0.11 \\ \hline 0.11 $	LE K 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 1 = 0.04] = 1 = 0.04] = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875 24.47 0.6 3.81		k-value kJ/m²-k 110 60 9 9	A (kJ)	X k /K (26) (27) (27) (27) (27) (27) (27) (27) (27

Interna	al floor					61.4					Г	18	٦	1105.2	(32d)
Interna	al ceiling					61.4					Γ	9	=	552.6	(32e)
* for win ** inclua	dows and le the area	roof windo as on both	ows, use e sides of in	ffective wi nternal wal	ndow U-va Is and part	lue calcul itions	ated using	ı formula 1,	/[(1/U-valu	ıe)+0.04] a	⊾ as given in	paragraph	 3.2		-
Fabric	heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				6	6.11	(33)
Heat c	apacity	Cm = S(	Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	157	773.49	(34)
Therm	al mass	parame	ter (TMF	P = Cm ÷	- TFA) in	⊨kJ/m²K			= (34)	÷ (4) =			1	59.49	(35)
For desi can be ι	ign assess used instea	ments wh ad of a dei	ere the de tailed calci	tails of the ulation.	constructi	on are no	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f			_
Therm	al bridge	es : S (L	x Y) cal	culated (	using Ap	pendix l	<						6	3.18	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)			()	()					-
Total f	abric he	at loss							(33) +	(36) =			7	4.29	(37)
Ventila	ation hea	at loss ca	alculated	monthly	/		I		(38)m	= 0.33 × (	25)m x (5) I	_	I		
(0.0)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			(20)
(38)m=	29.45	29.06	28.67	26.74	26.35	24.42	24.42	24.03	25.19	26.35	27.13	27.9			(38)
Heat tr	ransfer c	coefficier	nt, W/K						(39)m	= (37) + (3	38)m	·			
(39)m=	103.74	103.35	102.97	101.03	100.65	98.71	98.71	98.33	99.49	100.65	101.42	102.19			
Heat lo	oss nara	meter (F	HP) W/	′m²K					ر (40)m	Average = = (39)m ÷	Sum(39)₁. √(4)	12 /12=	1(	00.94	(39)
(40)m=	1.05	1.05	1.04	1.02	1.02	1	1	0.99	1.01	1.02	1.03	1.03			
( - )										Average =	Sum(40)1			1.02	(40)
Numbe	er of day	vs in mor	nth (Tab	le 1a)			-								-
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31			(41)
4. Wa	ater heat	ing ener	gy requi	irement:								kWh/ye	ear:		
Δεειισ		inancy I	M									70	1		(42)
if TF	A > 13.9	9, N = 1	<b>•</b> + 1.76 x	[1 - exp	(-0.0003	49 x (TF		)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.	.9)	73			(42)
if TF	A £ 13.9	9, N = 1			_			<i>i</i>					1		
Annua Reduce	l averag	e hot wa al average	ater usag hot water	ge in litre usage by :	es per da 5% if the d	y Vd,av welling is	erage = desianed i	(25 x N) to achieve	+ 36 a water us	se target o	99 f	.02			(43)
not more	e that 125	litres per p	person per	day (all w	ater use, ł	not and co	ld)			<u>j</u>					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot wate	er usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)							
(44)m=	108.92	104.96	101	97.04	93.08	89.11	89.11	93.08	97.04	101	104.96	108.92			
										Total = Su	m(44) <sub>112</sub> =	=	1.	188.2	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x D	0Tm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)			
(45)m=	161.52	141.27	145.78	127.09	121.95	105.23	97.51	111.9	113.23	131.96	144.05	156.43			-
lf instan	taneous w	ater heatir	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46,	) to (61)	Total = Su	m(45) <sub>112</sub> =	=	15	57.91	(45)
(46)m=	24.23	21.19	21.87	19.06	18.29	15.78	14.63	16.78	16.98	19.79	21.61	23.46			(46)
Water	storage	IOSS:	in clustin												
Storag	e volum	e (ittres)		ig any so	nar or W		storage		arrie ves	sei		210			(47)
n comi Otherv	numity h vise if no	eating a	nu no ta hot wate	ank in aw ar (this in	enng, e Icludes i	nter 110 nstantar	nines in Neous co	(47) mbi boili	ers) ente	er '0' in <i>(</i>	47)				
0.000		2 0.0100				locanta					•••				

Water storage loss:

a) If m	nanufact	urer's de	eclared I	oss fact	or is kno	wn (kWł	n/day):				1.	.97	(	48)
Tempe	erature f	actor fro	m Table	2b							0.	54	(	<b>19</b> )
Energy	y lost fro	m water	r storage	e, kWh/y	ear			(48) x (49	) =		1.	.06	(1	50)
b) If m Hot wa If com Volum	nanufact ater stora munity h e factor	urer's de age loss neating s from Ta	eclared o factor fi see secti ble 2a	cylinder rom Tab on 4.3	loss fact le 2 (kW	or is not h/litre/da	known: ay)					0	()	51) 52)
Tempe	erature f	actor fro	m Table	2b								0	(	53)
Energy	y lost fro	m water	<sup>.</sup> storage	e, kWh/y	ear			(47) x (51	) x (52) x (	53) =		0	(1	54)
Enter	(50) or	(54) in (5	55)	-							1.	.06	(	55)
Water	storage	loss cal	culated	for each	month			((56)m = (	55) × (41)	m				
(56)m=	32.98	29.79	32.98	31.91	32.98	31.91	32.98	32.98	31.91	32.98	31.91	32.98	(1	56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m=	32.98	29.79	32.98	31.91	32.98	31.91	32.98	32.98	31.91	32.98	31.91	32.98	()	57)
Primar	v circuit	loss (ar	nual) fro	y om Table	- - 3							0	(1	58)
Primar	y circuit	loss cal	culated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m			-		
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	ı cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	()	59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)	)m		_	-			
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(	<u>3</u> 1)
Total h	heat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × (	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	217.76	192.07	202.02	181.52	178.19	159.66	153.75	168.14	167.66	188.2	198.47	212.67	(	32)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contributi	ion to wate	r heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(	33)
Output	t from w	ater hea	ter			-		-	-			-		
(64)m=	217.76	192.07	202.02	181.52	178.19	159.66	153.75	168.14	167.66	188.2	198.47	212.67		
			-	•	-		-	Out	out from wa	ater heate	r (annual)₁	12	2220.09 (	34)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	]	
(65)m=	98.7	87.61	93.46	85.8	85.54	78.53	77.41	82.2	81.19	88.87	91.44	97	(	35)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a	):									
Metab	olic gain	is (Table	e 5), Wat	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	(	36)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5		•			
(67)m=	22.69	20.15	16.39	12.41	9.28	7.83	8.46	11	14.76	18.74	21.88	23.32	(	37)
Applia	nces ga	ins (calc	ulated ir	n Appeno	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	254.54	257.18	250.52	236.35	218.47	201.65	190.42	187.78	194.44	208.61	226.5	243.31	(	38)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)	), also se	ee Table	5	-			
(69)m=	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	(	39)
Pumps	s and fa	ns gains	(Table	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(	70)

Losse	s e.g. ev	/aporatio	n (nega	tive va	lues) (Ta	able	5)									
(71)m=	-109.16	-109.16	-109.16	-109.1	6 -109.16	3 -1	09.16	-109.16	-109	9.16	-109.16	-109.1	6 -109.16	-109.16		(71)
Water	heating	gains (T	able 5)												-	
(72)m=	132.66	130.37	125.62	119.16	6 114.97	7 1	09.07	104.05	110	.48	112.76	119.4	5 126.99	130.38		(72)
Total	internal	gains =					(66)	m + (67)m	n + (68	B)m +	(69)m + (1	70)m +	(71)m + (72)	m		
(73)m=	476.82	474.64	459.47	434.86	6 409.65	5 3	85.49	369.87	376	6.2	388.9	413.74	442.3	463.95		(73)
6. Sc	lar gain	s:														
Solar	gains are	calculated	using sola	r flux fro	m Table 6	a and	d assoc	iated equa	ations	to cor	nvert to the	e applic	able orientat	ion.		
Orient	ation: /	Access F	actor	Are	a		Flu	X blo Go		т	g_		FF		Gains	
	r					1		ole da	1	- T c		_			( • • • )	_
North	0.9x	0.77	X		1.57	x	1	0.63	X		0.63	×	0.7	=	5.1	(74)
North	0.9x	0.77	X	· ·	1.57	x	1	0.63	X		0.63	×	0.7	=	5.1	(74)
North	0.9x	0.77	X		3	x		0.63	X		0.63	×	0.7	=	9.75	(74)
North	0.9x	0.77	X		2.2	x	1	0.63	X		0.63	×	0.7	=	7.15	(74)
North	0.9x	0.77	X		1.32	x	1	0.63	X		0.63	×	0.7	=	4.29	(74)
North	0.9x	0.77	x		1.57	x	2	20.32	x		0.63	×	0.7	=	9.75	(74)
North	0.9x	0.77	x		1.57	x	2	20.32	x		0.63	×	0.7	=	9.75	(74)
North	0.9x	0.77	x		3	x	2	20.32	x		0.63	×	0.7	=	18.63	(74)
North	0.9x	0.77	x		2.2	x	2	20.32	x		0.63	×	0.7	=	13.66	(74)
North	0.9x	0.77	x		1.32	x	2	20.32	x		0.63	×	0.7	=	8.2	(74)
North	0.9x	0.77	x		1.57	x	3	34.53	x		0.63	x	0.7	=	16.57	(74)
North	0.9x	0.77	x		1.57	x	3	34.53	x		0.63	×	0.7	=	16.57	(74)
North	0.9x	0.77	x		3	x	3	34.53	x		0.63	x	0.7	=	31.66	(74)
North	0.9x	0.77	x		2.2	x	3	84.53	x		0.63	x	0.7	=	23.22	(74)
North	0.9x	0.77	x		1.32	x	3	84.53	x		0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x		1.57	x	5	5.46	x		0.63	×	0.7	=	26.61	(74)
North	0.9x	0.77	X		1.57	x	5	5.46	x		0.63	x	0.7	=	26.61	(74)
North	0.9x	0.77	X		3	x	5	5.46	x		0.63	×	0.7	=	50.85	(74)
North	0.9x	0.77	x		2.2	x	5	5.46	x		0.63	×	0.7	=	37.29	(74)
North	0.9x	0.77	X		1.32	x	5	5.46	x		0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x		1.57	x	7	4.72	x		0.63	×	0.7	=	35.85	(74)
North	0.9x	0.77	x		1.57	x	7	4.72	x		0.63	x	0.7	=	35.85	(74)
North	0.9x	0.77	x		3	x	7	4.72	x		0.63	x	0.7	=	68.5	(74)
North	0.9x	0.77	x		2.2	x	7	4.72	x		0.63	x	0.7	=	50.23	(74)
North	0.9x	0.77	x		1.32	x	7	4.72	x		0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	·	1.57	x	7	9.99	x		0.63	x	0.7	=	38.38	(74)
North	0.9x	0.77	x		1.57	x	7	9.99	<b>x</b>		0.63	×	0.7	=	38.38	(74)
North	0.9x	0.77	x		3	x	7	'9.99	x		0.63	×	0.7	=	73.33	(74)
North	0.9x	0.77	x		2.2	x	7	9.99	x		0.63	x	0.7	=	53.78	(74)
North	0.9x	0.77	x	· ·	1.32	x	7		x		0.63	x	0.7	=	32.27	(74)

North	0.9x	0.77	x	1.57	x	74.68	x	0.63	x	0.7	] =	35.83	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.63	x	0.7	<b>j</b> =	35.83	- (74)
North	0.9x	0.77	x	3	x	74.68	x	0.63	x	0.7	<b>j</b> =	68.47	- (74)
North	0.9x	0.77	x	2.2	x	74.68	x	0.63	x	0.7	<b>i</b> =	50.21	- (74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	i =	30.13	<b>–</b> (74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.63	x	0.7	=	28.43	(74)
North	0.9x	0.77	x	1.57	×	59.25	x	0.63	x	0.7	] =	28.43	(74)
North	0.9x	0.77	x	3	x	59.25	x	0.63	x	0.7	=	54.32	(74)
North	0.9x	0.77	x	2.2	x	59.25	x	0.63	x	0.7	=	39.83	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	] =	23.9	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.63	x	0.7	=	19.92	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.63	x	0.7	=	19.92	(74)
North	0.9x	0.77	x	3	x	41.52	x	0.63	x	0.7	=	38.06	(74)
North	0.9x	0.77	x	2.2	x	41.52	x	0.63	x	0.7	] =	27.91	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	] =	16.75	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.63	x	0.7	=	11.61	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.63	x	0.7	=	11.61	(74)
North	0.9x	0.77	x	3	x	24.19	x	0.63	x	0.7	] =	22.18	(74)
North	0.9x	0.77	x	2.2	x	24.19	x	0.63	x	0.7	=	16.26	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.63	x	0.7	=	6.29	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.63	x	0.7	=	6.29	(74)
North	0.9x	0.77	x	3	x	13.12	x	0.63	x	0.7	=	12.03	(74)
North	0.9x	0.77	x	2.2	x	13.12	x	0.63	x	0.7	=	8.82	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.63	x	0.7	] =	4.25	(74)
North	0.9x	0.77	x	3	x	8.86	x	0.63	x	0.7	] =	8.13	(74)
North	0.9x	0.77	x	2.2	x	8.86	x	0.63	x	0.7	=	5.96	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
East	0.9x	0.77	x	8.45	x	19.64	x	0.63	x	0.7	=	50.72	(76)
East	0.9x	0.77	x	2.73	x	19.64	x	0.63	x	0.7	=	16.39	(76)
East	0.9x	0.77	x	2.73	x	19.64	x	0.63	x	0.7	=	16.39	(76)
East	0.9x	0.77	x	8.45	x	38.42	x	0.63	x	0.7	=	99.22	(76)
East	0.9x	0.77	x	2.73	x	38.42	x	0.63	x	0.7	=	32.06	(76)
East	0.9x	0.77	x	2.73	x	38.42	x	0.63	x	0.7	] =	32.06	(76)
East	0.9x	0.77	x	8.45	×	63.27	x	0.63	x	0.7	] =	163.4	(76)
East	0.9x	0.77	x	2.73	×	63.27	x	0.63	x	0.7	=	52.79	(76)
East	0.9x	0.77	x	2.73	x	63.27	x	0.63	x	0.7	=	52.79	(76)
East	0.9x	0.77	x	8.45	x	92.28	x	0.63	x	0.7	=	238.31	(76)
East	0.9x	0.77	x	2.73	x	92.28	x	0.63	x	0.7	=	76.99	(76)

East	0.9x	0.77	x	2.73	x	92.28	x	0.63	x	0.7	=	76.99	(76)
East	0.9x	0.77	x	8.45	x	113.09	x	0.63	x	0.7	] =	292.05	(76)
East	0.9x	0.77	x	2.73	x	113.09	x	0.63	x	0.7	] =	94.36	(76)
East	0.9x	0.77	x	2.73	x	113.09	x	0.63	x	0.7	=	94.36	(76)
East	0.9x	0.77	x	8.45	x	115.77	x	0.63	x	0.7	] =	298.97	(76)
East	0.9x	0.77	x	2.73	x	115.77	x	0.63	x	0.7	=	96.59	(76)
East	0.9x	0.77	x	2.73	x	115.77	x	0.63	×	0.7	=	96.59	(76)
East	0.9x	0.77	x	8.45	x	110.22	x	0.63	x	0.7	=	284.63	(76)
East	0.9x	0.77	x	2.73	x	110.22	x	0.63	x	0.7	=	91.96	(76)
East	0.9x	0.77	x	2.73	x	110.22	x	0.63	x	0.7	=	91.96	(76)
East	0.9x	0.77	x	8.45	x	94.68	x	0.63	x	0.7	=	244.49	(76)
East	0.9x	0.77	x	2.73	x	94.68	x	0.63	x	0.7	=	78.99	(76)
East	0.9x	0.77	x	2.73	x	94.68	x	0.63	×	0.7	=	78.99	(76)
East	0.9x	0.77	x	8.45	x	73.59	x	0.63	x	0.7	=	190.04	(76)
East	0.9x	0.77	x	2.73	x	73.59	x	0.63	x	0.7	=	61.4	(76)
East	0.9x	0.77	x	2.73	x	73.59	x	0.63	×	0.7	=	61.4	(76)
East	0.9x	0.77	x	8.45	x	45.59	x	0.63	x	0.7	=	117.73	(76)
East	0.9x	0.77	x	2.73	x	45.59	x	0.63	×	0.7	] =	38.04	(76)
East	0.9x	0.77	x	2.73	x	45.59	x	0.63	x	0.7	=	38.04	(76)
East	0.9x	0.77	x	8.45	x	24.49	x	0.63	x	0.7	=	63.24	(76)
East	0.9x	0.77	x	2.73	x	24.49	x	0.63	x	0.7	=	20.43	(76)
East	0.9x	0.77	x	2.73	x	24.49	x	0.63	x	0.7	=	20.43	(76)
East	0.9x	0.77	x	8.45	x	16.15	x	0.63	x	0.7	=	41.71	(76)
East	0.9x	0.77	x	2.73	x	16.15	x	0.63	x	0.7	=	13.48	(76)
East	0.9x	0.77	x	2.73	x	16.15	x	0.63	x	0.7	=	13.48	(76)
Roofligh	nts <mark>0.9</mark> x	1	x	2.2	x	16.18	x	0.63	x	0.7	=	14.12	(82)
Roofligh	nts <mark>0.9</mark> x	1	x	0.68	x	43.99	x	0.63	x	0.7	=	11.87	(82)
Roofligh	nts <mark>0.9x</mark>	1	x	2.2	x	30.63	x	0.63	x	0.7	=	26.75	(82)
Roofligh	nts <mark>0.9x</mark>	1	x	0.68	x	80.27	x	0.63	x	0.7	=	21.66	(82)
Roofligh	nts <mark>0.9x</mark>	1	x	2.2	x	55.7	x	0.63	x	0.7	=	48.64	(82)
Roofligh	nts <mark>0.9x</mark>	1	x	0.68	x	121.32	x	0.63	x	0.7	=	32.74	(82)
Roofligh	nts <mark>0.9x</mark>	1	x	2.2	x	101.28	x	0.63	x	0.7	] =	88.44	(82)
Roofligh	nts <mark>0.9</mark> x	1	x	0.68	x	165.18	x	0.63	×	0.7	] =	44.58	(82)
Roofligh	nts <mark>0.9x</mark>	1	x	2.2	x	149.52	x	0.63	x	0.7	=	130.56	(82)
Roofligh	nts <mark>0.9x</mark>	1	x	0.68	x	195.41	x	0.63	x	0.7	] =	52.74	(82)
Roofligh	nts <mark>0.9</mark> x	1	x	2.2	x	166.08	x	0.63	x	0.7	=	145.01	(82)
Roofligh	nts <mark>0.9</mark> x	1	x	0.68	x	197.72	x	0.63	x	0.7	=	53.36	(82)
Roofligh	nts <mark>0.9</mark> x	1	x	2.2	x	152.65	x	0.63	x	0.7	=	133.29	(82)
Roofligh	nts <mark>0.9</mark> x	1	x	0.68	×	189.14	<b>x</b>	0.63	×	0.7	] =	51.05	(82)
Roofligh	nts <mark>0.9</mark> x	1	x	2.2	×	112.79	<b>x</b>	0.63	×	0.7	=	98.49	(82)
Roofligh	nts <mark>0.9</mark> x	1	x	0.68	×	166.58	x	0.63	×	0.7	=	44.96	(82)

Rooflig	hts <mark>0.9x</mark>	1	x	2.	2	x	7	0.26	x		0.63	<b>x</b>	0.7	=	61.35	(82)
Rooflig	hts 0.9x	1	x	0.0	68	x	1	36.8	×		0.63	= × [	0.7	= -	36.92	(82)
Rooflig	hts 0.9x	1	x	2.	2	x	3	37.03	x		0.63	 × [	0.7	=	32.34	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	0.0	58	x	9	2.07	×		0.63	 × [	0.7	=	24.85	(82)
Rooflig	hts 0.9x	1	x	2.	2	x	· ·	19.8	×		0.63		0.7	=	17.29	(82)
Rooflig	hts 0.9x	1	x	0.0	68	x	5	53.73	x		0.63		0.7	=	14.5	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	2.	2	x	1	3.64	×		0.63		0.7	=	11.91	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	0.6	68	x	3	86.94	×		0.63	_ × [	0.7		9.97	(82)
	_								-							
Solar g	pains in	watts, ca	alculated	d for eac	h month	<u> </u>			(83)m	า = Sเ	um(74)m .	(82)m	i		-	
(83)m=	140.88	271.73	452.3	689.05	884.64	9	26.66	873.34	720	.83	533.67	322.4	174.62	116.71		(83)
Total g	jains – i	nternal a	and sola r	r (84)m = T	= (73)m 1	+ (8	83)m	, watts	r						-	(2.1)
(84)m=	617.71	746.38	911.77	1123.92	1294.29	13	312.15	1243.22	1097	7.03	922.58	736.14	616.93	580.66		(84)
7. Me	an inter	nal temp	perature	(heating	seasor	າ)										
Temp	erature	during h	neating p	periods i	n the livi	ng	area	from Tab	ole 9	, Th′	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living ar	ea, h1,m	<u>า (s</u>	ee Ta	ble 9a)					-		-	
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.97	0.94	0.83	0.65		0.47	0.35	0.4	41	0.67	0.91	0.98	0.99		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	' in T	able	e 9c)					
(87)m=	19.47	19.72	20.12	20.6	20.87	2	20.97	20.99	20.	99	20.9	20.48	19.89	19.43	7	(87)
Temp	erature	durina h	neating r	beriods i	n rest of	dw	/ellina	from Ta	ble 9	9. Th	n2 (°C)			-	-	
=m(88)	20.04	20.05	20.05	20.07	20.07	2	20.08	20.08	20.	.09	20.08	20.07	20.06	20.06	7	(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina	h2	m (se	e Table	9a)				•			
(89)m=	0.98	0.97	0.92	0.8	0.6		0.41	0.28	0.3	33	0.6	0.88	0.97	0.99	7	(89)
Moon		l tompor	i naturo in	the rest	of dwoll	ing	T2 (f			to 7	/ in Tabl					
(90)m=	17.99	18.36	18.94	19.6	19 94		12(1)	20.08	20	08	19 99	19.46	18.62	17 95	7	(90)
(00)	11.00	10.00	10.01			1-		20.00		00	f	LA = Livi	ing area ÷ (	4) =	03	<b>(</b> 91)
		• .														
Mean	interna	I temper	ature (fo	or the wh	lole dwe	ellin T	g) = f	$LA \times T1$	+ (1	- tL	A) × T2	40.70	10	40.00	7	(02)
(92)m=	rodiuotr		19.29				20.34	20.35	20.		20.20	19.76	19	16.39		(92)
(93)m=	18 43	18 76	19 29	199	20.22		20.34	20.35	20	35	20.26	19 76	19	18.39	٦	(93)
8 Sp	ace hea	tina real	Jiremen	t		<u> </u>		20100			20.20	10110	1	10100		
Set T	i to the	mean int	ernal te	mperatu	re obtai	ned	l at ste	ep 11 of	Tabl	le 9b	o, so tha	t Ti.m=	(76)m an	d re-ca	lculate	
the ut	tilisation	factor fo	or gains	using Ta	able 9a						,		( - )		_	
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	ו:									_		-	
(94)m=	0.98	0.96	0.91	0.79	0.61		0.42	0.3	0.3	35	0.61	0.87	0.96	0.98		(94)
Usefu	ul gains,	hmGm	, W = (9	4)m x (8	4)m	-			<b>—</b>	1	1		1	I	7	
(95)m=	604.29	715.57	829.46	888.91	790.57	5	54.52	368.39	384	.54	565.68	643.98	593.74	570.36		(95)
Mont	nly aver	age exte	ernal tem	nperature	e trom T	abl T	e 8	10.0	40		444	40.0	74	4.0	7	(06)
	4.3	4.9	o.o				14.0	-[(30)m		.4 3)m	(06)m	10.6	7.1	4.2		(30)
(97)m-	1466 11	1432 95	1317 17	1110 94	857 51	5	1, VV =	370 55	~ [(9. 388	<sub>64</sub> T	613.2	J 922 31	1206.96	1450.6	3	(97)
(0) ///-	1.00.11	I 102.00		I	1 337.31	1	55.20	0.00			010.2	522.01	1.200.00	1 100.0	<u></u>	(0.)

Space	e heatin	g require	ement fo	r each n	nonth, k\	Wh/mont	th = 0.02	24 x [(97)	)m – (95	)m] x (4	1)m			
(98)m=	641.2	482.08	362.85	159.86	49.81	0	0	0	0	207.08	441.52	654.92		_
								Tota	l per year	(kWh/year	<sup>.</sup> ) = Sum(9	8)15,912 =	2999.31	(98)
Space	e heatin	g require	ement in	kWh/m <sup>2</sup>	/year								30.33	(99)
9a. Ene	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:			, .									
Fractio	on of sp	ace nea	it from s	econdar	y/supple	mentary	system	(202) = 1	(201) -				0	
Fractio	on of sp	ace nea	it from m	nain syst	em(s)			(202) = 1 - (204) =	-(201) =	(203)] -		·	1	$\begin{bmatrix} (202) \\ (204) \end{bmatrix}$
Efficio			ng nom	ing syste				(204) - (2	02) ~ [1	(200)] –			00.7	
Efficie	ncy of a	nain spa		omontar	v boatin	a svetor	0/						90.7	(200)
			I y/Suppi		Main		1, 70	A	0.00	0.1	Navi	Dee		_(200)
Space	Jan		iviar	Apr alculate	d above	Jun	Jui	Aug	Sep	Oct	INOV	Dec	Kvvn/yea	ar
	641.2	482.08	362.85	159.86	49.81	0	0	0	0	207.08	441.52	654.92		
L (211)m	= {[(98	)m x (20	L  4)] } x 1	$00 \div (20)$	)6)									(211)
()	706.94	531.51	400.06	176.25	54.91	0	0	0	0	228.31	486.79	722.07		()
L								Tota	l (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	=	3306.85	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month									4
= {[(98)	m x (20	)1)]}x1	00 ÷ (20	8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		-
								Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
Water	heating	 	tor (oolo	ulated a										
	217.76	192.07	202.02	181.52	178.19	159.66	153.75	168.14	167.66	188.2	198.47	212.67		
Efficien	icy of w	ater hea	iter	1		1							80	(216)
(217)m=	87.73	87.37	86.56	84.68	82.12	80	80	80	80	85.27	87.09	87.82		(217)
Fuel for	r water	heating,	kWh/m	onth										
(219)m (219)m=	= (64)	m x 100	) ÷ (217) 233.38	m 214.36	216 99	199.57	192 19	210 17	209 57	220 71	227.9	242 16		
(210)	210.20	210.00	200.00	211.00	210.00	100.01	102.10	Tota	I = Sum(2	19a) <sub>1 12</sub> =	227.0	2 12:10	2635.08	(219)
Annua	l totals									k	Wh/vear		kWh/vear	
Space	heating	fuel use	ed, main	system	1						, , , , , , , , , , , , , , , , , , ,		3306.85	1
Water I	neating	fuel use	d										2635.08	ī
Electric	ity for p	oumps, fa	ans and	electric	keep-ho	t						I		1
mecha	anical v	entilatio	n - balar	nced. ext	ract or p	ositive ir	nput fror	n outside	Ð			256.23		(230a)
centra	l hoatin				P		.p		-			200.20		(230c)
boilor	u rieaun											30		(2200)
				111- /	_				of (000-)	(220-)		45		(230e) T(004)
i otal el	iectricity	/ for the	above, I	kvvn/yea	ſ			sum	or (230a).	(230g) =			331.23	_ <sup>(231)</sup>
Electric	ity for li	ghting											400.75	(232)
Total de	elivered	l energy	for all u	ses (211	)(221)	+ (231)	+ (232).	(237b)	=				6673.91	(338)

#### 12a. CO2 emissions – Individual heating systems including micro-CHP Energy **Emission factor Emissions** kg CO2/kWh kg CO2/year kWh/year (211) x Space heating (main system 1) 0.216 = 714.28 (261) Space heating (secondary) (215) x = 0 (263) 0.519 (219) x Water heating 0.216 = (264) 569.18 (261) + (262) + (263) + (264) = Space and water heating 1283.46 (265) (231) x Electricity for pumps, fans and electric keep-hot (267) 0.519 171.91 (232) x Electricity for lighting = (268) 0.519 207.99 sum of (265)...(271) = Total CO2, kg/year (272) 1663.35 $(272) \div (4) =$ **Dwelling CO2 Emission Rate** (273) 16.82 El rating (section 14) 85 (274)

				User D	etails:						
Assessor Name:	Ondrej Ga	jdos			Strom	a Num	ber:		STRO	006629	
Software Name:	Stroma FS	AP 201	2		Softwa	are Ver	sion:		Versio	n: 1.0.5.60	
			Р	roperty.	Address	: Be Gre	en				
Address :	Be Green, 6	68-70 Bo	vill Road	d, LONE	ON, SE	23 1EJ					
1. Overall dwelling dimen	ISIONS:			•	- ( 2)		A 11	ark (100)		)/ a luma a (m. 2)	
Ground floor				Area	a(m²) 37.5	(1a) x			(2a) =		(3a)
First floor					20.7	(1b) x		65	(2b) -	91.26	](3b)
Second floor					20.7	$(10) \times (10) \times $	2.	2	(20) =	70.61	
Total floor area $TEA = (1a)$	)+(1b)+(1c)+	(1d)+(1e	)+ (1r		20.7	(10) X	2	.0	(20) -	70.01	(30)
	)1(10)1(10)1		·) ·( II	"	96.9	(4) (3a)+(3b)	)+(3c)+(3d	)+(3e)+	(3n) -	0.44.07	
Dweiling volume						(38)+(30	)+(30)+(30	)+(36)+	.(01) –	241.97	(5)
2. Ventilation rate:	main	S	econdar	'V	other		total			m <sup>3</sup> per hour	
Number of chimneys	heating	h 	eating	, 기 + ୮		л <sub>=</sub> г		x 4	40 =		
Number of open flues	0		0	]	0		0		20 =	0	
Number of intermittent fan	s		0		0		0		10 =	0	
Number of passive vents	3						0		10 =	0	$\left  \frac{7a}{7b} \right $
Number of flueless gas fire	26						0		10 =	0	$ \begin{bmatrix} 7 & 0 \\ 0 & 0 \end{bmatrix} $
Number of nucless gas in	55						0	~		0	(7C)
									Air ch	anges per hou	ır
Infiltration due to chimney	s, flues and f	ans = <mark>(6</mark>	a)+(6b)+(7	′a)+(7b)+(	7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has be	en carried out o	r is intende	ed, procee	d to (17), o	otherwise o	continue fr	om (9) to (	16)			-
Number of storeys in the	e dwelling (n	s)								0	(9)
Additional infiltration								[(9)	1]x0.1 =	0	(10)
Structural infiltration: 0.2	25 for steel of	r timber i	frame or	0.35 fo	r masoni	y constr	uction			0	(11)
deducting areas of opening	sent, use the va gs); if equal user	0.35	ponung ic	ine great	er wall are	a (allel					_
If suspended wooden flo	oor, enter 0.2	(unseal	ed) or 0.	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else	enter 0								0	(13)
Percentage of windows	and doors dr	aught st	ripped							0	(14)
Window infiltration					0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	- (15) =		0	(16)
Air permeability value, c	50, expresse	ed in cub	ic metre	s per ho	our per s	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabilit	y value, then	(18) = [(1	7) ÷ 20]+(8	8), otherw	se (18) = (	16)	·			0.25	(18)
Air permeability value applies	lt a pressurisati I	on test nas	s been aon	ie or a deg	gree air pe	rmeability	is being us	sed		0	
Shelter factor	1				(20) = 1 -	[0.075 x (1	9)] =			3 0.78	(19)
Infiltration rate incorporatir	na shelter fac	ctor			(21) = (18	) x (20) =				0.19	(21)
Infiltration rate modified fo	r monthly wir	nd speed	I			·				0.10	<u> </u>
Jan Feb N	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Tab	e 7									
(22)m= 5.1 5 4	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 infiltra	ation rat	e (allowi	ing for sl	nelter an	nd wind s	speed) =	: (21a) x	(22a)m					
	0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23		
Calcula	ate effec	ctive air	change	rate for t	he appli	cable ca	se	•		•		ـــــــــــــــــــــــــــــــــــــ		<b>_</b>
If me	echanica	al ventila	ation:							) (00-)		l	0.5	(23a)
If exh	aust air he	eat pump		endix N, (2	(23a) = (23a	a) × Fmv (e	equation (I	N5)), other	rwise (23b	(23a) = (23a)		ļ	0.5	(23b)
If bala	anced with	heat reco	overy: effic	ency in %	allowing	for in-use f	actor (fron	n Table 4h	) =			l	75.65	(23c)
a) If	balance	d mecha	anical ve	entilation	with he	at recove	ery (MVI 1	HR) (24a 1	a)m = (2: I	2b)m + (: 1	23b) × [′	l – (23c)	÷ 100]	
(24a)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31	0.3	0.32	0.33	0.34	0.35		(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	covery (N	MV) (24b T	o)m = (22	2b)m + (2 1	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	ve input v	ventilatio	on from c	outside	- (00)	<b>、</b>			
	f (22b)n	n < 0.5 ×	(23b), 1	then (24)	c) = (23t)	o); otherv	wise (24	c) = (220)	b) m + 0	.5 × (23b	)) 			(24a)
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(240)
d) lf i	natural <sup>v</sup> f (22h)m	ventilation – 1 th	on or wh en (24d)	iole hous m = (22)	se positiv	ve input <sup>.</sup> erwise (2	ventilatio	on from I 0 5 + [(2	Oft 2h)m² x	0.51				
(24d)m=	0	0									0	0		(24d)
Effor	 ctive air	change	rate - er	ter (2/1a	$\int \frac{1}{24}$	$\int_{-\infty}^{\infty} dr (24)$	$r_{\rm c}$	ld) in hoy	(25)	<u> </u>	Ů	<u> </u>		
(25)m=	0.37	0.36	0.36	0.33	0.33	0.31	0.31		0.32	0.33	0.34	0.35		(25)
(20)	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.0	0.02	0.00	0.01	0.00		()
3 He	at losse	s and he	ant loce i	naramet	or:									
0.110			at 1055	paramet	51.									
ELEN	IENT	Gros	SS (m <sup>2</sup> )	Openin rr	gs 1 <sup>2</sup>	Net Ar A ,r	rea m²	U-valı W/m2	ue :K	A X U (W/I	K)	k-value kJ/m²·k	A A	X k J/K
ELEN Doors	IENT	Gros area	5S (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07	rea m² x	U-valı W/m2	ue K	A X U (W/I 2.07	K)	k-value kJ/m²⋅k	A K Ku	X k J/K (26)
ELEN Doors Windov	<b>IENT</b> ws Type	Gros area	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07	rea m² x x1	U-valu W/m2 1 /[1/( 1.2 )+	ue K =   0.04] =	A X U (W/I 2.07 1.8	K)	k-value kJ/m²·k	а А К К.	X k J/K (26) (27)
ELEN Doors Window Window	<b>IENT</b> ws Type ws Type	Gros area	SS (m <sup>2</sup> )	Openin r	gs <sub>1</sub> 2	Net Ar A ,r 2.07 1.57	rea m <sup>2</sup> x x x1 x1	U-valu W/m2 [	ue K 0.04] = 0.04] = 0.04]	A X U (W/I 2.07 1.8 1.8	K)	k-value kJ/m²·ŀ	а А К К.	X k J/K (26) (27) (27)
ELEN Doors Window Window	<b>IENT</b> ws Type ws Type ws Type	Gros area e 1 e 2 e 3	ss (m <sup>2</sup> )	Openin m	gs <sub>J²</sub>	Net Ar A ,r 2.07 1.57 1.57 8.45	rea m <sup>2</sup> x x x1 x1 x1 x1	U-valu W/m2 [	ue K 0.04] =   0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68	K)	k-value kJ/m²·ŀ	A K K	X k J/K (26) (27) (27) (27)
ELEN Doors Window Window Window	IENT ws Type ws Type ws Type ws Type	Gros area e 1 e 2 e 3 e 4	ss (m <sup>2</sup> )	Openin r	gs <sub>12</sub>	Net Ar A ,r 2.07 1.57 1.57 8.45 2.73	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1	U-valı W/m2 [	LIE K 0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13	K)	k-value kJ/m²⋅ł	A K K	X k J/K (26) (27) (27) (27) (27)
ELEM Doors Window Window Window Window	<b>IENT</b> ws Type ws Type ws Type ws Type ws Type	Gros area e 1 e 2 e 3 e 4 e 5	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 8.45 2.73 2.73	rea m <sup>2</sup> x x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup>	U-valı W/m2 [	ue K 0.04] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13	k)	k-value kJ/m²·ŀ	а А ( k.	X k J/K (26) (27) (27) (27) (27) (27)
ELEN Doors Window Window Window Window Window	IENT ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 9 1 9 2 9 3 9 4 9 5 9 6	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 8.45 2.73 2.73 3	rea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-valu W/m2 1 /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+	LLE K 0.04] =   0.04] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13	8) 	k-value kJ/m²⋅ŀ	A K K	X k J/K (26) (27) (27) (27) (27) (27) (27)
ELEN Doors Window Window Window Window Window	IENT ws Type ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 2 1 2 2 2 3 2 4 2 5 2 6 2 7	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 3 2.22	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-vala W/m2 1 /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/( 1.2 )+	LE 	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.44 2.52	K)	k-value kJ/m²⋅ł	A K K	X k J/K (26) (27) (27) (27) (27) (27) (27) (27)
ELEN Doors Window Window Window Window Window Window	IENT ws Type ws Type ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 2 2 3 4 5 5 6 7 2 8	(m <sup>2</sup> )	Openin m	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 3 2.2 1.32	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vala W/m2 1 /[1/( 1.2 )+ /[1/( 1.2 )+	LIE K 0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.44 2.52 1.51	K)	k-value kJ/m²⋅ł	A K K	X k J/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Window Window Window Window Window Window Rooflig	MENT ws Type ws Type ws Type ws Type ws Type ws Type ws Type us Type	Gros area 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 8 9 1	ss (m <sup>2</sup> )	Openin m	gs <sub>12</sub>	Net Ar A ,r 2.07 1.57 1.57 8.45 2.73 2.73 3 2.2 1.32 2.2	ea m <sup>2</sup> x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vala W/m2 [1] /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	Le K 0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.14 2.52 1.51 2.64	K)	k-value kJ/m²-ŀ	A K K	X k J/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig	<b>TYPE</b> ws Type ws Type ws Type ws Type ws Type ws Type ws Type jhts Typ	Gros area 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 7 9 8 9 1 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 3 2.2 1.32 2.2 1.32 2.2	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vala W/m2 1 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	LE K 0.04] =   0.04] =	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816	к»	k-value kJ/m²-ŀ	A K K	X k (26) (27) (27) (27) (27) (27) (27) (27) (27) (27) (27) (27) (27)
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig Floor	<b>TYPE</b> ws Type ws Type ws Type ws Type ws Type ws Type ws Type hts Typ	Gros area 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 1 9 2 9 3 9 4 9 5 9 6 9 7 9 8 9 1 9 2 9 7 9 8 9 7 9 8 9 7 9 8 9 7 9 8 9 7 9 8 9 7 9 8 9 7 9 7 9 7 9 7 9 7 9 7 9 7 9 7	ss (m <sup>2</sup> )	Openin r	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 2.73 2.73 2.2 1.32 2.2 0.68 37.5	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vala W/m2	LE 	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875	<pre>k)</pre>	k-value kJ/m²-ŀ	A K K.	X k J/K (26) (27) (28) (2
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig Floor Walls	<b>TYPE</b> ws Type ws Type ws Type ws Type ws Type ws Type ws Type hts Typ hts Typ	Gros area 2 1 2 2 3 3 4 4 5 5 6 6 7 8 8 e 1 e 2 161.	58	Openin m	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 2.73 3 2.73 2.73 2.73 3 2.22 1.32 2.2 0.68 37.5 135.9	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	$\begin{array}{c} \text{U-value} \\ \text{W/m2} \\ \hline 1 \\ 1 \\$	Le K 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 1 0.04] = 0.04] = 1 0.04] = 1 0 0.04] = 1 0 0 0 0 0 0 0 0 0 0 0 0 0	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875 24.47	<pre>k)</pre>	k-value kJ/m²-ŀ	A K K 4125 8156	X k (26) (27) (28) (28) (29) (29) (29) (28) (29) (
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig Floor Walls Roof 1	Type ws Type ws Type ws Type ws Type ws Type ws Type ws Type yhts Typ yhts Typ	Gros area 2 1 2 2 3 3 4 4 5 5 6 6 2 7 2 8 e 1 e 2 161. 5.5	58 558 578	Openin           m           25.6           0	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 2.73 2.73 2.73 2.73 2.2 1.32 2.2 0.68 37.5 135.9 5.5	ea m <sup>2</sup> x x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup>	$\begin{array}{c} \text{U-valu}\\ \text{W/m2} \end{array}$	LE K 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 1 0.04] = 0.04] = 1 0.04] = 1 0 0.04] = 1 0 0 0 0 0 0 0 0 0 0 0 0 0	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875 24.47 0.6	<pre>k)</pre>	k-value kJ/m²-ŀ	A K K 4125 8156 49.5	X k //K (26) (27) (28) (28) (29) (20) (29) (29) (29) (29) (29) (29) (29) (29) (29) (29) (29) (29) (29) (29) (20) (29) (20) (2)) (2
ELEN Doors Window Window Window Window Window Window Rooflig Floor Walls Roof T Roof T	<b>Type</b> ws Type ws Type ws Type ws Type ws Type ws Type yhts Typ yhts Typ	Gros area $a^{2}$ 1 $a^{2}$ 2 $a^{3}$ 4 $a^{5}$ 5 $a^{6}$ 6 $a^{7}$ 7 $a^{8}$ 8 $e^{1}$ 1 $e^{2}$ 2 $a^{7}$ 1 $a^{7}$ 1	58 55	Openin           m           25.6           0           2.88	4	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 3 2.2 1.32 2.2 0.68 37.5 135.9 5.5 34.62	ea m <sup>2</sup> x x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x <sup>1</sup> x	$\begin{array}{c} \text{U-valu}\\ \text{W/m2} \end{array}$	Le K 0.04] =   0.04]	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875 24.47 0.6 3.81		k-value kJ/m²-ŀ	A K K 4125 8156 49.5 311.5	X k J/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Window Window Window Window Window Window Rooflig Rooflig Floor Walls Roof 1 Roof 1 Roof 1 Roof 1 Roof 1 Total a	<b>Type</b> ws Type ws Type ws Type ws Type ws Type ws Type yhts Typ yhts Typ fype1 Type2 urea of e	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 8 e 1 e 2 161. 5.5 37.3 Hements	58 55 57 57 57	Openin           m           25.6           0           2.88	4	Net Ar A ,r 2.07 1.57 1.57 2.73 2.73 2.73 2.73 2.73 3 2.2 1.32 2.2 1.32 2.2 0.68 37.5 135.9 5.5 34.62 242.0	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-value W/m2 $ \begin{bmatrix} 1 \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ /[1/(1.2)+ \\ 0.13 \\ \hline 0.11 \\ 0.11 \\ 0.11 $	LE K 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 1 = 0.04] = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1	A X U (W/I 2.07 1.8 1.8 9.68 3.13 3.13 3.13 3.13 3.44 2.52 1.51 2.64 0.816 4.875 24.47 0.6 3.81	K)	k-value kJ/m²-ŀ	A K K 4125 8156 49.5 311.5	X k (26) (27) (27) (27) (27) (27) (27) (27) (27) (27b)

Interna	al floor					61.4					Г	18	٦	1105.2	(32d)
Interna	al ceiling					61.4					Γ	9	=	552.6	(32e)
* for win ** inclua	dows and le the area	roof windo is on both	ows, use e sides of in	ffective wi nternal wal	ndow U-va Is and part	lue calcul itions	ated using	ı formula 1,	/[(1/U-valu	ie)+0.04] a	L Is given in	paragraph	 1 3.2		-
Fabric	heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				6	6.11	(33)
Heat c	apacity	Cm = S(	Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	157	773.49	(34)
Therm	al mass	parame	ter (TMF	P = Cm ÷	- TFA) in	⊨kJ/m²K			= (34)	÷ (4) =			1	59.49	(35)
For desi can be ι	ign assess used instea	ments wh ad of a dei	ere the de tailed calci	tails of the ulation.	constructi	on are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f			_
Therm	al bridge	es : S (L	x Y) cal	culated (	using Ap	pendix l	<						6	8.18	(36)
if details	of therma	l bridging	are not kn	own (36) =	= 0.05 x (3	1)			()	<i>(</i>					-
Total f	abric he	at loss							(33) +	(36) =			7	4.29	(37)
Ventila	ation hea	t loss ca	alculated	monthly	/		I		(38)m	= 0.33 × (	25)m x (5) I	_	I		
(0.0)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			(20)
(38)m=	29.45	29.06	28.67	26.74	26.35	24.42	24.42	24.03	25.19	26.35	27.13	27.9			(38)
Heat tr	ransfer c	oefficier	nt, W/K						(39)m	= (37) + (3	38)m	·			
(39)m=	103.74	103.35	102.97	101.03	100.65	98.71	98.71	98.33	99.49	100.65	101.42	102.19			
Heat lo	oss nara	meter (H	HP) W/	′m²K					ر (40)m	Average = = (39)m ÷	Sum(39)₁. √(4)	12 /12=	1(	00.94	(39)
(40)m=	1.05	1.05	1.04	1.02	1.02	1	1	0.99	1.01	1.02	1.03	1.03			
( - )										Average =	Sum(40)1			1.02	(40)
Numbe	er of day	rs in mor	nth (Tab	le 1a)			-								4
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31			(41)
4. Wa	ater heat	ing ener	gy requi	irement:								kWh/ye	ear:		
Δεειισ		inancy I	M									70	1		(42)
if TF	A > 13.9	9, N = 1	<b>•</b> + 1.76 x	[1 - exp	(-0.0003	49 x (TF		)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.	9)	73			(42)
if TF	A £ 13.9	9, N = 1			_			<i>i</i>					1		
Annua Reduce	l averag	e hot wa <i>I average</i>	ater usag hot water	ge in litre usage by :	es per da 5% if the d	y Vd,av welling is	erage = desianed i	(25 x N) to achieve	+ 36 a water us	se target o	99 f	.02			(43)
not more	e that 125	litres per p	person per	day (all w	ater use, ł	not and co	ld)			J					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot wate	er usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)							
(44)m=	108.92	104.96	101	97.04	93.08	89.11	89.11	93.08	97.04	101	104.96	108.92			
									-	Total = Su	m(44) <sub>112</sub> =	=	1.	188.2	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x D	0Tm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)			
(45)m=	161.52	141.27	145.78	127.09	121.95	105.23	97.51	111.9	113.23	131.96	144.05	156.43			-
lf instan	taneous w	ater heatir	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46,	) to (61)	Total = Su	m(45) <sub>112</sub> =	=	15	57.91	(45)
(46)m=	24.23	21.19	21.87	19.06	18.29	15.78	14.63	16.78	16.98	19.79	21.61	23.46			(46)
Water	storage	IOSS:	المحاد ال										I		
Storag	e volum	e (litres)		ig any so	blar or W		storage		ame ves	sei		210			(47)
n comi Otherv	numity h vise if no	eating a stored	nu no ta hot wate	ank in aw ar (this in	enng, e Icludes i	nter 110 nstantar	nines in Neous co	(47) mbi boili	ers) ente	er '()' in <i>(</i>	47)				
0.000						locanta					,				

Water storage loss:

a) If m	nanufact	turer's de	eclared l	oss fact	or is kno	wn (kWł	n/day):				1.	.97	(4	48)
Tempe	erature f	actor fro	m Table	2b							0.	54	(4	<b>19</b> )
Energy	y lost fro	om water	r storage	e, kWh/y	ear			(48) x (49	) =		1.	.06	(!	50)
b) If m Hot wa If com Volum	nanufact ater stora munity h e factor	turer's de age loss neating s from Ta	eclared ( factor fi see secti ble 2a	cylinder rom Tab on 4.3	loss fact le 2 (kW	or is not h/litre/da	known: ay)					0	(	51) 52)
Tempe	erature f	actor fro	m Table	2b								0	(!	53)
Energy	y lost fro	om water	r storage	, kWh/y	ear			(47) x (51	) x (52) x (	53) =		0	(!	54)
Enter	(50) or	(54) in (5	55)	-							1.	.06	(!	55)
Water	storage	loss cal	culated	for each	month			((56)m = (	55) × (41)	m				
(56)m=	32.98	29.79	32.98	31.91	32.98	31.91	32.98	32.98	31.91	32.98	31.91	32.98	(!	56)
If cylinde	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	lix H	
(57)m=	32.98	29.79	32.98	31.91	32.98	31.91	32.98	32.98	31.91	32.98	31.91	32.98	(!	57)
Primar	v circuit	loss (ar	nual) fr	om Table	- - 3							0	(!	58)
Primar	y circuit	loss cal	lculated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m			-		
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	ı cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(!	59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)	)m		_	-			
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(	<u>3</u> 1)
Total h	heat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × (	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	217.76	192.07	202.02	181.52	178.19	159.66	153.75	168.14	167.66	188.2	198.47	212.67	(	32)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contributi	ion to wate	r heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(	33)
Output	t from w	ater hea	iter					-	-			-		
(64)m=	217.76	192.07	202.02	181.52	178.19	159.66	153.75	168.14	167.66	188.2	198.47	212.67		
		-	•	-	-	-	-	Out	out from wa	ater heate	r (annual)₁	12	2220.09 (	34)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	]	
(65)m=	98.7	87.61	93.46	85.8	85.54	78.53	77.41	82.2	81.19	88.87	91.44	97	((	35)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table S	5 and 5a	):									
Metab	olic gain	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	136.46	(	36)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5			-		
(67)m=	22.69	20.15	16.39	12.41	9.28	7.83	8.46	11	14.76	18.74	21.88	23.32	((	37)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	254.54	257.18	250.52	236.35	218.47	201.65	190.42	187.78	194.44	208.61	226.5	243.31	((	38)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equa	tion L15	or L15a)	), also se	ee Table	5	-			
(69)m=	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	36.65	((	39)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(	70)

Losse	s e.g. ev	/aporatio	n (nega	ive val	ues) (Ta	ble	5)									
(71)m=	-109.16	-109.16	-109.16	-109.16	6 -109.16	5 -1	09.16	-109.16	-109	.16 -109	.16 -1	09.16	-109.16	-109.16		(71)
Water	heating	gains (T	able 5)													
(72)m=	132.66	130.37	125.62	119.16	114.97	1	09.07	104.05	110	.48 112	.76 1	19.45	126.99	130.38		(72)
Total	internal	gains =					(66)	m + (67)m	n + (68	3)m + (69)r	m + (70	)m + (	71)m + (72)	m		
(73)m=	476.82	474.64	459.47	434.86	409.65	3	85.49	369.87	376	5.2 388	3.9 4	13.74	442.3	463.95		(73)
6. Sc	lar gain	s:							-							
Solar	gains are	calculated	using sola	r flux fro	m Table 6a	a and	assoc	iated equa	tions	to convert	to the a	applica	ble orientat	ion.		
Orient	ation: /	Access F	actor	Are	a		Flu	X blo 6a		g_ Tabla	6h	-	FF		Gains	
	r							ole da		Table	00	F			( • • • )	_
North	0.9x	0.77	X	1	.57	x	1	0.63	X	0.63	3	×	0.7	=	5.1	(74)
North	0.9x	0.77	X	1	.57	x	1	0.63	X	0.63	3	×	0.7	=	5.1	(74)
North	0.9x	0.77	X		3	x	1	0.63	X	0.63	3	×	0.7	=	9.75	(74)
North	0.9x	0.77	X		2.2	x	1	0.63	X	0.63	3	×	0.7	=	7.15	(74)
North	0.9x	0.77	X		.32	x	1	0.63	X	0.63	3	×	0.7	=	4.29	(74)
North	0.9x	0.77	X	1	.57	x	2	20.32	X	0.63	3	×	0.7	=	9.75	(74)
North	0.9x	0.77	x	1	.57	x	2	20.32	x	0.63	3	×	0.7	=	9.75	(74)
North	0.9x	0.77	X		3	x	2	20.32	x	0.63	3	x	0.7	=	18.63	(74)
North	0.9x	0.77	x	:	2.2	x	2	20.32	X	0.63	3	x	0.7	=	13.66	(74)
North	0.9x	0.77	x	1	.32	x	2	20.32	x	0.63	3	x	0.7	=	8.2	(74)
North	0.9x	0.77	х	1	.57	x	3	84.53	x	0.63	3	x	0.7	=	16.57	(74)
North	0.9x	0.77	x	1	.57	x	3	34.53	x	0.63	3	×	0.7	=	16.57	(74)
North	0.9x	0.77	x		3	x	3	34.53	x	0.63	3	×	0.7	=	31.66	(74)
North	0.9x	0.77	x	:	2.2	x	3	34.53	x	0.63	3	x	0.7	=	23.22	(74)
North	0.9x	0.77	x	1	.32	x	3	34.53	x	0.63	3	×	0.7	=	13.93	(74)
North	0.9x	0.77	x	1	.57	x	5	5.46	x	0.63	3	x	0.7	=	26.61	(74)
North	0.9x	0.77	x	1	.57	x	5	5.46	x	0.63	3	× [	0.7	=	26.61	(74)
North	0.9x	0.77	x		3	x	5	5.46	x	0.63	3	×	0.7	=	50.85	(74)
North	0.9x	0.77	x	:	2.2	x	5	5.46	x	0.63	3	x	0.7	=	37.29	(74)
North	0.9x	0.77	x	1	.32	x	5	5.46	x	0.63	3	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1	.57	x	7	4.72	x	0.63	3	x	0.7	=	35.85	(74)
North	0.9x	0.77	x	1	.57	x	7	4.72	x	0.63	3	× [	0.7	=	35.85	(74)
North	0.9x	0.77	x		3	x	7	4.72	x	0.63	3	×	0.7	=	68.5	(74)
North	0.9x	0.77	x	:	2.2	x	7	4.72	x	0.63	3	×	0.7	=	50.23	(74)
North	0.9x	0.77	x	1	.32	x	7	4.72	x	0.63	3	×	0.7	=	30.14	(74)
North	0.9x	0.77	x	1	.57	x	7	9.99	x	0.63	3	×「	0.7	=	38.38	(74)
North	0.9x	0.77	x	1	.57	x	7	9.99	x	0.63	3	×	0.7	=	38.38	(74)
North	0.9x	0.77	x		3	x	7	9.99	x	0.63	3	×Ī	0.7	=	73.33	(74)
North	0.9x	0.77	x		2.2	x	7	9.99	x	0.63	3	×「	0.7	=	53.78	(74)
North	0.9x	0.77	×	1	.32	x	7	9.99	x	0.63	3	×	0.7		32.27	(74)

North	0.9x	0.77	x	1.57	x	74.68	x	0.63	x	0.7	] =	35.83	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.63	x	0.7	<b>j</b> =	35.83	- (74)
North	0.9x	0.77	x	3	x	74.68	x	0.63	x	0.7	<b>i</b> =	68.47	- (74)
North	0.9x	0.77	x	2.2	x	74.68	x	0.63	x	0.7	<b>i</b> =	50.21	- (74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	i =	30.13	<b>–</b> (74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.63	x	0.7	=	28.43	(74)
North	0.9x	0.77	x	1.57	×	59.25	×	0.63	x	0.7	] =	28.43	(74)
North	0.9x	0.77	x	3	x	59.25	x	0.63	x	0.7	=	54.32	(74)
North	0.9x	0.77	x	2.2	x	59.25	x	0.63	x	0.7	=	39.83	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	] =	23.9	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.63	x	0.7	=	19.92	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.63	x	0.7	=	19.92	(74)
North	0.9x	0.77	x	3	x	41.52	x	0.63	x	0.7	=	38.06	(74)
North	0.9x	0.77	x	2.2	x	41.52	x	0.63	x	0.7	] =	27.91	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	] =	16.75	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.63	x	0.7	=	11.61	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.63	x	0.7	=	11.61	(74)
North	0.9x	0.77	x	3	x	24.19	x	0.63	x	0.7	] =	22.18	(74)
North	0.9x	0.77	x	2.2	x	24.19	x	0.63	x	0.7	=	16.26	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.63	x	0.7	=	6.29	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.63	x	0.7	] =	6.29	(74)
North	0.9x	0.77	x	3	x	13.12	x	0.63	x	0.7	=	12.03	(74)
North	0.9x	0.77	x	2.2	x	13.12	x	0.63	x	0.7	] =	8.82	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.63	x	0.7	=	4.25	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.63	x	0.7	] =	4.25	(74)
North	0.9x	0.77	x	3	x	8.86	x	0.63	x	0.7	] =	8.13	(74)
North	0.9x	0.77	x	2.2	x	8.86	x	0.63	x	0.7	=	5.96	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
East	0.9x	0.77	x	8.45	x	19.64	x	0.63	x	0.7	=	50.72	(76)
East	0.9x	0.77	x	2.73	x	19.64	x	0.63	x	0.7	=	16.39	(76)
East	0.9x	0.77	x	2.73	x	19.64	x	0.63	x	0.7	=	16.39	(76)
East	0.9x	0.77	x	8.45	x	38.42	x	0.63	x	0.7	=	99.22	(76)
East	0.9x	0.77	x	2.73	x	38.42	x	0.63	x	0.7	=	32.06	(76)
East	0.9x	0.77	x	2.73	x	38.42	x	0.63	x	0.7	] =	32.06	(76)
East	0.9x	0.77	x	8.45	×	63.27	x	0.63	x	0.7	] =	163.4	(76)
East	0.9x	0.77	x	2.73	×	63.27	x	0.63	x	0.7	=	52.79	(76)
East	0.9x	0.77	x	2.73	x	63.27	x	0.63	x	0.7	=	52.79	(76)
East	0.9x	0.77	x	8.45	x	92.28	x	0.63	x	0.7	=	238.31	(76)
East	0.9x	0.77	x	2.73	x	92.28	x	0.63	x	0.7	=	76.99	(76)

East	0.9x	0.77	x	2.73	x	92.28	x	0.63	x	0.7	=	76.99	(76)
East	0.9x	0.77	x	8.45	x	113.09	x	0.63	x	0.7	] =	292.05	(76)
East	0.9x	0.77	x	2.73	x	113.09	x	0.63	x	0.7	] =	94.36	(76)
East	0.9x	0.77	x	2.73	x	113.09	x	0.63	x	0.7	] =	94.36	(76)
East	0.9x	0.77	x	8.45	x	115.77	x	0.63	x	0.7	] =	298.97	(76)
East	0.9x	0.77	x	2.73	x	115.77	x	0.63	x	0.7	=	96.59	(76)
East	0.9x	0.77	x	2.73	x	115.77	) x	0.63	x	0.7	=	96.59	(76)
East	0.9x	0.77	x	8.45	x	110.22	x	0.63	x	0.7	=	284.63	(76)
East	0.9x	0.77	x	2.73	x	110.22	x	0.63	x	0.7	=	91.96	(76)
East	0.9x	0.77	x	2.73	x	110.22	x	0.63	x	0.7	] =	91.96	(76)
East	0.9x	0.77	x	8.45	x	94.68	x	0.63	x	0.7	] =	244.49	(76)
East	0.9x	0.77	x	2.73	x	94.68	x	0.63	x	0.7	=	78.99	(76)
East	0.9x	0.77	x	2.73	x	94.68	x	0.63	x	0.7	] =	78.99	(76)
East	0.9x	0.77	x	8.45	x	73.59	x	0.63	x	0.7	=	190.04	(76)
East	0.9x	0.77	x	2.73	x	73.59	x	0.63	x	0.7	=	61.4	(76)
East	0.9x	0.77	x	2.73	x	73.59	x	0.63	x	0.7	] =	61.4	(76)
East	0.9x	0.77	x	8.45	x	45.59	x	0.63	x	0.7	=	117.73	(76)
East	0.9x	0.77	x	2.73	x	45.59	x	0.63	x	0.7	=	38.04	(76)
East	0.9x	0.77	x	2.73	x	45.59	x	0.63	x	0.7	] =	38.04	(76)
East	0.9x	0.77	x	8.45	x	24.49	x	0.63	x	0.7	=	63.24	(76)
East	0.9x	0.77	x	2.73	x	24.49	x	0.63	x	0.7	=	20.43	(76)
East	0.9x	0.77	x	2.73	x	24.49	x	0.63	x	0.7	=	20.43	(76)
East	0.9x	0.77	x	8.45	x	16.15	x	0.63	x	0.7	=	41.71	(76)
East	0.9x	0.77	x	2.73	x	16.15	x	0.63	x	0.7	=	13.48	(76)
East	0.9x	0.77	x	2.73	x	16.15	x	0.63	x	0.7	=	13.48	(76)
Roofligh	ts <mark>0.9x</mark>	1	x	2.2	x	16.18	x	0.63	x	0.7	=	14.12	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.68	x	43.99	x	0.63	x	0.7	=	11.87	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	2.2	x	30.63	x	0.63	x	0.7	=	26.75	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.68	x	80.27	x	0.63	x	0.7	=	21.66	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	2.2	x	55.7	x	0.63	x	0.7	] =	48.64	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.68	x	121.32	x	0.63	x	0.7	=	32.74	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	2.2	x	101.28	x	0.63	x	0.7	] =	88.44	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.68	x	165.18	x	0.63	x	0.7	] =	44.58	(82)
Roofligh	its <mark>0.9x</mark>	1	x	2.2	x	149.52	x	0.63	x	0.7	=	130.56	(82)
Roofligh	its <mark>0.9x</mark>	1	x	0.68	x	195.41	x	0.63	x	0.7	=	52.74	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	2.2	x	166.08	x	0.63	x	0.7	=	145.01	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	0.68	x	197.72	x	0.63	x	0.7	=	53.36	(82)
Roofligh	ts <mark>0.9x</mark>	1	x	2.2	x	152.65	x	0.63	x	0.7	=	133.29	(82)
Roofligh	its <mark>0.9x</mark>	1	x	0.68	×	189.14	<b>x</b>	0.63	×	0.7	] =	51.05	(82)
Roofligh	its <mark>0.9x</mark>	1	x	2.2	x	112.79	x	0.63	x	0.7	] =	98.49	(82)
Roofligh	its <mark>0.9x</mark>	1	x	0.68	x	166.58	x	0.63	x	0.7	=	44.96	(82)

Rooflig	hts 0.9x	1	x	2.	2	x	7	0.26	x		0.63	×	0.7	=	61.35	(82)
Rooflig	hts 0.9x	1	×	0.6	68	x	1	36.8	×		0.63	=  × [	0.7	=	36.92	(82)
Rooflig	hts 0.9x	1	x	2.	2	x	3	37.03	x		0.63	=    x [	0.7	=	32.34	(82)
Rooflig	hts <mark>0.9x</mark>	1	×	0.6	68	x	9	2.07	x		0.63	 × [	0.7	=	24.85	(82)
Rooflig	hts 0.9x	1	x	2.	2	x		19.8	x		0.63	 × [	0.7	=	17.29	(82)
Rooflig	hts <mark>0.9x</mark>	1	x	0.6	68	x	5	3.73	x		0.63	 × [	0.7	=	14.5	(82)
Rooflig	hts 0.9x	1	x	2.	2	x	1	3.64	x		0.63		0.7	=	11.91	(82)
Rooflig	hts 0.9x	1	x	0.6	68	x	3	6.94	x		0.63		0.7	=	9.97	(82)
	-								•	-						
Solar (	gains in	watts, ca	alculated	d for eac	h month	1			(83)m	n = Si	um(74)m .	(82)m		•	_	
(83)m=	140.88	271.73	452.3	689.05	884.64	9	26.66	873.34	720	.83	533.67	322.4	174.62	116.71		(83)
Total g	gains – i	nternal a	nd sola	r (84)m =	= (73)m	+ (8	83)m	, watts					-		-	
(84)m=	617.71	746.38	911.77	1123.92	1294.29	13	312.15	1243.22	109	7.03	922.58	736.14	616.93	580.66		(84)
7. Me	ean inter	nal temp	oerature	(heating	seasor	າ)										
Temp	perature	during h	neating p	periods in	n the livi	ng	area	from Tab	ole 9	, Th′	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	า (s	ee Ta	ble 9a)								
	Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.97	0.94	0.83	0.65		0.47	0.35	0.4	41	0.67	0.91	0.98	0.99		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	7 in T	Table	e 9c)				_	
(87)m=	19.47	19.72	20.12	20.6	20.87	2	20.97	20.99	20.	.99	20.9	20.48	19.89	19.43	7	(87)
Temr		durina h	eating r	eriods i	n rest of	dw	elling	from Ta		<u> </u>	)2 (°C)				-	
(88)m=	20.04	20.05	20.05	20.07	20.07		20.08	20.08	20.	.09	20.08	20.07	20.06	20.06	7	(88)
Litilio	L	tor for a	l oine for	I root of d	L Wolling	<u>г</u> 52	m (oc		<u> </u>				1		_	
(89)m=	0.98	0.97	0.92				,111 (SE 0 41		9a)	33	0.6	0.88	0.97	0.99	٦	(89)
(00)												•••••		0.00		
Mean	interna	I temper	ature in	the rest	of dwell	ing T	12 (1	ollow ste	eps 3	$\frac{1}{2}$ to $\frac{1}{2}$	in labl	e 9c)	1 40.00	47.05	7	(00)
(90)m=	17.99	18.30	18.94	19.6	19.94	4	20.07	20.08	20.	.08	19.99 f	19.46	18.62	17.95		
													ng area ÷ (·	+) -	0.3	(91)
Mear	interna	l temper	ature (fo	or the wh	ole dwe	llin	g) = fl	LA × T1	+ (1	– fL	A) × T2				-	
(92)m=	18.43	18.76	19.29	19.9	20.22	2	20.34	20.35	20.	.35	20.26	19.76	19	18.39		(92)
Apply	/ adjustr	nent to t	he mear	n interna	l tempe	ratu	ure fro	m Table	4e,	whe	re appro	opriate	1 10	10.00	7	(02)
(93)m=	18.43	18.76	19.29	19.9	20.22	2	20.34	20.35	20.	.35	20.26	19.76	19	18.39	_	(93)
8. Sp	ace nea	ting requ	uiremen		va aktai			on 11 of	Tab			ι. <b>Τ</b> . 100	(70)	d	levilete	
the ut	tilisation	factor fo	ernal te or dains	mperatu using Ta	re obtail able 9a	ied	atste	ерттог	Tab	ie 90	, so tha	t 11,m=	(76)m an	d re-ca	Iculate	
	Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hr	1 <u>.</u> 1:		1									-	
(94)m=	0.98	0.96	0.91	0.79	0.61		0.42	0.3	0.3	35	0.61	0.87	0.96	0.98	]	(94)
Usefu	ul gains,	hmGm	, W = (9	4)m x (8	4)m	_									_	
(95)m=	604.29	715.57	829.46	888.91	790.57	5	54.52	368.39	384	.54	565.68	643.98	593.74	570.36		(95)
Mont	hly aver	age exte	rnal ten	perature	e from T	abl	e 8								-	
(96)m=	4.3	4.9	6.5	8.9	11.7		14.6	16.6	16	5.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an interr	nal temp	erature,	Lm	۱, W =	=[(39)m : I	x [(9	3)m-	- (96)m	]			-	
(97)m=	1466.11	1432.95	1317.17	1110.94	857.51	5	66.25	370.55	388	3.64	613.2	922.31	1206.96	1450.63	3	(97)

(98)me         e41.2         492.08         362.85         159.86         49.81         0         0         0         207.08         441.52         654.92           Total per year (WWtywar) = Sum(89), str.n. =         2006.21         (98)           Space heating         equirement in WW/m <sup>3</sup> /year         30.33         (99)           Space heating:         0         (202) = 1 - (201) =         1         (201)           Fraction of space heat from main system(s)         (202) = (1 - (201) =         1         (204)           Fraction of space heating from main system(s)         (202) = (1 - (201) =         1         (204)           Fraction of space heating requirement (calculated above)         99.7         (206)         (201)         1         (204)           Lan         Feb         Mar         Apr         May         Jun         Jun         (204)         (30.20)         (201)	Space	e heatin	g require	ement fo	or each n	nonth, k	Wh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
Total par year (kWhyear) = Sum(06)	(98)m=	641.2	482.08	362.85	159.86	49.81	0	0	0	0	207.08	441.52	654.92		_
Space heating requirement in kWh/m²/year     30.33     (99)       Space heating requirements - Individual heating systems including micro-CHP)        Space heating:     0     (201)       Fraction of space heat from secondary/supplementary system     0     (201)       Fraction of space heat from main system 1     (202) = 1 - (201) =     1     (202)       Fraction of total heating from main system 1     (202) = (1 - (203)) =     1     (204)       Efficiency of an in space heating system 1     90.7     (203)     1     (204)       Efficiency of secondary/supplementary heating system, %     0     0.7     (203)       Space heating requirement (calculated above)     64.2     482.08     138.28     158.86     48.81     0     0     0     207.08     441.52     64.92       (211)m = {((168)m x (204)] x 100 + (206)     (211)m     ((168)m x (201)] x 100 + (206)     (211)     (211)m     531.61     40.06     176.25     54.91     0									Tota	al per year	(kWh/yeai	r) = Sum(9	8)15,912 =	2999.31	(98)
Ba. Energy requirements - Individual heating systems including micro-CHP)         Space heating: Fraction of space heat from main system 1          (202) = 1 - (201) = 1         (202) Fraction of space heat from main system 1         (204) = (202) × [1 - (203)] = 1         (204)          Efficiency of ania space heating system 1          (204) = (202) × [1 - (203)] = 1          Efficiency of ania space heating system 1          (204) = (202) × [1 - (203)] = 1          Efficiency of secondary/supplementary heating system, %           0         (208)	Space	e heatin	g require	ement in	ı kWh/m²	²/year								30.33	(99)
Space heating:       0       (201)         Fraction of space heat from main system(s)       (202) = 1 - (201) =       1       (202)         Fraction of total heating from main system 1       (204) = (202) × (1 - (203)) =       1       (204)         Efficiency of main space heating system 1       (204) = (202) × (1 - (203)) =       1       (204)         Efficiency of secondary/supplementary heating system, %       0       (206)       (206)         Space heating requirement (calculated above)       0       0       0       207.08       441.52       654.92         (211)       706.94       51.51       400.66       176.25       54.91       0       0       0       207.08       441.52       654.92       (211)         Space heating fuel (secondary), kWh/month       = (((98)m × (204)) ] × 100 ÷ (206)       (211)       706.94       531.51       400.61       72.07       72.07       72.07       708.04       72.07       708.04       72.07       708.04       72.07       708.04       72.07       708.04       72.07       708.04       72.07       70.07       708.04       72.07       70.07       708.04       72.07       70.07       70.07       72.07       70.07       70.07       72.07       70.07       70.08       72.07	9a. Ene	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	i micro-C	CHP)					
Fraction of space heat from secondary/supplementary system       0       (202)         Fraction of space heat from main system (s)       (202) = 1 - (201) =       1       (202)         Fraction of total heating from main system 1       (204) = (202) × [1 - (203)] =       1       (204)         Efficiency of main space heating system 1       (204) = (202) × [1 - (203)] =       1       (204)         Efficiency of secondary/supplementary heating system, %       0       0       0       (203)	Space	e heatir	ng:										r		-
Fraction of space heat from main system (s)       (202) = (-201) =       1       (204)         Fraction of total heating from main system 1       (204) = (202) × (1 - (203)) =       1       (204)         Efficiency of main space heating system 1       90.7       (206)       (206)       (208)         Ifficiency of secondary/supplementary heating system, %       0       0       0       (208)         Space heating requirement (calculated above)       (211)       644.32       (211)       (211)         Total (kWh/year) =Sum(211)_{1.4.9	Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system	(222)					0	(201)
Fraction of total heating from main system 1       (204) = (202) × (1 - (203)) =       1       (204)         Efficiency of main space heating system 1       0.7       (208)       0.7       (208)         Efficiency of secondary/supplementary heating system, %       0       0       0       (209)         Space heating requirement (calculated above)       641.2       482.08       362.85       159.86       49.81       0       0       0       227.08       441.52       654.92         (211) m = {[(98) m x (204)] } x 100 ÷ (206)       Total (WWhyear) =Sum(21), xm, x <sup>p</sup> 3306.85       (211)         Space heating fuel (secondary), kWh/month       =       (108) m x (201)] x 100 ÷ (208)       3306.85       (211)         Space heating fuel (secondary), kWh/month       =       (108) m x (201)] x 100 ÷ (208)       (215)       3306.85       (216)         Uptu from water heater (calculated above)       121.76       192.07       202.02       181.52       178.19       159.66       153.75       168.14       167.66       188.2       198.47       212.67         Efficiency of water heater       80       80       80       85.27       87.09       87.82       (217)         Lul for water heating fuel (sec       217.97       192.19       210.17       209.57 <td< td=""><td>Fracti</td><td>on of sp</td><td>ace hea</td><td>at from n</td><td>nain syst</td><td>em(s)</td><td></td><td></td><td>(202) = 1</td><td>- (201) =</td><td>(222)3</td><td></td><td></td><td>1</td><td>(202)</td></td<>	Fracti	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1	- (201) =	(222)3			1	(202)
Efficiency of main space heating system 1       90.7       (206)         Efficiency of secondary/supplementary heating system, %       0       (203)         Variable Space heating requirement (calculated above)       641.2       482.08       362.85       159.86       49.81       0       0       0       207.08       441.52       654.92         (211) m = ([(98)m x (204)] ) x 100 ÷ (206)       (211)	Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of secondary/supplementary heating system, %       0       (208)         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         Space heating requirement (calculated above)       [611.2       482.08       362.85       159.86       49.81       0       0       0       207.08       441.52       654.92         (211)m = ([(98)m x (204)] ) x 100 ÷ (206)       (211)       Total (kWhyear) =Sum(211), LSS. SE       3306.85       [211)         Space heating fuel (secondary), kWh/month       = ([(98)m x (201)] } x 100 ÷ (208)       (215)       3306.85       [211]         Space heating fuel (secondary), kWh/month       = ([(98)m x (201)] } x 100 ÷ (208)       (215)       0	Efficie	ency of I	main spa	ace heat	ing syste	em 1								90.7	(206)
$ \begin{array}{ c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	ז, % ו	1	1				0	(208)
Space heating requirement (calculated above) $\begin{bmatrix} 641.2 & 482.08 & 362.85 & 159.86 & 49.81 & 0 & 0 & 0 & 207.08 & 441.52 & 654.92 \\ (211) m = \{[(98)m \times (204)] \} \times 100 \div (206) & (211) \\ \hline T06.94 & 531.51 & 400.06 & 176.25 & 54.91 & 0 & 0 & 0 & 0 & 228.31 & 486.79 & 722.07 \\ \hline Total (Wh/year) =Sum(211)_{1.505^{m}} & 3306.85 & (211) \\ Space heating fuel (secondary), kWh/month = {[[(98)m \times (201)] } \times 100 \div (208) & (215) \\ \hline Total (kWh/year) =Sum(21)_{1.505^{m}} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \hline Total (kWh/year) =Sum(21)_{1.505^{m}} & 0 & (215) & (215) \\ \hline Water heating \\ Output from water heater (calculated above) & (217)^{m} & 87.73 & 87.37 & 86.56 & 84.68 & 82.12 & 80 & 80 & 80 & 85.27 & 87.09 & 87.82 & (217) \\ \hline Fuel for water heating, kWh/month & (219)m = (243)^{m} \times 100 \div (217)^{m} & (216)^{m} \times 100 \div (217)^{m} & (216)^{m} \times 100 \div (217)^{m} & 109.57 & 192.07 & 220.71 & 227.9 & 242.16 & (219)m = (64)m \times 100 \div (217)^{m} & 333.8 & 214.36 & 216.99 & 199.57 & 192.19 & 210.17 & 208.57 & 220.71 & 227.9 & 242.16 & (219)m = (243)m \times 100 \div (217)^{m} & (300 \div (230))^{m} & $		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Space	e heatin	g require	$\frac{1}{262.85}$			)	0	0	0	207.09	441 52	654 02		
(211) m = {([08) m x (204)] } x 100 + (206)       (211)         Total (WWh/year) =Sum(21)_{L_{XXII,17}}       3306.85         (211)       Total (WWh/year) =Sum(21)_{L_{XXII,17}}         Space heating fuel (secondary), kWh/month       = {([98) m x (201)] } x 100 + (208)         (215) m       0       0       0       0       0       0       0         Water heating       0       0       0       0       0       0       0       0         217.76       192.07       202.02       181.52       178.19       159.66       153.75       168.14       167.66       188.2       198.47       212.67         Efficiency of water heater       80       80       80       80       80       85.27       87.09       87.82       (217)         Fuel for water heating, kWh/month       (219) m       248.23       219.83       233.38       214.36       216.99       199.57       192.19       210.17       209.57       220.71       227.9       242.16         Carry mechaning fuel used, main system 1       Total = Sum(219a)_{L_{12}} =       KWh/year       3306.85       (219)         Annual totals       Kwain system 1       3306.85       2635.08       (219)       2635.08       (219)         Water	(014)	([(00	402.00	302.03		49.01	0	0	0	0	207.00	441.52	034.92		(014)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	(211)m	$= \{[(98) \\ 706 \ 94 \}$	)m x (20	$[4)] \} X ]$	176 25	54 91	0	0	0	0	228 31	486 79	722.07		(211)
Space heating fuel (secondary), kWh/month         = {[(98) m x (201)] } x 100 ÷ (208)         (215)m       0	l	700.04	001.01	400.00	170.20	04.01	Ů	Ů	Tota	l v al (kWh/yea	ar) =Sum(2	211) <sub>1 510 11</sub>	=	3306.85	(211)
$= \left[ \left[ (98) \text{m} \times (201) \right] \right] \times 100 \div (208) \\ (215) \text{m} 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0$	Space	e heatin	a fuel (s	econdar	v). kWh/	month									], ,
(215)m       0 <td>= {[(98)</td> <td>)m x (20</td> <td>)1)]}x1</td> <td>00 ÷ (20</td> <td>)8)</td> <td></td>	= {[(98)	)m x (20	)1)]}x1	00 ÷ (20	)8)										
$Total (kWh/year) = Sum(215)_{1.4417} = 0$ (215) Water heating Output from water heater (calculated above) 217.76 192.07 202.02 181.52 178.19 159.66 153.75 168.14 167.66 188.2 198.47 212.67 Efficiency of water heater 80 (216) (217)m= 87.73 87.37 86.56 84.68 82.12 80 80 80 80 80 80 80 80 80 80 80 80 80	(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
Water heating         Output from water heater (calculated above)         217.76       192.07       202.02       181.52       178.19       159.66       153.75       168.14       167.66       188.2       198.47       212.67         Efficiency of water heater       80       217.73       87.37       86.56       84.68       82.12       80       80       80       80       85.27       87.09       87.82       (216)         (217)m=       67.73       87.37       86.56       84.68       82.12       80       80       80       85.27       87.09       87.82       (217)         Fuel for water heating, kWh/month       (219)m = (64)m x 100 ÷ (217)m       (217)m = (64)m x 100 ÷ (217)m       (219)m = (263.23       219.83       233.38       214.36       216.99       199.57       192.19       210.17       209.57       220.71       227.9       242.16         KWh/year       KWh/year       KWh/year         Space heating fuel used, main system 1       Sole colspan= 400.0000         Water heating fuel used, extract or positive input from outside       256.23       (230a)         central heating pump:       30       30       (230e)         boiler									Tota	al (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	Ē	0	(215)
Output trom water heater (calculated above)       217.76       192.07       202.02       181.52       178.19       159.66       153.75       168.14       167.66       188.2       198.47       212.67         Efficiency of water heater       80       80       80       80       80       85.27       87.09       87.82       (216)         (217)m=       87.73       87.37       66.56       84.68       82.12       80       80       80       85.27       87.09       87.82       (217)         Fuel for water heating, kWh/month       (217)m=       6(4)m x 100 ÷ (217)m       (217)m=       248.23       219.83       233.38       214.36       216.99       199.57       192.19       210.17       209.57       220.71       227.9       242.16         Total = Sum(219a)         (219)m=         484.23       219.83       233.38       214.36       216.99       199.57       192.19       210.17       209.57       220.71       227.9       242.16         Total = Sum(219a)       237.8       KWh/year       3306.85       2635.08       2635.08       2635.08       2635.08       2635.08       2635.08       2635.08       2635.08       2635.08       2636.23 </td <td>Water</td> <td>heating</td> <td>J</td> <td></td>	Water	heating	J												
Link       Link <thlink< th="">       Link       Link</thlink<>	Output	from w 217.76	ater hea 192.07	ter (calc 202.02	ulated al	bove) 178.19	159.66	153.75	168.14	167.66	188.2	198.47	212.67		
$\begin{array}{c} (217)m = & \overline{87.73} & \overline{87.37} & \overline{86.56} & \overline{84.68} & \underline{82.12} & \underline{80} & \underline{80} & \underline{80} & \underline{80} & \underline{85.27} & \underline{87.09} & \underline{87.82} & (217) \\ \hline \\ Fuel for water heating, kWh/month \\ (219)m = & (64)m & x & 100 \div (217)m & \\ (219)m = & 248.23 & \underline{219.83} & \underline{233.38} & \underline{214.36} & \underline{216.99} & \underline{199.57} & \underline{192.19} & \underline{210.17} & \underline{209.57} & \underline{220.71} & \underline{227.9} & \underline{242.16} & \\ \hline & & & & & & & & & & & & & & & & &$	l Efficier	ncy of w	ater hea	iter										80	(216)
Fuel for water heating, kWh/month(219)m = $(64)m \times 100 \div (217)m$ (219)m = $248.23$ $219.83$ $233.38$ $214.36$ $216.99$ $199.57$ $192.19$ $210.17$ $209.57$ $220.71$ $227.9$ $242.16$ Total = Sum(219a) <sub>1-12</sub> =2635.08(219)Annual totalskWh/yearkWh/yearSpace heating fuel used, main system 13306.85Water heating fuel used2635.08Electricity for pumps, fans and electric keep-hotmechanical ventilation - balanced, extract or positive input from outside256.23(230a)central heating pump:30(230e)boiler with a fan-assisted flue45(230a)(230g) =Total electricity for the above, kWh/yearsum of (230a)(230g) =331.23(231)Electricity for lighting	(217)m=	87.73	87.37	86.56	84.68	82.12	80	80	80	80	85.27	87.09	87.82		(217)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	ا Fuel fo	r water	heating,	kWh/m	onth										
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	(219)m	= (64)	<u>m x 100</u>	) ÷ (217)	)m										
Annual totals       kWh/year       2635.08       (219)         Space heating fuel used, main system 1       3306.85       3306.85         Water heating fuel used       2635.08       2635.08         Electricity for pumps, fans and electric keep-hot       256.23       (230a)         central heating pump:       30       (230c)         boiler with a fan-assisted flue       45       (230e)         Total electricity for the above, kWh/year       sum of (230a)(230g) =       331.23       (231)         Electricity for lighting       400.75       (232)	(219)m=	248.23	219.83	233.38	214.36	216.99	199.57	192.19	210.17	209.57	220.71	227.9	242.16	0005.00	
Annual totalsKWI/yearSpace heating fuel used, main system 13306.85Water heating fuel used2635.08Electricity for pumps, fans and electric keep-hot256.23mechanical ventilation - balanced, extract or positive input from outside256.23central heating pump:30boiler with a fan-assisted flue45Total electricity for the above, kWh/yearsum of (230a)(230g) =Electricity for lighting400.75	Annua	l totolo							1010		100) <sub>112</sub> –	Mhhaa	. l	2635.08	(219)
Water heating fuel used       2635.08         Electricity for pumps, fans and electric keep-hot       256.23       (230a)         mechanical ventilation - balanced, extract or positive input from outside       256.23       (230a)         central heating pump:       30       (230c)         boiler with a fan-assisted flue       45       (230e)         Total electricity for the above, kWh/year       sum of (230a)(230g) =       331.23       (231)         Electricity for lighting       400.75       (232)	Space	heating	fuel use	ed, main	system	1					N.	wii/yeai	[	3306.85	٦
Electricity for pumps, fans and electric keep-hot         mechanical ventilation - balanced, extract or positive input from outside       256.23       (230a)         central heating pump:       30       (230c)         boiler with a fan-assisted flue       45       (230e)         Total electricity for the above, kWh/year       sum of (230a)(230g) =       331.23       (231)         Electricity for lighting       400.75       (232)	Water I	- heating	fuel use	d	-								[	2635.08	1
Detectivity for pumps, rans and electric keep-notmechanical ventilation - balanced, extract or positive input from outside256.23(230a)central heating pump:30(230c)boiler with a fan-assisted flue45(230e)Total electricity for the above, kWh/yearsum of (230a)(230g) =331.23(231)Electricity for lighting400.75(232)	Electric	nity for r		anc and	oloctric	kaan ha	+						l	2000.00	
mechanical ventilation - balanced, extract or positive input from outside256.23(230a)central heating pump:30(230c)boiler with a fan-assisted flue45(230e)Total electricity for the above, kWh/yearsum of (230a)(230g) =331.23Electricity for lighting400.75(232)	LIECUIC		umps, n	ans anu	electric	keep-no	ι .,								(222.)
central heating pump:30(230c)boiler with a fan-assisted flue45(230e)Total electricity for the above, kWh/yearsum of (230a)(230g) =331.23Electricity for lighting400.75(232)	mecha	anical v	entilatio	n - balar	nced, ext	ract or p	ositive II	nput fror	n outside	e			256.23		(230a)
boiler with a fan-assisted flue45(230e)Total electricity for the above, kWh/yearsum of (230a)(230g) =331.23(231)Electricity for lighting400.75(232)	centra	al heatir	ig pump	:									30		(230c)
Total electricity for the above, kWh/yearsum of (230a)(230g) =331.23(231)Electricity for lighting400.75(232)	boiler	with a f	an-assis	sted flue									45		(230e)
Electricity for lighting (232)	Total e	lectricity	/ for the	above,	kWh/yea	r			sum	of (230a).	(230g) =		[	331.23	(231)
	Electric	city for li	ghting										]	400.75	(232)
Electricity generated by PVs -2763.58 (233)	Electric	city gen	erated b	y PVs									ĺ	-2763.58	(233)

Total delivered energy for all uses (211)(221) + (2		3910.32 (338)	
12a. CO2 emissions – Individual heating systems	including micro-CHP		
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	714.28 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	569.18 (264)
Space and water heating	(261) + (262) + (263) + (264)	=	1283.46 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	171.91 (267)
Electricity for lighting	(232) x	0.519 =	207.99 (268)
Energy saving/generation technologies Item 1		0.519 =	-1434.3 (269)
Total CO2, kg/year	S	um of (265)(271) =	229.05 (272)
Dwelling CO2 Emission Rate	(2	272) ÷ (4) =	2.32 (273)
El rating (section 14)			98 (274)