# RS Energy

# Energy & Sustainability Statement

For

10a Havelock Road, Cowley, Oxford, OX4 3EP

Prepared on behalf of:

**Digby Architectural Services** 

RS Energy Ltd, Larch Close,

Ringwood, Hampshire, BH24 2PR

01425-472973 info@rsenergy.co.uk

Energy & Sustainability Statement –10a Havelock Road, Cowley, Oxford, OX4 3EP

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## **Executive Summary**

This report has been produced on behalf of Digby Architectural to demonstrate how the application for a new build dwelling in between 8 and 10 Havelock Road, Cowley, Oxford, OX4 3EP will address the carbon reduction and sustainability requirements set by Oxford City Council.

The Energy Assessment demonstrates that the proposed specification achieves the 40% reduction in carbon emissions beyond a compliant base case, which is a 19% reduction beyond Part L of the 2013 Building Regulations, with 25% of the energy used coming from a renewable source. Compliance has also been achieved under the most recent Part L 2021 Building Regulations, modelled in SAP 10.2.

The carbon savings by the proposed development are shown at each stage from the base case to the final compliant case.

A sustainability statement has been prepared to demonstrate a commitment to enhance the environmental performance of the development. This includes specification of materials, waste reduction, biodiversity and internal water use limited by design to 105 litres/per person/per day.

# Introduction to the Proposed Development

The proposed two-bedroom dwelling will be built as a two-storey side extension to 10 Havelock Road. It is proposed that the existing garage will be demolished to make way for the new dwelling. This will provide a well needed starter home within an established area.

The location is well served by public transport links, commuter links, amenity space, local convenience stores and supermarket, entertainment, schools and medical centres.

It is proposed that the build will mimic the existing host dwelling to ensure that it is in-keeping with the local area.





Existing and proposed dwelling Energy & Sustainability Statement –10a Havelock Road, Cowley, Oxford, OX4 3EP

# Energy Assessment

This assessment outlines the measures and specification proposed to meet the requirements outlined in Oxford City Council local plan Policy RE1.

The proposed dwelling has been modelled using SAP 2012 and is designed to achieve a **59.14%** reduction in carbon emissions beyond Part L 2013 Building Regulations. This includes the compliant base case which achieves a 41.41% reduction beyond Part L 2013 Building Regulations and a further **17.73**% reduction with the 25% renewable energy target being achieved as shown below:

#### Compliant Base Case

Target Emission Rate (TER) TER worksheet,	27.12
Appendix A	
Dwelling Emission Rate (DER) DER worksheet,	15.89
Appendix B	
Target Fabric Energy Efficiency (TFEE)	56.1
Dwelling Fabric Energy Efficiency (DFEE)	44
% Improvement DER/TER	41.41
% Improvement DFEE/TFEE	21.57

The specification of the building is such to ensure that it meets the base case (19% reduction/equivalent to Code level 4) beyond Building Regulations compliance, without any further measures such as photovoltaic panels, as a minimum. Opportunities to improve on this further have been considered for the next stage as shown below.

#### Further CO<sub>2</sub> reductions to meet the 59% target

27.12
11.08
57.2
39.9
59.14
21.57

To meet the targets set out in Policy RE1 an air source heat pump will provide space heating with photovoltaic panels producing a further renewable energy source.

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#### On-Site Renewable Energy

	Plot 1	Total
Renewable energy from heat pump	4424.33	4424.33
Renewable energy from wood burner	0.00	0.00
Renewable energy from PV	746.97	746.97
Total renewable energy use	5171.30	5171.30
Total dwelling energy use	6171.99	6171.99
% Renewable energy	83.8%	83.8%

This has been achieved based on the following design specification.

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# Proposed Design Specification

The following section outlines the measures which have been taken to reduce the energy demand of the proposal. This includes both architectural and building fabric measures (passive design) and energy efficient services (active design) considered at the earliest design stage.

Active design measures to reduce the energy demand include high efficiency lighting and ventilation. Other possible measures include enhanced U-values, air tightness improvement and the development approach to limiting thermal bridges. The specification for the proposal is listed below. Passivhaus methods will be considered and implemented where possible.

Demand Reduction Measures	Specification
Building Fabric - U-Values (W/m²K)	
Walls	0.16
Ground floor	0.11
Roofs	0.11
External opaque doors (whole frame)	1
Glazing (glazed doors, windows & rooflights (whole frame) Triple Glazed	1.2
Building Fabric - Other	
Air permeability (m³/hm²)	3.0
Thermal bridging	Insulation Company enhanced thermal bridging details i.e., Kingspan K106
Services	
Ventilation	MVHR
Low energy lighting	100%

It is proposed that the heating will be provided by an air source heat pump.

Photovoltaic panels have also been considered as a way to further increase the renewable energy source. 0.93 kWp will be installed on the roof facing south east.

# Cooling and Overheating

The developer will address the following as a matter of priority to reduce overheating risk and the requirement for active cooling:

#### 1. Glazing and free areas

Maximum glazing will not be exceeded and the openings will be designed to achieve or exceed the free areas stated in Approved Document O:Overheating

#### 2. Minimise internal heat generation through energy efficient design

For example, heat distribution infrastructure within the building will be designed to minimise pipe lengths and adopting pipe configurations which minimise heat loss e.g. twin pipes.

#### 3. Reduce the amount of heat entering the building in summer

For example, through use of carefully designed shading measures, including balconies, louvres, internal or external blinds, shutters, trees and vegetation.

# 4. Manage the heat within the building through exposed internal thermal mass and high ceilings

Increasing the amount of exposed thermal mass can help to absorb excess heat within the building.

#### 5. Passive ventilation

For example, through the use of openable windows, shallow floorplates, dual aspect units, designing in the 'stack effect'.

#### 6. Mechanical ventilation

Mechanical ventilation can be used to make use of 'free cooling' where the outside air temperature is below that in the building during summer months. This will require a by-pass on the heat recovery system for summer mode operation.

#### 7. Active cooling systems

If air conditioning is necessary, the lowest carbon options should be used.

#### **Overheating Risk Analysis**

Modelling will be carried out during the design stage to ensure that Part O 2021 compliance is achieved. This will either be through the simplified method or dynamic thermal modelling TM59.

## Renewable Energy

The use of renewable technology in the proposed design of this dwelling have been fully considered.

Photovoltaic panels have been identified as a suitable technology for incorporation into the design. The proposed system will provide 0.93 kWp. This is equivalent to an area of approximately 5m2, depending upon the array and configuration chosen.

An air source heat pump has been identified suitable to provide space heating.

An ASHP operates by converting the energy of the outside air to heat, creating a comfortable temperature inside the building as well as supplying energy for the hot water system.

Due to limited roof space, solar hot water cannot be used effectively alongside photovoltaic arrays. Accordingly, it is considered preferable to install photovoltaic arrays in the available space identified as these represent a greater carbon saving.

## Monitoring

The applicant will consider options for post occupancy monitoring of the dwelling. It is the intention of the applicant to provide smart meters at the development to support the growth of demand side response.

# Sustainability Statement

The report so far has sought to address the energy targets outlined in Oxford City Council Policy RE1.

The following section of this reports looks to address additional sustainability measures.

## Internal Water Use

It is the intention of the applicant to reduce the consumption of potable water within the proposed dwellings from all sources, using efficient fittings and flow restrictors where required.

Performance in domestic properties is assessed under the methodologies set out in Part G of the Building Regulations and the former Code for Sustainable Homes, achieving a maximum internal water use of **105 L/p/d** (litres per person per day) by design.

Although a variety of specifications are available to meet this target, the proposed flow rate criteria for dwellings at the development has been chosen as follows:

Fitting	Flow Rate / Capacity
Sanitary Fittings	
Dual Flush WC	4 litres per flush (full)
	2.6 litres per flush (part)
Taps (main)	5 litres per minute
Bath (if present)	170 litres to overflow
Shower	8 litres per minute
Taps (kitchen/utility)	6 litres per minute
Appliances	
Washing Machine	8.17 litres per kilogram (dry load)
Dishwasher	1.25 litres per place setting

This specification of fittings achieves an internal water consumption rate of 104.1 litres per person per day, meeting the required result of 105 litres per person per day.

The developer will minimise the use of mains water by:

- A. Incorporating water saving measures and equipment.
- B. Designing residential development so that mains water consumption would meet a target of 105 litres or less per head per day (excluding an allowance of 5 litres or less per head per day for external water consumption).

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## Flood Risk

#### Flood risk from rivers or the sea

Using GOV.UK's map, the development has been found to be in a Flood Zone 1 (there is less than a 0.1 per cent chance of flooding occurring each year). As the development is also less than 1 hectare, a Flood Risk Assessment is not required.



#### Flood risk from surface water

Using the GOV.UK's map, the development is within an area of medium flood risk from surface water, sometimes known as flash flooding. This happens when heavy rain cannot drain away and is difficult to predict as it depends on rainfall volume and location. The proposed site is already hardstanding; however, the developer will consider Sustainable Drainage Systems on the site so that it does not increase the site's risk of flooding.



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# Materials and Waste Reduction

Sustainable Specification

Materials will be chosen to lower the environmental impact of the development wherever possible. BRE's Green Guide will be consulted when finalising specifications of products and element build types. This applies primarily to:

- Roofs
- External walls
- Internal walls (including separating walls)
- Upper and ground floors (including separating floors)
- Windows

In all cases, it is the applicant's intention to secure Green Guide ratings of between A+ and D, exceeding the requirements of the former Code for Sustainable Homes. All timber used during the development will come from a 'legal source' and will not be on the CITES list, or in the case of Appendix III of the CITES list, it will not have been sourced from a country seeking to protect this species as listed in Appendix III.

To promote the reduction of emissions of gases with high Global Warming Potential (GWP) associated with the manufacture, installation, use and disposal of foamed thermal and acoustic insulating materials, products will be chosen with a GWP of <5 wherever possible. They may also be chosen to comply with additional voluntary industry standards for responsible sourcing, including FSC Chain of Custody and BES 6001:2008 Framework Standard for Responsible Sourcing of Construction Products certifications where applicable. Products such as paints and varnishes will be sourced to minimise the use of Volatile Organic Compounds (Formaldehyde, VCM, etc.).

# Minimising Site Waste

A Site Waste Management Plan (SWMP) will be created to include procedures, commitments for waste minimisation and diversion from landfill, as well as setting target benchmarks for resource efficiency in accordance with guidance from:

- DEFRA (Department for Environment, Food and Rural Affairs)
- BRE (Building Research Establishment)
- Envirowise
- WRAP (Waste & Resources Action Programme)
- Environmental performance indicators and/or key performance indicators (KPI) from Envirowise or Constructing Excellence.

The applicant will seek to establish a 'take back' scheme from suppliers in order to avoid the unnecessary waste of excess materials. Care will also be taken to minimise loss through breakage etc. following guidance from the Waste and Resources Action Programme (WRAP) and others.

# Biodiversity

The presence of any significant ecological features as defined using guidance from BRE will be noted, and the appropriate measures for protection and conservation undertaken before works begin. Features to promote biodiversity, such as bird and bat boxes, will be incorporated into the design wherever feasible.

Additional planting will be carried out to ensure a net gain in vegetation.

# Cycle Parking

Bicycle stores will be incorporated into the design of the development.

## Conclusion

This report outlines how a variety of sustainability criteria have been considered and solutions successfully incorporated into the proposed design of the development.

Based on the modelling undertaken, it has been demonstrated that it is possible to reduce regulated on-site carbon dioxide emissions of the proposed dwelling adjacent to 10 Havelock Road by 59.14% beyond the requirements of Part L 2013 of the Building Regulations, where the building and services specification described in this report is implemented. This is sufficient to meet the targets set out in Oxford City Council Policy RE1. Compliance will also be achieved under the most recent Part L 2021 Building Regulations.

Fabric performance has been improved to meet and surpass the requirements of Part L of the Building Regulations, whilst heating, hot water equipment and controls have been chosen to maximize carbon savings. An air source heat pump will provide space heating and photovoltaic panels have been incorporated into the design to provide 0.93kWp.

Additional efforts to enhance the environmental performance of the development include the specification of materials, waste reduction, biodiversity and internal water use limited by design to 105 Litres/per person/per day.

# Appendices

- Appendix A TER worksheet
- Appendix B Base case DER
- Appendix C Final compliant DER
- Appendix D Water calculations
- Appendix E SAP 10.2 worksheets

User Details:													
Assessor Name: Software Name:	Nat Stro	alie Wh oma FS	eeler AP 201	2		Strom Softwa	a Num are Vei	STRO Versio	O034641 ion: 1.0.5.59				
	4.0				roperty	Address	: Havelo	ck Road					
Address :	10a	Havelo	ck Road	, Cowle	y, Oxfo	ord, OX4	3EP						
1. Overall dwelling dim	nension	S:			_	<i>(</i> )							
One word file on					Are	a(m²)	1	Av. Hei	ight(m)	1	Volume(m <sup>3</sup> )	٦	
Ground floor						45.92	(1a) x	2	2.3	(2a) =	105.62	(3a)	
First floor					:	34.65	(1b) x	2	.56	(2b) =	88.7	(3b)	
Total floor area TFA = (	(1a)+(1b	o)+(1c)+(	(1d)+(1e	e)+(1r	n)	30.57	(4)						
Dwelling volume							(3a)+(3b	)+(3c)+(3d	l)+(3e)+	.(3n) =	194.32	(5)	
2. Ventilation rate:													
	ł	main Deating	Se h	econdar eating	у	other		total			m <sup>3</sup> per hour		
Number of chimneys	Ĺ	0	<u>ה</u> + ר	0	] + [	0	] = [	0	x 4	40 =	0	(6a)	
Number of open flues	Ē	0	<u> </u> + [	0	ī + Г	0		0	× 2	20 =	0	(6b)	
Number of intermittent	fans						- Ē	3	x ′	10 =	30	(7a)	
Number of passive vent	ts						Γ	0	x	10 =	0	(7b)	
Number of flueless gas	fires						Г	0	x 4	40 =	0	(7c)	
										Air ch	anges per ho	ur	
Infiltration due to chimn	eys, flu	es and fa	ans = <mark>(6</mark>	a)+(6b)+(7	a)+(7b)+	(7c) =		30	· ·	÷ (5) =	0.15	(8)	
If a pressurisation test has	been ca	ried out or	r is intende	ed, procee	d to (17),	otherwise	continue fr	rom (9) to (	(16)			-	
Number of storeys in	the dwo	elling (ne	5)								0	(9)	
Additional infiltration	0 0F (		<i></i>		0.05 (				[(9)-	-1]x0.1 =	0	(10)	
Structural infiltration:	0.25 to	r steel or	timber i	frame or	0.35 to	r masoni	ry constr	uction			0	(11)	
deducting areas of oper	nings); if e	equal user	0.35	ponung to	i ile grea		a (allei						
If suspended wooder	n floor, e	enter 0.2	(unseal	ed) or 0.	1 (seal	ed), else	enter 0				0	(12)	
lf no draught lobby, e	enter 0.0	)5, else e	enter 0							i	0	(13)	
Percentage of window	ws and	doors dr	aught st	ripped							0	(14)	
Window infiltration						0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)	
Infiltration rate						(8) + (10)	+ (11) + (1	12) + (13) +	+ (15) =		0	(16)	
Air permeability value	e, q50, e	expresse	ed in cub	oic metre	s per h	our per s	quare m	etre of e	nvelope	area	5	(17)	
If based on air permeat	oility val	ue, then	(18) = [(1	7) ÷ 20]+(8	3), otherw	rise (18) = (	(16)				0.4	(18)	
Air permeability value app	lies if a pi	ressurisatio	on test has	s been don	e or a de	gree air pe	rmeability	is being us	sed			_	
Number of sides shelte	red					(20) 1	10 07E v (4				2	(19)	
Shelter factor						(20) = 1 -	[0.075 X (1	[9]]=			0.85	(20)	
Infiltration rate incorpor	ating sh	elter fac	tor			(21) = (18	5) x (20) =				0.34	(21)	
Infiltration rate modified	tor mo	nthly win	nd speed	1 									
Jan Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind s	speed fr	om Tabl	e 7	<b></b>				<b></b>			I		
(22)m= 5.1 5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7			

#### Wind Factor $(22a)m = (22)m \div 4$

	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 rate	e (allowi	ng for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m					
Calcula	0.44 ate effec	0.43 Ctive air (	0.42 change i	0.38 rate for t	0.37 he appli	0.33 Cable ca	0.33 se	0.32	0.34	0.37	0.39	0.4		
lf me	chanica	al ventila	tion:										0	(23a)
If exha	aust air he	eat pump (	using Appe	endix N, (2	3b) = (23a	) × Fmv (e	equation (N	N5)) , other	wise (23b	o) = (23a)			0	(23b)
lf bala	nced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h)	=				0	(23c)
a) If	balance	d mecha	anical ve	ntilation	with hea	at recove	ery (MVI	HR) (24a	)m = (2	2b)m + (	23b) × [′	1 – (23c)	÷ 100]	
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mecha	anical ve	ntilation	without	heat rec	overy (N	MV) (24b	)m = (22	2b)m + (2	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ver	tilation o	or positiv	e input v	entilatio	on from c	outside	- (	,			
	f (22b)m	ו < 0.5 ×	: (23b), t	hen (240	c) = (23b	); other	vise (24	c) = (22b	) m + 0	.5 × (23b	)) 			(240)
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(240)
d) If i	natural v f (22b)m	v = 1. the	on or wh en (24d)	ole hous m = (22	e positiv b)m othe	rwise (2	ventilatio 4d)m =	on from 1 0.5 + [(2)	oft 2b)m² x	0.51				
(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(24d)
Effec	ctive air	change	rate - er	nter (24a	) or (24t	) or (24	c) or (24	d) in box	(25)	Į	1	1		
(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(25)
2 40	at loopo	o and ha	ot loop r	oromot	or					•	1			
ELEN	IENT	Gros area	ss (m²)	Openin m	gs <sup>2</sup>	Net Ar A ,r	ea n²	U-valı W/m2	ie K	A X U (W/	K)	k-value	) <	A X k kJ/K
Deers			. ,							(	/	1.0/111 1		
DOOLS						2.07	x	1.2	=	2.484		10,111		(26)
Windov	ws Type	e 1				2.07	x x	1.2	= 0.04] =	2.484 4.81				(26) (27)
Windov Windov	ws Type ws Type	e 1 e 2				2.07 3.63 7.25	x x <sup>1,</sup> x <sup>1,</sup>	1.2 /[1/( 1.4 )+ /[1/( 1.4 )+	0.04] = 0.04] =	2.484 4.81 9.61				(26) (27) (27)
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Windov Windov Windov Windov Windov Windov Rooflig Rooflig Floor	ws Type ws Type ws Type ws Type ws Type ws Type hts Typ hts Typ hts Typ	e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 1 e 2 e 3				2.07 3.63 7.25 0.58 1.36 0.74 1.65 0.75959 0.75959 0.75959 45.92	x x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{bmatrix} 0.04 \\ 0.04 \end{bmatrix} = \\ $	2.484 4.81 9.61 0.77 1.8 0.98 2.19 0.77 1.29131 1.29131 1.29131 5.9696				(26) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b)
Windov Windov Windov Windov Windov Windov Rooflig Rooflig Floor Walls	ws Type ws Type ws Type ws Type ws Type ws Type hts Typ hts Typ	e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 1 e 2 e 3 97.7	9	17.8	3	2.07 3.63 7.25 0.58 1.36 0.74 1.65 0.75959 0.75959 0.75959 0.75959 45.92 79.93	x x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	$ \begin{array}{c} 1.2\\ /[1/(1.4)+\\ /[1/(1.4)+\\ /[1/(1.4)+\\ /[1/(1.4)+\\ /[1/(1.4)+\\ /[1/(1.4)+\\ /[1/(1.4)+\\ /[1/(1.7)+\\ /[1/(1.7)+\\ (1/(1.7)+\\ 0.13\\ 0.18 \end{array} $	$\begin{bmatrix} 0.04 \\ 0.04 $	2.484 4.81 9.61 0.77 1.8 0.98 2.19 0.77 1.29131 1.29131 1.29131 1.29131 5.9696 14.39				(26) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (28)
Windov Windov Windov Windov Windov Windov Rooflig Rooflig Floor Walls Roof T	ws Type ws Type ws Type ws Type ws Type hts Typ hts Typ hts Typ	e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 1 e 2 e 3 97.7 9.66	9	17.80	6	2.07 3.63 7.25 0.58 1.36 0.74 1.65 0.75959 0.7595	x x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{bmatrix} & = \\ 0.04 \\ = \\ 0$	2.484 4.81 9.61 0.77 1.8 0.98 2.19 0.77 1.29131 1.29131 1.29131 1.29131 1.29131 1.29131				(26) (27) (27) (27) (27) (27) (27) (27b)(27b)(27b)(27b)(27b)(27b)(27b)(27b)
Windov Windov Windov Windov Windov Windov Windov Rooflig Rooflig Floor Walls Roof T Roof T	ws Type ws Type ws Type ws Type ws Type ws Type hts Typ hts Typ hts Typ	a 1 a 2 a 3 a 4 a 5 a 6 a 7 a 1 a 2 a 1 a 2 a 3 a 3 a 4 a 5 a 6 a 7 a 1 a 2 a 3 a 3 a 4 a 5 a 6 a 7 a 2 a 3 a 3 a 4 a 5 a 6 a 7 a 9 a 7 a 9 a 6 a 3 a 9 a 7 a 9 a 6 a 3 a 9 a 7 a 9 a 6 a 3 a 9 a 7 a 9 a 6 a 7 a 7	9	17.8 2.28	6	2.07 3.63 7.25 0.58 1.36 0.74 1.65 0.75959 0.7595	x x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	$\begin{array}{c} 1.2 \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.7)+ \\ /[1/(1.7)+ \\ (1/(1.7)+ \\ 0.13 \\ \hline 0.13 \\ \hline 0.13 \\ \hline 0.13 \end{array}$	$\begin{bmatrix} 0.04 \\ 0.04 $	2.484 4.81 9.61 0.77 1.8 0.98 2.19 0.77 1.29131 1.29131 1.29131 1.29131 5.9696 14.39 0.96 4.5				(26) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (29) (30)
Windov Windov Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Roof T Roof T Roof T Roof T	ws Type ws Type ws Type ws Type ws Type ws Type hts Typ hts Typ hts Typ - ype1 - ype2 - ype3	e 1 e 2 e 3 e 4 e 5 e 6 e 7 e 1 e 2 e 3 97.7 9.60 34.6 0.8	9	17.80 2.28 0 0	6	2.07 3.63 7.25 0.58 1.36 0.74 1.65 0.75959 0.75959 0.75959 0.75959 0.75959 1.592 0.75959	x x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	$\begin{array}{c} 1.2 \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.4)+ \\ /[1/(1.7)+ \\ /[1/(1.7)+ \\ (0.13) \\ \hline 0.13 \\ \hline 0.13 \\ \hline 0.13 \\ \hline 0.13 \end{array}$	$\begin{bmatrix} 0.04 \\ 0.04 $	2.484 4.81 9.61 0.77 1.8 0.98 2.19 0.77 1.29131 1.29131 1.29131 1.29131 1.29131 1.29131 1.29131 1.29131 1.29131 1.29131 1.29131 1.29131				(26) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27) (27) (27) (27) (27) (27) (27) (27

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* for wir ** includ	idows and le the area	l roof winde as on both	ows, use e sides of ir	effective wi nternal wal	indow U-va Is and part	alue calcul titions	lated using	g formula 1,	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	n 3.2	
Fabric	heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				52.97	(33)
Heat c	apacity	Cm = S(	(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
Therm	al mass	parame	ter (TMF		- TFA) ir	n kJ/m²K			250	(35)				
For des can be i	ign assess used inste	sments wh ad of a de	ere the de tailed calci	tails of the ulation.	construct	ion are no	t known pr	ecisely the	indicative	e values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix l	K						11.53	(36)
if details of thermal bridging are not known $(36) = 0.05 \times (31)$														
Total fabric heat loss (33) + (36) =													64.5	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (	(25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	38.22	37.98	37.75	36.65	36.44	35.48	35.48	35.3	35.85	36.44	36.86	37.29		(38)
Heat t	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (	38)m			
(39)m=	102.72	102.48	102.25	101.14	100.94	99.98	99.98	99.8	100.35	100.94	101.35	101.79		
		1	1				1			Average =	Sum(39)1	12 /12=	101.14	(39)
Heat lo	oss para	meter (H	HLP), W/	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.27	1.27	1.27	1.26	1.25	1.24	1.24	1.24	1.25	1.25	1.26	1.26		
Numb	er of day	/s in moi	nth (Tab	le 1a)					,	Average =	Sum(40)1	<sub>12</sub> /12=	1.26	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	L												1	
A \\\!	ater heat	ting ener	rav requi	irement:				•		-	•	k\\/b/v	ear:	
4. Wa	ater heat	ting enei	rgy requi	irement:								kWh/y	ear:	
4. Wa Assum if TF	ater heat ned occu A > 13.9	ting ener upancy, l 9, N = 1 9, N = 1	rgy requi N + 1.76 x	irement: [1 - exp	.(-0.0003	349 x (TF	FA -13.9	)2)] + 0.(	)013 x ( <sup>-</sup>	TFA -13	2. .9)	kWh/yo 47	ear:	(42)
4. Wa Assum if TF if TF Annua	ater hea ned occu A > 13.9 A £ 13.9	ting ener upancy, l 9, N = 1 9, N = 1 ue hot wa	rgy requi N + 1.76 x ater usao	irement: [1 - exp	(-0.0003	349 x (TF av Vd.av	-A -13.9 erace =	)2)] + 0.( (25 x N)	0013 x ( <sup>-</sup> + 36	TFA -13.	.9)	kWh/ye 47	əar:	(42)
4. Wa Assum if TF if TF Annua <i>Reduce</i>	ater heat ned occu A > 13.9 A £ 13.9 I averag the annua	ting ener upancy, l 9, N = 1 9, N = 1 ge hot wa al average	rgy requi N + 1.76 x ater usag <i>hot water</i>	irement: [1 - exp ge in litre usage by	(-0.0003 es per da 5% if the a	349 x (TF ay Vd,av Iwelling is	<sup>=</sup> A -13.9 erage = designed	)2)] + 0.0 (25 x N) to achieve	0013 x ( <sup>-</sup> + 36 a water us	TFA -13. se target o	.9) .9)	kWh/yo 47 95	ear:	(42) (43)
4. Wa Assum if TF if TF Annua Reduce not mor	ater heat hed occu A > 13.9 $A \pm 13.9$ I averag the annual the that 125	ting ener upancy, l 9, N = 1 9, N = 1 ge hot wa al average litres per j	rgy requi N + 1.76 x ater usag hot water person per	irement: [1 - exp ge in litre usage by day (all w	(-0.0003 es per da 5% if the a vater use, l	349 x (TF ay Vd,av welling is hot and co	FA -13.9 erage = designed i	)2)] + 0.( (25 x N) to achieve	)013 x ( <sup>-</sup> + 36 a water us	TFA -13. se target o	2. .9) 92	kWh/y 47 95	ear:   	(42) (43)
4. Wa Assum if TF if TF Annua Reduce not mor	ater heat A > 13.9 A > 13.9 $A \pm 13.9$ I averag the annua- the annu	ting ener upancy, l 9, N = 1 9, N = 1 ge hot wa al average litres per l Feb	rgy requi N + 1.76 x ater usag hot water person per Mar	irement: [1 - exp ge in litre usage by day (all w Apr	o(-0.0003 es per da 5% if the o vater use, l May	349 x (TF ay Vd,av welling is hot and co Jun	FA -13.9 rerage = designed i ld) Jul	)2)] + 0.( (25 x N) to achieve Aug	0013 x (* + 36 a water us Sep	TFA -13. se <i>target o</i> Oct	2. .9) 92 7 Nov	kWh/ya 47 95 Dec	ear:   	(42) (43)
4. Wa Assum if TF if TF Annua Reduce not mor	ater heat A = 13.9 A = 13.9 $A \pm 13.9$ $A \pm 1$	ting ener upancy, I 9, N = 1 9, N = 1 ge hot wa al average litres per Feb n litres per	rgy requi N + 1.76 x ater usag hot water person per Mar day for ea	irement: [1 - exp ge in litre usage by r day (all w Apr ach month	(-0.0003 es per da 5% if the o vater use, l May Vd,m = fa	349 x (TF ay Vd,av <i>Iwelling is</i> <i>hot and co</i> Jun ctor from 1	FA -13.9 erage = designed : id) Jul Table 1c x	)2)] + 0.0 (25 x N) to achieve Aug (43)	0013 x ( <sup>-</sup> + 36 <sup>a water us</sup> Sep	TFA -13. se target o Oct	2. .9) 92 f	kWh/y 47 95 Dec	ear:   	(42) (43)
4. Wa Assum if TF if TF Annua Reduce not mor Hot wat (44)m=	ater heat A > 13.9 A > 13.9 $A \pm 13.9$ $A \pm 1$	ting energy, I 9, N = 1 9, N = 1 10 + 00 + 00 + 00 + 00 + 00 + 00 + 00 +	rgy requi N + 1.76 x ater usag hot water person per Mar r day for ea 94.81	irement: [1 - exp ge in litre usage by f day (all w Apr ach month 91.09	(-0.0003 5% if the o vater use, I May Vd,m = fa 87.37	349 x (TF ay Vd,av lwelling is hot and co Jun ctor from 7 83.65	FA -13.9 erage = designed i id) Jul Table 1c x 83.65	)2)] + 0.( (25 x N) to achieve Aug (43) 87.37	0013 x (* + 36 <i>a water us</i> Sep 91.09	TFA -13. se target o Oct 94.81	2. .9) 92 Nov 98.52	kWh/yd 47 95 Dec 102.24	ear:     	(42) (43)
4. Wa Assum if TF if TF Annua Reduce not mor Hot wat (44)m=	ater heat hed occu A > 13.9 $A \pm 13.9$ I averag the annual the that 125 Jan er usage in 102.24	ting energy upancy, I 9, N = 1 9, N = 1 up hot was al average litres per p Feb n litres per 98.52	rgy requi N + 1.76 x ater usag hot water berson per Mar day for ea 94.81	irement: [1 - exp ge in litre usage by day (all w Apr ach month 91.09	(-0.0003 es per da 5% if the o vater use, l May Vd,m = fa 87.37	849 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1 83.65	FA -13.9 rerage = designed Id) Jul Table 1c x 83.65	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep 91.09	TFA -13. se target o Oct 94.81 Total = Su	2. .9) 92 Nov 98.52 m(44) <sub>112</sub> =	kWh/yd 47 95 Dec 102.24	ear:	(42) (43)
4. Wa Assum if TF if TF Annua Reduce not mor Hot wat (44)m= Energy	ater heat hed occu A > 13.9 $A \pm 13.9$ I average the annual the annua	ting energy upancy, I 9, N = 1 9, N = 1 up hot water litres per p Feb n litres per 98.52 thot water	rgy requi N + 1.76 x ater usag hot water berson per Mar day for ea 94.81 used - cal	irement: [1 - exp ge in litre usage by day (all w Apr ach month 91.09	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4.	349 x (TF ay Vd,av <i>twelling is</i> <i>hot and co</i> Jun <i>ctor from</i> 83.65 190 x Vd,r	FA - 13.9 $erage = designed find find find find find find find fin$	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600	0013 x ( + 36 a water us Sep 91.09	TFA -13. se target o Oct 94.81 Total = Su th (see Ta	2. .9) 92 Nov 98.52 m(44)112 ables 1b, 1	kWh/yd 47 95 Dec 102.24 = c, 1d)	ear:	(42) (43)
4. Wa Assum if TF if TF Annua <i>Reduce</i> <i>not mor</i> <i>Hot wat</i> (44)m= <i>Energy</i> (45)m=	ater heat hed occu A > 13.9 $A \pm 13.9$ I averag the annual the annual the that 125 Jan er usage in 102.24 content of 151.62	ting energy $p_{1} p_{2} p_{3} p_{4} = 1$ $p_{2} p_{3} p_{4} = 1$ $p_{3} p_{4} p_{4} p_{4} = 1$ $p_{4} p_{4} $	rgy requi N + 1.76 x ater usag hot water person per Mar day for ea 94.81 used - cal 136.84	irement: [1 - exp ge in litre usage by to day (all w Apr ach month 91.09 culated mo	(-0.0003 5% if the a sater use, I May Vd,m = fa 87.37 onthly = 4.	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78	FA - 13.9 $erage = designed is designed in the designed is designed is designed in the designed in the designed is designed in the designed in$	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04	0013 x (* + 36 a water us Sep 91.09 91.09	TFA -13 se target o Oct 94.81 Total = Su nth (see Ta 123.87	2. .9) 92 Nov 98.52 m(44) <sub>112</sub> ables 1b, 1 [135.22	kWh/yd 47 95 Dec 102.24 c, 1d) 146.84	ear:	(42) (43)
4. Wa Assum if TF if TF Annua <i>Reduce</i> <i>not mor</i> <i>Hot wat</i> (44)m= <i>Energy</i> (45)m= <i>If instan</i>	ater heat hed occu A > 13.9 $A \pm 13.9$ I averag the annual the that 125 Jan 102.24 content of 151.62 taneous w	ting energy Ipancy, I 9, N = 1 9, N = 1 1000000000000000000000000000000000000	rgy requi N + 1.76 x ater usag hot water person per Mar day for ea 94.81 used - cal 136.84	irement: [1 - exp ge in litre usage by day (all w Apr ach month 91.09 culated mo 119.3	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78	FA -13.9 erage = designed i ld) Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46,	0013 x ( + 36 a water us Sep 91.09 0 kWh/mor 106.29	TFA -13 se target o Oct 94.81 Total = Su nth (see Ta 123.87 Total = Su	2. .9) 92 98.52 m(44)112 ables 1b, 1 135.22 m(45)112	kWh/yu 47 95 Dec 102.24 = c, 1d) 146.84	ear: 1115.37	(42) (43) (44) (45)
4. Wa Assum if TF if TF Annua Reduce not mor Hot wat (44)m= Energy (45)m= If instan (46)m=	ater heat hed occu A > 13.9 A £ 13.9 A £ 13.9 A £ 13.9 I average the annual the annu	ting energy upancy, I 9, N = 1 9, N = 1 19 hot water 10 hot water 11 hot water 132.61 19.89	rgy requi N + 1.76 x ater usag hot water person per Mar day for ea 94.81 used - cal 136.84 ng at point 20.53	irement: [1 - exp ge in litre usage by a day (all w Apr ach month 91.09 culated mo 119.3 of use (no	(-0.0003) es per da 5% if the a vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage), 14.82	FA -13.9 erage = designed i id) Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76	0013 x (* + 36 a water us Sep 91.09 91.09 0 kWh/mor 106.29 to (61) 15.94	TFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58	2. .9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1 135.22 m(45) <sub>112</sub> = 20.28	kWh/ya 47 95 Dec 102.24 c, 1d) 146.84 = 22.03	ear:	(42) (43) (44) (45) (46)
4. Wa Assum if TF if TF Annua <i>Reduce</i> <i>not mor</i> <i>Hot wat</i> (44)m= <i>Energy</i> (45)m= <i>If instan</i> (46)m= Water	ater heat hed occu A > 13.9 $A \pm 13.9$ I averag the annual the that 125 Jan er usage in 102.24 content of 151.62 taneous w 22.74 storage	ting energy Ipancy, I 9, N = 1 9, N = 1 10 + 00 + 00 10 + 00 +	rgy requi N + 1.76 x ater usag hot water person per Mar day for ea 94.81 used - cal 136.84 ng at point 20.53	irement: [1 - exp ge in litre usage by day (all w Apr ach month 91.09 culated mo 119.3	(-0.0003) es per da 5% if the a vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1 83.65 190 x Vd,r 98.78 r storage), 14.82	$= A - 13.9$ $= rage =$ $designed =$ $da$ $= 3.65$ $m \times nm \times E$ $= 91.54$ $= onter 0 in$ $= 13.73$	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46, 15.76	0013 x ( + 36 a water us Sep 91.09 0 kWh/mor 106.29 0 to (61) 15.94	TFA -13 se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58	2. .9) 92 98.52 m(44)112 ables 1b, 1 135.22 m(45)112 20.28	kWh/y 47 .95 Dec 102.24 = c, 1d) 146.84 = 22.03	ear: 1115.37	(42) (43) (44) (44) (45) (46)
4. Wa Assum if TF if TF Annua <i>Reduce</i> <i>not mor</i> <i>Hot wat</i> (44)m= <i>Energy</i> (45)m= <i>If instan</i> (46)m= Water Storag	ater heat hed occu A > 13.9 A £ 13.9 A £ 13.9 I average the annual te that 125 Jan 102.24 content of 151.62 taneous w 22.74 storage pe volum	ting energy Ipancy, I 9, N = 1 9, N = 1 19 hot was a average litres per p Feb n litres per 98.52 5 hot water 132.61 vater heatin 19.89 Toss: ne (litres)	rgy requi N + 1.76 x ater usag hot water person per Mar day for ea 94.81 used - cal 136.84 ng at point 20.53	irement: [1 - exp ge in litre usage by a day (all w Apr ach month 91.09 culated mo 119.3 f of use (no 17.9	(-0.0003) es per da 5% if the a vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS	FA - 13.9 $erage =$ $designed file designed file design$	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa	0013 x ( + 36 a water us Sep 91.09 91.09 0 kWh/mor 106.29 0 to (61) 15.94 ame vest	TFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 sel	2. .9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1 135.22 m(45) <sub>112</sub> = 20.28	kWh/y 47 95 Dec 102.24 <i>c, 1d)</i> 146.84 22.03	ear: 1115.37 1462.43	(42) (43) (44) (44) (45) (46) (47)
4. Wa Assum if TF if TF Annua <i>Reduce</i> <i>not mor</i> <i>Hot wat</i> (44)m= <i>Energy</i> (45)m= <i>If instan</i> (46)m= Water Storag If com	ater heat hed occu A > 13.9 $A \pm 13.9$ I average the annual the annua	ting energy upancy, I 9, N = 1 9, N = 1 19 hot water 10 litres per p Feb n litres per 98.52 132.61 vater heating 19.89 1055: ne (litres) ne ating a	rgy requi N + 1.76 x ater usag hot water person per Mar day for ea 94.81 used - cal 136.84 ng at point 20.53 ) includir and no ta	irement: [1 - exp ge in litre usage by day (all w Apr ach month 91.09 culated mo 119.3 cof use (no 17.9 ng any so ink in dw	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e	349 x (TF ay Vd,av <i>lwelling is</i> <i>hot and co</i> Jun <i>ctor from</i> 83.65 <i>190 x Vd,r</i> 98.78 <i>r storage),</i> 14.82 /WHRS nter 110	= A - 13.9 $= rage =$ $designed i$ $id)$ $= Jul$ $Table 1c x$ $= 83.65$ $m x nm x L$ $= 91.54$ $= nter 0 in$ $= 13.73$ $= storage$ $= 0 litres in$	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa (47)	0013 x ( + 36 a water us Sep 91.09 0 kWh/mor 106.29 0 to (61) 15.94 ame vest	TFA -13 se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 sel	2. .9) 92 Nov 98.52 m(44)112 = ables 1b, 1 135.22 m(45)112 = 20.28	kWh/ya 47 .95 Dec 102.24 <i>c, 1d)</i> 146.84 <i>22.03</i> 150	ear:	(42) (43) (44) (44) (45) (46) (47)
4. Wa Assum if TF if TF Annua <i>Reduce</i> <i>not mor</i> <i>Hot wat</i> (44)m= <i>Energy</i> (45)m= <i>If instan</i> (46)m= Water Storag If com Otherw	ater heat hed occu $\overline{A} > 13.9$ $\overline{A} \pm 13.9$	ting energy upancy, I 9, N = 1 9, N = 1 19, N = 1 1000000000000000000000000000000000000	rgy requi N + 1.76 x ater usag hot water person per Mar day for ea 94.81 used - cal 136.84 ng at point 20.53 ) includir and no ta hot wate	irement: [1 - exp ge in litre usage by a day (all w Apr ach month 91.09 culated mo 119.3 f of use (no 17.9 ng any so ank in dw er (this ir	(-0.0003) es per da 5% if the a vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e includes i	349 x (TF ay Vd,av lwelling is hot and co Jun ctor from 1 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS inter 110 nstantar	=A -13.9 erage = designed i id) Jul Table 1c x 83.65 m x nm x L 91.54 enter 0 in 13.73 storage ) litres in neous co	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46, 15.76 within sa (47) ombi boil	0013 x (* + 36 a water us Sep 91.09 91.09 0 kWh/mor 106.29 0 to (61) 15.94 ame vess ame vess	TFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 sel er '0' in (	2. .9) 92 Nov 98.52 m(44)112 ables 1b, 1 135.22 m(45)112 20.28	kWh/ya 47 95 Dec 102.24 c, 1d) 146.84 22.03 150	ear:	(42) (43) (44) (44) (45) (46) (47)
4. Wa Assum if TF if TF Annua Reduce not mor Hot wat (44)m= Energy (45)m= If instan (46)m= Water Storag If com Otherw Water a) If n	ater heat hed occu A > 13.9 $A \pm 13.9$ I average the annual the annual the annual the annual the annual the annual the annual to the annual	ting energy upancy, I 9, N = 1 9, N = 1 19, N = 1 19, N = 1 19, N = 1 1000000000000000000000000000000000000	rgy requi	irement: [1 - exp ge in litre usage by day (all w Apr ach month 91.09 culated mo 119.3 f of use (no 17.9 ng any so ank in dw er (this ir	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e ocludes i	349 x (TF ay Vd,av <i>lwelling is</i> <i>hot and co</i> Jun <i>ctor from</i> 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS nter 110 nstantar	= A - 13.9 $= rage =$ $designed i$ $dd)$ $= Jul$ $Table 1c x$ $= 83.65$ $m x nm x L$ $= 91.54$ $enter 0 in$ $= 13.73$ $storage$ $= 13.73$ $storage$ $= 1000 s co$ $= 1000 s co$	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46, 15.76 within sa (47) ombi boil	0013 x ( + 36 a water us Sep 91.09 0 kWh/mor 106.29 0 to (61) 15.94 ame vess ers) ente	TFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 Sel er '0' in (	2. .9) 92 Nov 98.52 m(44)112 = ables 1b, 1 135.22 m(45)112 = 20.28	kWh/ya 47 95 Dec 102.24 = c, 1d) 146.84 = 22.03 150	ear:	(42) (43) (44) (45) (46) (47)
4. Wa Assum if TF if TF Annua <i>Reduce</i> <i>not mor</i> <i>Hot wat</i> (44)m= <i>Energy</i> (45)m= <i>If instan</i> (46)m= Water Storag If com Otherw Water a) If n	ater heat hed occu A > 13.9 $A \pm 13.9$ I average the annual e that 125 Jan er usage in 102.24 content of 151.62 taneous w 22.74 storage pe volume munity heat vise if no storage hanufact prature f	ting energy upancy, I 9, N = 1 9, N = 1 9, N = 1 10, N =	rgy requinations of the seclared I	irement: [1 - exp ge in litre usage by day (all w Apr ach month 91.09 culated mo 119.3 f of use (no 17.9 ng any so ank in dw er (this ir oss facto 2b	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e ncludes i or is kno	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS onter 110 nstantar wn (kWł	=A -13.9 erage = designed : id) Jul Table 1c x 83.65 m x nm x L 91.54 enter 0 in 13.73 storage ) litres in neous co n/day):	)2)] + 0.0 (25 x N) to achieve (43) 87.37 07m / 3600 105.04 boxes (46, 15.76 within sa (47) ombi boil	0013 x ( + 36 a water us Sep 91.09 91.09 0 kWh/mor 106.29 0 to (61) 15.94 ame vess ers) ente	TFA -13 se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 Sel er '0' in (	2. .9) 92 Nov 98.52 m(44)112 ables 1b, 1 135.22 m(45)112 20.28	kWh/y 47 .95 Dec 102.24 c, 1d) 146.84 22.03 150 39	ear:	(42) (43) (44) (44) (45) (46) (47) (48) (48)

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Energy b) If m Hot wa	y lost fro nanufact ater stora	m water urer's de age loss	r storage eclared o factor fi	e, kWh/ye cylinder l rom Tabl	ear loss fact le 2 (kW	) =		0.	75 0		(50) (51)			
Volum	e factor	from Ta	ble 2a	011 4.5								0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	r storage	e, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Wotor			oulotod :	0.	75		(55)							
vvaler	storage				monun			((oc))n = (	55) × (41)	m 1				(==)
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	52 I I	(56)
ii cyinde			a solar sid	iage, (57)	m = (56)m 1	x [(50) – (	⊓ I I)] ÷ (⊃l	u), eise (o	/ )III = (36)	m where (		m Append		
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 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	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	heat requ	uired for	water h	eating ca	alculated	l for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	198.22	174.7	183.44	164.39	161.07	143.87	138.13	151.63	151.38	170.47	180.31	193.43		(62)
Solar Dł	-IW input of	calculated	using App	endix G o	r Appendix	H (negativ	ve quantity	/) (enter '0	if no sola	r contributi	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	iter											
(64)m=	198.22	174.7	183.44	164.39	161.07	143.87	138.13	151.63	151.38	170.47	180.31	193.43		
								Outp	out from w	ater heate	r (annual)₁	12	2011.05	(64)
Heat g	ains froi	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	1	-
(65)m=	87.69	77.76	82.78	75.74	75.34	68.92	67.71	72.2	71.42	78.46	81.03	86.1		(65)
inclu	ude (57)	n in cal	culation	ı of (65)m	only if c	vlinder is	s in the c	dwellina	or hot w	u vater is fr	om com	munitv h	eating	
5 Int	ternal da	ains (see	- Table 5	5 and 5a	).	,		· · J				,	3	
Matah		a (Table			)•									
Metab	Jan	Feb	<u>, Mar</u>	Apr	May	Jun	Jul	Αυσ	Sep	Oct	Nov	Dec		
(66)m =	123.68	123.68	123.68	123.68	123.68	123.68	123.68	123.68	123.68	123.68	123.68	123.68		(66)
Lightin	a apine		ted in Au	pondix			r   9a) a		Table 5					
(67)m-	19 67	17 47				6 79	, a	9 53	12.8	16.25	18.96	20.22		(67)
Applier							12 or 1 1	20) alac			10.00	20.22		(01)
	nces ga						165.06	3a), aisc			106.22	210.90		(68)
(00)11=	. 220.03	222.92	217.15	204.87	109.30	174.79	105.00	102.77	T 100.04	100.02	190.32	210.09		(00)
Cookir	ng gains		ated in A	ppendix	L, equat	ion L15	or L15a)	, also se	e lable	5				(00)
(69)m=	35.37	35.37	35.37	35.37	35.37	35.37	35.37	35.37	35.37	35.37	35.37	35.37		(69)
Pumps	s and far	ns gains	(Table !	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	aporatio	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94		(71)

Water	heating	g gains (T	able 5)															
(72)m=	117.86	115.72	111.26	105	2 10'	1.26	9	5.72	91.01	97.	04	99.19	105.4	6 112.55	115.73	]	(72)	)
Total i	interna	I gains =						(66)	m + (67)n	n + (68	B)m +	(69)m + (	70)m +	(71)m + (72)	m	-		
(73)m=	421.26	419.21	405.72	383.	92 36 <sup>-</sup>	1.77	34	40.4	326.5	332	.45	343.62	365.6	3 390.94	409.94	]	(73)	)
6. So	lar gair	ns:																
Solar (	gains are	calculated	using sola	r flux f	om Tabl	e 6a a	and	associ	ated equa	ations	to co	nvert to the	e applic	able orientat	ion.			
Orient	ation:	Access F	actor	A	Area		Flux Table 6a		т		g_	FF Table 6a			Gains			
				, 			Table 6a		ne oa	-			_			(vv)		
Northe	ast 0.9x	0.54	x		0.58		×	11.28		×		0.63	×	0.7	=	1.4	(75)	)
Northe	ast 0.9x	0.54	×		0.58		×	1	1.28	X		0.63	×	0.7	=	1.4	(75)	)
Northe	ast 0.9x	0.54	x		0.58		×	2	2.97	×		0.63	×	0.7	=	2.85	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	×		0.58		×	2	2.97	×		0.63	×	0.7	=	2.85	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	X		0.58		×	4	1.38	×		0.63	×	0.7	=	5.14	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	×		0.58		×	4	1.38	X		0.63	×	0.7	=	5.14	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		×	6	7.96	x		0.63	×	0.7	=	8.45	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		×	6	7.96	x		0.63	×	0.7	=	8.45	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		×	9	1.35	x		0.63	×	0.7	=	11.36	3 (75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		×	9	1.35	x		0.63	×	0.7	=	11.36	3 (75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		×	9	7.38	x		0.63	×	0.7	=	12.11	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		×	9	7.38	x		0.63	×	0.7	=	12.11	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		× [	ç	91.1	x		0.63	×	0.7	=	11.32	2 (75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		× [	ç	91.1	x		0.63	×	0.7	=	11.32	2 (75)	)
Northea	ast <mark>0.9x</mark>	0.54	x		0.58		×	7	2.63	x		0.63	x	0.7	=	9.03	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		× [	7	2.63	x		0.63	x	0.7	=	9.03	(75)	)
Northea	ast <mark>0.9x</mark>	0.54	x		0.58		× [	5	0.42	x		0.63	×	0.7	=	6.27	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		× [	5	0.42	x		0.63	×	0.7	=	6.27	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		× [	2	8.07	x		0.63	×	0.7	=	3.49	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		× [	2	8.07	x		0.63	×	0.7	=	3.49	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		× [	1	4.2	x		0.63	×	0.7	=	1.76	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		× [	1	4.2	x		0.63	×	0.7	=	1.76	(75)	)
Northe	ast <mark>0.9x</mark>	0.54	x		0.58		× [	ç	9.21	x		0.63	×	0.7	=	1.15	(75)	)
Northea	ast <mark>0.9x</mark>	0.54	x		0.58		× [	ç	9.21	x		0.63	x	0.7	=	1.15	(75)	)
Southe	ast <mark>0.9x</mark>	0.77	x		3.63		× [	3	6.79	x		0.63	x	0.7	=	40.82	2 (77)	)
Southe	ast <mark>0.9x</mark>	0.77	x		1.36		×	3	6.79	x		0.63	×	0.7	=	15.29	) (77)	)
Southe	ast <mark>0.9x</mark>	0.77	x		0.74		× [	3	6.79	x		0.63	×	0.7	=	8.32	(77)	)
Southe	ast <mark>0.9x</mark>	0.77	x		3.63		× [	6	2.67	x		0.63	x	0.7	=	69.53	3 (77)	)
Southe	ast <mark>0.9x</mark>	0.77	x		1.36		×	6	2.67	x		0.63	×	0.7	=	26.05	5 (77)	)
Southe	ast <mark>0.9x</mark>	0.77	x		0.74		×Ī	6	2.67	x		0.63	x	0.7	=	14.17	7 (77)	)
Southe	ast <mark>0.9x</mark>	0.77	x		3.63		×Ī	8	5.75	x		0.63	×	0.7	=	95.13	3 (77)	)
Southe	ast <mark>0.9x</mark>	0.77	x		1.36		×Ī	8	5.75	x		0.63	×	0.7	=	35.64	1 (77)	)

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Southeast 0.9x	0.77	x	0.74	x	85.75	x	0.63	×	0.7	] =	19.39	(77)
Southeast 0.9x	0.77	x	3.63	x	106.25	x	0.63	x	0.7	1 =	117.87	<b>–</b> (77)
Southeast 0.9x	0.77	x	1.36	x	106.25	×	0.63	x	0.7	1 =	44.16	<b>–</b> (77)
Southeast 0.9x	0.77	×	0.74	x	106.25	x	0.63	x	0.7	1 =	24.03	(77)
Southeast 0.9x	0.77	×	3.63	x	119.01	x	0.63	x	0.7	<b>j</b> =	132.03	(77)
Southeast 0.9x	0.77	×	1.36	x	119.01	x	0.63	x	0.7	] =	49.46	(77)
Southeast 0.9x	0.77	×	0.74	x	119.01	x	0.63	x	0.7	] =	26.91	(77)
Southeast 0.9x	0.77	x	3.63	x	118.15	x	0.63	x	0.7	] =	131.07	(77)
Southeast 0.9x	0.77	x	1.36	x	118.15	x	0.63	x	0.7	] =	49.11	(77)
Southeast 0.9x	0.77	x	0.74	x	118.15	x	0.63	x	0.7	] =	26.72	(77)
Southeast 0.9x	0.77	x	3.63	x	113.91	x	0.63	x	0.7	] =	126.37	(77)
Southeast 0.9x	0.77	x	1.36	x	113.91	x	0.63	x	0.7	] =	47.34	(77)
Southeast 0.9x	0.77	x	0.74	x	113.91	x	0.63	x	0.7	] =	25.76	(77)
Southeast 0.9x	0.77	x	3.63	x	104.39	x	0.63	x	0.7	] =	115.81	(77)
Southeast 0.9x	0.77	x	1.36	x	104.39	x	0.63	x	0.7	] =	43.39	(77)
Southeast 0.9x	0.77	x	0.74	x	104.39	x	0.63	x	0.7	] =	23.61	(77)
Southeast 0.9x	0.77	x	3.63	x	92.85	x	0.63	x	0.7	] =	103.01	(77)
Southeast 0.9x	0.77	x	1.36	x	92.85	x	0.63	×	0.7	] =	38.59	(77)
Southeast 0.9x	0.77	x	0.74	x	92.85	x	0.63	x	0.7	] =	21	(77)
Southeast 0.9x	0.77	x	3.63	x	69.27	x	0.63	x	0.7	] =	76.84	(77)
Southeast 0.9x	0.77	x	1.36	x	69.27	x	0.63	x	0.7	=	28.79	(77)
Southeast 0.9x	0.77	x	0.74	x	69.27	x	0.63	x	0.7	] =	15.67	(77)
Southeast 0.9x	0.77	x	3.63	x	44.07	x	0.63	x	0.7	=	48.89	(77)
Southeast 0.9x	0.77	x	1.36	x	44.07	x	0.63	x	0.7	=	18.32	(77)
Southeast 0.9x	0.77	x	0.74	x	44.07	<b>x</b>	0.63	x	0.7	] =	9.97	(77)
Southeast 0.9x	0.77	x	3.63	x	31.49	x	0.63	x	0.7	=	34.93	(77)
Southeast 0.9x	0.77	x	1.36	x	31.49	x	0.63	x	0.7	=	13.09	(77)
Southeast 0.9x	0.77	x	0.74	x	31.49	x	0.63	x	0.7	] =	7.12	(77)
Northwest 0.9x	0.77	x	7.25	x	11.28	x	0.63	x	0.7	=	25	(81)
Northwest 0.9x	0.77	x	1.65	x	11.28	x	0.63	x	0.7	=	5.69	(81)
Northwest 0.9x	0.77	x	7.25	x	22.97	x	0.63	x	0.7	=	50.89	(81)
Northwest 0.9x	0.77	x	1.65	x	22.97	x	0.63	x	0.7	=	11.58	(81)
Northwest 0.9x	0.77	x	7.25	x	41.38	x	0.63	×	0.7	] =	91.68	(81)
Northwest 0.9x	0.77	x	1.65	x	41.38	x	0.63	x	0.7	] =	20.87	(81)
Northwest 0.9x	0.77	x	7.25	x	67.96	x	0.63	x	0.7	=	150.57	(81)
Northwest 0.9x	0.77	x	1.65	x	67.96	x	0.63	x	0.7	=	34.27	(81)
Northwest 0.9x	0.77	x	7.25	×	91.35	x	0.63	×	0.7	] =	202.39	(81)
Northwest 0.9x	0.77	x	1.65	×	91.35	x	0.63	×	0.7	] =	46.06	(81)
Northwest 0.9x	0.77	x	7.25	x	97.38	x	0.63	×	0.7	] =	215.77	(81)
Northwest 0.9x	0.77	x	1.65	×	97.38	x	0.63	×	0.7	] =	49.11	(81)
Northwest 0.9x	0.77	x	7.25	x	91.1	x	0.63	x	0.7	] =	201.85	(81)

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Northwest 0.9x	0.77	x	1.65	x	91.1	x	0.63	x	0.7	] =	45.94	(81)
Northwest 0.9x	0.77	x	7.25	x	72.63	×	0.63	×	0.7	1 =	160.92	- (81)
Northwest 0.9x	0.77	x	1.65	x	72.63	×	0.63	×	0.7	] =	36.62	(81)
Northwest 0.9x	0.77	x	7.25	x	50.42	×	0.63	×	0.7	] =	111.72	(81)
Northwest 0.9x	0.77	x	1.65	x	50.42	×	0.63	×	0.7	] =	25.43	(81)
Northwest 0.9x	0.77	x	7.25	x	28.07	x	0.63	x	0.7	] =	62.19	(81)
Northwest 0.9x	0.77	x	1.65	x	28.07	x	0.63	x	0.7	=	14.15	(81)
Northwest 0.9x	0.77	x	7.25	x	14.2	x	0.63	x	0.7	] =	31.46	(81)
Northwest 0.9x	0.77	x	1.65	x	14.2	x	0.63	x	0.7	=	7.16	(81)
Northwest 0.9x	0.77	x	7.25	x	9.21	x	0.63	×	0.7	=	20.42	(81)
Northwest 0.9x	0.77	x	1.65	x	9.21	x	0.63	x	0.7	=	4.65	(81)
Rooflights 0.9x	1	x	0.76	x	20.97	x	0.63	×	0.7	=	6.32	(82)
Rooflights 0.9x	1	x	0.76	x	20.97	x	0.63	x	0.7	] =	6.32	(82)
Rooflights 0.9x	1	x	0.76	x	20.97	x	0.63	x	0.7	=	6.32	(82)
Rooflights 0.9x	1	x	0.76	x	44.3	x	0.63	x	0.7	=	13.36	(82)
Rooflights 0.9x	1	x	0.76	x	44.3	x	0.63	x	0.7	] =	13.36	(82)
Rooflights 0.9x	1	x	0.76	x	44.3	x	0.63	x	0.7	] =	13.36	(82)
Rooflights 0.9x	1	x	0.76	x	82.04	x	0.63	x	0.7	] =	24.73	(82)
Rooflights 0.9x	1	x	0.76	x	82.04	x	0.63	x	0.7	] =	24.73	(82)
Rooflights 0.9x	1	x	0.76	x	82.04	x	0.63	x	0.7	] =	24.73	(82)
Rooflights 0.9x	1	x	0.76	x	135.32	×	0.63	×	0.7	] =	40.8	(82)
Rooflights 0.9x	1	x	0.76	x	135.32	x	0.63	x	0.7	] =	40.8	_ (82)
Rooflights 0.9x	1	x	0.76	x	135.32	×	0.63	×	0.7	] =	40.8	(82)
Rooflights 0.9x	1	x	0.76	x	180.7	x	0.63	x	0.7	=	54.48	(82)
Rooflights 0.9x	1	x	0.76	x	180.7	x	0.63	x	0.7	] =	54.48	(82)
Rooflights 0.9x	1	x	0.76	x	180.7	x	0.63	x	0.7	=	54.48	(82)
Rooflights 0.9x	1	x	0.76	x	191.77	x	0.63	x	0.7	] =	57.81	(82)
Rooflights 0.9x	1	x	0.76	x	191.77	x	0.63	x	0.7	] =	57.81	(82)
Rooflights 0.9x	1	x	0.76	x	191.77	x	0.63	x	0.7	] =	57.81	(82)
Rooflights 0.9x	1	x	0.76	x	179.76	x	0.63	x	0.7	] =	54.2	(82)
Rooflights 0.9x	1	x	0.76	x	179.76	x	0.63	x	0.7	] =	54.2	(82)
Rooflights 0.9x	1	x	0.76	x	179.76	x	0.63	x	0.7	=	54.2	(82)
Rooflights 0.9x	1	x	0.76	x	144.31	x	0.63	x	0.7	=	43.51	(82)
Rooflights 0.9x	1	x	0.76	x	144.31	×	0.63	×	0.7	] =	43.51	(82)
Rooflights 0.9x	1	x	0.76	x	144.31	x	0.63	x	0.7	] =	43.51	(82)
Rooflights 0.9x	1	x	0.76	x	100.39	x	0.63	x	0.7	] =	30.27	(82)
Rooflights 0.9x	1	x	0.76	×	100.39	×	0.63	×	0.7	] =	30.27	(82)
Rooflights 0.9x	1	x	0.76	x	100.39	×	0.63	×	0.7	] =	30.27	(82)
Rooflights 0.9x	1	x	0.76	x	54.87	x	0.63	×	0.7	=	16.54	(82)
Rooflights 0.9x	1	x	0.76	x	54.87	x	0.63	x	0.7	] =	16.54	(82)
Rooflights 0.9x	1	x	0.76	×	54.87	×	0.63	×	0.7	] =	16.54	(82)

Rooflig	hts 0.9x	1	:	x [	0.7	6	x	2	26.72	x		0.63	×	0.7	=	8.05	(82)
Rooflig	hts <mark>0.9x</mark>	1		× [	0.7	6	x	2	26.72	x		0.63	_ × [	0.7	=	8.05	(82)
Rooflig	hts <mark>0.9x</mark>	1		× [	0.7	6	x	2	26.72	x		0.63		0.7	=	8.05	(82)
Rooflig	hts 0.9x	1		× [	0.7	6	x		16.9	x		0.63	× [	0.7	=	5.09	(82)
Rooflig	hts 0.9x	1		×Ī	0.7	6	x	· ·	16.9	x		0.63		0.7	=	5.09	(82)
Rooflig	hts <mark>0.9x</mark>	1		× [	0.7	6	x	· ·	16.9	x		0.63	 	0.7	=	5.09	(82)
	-									-							
Solar g	gains in	watts, c	alculate	d	for each	n month	۱			(83)m	า = S	um(74)m .	(82)m				
(83)m=	116.9	218	347.2		510.19	643	6	69.44	632.5	528	.92	403.07	254.25	143.48	97.78		(83)
Total g	jains – i	nternal a	and sola	ar (	(84)m =	: (73)m	+ (	83)m	, watts					-			
(84)m=	538.16	637.21	752.92		894.11	1004.77	10	009.84	959.01	861	.37	746.7	619.88	534.42	507.72		(84)
7. Me	an inter	nal temp	perature	e (I	heating	seaso	n)										
Temp	erature	during h	neating	ре	eriods ir	the liv	ing	area	from Tab	ble 9	, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains fo	' liv	ving are	a, h1,n	n (s	ee Ta	ble 9a)								
	Jan	Feb	Mar		Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98		0.93	0.8		0.6	0.45	0.5	52	0.79	0.96	0.99	1		(86)
Mean	interna	l temper	ature ir	ווי ווי	ving are	ea T1 (1	follo	w ste	ps 3 to 7	7 in T	abl	e 9c)					
(87)m=	19.66	19.84	20.15	Т	20.55	20.84	2	20.97	20.99	20.	99	20.88	20.48	20	19.63		(87)
Tomr		durina k	L Deating		riode in	rest of	f du	Alling	i from Ta		ат	ከ2 (°C)				I	
(88)m=	19.86	19.86	19.87	T	19.88	19.88		9.89	19.89	19	89	19.88	19.88	19.87	19.87	]	(88)
(00)								,						10.01			()
Utilisa	ation fac	tor for g	ains foi	r re	est of d	velling,	h2 T	,m (se	e lable	9a)	4	0.74	0.05			1	(20)
(69)11=		0.99	0.97		0.9	0.74		0.51	0.34	0.	4	0.71	0.95	0.99	I		(09)
Mean	interna	l temper	ature ir	n th	ne rest	of dwel	ling	T2 (f	ollow ste	eps 3	to T	7 in Tabl	e 9c)			1	
(90)m=	18.09	18.36	18.8		19.36	19.73	1	9.87	19.89	19.	88	19.8	19.29	18.59	18.05		(90)
												1	'LA = Liv	ing area ÷ (·	4) =	0.14	(91)
Mean	interna	l temper	ature (f	or	the wh	ole dwe	ellin	g) = fl	LA × T1	+ (1	– fL	A) × T2	-				
(92)m=	18.3	18.56	18.99		19.53	19.88	2	20.02	20.04	20.	03	19.95	19.45	18.78	18.26		(92)
Apply	v adjustr	nent to t	he mea	in i	internal	tempe	ratu	ire fro	m Table	e 4e,	whe	ere appro	opriate			1	
(93)m=	18.3	18.56	18.99		19.53	19.88	2	20.02	20.04	20.	03	19.95	19.45	18.78	18.26		(93)
8. Sp	ace hea	iting req	uiremer	nt				_						<i>i</i> `			
Set T	i to the tilisation	mean int	ternal te	em	iperatur sing Ta	e obtai	nec	l at ste	ep 11 of	Tab	le 9	o, so tha	t Ti,m=	(76)m an	d re-calo	culate	
	Jan	Feb	Mar	T	Anr	Mav	Т	Jun	.lul	Δ	ua	Sen	Oct	Nov	Dec		
Utilisa	ation fac	tor for a	ains. hi	 m:	7.01	iviay		ourr	Uui		ug			1101	000	l	
(94)m=	0.99	0.99	0.96	Τ	0.89	0.74		0.52	0.36	0.4	12	0.71	0.94	0.99	0.99		(94)
Usefu	ul gains,	hmGm	, W = (9	94)	)m x (84	1)m										1	
(95)m=	534.6	628.09	724.97	T	796.36	738.88		528	341.79	359	9.2	532.73	580.94	527.26	505.1		(95)
Month	hly aver	age exte	ernal tei	mp	erature	from T	abl	e 8	·	·		·	•	·			
(96)m=	4.3	4.9	6.5		8.9	11.7		14.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an intei	'na	al tempe	erature,	Lm	1, W =	=[(39)m	x [(9	3)m	– (96)m	]			1	
(97)m=	1438.1	1399.6	1276.6	3	1074.72	825.98	5	41.56	343.51	362	.72	586.55	893.65	1184.18	1431.45		(97)
Space	e heatin	g requir	ement f	or	each m	nonth, k	Wh	/mon	th = 0.02	24 x	[(97]	)m – (95 I	)m] x (4	41)m	1	1	
(98)m=	672.21	518.46	410.46		200.42	64.81		0	0		)	0	232.65	472.98	689.2		

								Tota	l per year	(kWh/yea	r) = Sum(9	8)15,912 =	3261.18	(98)
Spac	e heatin	ng require	ement in	kWh/m²	²/year								40.48	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heati	ng:			, .									
Fract	ion of sp	bace hea	at from s	econdar	y/supple	mentary	' system	(202) 1	(201)				0	(201)
Fract	ion of sp	bace hea	at from m	nain syst	em(s)			(202) = 1 -	-(201) =	(202)]			1	(202)
Fract		otal neati	ng from	main sys				(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
ETTICI	ency of	main spa	ace neat	ing syste	em 1		- 0/						93.5	(206)
EIIICI	ency of	seconda	ry/suppi	ementar I	y neating	g systen I	1, % I				1		0	(208)
Snac	Jan	Feb	Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Spac	672.21	518.46	410.46	200.42	64.81	0	0	0	0	232.65	472.98	689.2		
(211)n	L n = {[(98	1 3)m x (20	I  4)]}x1	$1_{00} \div (20)$	L )6)		1							(211)
()	718.94	554.5	438.99	214.35	69.31	0	0	0	0	248.83	505.86	737.11		()
		I						Tota	l (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	=	3487.9	(211)
Spac	e heatin	ng fuel (s	econdar	y), kWh/	month							I		-
= {[(98	5)m x (20	01)]}x1	00 ÷ (20	)8)		-	-			<u> </u>		-	I	
(215)m=	0	0	0	0	0	0	0	0 Tota		0	0	0		7(215)
Wator	hostin	a						Tota			- 10) <sub>15,1012</sub>	2	0	(213)
Output	t from w	<b>y</b> vater hea	ter (calc	ulated al	bove)									
	198.22	174.7	183.44	164.39	161.07	143.87	138.13	151.63	151.38	170.47	180.31	193.43		_
Efficie	ncy of w	ater hea	iter				1						79.8	(216)
(217)m=	87.82	87.54	86.9	85.34	82.6	79.8	79.8	79.8	79.8	85.64	87.27	87.92		(217)
Fuel fo	or water	heating, m x 100	kWh/mo (217) ∸ (217)	onth Im										
(219)m=	225.71	199.56	211.09	192.63	194.99	180.29	173.1	190.02	189.71	199.04	206.61	220.02		
		-	-			-		Tota	l = Sum(2	19a) <sub>112</sub> =			2382.76	(219)
Annua	al totals	; (								k	Wh/year	•	kWh/year	7
Space	neating	j tuel use	ed, main	system	1								3487.9	
Water	heating	fuel use	d										2382.76	
Electri	city for p	oumps, fa	ans and	electric	keep-ho	t								
centra	al heatir	ng pump	:									30		(230c)
boile	with a	fan-assis	sted flue									45		(230e)
Total e	electricit	y for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
Electri	city for I	ighting											347.36	(232)
Total o	delivered	d energy	for all u	ses (211	)(221)	+ (231)	+ (232).	(237b)	=				6293.02	(338)
12a.	CO2 en	nissions -	– Individ	ual heat	ing syste	ems inclu	udina mi	cro-CHF						
						_				<b>F</b>			Emili i	
						<b>En</b> kW	l <b>ergy</b> /h/year			kg CO	2/kWh	τοΓ	Emissions kg CO2/yea	ar

Space heating (main system 1)	(211) x	0.216	=	753.39	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	514.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1268.06	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	180.28	(268)
Total CO2, kg/year	sum	of (265)(271) =		1487.27	(272)

TER =

27.12 (273)

						User	Details:						
Assessor Name Software Name	Ð: :	Natalie Stroma	e Whe a FSA	eeler \P 201	2		Strom Softwa	a Num are Vei	ber: rsion:		STRO Versio	034641 n: 1.0.5.59	
					Р	roperty	/ Address	: Havelo	ck Road	I - No P∖	/		
Address :		10a Ha	aveloc	k Road	, Cowle	y , Oxf	ord, OX4	3EP					
1. Overall dwelling	l dimen	sions:				_	<i>(</i> )						
Cround floor						Ar	ea(m <sup>2</sup> )		Av. He	ight(m)		Volume(m <sup>3</sup> )	
Ground noor							45.92	(1a) x	2	2.3	(2a) =	105.62	(3a)
First floor							34.65	(1b) x	2	.56	(2b) =	88.7	(3b)
Total floor area TFA	A = (1a)	)+(1b)+(	1c)+(′	1d)+(1e	e)+(1r	n)	80.57	(4)					
Dwelling volume								(3a)+(3b)	)+(3c)+(3d	l)+(3e)+	.(3n) =	194.32	(5)
2. Ventilation rate:											-		_
		mai	in tina	S	econdar	у	other		total			m <sup>3</sup> per hour	,
Number of chimney	'S		0	] + [ <sup>.</sup>	0	+	0	] = [	0	x 4	40 =	0	(6a)
Number of open flu	es		0	] + [	0		0	 ] = [	0	x 2	20 =	0	 ](6b)
Number of intermitt	ent fans	s L	-			_] L			0	x ^	10 =	0	_`´´ ](7a)
Number of passive	vents								0	x ^	10 =	0	_`´´ ](7b)
Number of flueless	gas fire	es							0	x 4	40 =	0	_`´´ ](7c)
	<b>J</b>							L				0	
											Air ch	anges per ho	ur
Infiltration due to ch	imneys	s, flues a	and fa	ns = (6	a)+(6b)+(7	a)+(7b)-	+(7c) =	Г	0	<u> </u>	÷ (5) =	0	(8)
If a pressurisation tes	t has bee	en carried	outor	is intende	ed, procee	d to (17)	, otherwise	continue fr	rom (9) to (	(16)			
Number of storey	rs in the	e dwellin	ng (ns)	)								0	(9)
Additional infiltrat	ion									[(9)-	1]x0.1 =	0	(10)
Structural infiltrat	ion: 0.2	25 for ste	eel or	timber	frame or	0.35 f	or mason	ry constr	ruction			0	(11)
if both types of wa	ll are pre: Conening	sent, use t (s): if equa	the valu	ue corres	ponding to	the gre	ater wall are	a (after					
If suspended woo	oden flo	or, ente	er 0.2	(unseal	ed) or 0.	1 (sea	led), else	enter 0				0	(12)
If no draught lobb	oy, ente	er 0.05, e	else e	nter 0								0	(13)
Percentage of wi	ndows	and doo	ors dra	aught st	ripped							0	(14)
Window infiltratio	n						0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)
Infiltration rate							(8) + (10)	+ (11) + (1	12) + (13) -	+ (15) =		0	(16)
Air permeability v	alue, q	50, expr	ressed	d in cub	oic metre	s per h	nour per s	quare m	etre of e	nvelope	area	3	(17)
If based on air pern	neability	y value,	then	(18) = [(1	7) ÷ 20]+(8	3), other	wise (18) =	(16)				0.15	(18)
Air permeability value	e applies	if a pressu	urisatio	n test has	s been dor	e or a d	egree air pe	ermeability	is being u	sed			-
Number of sides sh	eltered						(20) – 1	[0 075 x (1	10)1			2	(19)
Sheller lactor			ar fa at	~ "			$(20) = 1^{-1}$	$(0.070 \times (10))$	[3]] –			0.85	_(20)
	iporatin				ı		(21) = (18	y x (20) =				0.13	_(21)
			y wind	a speed	1	1, -1	۸	0.07	0-+	Nett	Det		
Jan Fe	Μια	har A	4pr	iviay	Jun	Jui	Aug	Sep	UCt	INOV	Dec		
Monthly average wi	nd spe	ed from	Table	97	-			1				l	
(22)m= 5.1 5	4	.9 4	1.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

#### Wind Factor (22a)m = (22)m $\div$ 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 rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	: (21a) x	(22a)m					
	0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calcula	ate effec	ctive air i	change i tion:	rate for t	he appli	cable ca	se		-	-	-	 Г		
If ever	oust air he		uon. Ising Ann	andix N (2	3h) - (23a	) v Emv (e	auation (I	N5)) other	rwise (23h	(23a)		l	0.5	(23a)
If bala	inced with	heat reco	werv: effic	iency in %	allowing f	or in-use f	actor (fron	n Tahle 4h	) –	<i>(</i> 200)		ľ	0.5	(230)
a) If	halanco	d mech	anical ve	ntilation	with bo	at recover	any (M)/l		$^{-}$	2h)m ⊥ (	23b) v [	[ 1 _ (23c)	· 1001	(230)
(24a)m=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	1 - (230)	÷ 100]	(24a)
h) If	halance	d mech:	anical ve		without	heat rec		(24h)	$1 = \frac{1}{2}$	$\frac{1}{2}$ () m + ()	23b)	0.20		
(24b)m=	0			0	0						0	0		(24b)
c) If y	whole h		tract ver	tilation o	or positiv	e input v	ventilatio	n from c	L nutside					
i i	f (22b)m	$1 < 0.5 \times 10^{-1}$	: (23b), t	hen (240	c) = (23b	); otherv	vise (24	c) = (22t	m + 0.	.5 × (23b	<b>)</b> )			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	e input	ventilatio	on from l	oft	<b>!</b>	<b>!</b>			
i	f (22b)m	n = 1, the	en (24d)	m = (22k	o)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	ctive air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	ld) in boy	(25)					
(25)m=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(25)
3. Hea	at losses	s and he	at loss p	paramete	ər:									
ELEN	IENT	Gros area	ss (m²)	Openin m	gs 1²	Net Ar A ,r	ea n²	U-valı W/m2	ue K	A X U (W/I	K)	k-value kJ/m²·k	e / K ł	λXk ⟨J/Κ
ELEN Doors	IENT	Gros area	ss (m²)	Openin m	gs I <sup>2</sup>	Net Ar A ,r 2.07	ea n² X	U-valı W/m2	ue :K =	A X U (W/ 2.07	K)	k-value kJ/m²⋅k	9 / K	A X k (J/K (26)
<b>ELEN</b> Doors Windov	<b>IENT</b> ws Type	Gros area	88 (m²)	Openin m	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 3.68	ea m² x x	U-valı W/m2 [1 /[1/( 1.2 )+	ue :K = 0.04] =	A X U (W/ 2.07 4.21	K)	k-value kJ/m²·k	9 / K	A X k kJ/K (26) (27)
ELEN Doors Windov Windov	<b>IENT</b> ws Type ws Type	Gros area 1 2	88 (m²)	Openin m	gs ²	Net Ar A ,r 2.07 3.68 7.35	ea n <sup>2</sup> x x x <sup>1</sup> x <sup>1</sup>	U-valu W/m2	ue K 0.04] = 0.04] =	A X U (W/ 2.07 4.21 8.42	K)	k-value kJ/m²-k	• / <	A X k (26) (27) (27)
ELEN Doors Windov Windov Windov	<b>IENT</b> ws Type ws Type ws Type	Gros area 1 2 3	ss (m²)	Openin m	gs ,²	Net Ar A ,r 2.07 3.68 7.35 0.59	ea n <sup>2</sup> x x <sup>1</sup> x <sup>1</sup> x <sup>1</sup>	U-valu W/m2 [	ue K 0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68	к)	k-value kJ/m²·k	9 / K	A X k (26) (27) (27) (27)
ELEN Doors Windov Windov Windov Windov	IENT ws Type ws Type ws Type ws Type	Gros area 1 2 3 4	ss (m²)	Openin m	gs ²	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38	ea n <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-valu W/m2 [1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	ue K 0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68 1.58	к)	k-value kJ/m²·k	9 / K	A X k (26) (27) (27) (27) (27) (27)
ELEN Doors Windov Windov Windov Windov	IENT ws Type ws Type ws Type ws Type ws Type	Gros area 1 2 3 4 4 5	ss (m²)	Openin m	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75	ea n <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1	U-valu W/m2 [	ue K 0.04] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86	к)	k-value kJ/m²·k	• / <	A X k (26) (27) (27) (27) (27) (27) (27)
ELEN Doors Windov Windov Windov Windov Windov	IENT ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 1 2 3 4 4 5 6	ss (m²)	Openin m	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67	ea n <sup>2</sup> × x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-valu W/m2 [	Le K 0.04] =   0.04] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91	к)	k-value kJ/m²·k	• / <	A X k (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Windov	IENT ws Type ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 1 2 3 4 5 6 5 7	ss (m²)	Openin m	gs ²	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.59	ea n <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-valu W/m2 [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] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68	K)	k-value kJ/m²·k	9 / K	A X k (J/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Windov Rooflig	IENT ws Type ws Type ws Type ws Type ws Type ws Type hts Type	Gros area 1 2 3 4 5 5 6 7 e 1	ss (m²)	Openin m	gs ²	Net Ar A,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.59 0.77	ea n <sup>2</sup> x1 x1 x1 x1 x1 x1 x1 x	U-valu W/m2 [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 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924	к)	k-value kJ/m²·k	9 / (	A X k (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig	IENT ws Type ws Type ws Type ws Type ws Type ws Type hts Type hts Type	Gros area 1 2 3 4 5 6 7 e 1 e 2	ss (m²)	Openin	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.59 0.77	ea m <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-valu W/m2 1 /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/(1.2 )+	Le K 0.04] =   0.04] =	A X U (W/I 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924	к)	k-value kJ/m²·k	9 / (	A X k (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area 4 5 6 7 e 1 e 2 e 3	ss (m²)	Openin	gs ,2	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77	ea n <sup>2</sup> X x <sup>1</sup> X	U-valu 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 )+ /[1/(1.2 )+	Le K 0.04] =   0.04] =	A X U (W/I 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924	K)	k-value kJ/m²·k	• / <	A X k (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Floor	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area 4 5 6 7 e 1 e 2 e 3	ss (m²)	Openin	gs ²	Net Ar A,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 45.92	ea n <sup>2</sup> x <sup>1</sup> x <sup>1</sup>	U-value W/m2 1 /[1/(1.2)+	Le K = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	A X U (W/I 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 5.0512	K)	k-value kJ/m²·k		A X k (J/K (26) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b)
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Floor Walls	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area 4 5 6 7 e 1 e 2 e 3 97 7	ss (m²)	Openin m	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 45.92 79.71	ea m <sup>2</sup> X X X X X X X X X X X X X X X X X X X	U-value W/m2 1 (1/(1.2)+) (1/(1.2)+	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 0.04] = 1 0 0 0 0 0 0 0 0 0 0 0 0 0	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 0.924	к)	k-value kJ/m²·k		A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b)
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Floor Walls Roof T	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area 4 5 6 7 e 1 e 2 e 3 97.7 9.6	ss (m²)	Openin m	gs <sup>2</sup>	Net Ar A,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 45.92 79.71	ea m <sup>2</sup> X X X X X X X X X X X X X X X X X X X	U-valu 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)+ (1/(1.2)+ (1/(1.2)+ (1/(1.2)+ (0.11) 0.16 0.11	Le K 0.04] =   0.04]	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 5.0512 12.75 0.81	K)     I     I     I     I	k-value kJ/m²·k		A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Floor Walls Roof T Roof T	IENT ws Type ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area $a^{2}$ $a^{2}$ $a^{3}$ $a^{4}$ $a^{5}$ $a^{6}$ $a^{7}$ $a^{6}$ $a^{7}$ $a^{6}$ $a^{7}$ $a^{6}$ $a^{7}$ $a^$	9 9 5	Openin m 18.08 2.31	gs <sup>2</sup>	Net Ar A,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 0.77 45.92 79.71 7.35 34.65	ea m <sup>2</sup> X X X X X X X X X X X X X X X X X X X	U-value 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)+ /[1/(1.2)+ (1/(1.2)+ (1/(1.2)+ (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 0 0.04] = 1 0 0.04] = 1 0 0 0 0 0 0 0 0 0 0 0 0 0	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 0.924 0.924 12.75 0.81 3.81	<pre>k)</pre>	k-value kJ/m²-k		A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (
ELEN Doors Windov Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Roof T Roof T Roof T	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type fype1 -ype2	Gross area a 1 a 2 a 3 a 4 a 5 a 6 a 7 e 1 e 2 e 3 97.7 9.66 34.6	ss (m <sup>2</sup> )	Openin m 18.00 2.31 0	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.75 0.77 0.77 0.77 0.77 45.92 79.71 7.35 34.65	ea m <sup>2</sup> X X X X X X X X X X X X X X X X X X X	U-value 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)+ (1/(	Le K 0.04] =   0.04]	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 5.0512 12.75 0.81 3.81 0.09	<pre>k)</pre>	k-value kJ/m²-k		A X k (J/K (26) (27) (27) (27) (27) (27) (27) (27b)(27b) (27
ELEN Doors Windov Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Roof T Roof T Roof T Roof T	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type fype1 -ype2 -ype3 rea of e	Gross area a 1 a 2 a 3 a 4 a 5 a 6 a 7 a 6 a 7 a 6 a 7 a 6 a 7 a 6 a 7 a 6 a 7 a 97.7 9.66 34.6 0.8 lements	9 5 5 , m <sup>2</sup>	Openin m 18.08 2.31 0 0	gs ,2 3 	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 0.77 0.77 7.35 34.65 0.8	ea $n^2$ $x1$ <t< td=""><td>U-value W/m2 1 (1/(1.2)+)</td><td>Le K 0.04] =   0.04] =   0.04]</td><td>A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 0.924 5.0512 12.75 0.81 3.81 0.09</td><td>K)</td><td>k-value kJ/m²-k</td><td></td><td>A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (</td></t<>	U-value W/m2 1 (1/(1.2)+)	Le K 0.04] =   0.04]	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 0.924 5.0512 12.75 0.81 3.81 0.09	K)	k-value kJ/m²-k		A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (

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* for windows ** include the	and roof wind areas on both	lows, use e n sides of ir	effective wi nternal wal	indow U-va Is and pari	alue calcul titions	lated using	formula 1,	/[(1/U-valu	e)+0.04] a	ns given in	paragraph	3.2			
Fabric heat	loss, W/K	= S (A x	U)				(26)(30)	+ (32) =				45.56	(33)		
Heat capac	ity Cm = S	(A x k )						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)		
Thermal ma	ass parame	eter (TMF		: TFA) ir	n kJ/m²K			= (34)	÷ (4) =			0	(35)		
For design as can be used ii	sessments wh nstead of a de	nere the de stailed calc	tails of the ulation.	construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f				
Thermal bri	idges : S (L	. x Y) cal	culated	using Ap	pendix l	K						15.92	(36)		
if details of the	ermal bridging	are not kn	10wn (36) =	= 0.05 x (3	1)										
Total fabric	heat loss							(33) +	(36) =			61.47	(37)		
Ventilation	heat loss c	alculated	d monthly	y				(38)m	= 0.33 × (	25)m x (5)					
Ja															
(38)m= 17.4	16.6		(38)												
Heat transf	er coefficie	nt, W/K						(39)m	= (37) + (3	38)m					
(39)m= 78.8		_													
11	12 /12=	77.41	(39)												
Heat loss p	arameter (	HLP), W/	/m²K		0.05	0.05		(40)m	= (39)m ÷	(4)	0.07				
(40)m= 0.9	0.97	0.00													
Number of	days in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1.	12 /12=	0.96	(40)		
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
(41)m= 3 <sup>-</sup>	1 28	31	30	31	30	31	31	30	31	30	31		(41)		
				•	•										
	41)m= 31 28 31 30 31 30 31 31 30 31 30 31 30 31														
4. Water h	eating ene	rav reau	irement:								kWh/ve	ear:			
4. Water h	4. Water heating energy requirement:       kWh/year         Assumed occupancy, N       2.47														
4. Water h Assumed o if TFA >	eating ene ccupancy, 13.9, N = 1	rgy requ N + 1.76 x	irement: : [1 - exp	(-0.0003	349 x (TF	-13.9	)2)] + 0.0	)013 x ( <sup>-</sup>	ГFA -13.	<u>2.</u> 9)	kWh/ye 47	ear:	(42)		
4. Water h Assumed o if TFA 5 if TFA £	eating ene ccupancy, 13.9, N = 1 13.9, N = 1 rage bot w	rgy requ N + 1.76 x	irement: x [1 - exp	(-0.0003	349 x (TF	<sup>-</sup> A -13.9	)2)] + 0.( (25 x N)	)013 x ( <sup>-</sup> + 36	ΓFA -13.	<u>2.</u> 9)	kWh/ye	ear:	(42)		
4. Water h Assumed o if TFA > if TFA £ Annual ave Reduce the au	eating energy ccupancy, 13.9, $N = 1$ 13.9, $N = 1$ rage hot w mual average 125 litres per	rgy requ N + 1.76 x ater usag hot water	irement: [1 - exp ge in litre usage by r day (all w	(-0.0003 es per da 5% if the o	349 x (TF ay Vd,av Iwelling is	FA -13.9 erage = designed i	)2)] + 0.0 (25 x N) to achieve	0013 x ( <sup>-</sup> + 36 a water us	ΓFA -13. se target o	9) 2. 9)	kWh/ye 47 .95	ear:	(42) (43)		
4. Water h Assumed o if TFA > if TFA £ Annual ave Reduce the ai not more that	ccupancy, 13.9, N = 1 13.9, N = 1 rage hot w nual average 125 litres per	rgy requ N + 1.76 x ater usag hot water person per	irement: [1 - exp ge in litre usage by r day (all w	(-0.0003 es per da 5% if the d vater use, l	849 x (TF ay Vd,av Iwelling is hot and co	FA -13.9 erage = designed i ld)	)2)] + 0.0 (25 x N) to achieve	0013 x ( <sup>-</sup> + 36 a water us	IFA -13. se target o	9) 9)	kWh/ye 47 .95	ear:	(42) (43)		
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the al not more that	ccupancy, 13.9, N = 1 13.9, N = 1 rage hot w nnual average 125 litres per n Feb ge in litres pe	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea	irement: [1 - exp ge in litre usage by r day (all w Apr ach month	(-0.0003 es per da 5% if the d vater use, l May Vd.m = fa	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 2	FA -13.9 erage = designed i Id) Jul Table 1c x	)2)] + 0.0 (25 x N) to achieve Aug (43)	)013 x ( <sup>-</sup> + 36 <sup>a water us</sup> Sep	ΓFA -13. se target o Oct	2. 9) 1 Nov	kWh/ye 47 .95 Dec	ear:	(42) (43)		
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the ar not more that	ccupancy, 13.9, N = 1 13.9, N = 1 rage hot w nnual average 125 litres per n Feb ge in litres pe	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea	irement: [1 - exp ge in litre usage by f r day (all w Apr ach month	o(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa	849 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1	FA -13.9 erage = designed i Id) Jul Table 1c x	)2)] + 0.0 (25 x N) to achieve Aug (43)	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep	FFA -13. se target o Oct	9) 9) Nov	KWh/ye 47 .95 Dec	ear:	(42) (43)		
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the au not more that Ja Hot water usa (44)m= 102.	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09	(-0.0003 es per da 5% if the o vater use, l May Vd,m = fa 87.37	349 x (TF ay Vd,av <i>twelling is</i> <i>hot and co</i> Jun <i>ctor from T</i> 83.65	FA -13.9 erage = designed i Id) Jul Table 1c x 83.65	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep 91.09	FFA -13. se target o Oct 94.81	9) 9) Nov 98.52	kWh/ye 47 .95 Dec 102.24	ear:	(42) (43)		
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the ai not more that Ua Hot water usa (44)m= 102.	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres pe2498.52nt of hot watel	rgy requ N + 1.76 x ater usage hot water person per Mar r day for ea 94.81	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09	(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa 87.37	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r	FA -13.9 erage = designed i ld) Jul Table 1c x 83.65	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep 91.09	FFA -13. se target o Oct 94.81 Total = Su oth (see Ta	9) 9) Nov 98.52 m(44)112 = ables 1b, 1	kWh/ye 47 .95 Dec 102.24 c, 1d)	ear:	(42) (43)		
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the air not more that Ua Hot water usa (44)m= 102 Energy conter (45)m= 151.	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52nt of hot water62132.61	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81	irement: [1 - exp ge in litre usage by i r day (all w Apr ach month 91.09	o(-0.0003 5% if the a ster use, I May Vd,m = fa 87.37 onthly = 4.	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78	FA -13.9 erage = designed i Id) Table 1c x 83.65 m x nm x E 91.54	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep 91.09 	TFA -13. se target o Oct 94.81 Total = Su th (see Ta 123.87	2. 9) 92 Nov 98.52 m(44)112 ables 1b, 1 135.22	kWh/ye 47 .95 Dec 102.24 c, 1d) 146.84	ear:	(42) (43)		
4. Water h Assumed o if TFA > 1 if TFA £ Annual ave Reduce the ar not more that U Ja Hot water usa (44)m= 102 Energy conter (45)m= 151.	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres pe2498.52at of hot water62132.61us water heat	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no	(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78	FA -13.9 erage = designed i ld) Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46)	0013 x ( + 36 a water us Sep 91.09 	FFA -13. se target o Oct 94.81 Fotal = Su 123.87 Total = Su	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = m(45) <sub>112</sub> =	kWh/ye 47 .95 Dec 102.24 <i>c, 1d)</i> 146.84	ear: 1115.37 1462.43	(42) (43) (44) (45)		
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; if TFA £</li> <li>Annual ave Reduce the air not more that</li> <li>Hot water usa</li> <li>(44)m= 102.</li> <li>If instantaneou</li> <li>(46)m= 22.</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52nt of hot water62132.61us water heat7419.89	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81 - used - cal 136.84 ing at point 20.53	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9	(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage), 14.82	FA -13.9 erage = designed i ld) Jul Table 1c x 83.65 m x nm x E 91.54 enter 0 in 13.73	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76	0013 x ( + 36 a water us Sep 91.09 91.09 0 kWh/mor 106.29 	<ul> <li>IFA -13.</li> <li>se target o</li> <li>Oct</li> <li>94.81</li> <li>Fotal = Su</li> <li>123.87</li> <li>Fotal = Su</li> <li>18.58</li> </ul>	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1. 135.22 m(45) <sub>112</sub> = 20.28	kWh/ye 47 .95 Dec 102.24 <i>c, 1d)</i> 146.84 22.03	ear: 1115.37 1462.43	(42) (43) (44) (45) (46)		
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; if TFA £</li> <li>Annual averer Reduce the air not more that</li> <li>(44)m= 102</li> <li>Energy conterer</li> <li>(45)m= 151</li> <li>If instantaneous</li> <li>(46)m= 22</li> <li>Water store</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52nt of hot water62132.61us water heat7419.89age loss:	rgy requ N + 1.76 x ater usage betwater person per Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53	irement: [1 - exp ge in litre usage by or r day (all w Apr ach month 91.09 fculated mo 119.3 t of use (no 17.9	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17	A49 x (TF ay Vd,av <i>twelling is</i> <i>hot and co</i> Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage), 14.82	FA -13.9 erage = designed in ld) Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76	)013 x ( + 36 <i>a water us</i> Sep 91.09 <i>kWh/mor</i> 106.29 <i>to</i> (61) 15.94	<ul> <li>IFA -13.</li> <li>se target o</li> <li>Oct</li> <li>94.81</li> <li>Total = Su</li> <li>123.87</li> <li>Total = Su</li> <li>18.58</li> </ul>	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1. 135.22 m(45) <sub>112</sub> = 20.28	kWh/ye	ear: 1115.37 1462.43	(42) (43) (44) (44) (45) (46)		
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; if TFA £</li> <li>Annual ave Reduce the annot more that</li> <li>Hot water usa</li> <li>(44)m= 102</li> <li>Energy content</li> <li>(45)m= 151</li> <li>If instantaneous</li> <li>(46)m= 22</li> <li>Water stora</li> <li>Storage vol</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52at of hot water62132.61us water heat7419.89age loss:lume (litres	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81 used - cal 136.84 ing at point 20.53 ) includir	irement: [1 - exp ge in litre usage by a r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9 ng any so	(-0.0003) es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS	FA -13.9 erage = designed i di Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa	0013 x ( + 36 a water us Sep 91.09 91.09 0 kWh/mor 106.29 0 to (61) 15.94 ame vess	FFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 sel	2. 9) 92 Nov 98.52 m(44)112 135.22 m(45)112 20.28	kWh/ye 47 .95 Dec 102.24 c, 1d) 146.84 22.03	ear: 1115.37 1462.43	(42) (43) (44) (44) (45) (46) (47)		
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the ar not more that [Ja Hot water usa (44)m= 102. Energy conter (45)m= 151. If instantaneou (46)m= 22. Water stora Storage vol If communi	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per $24$ 98.52nt of hot water $62$ $132.61$ us water heat $74$ $19.89$ age loss:lume (litresty heating af no stored	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53 ) includir and no ta	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09 fculated mo 119.3 t of use (no 17.9 ng any so ank in dw	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e	A49 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS onter 110	FA -13.9 erage = designed iId) Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage ) litres in	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa (47)	0013 x ( + 36 a water us Sep 91.09 b kWh/mor 106.29 to (61) 15.94 ame vess	FFA - 13. se target o $Oct$ $94.81$ $Fotal = Su$ $123.87$ $Fotal = Su$ $18.58$ $sel$ $ar 'O' in '$	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1. 135.22 m(45) <sub>112</sub> = 20.28	kWh/ye 47 .95 Dec 102.24 <i>c</i> , 1 <i>d</i> ) 146.84 22.03	ear:	(42) (43) (44) (44) (45) (46) (47)		
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; if TFA £</li> <li>Annual ave Reduce the annot more that</li> <li>Ida Hot water usa</li> <li>(44)m= 102.</li> <li>Energy content</li> <li>(45)m= 151.</li> <li>If instantaneon</li> <li>(46)m= 22.</li> <li>Water stora</li> <li>Storage vol</li> <li>If communi</li> <li>Otherwise in</li> <li>Water stora</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52at of hot water62132.61us water heat7419.89age loss:lume (litresty heating af no storedage loss:	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53 ) includir and no ta hot wate	irement: [1 - exp ge in litre usage by 1 r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9 ng any so ank in dw er (this ir	(-0.0003) es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e ncludes i	349 x (TF ay Vd,av <i>lwelling is</i> <i>hot and co</i> Jun <i>ctor from</i> 83.65 190 x Vd,r 98.78 <i>r storage),</i> 14.82 /WHRS nter 110 nstantar	FA -13.9 erage = designed i ld) Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage litres in neous co	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa (47) ombi boile	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep 91.09 91.09 91.09 0 <i>kWh/mor</i> 106.29 0 <i>to</i> (61) 15.94 ame vess ame vess ers) ente	FFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 sel er '0' in (	2. 9) 92 Nov 98.52 m(44)112 135.22 m(45)112 20.28	kWh/ye	ear: 1115.37 1462.43	(42) (43) (44) (44) (45) (46) (47)		
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; 1 if TFA £</li> <li>Annual averer Reduce the air not more that</li> <li>(44)m= 102</li> <li>Energy conterer</li> <li>(45)m= 151</li> <li>If instantaneon</li> <li>(46)m= 22</li> <li>Water stora</li> <li>Storage vol</li> <li>If communition</li> <li>Otherwise in</li> <li>Water stora</li> <li>a) If manufation</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per $24$ 98.52at of hot water $62$ 132.61us water heat $74$ 19.89age loss:lume (litresty heating af no storedage loss:facturer's d	rgy requ N + 1.76 x ater usage hot water person per Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53 ) includir and no ta hot water eclared I	irement: [1 - exp ge in litre usage by a r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9 ng any so ank in dw er (this ir oss facto	(-0.0003) es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e ncludes i	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS nter 110 nstantar wn (kWł	FA -13.9 erage = designed i d Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage 0 litres in neous co n/day):	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa (47) ombi boild	0013 x ( + 36 a water us Sep 91.09 	FFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 sel er '0' in (	2. 9) 92 Nov 98.52 m(44)112 = ables 1b, 1 135.22 m(45)112 = 20.28 20.28	kWh/ye	ear: 1115.37 1462.43	<ul> <li>(42)</li> <li>(43)</li> <li>(44)</li> <li>(45)</li> <li>(46)</li> <li>(47)</li> <li>(48)</li> </ul>		
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; 1 if TFA £</li> <li>Annual averer Reduce the air not more that</li> <li>(44)m= 102.</li> <li>Energy conterer</li> <li>(45)m= 151.</li> <li>If instantaneous</li> <li>(46)m= 22.</li> <li>Water stora</li> <li>Storage vol</li> <li>If communition</li> <li>Otherwise if Water stora</li> <li>a) If manuf</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per $24$ 98.52nt of hot water $62$ 132.61us water heat $74$ 19.89age loss:lume (litresty heating af no storedage loss:facturer's dre factor from	rgy requ N + 1.76 x ater usage hot water person per- Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53 ) includir and no ta hot water eclared I pom Table	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9 ng any so ank in dw er (this in oss facto 2b	(-0.0003) es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e ncludes i	849 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 98.78 storage), 14.82 /WHRS nter 110 nstantar wn (kWł	FA -13.9 erage = designed i d Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage 0 litres in neous co n/day):	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa (47) ombi boild	0013 x ( + 36 a water us Sep 91.09 b kWh/mor 106.29 to (61) 15.94 ame vess ers) ente	FFA -13. se target o Oct 94.81 Fotal = Su 123.87 Fotal = Su 18.58 sel er '0' in (	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1. 135.22 m(45) <sub>112</sub> = 20.28 20.28 47) 1 0.	kWh/ye	ear:	<ul> <li>(42)</li> <li>(43)</li> <li>(44)</li> <li>(44)</li> <li>(45)</li> <li>(46)</li> <li>(47)</li> <li>(48)</li> <li>(49)</li> </ul>		

RS Energy Limited info@rsenergy.co.uk

The water storage loss factor from Table 2 (KVIIIIIIIe day) for ommunity heating see section 4.3 Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = $0$ (53) Water storage loss calculated for each month (56)m = (55) x (41)m (56)m = (51) 1 22.68 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 (56) Water storage loss calculated for each month (56)m = (55) x (41)m (56)m = (51) 1 22.68 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 (57) Temperature decicated solar storage, (57)m = (56)m x (50) - (H11) + (50), else (57)m = (56)m where (H11) is from Appendix H (57)m = (25.11 22.68 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 (57) Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)m = (23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 22.51 23.26 (59) Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m (61)m = $0$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
$ \begin{array}{c} \text{(c)} \text{(b)} \\ \text{(b)} \\ \text{(c)} \\ \text{(c)}$
Temperature factor from Table 2b       0       0       (5)         Energy lost from water storage, kWh/year       (47) $\times$ (51) $\times$ (52) $\times$ (53) =       0       (54)         Enter (50) or (54) in (55)       25.11       24.3       25.11       650       x(9)         Viginder contains dedicated soft strage, (57)m = (58)m × (50) - (H11) + (50), else (57)m = (65)m where (H11) is from Appendix H       (57)m       (58)       73.25       21.0       22.65       23.26       22.51       23.26       22.51       23.26       (69)       (69)         Combi loss calculated for each month (61)m = (60) + 365 × (41)m       (61)m       (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m       (62)       (62)m = 0.0       0       0       0       0       0
Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54) Enter (50) or (54) in (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (56) (57) (56) (56) (57) (57) (56) (56) (57) (57) (56) (56) (57) (57) (57) (57) (57) (57) (57) (57
Enter (50) or (54) in (55)       0.81       (55)         Water storage loss calculated for each month       ((56)m = (55) × (41)m       (56)m = (55) × (41)m         (36)m = $25.11$ 22.48       25.11       24.3       25.11       24.3       25.11       24.3       25.11       (56)m + (57)m = (56)m × (150) - (H11) + (50), else (57)m = (56)m where (H11) is from Appendix H       (57)m = $25.11$ 22.68       25.11       24.3       25.11       24.3       25.11       (57)m = (58) × (41)m         (modified by factor from Table 4 5       0       0       0       0       (58)         Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m       (69)m = (22.51       23.26       22.51       23.26       25.51       23.26       (59)         Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m       (61)m = (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Water storage loss calculated for each month       ((56)m = (55) × (41)m         (56)m =       25.11       22.88       25.11       24.3       25.11       26.3       26.51       23.26       22.51       23.26       22.51       23.26       22.51       23.26       25.1       23.26       25.1       23.26       25.1       23.26       25.51       23.26       25.51       23.26       25.51       23.26       25.51       23.26       25.51
(6)m=       25.11       22.68       25.11       24.3
If cylinder contains dedicated solar storage, (57)m = (56)m × ((50) - (H11)) + (50), else (57)m = (56)m where (H11) is from Appendix H (57)m = $25.11$ 22.68 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 (57) Primary circuit loss calculated for each month (59)m = (58) + 365 × (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)m = $23.26$ 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 (59) Combi loss calculated for each month (61)m = (60) + 365 × (41)m (61)m = $0$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Primary circuit loss (annual) from Table 3       0       (58)         Primary circuit loss calculated for each month (59)m = (58) $\div$ 365 x (41)m       (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)       (59)me         (69)me       23.26       21.01       23.26       22.51       23.26       22.51       23.26       22.51       23.26       (59)         Combi loss calculated for each month (61)m = (60) $\div$ 365 x (41)m       (61)m       (61)m       (61)m       (62)m       (61)m       (61)m       (62)m       (61)m       (61)m       (61)m       (61)m       (61)m       (61)m       (62)m       (61)m       (61)m       (62)m       (61)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (62)m       (61)m       (62)m       (62)m       (61)m       (62)m       (61)m       (62)m       (62)m       (61)m       (62)m       (61)m       (62)m       (62)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (62)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (63)m       (63)m       (64)m       (61)m       (61)m<
Primary circuit loss (aintual) non radie 3 (10) Primary circuit loss (aintual) non radie 3 (10) Primary circuit loss calculated for each month (59) m = (58) $\div$ 365 x (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (69) m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 (59) Combi loss calculated for each month (61) m = (60) $\div$ 365 x (41) m (61) m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
$ \begin{array}{c} \text{(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)} \\ \text{(59)m} = 23.26 \ 21.01 \ 23.26 \ 22.51 \ 23.26 \$
(59)me       23.26       21.01       23.26       22.51       23.26       23.26       22.51       23.26       22.51       23.26       (59)         Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m       (61)m =       0
Combi loss calculated for each month (61)m = (60) $\div$ 365 x (41)m (61)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Control of the order methan (c) (m = (co) + coc A (m))       (co) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ (62)m = $200$ 176.3 185.21 166.11 162.85 145.59 139.91 153.41 153.1 172.25 182.03 195.21         Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)         (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)       (63)m = $0$
Total float required for which floating calculated for each month (02) in 2 0.05 X (45) in 1 (45) in 1 (55) in 1
(ac), in 2 200       110.0       100.11       102.00       100.01
Colar bit Winput calculated using Appendix 0 of Appendix IT (regarive quality) (effer 0 in to solar contribution to watch neuting)         (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)         (63)m=       0
$\begin{array}{c} (63) \text{m} = & \hline 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 &$
$\begin{array}{c c c c c c c c c c c c c c c c c c c $
Comparison of the state in
$\begin{array}{c c c c c c c c c c c c c c c c c c c $
Heat gains from water heating, kWh/month $0.25 \stackrel{\prime}{} [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$ (65)m=       89.11       79.05       84.2       77.12       76.76       70.29       69.13       73.62       72.79       79.89       82.41       87.52       (65)         include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating       5.       Internal gains (see Table 5 and 5a):         Metabolic gains (Table 5), Watts       Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       123.68
Heat gains from water heating, kwn/month 0.25       [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (57)m + (59)m]         (65)m=       89.11       79.05       84.2       77.12       76.76       70.29       69.13       73.62       72.79       79.89       82.41       87.52       (65)         include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating       5.       Internal gains (see Table 5 and 5a):         Metabolic gains (Table 5), Watts
(65)m=       89.11       79.05       84.2       77.12       76.76       70.29       69.13       73.62       72.79       79.89       82.41       87.52       (65)         include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating       5.       Internal gains (see Table 5 and 5a):         Metabolic gains (Table 5), Watts
Include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating         5. Internal gains (see Table 5 and 5a):         Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       123.68
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec         (66)m=       123.68<
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       123.68
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         123.68
(66)m= 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 (66)
Lighting gains (calculated in Appendix Legulation L9 or L9a) also see Table 5
(67)m= 19.67 17.47 14.21 10.76 8.04 6.79 7.33 9.53 12.8 16.25 18.96 20.21 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m=         220.63         222.92         217.15         204.87         189.36         174.79         165.06         162.77         168.54         180.82         196.32         210.89         (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 (69)
Pumps and fans gains (Table 5a)
(70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (70)
Losses e.g. evaporation (negative values) (Table 5)

Water	heating	g gains (T	able 5)												
(72)m=	119.77	117.63	113.17	107.11	103.17	' <u></u>	97.63	92.92	98.	96 101.1	107.3	7 114.46	117.64		(72)
Total	interna	I gains =					(66)	)m + (67)m	n + (68	3)m + (69)m +	⊦ (70)m +	(71)m + (72)	)m	-	
(73)m=	420.17	418.12	404.63	382.83	360.68	3 3	39.31	325.41	331	.36 342.53	364.5	4 389.85	408.85		(73)
6. So	lar gair	าร:													
Solar (	gains are	calculated u	using solai	r flux from	Table 6a	a anc	l assoc	iated equa	tions	to convert to	the applic	able orientat	tion.		
Orient	ation:	Access F	actor	Area	l		Flu	IX bla 6a		g_ Table 6k	<b>-</b>	FF Table 6c		Gains	
<b>N</b> 1 (1									1		J			( • • • )	
Northe	ast 0.9x	0.54	X	0.	59	X	1	1.28	X	0.5	×	0.7	=	1.13	(75)
Northe	ast 0.9x	0.54	X	0.	59	x		1.28	X	0.5	×	0.7	=	1.13	(75)
Northe	ast 0.9x	0.54	X	0.	59	x	2	22.97	X	0.5	x	0.7	=	2.3	(75)
Northe	ast 0.9x	0.54	×	0.	59	x	2	22.97	X	0.5	X	0.7	=	2.3	(75)
Northe	ast 0.9x	0.54	×	0.	59	x		41.38	X	0.5	×	0.7	=	4.15	(75)
Northe	ast <mark>0.9x</mark>	0.54	×	0.	59	x		41.38	X	0.5	x	0.7	=	4.15	(75)
Northe	ast 0.9x	0.54	x	0.	59	x	6	67.96	X	0.5	x	0.7	=	6.82	(75)
Northe	ast 0.9x	0.54	x	0.	59	x	6	67.96	x	0.5	×	0.7	=	6.82	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	9	91.35	x	0.5	x	0.7	=	9.17	(75)
Northe	ast <mark>0.9x</mark>	0.54	X	0.	59	x	ę	91.35	x	0.5	x	0.7	=	9.17	(75)
Northe	ast <mark>0.9x</mark>	0.54	X	0.	59	x	6	97.38	x	0.5	x	0.7	=	9.77	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	9	97.38	x	0.5	x	0.7	=	9.77	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		91.1	x	0.5	x	0.7	=	9.14	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		91.1	x	0.5	x	0.7	=	9.14	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	7	72.63	x	0.5	x	0.7	=	7.29	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	7	72.63	x	0.5	x	0.7	=	7.29	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	5	50.42	x	0.5	x	0.7	=	5.06	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	5	50.42	x	0.5	x	0.7	=	5.06	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	2	28.07	x	0.5	x	0.7	=	2.82	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	2	28.07	x	0.5	x	0.7	=	2.82	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		14.2	x	0.5	x	0.7	=	1.42	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		14.2	x	0.5	x	0.7	=	1.42	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		9.21	x	0.5	x	0.7	=	0.92	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		9.21	x	0.5	x	0.7	=	0.92	(75)
Southe	ast <mark>0.9x</mark>	0.77	x	3.	68	x	3	36.79	x	0.5	x	0.7	=	32.84	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	1.:	38	x	3	36.79	x	0.5	x	0.7	=	12.32	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	0.	75	x	3	36.79	x	0.5	x	0.7	=	6.69	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	3.	68	x	6	62.67	x	0.5	x	0.7	=	55.94	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	1.	38	x	6	62.67	x	0.5	x	0.7	=	20.98	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	0.	75	x	6	62.67	x	0.5	x	0.7	=	11.4	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	3.	68	x		35.75	x	0.5	x	0.7	=	76.54	(77)
Southe	ast <mark>0.9x</mark>	0.77	×	1.5	38	x	6	35.75	x	0.5	x	0.7		28.7	(77)

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Southeast 0.9x	0.77	x	0.75	x	85.75	x	0.5	x	0.7	] =	15.6	(77)
Southeast 0.9x	0.77	x	3.68	x	106.25	x	0.5	x	0.7	i =	94.84	<b>-</b> (77)
Southeast 0.9x	0.77	x	1.38	x	106.25	x	0.5	x	0.7	i =	35.56	- (77)
Southeast 0.9x	0.77	x	0.75	x	106.25	x	0.5	x	0.7	<b>i</b> =	19.33	_ ](77)
Southeast 0.9x	0.77	x	3.68	x	119.01	x	0.5	x	0.7	<b>j</b> =	106.23	-  (77)
Southeast 0.9x	0.77	x	1.38	x	119.01	x	0.5	x	0.7	] =	39.84	(77)
Southeast 0.9x	0.77	x	0.75	×	119.01	<b>x</b>	0.5	x	0.7	] =	21.65	(77)
Southeast 0.9x	0.77	x	3.68	x	118.15	x	0.5	x	0.7	] =	105.46	(77)
Southeast 0.9x	0.77	x	1.38	x	118.15	x	0.5	x	0.7	=	39.55	(77)
Southeast 0.9x	0.77	x	0.75	x	118.15	x	0.5	x	0.7	=	21.49	(77)
Southeast 0.9x	0.77	x	3.68	x	113.91	x	0.5	x	0.7	=	101.67	(77)
Southeast 0.9x	0.77	x	1.38	x	113.91	x	0.5	x	0.7	=	38.13	(77)
Southeast 0.9x	0.77	x	0.75	x	113.91	x	0.5	x	0.7	=	20.72	(77)
Southeast 0.9x	0.77	x	3.68	x	104.39	x	0.5	x	0.7	=	93.18	(77)
Southeast 0.9x	0.77	x	1.38	x	104.39	x	0.5	x	0.7	=	34.94	(77)
Southeast 0.9x	0.77	x	0.75	x	104.39	<b>x</b>	0.5	x	0.7	] =	18.99	(77)
Southeast 0.9x	0.77	x	3.68	x	92.85	x	0.5	x	0.7	=	82.88	(77)
Southeast 0.9x	0.77	x	1.38	x	92.85	x	0.5	x	0.7	=	31.08	(77)
Southeast 0.9x	0.77	x	0.75	x	92.85	x	0.5	x	0.7	=	16.89	(77)
Southeast 0.9x	0.77	x	3.68	x	69.27	x	0.5	x	0.7	=	61.83	(77)
Southeast 0.9x	0.77	x	1.38	x	69.27	x	0.5	x	0.7	=	23.19	(77)
Southeast 0.9x	0.77	x	0.75	x	69.27	<b>x</b>	0.5	x	0.7	] =	12.6	(77)
Southeast 0.9x	0.77	x	3.68	x	44.07	x	0.5	x	0.7	=	39.34	(77)
Southeast 0.9x	0.77	x	1.38	x	44.07	x	0.5	x	0.7	=	14.75	(77)
Southeast 0.9x	0.77	x	0.75	x	44.07	x	0.5	x	0.7	] =	8.02	(77)
Southeast 0.9x	0.77	x	3.68	x	31.49	x	0.5	x	0.7	] =	28.11	(77)
Southeast 0.9x	0.77	x	1.38	x	31.49	x	0.5	x	0.7	] =	10.54	(77)
Southeast 0.9x	0.77	x	0.75	x	31.49	x	0.5	x	0.7	] =	5.73	(77)
Northwest 0.9x	0.77	x	7.35	x	11.28	x	0.5	x	0.7	=	20.11	(81)
Northwest 0.9x	0.77	x	1.67	x	11.28	x	0.5	x	0.7	] =	4.57	(81)
Northwest 0.9x	0.77	x	7.35	x	22.97	x	0.5	x	0.7	] =	40.94	(81)
Northwest 0.9x	0.77	x	1.67	x	22.97	x	0.5	x	0.7	] =	9.3	(81)
Northwest 0.9x	0.77	x	7.35	x	41.38	x	0.5	x	0.7	] =	73.77	(81)
Northwest 0.9x	0.77	x	1.67	x	41.38	x	0.5	x	0.7	] =	16.76	(81)
Northwest 0.9x	0.77	x	7.35	x	67.96	x	0.5	x	0.7	=	121.15	(81)
Northwest 0.9x	0.77	x	1.67	x	67.96	x	0.5	x	0.7	] =	27.53	(81)
Northwest 0.9x	0.77	x	7.35	x	91.35	x	0.5	x	0.7	=	162.85	(81)
Northwest 0.9x	0.77	x	1.67	×	91.35	x	0.5	×	0.7	] =	37	(81)
Northwest 0.9x	0.77	x	7.35	x	97.38	x	0.5	x	0.7	=	173.61	(81)
Northwest 0.9x	0.77	x	1.67	x	97.38	x	0.5	x	0.7	=	39.45	(81)
Northwest 0.9x	0.77	x	7.35	x	91.1	x	0.5	x	0.7	=	162.41	(81)

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Northwest 0.9x	0.77	x	1.67	x	91.1	x	0.5	x	0.7	=	36.9	(81)
Northwest 0.9x	0.77	x	7.35	x	72.63	x	0.5	×	0.7	=	129.48	(81)
Northwest 0.9x	0.77	x	1.67	x	72.63	x	0.5	×	0.7	] =	29.42	(81)
Northwest 0.9x	0.77	×	7.35	x	50.42	x	0.5	x	0.7	=	89.89	(81)
Northwest 0.9x	0.77	x	1.67	x	50.42	x	0.5	×	0.7	=	20.42	(81)
Northwest 0.9x	0.77	x	7.35	x	28.07	x	0.5	×	0.7	] =	50.04	(81)
Northwest 0.9x	0.77	x	1.67	x	28.07	×	0.5	×	0.7	] =	11.37	(81)
Northwest 0.9x	0.77	x	7.35	x	14.2	x	0.5	x	0.7	] =	25.31	(81)
Northwest 0.9x	0.77	x	1.67	x	14.2	x	0.5	x	0.7	] =	5.75	(81)
Northwest 0.9x	0.77	x	7.35	x	9.21	x	0.5	x	0.7	=	16.43	(81)
Northwest 0.9x	0.77	x	1.67	x	9.21	x	0.5	x	0.7	] =	3.73	(81)
Rooflights 0.9x	1	x	0.77	x	20.97	x	0.57	x	0.7	=	5.8	(82)
Rooflights 0.9x	1	x	0.77	x	20.97	x	0.57	x	0.7	] =	5.8	(82)
Rooflights 0.9x	1	x	0.77	x	20.97	x	0.57	×	0.7	=	5.8	(82)
Rooflights 0.9x	1	x	0.77	x	44.3	x	0.57	x	0.7	=	12.25	(82)
Rooflights 0.9x	1	x	0.77	x	44.3	x	0.57	x	0.7	=	12.25	(82)
Rooflights 0.9x	1	x	0.77	x	44.3	x	0.57	x	0.7	=	12.25	(82)
Rooflights 0.9x	1	x	0.77	x	82.04	x	0.57	x	0.7	=	22.68	(82)
Rooflights 0.9x	1	x	0.77	x	82.04	x	0.57	x	0.7	=	22.68	(82)
Rooflights 0.9x	1	x	0.77	x	82.04	x	0.57	x	0.7	=	22.68	(82)
Rooflights 0.9x	1	x	0.77	x	135.32	x	0.57	×	0.7	=	37.42	(82)
Rooflights 0.9x	1	x	0.77	x	135.32	x	0.57	x	0.7	=	37.42	(82)
Rooflights 0.9x	1	x	0.77	x	135.32	x	0.57	x	0.7	=	37.42	(82)
Rooflights 0.9x	1	x	0.77	x	180.7	x	0.57	x	0.7	] =	49.96	(82)
Rooflights 0.9x	1	x	0.77	x	180.7	x	0.57	x	0.7	] =	49.96	(82)
Rooflights 0.9x	1	x	0.77	x	180.7	x	0.57	×	0.7	=	49.96	(82)
Rooflights 0.9x	1	x	0.77	x	191.77	x	0.57	×	0.7	] =	53.03	(82)
Rooflights 0.9x	1	x	0.77	x	191.77	x	0.57	x	0.7	] =	53.03	(82)
Rooflights 0.9x	1	x	0.77	x	191.77	x	0.57	x	0.7	=	53.03	(82)
Rooflights 0.9x	1	x	0.77	x	179.76	x	0.57	x	0.7	=	49.71	(82)
Rooflights 0.9x	1	x	0.77	x	179.76	x	0.57	x	0.7	=	49.71	(82)
Rooflights 0.9x	1	x	0.77	x	179.76	x	0.57	x	0.7	=	49.71	(82)
Rooflights 0.9x	1	x	0.77	x	144.31	x	0.57	x	0.7	=	39.9	(82)
Rooflights 0.9x	1	x	0.77	x	144.31	x	0.57	×	0.7	=	39.9	(82)
Rooflights 0.9x	1	x	0.77	x	144.31	x	0.57	×	0.7	] =	39.9	(82)
Rooflights 0.9x	1	x	0.77	x	100.39	x	0.57	x	0.7	=	27.76	(82)
Rooflights 0.9x	1	x	0.77	x	100.39	x	0.57	×	0.7	=	27.76	(82)
Rooflights 0.9x	1	x	0.77	×	100.39	x	0.57	×	0.7	=	27.76	(82)
Rooflights 0.9x	1	x	0.77	×	54.87	x	0.57	x	0.7	=	15.17	(82)
Rooflights 0.9x	1	x	0.77	×	54.87	x	0.57	×	0.7	=	15.17	(82)
Rooflights 0.9x	1	x	0.77	x	54.87	x	0.57	x	0.7	=	15.17	(82)

Rooflig	hts <mark>0.9x</mark>	1		x	0.7	7	x	2	26.72	×		0.57	x	0.7		= [	7.39	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x	2	26.72	x		0.57		0.7		= [	7.39	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x	2	26.72	×		0.57		0.7		= [	7.39	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x		16.9	×		0.57	 	0.7		= [	4.67	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x		16.9	x		0.57		0.7		= [	4.67	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x		16.9	x		0.57		0.7		= [	4.67	(82)
Solar g	Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m																	
(83)m=	96.2	179.93	287.7	'3	424.3	535.78	5	58.18	527.24	440	.29	334.55	210.17	118.18	80.4			(83)
Total g	jains – i	nternal a	and so	lar	(84)m =	- (73)m	+ (	83)m	, watts									
(84)m=	516.37	598.05	692.3	6	807.13	896.46	8	97.49	852.65	771	.64	677.09	574.71	508.02	489.2	5		(84)
7. Mean internal temperature (heating season)																		
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)																		
Utilisation factor for gains for living area, h1,m (see Table 9a)																		
	Jan	Feb	Ma	r	Apr	May	,	Jun	Jul	A	ug	Sep	Oct	Nov	De	с		
(86)m=	0.72	0.68	0.62	2	0.54	0.44		0.35	0.28	0.3	31	0.44	0.58	0.68	0.73			(86)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)																		
(87)m=	17.22	17.53	18.1	1	18.83	19.57	2	20.13	20.43	20.	37	, 19.88	18.99	17.94	17.15	5		(87)
Tomr		durina h			ariode in	rest o	f dw	olling	i from Ta		יד אד ב							
(88)m=	20.1	20.1	20.1	μ 1	20.12	20.12		20.13	20.13	20.	13	20.12	20.12	20.11	20.11	1		(88)
								,										
Utilisa	ation fac	tor for g	ains fo	or ro	est of d	velling	, h2 T	,m (se		9a)	7	0.44	0.50	0.67	0.70			(80)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$												(03)						
Mean	interna	l temper	ature	in t	he rest	of dwel	lling	T2 (f	ollow ste	eps 3	to 7	7 in Tabl	e 9c)			_		
(90)m=	15.29	15.71	16.4	8	17.48	18.41	1	9.14	19.51	19.	45	18.86	17.68	16.32	15.2			(90)
												Ť	'LA = LIV	ing area ÷ (·	4) =		0.14	(91)
Mean	interna	l temper	ature	(foi	the wh	ole dw	ellin	g) = f	LA x T1	+ (1	– fL	A) × T2						
(92)m=	15.55	15.96	16.7	·	17.67	18.57	1	9.28	19.64	19.	58	19	17.86	16.54	15.47	7		(92)
Apply	v adjustr	nent to t	he me	an	internal	tempe	ratu	ire fro	m Table	e 4e,	whe	ere appro	opriate			_		
(93)m=	15.55	15.96	16.7	,	17.67	18.57		9.28	19.64	19.	58	19	17.86	16.54	15.47	7		(93)
8. Sp	ace hea	ting req	uireme	ent									. =-	(70)			1. <i>i</i> .	
Set I	i to the tilisation	mean inf	ernal or gair	tem	iperatur Ising Ta	e obtai ble 9a	inec	l at ste	ep 11 of	labi	e 9t	o, so tha	t II,m=	:(76)m an	d re-ca	alc	ulate	
	Jan	Feb	Ma	r	Apr	Mav	,	Jun	Jul	A	ua	Sep	Oct	Nov	De	с		
Utilisa	ation fac	tor for g	ains, ł	<u>.</u> nm:	7.01	may	_	oun	- oui		<u>aa</u>	000	000			<u> </u>		
(94)m=	0.63	0.59	0.54		0.46	0.37		0.28	0.21	0.2	24	0.36	0.49	0.59	0.64			(94)
Usefu	ul gains,	hmGm	, W =	(94	)m x (84	4)m	-											
(95)m=	326.48	354.48	371.3	51	368.79	333.27	2	55.09	182.15	183	.99	241.57	283.76	300.14	314.3	8		(95)
Mont	hly aver	age exte	ernal te	emp	perature	from T	Fabl	e 8						·	-			
(96)m=	4.3	4.9	6.5		8.9	11.7		14.6	16.6	16	.4	14.1	10.6	7.1	4.2	_		(96)
Heat	loss rat	e for me	an inte	erna	al tempe	erature	, Lm	1, W =	=[(39)m	x [(9	3)m-	– (96)m	]					
(97)m=	887.79	870.36	800.7	3	679.06	530.47	3	56.39	231.63	241	.59	375.57	560.52	733.5	879.6	1		(97)
Spac	e heatin	g require	ement	for	each m	nonth, I	w۲ ۲	/mon	th = 0.02	24 x [	(97)	)m – (95	)m] x ( <sup>,</sup>	41)m	<u> </u>			
(98)m=	417.61	346.67	319.4	9	223.39	146.72		0	0	0	)	0	205.91	312.01	420.5	3		

Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =									2392.35	(98)				
Spac	e heatir	ng require	ement in	ı kWh/m²	²/year								29.69	(99)
9a. En	ergy re	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Spac	e heati	ng:			, .									
Fraction of space heat from secondary/supplementary system											0	(201)		
Fraction of space heat from main system(s) (202) = 1 – (201) =										1	(202)			
Fract	on of to	otal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1												193.81	(206)	
Efficiency of secondary/supplementary heating system, %											0	(208)		
_	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Spac	e heatir	ng require	ement (c	calculate	d above	)				005.04	240.04	400.50		
(0.1.1)	417.61	346.67	319.49	223.39	146.72	0	0	0	0	205.91	312.01	420.53	1	
(211)m	$1 = \{[(98)] = (98) \}$	3)m x (20	)4)] } X 1	$100 \div (20)$	)6) 75 7	0	0	0	0	106.24	160.00	216.09		(211)
	213.40	170.07	104.00	113.20	10.1	0	0	Tota	l (kWh/yea	ar) = Sum(2)	211)	=	1234 38	7(211)
Space	e heatir	na fuel (s	econdar	v) kWh/	month					, ,	v 15, 10 1	2	1201.00	](,
= {[(98	)m x (2	01)] } x 1	00 ÷ (20	)8)	monun									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
					-			Tota	ll (kWh/yea	ar) =Sum(	215) <sub>15,101</sub>	<b>II</b> <sub>2</sub>	0	(215)
Water	heating	g												
Output	from w	ater hea	$\frac{195}{195}$	ulated a	bove)	145 50	120.01	152 /1	152.1	172.25	192.02	105 21		
Efficie		vater hea		100.11	102.00	145.59	139.91	155.41	155.1	172.25	102.03	195.21	282.62	<b>1</b> (216)
(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	202.02	(217)
Fuel fo	or water	heating.	kWh/m	onth										
(219)m	<u>1 = (64</u>	<u>)m x 100</u>	) ÷ (217)	)m	1	1	1	1	1	1	1	1	1	
(219)m=	70.76	62.38	65.53	58.78	57.62	51.51	49.5	54.28	54.17	60.95	64.41	69.07	<u> </u>	-
								lota	I = Sum(2)	19a) <sub>112</sub> =			718.97	(219)
Annual totals kWh/year										1234.38	1			
Water beating fuel used										719.07	] T			
			u										/ 10.9/	]
Electri	city for	pumps, r	ans and	electric	кеер-по	τ							1	
mech	anical v	entilatio	n - balar	nced, ext	ract or p	ositive i	nput fron	n outside	Э			165.95		(230a) _
Total electricity for the above, kWh/year sum of (230a)(230g) =									165.95	(231)				
Electricity for lighting									347.33	(232)				
Total c	lelivere	d energy	for all u	ses (211	)(221)	+ (231)	+ (232).	(237b)	=				2466.63	(338)
12a. (	CO2 en	nissions ·	– Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHP						
						En kW	ergy /h/year			Emiss kg CO	i <b>on fac</b> 2/kWh	tor	<b>Emissions</b> kg CO2/vea	r
Space heating (main system 1)							(211) x				19	=	640.64	(261)
										L				<b>.</b>

Space heating (secondary)	(215) x	0.519	=	0	(263)								
Water heating	(219) x	0.519	=	373.14	(264)								
Space and water heating	(261) + (262) + (263) +	(264) =		1013.79	(265)								
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	86.13	(267)								
Electricity for lighting	(232) x	0.519	=	180.27	(268)								
Total CO2, kg/year		sum of (265)(271) =		1280.18	(272)								
Dwelling CO2 Emission Rate		(272) ÷ (4) =		15.89	(273)								
El rating (section 14)				86	(274)								
						User	Details:						
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Assessor Name:       Natalie Wheeler       Stroma Number:       STR0034641         Software Name:       Stroma FSAP 2012       Software Version:       Version: 1.0.5.59         Property Address: Havelock Road													
					P	roperty	Address	: Havelo	ck Road				
Address :		10a	Havelo	ck Road	, Cowle	y , Oxfo	ord, OX4	3EP					
1. Overall dwellin	ig din	nension	S:										
						Are	ea(m²)	L., .	Av. He	ight(m)	1	Volume(m <sup>3</sup> )	
Ground noor $45.92$ (1a) x $2.3$ $(2a) =$ First floor $34.65$ (1b) x $2.56$ $(2b) =$											105.62	(3a)	
First floor 34.65 (1b) x 2.56 (2b) =										88.7	(3b)		
Total floor area TF	- A = (	(1a)+(1b	)+(1c)+(	(1d)+(1e	e)+(1r	n)	80.57	(4)					
Dwelling volume								(3a)+(3b	)+(3c)+(3d	l)+(3e)+	.(3n) =	194.32	(5)
2. Ventilation rate	e:												
		ŀ	main Neating	S(	econdar	у	other		total			m <sup>3</sup> per hour	
Number of chimne	eys	Ĺ	0	] + [	0	] + [	0	] = [	0	X 4	40 =	0	(6a)
Number of open flu	ues	Г	0		0		0		0	x	20 =	0	(6b)
Number of intermit	ttent	∟ fans							0	<b>x</b> '	10 =	0	(7a)
Number of passive	e ven	ts						Г	0	x ^	10 =	0	(7b)
Number of flueless	s gas	fires						Г	0	× 4	40 =	0	(7c)
													_
											Air ch	anges per ho	ur
Infiltration due to c	himn	eys, flu	es and fa	ans = <mark>(6</mark>	a)+(6b)+(7	'a)+(7b)+	-(7c) =	Γ	0		÷ (5) =	0	(8)
If a pressurisation te	est has	been car	ried out or	r is intende	ed, procee	d to (17),	otherwise	continue fr	om (9) to (	(16)			-
Number of store	eys in	the dwe	elling (ne	5)						(0)	11-0-4	0	(9)
Additional Infiltra		0.25 for	, atool or	timbor	frama ar	0.25 fr	r maaan	n constr	uction	[(9)	-1]x0.1 =	0	(10)
if both types of w	allon. all are	present.	steer of use the va	lue corres	pondina to	0.35 IC	ater wall are	a (after	uction			0	(11)
deducting areas	of ope	nings); if e	equal user	0.35	, · · · · · · · · · · · · · · · · · · ·	<b>J</b>							
If suspended wo	oder	n floor, e	enter 0.2	(unseal	ed) or 0.	1 (seal	ed), else	enter 0				0	(12)
If no draught lob	oby, e	enter 0.0	95, else e	enter 0								0	(13)
Percentage of w	vindo	ws and	doors dr	aught st	ripped							0	(14)
Window infiltration	on						0.25 - [0.2	2 x (14) ÷ 1	= [00]	(45)		0	(15)
Infiltration rate							(8) + (10)	+ (11) + (1	12) + (13) -	+ (15) =		0	(16)
Air permeability	value	e, q50, e	expresse		$\frac{7}{2}$ $\frac{201}{2}$	s per h	our per s	quare m	etre of e	envelope	area	3	(17)
If based on air per	mear	lies if a pr	ue, then	(10) = ((1))	7) <del>-</del> 20]+(0	b), other	$rac{10}{2}$	(10) vrmeability	is being u	sod		0.15	(18)
Number of sides s	helte	red	00001100110	511 1031 1140	5 50011 001			inicability	is being ut	300	1	2	<b>(</b> 19)
Number of sides sheltered       2       (19)         Shelter factor $(20) = 1 - [0.075 \times (19)] =$ $0.85$ (20)													
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.13$ (21)									(21)				
Infiltration rate modified for monthly wind speed													
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec													
Monthly average w	vind s	speed fr	om Tabl	e 7									
(22)m= 5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

#### Wind Factor (22a)m = (22)m $\div$ 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 rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	: (21a) x	(22a)m					
	0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calcula	ate effec	ctive air i	change i tion:	rate for t	he appli	cable ca	se		-	-	-	 Г		
If ever	oust air he		uon. Ising Ann	andix N (2	3h) - (23a	) v Emv (e	auation (I	N5)) other	rwise (23h	(23a)		l	0.5	(23a)
If bala	unced with	heat reco	werv: effic	iency in %	allowing f	or in-use f	actor (fron	n Tahle 4h	) –	<i>(</i> 200)		ľ	0.5	(230)
a) If	halanco	d mech	anical ve	ntilation	with bo	at recover	any (M)/l		$^{-}$	2h)m ⊥ (	23b) v [	[ 1 _ (23c)	· 1001	(230)
(24a)m=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	1 - (230)	÷ 100]	(24a)
h) If	halance	d mech:	anical ve		without	heat rec		(24h)	$1 = \frac{1}{2}$	$\frac{1}{2}$ () m + ()	23b)	0.20		
(24b)m=	0				0						0	0		(24b)
c) If y	whole h		tract ver	tilation o	or positiv	e input v	ventilatio	n from c	L nutside					
i i	f (22b)m	$1 < 0.5 \times 10^{-1}$	: (23b), t	hen (240	c) = (23b	); otherv	vise (24	c) = (22t	m + 0.	.5 × (23b	<b>)</b> )			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	e input	ventilatio	on from l	oft	<b>!</b>	<b>!</b>			
i	f (22b)m	n = 1, the	en (24d)	m = (22k	o)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	ctive air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	ld) in boy	(25)					
(25)m=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(25)
3. Hea	at losses	s and he	at loss p	paramete	ər:									
ELEN	IENT	Gros area	ss (m²)	Openin m	gs 1²	Net Ar A ,r	ea n²	U-valı W/m2	ue K	A X U (W/I	K)	k-value kJ/m²·k	e / K ł	λXk ⟨J/Κ
ELEN Doors	IENT	Gros area	ss (m²)	Openin m	gs I <sup>2</sup>	Net Ar A ,r 2.07	ea n² X	U-valı W/m2	ue :K =	A X U (W/ 2.07	K)	k-value kJ/m²⋅k	9 / K	A X k (J/K (26)
<b>ELEN</b> Doors Windov	<b>IENT</b> ws Type	Gros area	88 (m²)	Openin m	gs 1 <sup>2</sup>	Net Ar A ,r 2.07 3.68	ea m² x x	U-valı W/m2 [1 /[1/( 1.2 )+	ue :K = 0.04] =	A X U (W/ 2.07 4.21	K)	k-value kJ/m²·k	9 / K	A X k (J/K (26) (27)
ELEN Doors Windov Windov	<b>IENT</b> ws Type ws Type	Gros area 1 2	88 (m²)	Openin m	gs ²	Net Ar A ,r 2.07 3.68 7.35	ea n <sup>2</sup> x x x <sup>1</sup> x <sup>1</sup>	U-valu W/m2	ue K 0.04] = 0.04] =	A X U (W/ 2.07 4.21 8.42	K)	k-value kJ/m²-k	• / <	A X k (26) (27) (27)
ELEN Doors Windov Windov Windov	<b>IENT</b> ws Type ws Type ws Type	Gros area 1 2 3	ss (m²)	Openin m	gs ,²	Net Ar A ,r 2.07 3.68 7.35 0.59	ea n <sup>2</sup> x x <sup>1</sup> x <sup>1</sup> x <sup>1</sup>	U-valu W/m2 [	ue K 0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68	K)	k-value kJ/m²·k	9 / K	A X k (26) (27) (27) (27)
ELEN Doors Windov Windov Windov Windov	IENT ws Type ws Type ws Type ws Type	Gros area 1 2 3 4	ss (m²)	Openin m	gs ²	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38	ea n <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-valu W/m2 [1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	ue K 0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68 1.58	к)	k-value kJ/m²·k	9 / K	A X k (26) (27) (27) (27) (27) (27)
ELEN Doors Windov Windov Windov Windov	IENT ws Type ws Type ws Type ws Type ws Type	Gros area 1 2 3 4 4 5	ss (m²)	Openin m	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75	ea n <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1	U-valu W/m2 [	ue K 0.04] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86	к)	k-value kJ/m²·k	• / <	A X k (26) (27) (27) (27) (27) (27) (27)
ELEN Doors Windov Windov Windov Windov Windov	IENT ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 1 2 3 4 4 5 6	ss (m²)	Openin m	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67	ea n <sup>2</sup> × x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-valu W/m2 [	Le K 0.04] =   0.04] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91	к)	k-value kJ/m²·k	• / <	A X k (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Windov	IENT ws Type ws Type ws Type ws Type ws Type ws Type ws Type	Gros area 1 2 3 4 5 6 5 7	ss (m²)	Openin m	gs ²	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.59	ea n <sup>2</sup> x x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-valu W/m2 [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] =   0.04] =   0.04] =   0.04] =   0.04] =	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68	K)	k-value kJ/m²·k	9 / K	A X k (J/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Windov Rooflig	IENT ws Type ws Type ws Type ws Type ws Type ws Type hts Type	Gros area 1 2 3 4 5 5 6 7 e 1	ss (m²)	Openin m	gs ²	Net Ar A,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.59 0.77	ea n <sup>2</sup> x1 x1 x1 x1 x1 x1 x1 x	U-valu W/m2 [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 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924	к)	k-value kJ/m²·k	9 / (	A X k (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig	IENT ws Type ws Type ws Type ws Type ws Type ws Type hts Type hts Type	Gros area 1 2 3 4 5 6 7 e 1 e 2	ss (m²)	Openin	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.59 0.77	ea m <sup>2</sup> × x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	U-valu W/m2 1 /[1/( 1.2 )+ /[1/( 1.2 )+ /[1/(1.2 )+	Le K 0.04] =   0.04] =	A X U (W/I 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924	к)	k-value kJ/m²·k	9 / (	A X k (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area 4 5 6 7 e 1 e 2 e 3	ss (m²)	Openin	gs ,2	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77	ea n <sup>2</sup> X x <sup>1</sup> X	U-valu 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 )+ /[1/(1.2 )+	Le K 0.04] =   0.04] =	A X U (W/I 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924	K)	k-value kJ/m²·k	• / <	A X k (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Floor	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area 4 5 6 7 e 1 e 2 e 3	ss (m²)	Openin	gs ²	Net Ar A,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 45.92	ea n <sup>2</sup> x <sup>1</sup> x <sup>1</sup>	U-value W/m2 1 /[1/(1.2)+	Le K = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	A X U (W/I 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 5.0512	K)	k-value kJ/m²·k		A X k (J/K (26) (27) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b)
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Floor Walls	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area 4 5 6 7 e 1 e 2 e 3 97 7	ss (m²)	Openin m	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 45.92 79.71	ea m <sup>2</sup> X X X X X X X X X X X X X X X X X X X	U-value W/m2 1 (1/(1.2)+) (1/(1.2)+	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 0.04] = 1 0 0.04] = 1 0 0 0 0 0 0 0 0 0 0 0 0 0	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 0.924	K)	k-value kJ/m²·k		A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b) (27b)
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Floor Walls Roof T	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area 4 5 6 7 e 1 e 2 e 3 97.7 9.6	ss (m²)	Openin m	gs <sup>2</sup>	Net Ar A,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 45.92 79.71	ea m <sup>2</sup> X X X X X X X X X X X X X X X X X X X	U-valu 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)+ (1/(1.2)+ (1/(1.2)+ (1/(1.2)+ (0.11) 0.16 0.11	Le K 0.04] =   0.04]	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 5.0512 12.75 0.81	K)     I     I     I     I     I	k-value kJ/m²·k		A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (
ELEN Doors Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Floor Walls Roof T Roof T	IENT ws Type ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type	Gros area $a^{2}$ $a^{2}$ $a^{3}$ $a^{4}$ $a^{5}$ $a^{6}$ $a^{7}$ $a^{6}$ $a^{7}$ $a^{6}$ $a^{7}$ $a^{6}$ $a^{7}$ $a^$	9 9 5	Openin m 18.08 2.31	gs <sup>2</sup>	Net Ar A,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 0.77 45.92 79.71 7.35 34.65	ea m <sup>2</sup> X X X X X X X X X X X X X X X X X X X	U-value 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)+ /[1/(1.2)+ (1/(1.2)+ (1/(1.2)+ (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 0 0.04] = 1 0 0.04] = 1 0 0 0 0 0 0 0 0 0 0 0 0 0	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 0.924 0.924 0.924 12.75 0.81 3.81	<pre>k)</pre>	k-value kJ/m²-k		A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (
ELEN Doors Windov Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Roof T Roof T Roof T Roof T	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type fype1 -ype2	Gross area a 1 a 2 a 3 a 4 a 5 a 6 a 7 e 1 e 2 e 3 97.7 9.66 34.6	ss (m <sup>2</sup> )	Openin m 18.00 2.31 0	gs <sup>2</sup>	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.75 0.77 0.77 0.77 0.77 45.92 79.71 7.35 34.65	ea m <sup>2</sup> X X X X X X X X X X X X X X X X X X X	U-value 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)+ /(1/(1.2)+ (1/	Le K 0.04] =   0.04]	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 5.0512 12.75 0.81 3.81 0.09	<pre>k)</pre>	k-value kJ/m²-k		A X k (J/K (26) (27) (27) (27) (27) (27) (27) (27b)(27b) (27
ELEN Doors Windov Windov Windov Windov Windov Windov Rooflig Rooflig Rooflig Roof T Roof T Roof T Roof T	IENT ws Type ws Type ws Type ws Type ws Type hts Type hts Type hts Type fype1 -ype2 -ype3 rea of e	Gross area a 1 a 2 a 3 a 4 a 5 a 6 a 7 a 6 a 7 a 6 a 7 a 6 a 7 a 6 a 7 a 6 a 7 a 97.7 9.66 34.6 0.8 lements	9 5 5 , m <sup>2</sup>	Openin m 18.08 2.31 0 0	gs ,2 3 	Net Ar A ,r 2.07 3.68 7.35 0.59 1.38 0.75 1.67 0.77 0.77 0.77 0.77 0.77 7.35 34.65 0.8	ea $n^2$ $x1$ <t< td=""><td>U-value W/m2 1 (1/(1.2)+)</td><td>Le K 0.04] =   0.04] =   0.04]</td><td>A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 0.924 5.0512 12.75 0.81 3.81 0.09</td><td>K)</td><td>k-value kJ/m²-k</td><td></td><td>A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (</td></t<>	U-value W/m2 1 (1/(1.2)+)	Le K 0.04] =   0.04]	A X U (W/ 2.07 4.21 8.42 0.68 1.58 0.86 1.91 0.68 0.924 0.924 0.924 0.924 0.924 5.0512 12.75 0.81 3.81 0.09	K)	k-value kJ/m²-k		A X k (J/K (26) (27) (27) (27) (27) (27) (27b) (

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* for windows ** include the	and roof wind areas on both	lows, use e n sides of ir	effective wi nternal wal	indow U-va Is and pari	alue calcul titions	lated using	formula 1,	/[(1/U-valu	e)+0.04] a	ns given in	paragraph	3.2	
Fabric heat	loss, W/K	= S (A x	U)				(26)(30)	+ (32) =				45.56	(33)
Heat capac	ity Cm = S	(A x k )						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal ma	ass parame	eter (TMF		: TFA) ir	n kJ/m²K			= (34)	÷ (4) =			0	(35)
For design as can be used ii	sessments wh nstead of a de	nere the de stailed calc	tails of the ulation.	construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bri	idges : S (L	. x Y) cal	culated	using Ap	pendix l	K						15.92	(36)
if details of the	ermal bridging	are not kn	10wn (36) =	= 0.05 x (3	1)								
Total fabric	heat loss							(33) +	(36) =			61.47	(37)
Ventilation	heat loss c	alculated	d monthly	y				(38)m	= 0.33 × (	25)m x (5)			
Ja	in Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 17.4	41 17.21	17.01	15.98	15.78	14.76	14.76	14.55	15.17	15.78	16.19	16.6		(38)
Heat transf	er coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m= 78.8	89 78.68	78.48	77.46	77.25	76.23	76.23	76.03	76.64	77.25	77.66	78.07		_
11			1					(10)	Average =	Sum(39) <sub>1.</sub>	12 /12=	77.41	(39)
Heat loss p	arameter (	HLP), W/	/m²K		0.05	0.05		(40)m	= (39)m ÷	(4)	0.07		
(40)m= 0.9	0.98	0.97	0.96	0.96	0.95	0.95	0.94	0.95	0.96	0.96	0.97	0.00	
Number of	days in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1.	12 /12=	0.96	(40)
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 3 <sup>2</sup>	1 28	31	30	31	30	31	31	30	31	30	31		(41)
				•	•								
4. Water h	eating ene	rav reau	irement:								kWh/ve	ear:	
4. Water h	eating ene	rgy requ	irement:								kWh/ye	ear:	
4. Water h Assumed o if TFA >	eating ene ccupancy, 13.9, N = 1	rgy requ N + 1.76 x	irement: : [1 - exp	(-0.0003	349 x (TF	-13.9	)2)] + 0.0	)013 x ( <sup>-</sup>	ГFA -13.	<u>2.</u> 9)	kWh/ye 47	ear:	(42)
4. Water h Assumed o if TFA 5 if TFA £	eating ene ccupancy, 13.9, N = 1 13.9, N = 1 rage bot w	rgy requ N + 1.76 x	irement: x [1 - exp	(-0.0003	349 x (TF	<sup>-</sup> A -13.9	)2)] + 0.( (25 x N)	)013 x ( <sup>-</sup> + 36	ΓFA -13.	<u>2.</u> 9)	kWh/ye	ear:	(42)
4. Water h Assumed o if TFA > if TFA £ Annual ave Reduce the au	eating energy ccupancy, 13.9, $N = 1$ 13.9, $N = 1$ rage hot w mual average 125 litres per	rgy requ N + 1.76 x ater usag hot water	irement: [1 - exp ge in litre usage by r day (all w	(-0.0003 es per da 5% if the o	349 x (TF ay Vd,av Iwelling is	FA -13.9 erage = designed i	)2)] + 0.0 (25 x N) to achieve	0013 x ( <sup>-</sup> + 36 a water us	ΓFA -13. se target o	9) 2. 9)	KWh/ye 47 .95	ear:	(42) (43)
4. Water h Assumed o if TFA > if TFA £ Annual ave Reduce the ai not more that	ccupancy, 13.9, $N = 1$ 13.9, $N = 1$ rage hot w nnual average 125 litres per	rgy requ N + 1.76 x ater usag hot water person per	irement: [1 - exp ge in litre usage by r day (all w	(-0.0003 es per da 5% if the d vater use, l	849 x (TF ay Vd,av Iwelling is hot and co	FA -13.9 erage = designed i ld)	)2)] + 0.0 (25 x N) to achieve	0013 x ( <sup>-</sup> + 36 a water us	IFA -13. se target o	9) 9)	kWh/ye 47 .95	ear:	(42) (43)
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the al not more that	ccupancy, 13.9, N = 1 13.9, N = 1 rage hot w nnual average 125 litres per n Feb ge in litres pe	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea	irement: [1 - exp ge in litre usage by r day (all w Apr ach month	(-0.0003 es per da 5% if the d vater use, l May Vd.m = fa	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 2	FA -13.9 erage = designed i Id) Jul Table 1c x	)2)] + 0.0 (25 x N) to achieve Aug (43)	)013 x ( <sup>-</sup> + 36 <sup>a water us</sup> Sep	ΓFA -13. se target o Oct	2. 9) 1 Nov	kWh/ye 47 .95 Dec	ear:	(42) (43)
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the ar not more that	ccupancy, 13.9, N = 1 13.9, N = 1 rage hot w nnual average 125 litres per n Feb ge in litres pe	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea	irement: [1 - exp ge in litre usage by f r day (all w Apr ach month	o(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa	849 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1	FA -13.9 erage = designed i Id) Jul Table 1c x	)2)] + 0.0 (25 x N) to achieve Aug (43)	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep	FFA -13. se target o Oct	9) 9) Nov	KWh/ye 47 .95 Dec	ear:	(42) (43)
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the au not more that Ja Hot water usa (44)m= 102.	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09	(-0.0003 es per da 5% if the o vater use, l May Vd,m = fa 87.37	349 x (TF ay Vd,av <i>twelling is</i> <i>hot and co</i> Jun ctor from 7 83.65	FA -13.9 erage = designed i Id) Jul Table 1c x 83.65	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep 91.09	FFA -13. se target o Oct 94.81	9) 9) Nov 98.52	kWh/ye 47 .95 Dec 102.24	ear:	(42) (43)
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the ai not more that Ua Hot water usa (44)m= 102.	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres pe2498.52nt of hot water	rgy requ N + 1.76 x ater usage hot water person per Mar r day for ea 94.81	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09	(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa 87.37	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r	FA -13.9 erage = designed i ld) Jul Table 1c x 83.65	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep 91.09	FFA -13. se target o Oct 94.81 Total = Su oth (see Ta	9) 9) Nov 98.52 m(44)112 = ables 1b, 1	kWh/ye 47 .95 Dec 102.24 c, 1d)	ear:	(42) (43)
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the air not more that Ua Hot water usa (44)m= 102 Energy conter (45)m= 151.	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52nt of hot water62132.61	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81	irement: [1 - exp ge in litre usage by i r day (all w Apr ach month 91.09	o(-0.0003 5% if the a ster use, I May Vd,m = fa 87.37 onthly = 4.	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78	FA -13.9 erage = designed i Id) Table 1c x 83.65 m x nm x E 91.54	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep 91.09 	TFA -13. se target o Oct 94.81 Total = Su th (see Ta 123.87	2. 9) 92 Nov 98.52 m(44)112 ables 1b, 1 135.22	kWh/ye 47 .95 Dec 102.24 c, 1d) 146.84	ear:	(42) (43)
4. Water h Assumed o if TFA > 1 if TFA £ Annual ave Reduce the ar not more that U Ja Hot water usa (44)m= 102 Energy conter (45)m= 151.	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres pe2498.52at of hot water62132.61us water heat	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no	(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage),	FA -13.9 erage = designed i ld) Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46)	0013 x ( + 36 a water us Sep 91.09 	FFA -13. se target o Oct 94.81 Fotal = Su 123.87 Total = Su	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = m(44) <sub>112</sub> = m(45) <sub>112</sub> =	kWh/ye 47 .95 Dec 102.24 <i>c, 1d)</i> 146.84	ear: 1115.37 1462.43	(42) (43) (44) (45)
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; if TFA £</li> <li>Annual ave Reduce the air not more that</li> <li>Hot water usa</li> <li>(44)m= 102.</li> <li>If instantaneou</li> <li>(46)m= 22.</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52nt of hot water62132.61us water heat7419.89	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81 - used - cal 136.84 ing at point 20.53	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9	(-0.0003 es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17	849 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage), 14.82	FA -13.9 erage = designed i ld) Jul Table 1c x 83.65 m x nm x E 91.54 enter 0 in 13.73	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76	0013 x ( + 36 a water us Sep 91.09 91.09 0 kWh/mor 106.29 	<ul> <li>IFA -13.</li> <li>se target o</li> <li>Oct</li> <li>94.81</li> <li>Fotal = Su</li> <li>123.87</li> <li>Fotal = Su</li> <li>18.58</li> </ul>	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1. 135.22 m(45) <sub>112</sub> = 20.28	kWh/ye 47 .95 Dec 102.24 <i>c, 1d)</i> 146.84 22.03	ear: 1115.37 1462.43	(42) (43) (44) (45) (46)
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; if TFA £</li> <li>Annual averer Reduce the air not more that</li> <li>(44)m= 102</li> <li>Energy conterer</li> <li>(45)m= 151</li> <li>If instantaneous</li> <li>(46)m= 22</li> <li>Water store</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52nt of hot water62132.61us water heat7419.89age loss:	rgy requ N + 1.76 x ater usage hot water person per Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53	irement: [1 - exp ge in litre usage by or r day (all w Apr ach month 91.09 fculated mo 119.3 t of use (no 17.9	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17	A49 x (TF ay Vd,av <i>twelling is</i> <i>hot and co</i> Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage), 14.82	FA -13.9 erage = designed in ld) Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76	)013 x ( + 36 <i>a water us</i> Sep 91.09 <i>kWh/mor</i> 106.29 <i>to</i> (61) 15.94	<ul> <li>IFA -13.</li> <li>se target o</li> <li>Oct</li> <li>94.81</li> <li>Total = Su</li> <li>123.87</li> <li>Total = Su</li> <li>18.58</li> </ul>	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1. 135.22 m(45) <sub>112</sub> = 20.28	kWh/ye	ear: 1115.37 1462.43	(42) (43) (44) (44) (45) (46)
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; if TFA £</li> <li>Annual ave Reduce the annot more that</li> <li>Hot water usa</li> <li>(44)m= 102</li> <li>Energy content</li> <li>(45)m= 151</li> <li>If instantaneous</li> <li>(46)m= 22</li> <li>Water stora</li> <li>Storage vol</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52at of hot water62132.61us water heat7419.89age loss:lume (litres	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81 136.84 ing at point 20.53 ) includir	irement: [1 - exp ge in litre usage by a r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9 ng any so	(-0.0003) es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 1 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS	FA -13.9 erage = designed i di Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa	0013 x ( + 36 a water us Sep 91.09 91.09 0 kWh/mor 106.29 0 to (61) 15.94 ame vess	FFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 sel	2. 9) 92 Nov 98.52 m(44)112 135.22 m(45)112 20.28	kWh/ye 47 .95 Dec 102.24 c, 1d) 146.84 22.03	ear: 1115.37 1462.43	(42) (43) (44) (44) (45) (46) (47)
4. Water h Assumed o if TFA 5 if TFA £ Annual ave Reduce the ar not more that [Ja Hot water usa (44)m= 102. Energy conter (45)m= 151. If instantaneou (46)m= 22. Water stora Storage vol If communi	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per $24$ 98.52nt of hot water $62$ 132.61us water heat $74$ 19.89age loss:lume (litresty heating af no stored	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53 ) includir and no ta	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09 fculated mo 119.3 t of use (no 17.9 ng any so ank in dw	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e	A49 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS onter 110	FA -13.9 erage = designed i d Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage ) litres in	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa (47)	0013 x ( + 36 a water us Sep 91.09 b kWh/mor 106.29 b to (61) 15.94 ame vess	<ul> <li>IFA -13.</li> <li>se target o</li> <li>Oct</li> <li>94.81</li> <li>Total = Su</li> <li>123.87</li> <li>Total = Su</li> <li>18.58</li> <li>sel</li> </ul>	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1. 135.22 m(45) <sub>112</sub> = 20.28	kWh/ye 47 .95 Dec 102.24 <i>c</i> , 1 <i>d</i> ) 146.84 22.03	ear:	(42) (43) (44) (44) (45) (46) (47)
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; if TFA £</li> <li>Annual ave Reduce the annot more that</li> <li>Ida Hot water usa</li> <li>(44)m= 102.</li> <li>Energy content</li> <li>(45)m= 151.</li> <li>If instantaneon</li> <li>(46)m= 22.</li> <li>Water stora</li> <li>Storage vol</li> <li>If communi</li> <li>Otherwise in</li> <li>Water stora</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52at of hot water62132.61us water heat7419.89age loss:lume (litresty heating af no storedage loss:	rgy requ N + 1.76 x ater usag hot water person per Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53 ) includir and no ta hot wate	irement: [1 - exp ge in litre usage by 1 r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9 ng any so ank in dw er (this ir	(-0.0003) es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e ncludes i	349 x (TF ay Vd,av <i>lwelling is</i> <i>hot and co</i> Jun <i>ctor from</i> 83.65 190 x Vd,r 98.78 <i>r storage),</i> 14.82 /WHRS nter 110 nstantar	FA -13.9 erage = designed i ld) Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage litres in neous co	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa (47) ombi boile	0013 x ( <sup>-</sup> + 36 <i>a water us</i> Sep 91.09 91.09 91.09 0 <i>kWh/mor</i> 106.29 0 <i>to</i> (61) 15.94 ame vess ame vess ers) ente	FFA -13. Se target o Oct 94.81 Fotal = Su 123.87 Fotal = Su 18.58 sel er '0' in (	2. 9) 92 Nov 98.52 m(44)112 135.22 m(45)112 20.28	kWh/ye	ear: 1115.37 1462.43	(42) (43) (44) (44) (45) (46) (47)
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; 1 if TFA £</li> <li>Annual averer Reduce the air not more that</li> <li>(44)m= 102</li> <li>Energy conterer</li> <li>(45)m= 151</li> <li>If instantaneon</li> <li>(46)m= 22</li> <li>Water stora</li> <li>Storage vol</li> <li>If communition</li> <li>Otherwise in</li> <li>Water stora</li> <li>a) If manufation</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per $24$ 98.52at of hot water $62$ 132.61us water heat $74$ 19.89age loss:lume (litresty heating af no storedage loss:facturer's d	rgy requ N + 1.76 x ater usage hot water person per Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53 ) includir and no ta hot water eclared I	irement: [1 - exp ge in litre usage by a r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9 ng any so ank in dw er (this ir oss facto	(-0.0003) es per da 5% if the d vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e ncludes i	349 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 r storage), 14.82 /WHRS nter 110 nstantar wn (kWł	FA -13.9 erage = designed i d Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage 0 litres in neous co n/day):	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa (47) ombi boild	0013 x ( + 36 a water us Sep 91.09 	FFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 sel er '0' in (	2. 9) 92 Nov 98.52 m(44)112 = ables 1b, 1 135.22 m(45)112 = 20.28 20.28	kWh/ye	ear: 1115.37 1462.43	<ul> <li>(42)</li> <li>(43)</li> <li>(44)</li> <li>(45)</li> <li>(46)</li> <li>(47)</li> <li>(48)</li> </ul>
<ul> <li>4. Water h</li> <li>Assumed on if TFA &gt; 1 if TFA £</li> <li>Annual averer Reduce the air not more that</li> <li>(44)m= 102.</li> <li>Energy conterer</li> <li>(45)m= 151.</li> <li>If instantaneous</li> <li>(46)m= 22.</li> <li>Water stora</li> <li>Storage vol</li> <li>If communition</li> <li>Otherwise if Water stora</li> <li>a) If manuf</li> </ul>	leating energyccupancy, $13.9, N = 1$ $13.9, N = 1$ $13.9, N = 1$ rage hot wnual average $125$ litres perinFebge in litres per2498.52nt of hot water62132.61us water heat7419.89age loss:lume (litresty heating af no storedage loss:facturer's dre factor from	rgy requ N + 1.76 x ater usage hot water person per- Mar r day for ea 94.81 r used - cal 136.84 ing at point 20.53 ) includir and no ta hot water eclared I pom Table	irement: [1 - exp ge in litre usage by r day (all w Apr ach month 91.09 culated mo 119.3 t of use (no 17.9 ng any so ank in dw er (this in oss facto 2b	(-0.0003) es per da 5% if the o vater use, l May Vd,m = fa 87.37 onthly = 4. 114.47 o hot water 17.17 olar or W velling, e ncludes i	849 x (TF ay Vd,av Iwelling is hot and co Jun ctor from 7 83.65 190 x Vd,r 98.78 98.78 storage), 14.82 /WHRS nter 110 nstantar wn (kWł	FA -13.9 erage = designed i d Jul Table 1c x 83.65 m x nm x D 91.54 enter 0 in 13.73 storage 0 litres in neous co n/day):	)2)] + 0.0 (25 x N) to achieve Aug (43) 87.37 07m / 3600 105.04 boxes (46) 15.76 within sa (47) ombi boild	0013 x ( + 36 a water us Sep 91.09 b kWh/mor 106.29 to (61) 15.94 ame vess ers) ente	FFA -13. se target o Oct 94.81 Total = Su 123.87 Total = Su 18.58 sel er '0' in (	2. 9) 92 Nov 98.52 m(44) <sub>112</sub> = ables 1b, 1. 135.22 m(45) <sub>112</sub> = 20.28 20.28 47) 1 0.	kWh/ye 47 .95 Dec 102.24 <i>c</i> , 1 <i>d</i> ) 146.84 <i>c</i> , 1 <i>d</i> ) 146.84 <i>c</i> , 1 <i>d</i> ) 146.84 <i>c</i> , 1 <i>d</i> )	ear:	<ul> <li>(42)</li> <li>(43)</li> <li>(44)</li> <li>(44)</li> <li>(45)</li> <li>(46)</li> <li>(47)</li> <li>(48)</li> <li>(49)</li> </ul>

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The water storage loss factor from Table 2 (KVIIIIIIIe day) for ommunity heating see section 4.3 Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = $0$ (53) Water storage loss calculated for each month (56)m = (55) x (41)m (56)m = (51) 1 22.68 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 (56) Water storage loss calculated for each month (56)m = (55) x (41)m (56)m = (51) 1 22.68 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 (57) Temperature decicated solar storage, (57)m = (56)m x (50) - (H11) + (50), else (57)m = (56)m where (H11) is from Appendix H (57)m = (25.11 22.68 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 (57) Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)m = (23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 22.51 23.26 (59) Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m (61)m = $0$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
$ \begin{array}{c} \text{(c)} \text{(b)} \\ \text{(b)} \\ \text{(c)} \\ \text{(c)}$
Temperature factor from Table 2b       0       0       (5)         Energy lost from water storage, kWh/year       (47) $\times$ (51) $\times$ (52) $\times$ (53) =       0       (54)         Enter (50) or (54) in (55)       25.11       24.3       25.11       650       x(9)         Viginder contains dedicated soft strage, (57)m = (58)m × (50) - (H11) + (50), else (57)m = (65)m where (H11) is from Appendix H       (57)m       (58)       73.25       21.0       22.65       23.26       22.51       23.26       22.51       23.26       (69)       (69)         Combi loss calculated for each month (61)m = (60) + 365 × (41)m       (61)m       (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m       (62)       (62)m = 0.0       0       0       0       0       0
Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54) Enter (50) or (54) in (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (47) (55) (56) (57) (56) (56) (57) (57) (56) (56) (57) (57) (56) (56) (57) (57) (57) (57) (57) (57) (57) (57
Enter (50) or (54) in (55)       0.81       (55)         Water storage loss calculated for each month       ((56)m = (55) × (41)m       (56)m = (55) × (41)m         (36)m = $25.11$ 22.48       25.11       24.3       25.11       24.3       25.11       24.3       25.11       (56)m + (57)m = (56)m × (150) - (H11) + (50), else (57)m = (56)m where (H11) is from Appendix H       (57)m = $25.11$ 22.68       25.11       24.3       25.11       24.3       25.11       (57)m = (58) × (41)m         (modified by factor from Table 4 5       0       0       0       0       (58)         Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m       (69)m = (22.51       23.26       22.51       23.26       25.51       23.26       (59)         Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m       (61)m = (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Water storage loss calculated for each month       ((56)m = (55) × (41)m         (56)m =       25.11       22.88       25.11       24.3       25.11       26.3       26.51       23.26       22.51       23.26       22.51       23.26       22.51       23.26       25.1       23.26       25.1       23.26       25.1       23.26       25.51       23.26       25.51       23.26       25.51       23.26       25.51       23.26       25.51
(6)m=       25.11       22.68       25.11       24.3
If cylinder contains dedicated solar storage, (57)m = (56)m × ((50) - (H11)) + (50), else (57)m = (56)m where (H11) is from Appendix H (57)m = $25.11$ 22.68 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 24.3 25.11 (57) Primary circuit loss calculated for each month (59)m = (58) + 365 × (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)m = $23.26$ 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 (59) Combi loss calculated for each month (61)m = (60) + 365 × (41)m (61)m = $0$ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Primary circuit loss (annual) from Table 3       0       (58)         Primary circuit loss calculated for each month (59)m = (58) $\div$ 365 x (41)m       (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)       (59)me         (69)me       23.26       21.01       23.26       22.51       23.26       22.51       23.26       22.51       23.26       (59)         Combi loss calculated for each month (61)m = (60) $\div$ 365 x (41)m       (61)m       (61)m       (61)m       (62)m       (61)m       (61)m       (62)m       (61)m       (61)m       (61)m       (61)m       (61)m       (61)m       (62)m       (61)m       (61)m       (62)m       (61)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (62)m       (61)m       (62)m       (62)m       (62)m       (61)m       (62)m       (62)m       (61)m       (62)m       (61)m       (62)m       (61)m       (62)m       (62)m       (61)m       (62)m       (63)m       (63)m       (64)m       (61)m       (61)m<
Primary circuit loss (aintual) non radie 3 (10) Primary circuit loss (aintual) non radie 3 (10) Primary circuit loss calculated for each month (59) m = (58) $\div$ 365 x (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (69) m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 22.51 23.26 (59) Combi loss calculated for each month (61) m = (60) $\div$ 365 x (41) m (61) m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
$ \begin{array}{c} \text{(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)} \\ \text{(59)m} = 23.26 \ 21.01 \ 23.26 \ 22.51 \ 23.26 \$
(59)me       23.26       21.01       23.26       22.51       23.26       23.26       22.51       23.26       22.51       23.26       (59)         Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m       (61)m =       0
Combi loss calculated for each month (61)m = (60) $\div$ 365 x (41)m (61)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Control of the order methan (c) (m = (co) + coc A (m))       (co) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ (62)m = $200$ 176.3 185.21 166.11 162.85 145.59 139.91 153.41 153.1 172.25 182.03 195.21         Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)         (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)       (63)m = $0$
Total float required for which floating calculated for each month (02) in 2 0.05 X (45) in 1 (45) in 1 (55) in 1
(ac), in 2 200       110.0       100.11       102.00       100.01
Colar bit Winput calculated using Appendix 0 of Appendix IT (regarive quality) (effer 0 in to solar contribution to watch neuting)         (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)         (63)m=       0
$\begin{array}{c} (63) \text{m} = & \hline 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 &$
$\begin{array}{c c c c c c c c c c c c c c c c c c c $
Comparison of the state in
$\begin{array}{c c c c c c c c c c c c c c c c c c c $
Heat gains from water heating, kWh/month $0.25 \stackrel{\prime}{} [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$ (65)m=       89.11       79.05       84.2       77.12       76.76       70.29       69.13       73.62       72.79       79.89       82.41       87.52       (65)         include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating       5.       Internal gains (see Table 5 and 5a):         Metabolic gains (Table 5), Watts       Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       123.68
Heat gains from water heating, kwn/month 0.25       [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (57)m + (59)m]         (65)m=       89.11       79.05       84.2       77.12       76.76       70.29       69.13       73.62       72.79       79.89       82.41       87.52       (65)         include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating       5.       Internal gains (see Table 5 and 5a):         Metabolic gains (Table 5), Watts
(65)m=       89.11       79.05       84.2       77.12       76.76       70.29       69.13       73.62       72.79       79.89       82.41       87.52       (65)         include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating       5.       Internal gains (see Table 5 and 5a):         Metabolic gains (Table 5), Watts
Include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating         5. Internal gains (see Table 5 and 5a):         Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       123.68
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec         (66)m=       123.68<
Metabolic gains (Table 5), Watts         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec         (66)m=       123.68
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         123.68
(66)m= 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 123.68 (66)
Lighting gains (calculated in Appendix Legulation L9 or L9a) also see Table 5
(67)m= 19.67 17.47 14.21 10.76 8.04 6.79 7.33 9.53 12.8 16.25 18.96 20.21 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m=         220.63         222.92         217.15         204.87         189.36         174.79         165.06         162.77         168.54         180.82         196.32         210.89         (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 35.37 35.37 35.37 35.37 35.37 35.37 35.37 35.37 (69)
Pumps and fans gains (Table 5a)
(70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (70)
Losses e.g. evaporation (negative values) (Table 5)

Water	heating	g gains (T	able 5)												
(72)m=	119.77	117.63	113.17	107.11	103.17	' <u></u>	97.63	92.92	98.	96 101.1	107.3	7 114.46	117.64		(72)
Total	interna	I gains =					(66)	)m + (67)m	n + (68	3)m + (69)m +	⊦ (70)m +	(71)m + (72)	)m	-	
(73)m=	420.17	418.12	404.63	382.83	360.68	3 3	39.31	325.41	331	.36 342.53	364.5	4 389.85	408.85		(73)
6. So	lar gair	าร:													
Solar (	gains are	calculated u	using solai	r flux from	Table 6a	a anc	l assoc	iated equa	tions	to convert to	the applic	able orientat	tion.		
Orient	ation:	Access F	actor	Area	l		Flu	IX bla 6a		g_ Table 6k	<b>-</b>	FF Table 6c		Gains	
<b>N</b> 1 (1									1		J			( • • • )	
Northe	ast 0.9x	0.54	X	0.	59	X	1	1.28	X	0.5	×	0.7	=	1.13	(75)
Northe	ast 0.9x	0.54	X	0.	59	x		1.28	X	0.5	×	0.7	=	1.13	(75)
Northe	ast 0.9x	0.54	X	0.	59	x	2	22.97	X	0.5	x	0.7	=	2.3	(75)
Northe	ast 0.9x	0.54	×	0.	59	x	2	22.97	X	0.5	x	0.7	=	2.3	(75)
Northe	ast 0.9x	0.54	×	0.	59	x		41.38	X	0.5	×	0.7	=	4.15	(75)
Northe	ast <mark>0.9x</mark>	0.54	×	0.	59	x		41.38	X	0.5	x	0.7	=	4.15	(75)
Northe	ast 0.9x	0.54	x	0.	59	x	6	67.96	X	0.5	x	0.7	=	6.82	(75)
Northe	ast 0.9x	0.54	x	0.	59	x	6	67.96	x	0.5	×	0.7	=	6.82	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	9	91.35	x	0.5	x	0.7	=	9.17	(75)
Northe	ast <mark>0.9x</mark>	0.54	X	0.	59	x	ę	91.35	x	0.5	x	0.7	=	9.17	(75)
Northe	ast <mark>0.9x</mark>	0.54	X	0.	59	x	6	97.38	x	0.5	x	0.7	=	9.77	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	9	97.38	x	0.5	x	0.7	=	9.77	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		91.1	x	0.5	x	0.7	=	9.14	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		91.1	x	0.5	x	0.7	=	9.14	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	7	72.63	x	0.5	x	0.7	=	7.29	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	7	72.63	x	0.5	x	0.7	=	7.29	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	5	50.42	x	0.5	x	0.7	=	5.06	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	5	50.42	x	0.5	x	0.7	=	5.06	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	2	28.07	x	0.5	x	0.7	=	2.82	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x	2	28.07	x	0.5	x	0.7	=	2.82	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		14.2	x	0.5	x	0.7	=	1.42	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		14.2	x	0.5	x	0.7	=	1.42	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		9.21	x	0.5	x	0.7	=	0.92	(75)
Northe	ast <mark>0.9x</mark>	0.54	x	0.	59	x		9.21	x	0.5	x	0.7	=	0.92	(75)
Southe	ast <mark>0.9x</mark>	0.77	x	3.	68	x	3	36.79	x	0.5	x	0.7	=	32.84	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	1.:	38	x	3	36.79	x	0.5	x	0.7	=	12.32	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	0.	75	x	3	36.79	x	0.5	x	0.7	=	6.69	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	3.	68	x	6	62.67	x	0.5	x	0.7	=	55.94	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	1.5	38	x	6	62.67	x	0.5	x	0.7	=	20.98	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	0.	75	x	6	62.67	x	0.5	x	0.7	=	11.4	(77)
Southe	ast <mark>0.9x</mark>	0.77	x	3.	68	x		35.75	x	0.5	x	0.7	=	76.54	(77)
Southe	ast <mark>0.9x</mark>	0.77	×	1.5	38	x	6	35.75	x	0.5	x	0.7		28.7	(77)

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Southeast 0.9x	0.77	x	0.75	x	85.75	x	0.5	x	0.7	] =	15.6	(77)
Southeast 0.9x	0.77	x	3.68	x	106.25	x	0.5	x	0.7	i =	94.84	<b>-</b> (77)
Southeast 0.9x	0.77	x	1.38	x	106.25	x	0.5	x	0.7	i =	35.56	- (77)
Southeast 0.9x	0.77	x	0.75	x	106.25	x	0.5	x	0.7	<b>i</b> =	19.33	_ ](77)
Southeast 0.9x	0.77	x	3.68	x	119.01	x	0.5	x	0.7	<b>j</b> =	106.23	-  (77)
Southeast 0.9x	0.77	x	1.38	x	119.01	x	0.5	x	0.7	] =	39.84	(77)
Southeast 0.9x	0.77	x	0.75	×	119.01	<b>x</b>	0.5	x	0.7	] =	21.65	(77)
Southeast 0.9x	0.77	x	3.68	x	118.15	x	0.5	x	0.7	] =	105.46	(77)
Southeast 0.9x	0.77	x	1.38	x	118.15	x	0.5	x	0.7	=	39.55	(77)
Southeast 0.9x	0.77	x	0.75	x	118.15	x	0.5	x	0.7	=	21.49	(77)
Southeast 0.9x	0.77	x	3.68	x	113.91	x	0.5	x	0.7	=	101.67	(77)
Southeast 0.9x	0.77	x	1.38	x	113.91	x	0.5	x	0.7	=	38.13	(77)
Southeast 0.9x	0.77	x	0.75	x	113.91	x	0.5	x	0.7	=	20.72	(77)
Southeast 0.9x	0.77	x	3.68	x	104.39	x	0.5	x	0.7	=	93.18	(77)
Southeast 0.9x	0.77	x	1.38	x	104.39	x	0.5	x	0.7	=	34.94	(77)
Southeast 0.9x	0.77	x	0.75	x	104.39	<b>x</b>	0.5	x	0.7	] =	18.99	(77)
Southeast 0.9x	0.77	x	3.68	x	92.85	x	0.5	x	0.7	=	82.88	(77)
Southeast 0.9x	0.77	x	1.38	x	92.85	x	0.5	x	0.7	=	31.08	(77)
Southeast 0.9x	0.77	x	0.75	x	92.85	x	0.5	x	0.7	=	16.89	(77)
Southeast 0.9x	0.77	x	3.68	x	69.27	x	0.5	x	0.7	=	61.83	(77)
Southeast 0.9x	0.77	x	1.38	x	69.27	x	0.5	x	0.7	=	23.19	(77)
Southeast 0.9x	0.77	x	0.75	x	69.27	<b>x</b>	0.5	x	0.7	] =	12.6	(77)
Southeast 0.9x	0.77	x	3.68	x	44.07	x	0.5	x	0.7	=	39.34	(77)
Southeast 0.9x	0.77	x	1.38	x	44.07	x	0.5	x	0.7	=	14.75	(77)
Southeast 0.9x	0.77	x	0.75	x	44.07	x	0.5	x	0.7	] =	8.02	(77)
Southeast 0.9x	0.77	x	3.68	x	31.49	x	0.5	x	0.7	] =	28.11	(77)
Southeast 0.9x	0.77	x	1.38	x	31.49	x	0.5	x	0.7	] =	10.54	(77)
Southeast 0.9x	0.77	x	0.75	x	31.49	x	0.5	x	0.7	] =	5.73	(77)
Northwest 0.9x	0.77	x	7.35	x	11.28	x	0.5	x	0.7	=	20.11	(81)
Northwest 0.9x	0.77	x	1.67	x	11.28	x	0.5	x	0.7	] =	4.57	(81)
Northwest 0.9x	0.77	x	7.35	x	22.97	x	0.5	x	0.7	] =	40.94	(81)
Northwest 0.9x	0.77	x	1.67	x	22.97	x	0.5	x	0.7	] =	9.3	(81)
Northwest 0.9x	0.77	x	7.35	x	41.38	x	0.5	x	0.7	] =	73.77	(81)
Northwest 0.9x	0.77	x	1.67	x	41.38	x	0.5	x	0.7	] =	16.76	(81)
Northwest 0.9x	0.77	x	7.35	x	67.96	x	0.5	x	0.7	=	121.15	(81)
Northwest 0.9x	0.77	x	1.67	x	67.96	x	0.5	x	0.7	] =	27.53	(81)
Northwest 0.9x	0.77	x	7.35	x	91.35	x	0.5	x	0.7	=	162.85	(81)
Northwest 0.9x	0.77	x	1.67	×	91.35	x	0.5	×	0.7	] =	37	(81)
Northwest 0.9x	0.77	x	7.35	x	97.38	x	0.5	x	0.7	=	173.61	(81)
Northwest 0.9x	0.77	x	1.67	x	97.38	x	0.5	x	0.7	=	39.45	(81)
Northwest 0.9x	0.77	x	7.35	x	91.1	x	0.5	x	0.7	=	162.41	(81)

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Northwest 0.9x	0.77	x	1.67	x	91.1	x	0.5	x	0.7	=	36.9	(81)
Northwest 0.9x	0.77	x	7.35	x	72.63	x	0.5	×	0.7	=	129.48	(81)
Northwest 0.9x	0.77	x	1.67	x	72.63	x	0.5	×	0.7	] =	29.42	(81)
Northwest 0.9x	0.77	×	7.35	x	50.42	x	0.5	x	0.7	=	89.89	(81)
Northwest 0.9x	0.77	x	1.67	x	50.42	x	0.5	×	0.7	=	20.42	(81)
Northwest 0.9x	0.77	x	7.35	x	28.07	x	0.5	×	0.7	] =	50.04	(81)
Northwest 0.9x	0.77	x	1.67	x	28.07	×	0.5	×	0.7	] =	11.37	(81)
Northwest 0.9x	0.77	x	7.35	x	14.2	x	0.5	x	0.7	] =	25.31	(81)
Northwest 0.9x	0.77	x	1.67	x	14.2	x	0.5	x	0.7	] =	5.75	(81)
Northwest 0.9x	0.77	x	7.35	x	9.21	x	0.5	x	0.7	=	16.43	(81)
Northwest 0.9x	0.77	x	1.67	x	9.21	x	0.5	x	0.7	] =	3.73	(81)
Rooflights 0.9x	1	x	0.77	x	20.97	x	0.57	x	0.7	=	5.8	(82)
Rooflights 0.9x	1	x	0.77	x	20.97	x	0.57	x	0.7	] =	5.8	(82)
Rooflights 0.9x	1	x	0.77	x	20.97	x	0.57	×	0.7	=	5.8	(82)
Rooflights 0.9x	1	x	0.77	x	44.3	x	0.57	x	0.7	=	12.25	(82)
Rooflights 0.9x	1	x	0.77	x	44.3	x	0.57	x	0.7	=	12.25	(82)
Rooflights 0.9x	1	x	0.77	x	44.3	x	0.57	x	0.7	=	12.25	(82)
Rooflights 0.9x	1	x	0.77	x	82.04	x	0.57	x	0.7	=	22.68	(82)
Rooflights 0.9x	1	x	0.77	x	82.04	x	0.57	x	0.7	=	22.68	(82)
Rooflights 0.9x	1	x	0.77	x	82.04	x	0.57	x	0.7	=	22.68	(82)
Rooflights 0.9x	1	x	0.77	x	135.32	x	0.57	×	0.7	=	37.42	(82)
Rooflights 0.9x	1	x	0.77	x	135.32	x	0.57	x	0.7	=	37.42	(82)
Rooflights 0.9x	1	x	0.77	x	135.32	x	0.57	x	0.7	=	37.42	(82)
Rooflights 0.9x	1	x	0.77	x	180.7	x	0.57	x	0.7	] =	49.96	(82)
Rooflights 0.9x	1	x	0.77	x	180.7	x	0.57	×	0.7	] =	49.96	(82)
Rooflights 0.9x	1	x	0.77	x	180.7	x	0.57	x	0.7	=	49.96	(82)
Rooflights 0.9x	1	x	0.77	x	191.77	x	0.57	×	0.7	] =	53.03	(82)
Rooflights 0.9x	1	x	0.77	x	191.77	x	0.57	x	0.7	] =	53.03	(82)
Rooflights 0.9x	1	x	0.77	x	191.77	x	0.57	x	0.7	=	53.03	(82)
Rooflights 0.9x	1	x	0.77	x	179.76	x	0.57	×	0.7	=	49.71	(82)
Rooflights 0.9x	1	x	0.77	x	179.76	x	0.57	x	0.7	=	49.71	(82)
Rooflights 0.9x	1	x	0.77	x	179.76	x	0.57	x	0.7	=	49.71	(82)
Rooflights 0.9x	1	x	0.77	x	144.31	x	0.57	×	0.7	=	39.9	(82)
Rooflights 0.9x	1	x	0.77	x	144.31	x	0.57	×	0.7	=	39.9	(82)
Rooflights 0.9x	1	x	0.77	x	144.31	x	0.57	×	0.7	] =	39.9	(82)
Rooflights 0.9x	1	x	0.77	x	100.39	x	0.57	x	0.7	=	27.76	(82)
Rooflights 0.9x	1	x	0.77	x	100.39	x	0.57	×	0.7	=	27.76	(82)
Rooflights 0.9x	1	x	0.77	×	100.39	x	0.57	×	0.7	=	27.76	(82)
Rooflights 0.9x	1	x	0.77	×	54.87	x	0.57	x	0.7	=	15.17	(82)
Rooflights 0.9x	1	x	0.77	×	54.87	x	0.57	×	0.7	=	15.17	(82)
Rooflights 0.9x	1	x	0.77	x	54.87	x	0.57	x	0.7	=	15.17	(82)

Rooflig	hts <mark>0.9x</mark>	1		x	0.7	7	x	2	26.72	x		0.57	x	0.7		= [	7.39	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x	2	26.72	x		0.57		0.7		= [	7.39	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x	2	26.72	x		0.57		0.7		= [	7.39	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x		16.9	x		0.57		0.7		= [	4.67	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x		16.9	] ×		0.57	- ×	0.7		= [	4.67	(82)
Rooflig	hts 0.9x	1		x	0.7	7	x		16.9	] ×		0.57	×	0.7		= [	4.67	(82)
	L									3						L		
Solar g	gains in	watts, ca	alculat	ted	for eacl	n mont	h			(83)m	ו = S	um(74)m .	(82)m		-			
(83)m=	96.2	179.93	287.7	'3	424.3	535.78	5	58.18	527.24	440	.29	334.55	210.17	118.18	80.4			(83)
Total g	jains – i	nternal a	and so	lar	(84)m =	- (73)m	+ (	83)m	, watts									
(84)m=	516.37	598.05	692.3	6	807.13	896.46	8	97.49	852.65	771	.64	677.09	574.71	508.02	489.2	25		(84)
7. Me	an inter	nal temp	peratu	re (	heating	seaso	n)											
Temp	erature	during h	neating	g pe	eriods ir	the liv	ving	area	from Tab	ble 9	, Th	1 (°C)				[	21	(85)
Utilisa	ation fac	ctor for g	ains fo	or li	ving are	ea, h1,r	n (s	ee Ta	ble 9a)									
	Jan	Feb	Ma	r	Apr	May	,	Jun	Jul	A	ug	Sep	Oct	Nov	De	с		
(86)m=	0.72	0.68	0.62	2	0.54	0.44		0.35	0.28	0.3	31	0.44	0.58	0.68	0.73			(86)
Mean	interna	l temper	ature	in li	iving are	ea T1 (	follc	w ste	ps 3 to 7	7 in T	able	e 9c)						
(87)m=	17.22	17.53	18.1	1	18.83	19.57	2	20.13	20.43	20.	37	, 19.88	18.99	17.94	17.1	5		(87)
Tomr		durina h			ariode in	rest o	f dw	olling	i from Ta		а ті	רי רייר						
(88)m=	20.1	20.1	20.1	μ 1	20.12	20.12		20.13	20.13	20.	13	20.12	20.12	20.11	20.1	1		(88)
				<u> </u>				,										
Utilisa	ation fac	tor for g	ains fo	or re	est of d	velling	, h2 T	,m (se		9a)	7	0.44	0.50	0.67	0.70			(80)
(09)11=	0.71	0.07	0.01		0.52	0.42		0.32	0.24	0.2	27	0.41	0.56	0.07	0.72			(03)
Mean	interna	l temper	ature	in t	he rest	of dwel	lling	T2 (f	ollow ste	eps 3	to 7	7 in Tabl	e 9c)		. <u> </u>			
(90)m=	15.29	15.71	16.4	8	17.48	18.41	1	9.14	19.51	19.	45	18.86	17.68	16.32	15.2	-		(90)
												Ť	LA = LIV	ing area ÷ (·	4) =		0.14	(91)
Mean	interna	l temper	ature	(for	the wh	ole dw	ellin	g) = f	LA x T1	+ (1	– fL	A) × T2						
(92)m=	15.55	15.96	16.7	,	17.67	18.57	1	9.28	19.64	19.	58	19	17.86	16.54	15.47	7		(92)
Apply	v adjustr	nent to t	he me	an	internal	tempe	ratu	ire fro	m Table	e 4e,	whe	ere appro	opriate					
(93)m=	15.55	15.96	16.7	,	17.67	18.57		9.28	19.64	19.	58	19	17.86	16.54	15.47	7		(93)
8. Sp	ace hea	ting req	uireme	ent										(70)				
Set I	i to the tilisation	mean inf	ernal or gair	tem	iperatur Ising Ta	e obtai ble 9a	inec	l at ste	ep 11 of	labi	le 9t	o, so tha	t II,m=	:(76)m an	d re-c	alc	ulate	
	Jan	Feb	Ma		Apr	Mav	,	Jun	Jul	A	ua	Sep	Oct	Nov	De	с		
Utilisa	ation fac	tor for g	ains, ł	<u>.</u> nm:	7.01	may	_	oun	- oui		u.g	000	000			<u> </u>		
(94)m=	0.63	0.59	0.54		0.46	0.37		0.28	0.21	0.2	24	0.36	0.49	0.59	0.64			(94)
Usefu	ul gains,	hmGm	, W =	(94	)m x (84	4)m								_!				
(95)m=	326.48	354.48	371.3	31	368.79	333.27	2	55.09	182.15	183	.99	241.57	283.76	300.14	314.3	88		(95)
Mont	hly aver	age exte	ernal te	emp	perature	from T	Fabl	e 8						-				
(96)m=	4.3	4.9	6.5		8.9	11.7		14.6	16.6	16	.4	14.1	10.6	7.1	4.2			(96)
Heat	loss rat	e for me	an inte	erna	al tempe	erature	, Lm	1,W =	=[(39)m	x [(9	3)m	– (96)m	]					
(97)m=	887.79	870.36	800.7	3	679.06	530.47	3	56.39	231.63	241	.59	375.57	560.52	733.5	879.6	51		(97)
Space	e heatin	g require	ement	for	each m	nonth, k	w۲ ۲	/mon	th = 0.02	24 x   1	[(97)	)m – (95	)m] x (	41)m				
(98)m=	417.61	346.67	319.4	9	223.39	146.72		0	0		)	0	205.91	312.01	420.5	3		

Total per year (kWh/year) = Sum(98) <sub>159</sub>											8)15,912 =	2392.35	(98)	
Space heating requirement in kWh/m²/year											29.69	(99)		
9a. En	ergy req	uiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Spac	e heatin	g:			, .							I		
Fract	on of sp	ace hea	at from s	econdar	y/supple	mentary	system	(202) 1	(201)				0	(201)
Fract	on of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	-(201) =	(000)]			1	(202)
Efficiency of main space heating system 1 $(204) = (202) \times [1 - (203)] =$													1	(204)
Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system %													193.81	(206)
Efficiency of secondary/supplementary heating system, %													0	(208)
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Description											Dec	kWh/yea	ar	
Space	417.61	346.67	319.49	223.39	146.72	0	0	0	0	205.91	312.01	420.53		
(211)m		m x (20	$\frac{1}{1}$	$1 \rightarrow (20)$	)6)		-	-						(211)
(211)11	215.48	178.87	164.85	115.26	75.7	0	0	0	0	106.24	160.99	216.98		(211)
215.48 178.87 164.85 115.26 75.7 0 0 0 0 106.24 160.99 216.98 Total (kWh/year) =Sum(211) <sub>151012</sub> =												1234.38	(211)	
Space	e heating	g fuel (s	econdar	y), kWh/	month							I		_
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		-
								lota	ii (kvvn/yea	ar) = Sum(2)	215) <sub>15,1012</sub>	<u>,</u>	0	(215)
Output	from wa	ater hea	ter (calc	ulated a	hove)									
Output	200	176.3	185.21	166.11	162.85	145.59	139.91	153.41	153.1	172.25	182.03	195.21		
Efficie	ncy of wa	ater hea	ter										282.62	(216)
(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62		(217)
Fuel fo	or water l	neating,	kWh/m	onth										
(219)m (219)m=	1 = (64)	<u>n x 100</u> 62.38	$5 \div (217)$ 65.53	58.78	57.62	51.51	49.5	54.28	54.17	60.95	64.41	69.07		
								Tota	I = Sum(2	19a) <sub>112</sub> =			718.97	(219)
Annua	I totals									k	Wh/year		kWh/year	
Space	heating	fuel use	ed, main	system	1								1234.38	]
Water	heating	fuel use	ed										718.97	]
Electri	city for p	umps, f	ans and	electric	keep-ho	t								_
mech	anical ve	entilatio	n - balar	nced, ext	ract or p	ositive i	nput fror	n outside	e			165.95		(230a)
Total e	electricity	for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			165.95	(231)
Electri	city for lig	ghting											347.33	(232)
Electricity generated by PVs											-746.97	(233)		
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =											1719.65	(338)		
12a. (	CO2 emi	issions ·	– Individ	ual heati	ing syste	ems inclu	uding mi	cro-CHF	)					_
						En kW	ergy /h/vear			Emiss ka CO	<b>ion fac</b> 2/kWh	tor	Emissions	ar

Space heating (main system 1)	(211) x	0.519	=	640.64	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	373.14	(264)
Space and water heating	(261) + (262) + (263) + (264	4) =		1013.79	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	86.13	(267)
Electricity for lighting	(232) x	0.519	=	180.27	(268)
Energy saving/generation technologies		0.510	=	207.69	
		0.519		-367.06	(209)
Total CO2, kg/year		sum of (265)(271) =		892.5	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		11.08	(273)
EI rating (section 14)				90	(274)



### Part G Compliance Report

#### **PROJECT DETAILS**

Project Reference: RS1745 Client: Property: 10a Havelock Road Cowley Oxford OX4 3EP

Local Authority: Agent:

Assessor:	Natalie Wheeler
Address:	RS Energy
Contact:	info@rsenergy.co.uk
Software:	G-Calc 2015 version 3.0.2
Prepared on:	13-Dec-22

#### **RESULT SUMMARY**

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 2 bed dwelling, as designed, achieves a water consumption of 109.1 litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Wa	ater Calculator	for New	Dwelling	5	-
Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)		4.42	0.00	0
WC(dual flush)	Full flush vol.	4	1.46	0.00	5.84
	Part flush vol.	2.6	2.96	0.00	7.7
WC(multiple fittings)	Average effective Flush vol. (litres)		4.42	0.00	0
Taps(excl. Kitchen)	Flow rate (litres/min)	5	1.58	1.58	9.48
Bath (shower also present)	Capacity to overflow (litres)	170	0.11	0.00	18.7
Shower (bath also present)	Flow rate (litres/min)	8	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)	0	0.50	0.00	0
Shower only	Flow rate (litres/minute)	0	5.6	0.00	0
Kitchen sink taps	Flow rate (litres/minute)	6	0.44	10.36	13
Washing Machine	litres/kg	8 17	2.1	0.0	17.16
Dishwasher	litres/place	1 25	2.1	0.0	4.5
Waste disposal	litrog/ugo	1.25	2.00	0.0	2.00
Water softener	litres/person/day	1	3.08	0.0	3.08
		0 Total calc	1.0 culated use	0.0	0
		(litres/pei Contribut	rson/day) ion from grey	water	114.42
		(litres/per Contribut	rson/day) ion from rain	water	-
		(litres/per	rson/day)		-
	-	Normalisa Total Wor	ation factor	ion Codo	0.91
		for Sustai (litres/per	nable Homes son/dav)		104.1
		External	water use		5.0
		Total Wat (litres/pei	ter Consumpt rson/day)	ion. (36(1))	109.1

Summary of fitting types "As Designed"											
Туре	Description	Flow rates, volumes etc.	Qty								
Taps	ТВС	5 litres/min	1								
Baths		170 litres to overflow	1								
Dishwashers	ТВС	1.25 litres/place	1								
Washing Machines	ТВС	8.17 litres/kg	1								
Showers	ТВС	8 litres/min	1								
WC's	ТВС	4 / 2.6 litres flush vols.	1								
Kitchen/Utility taps	TBC	6 litres/min	1								

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer (). The completed table should be returned to the assessor: Natalie Wheeler (Contact: info@rsenergy.co.uk).

Declaration of fitting types "As Built"											
Туре	Make and Model	Flow rates, volumes etc.	Qty								
Taps											
Baths											
Dishwashers											
Washing Machines											
Showers											
WC's											
Kitchen/Utility taps											

Project ref: RS1745 - 10a Havelock Road

The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

Signature: ..... Date: ..... Name: .....

-----End of Report-----



Oxford OX4 3EP

## DER WORKSHEET

Dwelling Reference: Dwelling Type: 10a Havelock Road RS1745 New Dwelling Design Stage

1	Overall	dwelling	dimensions

	Area(m²)	Av. Height(m)		Volume(m³)	
Basement Ground Floor Total floor area TFA Dwelling volume	45.92 ( 1a) 34.65 ( 1b)	) x 2.3 ) x 2.56	(2a) = (2b) =	105.62 88.7 80.57 194.32	( 3a) ( 3b) ( 4) ( 5)
2. Ventilation Rate					
Chimneys/Flues	0	v 80 -		0	(62)
Onen chimneys	0	x 20 -		0	(66)
Chimneys / flues attached to closed fire	0	x 20 =		0	(00)
Elues attached to solid fuel boiler	0	x 10 -		0	(0C)
Flues attached to other heater	0	x 20 =		0	(60)
Number of blocked chimpour	0	x 35 =		0	(66)
Number of blocked clinineys	0	x 20 =		0	(6†)
Number of intermittent extract rans	3	x 10 =		30	(7a)
Number of passive vents	0	x 10 =		0	(7b)
Number of flueless gas fires	0	x 40 =		0	(7c)
		Air changes pe	er hour		
Number of storeys in the dwelling (ns)			0.15	0.15	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc			0	0	(9)
Additional infiltration			0	0	(10)
Structural infiltration			0	0	(11)
Suspended wooden ground floor			0	0	(12)
No draught lobby			0	0	(13)
Window infiltration			0	0	(14)
			0	0	(15)
Air permeability value AP50 $(m^3/h/m^2)$			0	0	(15) (17)
Air permeability value, AP4, (m <sup>3</sup> /h/m <sup>2</sup> )			5 0	3	(17) (17)
Air permeability value)			03	03	(12) (12)
Number of sides on which dwelling is sheltered			2	2	(19)





Shelter fa Infiltratio Infiltratio	actor on rate inc on rate m	corporati odified fo	ing shelte or month	er factor ly wind sp	beed								0.85 0.26	(20) (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Monthly	Vonthly average wind speed from Table U2													
Wind Fac	5.1 ctor	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Adjusted	1.28 infiltratio	1.25 on rate (a	1.23 allowing f	1.1 or shelte	1.08 r and wir	0.95 nd speed)	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Calculate	0.33 e effective	0.32 e air chan	0.32 Ige rate fo	0.28 or the app	0.28 olicable c	0.25 ase:	0.25	0.24	0.26	0.28	0.29	0.3	3.4	(22b)
a) If bala	nced mec	chanical v	ventilatio	n with he	at recove	ery (MVH	R)						0.5 0.5 46.5	(23a) (23b) (23c)
b) If bala	0.6 nced med	0.59 chanical v	0.58 /entilatio	0.55 n without	0.55 t heat red	0.51 covery (N	0.51 1V)	0.51	0.53	0.55	0.56	0.57		(24a)
c) lf who	0 le house e	0 extract ve	0 entilation	0 or positi	0 ve input	0 ventilatio	0 on from o	0 outside	0	0	0	0		(24b)
d) lf natu	0 Iral ventil	0 ation or v	0 whole ho	0 use positi	0 ive input	0 ventilati	0 on from l	0 oft	0	0	0	0		(24c)
Effective	0 air chang	0 ge rate	0	0	0	0	0	0	0	0	0	0		(24d)
Effective	0.6 air chang	0.59 ge rate fro	0.58 om PCDB	0.55 :	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(25)
	0.6	0.59	0.58	0.55	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(25)

#### 3. Heat losses and heat loss parameter

#### Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k -value

		-	-		-			
ELEMENT Solid door	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A 2.07 k	X k J/K <sub>(26)</sub>
Semi-glazed door							2.07	(26a)
Window							18.33	(27)
Roof window							2.65	(27a)
Basement floor				0			0	(28)
Ground floor				0			5.05	(28a)
Exposed floor				0			0	(28b)
Basement wall				0			0	(29)
External wall				0			12.75	(29a)





Roof							0					4.71	(30)
Total area of	external ele	ments ∑A	, m²									188.82	(31)
Party Wall												0	(32)
Party floor												0	(32a)
Party ceiling												0	(32b)
Internal wall	**											0	(33c)
Internal floor												0	(32d)
Internal ceilin	ng floor											0	(32e)
Fabric heat lo	oss, W/K = ∑	(A x U)										45.56	(33)
Heat capacity	eat capacity $Cm = \sum (A \times K)$												
Thermal mas	hermal mass parameter (TMP = Cm ÷ TFA) in kJ/m <sup>2</sup> K												
Linear Therm	inear Thermal bridges: $\sum$ (L x $\Psi$ ) calculated using Appendix K												
Point Therma	point Thermal bridges: $\sum \chi$ (W/K) if significant point thermal bridge present and values available												
Total fabric h	otal fabric heat loss H = $\Sigma(A \times U) + \Sigma(L \times \Psi) + \Sigma\chi$												
Ventilation h	eat loss calc	ulated mo	nthly										
38. Heat transfei	31 37.89 coefficient,	37.48 W/K	35.4	34.99	32.92	32.92	32.5	33.74	34.99	35.82	36.65		(38)
99. Heat loss par	78 99.37 ameter (HLP	98.95 9), W/m²K	96.88	96.46	94.39	94.39	93.98	95.22	96.46	97.29	98.12		(39)
1.2	/ 1.72	1 7 2	1 2	1 2	1 17	1 17	1 17	1 1 2	1 2	1 21	1 22		(40)
Number of d	ays in month	n (Table 1a	a)	1.2	1.17	1.17	1.1/	1.10	1.2	1.21	1.22		(10)
31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water	heating ene	ergy requ	irement										
Assumed occ	upancy, N											2.47	(42)
Hot water us	age in litres	per day fo	or mixer s	howers, \	/d,showe	er (from A	Appendix	l)					( )
90. Hot water us	33 88.97 age in litres	86.99 per day fo	83.21 or baths, \	80.42 /d,bath (1	77.3 From App	75.53 endix J)	77.49	79.65	82.99	86.86	89.98		(42a)
28.	37 27.95	27.36	26.26	25.45	24.54	24.05	24.64	25.28	26.25	27.37	28.28		(42b)
Hot water us	age in litres	per day fo	r other u	ses, Vd,o	ther (froi	m Append	(L xib						
39.	96 38.51	37.06	35.6	34.15	32.7	32.7	34.15	35.6	37.06	38.51	39.96		(42c)
Annual avera	ige hot wate	r usage in	litres per	day Vd,a	iverage (	from App	endix J)					146.15	(43)
Hot water us	age in litres	per day fo	r each m	onth Vd,ı	n = (42a)	+ (42b) +	+ (42c)						
158 Energy conte	8.66 155.43 Int of hot wa	3 151.41 iter used =	145.08 • <b>4.18 x V</b>	140.01 d,m x nm	134.53 x DTm /	132.27 3600 kW	136.28 h/month	140.52 (from Ap	146.29 opendix J	152.73 )	158.22	1751.45	(44)
25: Distribution l	1.29 221.33 oss (46) = 0.	3 232.71 15 x (45)	198.6	188.48	165.43	159.97	168.74	173.28	198.52	217.59	247.74	2423.68	(45)
27	60 22 2	2/ 01	20 70	28 27	2/1 Q1	24	25 21	25.00	20 70	2761	27 16		(46)

 37.69
 33.2
 34.91
 29.79
 28.27
 24.81
 24
 25.31
 25.99
 29.78
 32.64
 37.16
 (46)

 Storage volume (litres) including any solar or WWHRS storage within same vessel
 150
 (47)

 Water storage loss (or HIU loss)
 150
 150
 (47)





+0)
19)
50)
51)
52)
53)
54)
55)
56)
>
»/)
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59)
51)
/_/
52)
,
53a)
53b)
53c)
53d)
54)
5/12)
,-+a)
55)

#### 5. Internal gains (see Tables 5 and 5a)

Metabolic gains (Table 5), watts

148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42

(66)



Page 4



Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5

Appliance	26.58 es gains (	23.61 calculate	19.2 d in Appe	14.54 endix L, e	10.87 quation l	9.17 .16 or L10	9.91 5a), also s	12.88 see Table	17.29 5	21.96	25.63	27.32	(67)
Cooking (	329.3 gains (cal	332.71 culated ii	324.1 n Appenc	305.77 lix L, equa	282.63 ation L18	260.88 or L18a)	246.35 , also see	242.93 Table 5	251.55	269.88	293.02	314.77	(68)
Pumps ar	52.32 nd fans ga	52.32 ains (Tab	52.32 le 5a)	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	(69)
Losses e.	0 g. evapor	0 ation (ne	0 egative va	0 ilues) (Ta	0 ble 5	0	0	0	0	0	0	0	(70)
Water he	-98.94 eating gai	-98.94 ns (Table	-98.94 5)	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	(71)
Total inte	174.94 ernal gain	172.15 s	166.63	154.35	146.87	139.03	134.13	138.05	142.66	151.35	163.12	173.35	(72)
	632.6	630.25	611.72	576.44	542.15	510.87	492.18	495.65	513.28	544.97	583.55	617.22	(73)

6. Solar gains

Solar gains in watts, calculated for each month													
	107.23	199.97	318.49	467.99	589.81	614.05	580.17	485.17	369.73	233.22	131.62	89.69	(83)
Total gain	s – inter	nal and s	olar (wat	ts)									
	739.83	830.23	930.21	1044.43	1131.96	1124.92	1072.35	980.82	883.01	778.2	715.17	706.91	(84)

7. Me	an inter	nal tem	perature	e (heatin	g seasor	ו)								
Tempera Utilisatic	ature duri on factor	ing heatiı for gains	ng period for living	ls in the l area, 🛙 1	iving area ,m (see T	a from Ta able 9a)	ible 9, Th	1 (°C)					21	(85)
Mean int	0.99 ternal ter	0.98 nperatur	0.95 e in living	0.87 g area T1	0.72 (follow s	0.53 teps 3 ar	0.39 nd 4 in Ta	0.44 ble 9c)	0.69	0.92	0.98	0.99		(86)
Tempera	20.5 ature duri	20.16 ing heatii	20.39 ng period	20.68 Is in rest	20.86 of dwellii	20.92 ng from 1	20.94 Table 9, T	20.93 h <b>2 (°C)</b>	20.89	20.65	20.29	20.14		(87)
Roof	19.89	19.89	19.9	19.92 ເ	19.92 Jtilisatior	19.94 n factor f	19.94 or gains f	19.95 or rest of	19.93 f dwelling	19.92 g, ⊡2,m (s	19.91 ee Table	19.91 9a)		(88)
Roof	0.98	0.97	0.94	0.84	0.66 Me	0.44 ean interr	0.29 nal tempe	0.34 erature ir	0.6 the rest	0.88 of dwell	0.97 ing T2	0.99		(89)
Living ar	19.44 ea fractic	18.95 on	19.24	19.59	19.78	19.86	19.86	19.87	19.83	19.57	19.13	18.96	0.14	(90) (91)
Mean int	ternal ter	mperatur	e (for the	e whole d	lwelling)									
Adjusted	19.58 I mean in	19.11 Iternal te	19.4 mperatu	19.74 re:	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12		(92)
	19.58	19.11	19.4	19.74	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12		(93)

8. Space heating requirement







Utilisation factor for gains,

Useful ga	0.98 nins, mGn	0.97 n,W	0.93	0.83	0.66	0.45	0.3	0.34	0.61	0.88	0.96	0.98		(94)
Monthly	727.26 average e	801.5 external t	863.68 emperat	868.27 ure from	745.43 Table U1	504.23	321.09	338.2	535.73	681.76	689.18	695.67		(95)
Heat loss	4.3 rate for	4.9 mean int	6.5 ernal tem	8.9 nperature	11.7 e	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Space he	1525.07 ating req	1412.31 uirement	1276.25 for each	1050.18 month	793.52	509.82	321.67	339.34	558.93	879.59	1185.87	1464.34		(97)
Solar spa	593.57 ce heatin	410.47 Ig calcula	306.95 ted using	130.97 Appendi	35.78 ix H (nega	0 ative qua	0 ntity)	0	0	147.18	357.62	571.89		(98a)
Space he	0 ating req	0 uirement	0 for each	0 month a	0 Ifter sola	0 r contribu	0 ution	0	0	0	0	0		(98b)
Space he	593.57 ating req	410.47 uirement	306.95 : in kWh/	130.97 m²/year	35.78	0	0	0	0	147.18	357.62	571.89	31.7	(98c) (99)

8c. Sp	ace Co	oling req	uiremen	t										
Heat los	s rate,													
Utilisatio	0 on factor	0 • for loss	0	0	0	0	0	0	0	0	0	0		(100)
Useful lo	0 oss, mLm	0 1 (watts)	0	0	0	0	0	0	0	0	0	0		(101)
Gains	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Space co	0 oling re	0 quiremen	0 It for mon	0 th, whole	0 e dwellin{	0 g, continı	0 Jous (kW	0 h)	0	0	0	0		(103) (104)
Cooled f Intermit	0 raction tency fac	0 ctor	0	0	0	0	0	0	0	0	0	0	0	(104) (105)
Space co	0 oling re	0 quiremen	0 It for mon	0 th	0	0	0	0 0	0	0	0	0	0	(106)
Space co	0 ooling re	0 quiremen	0 .t in kWh/	0 m²/year	0	0	0	0	0	0	0	0	0	(107) (108)
8f Sn	ace hea	ting rea	uirement											

Fabric Energy Efficiency,	0	0	(109)

9a. Energy requirements - Individual heating systems including micro-CHP





Fraction of space heat from secondary/supplementary system, 0									0	(201)					
Fraction of	f space h	leat from	n main sy	vstem(s),										1	(202)
Fraction of	f main he	eating fr	om main	system 2	<u>2,</u>									0	(203)
Fraction of	f total sp	ace heat	t from m	ain syste	m 1,									1	(204)
Fraction of	f total sp	ace heat	t from m	ain syste	m 2,									0	(205)
Efficiency	of main s	space he	ating sys	stem 1 (ir	ı %),									352.38	(206)
Efficiency	of main s	space he	ating sys	stem 2 (ir	ı %),									0	(207)
Efficiency	of secon	dary/sup	oplement	tary heat	ing systei	m, %,								0	(208)
Cooling Sy	stem Sea	asonal Ei	nergy Eff	iciency R	atio,				0					0	(209)
Space hear	ting requ	uirement	t (calcula	ted abov	e) <i>,</i>										
(	0	0	0	0	0	0	0	0		0	0	0	0		(210)
Space hea	ting fuel	(main h	eating sy	stem 1),	kWh/mo	nth			0					0	
-	168.45	116.48	87.11	37.17	10.15	0	0	0		0	41.77	101.49	162.29		(211)
Space hea	ting fuel	(main h	eating sy	stem 2),	kWh/mo	nth			0					0	
(	D	0	0	0	0	0	0	0		0	0	0	0		(213)
Space hea	ting fuel	(second	ary), kWl	h/month					0					0	
(	0	0	0	0	0	0	0	0		0	0	0	0		(215)
Output fro	om watei	r heater)	,						0					282.03	(216)
Efficiency	of water	heater													
	282.03	282.03	282.03	282.03	282.03	282.03	282.03	28	2.03	282.03	282.03	282.03	282.03		(217)
Fuel for wa	ater hea	ting													
Space Coo	109.75 ling	97.13	103.17	90.41	87.48	78.64	77.38	80	.48	81.43	91.04	97.14	108.5	1102.56	(219)
	n	0	0	0	0	0	0	0		0	0	0	0		(221)
Annual tot	als	0	0	0	0	0	0	kW	h/vea	ur kW	/h/vear	0	0		()
Space hea	ting fuel	used, m	ain syste	m 1							,			724.91	(211)
Space hea	ting fuel	used, m	ain syste	m 2										0	(213)
Space hea	ting fuel	used, se	condary											0	(215)
Water hea	iting fuel	used												1102.56	(219)
Electricity	for insta	ntaneou	is electric	shower	(s)									0	(64a)
Space cool	ling fuel	used												0	(221)
Electricity	for pum	ps, fans a	and elect	ric keep-	hot										( )
Mechanica	al vent fa	ans - bala	anced, ex	tract or p	oositive ir	nput from	n outside		0		0			205.78	(230a)
warm air h	neating s	ystem fa	ins											0	(230b)
Heating ci	rculation	n pump o	or water p	oump wit	hin warn:	n air heat	ing unit							0	(230c)
Oil boiler a	auxiliary	(oil pum	p, flue fa	in, etc; e>	cludes ci	rculation	pump)							0	(230d)
Gas boiler	auxiliary	/ (flue fa	n, etc; ex	cludes ci	rculation	pump)								0	(230e)
Maintainir	ng electri	ic keep-h	not facilit	y for gas	combi bo	oiler								0	(230f)
Pump for s	solar wat	ter heati	ng											0	(230g)
Pump for s	storage \	NWHRS												0	(230h)
Total elect	ricity for	r the abo	ove											205.78	(231)
Electricity	for lighti	ing												187.77	(232)
															. ,





Energy sa	iving/ger	neration	technolo	gies (App	endices N	VI, N) - Er	ergy use	d in dwel	ling					
Electricity	y generat	ted by P\	√s (Apper	ndix M) (r	negative o	quantity)								
Electricity	15.01 / generat	23.18 ted bv w	36.25 ind turbir	43.94 nes (Appe	50.14 endix M) (	47.73 (negative	47.16 quantity	42.93	35.9	27.63	17.11	12.73	399.71	(233a)
Electricity	0 7 generat	0 ted by hy	0 /dro-elec	0 tric genei	0 rators	0	0	0	0	0	0	0	0	(234a)
Electricity	0 y used or	0 net elec	0 ctricity ge	0 nerated l	0 by micro-	0 CHP	0	0	0	0	0	0	0	(235a)
Energy sa	0 iving/ger	0 neration	0 technolo	0 gies (App	0 endices N	0 M, N) - Er	0 Nergy exp	0 orted	0	0	0	0	0	(235c)
Electricity	generat	ted by P	vs (Apper	ndix M) (r	negative o	quantity)								
Electricity	2.84 / generat	6.45 ted by w	13.79 ind turbir	22.51 nes (Appe	31.39 endix M) (	32.18 (negative	31.8 quantity	26.44 )	18.9	10.13	4.03	2.22	202.69	(233b)
Electricity	0 y generat	0 ted by hy	0 /dro-elec	0 tric genei	0 rators	0	0	0	0	0	0	0	0	(234b)
Electricity	0 y used or	0 net elec	0 ctricity ge	0 nerated l	0 by micro-	0 CHP	0	0	0	0	0	0	0	(235b)
Appendix	0 Q items	0 : annual	0 energy	0	0	0	0	0	0	0	0	0	0	(235d)
Appendix	Q, <iten< td=""><td>n 1 descr</td><td>ription&gt;</td><td></td><td></td><td></td><td></td><td>Fuel</td><td>I</td><td>kWh/year</td><td></td><td></td><td></td><td></td></iten<>	n 1 descr	ription>					Fuel	I	kWh/year				
energy sa	ived												0	(236a)
energy us	sed												0	(237a)
Total deli	vered en	ergy for	all uses									1	618.61	

#### 10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	k)Wb/wear	Eugl price	Fuel cost f/year	r
Space heating - main system 1 (electric off-peak tariff	Kwiij year	r der price	i dei cost Lyyea	
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(240a)
Low-rate fraction	0		119.54	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(241a)
Low-rate fraction	0		119.54	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(242a)





Low-rate fraction	0		119.54	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Space heating - secondary cost (other fuel)	0		0	(242e)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		0	(243)
Low-rate fraction	0		0	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Water heating cost (other fuel)	0		181.81	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (24	7)			
Energy For instantaneous electric shower(s)	0		0	(247a)
Space cooling	0		0	(248)
Pumps, fans And electric keep-hot	0		33.93	(249)
Energy For lighting	0		30.96	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		-77.23	(252)
Appendix Q, <item 1="" description=""></item>	Fuel	kWh/year		
energy saved Or generated	0		0	(253)
energy used	0		0	(254)
Total energy cost	0		289.02	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)

11a. SAP rating – Individual heating systems including micro-CHP		
Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	0.83	(257)
SAP rating	86.57	(258)
122 CO2 emissions – Individual heating systems including micro-CHP		

Energy	Emission factor	Emissions	
KWh/year	kg	kg CO2/year	
Space heating - main system 1		113.54	(261)
Space heating - main system 2		0	(262)
Space heating - secondary		0	(263)
Energy for water heating		155.4	(264)
Energy for instantaneous electric shower(s)		0	(264a)





Space and water heating		0	(265)
Space cooling		0	(266)
Electricity for pumps, fans and electric keep		28.54	(267)
Electricity for lighting		27.1	(268)
energy saved or generated	0	-78.25	(269b)
Appendix Q items			
energy saved	0	0	
energy used	0	0	
energy saved	0	0	(270b)
energy used		0	(271b)
Total CO2, kg/year		246.33	(272)
Dwelling CO2 Emission Rate		3.06	(273)
El rating		97	(274)

#### 13a. Primary Energy – Individual heating systems including micro-CHP

	Energy	Emission factor	Emissionsr	
	KWh/year	kg	kg CO2/year	
Space heating - main system 1		_	1145.22	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1677.18	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			0	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			311.3	(281)
Electricity for lighting			288.01	(282)
energy saved or generated	0		-688.23	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			2733.47	(286)
Dwelling PE Rate			33.93	(287)





Dwelling Reference: Dwelling Type: 10a Havelock Road

Oxford OX4 3EP RS1745 New Dwelling Design Stage

1.	Overall	dwelling	dimensions

	Area(m²)	ļ	Av. He	eight(m)		Volume(m³)	
Basement Ground Floor Total floor area TFA Dwelling volume	45.92 ( 1a) 34.65 ( 1b)	X X	2.3 2.56		(2a) = (2b) =	105.62 88.7 80.57 194.32	( 3a) ( 3b) ( 4) ( 5)
2. Ventilation Rate							
Chimneys/Flues	0	х	80	=		0	(6a)
Open chimneys	0	х	20	=		0	(6b)
Chimneys / flues attached to closed fire	0	х	10	=		0	(6c)
Flues attached to solid fuel boiler	0	х	20	=		0	(6d)
Flues attached to other heater	0	x	35	=		0	(6e)
Number of blocked chimneys	0	x	20	=		0	(6C)
Number of intermittent extract fans	3	v	10	_		30	(01)
Number of passive vents	0	×	10	_		0	(7a) (7b)
Number of flueless gas fires	0	×	10	_		0	(70)
	0	^ _	40 Air ch	– anges per	hour	0	(70)
Number of storeys in the dwelling (ns)					0.15	0.15	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc					0	0	(9)
Additional infiltration					0	0	(10)
Structural infiltration					0	0	(11)
Suspended wooden ground floor					0	0	(12)
No draught lobby					0	0	(13)
Window infiltration					0	0	(14)
Infiltration rate					0	0	(15)
Air permeability value, AP50, (m <sup>3</sup> /h/m <sup>2</sup> )					3	2	(17)
Air permeability value, AP4, (m³/h/m²)					0	0	(17a)
Air permeability value)					0.3	0.3	(18)
Number of sides on which dwelling is sheltered					2	2	(19)





Shelter fa	actor												0.85	(20)
Infiltratio	on rate ind	corporati	ing shelte	er factor									0.26	(21)
Infiltratio	on rate m	odified fo	or month	ly wind sp	beed									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Monthly	average v	wind spe	ed from 1	Table U2										
Wind Fac	5.1 ctor	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Adjusted	1.28 infiltratio	1.25 on rate (a	1.23 allowing f	1.1 or shelter	1.08 r and win	0.95 nd speed)	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Calculate	0.33 e effective	0.32 e air chan	0.32 Ige rate fo	0.28 or the app	0.28 plicable c	0.25 ase:	0.25	0.24	0.26	0.28	0.29	0.3	3.4	(22b)
a) If bala	nced mec	chanical v	ventilatio	n with he	at recove	ery (MVH	R)						0.5 0.5 46.5	(23a) (23b) (23c)
b) If bala	0.6 nced med	0.59 chanical v	0.58 /entilatio	0.55 n without	0.55 t heat red	0.51 covery (N	0.51 IV)	0.51	0.53	0.55	0.56	0.57		(24a)
c) lf who	0 le house e	0 extract ve	0 entilation	0 or positi	0 ve input	0 ventilatio	0 on from o	0 outside	0	0	0	0		(24b)
d) If natu	0 Iral ventila	0 ation or v	0 whole ho	0 use positi	0 ive input	0 ventilatio	0 on from l	0 oft	0	0	0	0		(24c)
Effective	0 air chang	0 ge rate	0	0	0	0	0	0	0	0	0	0		(24d)
Effective	0.6 air chang	0.59 ge rate fro	0.58 om PCDB	0.55 :	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(25)
	0.6	0.59	0.58	0.55	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(25)

#### 3. Heat losses and heat loss parameter

#### Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k -value

		-	-		-			
ELEMENT Solid door	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A 2.07 k	X k J/K <sub>(26)</sub>
Semi-glazed door							2.07	(26a)
Window							18.33	(27)
Roof window							2.65	(27a)
Basement floor				0			0	(28)
Ground floor				0			5.05	(28a)
Exposed floor				0			0	(28b)
Basement wall				0			0	(29)
External wall				0			12.75	(29a)





Roof								0					4.71	(30)
Total ar	ea of exte	ernal eler	ments ∑A,	m²									188.82	(31)
Party W	/all												0	(32)
Party flo	oor												0	(32a)
Party ce	eiling												0	(32b)
Internal	wall **												0	(33c)
Internal	floor												0	(32d)
Internal	ceiling fl	oor											0	(32e)
Fabric h	eat loss, '	W/K = ∑ (	(A x U)										45.56	(33)
Heat ca	pacity Cm	n = ∑(A x I	k)										0	(34)
Therma	l mass pa	rameter	(TMP = Ci	m ÷ TFA)	in kJ/m²k	<							250	(35)
Linear T	hermal b	ridges: ∑	(L x Ψ) ca	lculated	using Ap	pendix K							15.92	(36)
Point Th	nermal br	idges: ∑χ	(W/K) if s	significan	it point th	nermal br	ridge pres	sent and	values av	ailable			15.92	(36a)
Total fa	bric heat	loss H = 🏾	<u>∑</u> (A × U) +	$\Sigma(L \times \Psi)$	+∑χ								61.47	(37)
Ventilat	ion heat	loss calcu	lated mo	nthly										
Heat tra	38.31 ansfer coe	37.89 efficient, '	37.48 W/K	35.4	34.99	32.92	32.92	32.5	33.74	34.99	35.82	36.65		(38)
Heat los	99.78 ss parame	99.37 eter (HLP)	98.95 ), W/m²K	96.88	96.46	94.39	94.39	93.98	95.22	96.46	97.29	98.12		(39)
	1 24	1 2 3	1 23	1 2	12	1 17	1 17	1 17	1 1 2	12	1 21	1 22		(40)
Numbe	r of days i	in month	(Table 1a	)	1.2	1.17	1.1/	1.17	1.10	1.2	1.21	1.22		(10)
	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. W	ater heat	ting ene	rgy requ	irement										
Assume	d occupa	ncv. N											2 47	(42)
Hot wat	ter usage	in litres p	per day fo	r mixer s	howers, V	/d,showe	er (from A	Appendix	J)				2.47	(72)
	00.22	00 07	86.00	02 71	QO 12	2 77	75 52	77.40	70.65	82.00	96.96	00.00		(42a)
Hot wat	ter usage	in litres p	per day fo	r baths, \	Vd,bath (1	from App	pendix J)	77.45	75.05	02.55	80.80	05.50		(124)
	28.37	27.95	27.36	26.26	25.45	24.54	24.05	24.64	25.28	26.25	27.37	28.28		(42b)
Hot wat	ter usage	in litres p	per day fo	r other u	ises, Vd,o	ther (fro	m Appen	dix J)						,
	39.96	38.51	37.06	35.6	34.15	32.7	32.7	34.15	35.6	37.06	38.51	39.96		(42c)
Annual	average h	not water	usage in	litres pe	r day Vd,a	average (	from App	pendix J)					146.15	(43)
Hot wat	ter usage	in litres p	per day fo	r each m	onth Vd,i	m = (42a)	) + (42b) ·	+ (42c)						. ,
	158.66	155.43	151.41	145.08	140.01	134.53	132.27	136.28	140.52	146.29	152.73	158.22	1751.45	(44)
Energy	content o	f hot wat	ter used =	4.18 x V	′d,m x nm	x DTm /	′ 3600 kW	/h/month	n (from A	ppendix .	)			
	251.29	221.33	232.71	198.6	188.48	165.43	159.97	168.74	173.28	198.52	217.59	247.74	2423.68	(45)
Distribu	tion loss	(46) = 0.1	L5 x (45)											
	37 69	33.2	34 91	29 79	28 27	24 81	24	25 31	25 99	29 78	32 64	37 16		(46)

 37.69
 33.2
 34.91
 29.79
 28.27
 24.81
 24
 25.31
 25.99
 29.78
 32.64
 37.16
 (46)

 Storage volume (litres) including any solar or WWHRS storage within same vessel
 150
 (47)

 Water storage loss (or HIU loss)
 150
 150
 (47)





a) If manufacturer's declared loss factor is known (kWh/day): 2.0	09	(48)
Temperature factor from Table 2b 0.5	54	(49)
Energy lost from water storage, kWh/day (48) x (49) = 1.	13	(50)
b) If manufacturer's declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	)	(51)
Volume factor from Table 2a	)	(52)
Temperature factor from Table 2b	)	(53)
Energy lost from water storage, kWh/day	)	(54)
Enter (50) or (54) in (55)	13	(55)
Water storage (or HIU) loss calculated for each month (56) = (55) × (41)		<b>、</b>
34.99 31.6 34.99 33.86 34.99 33.86 34.99 33.86 34.99 33.86 34.99 33.86 34.99 If the vessel contains dedicated solar storage or dedicated WWHRS storage,		(56)
(57)m = (56)m ᠌ [(47) − Vs] ÷ (47), else (57)m = (56)m		
where Vs is Vww from Appendix G3 or (H12) from Appendix H (as applicable).		
34.99 31.6 34.99 33.86 34.99 33.86 34.99 34.99 33.86 34.99 33.86 34.99 Primary circuit loss for each month from Table 3		(57)
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only hea	t networ	ks)
23 26 21 01 23 26 22 51 23 26 22 51 23 26 23 26 23 26 22 51 23 26 22 51 23 26		(59)
Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)		(00)
0 $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$		(61)
309.53 273.95 290.96 254.97 246.73 221.8 218.22 226.99 229.65 256.77 273.96 305.99 CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating	3109.51 g)	(62)
0 0 0 0 0 0 0 0 0 0		(63a)
PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)		、 ,
0 0 0 0 0 0 0 0 0 0		(63b)
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)		
0 0 0 0 0 0 0 0 0 0		(63c)
FGHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no FGHRS contribution to water heating)		
0 0 0 0 0 0 0 0 0 0		(63d)
Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)		
309.53 273.95 290.96 254.97 246.73 221.8 218.22 226.99 229.65 256.77 273.96 305.99 Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)	3109.51	(64)
		(64a)
Heat gains from water heating, kWh/month $0.25 \times (0.85 \times (45) + (61) + (64a)] + 0.8 \times [(46) + (57) + (59)]$		/
130.15 115.68 123.97 111.13 109.27 100.1 99.79 102.71 102.71 112.61 117.45 128.97 include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network		(65)

#### 5. Internal gains (see Tables 5 and 5a)

Metabolic gains (Table 5), watts

148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42

(66)



Page 4



Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5

Appliance	26.58 es gains (	23.61 calculate	19.2 d in Appe	14.54 endix L, e	10.87 quation L	9.17 .16 or L16	9.91 5a), also s	12.88 see Table	17.29 5	21.96	25.63	27.32	(67)
Cooking §	329.3 gains (cal	332.71 culated in	324.1 n Appenc	305.77 lix L, equa	282.63 ation L18	260.88 or L18a)	246.35 , also see	242.93 Table 5	251.55	269.88	293.02	314.77	(68)
Pumps ar	52.32 nd fans ga	52.32 ains (Tabl	52.32 le 5a)	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	(69)
Losses e.;	0 g. evapor	0 ation (ne	0 gative va	0 ilues) (Ta	0 ble 5	0	0	0	0	0	0	0	(70)
Water he	-98.94 ating gai	-98.94 ns (Table	-98.94 5)	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	(71)
Total inte	174.94 ernal gain	172.15 s	166.63	154.35	146.87	139.03	134.13	138.05	142.66	151.35	163.12	173.35	(72)
	632.6	630.25	611.72	576.44	542.15	510.87	492.18	495.65	513.28	544.97	583.55	617.22	(73)

6. Solar gains

Solar gains in watts, calculated for each month													
1	107.23	199.97	318.49	467.99	589.81	614.05	580.17	485.17	369.73	233.22	131.62	89.69	(83)
Total gains	s – interi	nal and s	olar (wat	ts)									
7	739.83	830.23	930.21	1044.43	1131.96	1124.92	1072.35	980.82	883.01	778.2	715.17	706.91	(84)

7. Me	ean intei	rnal tem	perature	e (heatin	ıg seasoı	า)								
Temper Utilisatio	ature dur on factor	ring heati for gains	ng perioo for living	ds in the garea, 🛙 1	living are .,m (see 1	a from Ta Table 9a)	able 9, Th	1 (°C)					21	(85)
Mean in	0.99 Iternal te	0.98 mperatui	0.95 re in livin	0.87 g area T1	0.72 . (follow s	0.53 steps 3 ai	0.39 nd 4 in Ta	0.44 ible 9c)	0.69	0.92	0.98	0.99		(86)
Temper	20.5 ature dur	20.16 ring heati	20.39 ng period	20.68 ds in rest	20.86 of dwelli	20.92 ng from <sup>-</sup>	20.94 Table 9, T	20.93 h2 (°C)	20.89	20.65	20.29	20.14		(87)
Roof	19.89 19.89 19.9 19.92 19.92 19.94 19.94 19.95 19.93 19.92 19.91 19.91 Oof Utilisation factor for gains for rest of dwelling, 22,m (see Table 9a)													
Roof	0.98	0.97	0.94	0.84	0.66 Me	0.44 ean inter	0.29 nal temp	0.34 erature ir	0.6 n the rest	0.88 of dwell	0.97 ing T2	0.99		(89)
Living ar	19.44 rea fractio	18.95 on	19.24	19.59	19.78	19.86	19.86	19.87	19.83	19.57	19.13	18.96	0.14	(90) (91)
Mean in	ternal te	mperatu	re (for th	e whole o	dwelling)									(0.2)
Adjuste	19.58 d mean ir	19.11 nternal te	19.4 mperatu	19.74 re:	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12		(92)
	19.58	19.11	19.4	19.74	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12		(93)

8. Space heating requirement







#### Utilisation factor for gains,

Useful ga	0.98 ins, mGm	0.97 1, W	0.93	0.83	0.66	0.45	0.3	0.34	0.61	0.88	0.96	0.98		(94)
Monthly	727.26 average e	801.5 external t	863.68 emperat	868.27 ure from	745.43 Table U1	504.23	321.09	338.2	535.73	681.76	689.18	695.67		(95)
Heat loss	4.3 rate for	4.9 mean inte	6.5 ernal tem	8.9 nperature	11.7 2	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Space hea	1525.07 ating req	1412.31 uirement	1276.25 for each	1050.18 month	793.52	509.82	321.67	339.34	558.93	879.59	1185.87	1464.34		(97)
Solar spa	593.57 ce heatin	410.47 g calcula	306.95 ted using	130.97 Appendi	35.78 ix H (nega	0 ative qua	0 ntity)	0	0	147.18	357.62	571.89		(98a)
Space hea	0 ating req	0 uirement	0 for each	0 month a	0 Ifter solar	0 r contribu	0 ution	0	0	0	0	0		(98b)
Space he	593.57 ating req	410.47 uirement	306.95 in kWh/	130.97 m²/year	35.78	0	0	0	0	147.18	357.62	571.89	31.7	(98c) (99)

8c. S	pace Co	oling rec	quirem	ient										
Heat los	ss rate,													
Utilisati	0 on factor	0 r for loss	0	0	0	0	0	0	0	0	0	0		(100)
Useful l	0 oss, mLrr	0 1 (watts)	0	0	0	0	0	0	0	0	0	0		(101)
Gains	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Space c	0 ooling re	0 quiremer	0 nt for n	0 nonth, wh	0 ole dwel	0 ling, cont	0 inuous (k	0 (Wh)	0	0	0	0		(103) (104)
Cooled Intermi <sup>:</sup>	0 fraction ttency fa	0 ctor	0	0	0	0	0	0	0	0	0	0	0	(104) (105)
Space c	0 ooling re	0 quiremei	0 nt for n	0 nonth	0	0	0	000	0	0	0	0	0	(106)
Space c	0 ooling re	0 quiremei	0 nt in kV	0 Vh/m²/yea	0 ar	0	0	0	0	0	0	0	0	(107) (108)
8f. Sj	pace hea	ating rec	quirem	ient										

Fabric Energy Efficiency,

9a. Energy requirements - Individual heating systems including micro-CHP



0

(109)

0



Fraction of space heat from secondary/supplementary system, 0													0	(201)	
Fraction	of space I	heat fron	n main sy	/stem(s),										1	(202)
Fraction	of main h	eating fr	om main	system 2	2,									0	(203)
Fraction	of total sp	bace hea	t from m	ain syste	m 1,									1	(204)
Fraction	of total sp	bace hea	t from m	ain syste	m 2,									0	(205)
Efficienc	y of main	space he	eating sys	stem 1 (ir	n %) <i>,</i>									352.38	(206)
Efficienc	y of main	space he	eating sys	stem 2 (ir	n %) <i>,</i>									0	(207)
Efficienc	y of secor	ndary/su	pplement	tary heat	ing syste	m, %,								0	(208)
Cooling	System Se	asonal E	nergy Eff	iciency R	atio,				0					0	(209)
Space he	eating req	uirement	t (calcula	ted abov	e),										
	0	0	0	0	0	0	0	0		0	0	0	0		(210)
Space he	eating fuel	l (main h	eating sy	stem 1),	kWh/mo	nth			0					0	
	168.45	116.48	87.11	37.17	10.15	0	0	0		0	41.77	101.49	162.29		(211)
Space he	eating fuel	l (main h	eating sy	stem 2),	kWh/mo	nth			0					0	
	0	0	0	0	0	0	0	0		0	0	0	0		(213)
Space he	Space heating fuel (secondary), kWh/month														
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0															(215)
Output from water heater), 0 Efficiency of water heater														282.03	(216)
Efficiency of water heater															
	282.03	282.03	282.03	282.03	282.03	282.03	282.03	28	2.03	282.03	282.03	282.03	282.03		(217)
Fuel for	water hea	iting													
Snace Co	109.75 Joling	97.13	103.17	90.41	87.48	78.64	77.38	80	.48	81.43	91.04	97.14	108.5	1102.56	(219)
opuee et	0	0	0	0	0	0	0	0		0	0	0	0		(221)
Annual t	otals	0	0	0	0	0	0	kW	h/vea	or kW	/h/vear	0	0		(221)
Space he	eating fuel	l used, m	ain syste	m 1					, , ee		,,,,			724.91	(211)
Space he	eating fuel	l used, m	ain syste	m 2										0	(213)
Space he	eating fuel	l used, se	econdary											0	(215)
Water h	eating fue	lused												1102.56	(219)
Electricit	y for insta	antaneou	us electrio	shower	(s)									0	(64a)
Space co	oling fuel	used												0	(221)
Electricit	y for pum	ips, fans	and elect	tric keep-	hot										( )
Mechan	ical vent f	ans - bala	anced, ex	tract or p	oositive ii	nput from	n outside		0		0			205.78	(230a)
warm ai	r heating s	system fa	ans											0	(230b)
Heating	circulatior	n pump c	or water p	pump wit	hin warn:	n air heat	ing unit							0	(230c)
Oil boile	r auxiliary	(oil pum	ip, flue fa	in, etc; ex	cludes ci	rculation	pump)							0	(230d)
Gas boile	er auxiliar	y (flue fa	n, etc; ex	cludes ci	rculation	pump)								0	(230e)
Maintair	ning electr	ic keep-ł	not facilit	y for gas	combi bo	oiler								0	(230f)
Pump fo	r solar wa	ter heati	ing											0	(230g)
Pump fo	r storage	WWHRS												0	(230h)
Total ele	ctricity fo	r the abo	ove											205.78	(231)
Electricit	y for light	ing												187.77	(232)





Energy sa	aving/ger	neration	technolo	gies (App	pendices l	M, N) - Er	nergy use	d in dwe	lling					
Electricit	y generat	ted by P	Vs (Apper	ndix M) (I	negative	quantity)								
Electricit	15.01 y generat	23.18 ted by w	36.25 ind turbi	43.94 nes (App	50.14 endix M)	47.73 (negative	47.16 e quantity	42.93 /)	35.9	27.63	17.11	12.73	399.71	(233a)
Electricit	0 y generat	0 ted by hy	0 ydro-elec	0 tric gene	0 rators	0	0	0	0	0	0	0	0	(234a)
Electricit	0 y used or	0 net elec	0 ctricity ge	0 nerated	0 by micro-	0 CHP	0	0	0	0	0	0	0	(235a)
Energy sa Electricit	0 aving/ger v generat	0 neration ted by P	0 technolo Vs (Apper	0 gies (App ndix M) (1	0 Dendices I Degative	0 M, N) - Er quantity)	0 nergy exp	0 oorted	0	0	0	0	0	(235c)
Electricit	2.84 y generat	6.45 ted by w	13.79 ind turbi	22.51 nes (App	31.39 endix M)	32.18 (negative	31.8 e quantity	26.44 ⁄)	18.9	10.13	4.03	2.22	202.69	(233b)
Electricit	0 y generat	0 ted by hy	0 ydro-elec	0 tric gene	0 rators	0	0	0	0	0	0	0	0	(234b)
Electricit	0 y used or	0 net elec	0 ctricity ge	0 nerated	0 by micro-	0 CHP	0	0	0	0	0	0	0	(235b)
Appendi	0 x Q items	0 : annual	0 energy	0	0	0	0	0	0	0	0	0	0	(235d)
Appendi	x Q, <iten< td=""><td>n 1 desci</td><td>ription&gt;</td><td></td><td></td><td></td><td></td><td>Fuel</td><td></td><td>kWh/year</td><td></td><td></td><td></td><td></td></iten<>	n 1 desci	ription>					Fuel		kWh/year				
energy s	aved												0	(236a)
energy u	sed												0	(237a)
Total del	ivered er	nergy for	all uses									1	618.61	

#### 10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	k)Wb/year	Eugl price	Fuel cost f/year	r
Space heating - main system 1 (electric off-peak tariff	Kwiij year	r der price	i dei cost Lyyea	
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(240a)
Low-rate fraction	0		119.54	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(241a)
Low-rate fraction	0		119.54	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(242a)





Low-rate fraction	0		119.54	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Space heating - secondary cost (other fuel)	0		0	(242e)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		0	(243)
Low-rate fraction	0		0	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Water heating cost (other fuel)	0		181.81	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (24	47)			
Energy For instantaneous electric shower(s)	0		0	(247a)
Space cooling	0		0	(248)
Pumps, fans And electric keep-hot	0		33.93	(249)
Energy For lighting	0		30.96	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		-77.23	(252)
Appendix Q, <item 1="" description=""></item>	Fuel	kWh/year		
energy saved Or generated	0		0	(253)
energy used	0		0	(254)
Total energy cost	0		289.02	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)

11a. SAP rating – Individual heating systems including micro-CHP		
Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	0.83	(257)
SAP rating	86.57	(258)
12a CO2 emissions – Individual heating systems including micro-CHP		

Energy		Emission factor	Emissions	
KWh/yea	r	kg	kg CO2/year	
Space heating - main system 1			113.54	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			155.4	(264)
Energy for instantaneous electric shower(s)			0	(264a





0	(265)
0	(266)
28.54	(267)
27.1	(268)
-78.25	(269b)
0	
0	
0	(270b)
0	(271b)
246.33	(272)
3.06	(273)
97	(274)
	0 0 28.54 27.1 -78.25 0 0 0 0 246.33 3.06 97

#### 13a. Primary Energy – Individual heating systems including micro-CHP

	Fnerøv	Emission factor	Emissionsr	
	KWh/vear	kg	kg CO2/vear	
Space heating - main system 1		9	1145.22	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1677.18	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			0	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			311.3	(281)
Electricity for lighting			288.01	(282)
energy saved or generated	0		-688.23	,
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			2733.47	(286)
Dwelling PE Rate			33.93	(287)





Dwelling Reference: Dwelling Type: 10a Havelock Road

Oxford OX4 3EP RS1745 New Dwelling Design Stage

1.	Overall	dwelling	dimensio	วทร

	Area(m²)	Av. Height(	m)	Volume(m³)	
Basement Ground Floor Total floor area TFA Dwelling volume	45.92 ( 1a) 34.65 ( 1b)	x 2.3 x 2.56	(2a) = (2b) =	105.62 88.7 80.57 194.32	( 3a) ( 3b) ( 4) ( 5)
2. Ventilation Rate					
Chimneys/Flues	0	x 80 =		0	(6a)
Open chimneys	0	x 20 =		0	(6b)
Chimneys / flues attached to closed fire	0	x 10 =		0	(6c)
Flues attached to solid fuel boiler	0	x 20 =		0	(6d)
Flues attached to other heater	0	x 25 =		0	(6e)
Number of blocked chimneys	0	x 20 -		0	(6C)
Number of intermittent extract fans	2	x 20 =		20	(01)
Number of passive vents	0	x 10 =		50	(7a) (7b)
Number of flueless gas fires	0	x 10 =		0	(70)
Number of fluciess gas files	0	Air changes	per hour	0	(70)
Number of storeys in the dwelling (ns)			0.15	0.15	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc			0	0	(9)
Additional infiltration			0	0	(10)
Structural infiltration			0	0	(11)
Suspended wooden ground floor			0	0	(12)
No draught lobby			0	0	(13)
Percentage of windows and doors draught proofed			0	0	(14)
			0	0	(15)
Air permeability value AP50 $(m^3/h/m^2)$			0	0	(16)
Air permeability value, AP4. $(m^3/h/m^2)$			5 0	3 0	(17) (175)
Air permeability value)			03	03	(12)
Number of sides on which dwelling is sheltered			2	2	(19)





Shelter fa	actor												0.85	(20)
Infiltratio	on rate in	corporati	ing shelte	er factor									0.26	(21)
Infiltration rate modified for monthly wind speed														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Monthly	average	wind spe	ed from 1	Fable U2										
Wind Fac	5.1 ctor	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Adjusted	1.28 infiltratio	1.25 on rate (a	1.23 allowing f	1.1 or shelte	1.08 r and wir	0.95 nd speed)	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Calculate	0.33 e effective	0.32 e air chan	0.32 Ige rate fo	0.28 or the ap	0.28 plicable c	0.25 ase:	0.25	0.24	0.26	0.28	0.29	0.3	3.4	(22b)
a) If bala	nced mec	chanical v	ventilatio	n with he	at recove	ery (MVH	R)						0.5 0.5 46.5	(23a) (23b) (23c)
b) If bala	0.6 nced med	0.59 chanical v	0.58 ventilatio	0.55 n without	0.55 t heat red	0.51 covery (N	0.51 1V)	0.51	0.53	0.55	0.56	0.57		(24a)
c) lf who	0 le house e	0 extract ve	0 entilation	0 I or positi	0 ve input	0 ventilatio	0 on from c	0 outside	0	0	0	0		(24b)
d) If natu	0 Iral ventil	0 ation or v	0 whole ho	0 use posit	0 ive input	0 ventilati	0 on from l	0 oft	0	0	0	0		(24c)
Effective	0 air chang	0 ge rate	0	0	0	0	0	0	0	0	0	0		(24d)
Effective	0.6 air chang	0.59 ge rate fro	0.58 om PCDB	0.55 :	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(25)
	0.6	0.59	0.58	0.55	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(25)

#### 3. Heat losses and heat loss parameter

#### Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k -value

ELEMENT Solid doorGross area (m²)Openings m²Net Area A ,m²U-value W/m2KA X U (W/K)k-value kJ/m²·KA X k (207207kJ/k208Semi-glazed door2.072.072.082.072.082.072.082.072.08Window2.072.072.072.072.072.08Roof window2.052.07				-	-	-			
Semi-glazed door       2.07       (26a)         Window       18.33       (27)         Roof window       2.65       (27a)         Basement floor       0       0       (28)         Ground floor       0       5.05       (28a)         Exposed floor       0       0       (28b)         Basement wall       0       0       (29)         External wall       0       12.75       (29a)	ELEMENT Solid door	Gross area (m²)	Openings m <sup>2</sup>	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	4 2.07 k	AXk (J/K <sub>(26)</sub>
Window       18.33       (27)         Roof window       2.65       (27a)         Basement floor       0       0       (28)         Ground floor       0       5.05       (28a)         Exposed floor       0       0       (29)         Basement wall       0       12.75       (29a)	Semi-glazed door							2.07	(26a)
Roof window       2.65       (27a)         Basement floor       0       0       (28)         Ground floor       0       5.05       (28a)         Exposed floor       0       0       (28b)         Basement wall       0       0       (29)         External wall       0       12.75       (29a)	Window							18.33	(27)
Basement floor       0       0       (28)         Ground floor       0       5.05       (28a)         Exposed floor       0       0       (28b)         Basement wall       0       0       (29)         External wall       0       12.75       (29a)	Roof window							2.65	(27a)
Ground floor       0       5.05       (28a)         Exposed floor       0       0       (28b)         Basement wall       0       0       (29)         External wall       0       12.75       (29a)	Basement floor				0			0	(28)
Exposed floor         0         0         (28b)           Basement wall         0         0         (29)           External wall         0         12.75         (29a)	Ground floor				0			5.05	(28a)
Basement wall         0         0         (29)           External wall         0         12.75         (29a)	Exposed floor				0			0	(28b)
<b>External wall</b> 0 12.75 (29a)	Basement wall				0			0	(29)
	External wall				0			12.75	(29a)





Roof							0					4.71	(30)
Total area of ext	ernal elem	nents ∑A,	m²									188.82	(31)
Party Wall												0	(32)
Party floor												0	(32a)
Party ceiling												0	(32b)
Internal wall **												0	(33c)
Internal floor												0	(32d)
Internal ceiling fl	oor											0	(32e)
Fabric heat loss,	W/K = ∑ (A	A x U)										45.56	(33)
Heat capacity Cn	n = ∑(A x k	()										0	(34)
Thermal mass pa	irameter (	TMP = Cr	n ÷ TFA) i	in kJ/m²K								250	(35)
Linear Thermal b	ridges: ∑	(L x Ψ) ca	Iculated	using App	endix K							15.92	(36)
Point Thermal br	idges: Σχ	(W/K) if s	ignificant	t point th	ermal bri	idge pres	ent and v	alues av	ailable			15.92	(36a)
Total fabric heat	$\log H = \Sigma$	(A × U) +	$\Sigma(L \times \Psi)$	+Σχ		•						61.47	(37)
Ventilation heat	– loss calcu	lated mo	nthly	2/								01.17	(37)
38.31 Heat transfer co	37.89 efficient. V	37.48 N/К	35.4	34.99	32.92	32.92	32.5	33.74	34.99	35.82	36.65		(38)
00.79	00.27		06.00	06.46	04.20	04.20	02.09	05.22	06.46	07 20	00 1 2		(20)
Heat loss parame	99.37 eter (HLP)	98.95 , W/m²K	90.88	90.40	94.39	94.39	93.98	95.22	90.40	97.29	98.12		(59)
1.24 Number of days	1.23 in month	1.23 (Table 1a	1.2 )	1.2	1.17	1.17	1.17	1.18	1.2	1.21	1.22		(40)
31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ener	rgy requi	rement										
Assumed occupa	ncy, N											2.47	(42)
Hot water usage	in litres p	er day fo	r mixer sl	nowers, V	'd,showe	r (from A	ppendix	1)					
90.33 Hot water usage	88.97 in litres p	86.99 er day fo	83.21 r baths, V	80.42 d,bath (f	77.3 rom App	75.53 endix J)	77.49	79.65	82.99	86.86	89.98		(42a)
28.37 Hot water usage	27.95 in litres p	27.36 er day fo	26.26 r other us	25.45 ses, Vd,ot	24.54 her (fror	24.05 n Append	24.64 dix J)	25.28	26.25	27.37	28.28		(42b)
39.96	38 51	37.06	35.6	34.15	327	32.7	, 34 15	35.6	37.06	38 51	39.96		(42c)
Annual average I	not water	usage in	litres per	day Vd,a	verage (f	from App	endix J)	33.0	57.00	50.51	55.50	146 15	(43)
Hot water usage	in litres p	er day fo	r each mo	onth Vd,n	n = (42a)	+ (42b) +	· (42c)					110110	(13)
158.66	155 /12	151 /1	1/15 0.0	1/10/01	12/ 52	122.27	126.28	1/0 52	1/6 20	152 72	158 22	1751 //5	(44)
Energy content of	of hot wat	er used =	4.18 x V	d,m x nm	x DTm /	3600 kW	'h/month	(from Ap	pendix J	)	130.22	1751.45	()
251.29 Distribution loss	221.33 (46) = 0.1	232.71 5 x (45)	198.6	188.48	165.43	159.97	168.74	173.28	198.52	217.59	247.74	2423.68	(45)
37.69	33.2	34.91	29.79	28.27	24.81	24	25.31	25.99	29.78	32.64	37.16		(46)
Storage volume	(litres) inc	luding an	y solar or	<sup>·</sup> WWHRS	storage	within sa	ame vesse	el				150	(47)

Water storage loss (or HIU loss)




a) If manufacturer's declared loss factor is known (kWh/day):	2.09	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	1.13	(50)
b) If manufacturer's declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)
Energy lost from water storage, kWh/day	0	(54)
Enter (50) or (54) in (55)	1.13	(55)
Water storage (or HIU) loss calculated for each month (56) = $(55) \times (41)$		
34.99 31.6 34.99 33.86 34.99 33.86 34.99 34.99 33.86 34.99 33.86 34.99 If the vessel contains dedicated solar storage or dedicated WWHRS storage,		(56)
(57)m = (56)m ᠌ [(47) − Vs] ÷ (47), else (57)m = (56)m		
where Vs is Vww from Appendix G3 or (H12) from Appendix H (as applicable).		
34.99 31.6 34.99 33.86 34.99 33.86 34.99 34.99 33.86 34.99 33.86 34.99 Primary circuit loss for each month from Table 3		(57)
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only	neat networ	·ks)
23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 23.26 22.51 23.26 22.51 23.26 Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)		(59)
		(61)
Total heat required for water heating calculated for each month $(62) = 0.85 \times (45) + (46) + (57) + (59) + (61)$		( )
309.53 273.95 290.96 254.97 246.73 221.8 218.22 226.99 229.65 256.77 273.96 305.99 CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water hear	3109.51 ting)	(62)
0 0 0 0 0 0 0 0 0 0		(63a)
PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)		ι <i>γ</i>
0 0 0 0 0 0 0 0 0 0 0		(63b)
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)		
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(63c)
		(624)
Output from water heater for each month, kWh/month (64) = $(62) + (63a) + (63b) + (63c) + (63d)$		(050)
309.53 273.95 290.96 254.97 246.73 221.8 218.22 226.99 229.65 256.77 273.96 305.99 Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)	3109.51	(64)
0 0 0 0 0 0 0 0 0 0		(64a)
Heat gains from water heating, kWh/month 0.25 x [0.85 × (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59) ]		
130.15 115.68 123.97 111.13 109.27 100.1 99.79 102.71 102.71 112.61 117.45 128.97 include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network		(65)

#### 5. Internal gains (see Tables 5 and 5a)

Metabolic gains (Table 5), watts

148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42

(66)



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Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5

Appliance	26.58 es gains (	23.61 calculate	19.2 d in Appe	14.54 endix L, e	10.87 quation L	9.17 .16 or L16	9.91 5a), also s	12.88 see Table	17.29 5	21.96	25.63	27.32	(67)
Cooking §	329.3 gains (cal	332.71 culated in	324.1 n Appenc	305.77 lix L, equa	282.63 ation L18	260.88 or L18a)	246.35 , also see	242.93 Table 5	251.55	269.88	293.02	314.77	(68)
Pumps ar	52.32 nd fans ga	52.32 ains (Tabl	52.32 le 5a)	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	(69)
Losses e.;	0 g. evapor	0 ation (ne	0 gative va	0 ilues) (Ta	0 ble 5	0	0	0	0	0	0	0	(70)
Water he	-98.94 ating gai	-98.94 ns (Table	-98.94 5)	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	(71)
Total inte	174.94 ernal gain	172.15 s	166.63	154.35	146.87	139.03	134.13	138.05	142.66	151.35	163.12	173.35	(72)
	632.6	630.25	611.72	576.44	542.15	510.87	492.18	495.65	513.28	544.97	583.55	617.22	(73)

6. Solar gains

Solar gains in watts, calculated for each month													
	107.23	199.97	318.49	467.99	589.81	614.05	580.17	485.17	369.73	233.22	131.62	89.69	(83)
Total gain	Total gains – internal and solar (watts)												
	739.83	830.23	930.21	1044.43	1131.96	1124.92	1072.35	980.82	883.01	778.2	715.17	706.91	(84)

7. Me	ean intei	rnal tem	perature	e (heatin	ıg seasoı	า)								
Temper Utilisatio	ature dur on factor	ring heati for gains	ng perioo for living	ds in the garea, 🛙 1	living are .,m (see 1	a from Ta Table 9a)	able 9, Th	1 (°C)					21	(85)
Mean in	0.99 Iternal te	0.98 mperatui	0.95 re in livin	0.87 g area T1	0.72 . (follow s	0.53 steps 3 ai	0.39 nd 4 in Ta	0.44 ible 9c)	0.69	0.92	0.98	0.99		(86)
Temper	20.5 ature dur	20.16 ring heati	20.39 ng period	20.68 ds in rest	20.86 of dwelli	20.92 ng from <sup>-</sup>	20.94 Table 9, T	20.93 h2 (°C)	20.89	20.65	20.29	20.14		(87)
Roof	19.89	19.89	19.9	19.92	19.92 Utilisatio	19.94 n factor f	19.94 for gains f	19.95 for rest o	19.93 f dwellin <sub>{</sub>	19.92 g,	19.91 see Table	19.91 9a)		(88)
Roof	0.98	0.97	0.94	0.84	0.66 Me	0.44 ean inter	0.29 nal temp	0.34 erature ir	0.6 n the rest	0.88 of dwell	0.97 ing T2	0.99		(89)
Living ar	19.44 rea fractio	18.95 on	19.24	19.59	19.78	19.86	19.86	19.87	19.83	19.57	19.13	18.96	0.14	(90) (91)
Mean in	ternal te	mperatu	re (for th	e whole o	dwelling)									(0.2)
Adjuste	19.58 d mean ir	19.11 nternal te	19.4 mperatu	19.74 re:	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12		(92)
	19.58	19.11	19.4	19.74	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12		(93)

8. Space heating requirement







Utilisation factor for gains,

Useful ga	0.98 ins, mGm	0.97 1, W	0.93	0.83	0.66	0.45	0.3	0.34	0.61	0.88	0.96	0.98		(94)
Monthly	727.26 average e	801.5 external t	863.68 emperat	868.27 ure from	745.43 Table U1	504.23	321.09	338.2	535.73	681.76	689.18	695.67		(95)
Heat loss	4.3 rate for	4.9 mean inte	6.5 ernal tem	8.9 nperature	11.7 2	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Space hea	1525.07 ating req	1412.31 uirement	1276.25 for each	1050.18 month	793.52	509.82	321.67	339.34	558.93	879.59	1185.87	1464.34		(97)
Solar spa	593.57 ce heatin	410.47 g calcula	306.95 ted using	130.97 Appendi	35.78 x H (nega	0 ative qua	0 ntity)	0	0	147.18	357.62	571.89		(98a)
Space hea	0 ating req	0 uirement	0 for each	0 month a	0 fter solar	0 · contribu	0 ution	0	0	0	0	0		(98b)
Space hea	593.57 ating req	410.47 uirement	306.95 in kWh/	130.97 m²/year	35.78	0	0	0	0	147.18	357.62	571.89	31.7	(98c) (99)

8c. S	Space C	ooling re	quirem	ent										
Heat lo	oss rate,	1												
Utilisat	0 tion fact:	0 cor for loss	0	0	0	0	0	0	0	0	0	0		(100)
Useful	0 loss, ml	0 Lm (watts)	0 )	0	0	0	0	0	0	0	0	0		(101)
Gains	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Space (	0 cooling	0 requireme	0 ent for m	0 1onth, wh	0 ole dwel	0 ling, cont	0 inuous (ł	0 kWh)	0	0	0	0		(103) (104)
Cooled Interm	0 fractioi ittency	0 n factor	0	0	0	0	0	0	0	0	0	0	0	(104) (105)
Space (	0 cooling	0 requireme	0 ent for m	0 nonth	0	0	0	0	0	0	0	0	0	(106)
Space o	0 cooling I	0 requireme	0 ≥nt in k₩	0 √h/m²/yea	0 ar	0	0	0	0	0	0	0	0	(107) (108)
8f. S	Space h	leating re	quirem	ent										

Fabric Energy Efficiency,

9a. Energy requirements - Individual heating systems including micro-CHP



0

(109)

**TER WORKSHEET** 

0



Fraction of space	e heat fror	m second	ary/supp	lementai	ry system	,		0					0	(201)
Fraction of space	e heat fror	m main sy	/stem(s),										1	(202)
Fraction of main	heating fr	rom main	system 2	2,									0	(203)
Fraction of total	space hea	nt from m	ain syste	m 1,									1	(204)
Fraction of total	space hea	nt from m	ain syste	m 2,									0	(205)
Efficiency of mai	n space he	eating sys	stem 1 (ir	ו %) <i>,</i>									352.38	(206)
Efficiency of mai	n space he	eating sys	stem 2 (ir	ו %) <i>,</i>									0	(207)
Efficiency of seco	ondary/su	pplemen	tary heat	ing syste	m, %,								0	(208)
Cooling System S	easonal E	inergy Eff	iciency R	atio,				0					0	(209)
Space heating re	quiremen	t (calcula	ted abov	e),										
0	0	0	0	0	0	0	0		0	0	0	0		(210)
Space heating fu	el (main h	leating sy	stem 1),	kWh/mo	nth			0					0	
168.45	116.48	87.11	37.17	10.15	0	0	0		0	41.77	101.49	162.29		(211)
Space heating fu	el (main h	leating sy	stem 2),	kWh/mo	nth			0					0	
0	0	0	0	0	0	0	0		0	0	0	0		(213)
Space heating fu	el (secono	dary), kW	h/month					0					0	
0	0	0	0	0	0	0	0		0	0	0	0		(215)
Output from wat	er heater	),						0					282.03	(216)
Efficiency of wat	er heater													
282.03	282.03	282.03	282.03	282.03	282.03	282.03	28	2.03	282.03	282.03	282.03	282.03		(217)
Fuel for water he	eating													
109.75 Space Cooling	97.13	103.17	90.41	87.48	78.64	77.38	80	.48	81.43	91.04	97.14	108.5	1102.56	(219)
0	0	0	0	0	0	0	0		0	0	0	0		(221)
Annual totals	-	-	-	-	-	-	kW	h/vea	ar kV	vh/year	-	-		( )
Space heating fu	el used, m	nain syste	em 1										724.91	(211)
Space heating fu	el used, m	nain syste	em 2										0	(213)
Space heating fu	el used, se	econdary											0	(215)
Water heating fu	iel used												1102.56	(219)
Electricity for ins	tantaneo	us electri	c shower	(s)									0	(64a)
Space cooling fu	el used												0	(221)
Electricity for pu	mps, fans	and elect	tric keep-	-hot										
Mechanical vent	fans - bal	anced, e>	tract or p	positive i	nput from	n outside	!	0		0			205.78	(230a)
warm air heating	system f	ans											0	(230b)
Heating circulati	on pump o	or water	pump wit	thin warn	n air heat	ing unit							0	(230c)
Oil boiler auxilia	y (oil pum	np, flue fa	an, etc; ex	xcludes c	irculation	i pump)							0	(230d)
Gas boiler auxilia	ry (flue fa	an, etc; ex	cludes ci	irculation	pump)								0	(230e)
Maintaining elec	tric keep-	hot facilit	y for gas	combi bo	oiler								0	(230f)
Pump for solar w	vater heat	ing											0	(230g)
Pump for storage	e WWHRS												0	(230h)
Total electricity	or the abo	ove											205.78	(231)
Electricity for lig	nting												187.77	(232)
														. ,





Energy sa	aving/ger	neration	technolo	gies (App	endices I	M, N) - Er	nergy use	ed in dwe	lling					
Electricit	y generat	ted by P	√s (Apper	ndix M) (I	negative	quantity)								
	15.01	23.18	36.25	43.94	50.14	47.73	47.16	42.93	35.9	27.63	17.11	12.73	399.71	(233a)
Electricit	y generat	ted by w	ind turbir	nes (App	endix M)	(negative	e quantity	()						
Electricit	0 v generat	0 tod by by	0 vdro-elec	0 tric gone	0 rators	0	0	0	0	0	0	0	0	(234a)
Lieunin	ygenera	Leu by H	yui o-eiec	the gene	Tators									(225)
Electricit	0 y used or	0 net elec	0 ctricity ge	0 nerated	0 by micro-	0 CHP	0	0	0	0	0	0	0	(235a)
Energy sa	0 aving/ger	0 neration	0 technolo	0 gies (Apr	0 Dendices l	0 M. N) - Fr	0 Dergy exp	0 oorted	0	0	0	0	0	(235c)
Electricit	y generat	ted by P	Vs (Apper	ndix M) (i	negative	quantity)								
Electricit	2.84 y generat	6.45 ted by w	13.79 ind turbir	22.51 nes (App	31.39 endix M)	32.18 (negative	31.8 quantity	26.44 /)	18.9	10.13	4.03	2.22	202.69	(233b)
	0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)
Electricit	y generat	ted by hy	ydro-elec	tric gene	rators									
Electricit	0 y used or	0 net elec	0 ctricity ge	0 nerated	0 by micro-	0 CHP	0	0	0	0	0	0	0	(235b)
Appendix	0 x Q items	0 : annual	0 energy	0	0	0	0	0	0	0	0	0	0	(235d)
Appendix	x Q, <iten< td=""><td>n 1 desci</td><td>ription&gt;</td><td></td><td></td><td></td><td></td><td>Fuel</td><td></td><td>kWh/vear</td><td></td><td></td><td></td><td></td></iten<>	n 1 desci	ription>					Fuel		kWh/vear				
energy sa	aved		-							,,,			0	(236a)
energy u	sed												0	(237a)
Total del	ivered er	nergy for	all uses									1	L618.61	

#### 10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/year	Fuel price	Fuel cost £/year	
Space heating - main system 1 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(240a)
Low-rate fraction	0		119.54	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(241a)
Low-rate fraction	0		119.54	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(242a)





Low-rate fraction	0		119.54	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Space heating - secondary cost (other fuel)	0		0	(242e)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		0	(243)
Low-rate fraction	0		0	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Water heating cost (other fuel)	0		181.81	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (24	17)			
Energy For instantaneous electric shower(s)	0		0	(247a)
Space cooling	0		0	(248)
Pumps, fans And electric keep-hot	0		33.93	(249)
Energy For lighting	0		30.96	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		-77.23	(252)
Appendix Q, <item 1="" description=""></item>	Fuel	kWh/year		
energy saved Or generated	0		0	(253)
energy used	0		0	(254)
Total energy cost	0		289.02	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)

11a. SAP rating – Individual heating systems including micro-CHP		
Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	0.83	(257)
SAP rating	86.57	(258)
12a CO2 emissions – Individual heating systems including micro-CHP		

Energy		Emission factor	Emissions	
KWh/yea	r	kg	kg CO2/year	
Space heating - main system 1			113.54	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			155.4	(264)
Energy for instantaneous electric shower(s)			0	(264a





56) 57) 58)
67) 58)
, 58)
501
59b)
70b)
71b)
72)
73)
74)
777777777777777777777777777777777777777

#### 13a. Primary Energy – Individual heating systems including micro-CHP

kto of y     kg     kg CO2/year       Space heating - main system 1     1145.22     (275)       Space heating - main system 2     0     (276)       Space heating - secondary     0     (277)       Energy for water heating     1677.18     (278)       Space and water heating     0     (279)       Space cooling     0     (279)       Space cooling     0     (280)       Electricity for pumps, fans and electric keep     311.3     (281)       Electricity for lighting     288.01     (282)       energy saved or generated     0     -688.23       Appendix Q items     0     0       energy used     0     0       energy saved     0     0       energy used     0     0       otal PE, kWh/year     0     (285b)		Energy	Emission factor	Emissionsr	
Space heating - main system 11145.22(275)Space heating - main system 20(276)Space heating - secondary0(277)Energy for water heating1677.18(278)Energy for instantaneous electric shower(s)0(278a)Space and water heating0(279)Space cooling0(280)Electricity for pumps, fans and electric keep311.3(281)Electricity for lighting288.01(282)energy saved or generated0-688.23Appendix Q items00-energy used00(284b)energy saved00(285b)Total PE, kWh/year2733.47(286)		KWh/vear	kg	kg CO2/vear	
Space heating - main system 2   0   (276)     Space heating - secondary   0   (277)     Energy for water heating   1677.18   (278a)     Space and water heating   0   (279)     Space cooling   0   (279)     Electricity for pumps, fans and electric keep   311.3   (281)     Electricity for lighting   288.01   (282)     energy saved or generated   0   -688.23     Appendix Q items   0   (284)     energy used   0   0   (284)     energy saved or generated   0   -688.23   -     Appendix Q items   0   0   -   -     energy used   0   0   (284)   -     energy used   0   0   -   -   -   -     energy used   0   0   (284)   -	Space heating - main system 1		0	1145.22	(275)
Space heating - secondary   0   (277)     Energy for water heating   1677.18   (278)     Energy for instantaneous electric shower(s)   0   (278a)     Space and water heating   0   (279)     Space cooling   0   (280)     Electricity for pumps, fans and electric keep   311.3   (281)     Electricity for lighting   288.01   (282)     energy saved or generated   0   -688.23     Appendix Q items   0   0     energy used   0   0   (284)     energy saved   0   0   (284)     energy used   0   0   (284)     energy used   0   0   (284)     energy used   0   0   (285)     Total PE, kWh/year   2733.47   (286)	Space heating - main system 2			0	(276)
Energy for water heating   1677.18   (278)     Energy for instantaneous electric shower(s)   0   (278a)     Space and water heating   0   (279)     Space cooling   0   (280)     Electricity for pumps, fans and electric keep   311.3   (281)     Electricity for lighting   288.01   (282)     energy saved or generated   0   -688.23     Appendix Q items   0   0     energy used   0   0     energy saved   0   (284b)     energy used   0   (284b)     energy used   0   (284b)     on the grap used   0   (284b)     energy used   2733.47   (285b)	Space heating - secondary			0	(277)
Energy for instantaneous electric shower(s)   0   (278)     Space and water heating   0   (280)     Space cooling   311.3   (281)     Electricity for pumps, fans and electric keep   311.3   (282)     Electricity for lighting   288.01   (282)     energy saved or generated   0   -688.23     Appendix Q items   0   0     energy used   0   0     energy saved   0   0     energy used   0   (284b)     energy used   0   (284b)     energy used   0   (284b)     Total PE, kWh/year   2733.47   (286)	Energy for water heating			1677.18	(278)
Space and water heating   0   (279)     Space cooling   0   (280)     Electricity for pumps, fans and electric keep   311.3   (281)     Electricity for lighting   288.01   (282)     energy saved or generated   0   -688.23     Appendix Q items   0   -688.23     energy saved   0   0     energy used   0   0     energy used   0   0     energy used   0   (284b)     energy used   0   (284b)     Total PE, kWh/year   2733.47   (286)	Energy for instantaneous electric shower(s)			0	(278a)
Space cooling   0   (280)     Electricity for pumps, fans and electric keep   311.3   (281)     Electricity for lighting   288.01   (282)     energy saved or generated   0   -688.23   (282)     Appendix Q items   0   -688.23   -     energy saved   0   0   -     energy used   0   0   -     energy used   0   0   (284b)     energy used   0   0   (285b)     Total PE, kWh/year   2733.47   (286)	Space and water heating			0	(279)
Electricity for pumps, fans and electric keep   311.3   (281)     Electricity for lighting   288.01   (282)     energy saved or generated   0   -688.23     Appendix Q items   0   0     energy saved   0   0     energy saved   0   0     energy used   0   0     energy used   0   (284b)     energy used   0   (285b)     Total PE, kWh/year   2733.47   (286)	Space cooling			0	(280)
Electricity for lighting   288.01   (282)     energy saved or generated   0   -688.23     Appendix Q items   0   0     energy saved   0   0     energy used   0   0     energy saved   0   0     energy used   0   0     energy used   0   (284b)     energy used   0   (285b)     Total PE, kWh/year   2733.47   (286)	Electricity for pumps, fans and electric keep			311.3	(281)
energy saved or generated0-688.23Appendix Q items00energy saved00energy used00energy saved00energy used00energy used00energy used0284b)energy used0285b)Total PE, kWh/year2733.47286)	Electricity for lighting			288.01	(282)
Appendix Q items   0	energy saved or generated	0		-688.23	
energy saved 0 0   energy used 0 0   energy saved 0 0   energy used 0 (284b)   energy used 0 (285b)   Total PE, kWh/year 2733.47 (286)	Appendix Q items				
energy used     0     0       energy saved     0     0     (284b)       energy used     0     0     (285b)       Total PE, kWh/year     2733.47     (286)	energy saved	0		0	
energy saved 0 (284b)   energy used 0 (285b)   Total PE, kWh/year 2733.47 (286)	energy used	0		0	
energy used     0     (285b)       Total PE, kWh/year     2733.47     (286)	energy saved	0		0	(284b)
Total PE, kWh/year 2733.47 (286)	energy used			0	(285b)
	Total PE, kWh/year			2733.47	(286)
Dwelling PE Rate 33.93 (287)	Dwelling PE Rate			33.93	(287)





Dwelling Reference: Dwelling Type: 10a Havelock Road

Oxford OX4 3EP RS1745 New Dwelling Design Stage

1. Overall dwelling dimensions						
	Area(m²)	A	v. Hei	ght(m)	Volume(m³)	
Basement Ground Floor Total floor area TFA	45.92 (1a) 34.65 (1b)	x x	2.3 2.56	(2a) = (2b) =	105.62 88.7 80.57	( 3a) ( 3b) ( 4)
Dwelling volume					194.32	(5)
2. Ventilation Rate						
Chimneys/Flues	0	х	80 =	:	0	(6a)
Open chimneys	0	х	20 =	:	0	(6b)
Chimneys / flues attached to closed fire	0	х	10 =	:	0	(6c)
Flues attached to solid fuel boiler	0	х	20 =	:	0	(6d)
Flues attached to other heater	0	х	35 =	:	0	(6e)
Number of blocked chimneys	0	х	20 =	:	0	(6f)
Number of intermittent extract fans	3	х	10 =	:	30	(7a)
Number of passive vents	0	х	10 =	:	0	(7b)
Number of flueless gas fires	0	х	40 =	:	0	(7c)
		A	ir chai	nges per hour		( )
Number of storeys in the dwelling (ns)				0.15	0.15	(8)
Infiltration due to chimneys, flues, fans, PSVs, etc				0	0	(9)
Structural infiltration				0	0	(10)
Suspended wooden ground floor				0	0	(11)
No draught lobby				0	0	(12)
Percentage of windows and doors draught proofed				0	0	(14)
Window infiltration				0	0	(15)
Infiltration rate				0	0	(16)
Air permeability value, AP50, $(M^{2}/n/m^{2})$				3	3	(17)
Air permeability value)				0 2	0	(1/a) (10)
Number of sides on which dwelling is sheltered				2	2	(10)
						. /





Shelter fa	actor												0.85	(20)
Infiltratio	on rate in	corporati	ing shelte	er factor									0.26	(21)
Infiltratio	on rate m	odified fo	or month	ly wind sp	beed									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	(22)
Monthly	average	wind spe	ed from 1	Table U2										
Wind Fac	5.1 ctor	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Adjusted	1.28 infiltratio	1.25 on rate (a	1.23 allowing f	1.1 or shelte	1.08 r and wir	0.95 nd speed)	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Calculate	0.33 e effective	0.32 e air chan	0.32 Ige rate fo	0.28 or the ap	0.28 plicable c	0.25 case:	0.25	0.24	0.26	0.28	0.29	0.3	3.4	(22b)
a) If bala	nced mec	chanical v	ventilatio	n with he	at recove	erv (MVH	R)						0.5 0.5 46.5	(23a) (23b) (23c)
b) If bala	0.6 nced med	0.59 chanical v	0.58 /entilatio	0.55 n without	0.55 t heat red	0.51 covery (N	0.51 1V)	0.51	0.53	0.55	0.56	0.57		(24a)
c) lf who	0 le house e	0 extract ve	0 entilation	0 or positi	0 ve input	0 ventilatio	0 on from o	0 outside	0	0	0	0		(24b)
d) If natu	0 Iral ventil	0 ation or v	0 whole ho	0 use posit	0 ive input	0 ventilati	0 on from l	0 oft	0	0	0	0		(24c)
Effective	0 air chang	0 ge rate	0	0	0	0	0	0	0	0	0	0		(24d)
Effective	0.6 air chang	0.59 ge rate fro	0.58 om PCDB	0.55 :	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(25)
	0.6	0.59	0.58	0.55	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(25)

#### 3. Heat losses and heat loss parameter

#### Items in the table below are to be expanded as necessary to allow for all different types of element e.g. 4 wall types. The k -value

		-	-		-			
ELEMENT Solid door	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A 2.07 k	X k J/K <sub>(26)</sub>
Semi-glazed door							2.07	(26a)
Window							18.33	(27)
Roof window							2.65	(27a)
Basement floor				0			0	(28)
Ground floor				0			5.05	(28a)
Exposed floor				0			0	(28b)
Basement wall				0			0	(29)
External wall				0			12.75	(29a)





Roof							0					4.71	(30)
Total area of ext	ernal elen	nents ∑A,	m²									188.82	(31)
Party Wall												0	(32)
Party floor												0	(32a)
Party ceiling												0	(32b)
Internal wall **												0	(33c)
Internal floor												0	(32d)
Internal ceiling f	iternal ceiling floor												
Fabric heat loss,	abric heat loss, W/K = $\sum$ (A x U)												
leat capacity $Cm = \sum (A \times k)$													(34)
hermal mass parameter (TMP = Cm $\div$ TFA) in kJ/m <sup>2</sup> K													(35)
inear Thermal bridges: $\sum$ (L x $\Psi$ ) calculated using Appendix K													(36)
Point Thermal b	Point Thermal bridges: $\sum \chi$ (W/K) if significant point thermal bridge present and values available												(36a)
Total fabric heat	: loss H = ∑	(A × U) +	$\Sigma(L\times\Psi)$	+∑χ								61.47	(37)
Ventilation heat	loss calcu	lated mo	nthly										
38.31 Heat transfer co	37.89 efficient, N	37.48 N/К	35.4	34.99	32.92	32.92	32.5	33.74	34.99	35.82	36.65		(38)
99.78 Heat loss param	99.37 eter (HLP)	98.95 , W/m²K	96.88	96.46	94.39	94.39	93.98	95.22	96.46	97.29	98.12		(39)
1.24 Number of days	1.23	, , 1.23 (Table 1a	1.2	1.2	1.17	1.17	1.17	1.18	1.2	1.21	1.22		(40)
Number of days			)										
31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ating ene	rgy requi	rement										
Assumed occupa	ancy, N											2.47	(42)
Hot water usage	in litres p	er day fo	r mixer sl	nowers, V	/d,showe	er (from A	Appendix	l)					
90.33 Hot water usage	88.97 in litres p	86.99 er day fo	83.21 r baths, V	80.42 /d,bath (f	77.3 rom App	75.53 endix J)	77.49	79.65	82.99	86.86	89.98		(42a)
28.37 Hot water usage	27.95 in litres p	27.36 er day fo	26.26 r other u	25.45 ses, Vd,ot	24.54 ther (fror	24.05 n Append	24.64 dix J)	25.28	26.25	27.37	28.28		(42b)
39.96 Annual average	38.51 hot water	37.06 usage in	35.6 litres per	34.15 day Vd,a	32.7 verage (f	32.7 from App	34.15 endix J)	35.6	37.06	38.51	39.96	146.15	(42c) (43)
Hot water usage	in litres p	er day fo	r each me	onth Vd,n	n = (42a)	+ (42b) +	+ (42c)					1 10110	()
158.66 Energy content of	5 155.43 of hot wat	151.41 er used =	145.08 4.18 x Ve	140.01 d.m x nm	134.53 x DTm /	132.27 3600 kW	136.28 h/month	140.52 (from Ar	146.29 ppendix J	152.73	158.22	1751.45	(44)
251.29 Distribution loss	) 221.33 (46) = 0.1	232.71 5 x (45)	198.6	188.48	165.43	159.97	168.74	173.28	198.52	217.59	247.74	2423.68	(45)
27 60	22.2	3/ 01	20 70	28 22	<b>2∕I </b> 21	24	25 21	25 00	20 72	32 64	37 16		(46)
Storage volume	(litres) inc	luding an	y solar o	r WWHRS	storage	within sa	ame vesse	20.99	23.10	52.04	37.10	150	(47)

Water storage loss (or HIU loss)





a) If manufacturer's declared loss factor is known (kWh/day): 2.09	(48)													
Temperature factor from Table 2b0.54(4)														
Energy lost from water storage, kWh/day (48) x (49) = 1.13	(50)													
If manufacturer's declared loss factor is not known :														
ot water storage loss factor from Table 2 (kWh/litre/day) 0 (														
olume factor from Table 2a														
Temperature factor from Table 2b 0	(53)													
Energy lost from water storage, kWh/day 0	(54)													
Enter (50) or (54) in (55)	(55)													
Water storage (or HIU) loss calculated for each month (56) = (55) × (41)														
34.99 31.6 34.99 33.86 34.99 33.86 34.99 33.86 34.99 33.86 34.99 33.86 34.99	(56)													
$(57)$ m = (56)m $\mathbb{D}[(47) = V(s] \div (47)$ else (57)m = (56)m														
where Vs is Vww from Annendix G3 or (H12) from Annendix H (as annlicable)														
	( )													
34.99 31.6 34.99 33.86 34.99 33.86 34.99 33.86 34.99 33.86 34.99 33.86 34.99 Primary circuit loss for each month from Table 3	(57)													
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only heat	networks)													
23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 23.26 22.51 23.26 22.51 23.26 22.51 23.26	(59)													
	(61)													
Total heat required for water heating calculated for each month (62) = $0.85 \times (45) + (46) + (57) + (59) + (61)$	(61)													
309.53 273.95 290.96 254.97 246.73 221.8 218.22 226.99 229.65 256.77 273.96 305.99 32 CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)	109.51 (62)													
	(63a)													
PV diverter DHW input calculated using Appendix G (negative quantity) (enter 0 if no PV diverter contribution)	(050)													
0 0 0 0 0 0 0 0 0 0	(63b)													
Solar DHW input calculated using Appendix H (negative quantity) (enter 0 if no solar contribution to water heating)														
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(63c)													
	(63d)													
Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)	(000)													
309.53 273.95 290.96 254.97 246.73 221.8 218.22 226.99 229.65 256.77 273.96 305.99 300 300 300 300 300 300 300 300 300 3	LO9.51 (64)													
0 0 0 0 0 0 0 0 0 0	(64a)													
Heat gains from water heating, kWh/month 0.25 x $[0.85 \times (45) + (61) + (64a)] + 0.8 x [(46) + (57) + (59)]$														
130.15 115.68 123.97 111.13 109.27 100.1 99.79 102.71 102.71 112.61 117.45 128.97 include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network	(65)													

#### 5. Internal gains (see Tables 5 and 5a)

Metabolic gains (Table 5), watts

148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42 148.42

(66)





Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5

Appliance	26.58 es gains (	23.61 calculate	19.2 d in Appe	14.54 endix L, e	10.87 quation L	9.17 .16 or L16	9.91 5a), also s	12.88 see Table	17.29 5	21.96	25.63	27.32	(67)
Cooking §	329.3 gains (cal	332.71 culated in	324.1 n Appenc	305.77 lix L, equa	282.63 ation L18	260.88 or L18a)	246.35 , also see	242.93 Table 5	251.55	269.88	293.02	314.77	(68)
Pumps ar	52.32 nd fans ga	52.32 ains (Tabl	52.32 le 5a)	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	(69)
Losses e.;	0 g. evapor	0 ation (ne	0 gative va	0 ilues) (Ta	0 ble 5	0	0	0	0	0	0	0	(70)
Water he	-98.94 ating gai	-98.94 ns (Table	-98.94 5)	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	-98.94	(71)
Total inte	174.94 ernal gain	172.15 s	166.63	154.35	146.87	139.03	134.13	138.05	142.66	151.35	163.12	173.35	(72)
	632.6	630.25	611.72	576.44	542.15	510.87	492.18	495.65	513.28	544.97	583.55	617.22	(73)

6. Solar gains

Solar gains	olar gains in watts, calculated for each month													
1	107.23	199.97	318.49	467.99	589.81	614.05	580.17	485.17	369.73	233.22	131.62	89.69	(83)	
Total gains – internal and solar (watts)														
7	739.83	830.23	930.21	1044.43	1131.96	1124.92	1072.35	980.82	883.01	778.2	715.17	706.91	(84)	

7. Me	ean intei	rnal tem	perature	e (heatin	ıg seasoı	า)								
Temper Utilisatio	ature dur on factor	ring heati for gains	ng perioo for living	ds in the garea, 🛙 1	living are .,m (see 1	a from Ta Table 9a)	able 9, Th	1 (°C)					21	(85)
Mean in	0.99 Iternal te	0.98 mperatui	0.95 re in livin	0.87 g area T1	0.72 . (follow s	0.53 steps 3 ai	0.39 nd 4 in Ta	0.44 ible 9c)	0.69	0.92	0.98	0.99		(86)
Temper	20.5 ature dur	20.16 ring heati	20.39 ng period	20.68 ds in rest	20.86 of dwelli	20.92 ng from <sup>-</sup>	20.94 Table 9, T	20.93 h2 (°C)	20.89	20.65	20.29	20.14		(87)
Roof	19.89	19.89	19.9	19.92	19.92 Utilisatio	19.94 n factor f	19.94 for gains f	19.95 for rest o	19.93 f dwellin	19.92 g,	19.91 see Table	19.91 9a)		(88)
Roof	0.98	0.97	0.94	0.84	0.66 Me	0.44 ean inter	0.29 nal temp	0.34 erature ir	0.6 n the rest	0.88 of dwell	0.97 ing T2	0.99		(89)
Living ar	19.44 rea fractio	18.95 on	19.24	19.59	19.78	19.86	19.86	19.87	19.83	19.57	19.13	18.96	0.14	(90) (91)
Mean in	ternal te	mperatu	re (for th	e whole o	dwelling)									(0.2)
Adjuste	19.58 d mean ir	19.11 nternal te	19.4 mperatu	19.74 re:	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12		(92)
	19.58	19.11	19.4	19.74	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12		(93)

8. Space heating requirement







#### Utilisation factor for gains,

Useful ga	0.98 ins, mGm	0.97 1, W	0.93	0.83	0.66	0.45	0.3	0.34	0.61	0.88	0.96	0.98		(94)
Monthly	727.26 average e	801.5 external t	863.68 emperat	868.27 ure from	745.43 Table U1	504.23	321.09	338.2	535.73	681.76	689.18	695.67		(95)
Heat loss	4.3 rate for	4.9 mean inte	6.5 ernal tem	8.9 nperature	11.7 2	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Space hea	1525.07 ating req	1412.31 uirement	1276.25 for each	1050.18 month	793.52	509.82	321.67	339.34	558.93	879.59	1185.87	1464.34		(97)
Solar spa	593.57 ce heatin	410.47 g calcula	306.95 ted using	130.97 Appendi	35.78 x H (nega	0 ative qua	0 ntity)	0	0	147.18	357.62	571.89		(98a)
Space hea	0 ating req	0 uirement	0 for each	0 month a	0 fter solar	0 r contribu	0 ution	0	0	0	0	0		(98b)
Space hea	593.57 ating req	410.47 uirement	306.95 in kWh/	130.97 m²/year	35.78	0	0	0	0	147.18	357.62	571.89	31.7	(98c) (99)

8c. S	pace Co	ooling re	quirem	ent										
Heat lo	ss rate,													
Utilisati	0 ion facto	0 or for los:	0 s	0	0	0	0	0	0	0	0	0		(100)
Useful l	0 loss, mL	0 m (watts	)	0	0	0	0	0	0	0	0	0		(101)
Gains	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Space c	0 cooling r	0 equirem(	0 ent for m	0 1onth, wh	0 ole dwel	0 lling, cont	0 tinuous (l	0 kWh)	0	0	0	0		(103) (104)
Cooled Intermi	0 fraction ittency f	0 actor	0	0	0	0	0	0	0	0	0	0	0	(104) (105)
Space c	0 cooling r	0 equirema	0 ent for m	0 1onth	0	0	0	0	0	0	0	0	0	(106)
Space c	0 :ooling r	0 equireme	0 ent in kW	0 /h/m²/yea	0 ar	0	0	0	0	0	0	0	0	(107) (108)
8f. S	pace he	eating re	quirem	ent										

Fabric Energy Efficiency,

9a. Energy requirements - Individual heating systems including micro-CHP



0

(109)

0



Fraction of space	heat from	n second	ary/supp	lementai	ry system	,		0					0	(201)
Fraction of space heat from main system(s),										1	(202)			
Fraction of main heating from main system 2,											0	(203)		
Fraction of total space heat from main system 1,											1	(204)		
Fraction of total space heat from main system 2,												0	(205)	
Efficiency of main space heating system 1 (in %),												352.38	(206)	
Efficiency of main space heating system 2 (in %),												0	(207)	
Efficiency of seco	ondary/su	pplemen	tary heat	ing syste	m, %,								0	(208)
Cooling System S	easonal E	nergy Eff	iciency R	atio,				0					0	(209)
Space heating re	quiremen	t (calcula	ted abov	e),										
0	0	0	0	0	0	0	0		0	0	0	0		(210)
Space heating fu	el (main h	eating sy	rstem 1),	kWh/mo	nth			0					0	
168.45	116.48	87.11	37.17	10.15	0	0	0		0	41.77	101.49	162.29		(211)
Space heating fu	el (main h	eating sy	vstem 2),	kWh/mo	nth			0					0	
0	0	0	0	0	0	0	0		0	0	0	0		(213)
Space heating fu	el (secono	lary), kW	h/month					0					0	
0	0	0	0	0	0	0	0		0	0	0	0		(215)
Output from wat	er heater	),						0					282.03	(216)
Efficiency of wat	er heater													
282.03	282.03	282.03	282.03	282.03	282.03	282.03	28	2.03	282.03	282.03	282.03	282.03		(217)
Fuel for water he	ating													
109.75 Space Cooling	97.13	103.17	90.41	87.48	78.64	77.38	80	.48	81.43	91.04	97.14	108.5	1102.56	(219)
0	0	0	0	0	0	0	0		0	0	0	0		(221)
Annual totals	-1						kW	h/yea	ar kV	Vh/year				
Space heating fu	el used, m	iain syste	em 1										724.91	(211)
Space heating fu	el used, fr	an syste											0	(213)
Space nearing fu	el used, se	econdary											0	(215)
Floctricity for inc	ei useu	us alactri	c chowor	(c)									1102.56	(219)
Space cooling fur		as electric	L SHOWEI	(5)									0	(64a)
Electricity for put	mns fans	and elect	tric koon	hot									0	(221)
Mechanical vent	fans - hal	and elect	tract or i	not positivo i	nnut fron	a outsida		0		0			205 70	(220-)
warm air beating	system f	anceu, ez		JUSITIVE	input non	li outside		0		0			205.78	(230a)
Warn an reading system rais										0	(2300)			
Oil boiler auxiliar	v (oil nun	on flue fa	n etc.ev	vcludos ci	irculation								0	(2300)
Gas boiler auxilia	ry (flue fa	n etc. ex	voludes ci	rculation	numn)	i punipj							0	(2300)
Maintaining electric keen-hot facility for gas combi holler									0	(2308)				
Dump for solar water heating									0	(230ľ)				
Pump for storage	WW/HRS	o'''											0	(220K)
Total electricity f	or the abo	ove											205 70	(22011)
Electricity for light	nting												197 77	(222)
Licensery for light	6,11,2												10/.//	(232)





Energy sa	aving/ger	neration	technolog	gies (App	endices N	И, N) - En	ergy use	d in dwel	ling					
Electricity	y generat	ted by P\	/s (Apper	idix M) (n	egative o	quantity)								
	15.01	23.18	36.25	43.94	50.14	47.73	47.16	42.93	35.9	27.63	17.11	12.73	399.71	(233a)
Electricity	y generat	ted by wi	ind turbir	ies (Appe	ndix M) (	negative	quantity	)						
	0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)
Electricity	y generat	ted by hy	dro-elect	ric gener	ators									
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)
Electricity	y used or	net elec	tricity ge	nerated b	by micro-	СНР								
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235c)
Energy sa	aving/ger	neration	technolo	gies (App	endices N	И, N) - En	ergy exp	orted						
Electricity	y generat	ted by P\	/s (Apper	idix M) (n	egative o	quantity)								
	2.84	6.45	13.79	22.51	31.39	32.18	31.8	26.44	18.9	10.13	4.03	2.22	202.69	(233b)
Electricity	y generat	ted by wi	ind turbir	ies (Appe	ndix M) (	negative	quantity	)						
	0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)
Electricity	y generat	ted by hy	dro-elect	tric gener	ators									
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)
Electricity	y used or	net elec	tricity ge	nerated b	by micro-	СНР								
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)
Appendix	c Q items	: annual	energy											
Appendix	۵, <iten< td=""><td>n 1 descr</td><td>iption&gt;</td><td></td><td></td><td></td><td></td><td>Fuel</td><td>k</td><td>Wh/year</td><td></td><td></td><td></td><td></td></iten<>	n 1 descr	iption>					Fuel	k	Wh/year				
energy sa	aved												0	(236a)
energy us	sed												0	(237a)
Total deli	ivered en	ergy for	all uses									1	518.61	

#### 10a. Fuel costs – Individual heating systems including micro-CHP

Fuel required	kWh/vear	Euel price	Euel cost f/year	
Space heating - main system 1 (electric off-peak tariff	ktorių year	i dei price		
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(240a)
Low-rate fraction	0		119.54	(240b)
High-rate cost	0		0	(240c)
Low-rate cost	0		0	(240d)
Space heating - main system 1 cost (other fuel)	0		0	(240e)
Space heating - main system 2 (electric off-peak tariff				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(241a)
Low-rate fraction	0		119.54	(241b)
High-rate cost	0		0	(241c)
Low-rate cost	0		0	(241d)
Space heating - main system 2 cost (other fuel)	0		0	(241e)
Space heating - secondary (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		119.54	(242a)





Low-rate fraction	0		119.54	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Space heating - secondary cost (other fuel)	0		0	(242e)
Water heating (electric off-peak tariff)				
High-rate fraction (Table 12a, or Appendix F for electric CPSU)	0		0	(243)
Low-rate fraction	0		0	(242b)
High-rate cost	0		0	(242c)
Low-rate cost	0		0	(242d)
Water heating cost (other fuel)	0		181.81	(247)
(for a DHW-only heat network use (342a) or (342b) instead of (24	47)			
Energy For instantaneous electric shower(s)	0		0	(247a)
Space cooling	0		0	(248)
Pumps, fans And electric keep-hot	0		33.93	(249)
Energy For lighting	0		30.96	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		-77.23	(252)
Appendix Q, <item 1="" description=""></item>	Fuel	kWh/year		
energy saved Or generated	0		0	(253)
energy used	0		0	(254)
Total energy cost	0		289.02	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)

11a. SAP rating – Individual heating systems including micro-CHP		
Energy cost deflator	0.36	(256)
Energy cost factor (ECF)	0.83	(257)
SAP rating	86.57	(258)
122 CO2 emissions - Individual beating systems including micro-CHP		

**Emission factor** Emissions Energy KWh/year kg kg CO2/year Space heating - main system 1 113.54 (261) Space heating - main system 2 0 (262) Space heating - secondary 0 (263) Energy for water heating 155.4 (264) Energy for instantaneous electric shower(s) 0 (264a)





Space and water heating	0	(265)
Space cooling	0	(266)
Electricity for pumps, fans and electric keep	28.54	(267)
Electricity for lighting	27.1	(268)
energy saved or generated 0	-78.25	(269b)
Appendix Q items		
energy saved 0	0	
energy used 0	0	
energy saved 0	0	(270b)
energy used	0	(271b)
Total CO2, kg/year	246.33	(272)
Dwelling CO2 Emission Rate	3.06	(273)
El rating	97	(274)

#### 13a. Primary Energy – Individual heating systems including micro-CHP

	Fnergy	Emission factor	Fmissionsr	
	KWh/vear	kg	kg CO2/vear	
Space heating - main system 1	,,	0	1145.22	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1677.18	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			0	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			311.3	(281)
Electricity for lighting			288.01	(282)
energy saved or generated	0		-688.23	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			2733.47	(286)
Dwelling PE Rate			33.93	(287)

