Energy & Sustainability Statement

For

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

Prepared on behalf of:

Digby Architectural Services

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Date	Version	Notes
12/12/2022	V1	

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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 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, Appendix A	27.12
Dwelling Emission Rate (DER) DER worksheet, Appendix B	15.89
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_2 reductions to meet the 59% target

Target Emission Rate (TER) TER worksheet, Appendix A	27.12
Dwelling Emission Rate (DER) DER worksheet, Appendix C	11.08
Target Fabric Energy Efficiency (TFEE)	57.2
Dwelling Fabric Energy Efficiency (DFEE)	39.9
% Improvement DER/TER	**59.14**
% Improvement DFEE/TFEE	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.

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.

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 (m^3/hm^2)	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.

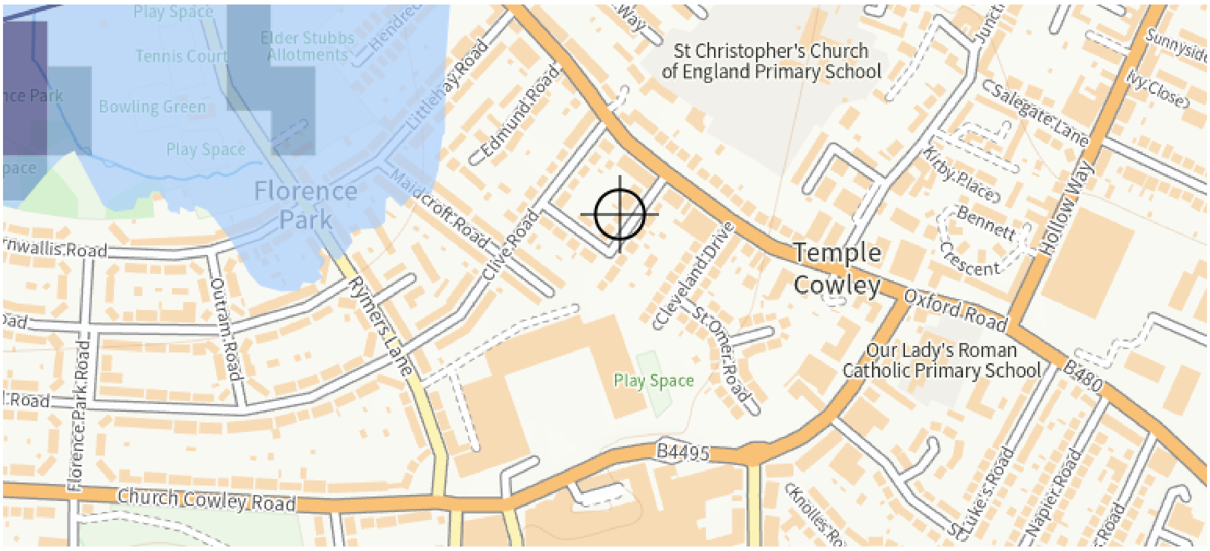
The developer will minimise the use of mains water by:

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).

Flood Risk

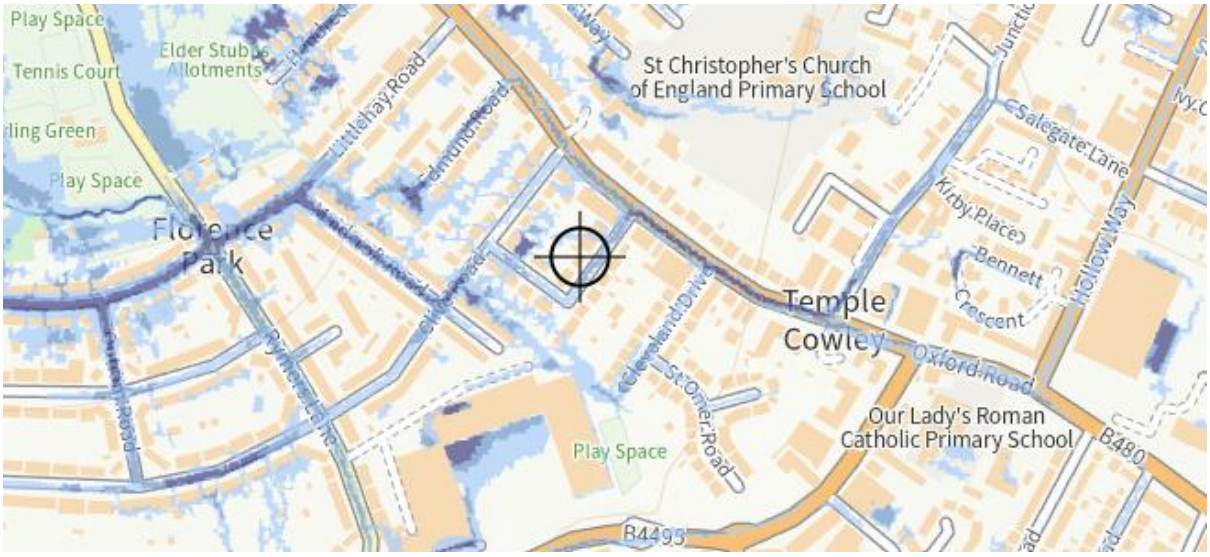
Flood risk from rivers or the sea

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.



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

RS Energy Limited
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TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Natalie Wheeler	**Stroma Number:**	STRO034641
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: Havelock Road

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

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	45.92	(1a)	x	2.3	(2a)	=	105.62	(3a)
First floor	34.65	(1b)	x	2.56	(2b)	=	88.7	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.57	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	194.32	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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 per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(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)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.2	=	2.484			(26)
Windows Type 1			3.63	x1/[1/(1.4)+ 0.04]		=	4.81			(27)
Windows Type 2			7.25	x1/[1/(1.4)+ 0.04]		=	9.61			(27)
Windows Type 3			0.58	x1/[1/(1.4)+ 0.04]		=	0.77			(27)
Windows Type 4			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 5			0.74	x1/[1/(1.4)+ 0.04]		=	0.98			(27)
Windows Type 6			1.65	x1/[1/(1.4)+ 0.04]		=	2.19			(27)
Windows Type 7			0.58	x1/[1/(1.4)+ 0.04]		=	0.77			(27)
Rooflights Type 1			0.7595974	x1/[1/(1.7) + 0.04]		=	1.291316			(27b)
Rooflights Type 2			0.7595974	x1/[1/(1.7) + 0.04]		=	1.291316			(27b)
Rooflights Type 3			0.7595974	x1/[1/(1.7) + 0.04]		=	1.291316			(27b)
Floor			45.92	x	0.13	=	5.9696			(28)
Walls	97.79	17.86	79.93	x	0.18	=	14.39			(29)
Roof Type1	9.66	2.28	7.38	x	0.13	=	0.96			(30)
Roof Type2	34.65	0	34.65	x	0.13	=	4.5			(30)
Roof Type3	0.8	0	0.8	x	0.13	=	0.1			(30)
Total area of elements, m²			188.82							(31)

TER WorkSheet: New dwelling design stage

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	52.97	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		11.53	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	64.5	(37)

Ventilation heat loss calculated monthly (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 transfer coefficient, 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	

Average = Sum(39)1…12 /12= 101.14 (39)

Heat loss parameter (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	

Average = Sum(40)1…12 /12= 1.26 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.95 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.24	98.52	94.81	91.09	87.37	83.65	83.65	87.37	91.09	94.81	98.52	102.24	

Total = Sum(44)1…12 = 1115.37 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.62	132.61	136.84	119.3	114.47	98.78	91.54	105.04	106.29	123.87	135.22	146.84	

Total = Sum(45)1…12 = 1462.43 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.74	19.89	20.53	17.9	17.17	14.82	13.73	15.76	15.94	18.58	20.28	22.03	(46)

Water storage loss:

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

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)
Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

TER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(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	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	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)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	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 DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(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

Output from water heater (annual)$_{1...12}$ — 2011.05 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	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)

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	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 L, equation 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	20.22	(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	35.37	35.37	35.37	35.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-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)

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Water heating gains (Table 5)

(72)m=	117.86	115.72	111.26	105.2	101.26	95.72	91.01	97.04	99.19	105.46	112.55	115.73	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	421.26	419.21	405.72	383.92	361.77	340.4	326.5	332.45	343.62	365.63	390.94	409.94	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	0.58	x	11.28	x	0.63	x	0.7	=	1.4	(75)
Northeast 0.9x	0.54	x	0.58	x	11.28	x	0.63	x	0.7	=	1.4	(75)
Northeast 0.9x	0.54	x	0.58	x	22.97	x	0.63	x	0.7	=	2.85	(75)
Northeast 0.9x	0.54	x	0.58	x	22.97	x	0.63	x	0.7	=	2.85	(75)
Northeast 0.9x	0.54	x	0.58	x	41.38	x	0.63	x	0.7	=	5.14	(75)
Northeast 0.9x	0.54	x	0.58	x	41.38	x	0.63	x	0.7	=	5.14	(75)
Northeast 0.9x	0.54	x	0.58	x	67.96	x	0.63	x	0.7	=	8.45	(75)
Northeast 0.9x	0.54	x	0.58	x	67.96	x	0.63	x	0.7	=	8.45	(75)
Northeast 0.9x	0.54	x	0.58	x	91.35	x	0.63	x	0.7	=	11.36	(75)
Northeast 0.9x	0.54	x	0.58	x	91.35	x	0.63	x	0.7	=	11.36	(75)
Northeast 0.9x	0.54	x	0.58	x	97.38	x	0.63	x	0.7	=	12.11	(75)
Northeast 0.9x	0.54	x	0.58	x	97.38	x	0.63	x	0.7	=	12.11	(75)
Northeast 0.9x	0.54	x	0.58	x	91.1	x	0.63	x	0.7	=	11.32	(75)
Northeast 0.9x	0.54	x	0.58	x	91.1	x	0.63	x	0.7	=	11.32	(75)
Northeast 0.9x	0.54	x	0.58	x	72.63	x	0.63	x	0.7	=	9.03	(75)
Northeast 0.9x	0.54	x	0.58	x	72.63	x	0.63	x	0.7	=	9.03	(75)
Northeast 0.9x	0.54	x	0.58	x	50.42	x	0.63	x	0.7	=	6.27	(75)
Northeast 0.9x	0.54	x	0.58	x	50.42	x	0.63	x	0.7	=	6.27	(75)
Northeast 0.9x	0.54	x	0.58	x	28.07	x	0.63	x	0.7	=	3.49	(75)
Northeast 0.9x	0.54	x	0.58	x	28.07	x	0.63	x	0.7	=	3.49	(75)
Northeast 0.9x	0.54	x	0.58	x	14.2	x	0.63	x	0.7	=	1.76	(75)
Northeast 0.9x	0.54	x	0.58	x	14.2	x	0.63	x	0.7	=	1.76	(75)
Northeast 0.9x	0.54	x	0.58	x	9.21	x	0.63	x	0.7	=	1.15	(75)
Northeast 0.9x	0.54	x	0.58	x	9.21	x	0.63	x	0.7	=	1.15	(75)
Southeast 0.9x	0.77	x	3.63	x	36.79	x	0.63	x	0.7	=	40.82	(77)
Southeast 0.9x	0.77	x	1.36	x	36.79	x	0.63	x	0.7	=	15.29	(77)
Southeast 0.9x	0.77	x	0.74	x	36.79	x	0.63	x	0.7	=	8.32	(77)
Southeast 0.9x	0.77	x	3.63	x	62.67	x	0.63	x	0.7	=	69.53	(77)
Southeast 0.9x	0.77	x	1.36	x	62.67	x	0.63	x	0.7	=	26.05	(77)
Southeast 0.9x	0.77	x	0.74	x	62.67	x	0.63	x	0.7	=	14.17	(77)
Southeast 0.9x	0.77	x	3.63	x	85.75	x	0.63	x	0.7	=	95.13	(77)
Southeast 0.9x	0.77	x	1.36	x	85.75	x	0.63	x	0.7	=	35.64	(77)

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Southeast 0.9x	0.77	x	0.74	x	85.75	x	0.63	x	0.7	=	19.39	(77)
Southeast 0.9x	0.77	x	3.63	x	106.25	x	0.63	x	0.7	=	117.87	(77)
Southeast 0.9x	0.77	x	1.36	x	106.25	x	0.63	x	0.7	=	44.16	(77)
Southeast 0.9x	0.77	x	0.74	x	106.25	x	0.63	x	0.7	=	24.03	(77)
Southeast 0.9x	0.77	x	3.63	x	119.01	x	0.63	x	0.7	=	132.03	(77)
Southeast 0.9x	0.77	x	1.36	x	119.01	x	0.63	x	0.7	=	49.46	(77)
Southeast 0.9x	0.77	x	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	x	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	x	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	x	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	x	91.35	x	0.63	x	0.7	=	202.39	(81)
Northwest 0.9x	0.77	x	1.65	x	91.35	x	0.63	x	0.7	=	46.06	(81)
Northwest 0.9x	0.77	x	7.25	x	97.38	x	0.63	x	0.7	=	215.77	(81)
Northwest 0.9x	0.77	x	1.65	x	97.38	x	0.63	x	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	x	0.63	x	0.7	=	160.92	(81)
Northwest	0.9x	0.77	x	1.65	x	72.63	x	0.63	x	0.7	=	36.62	(81)
Northwest	0.9x	0.77	x	7.25	x	50.42	x	0.63	x	0.7	=	111.72	(81)
Northwest	0.9x	0.77	x	1.65	x	50.42	x	0.63	x	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	x	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	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	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	x	0.63	x	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	x	0.63	x	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	x	0.63	x	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	x	100.39	x	0.63	x	0.7	=	30.27	(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	x	54.87	x	0.63	x	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	x	54.87	x	0.63	x	0.7	=	16.54	(82)

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Rooflights 0.9x	1	x	0.76	x	26.72	x	0.63	x	0.7	=	8.05	(82)
Rooflights 0.9x	1	x	0.76	x	26.72	x	0.63	x	0.7	=	8.05	(82)
Rooflights 0.9x	1	x	0.76	x	26.72	x	0.63	x	0.7	=	8.05	(82)
Rooflights 0.9x	1	x	0.76	x	16.9	x	0.63	x	0.7	=	5.09	(82)
Rooflights 0.9x	1	x	0.76	x	16.9	x	0.63	x	0.7	=	5.09	(82)
Rooflights 0.9x	1	x	0.76	x	16.9	x	0.63	x	0.7	=	5.09	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	116.9	218	347.2	510.19	643	669.44	632.5	528.92	403.07	254.25	143.48	97.78	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	538.16	637.21	752.92	894.11	1004.77	1009.84	959.01	861.37	746.7	619.88	534.42	507.72	(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	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.6	0.45	0.52	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.66	19.84	20.15	20.55	20.84	20.97	20.99	20.99	20.88	20.48	20	19.63	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.86	19.86	19.87	19.88	19.88	19.89	19.89	19.89	19.88	19.88	19.87	19.87	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.51	0.34	0.4	0.71	0.95	0.99	1	(89)

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

(90)m=	18.09	18.36	18.8	19.36	19.73	19.87	19.89	19.88	19.8	19.29	18.59	18.05	(90)

fLA = Living area ÷ (4) = | 0.14 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.3	18.56	18.99	19.53	19.88	20.02	20.04	20.03	19.95	19.45	18.78	18.26	(92)

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

(93)m=	18.3	18.56	18.99	19.53	19.88	20.02	20.04	20.03	19.95	19.45	18.78	18.26	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.89	0.74	0.52	0.36	0.42	0.71	0.94	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	534.6	628.09	724.97	796.36	738.88	528	341.79	359.2	532.73	580.94	527.26	505.1	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1438.1	1399.6	1276.66	1074.72	825.98	541.56	343.51	362.72	586.55	893.65	1184.18	1431.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	672.21	518.46	410.46	200.42	64.81	0	0	0	0	232.65	472.98	689.2	

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Total per year (kWh/year) = Sum(98)1...5,9...12 =	3261.18	(98)
Space heating requirement in kWh/m²/year	40.48	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	672.21	518.46	410.46	200.42	64.81	0	0	0	0	232.65	472.98	689.2		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	718.94	554.5	438.99	214.35	69.31	0	0	0	0	248.83	505.86	737.11		(211)
Total (kWh/year) =Sum(211)1...5,10...12=													3487.9	(211)
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		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	198.22	174.7	183.44	164.39	161.07	143.87	138.13	151.63	151.38	170.47	180.31	193.43		
Efficiency of water heater													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 for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (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		
Total = Sum(219a)1...12 =													2382.76	(219)

Annual totals

		kWh/year	kWh/year	
Space heating fuel used, main system 1			3487.9	
Water heating fuel used			2382.76	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			347.36	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6293.02	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

TER WorkSheet: New dwelling design stage

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)

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User Details:

Assessor Name:	Natalie Wheeler	**Stroma Number:**	STRO034641
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: Havelock Road - No PV

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

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	45.92	(1a)	x	2.3	(2a)	=	105.62	(3a)
First floor	34.65	(1b)	x	2.56	(2b)	=	88.7	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.57	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	194.32	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 78.2 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)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	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			3.68	x1/[1/(1.2)+ 0.04]		=	4.21			(27)
Windows Type 2			7.35	x1/[1/(1.2)+ 0.04]		=	8.42			(27)
Windows Type 3			0.59	x1/[1/(1.2)+ 0.04]		=	0.68			(27)
Windows Type 4			1.38	x1/[1/(1.2)+ 0.04]		=	1.58			(27)
Windows Type 5			0.75	x1/[1/(1.2)+ 0.04]		=	0.86			(27)
Windows Type 6			1.67	x1/[1/(1.2)+ 0.04]		=	1.91			(27)
Windows Type 7			0.59	x1/[1/(1.2)+ 0.04]		=	0.68			(27)
Rooflights Type 1			0.77	x1/[1/(1.2) + 0.04]		=	0.924			(27b)
Rooflights Type 2			0.77	x1/[1/(1.2) + 0.04]		=	0.924			(27b)
Rooflights Type 3			0.77	x1/[1/(1.2) + 0.04]		=	0.924			(27b)
Floor			45.92	x	0.11	=	5.0512	0	0	(28)
Walls	97.79	18.08	79.71	x	0.16	=	12.75	0	0	(29)
Roof Type1	9.66	2.31	7.35	x	0.11	=	0.81	0	0	(30)
Roof Type2	34.65	0	34.65	x	0.11	=	3.81	0	0	(30)
Roof Type3	0.8	0	0.8	x	0.11	=	0.09	0	0	(30)
Total area of elements, m²			188.82							(31)

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** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.56 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 0 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.92 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 61.47 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	17.41	17.21	17.01	15.98	15.78	14.76	14.76	14.55	15.17	15.78	16.19	16.6	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.89	78.68	78.48	77.46	77.25	76.23	76.23	76.03	76.64	77.25	77.66	78.07	

Average = Sum(39)1…12 /12= 77.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.97	0.96	0.96	0.95	0.95	0.94	0.95	0.96	0.96	0.97	

Average = Sum(40)1…12 /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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

(44)m=	102.24	98.52	94.81	91.09	87.37	83.65	83.65	87.37	91.09	94.81	98.52	102.24	

Total = Sum(44)1…12 = 1115.37 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.62	132.61	136.84	119.3	114.47	98.78	91.54	105.04	106.29	123.87	135.22	146.84	

Total = Sum(45)1…12 = 1462.43 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.74	19.89	20.53	17.9	17.17	14.82	13.73	15.76	15.94	18.58	20.28	22.03	(46)

Water storage loss:

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

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.5 (48)

Temperature factor from Table 2b 0.54 (49)

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Energy lost from water storage, kWh/year	(48) x (49) =	0.81	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.81	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200	176.3	185.21	166.11	162.85	145.59	139.91	153.41	153.1	172.25	182.03	195.21	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	200	176.3	185.21	166.11	162.85	145.59	139.91	153.41	153.1	172.25	182.03	195.21

Output from water heater (annual)1…12 — 2031.98 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	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	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 L, equation 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	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	(70)
Losses e.g. evaporation (negative values) (Table 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)

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Water heating gains (Table 5)

(72)m=	119.77	117.63	113.17	107.11	103.17	97.63	92.92	98.96	101.1	107.37	114.46	117.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	420.17	418.12	404.63	382.83	360.68	339.31	325.41	331.36	342.53	364.54	389.85	408.85	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.54	x	0.59	x	11.28	x	0.5	x	0.7	=	1.13	(75)
Northeast	0.9x	0.54	x	0.59	x	11.28	x	0.5	x	0.7	=	1.13	(75)
Northeast	0.9x	0.54	x	0.59	x	22.97	x	0.5	x	0.7	=	2.3	(75)
Northeast	0.9x	0.54	x	0.59	x	22.97	x	0.5	x	0.7	=	2.3	(75)
Northeast	0.9x	0.54	x	0.59	x	41.38	x	0.5	x	0.7	=	4.15	(75)
Northeast	0.9x	0.54	x	0.59	x	41.38	x	0.5	x	0.7	=	4.15	(75)
Northeast	0.9x	0.54	x	0.59	x	67.96	x	0.5	x	0.7	=	6.82	(75)
Northeast	0.9x	0.54	x	0.59	x	67.96	x	0.5	x	0.7	=	6.82	(75)
Northeast	0.9x	0.54	x	0.59	x	91.35	x	0.5	x	0.7	=	9.17	(75)
Northeast	0.9x	0.54	x	0.59	x	91.35	x	0.5	x	0.7	=	9.17	(75)
Northeast	0.9x	0.54	x	0.59	x	97.38	x	0.5	x	0.7	=	9.77	(75)
Northeast	0.9x	0.54	x	0.59	x	97.38	x	0.5	x	0.7	=	9.77	(75)
Northeast	0.9x	0.54	x	0.59	x	91.1	x	0.5	x	0.7	=	9.14	(75)
Northeast	0.9x	0.54	x	0.59	x	91.1	x	0.5	x	0.7	=	9.14	(75)
Northeast	0.9x	0.54	x	0.59	x	72.63	x	0.5	x	0.7	=	7.29	(75)
Northeast	0.9x	0.54	x	0.59	x	72.63	x	0.5	x	0.7	=	7.29	(75)
Northeast	0.9x	0.54	x	0.59	x	50.42	x	0.5	x	0.7	=	5.06	(75)
Northeast	0.9x	0.54	x	0.59	x	50.42	x	0.5	x	0.7	=	5.06	(75)
Northeast	0.9x	0.54	x	0.59	x	28.07	x	0.5	x	0.7	=	2.82	(75)
Northeast	0.9x	0.54	x	0.59	x	28.07	x	0.5	x	0.7	=	2.82	(75)
Northeast	0.9x	0.54	x	0.59	x	14.2	x	0.5	x	0.7	=	1.42	(75)
Northeast	0.9x	0.54	x	0.59	x	14.2	x	0.5	x	0.7	=	1.42	(75)
Northeast	0.9x	0.54	x	0.59	x	9.21	x	0.5	x	0.7	=	0.92	(75)
Northeast	0.9x	0.54	x	0.59	x	9.21	x	0.5	x	0.7	=	0.92	(75)
Southeast	0.9x	0.77	x	3.68	x	36.79	x	0.5	x	0.7	=	32.84	(77)
Southeast	0.9x	0.77	x	1.38	x	36.79	x	0.5	x	0.7	=	12.32	(77)
Southeast	0.9x	0.77	x	0.75	x	36.79	x	0.5	x	0.7	=	6.69	(77)
Southeast	0.9x	0.77	x	3.68	x	62.67	x	0.5	x	0.7	=	55.94	(77)
Southeast	0.9x	0.77	x	1.38	x	62.67	x	0.5	x	0.7	=	20.98	(77)
Southeast	0.9x	0.77	x	0.75	x	62.67	x	0.5	x	0.7	=	11.4	(77)
Southeast	0.9x	0.77	x	3.68	x	85.75	x	0.5	x	0.7	=	76.54	(77)
Southeast	0.9x	0.77	x	1.38	x	85.75	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	=	94.84	(77)
Southeast	0.9x	0.77	x	1.38	x	106.25	x	0.5	x	0.7	=	35.56	(77)
Southeast	0.9x	0.77	x	0.75	x	106.25	x	0.5	x	0.7	=	19.33	(77)
Southeast	0.9x	0.77	x	3.68	x	119.01	x	0.5	x	0.7	=	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	x	119.01	x	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	x	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	x	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	x	91.35	x	0.5	x	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	x	0.7	=	129.48	(81)
Northwest 0.9x	0.77	x	1.67	x	72.63	x	0.5	x	0.7	=	29.42	(81)
Northwest 0.9x	0.77	x	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	x	0.7	=	20.42	(81)
Northwest 0.9x	0.77	x	7.35	x	28.07	x	0.5	x	0.7	=	50.04	(81)
Northwest 0.9x	0.77	x	1.67	x	28.07	x	0.5	x	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	x	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	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	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	x	0.7	=	49.96	(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	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	x	0.7	=	39.9	(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	100.39	x	0.57	x	0.7	=	27.76	(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	x	0.7	=	27.76	(82)
Rooflights 0.9x	1	x	0.77	x	54.87	x	0.57	x	0.7	=	15.17	(82)
Rooflights 0.9x	1	x	0.77	x	54.87	x	0.57	x	0.7	=	15.17	(82)
Rooflights 0.9x	1	x	0.77	x	54.87	x	0.57	x	0.7	=	15.17	(82)

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Rooflights 0.9x	1	x	0.77	x	26.72	x	0.57	x	0.7	=	7.39	(82)
Rooflights 0.9x	1	x	0.77	x	26.72	x	0.57	x	0.7	=	7.39	(82)
Rooflights 0.9x	1	x	0.77	x	26.72	x	0.57	x	0.7	=	7.39	(82)
Rooflights 0.9x	1	x	0.77	x	16.9	x	0.57	x	0.7	=	4.67	(82)
Rooflights 0.9x	1	x	0.77	x	16.9	x	0.57	x	0.7	=	4.67	(82)
Rooflights 0.9x	1	x	0.77	x	16.9	x	0.57	x	0.7	=	4.67	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	96.2	179.93	287.73	424.3	535.78	558.18	527.24	440.29	334.55	210.17	118.18	80.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	516.37	598.05	692.36	807.13	896.46	897.49	852.65	771.64	677.09	574.71	508.02	489.25	(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	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.72	0.68	0.62	0.54	0.44	0.35	0.28	0.31	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	18.11	18.83	19.57	20.13	20.43	20.37	19.88	18.99	17.94	17.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.11	20.12	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.71	0.67	0.61	0.52	0.42	0.32	0.24	0.27	0.41	0.56	0.67	0.72	(89)

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

(90)m=	15.29	15.71	16.48	17.48	18.41	19.14	19.51	19.45	18.86	17.68	16.32	15.2	(90)

fLA = Living area ÷ (4) = 0.14 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	15.55	15.96	16.7	17.67	18.57	19.28	19.64	19.58	19	17.86	16.54	15.47	(92)

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

(93)m=	15.55	15.96	16.7	17.67	18.57	19.28	19.64	19.58	19	17.86	16.54	15.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.63	0.59	0.54	0.46	0.37	0.28	0.21	0.24	0.36	0.49	0.59	0.64	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	326.48	354.48	371.31	368.79	333.27	255.09	182.15	183.99	241.57	283.76	300.14	314.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	887.79	870.36	800.73	679.06	530.47	356.39	231.63	241.59	375.57	560.52	733.5	879.61	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	417.61	346.67	319.49	223.39	146.72	0	0	0	0	205.91	312.01	420.53	(98)

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Total per year (kWh/year) = Sum(98)1...5,9...12 =	2392.35	(98)
Space heating requirement in kWh/m²/year	29.69	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [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/year	
Space heating requirement (calculated above)	417.61	346.67	319.49	223.39	146.72	0	0	0	0	205.91	312.01	420.53		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	215.48	178.87	164.85	115.26	75.7	0	0	0	0	106.24	160.99	216.98		(211)
Total (kWh/year) =Sum(211)1...5,10...12=													1234.38	(211)
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		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	200	176.3	185.21	166.11	162.85	145.59	139.91	153.41	153.1	172.25	182.03	195.21		
Efficiency of water heater													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 for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (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		
Total = Sum(219a)1...12 =													718.97	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1234.38	
Water heating fuel used			718.97	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		165.95		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165.95	(231)
Electricity for lighting			347.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			2466.63	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	640.64	(261)

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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)
EI rating (section 14)				86	(274)

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User Details:

Assessor Name:	Natalie Wheeler	**Stroma Number:**	STRO034641
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: Havelock Road

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

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	45.92	(1a)	x	2.3	(2a)	=	105.62	(3a)
First floor	34.65	(1b)	x	2.56	(2b)	=	88.7	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.57	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	194.32	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 78.2 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)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	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			3.68	x1/[1/(1.2)+ 0.04]		=	4.21			(27)
Windows Type 2			7.35	x1/[1/(1.2)+ 0.04]		=	8.42			(27)
Windows Type 3			0.59	x1/[1/(1.2)+ 0.04]		=	0.68			(27)
Windows Type 4			1.38	x1/[1/(1.2)+ 0.04]		=	1.58			(27)
Windows Type 5			0.75	x1/[1/(1.2)+ 0.04]		=	0.86			(27)
Windows Type 6			1.67	x1/[1/(1.2)+ 0.04]		=	1.91			(27)
Windows Type 7			0.59	x1/[1/(1.2)+ 0.04]		=	0.68			(27)
Rooflights Type 1			0.77	x1/[1/(1.2) + 0.04]		=	0.924			(27b)
Rooflights Type 2			0.77	x1/[1/(1.2) + 0.04]		=	0.924			(27b)
Rooflights Type 3			0.77	x1/[1/(1.2) + 0.04]		=	0.924			(27b)
Floor			45.92	x	0.11	=	5.0512	0	0	(28)
Walls	97.79	18.08	79.71	x	0.16	=	12.75	0	0	(29)
Roof Type1	9.66	2.31	7.35	x	0.11	=	0.81	0	0	(30)
Roof Type2	34.65	0	34.65	x	0.11	=	3.81	0	0	(30)
Roof Type3	0.8	0	0.8	x	0.11	=	0.09	0	0	(30)
Total area of elements, m²			188.82							(31)

DER WorkSheet: New dwelling design stage

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	45.56	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	= (34) ÷ (4) =	0	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.92	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	61.47	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	17.41	17.21	17.01	15.98	15.78	14.76	14.76	14.55	15.17	15.78	16.19	16.6	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.89	78.68	78.48	77.46	77.25	76.23	76.23	76.03	76.64	77.25	77.66	78.07	

Average = Sum(39)$_{1…12}$ /12= 77.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.97	0.96	0.96	0.95	0.95	0.94	0.95	0.96	0.96	0.97	

Average = Sum(40)$_{1…12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.47 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.95 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.24	98.52	94.81	91.09	87.37	83.65	83.65	87.37	91.09	94.81	98.52	102.24	

Total = Sum(44)$_{1…12}$ = 1115.37 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.62	132.61	136.84	119.3	114.47	98.78	91.54	105.04	106.29	123.87	135.22	146.84	

Total = Sum(45)$_{1…12}$ = 1462.43 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.74	19.89	20.53	17.9	17.17	14.82	13.73	15.76	15.94	18.58	20.28	22.03	(46)

Water storage loss:

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

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.5 (48)

Temperature factor from Table 2b 0.54 (49)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(48) x (49) =	0.81	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.81	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200	176.3	185.21	166.11	162.85	145.59	139.91	153.41	153.1	172.25	182.03	195.21	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	200	176.3	185.21	166.11	162.85	145.59	139.91	153.41	153.1	172.25	182.03	195.21

Output from water heater (annual)1…12 — 2031.98 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	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	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 L, equation 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	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	(70)

Losses e.g. evaporation (negative values) (Table 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)

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Water heating gains (Table 5)

(72)m=	119.77	117.63	113.17	107.11	103.17	97.63	92.92	98.96	101.1	107.37	114.46	117.64	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	420.17	418.12	404.63	382.83	360.68	339.31	325.41	331.36	342.53	364.54	389.85	408.85	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.54	x	0.59	x	11.28	x	0.5	x	0.7	=	1.13	(75)
Northeast 0.9x	0.54	x	0.59	x	11.28	x	0.5	x	0.7	=	1.13	(75)
Northeast 0.9x	0.54	x	0.59	x	22.97	x	0.5	x	0.7	=	2.3	(75)
Northeast 0.9x	0.54	x	0.59	x	22.97	x	0.5	x	0.7	=	2.3	(75)
Northeast 0.9x	0.54	x	0.59	x	41.38	x	0.5	x	0.7	=	4.15	(75)
Northeast 0.9x	0.54	x	0.59	x	41.38	x	0.5	x	0.7	=	4.15	(75)
Northeast 0.9x	0.54	x	0.59	x	67.96	x	0.5	x	0.7	=	6.82	(75)
Northeast 0.9x	0.54	x	0.59	x	67.96	x	0.5	x	0.7	=	6.82	(75)
Northeast 0.9x	0.54	x	0.59	x	91.35	x	0.5	x	0.7	=	9.17	(75)
Northeast 0.9x	0.54	x	0.59	x	91.35	x	0.5	x	0.7	=	9.17	(75)
Northeast 0.9x	0.54	x	0.59	x	97.38	x	0.5	x	0.7	=	9.77	(75)
Northeast 0.9x	0.54	x	0.59	x	97.38	x	0.5	x	0.7	=	9.77	(75)
Northeast 0.9x	0.54	x	0.59	x	91.1	x	0.5	x	0.7	=	9.14	(75)
Northeast 0.9x	0.54	x	0.59	x	91.1	x	0.5	x	0.7	=	9.14	(75)
Northeast 0.9x	0.54	x	0.59	x	72.63	x	0.5	x	0.7	=	7.29	(75)
Northeast 0.9x	0.54	x	0.59	x	72.63	x	0.5	x	0.7	=	7.29	(75)
Northeast 0.9x	0.54	x	0.59	x	50.42	x	0.5	x	0.7	=	5.06	(75)
Northeast 0.9x	0.54	x	0.59	x	50.42	x	0.5	x	0.7	=	5.06	(75)
Northeast 0.9x	0.54	x	0.59	x	28.07	x	0.5	x	0.7	=	2.82	(75)
Northeast 0.9x	0.54	x	0.59	x	28.07	x	0.5	x	0.7	=	2.82	(75)
Northeast 0.9x	0.54	x	0.59	x	14.2	x	0.5	x	0.7	=	1.42	(75)
Northeast 0.9x	0.54	x	0.59	x	14.2	x	0.5	x	0.7	=	1.42	(75)
Northeast 0.9x	0.54	x	0.59	x	9.21	x	0.5	x	0.7	=	0.92	(75)
Northeast 0.9x	0.54	x	0.59	x	9.21	x	0.5	x	0.7	=	0.92	(75)
Southeast 0.9x	0.77	x	3.68	x	36.79	x	0.5	x	0.7	=	32.84	(77)
Southeast 0.9x	0.77	x	1.38	x	36.79	x	0.5	x	0.7	=	12.32	(77)
Southeast 0.9x	0.77	x	0.75	x	36.79	x	0.5	x	0.7	=	6.69	(77)
Southeast 0.9x	0.77	x	3.68	x	62.67	x	0.5	x	0.7	=	55.94	(77)
Southeast 0.9x	0.77	x	1.38	x	62.67	x	0.5	x	0.7	=	20.98	(77)
Southeast 0.9x	0.77	x	0.75	x	62.67	x	0.5	x	0.7	=	11.4	(77)
Southeast 0.9x	0.77	x	3.68	x	85.75	x	0.5	x	0.7	=	76.54	(77)
Southeast 0.9x	0.77	x	1.38	x	85.75	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	=	94.84	(77)
Southeast 0.9x	0.77	x	1.38	x	106.25	x	0.5	x	0.7	=	35.56	(77)
Southeast 0.9x	0.77	x	0.75	x	106.25	x	0.5	x	0.7	=	19.33	(77)
Southeast 0.9x	0.77	x	3.68	x	119.01	x	0.5	x	0.7	=	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	x	119.01	x	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	x	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	x	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	x	91.35	x	0.5	x	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	x	0.7	=	129.48	(81)
Northwest 0.9x	0.77	x	1.67	x	72.63	x	0.5	x	0.7	=	29.42	(81)
Northwest 0.9x	0.77	x	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	x	0.7	=	20.42	(81)
Northwest 0.9x	0.77	x	7.35	x	28.07	x	0.5	x	0.7	=	50.04	(81)
Northwest 0.9x	0.77	x	1.67	x	28.07	x	0.5	x	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	x	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	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	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	x	0.7	=	49.96	(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	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	x	0.7	=	39.9	(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	100.39	x	0.57	x	0.7	=	27.76	(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	x	0.7	=	27.76	(82)
Rooflights 0.9x	1	x	0.77	x	54.87	x	0.57	x	0.7	=	15.17	(82)
Rooflights 0.9x	1	x	0.77	x	54.87	x	0.57	x	0.7	=	15.17	(82)
Rooflights 0.9x	1	x	0.77	x	54.87	x	0.57	x	0.7	=	15.17	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	0.77	x	26.72	x	0.57	x	0.7	=	7.39	(82)
Rooflights 0.9x	1	x	0.77	x	26.72	x	0.57	x	0.7	=	7.39	(82)
Rooflights 0.9x	1	x	0.77	x	26.72	x	0.57	x	0.7	=	7.39	(82)
Rooflights 0.9x	1	x	0.77	x	16.9	x	0.57	x	0.7	=	4.67	(82)
Rooflights 0.9x	1	x	0.77	x	16.9	x	0.57	x	0.7	=	4.67	(82)
Rooflights 0.9x	1	x	0.77	x	16.9	x	0.57	x	0.7	=	4.67	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	96.2	179.93	287.73	424.3	535.78	558.18	527.24	440.29	334.55	210.17	118.18	80.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	516.37	598.05	692.36	807.13	896.46	897.49	852.65	771.64	677.09	574.71	508.02	489.25	(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	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.72	0.68	0.62	0.54	0.44	0.35	0.28	0.31	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	18.11	18.83	19.57	20.13	20.43	20.37	19.88	18.99	17.94	17.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.11	20.12	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.71	0.67	0.61	0.52	0.42	0.32	0.24	0.27	0.41	0.56	0.67	0.72	(89)

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

(90)m=	15.29	15.71	16.48	17.48	18.41	19.14	19.51	19.45	18.86	17.68	16.32	15.2	(90)

fLA = Living area ÷ (4) = | 0.14 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	15.55	15.96	16.7	17.67	18.57	19.28	19.64	19.58	19	17.86	16.54	15.47	(92)

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

(93)m=	15.55	15.96	16.7	17.67	18.57	19.28	19.64	19.58	19	17.86	16.54	15.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.63	0.59	0.54	0.46	0.37	0.28	0.21	0.24	0.36	0.49	0.59	0.64	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	326.48	354.48	371.31	368.79	333.27	255.09	182.15	183.99	241.57	283.76	300.14	314.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	887.79	870.36	800.73	679.06	530.47	356.39	231.63	241.59	375.57	560.52	733.5	879.61	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	417.61	346.67	319.49	223.39	146.72	0	0	0	0	205.91	312.01	420.53	(98)

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2392.35 (98)

Space heating requirement in kWh/m²/year 29.69 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [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/year	
Space heating requirement (calculated above)	417.61	346.67	319.49	223.39	146.72	0	0	0	0	205.91	312.01	420.53		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	215.48	178.87	164.85	115.26	75.7	0	0	0	0	106.24	160.99	216.98		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1234.38	(211)
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		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	200	176.3	185.21	166.11	162.85	145.59	139.91	153.41	153.1	172.25	182.03	195.21		
Efficiency of water heater													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 for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (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		
Total = Sum(219a)$_{1...12}$ =													718.97	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1234.38	
Water heating fuel used			718.97	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		165.95		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165.95	(231)
Electricity for lighting			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. CO_2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO_2/kWh	**Emissions** kg CO_2/year

DER WorkSheet: New dwelling design stage

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) =			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					
Item 1		0.519	=	-387.68	(269)
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 Water Calculator for New Dwellings					
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 dry load	8.17	2.1	0.0	17.16
Dishwasher	litres/place setting	1.25	3.6	0.0	4.5
Waste disposal	litres/use	1	3.08	0.0	3.08
Water softener	litres/person/day	0	1.0	0.0	0
		Total calculated use (litres/person/day)			114.42
		Contribution from greywater (litres/person/day)			-
		Contribution from rainwater (litres/person/day)			-
		Normalisation factor			0.91
		Total Water Consumption. Code for Sustainable Homes (litres/person/day)			**104.1**
		External water use			5.0
		Total Water Consumption. (36(1)) (litres/person/day)			**109.1**

Summary of fitting types "As Designed"			
Type	Description	Flow rates, volumes etc.	Qty
Taps	TBC	5 litres/min	1
Baths		170 litres to overflow	1
Dishwashers	TBC	1.25 litres/place	1
Washing Machines	TBC	8.17 litres/kg	1
Showers	TBC	8 litres/min	1
WC's	TBC	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"			
Type	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.

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

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

DER WORKSHEET

Dwelling Reference: RS1745
Dwelling Type: New Dwelling Design Stage

10a Havelock Road
Oxford
OX4 3EP

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)			Volume(m³)	
Basement	45.92 (1a)	x	2.3	(2a)	=	105.62	(3a)
Ground Floor	34.65 (1b)	x	2.56	(2b)	=	88.7	(3b)
Total floor area TFA						80.57	(4)
Dwelling volume						194.32	(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	35	=	0	(6e)
Number of blocked chimneys	0	x	20	=	0	(6f)
Number of intermittent extract fans	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 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)
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)
Window infiltration	0	0	(15)
Infiltration rate	0	0	(16)
Air permeability value, AP50, (m³/h/m²)	3	3	(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 factor	0.85	(20)
Infiltration rate incorporating shelter 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 speed from Table U2	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Wind Factor	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)	0.33	0.32	0.32	0.28	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.3	3.4	(22b)

Calculate effective air change rate for the applicable case:

	0.5	(23a)
	0.5	(23b)
	46.5	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
a) If balanced mechanical ventilation with heat recovery (MVHR)	0.6	0.59	0.58	0.55	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57	(24a)
b) If balanced mechanical ventilation without heat recovery (MV)	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
c) If whole house extract ventilation or positive input ventilation from outside	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
d) If natural ventilation or whole house positive input ventilation from loft	0	0	0	0	0	0	0	0	0	0	0	0	(24d)
Effective air change rate	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)
Effective air change rate from PCDB:	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	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door							2.07	(26)
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 elements ∑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 floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		45.56	(33)
Heat capacity Cm = ∑(A x k)		0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		15.92	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		15.92	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		61.47	(37)

Ventilation heat loss calculated monthly

38.31	37.89	37.48	35.4	34.99	32.92	32.92	32.5	33.74	34.99	35.82	36.65		(38)

Heat transfer coefficient, W/K

99.78	99.37	98.95	96.88	96.46	94.39	94.39	93.98	95.22	96.46	97.29	98.12		(39)

Heat loss parameter (HLP), W/m²K

1.24	1.23	1.23	1.2	1.2	1.17	1.17	1.17	1.18	1.2	1.21	1.22		(40)

Number of days in month (Table 1a)

31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement

Assumed occupancy, N	2.47	(42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

90.33	88.97	86.99	83.21	80.42	77.3	75.53	77.49	79.65	82.99	86.86	89.98		(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

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 usage in litres per day for other uses, Vd,other (from Appendix 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 hot water usage in litres per day Vd,average (from Appendix J)	146.15	(43)

Hot water usage in litres per day for each month Vd,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 of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

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)

Distribution loss (46) = 0.15 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)

Storage volume (litres) including any solar or WWHRS storage within same vessel	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) × (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		(56)

If the vessel contains dedicated solar storage or dedicated WWHRS storage,
(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		(57)

Primary circuit loss for each month from Table 3
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	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)

0	0	0	0	0	0	0	0	0	0	0	0		(61)

Total heat required for water heating calculated for each month (62) = 0.85 × (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	3109.51	(62)

CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)

0	0	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	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		(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	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	3109.51	(64)

Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)

0	0	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		(65)

include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network

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		(66)

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

26.58	23.61	19.2	14.54	10.87	9.17	9.91	12.88	17.29	21.96	25.63	27.32	(67)

Appliances gains (calculated in Appendix L, equation L16 or L16a), also see Table 5

329.3	332.71	324.1	305.77	282.63	260.88	246.35	242.93	251.55	269.88	293.02	314.77	(68)

Cooking gains (calculated in Appendix L, equation L18 or L18a), also see Table 5

52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	(69)

Pumps and fans gains (Table 5a)

0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5

-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 gains (Table 5)

174.94	172.15	166.63	154.35	146.87	139.03	134.13	138.05	142.66	151.35	163.12	173.35	(72)

Total internal gains

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 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. 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, ⍰1,m (see Table 9a)

0.99	0.98	0.95	0.87	0.72	0.53	0.39	0.44	0.69	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 and 4 in Table 9c)

20.5	20.16	20.39	20.68	20.86	20.92	20.94	20.93	20.89	20.65	20.29	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

19.89	19.89	19.9	19.92	19.92	19.94	19.94	19.95	19.93	19.92	19.91	19.91	(88)

Roof Utilisation factor for gains for rest of dwelling, ⍰2,m (see Table 9a)

0.98	0.97	0.94	0.84	0.66	0.44	0.29	0.34	0.6	0.88	0.97	0.99	(89)

Roof Mean internal temperature in the rest of dwelling T2

19.44	18.95	19.24	19.59	19.78	19.86	19.86	19.87	19.83	19.57	19.13	18.96	(90)

Living area fraction 0.14 (91)

Mean internal temperature (for the whole dwelling)

19.58	19.11	19.4	19.74	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12	(92)

Adjusted mean internal temperature:

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,	0.98	0.97	0.93	0.83	0.66	0.45	0.3	0.34	0.61	0.88	0.96	0.98		(94)
Useful gains, mGm , W	727.26	801.5	863.68	868.27	745.43	504.23	321.09	338.2	535.73	681.76	689.18	695.67		(95)
Monthly average external temperature from Table U1	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature	1525.07	1412.31	1276.25	1050.18	793.52	509.82	321.67	339.34	558.93	879.59	1185.87	1464.34		(97)
Space heating requirement for each month	593.57	410.47	306.95	130.97	35.78	0	0	0	0	147.18	357.62	571.89		(98a)
Solar space heating calculated using Appendix H (negative quantity)	0	0	0	0	0	0	0	0	0	0	0	0		(98b)
Space heating requirement for each month after solar contribution	593.57	410.47	306.95	130.97	35.78	0	0	0	0	147.18	357.62	571.89		(98c)
Space heating requirement in kWh/m²/year													31.7	(99)

8c. Space Cooling requirement

Heat loss rate,	0	0	0	0	0	0	0	0	0	0	0	0		(100)
Utilisation factor for loss	0	0	0	0	0	0	0	0	0	0	0	0		(101)
Useful loss, mLm (watts)	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Gains	0	0	0	0	0	0	0	0	0	0	0	0		(103)
Space cooling requirement for month, whole dwelling, continuous (kWh)														(104)
	0	0	0	0	0	0	0	0	0	0	0	0		(104)
Cooled fraction													0	(105)
Intermittency factor	0	0	0	0	0	0	0	0	0	0	0	0		(106)
Space cooling requirement for month								0					0	
	0	0	0	0	0	0	0	0	0	0	0	0		(107)
Space cooling requirement in kWh/m²/year													0	(108)

8f. Space heating requirement

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 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 secondary/supplementary heating system, %,													0	(208)
Cooling System Seasonal Energy Efficiency Ratio,								0					0	(209)
Space heating requirement (calculated above),														
	0	0	0	0	0	0	0	0	0	0	0	0		(210)
Space heating fuel (main heating system 1), kWh/month								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 fuel (main heating system 2), kWh/month								0					0	
	0	0	0	0	0	0	0	0	0	0	0	0		(213)
Space heating fuel (secondary), kWh/month								0					0	
	0	0	0	0	0	0	0	0	0	0	0	0		(215)
Output from water heater),								0					282.03	(216)
Efficiency of water heater														
	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03		(217)
Fuel for water heating														
	109.75	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)
Space Cooling														
	0	0	0	0	0	0	0	0	0	0	0	0		(221)
Annual totals								kWh/year		kWh/year				
Space heating fuel used, main system 1													724.91	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													1102.56	(219)
Electricity for instantaneous electric shower(s)													0	(64a)
Space cooling fuel used													0	(221)
Electricity for pumps, fans and electric keep-hot														
Mechanical vent fans - balanced, extract or positive input from outside								0		0			205.78	(230a)
warm air heating system fans													0	(230b)
Heating circulation pump or water pump within warm air heating unit													0	(230c)
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)													0	(230d)
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)													0	(230e)
Maintaining electric keep-hot facility for gas combi boiler													0	(230f)
Pump for solar water heating													0	(230g)
Pump for storage WWHRS													0	(230h)
Total electricity for the above													205.78	(231)
Electricity for lighting													187.77	(232)

Energy saving/generation technologies (Appendices M, N) - Energy used in dwelling

Electricity generated by PVs (Appendix M) (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)

Electricity generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	(235c)

Energy saving/generation technologies (Appendices M, N) - Energy exported

Electricity generated by PVs (Appendix M) (negative 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 generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)

Appendix Q items: annual energy

	Fuel	kWh/year		
Appendix Q, <item 1 description>				
energy saved			0	(236a)
energy used			0	(237a)
Total delivered energy for all uses			1618.61	

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 (247)				
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>	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 KWh/year	Emission factor kg	Emissions 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)
EI rating			97	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr 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)

DFEE WORKSHEET

Dwelling Reference: RS1745

Dwelling Type: New Dwelling Design Stage

10a Havelock Road
Oxford
OX4 3EP

1. Overall dwelling dimensions

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	45.92	(1a)	x	2.3	(2a)	=	105.62	(3a)
Ground Floor	34.65	(1b)	x	2.56	(2b)	=	88.7	(3b)
Total floor area TFA							80.57	(4)
Dwelling volume							194.32	(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	35	=	0	(6e)
Number of blocked chimneys	0	x	20	=	0	(6f)
Number of intermittent extract fans	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 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)
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)
Window infiltration	0	0	(15)
Infiltration rate	0	0	(16)
Air permeability value, AP50, (m³/h/m²)	3	3	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
Shelter factor													0.85	(20)
Infiltration rate incorporating shelter factor													0.26	(21)
Infiltration rate modified for monthly wind speed														(22)
Monthly average wind speed from Table U2	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Wind Factor	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)	0.33	0.32	0.32	0.28	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.3	3.4	(22b)
Calculate effective air change rate for the applicable case:													0.5	(23a)
													0.5	(23b)
													46.5	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)	0.6	0.59	0.58	0.55	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(24a)
b) If balanced mechanical ventilation without heat recovery (MV)	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or positive input ventilation from outside	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house positive input ventilation from loft	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air change rate	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)
Effective air change rate from PCDB:	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	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door					2.07			(26)
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 elements ∑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 floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		45.56	(33)
Heat capacity Cm = ∑(A x k)		0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		15.92	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		15.92	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		61.47	(37)

Ventilation heat loss calculated monthly

38.31	37.89	37.48	35.4	34.99	32.92	32.92	32.5	33.74	34.99	35.82	36.65	(38)

Heat transfer coefficient, W/K

99.78	99.37	98.95	96.88	96.46	94.39	94.39	93.98	95.22	96.46	97.29	98.12	(39)

Heat loss parameter (HLP), W/m²K

1.24	1.23	1.23	1.2	1.2	1.17	1.17	1.17	1.18	1.2	1.21	1.22	(40)

Number of days in month (Table 1a)

31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement

Assumed occupancy, N	2.47	(42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

90.33	88.97	86.99	83.21	80.42	77.3	75.53	77.49	79.65	82.99	86.86	89.98	(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

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 usage in litres per day for other uses, Vd,other (from Appendix 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 hot water usage in litres per day Vd,average (from Appendix J)	146.15	(43)

Hot water usage in litres per day for each month Vd,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 of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

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)

Distribution loss (46) = 0.15 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)

Storage volume (litres) including any solar or WWHRS storage within same vessel	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) × (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		(56)

If the vessel contains dedicated solar storage or dedicated WWHRS storage,
(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		(57)

Primary circuit loss for each month from Table 3
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	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)

0	0	0	0	0	0	0	0	0	0	0	0		(61)

Total heat required for water heating calculated for each month (62) = 0.85 × (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	3109.51	(62)

CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)

0	0	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	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		(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	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	3109.51	(64)

Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)

0	0	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		(65)

include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network

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		(66)

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

26.58	23.61	19.2	14.54	10.87	9.17	9.91	12.88	17.29	21.96	25.63	27.32	(67)

Appliances gains (calculated in Appendix L, equation L16 or L16a), also see Table 5

329.3	332.71	324.1	305.77	282.63	260.88	246.35	242.93	251.55	269.88	293.02	314.77	(68)

Cooking gains (calculated in Appendix L, equation L18 or L18a), also see Table 5

52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	(69)

Pumps and fans gains (Table 5a)

0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5

-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 gains (Table 5)

174.94	172.15	166.63	154.35	146.87	139.03	134.13	138.05	142.66	151.35	163.12	173.35	(72)

Total internal gains

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 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. 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, η1,m (see Table 9a)

0.99	0.98	0.95	0.87	0.72	0.53	0.39	0.44	0.69	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 and 4 in Table 9c)

20.5	20.16	20.39	20.68	20.86	20.92	20.94	20.93	20.89	20.65	20.29	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

19.89	19.89	19.9	19.92	19.92	19.94	19.94	19.95	19.93	19.92	19.91	19.91	(88)

Roof Utilisation factor for gains for rest of dwelling, η2,m (see Table 9a)

0.98	0.97	0.94	0.84	0.66	0.44	0.29	0.34	0.6	0.88	0.97	0.99	(89)

Roof Mean internal temperature in the rest of dwelling T2

19.44	18.95	19.24	19.59	19.78	19.86	19.86	19.87	19.83	19.57	19.13	18.96	(90)

Living area fraction 0.14 (91)

Mean internal temperature (for the whole dwelling)

19.58	19.11	19.4	19.74	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12	(92)

Adjusted mean internal temperature:

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,														
	0.98	0.97	0.93	0.83	0.66	0.45	0.3	0.34	0.61	0.88	0.96	0.98		(94)
Useful gains, mGm , W														
	727.26	801.5	863.68	868.27	745.43	504.23	321.09	338.2	535.73	681.76	689.18	695.67		(95)
Monthly average external temperature from Table U1														
	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature														
	1525.07	1412.31	1276.25	1050.18	793.52	509.82	321.67	339.34	558.93	879.59	1185.87	1464.34		(97)
Space heating requirement for each month														
	593.57	410.47	306.95	130.97	35.78	0	0	0	0	147.18	357.62	571.89		(98a)
Solar space heating calculated using Appendix H (negative quantity)														
	0	0	0	0	0	0	0	0	0	0	0	0		(98b)
Space heating requirement for each month after solar contribution														
	593.57	410.47	306.95	130.97	35.78	0	0	0	0	147.18	357.62	571.89		(98c)
Space heating requirement in kWh/m²/year													31.7	(99)

8c. Space Cooling requirement

Heat loss rate,														
	0	0	0	0	0	0	0	0	0	0	0	0		(100)
Utilisation factor for loss														
	0	0	0	0	0	0	0	0	0	0	0	0		(101)
Useful loss, mLm (watts)														
	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Gains														
	0	0	0	0	0	0	0	0	0	0	0	0		(103)
Space cooling requirement for month, whole dwelling, continuous (kWh)														(104)
	0	0	0	0	0	0	0	0	0	0	0	0		(104)
Cooled fraction													0	(105)
Intermittency factor														
	0	0	0	0	0	0	0	0	0	0	0	0		(106)
Space cooling requirement for month								0					0	
	0	0	0	0	0	0	0	0	0	0	0	0		(107)
Space cooling requirement in kWh/m²/year													0	(108)

8f. Space heating requirement

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 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 secondary/supplementary heating system, %,															0	(208)
Cooling System Seasonal Energy Efficiency Ratio,													0		0	(209)
Space heating requirement (calculated above),																
	0	0	0	0	0	0	0	0	0	0	0	0				(210)
Space heating fuel (main heating system 1), kWh/month													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 fuel (main heating system 2), kWh/month													0		0	
	0	0	0	0	0	0	0	0	0	0	0	0				(213)
Space heating fuel (secondary), kWh/month													0		0	
	0	0	0	0	0	0	0	0	0	0	0	0				(215)
Output from water heater),													0		282.03	(216)
Efficiency of water heater																
	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03				(217)
Fuel for water heating																
	109.75	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)
Space Cooling																
	0	0	0	0	0	0	0	0	0	0	0	0				(221)
Annual totals													kWh/year	kWh/year		
Space heating fuel used, main system 1															724.91	(211)
Space heating fuel used, main system 2															0	(213)
Space heating fuel used, secondary															0	(215)
Water heating fuel used															1102.56	(219)
Electricity for instantaneous electric shower(s)															0	(64a)
Space cooling fuel used															0	(221)
Electricity for pumps, fans and electric keep-hot																
Mechanical vent fans - balanced, extract or positive input from outside													0	0	205.78	(230a)
warm air heating system fans															0	(230b)
Heating circulation pump or water pump within warm air heating unit															0	(230c)
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)															0	(230d)
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)															0	(230e)
Maintaining electric keep-hot facility for gas combi boiler															0	(230f)
Pump for solar water heating															0	(230g)
Pump for storage WWHRS															0	(230h)
Total electricity for the above															205.78	(231)
Electricity for lighting															187.77	(232)

Energy saving/generation technologies (Appendices M, N) - Energy used in dwelling

Electricity generated by PVs (Appendix M) (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)

Electricity generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	(235c)

Energy saving/generation technologies (Appendices M, N) - Energy exported

Electricity generated by PVs (Appendix M) (negative 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 generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)

Appendix Q items: annual energy

	Fuel	kWh/year		
Appendix Q, <item 1 description>				
energy saved			0	(236a)
energy used			0	(237a)
Total delivered energy for all uses			1618.61	

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 (247)				
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>	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 KWh/year	Emission factor kg	Emissions 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)
EI rating			97	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr 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)

TER WORKSHEET

Dwelling Reference: RS1745
Dwelling Type: New Dwelling Design Stage

10a Havelock Road
Oxford
OX4 3EP

1. Overall dwelling dimensions

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	45.92	(1a)	x	2.3	(2a)	=	105.62	(3a)
Ground Floor	34.65	(1b)	x	2.56	(2b)	=	88.7	(3b)
Total floor area TFA							80.57	(4)
Dwelling volume							194.32	(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	35	=	0	(6e)
Number of blocked chimneys	0	x	20	=	0	(6f)
Number of intermittent extract fans	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 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)
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)
Window infiltration	0	0	(15)
Infiltration rate	0	0	(16)
Air permeability value, AP50, (m³/h/m²)	3	3	(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 factor													0.85	(20)
Infiltration rate incorporating shelter 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 speed from Table U2														
	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Wind Factor														
	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)														
	0.33	0.32	0.32	0.28	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.3	3.4	(22b)
Calculate effective air change rate for the applicable case:														
													0.5	(23a)
													0.5	(23b)
													46.5	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)														
	0.6	0.59	0.58	0.55	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57		(24a)
b) If balanced mechanical ventilation without heat recovery (MV)														
	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ventilation or positive input ventilation from outside														
	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural ventilation or whole house positive input ventilation from loft														
	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air change rate														
	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)
Effective air change rate from PCDB:														
	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	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door							2.07	(26)
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 elements ∑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 floor													0	(32e)
Fabric heat loss, W/K = ∑ (A x U)													45.56	(33)
Heat capacity Cm = ∑(A x k)													0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K													250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K													15.92	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available													15.92	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ													61.47	(37)
Ventilation heat loss calculated monthly														
	38.31	37.89	37.48	35.4	34.99	32.92	32.92	32.5	33.74	34.99	35.82	36.65		(38)
Heat transfer coefficient, W/K														
	99.78	99.37	98.95	96.88	96.46	94.39	94.39	93.98	95.22	96.46	97.29	98.12		(39)
Heat loss parameter (HLP), W/m²K														
	1.24	1.23	1.23	1.2	1.2	1.17	1.17	1.17	1.18	1.2	1.21	1.22		(40)
Number of days in month (Table 1a)														
	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement

Assumed occupancy, N													2.47	(42)
Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)														
	90.33	88.97	86.99	83.21	80.42	77.3	75.53	77.49	79.65	82.99	86.86	89.98		(42a)
Hot water usage in litres per day for baths, Vd,bath (from Appendix J)														
	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 usage in litres per day for other uses, Vd,other (from Appendix 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 hot water usage in litres per day Vd,average (from Appendix J)													146.15	(43)
Hot water usage in litres per day for each month Vd,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 of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)														
	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)
Distribution loss (46) = 0.15 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)
Storage volume (litres) including any solar or WWHRS storage within same vessel													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) × (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		(56)

If the vessel contains dedicated solar storage or dedicated WWHRS storage,
(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		(57)

Primary circuit loss for each month from Table 3
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	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)

0	0	0	0	0	0	0	0	0	0	0	0		(61)

Total heat required for water heating calculated for each month (62) = 0.85 × (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	3109.51	(62)

CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)

0	0	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	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		(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	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	3109.51	(64)

Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)

0	0	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		(65)

include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network

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		(66)

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

26.58	23.61	19.2	14.54	10.87	9.17	9.91	12.88	17.29	21.96	25.63	27.32	(67)

Appliances gains (calculated in Appendix L, equation L16 or L16a), also see Table 5

329.3	332.71	324.1	305.77	282.63	260.88	246.35	242.93	251.55	269.88	293.02	314.77	(68)

Cooking gains (calculated in Appendix L, equation L18 or L18a), also see Table 5

52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	(69)

Pumps and fans gains (Table 5a)

0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5

-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 gains (Table 5)

174.94	172.15	166.63	154.35	146.87	139.03	134.13	138.05	142.66	151.35	163.12	173.35	(72)

Total internal gains

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 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. 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, ⍰1,m (see Table 9a)

0.99	0.98	0.95	0.87	0.72	0.53	0.39	0.44	0.69	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 and 4 in Table 9c)

20.5	20.16	20.39	20.68	20.86	20.92	20.94	20.93	20.89	20.65	20.29	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

19.89	19.89	19.9	19.92	19.92	19.94	19.94	19.95	19.93	19.92	19.91	19.91	(88)

Roof Utilisation factor for gains for rest of dwelling, ⍰2,m (see Table 9a)

0.98	0.97	0.94	0.84	0.66	0.44	0.29	0.34	0.6	0.88	0.97	0.99	(89)

Roof Mean internal temperature in the rest of dwelling T2

19.44	18.95	19.24	19.59	19.78	19.86	19.86	19.87	19.83	19.57	19.13	18.96	(90)

Living area fraction 0.14 (91)

Mean internal temperature (for the whole dwelling)

19.58	19.11	19.4	19.74	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12	(92)

Adjusted mean internal temperature:

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,														
	0.98	0.97	0.93	0.83	0.66	0.45	0.3	0.34	0.61	0.88	0.96	0.98		(94)
Useful gains, mGm , W														
	727.26	801.5	863.68	868.27	745.43	504.23	321.09	338.2	535.73	681.76	689.18	695.67		(95)
Monthly average external temperature from Table U1														
	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature														
	1525.07	1412.31	1276.25	1050.18	793.52	509.82	321.67	339.34	558.93	879.59	1185.87	1464.34		(97)
Space heating requirement for each month														
	593.57	410.47	306.95	130.97	35.78	0	0	0	0	147.18	357.62	571.89		(98a)
Solar space heating calculated using Appendix H (negative quantity)														
	0	0	0	0	0	0	0	0	0	0	0	0		(98b)
Space heating requirement for each month after solar contribution														
	593.57	410.47	306.95	130.97	35.78	0	0	0	0	147.18	357.62	571.89		(98c)
Space heating requirement in kWh/m²/year													31.7	(99)

8c. Space Cooling requirement

Heat loss rate,														
	0	0	0	0	0	0	0	0	0	0	0	0		(100)
Utilisation factor for loss														
	0	0	0	0	0	0	0	0	0	0	0	0		(101)
Useful loss, mLm (watts)														
	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Gains														
	0	0	0	0	0	0	0	0	0	0	0	0		(103)
Space cooling requirement for month, whole dwelling, continuous (kWh)														(104)
	0	0	0	0	0	0	0	0	0	0	0	0		(104)
Cooled fraction													0	(105)
Intermittency factor														
	0	0	0	0	0	0	0	0	0	0	0	0		(106)
Space cooling requirement for month								0					0	
	0	0	0	0	0	0	0	0	0	0	0	0		(107)
Space cooling requirement in kWh/m²/year													0	(108)

8f. Space heating requirement

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 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 secondary/supplementary heating system, %,															0	(208)
Cooling System Seasonal Energy Efficiency Ratio,													0		0	(209)
Space heating requirement (calculated above),																
	0	0	0	0	0	0	0	0	0	0	0	0				(210)
Space heating fuel (main heating system 1), kWh/month													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 fuel (main heating system 2), kWh/month													0		0	
	0	0	0	0	0	0	0	0	0	0	0	0				(213)
Space heating fuel (secondary), kWh/month													0		0	
	0	0	0	0	0	0	0	0	0	0	0	0				(215)
Output from water heater),													0		282.03	(216)
Efficiency of water heater																
	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03				(217)
Fuel for water heating																
	109.75	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)
Space Cooling																
	0	0	0	0	0	0	0	0	0	0	0	0				(221)
Annual totals													kWh/year	kWh/year		
Space heating fuel used, main system 1															724.91	(211)
Space heating fuel used, main system 2															0	(213)
Space heating fuel used, secondary															0	(215)
Water heating fuel used															1102.56	(219)
Electricity for instantaneous electric shower(s)															0	(64a)
Space cooling fuel used															0	(221)
Electricity for pumps, fans and electric keep-hot																
Mechanical vent fans - balanced, extract or positive input from outside													0	0	205.78	(230a)
warm air heating system fans															0	(230b)
Heating circulation pump or water pump within warm air heating unit															0	(230c)
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)															0	(230d)
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)															0	(230e)
Maintaining electric keep-hot facility for gas combi boiler															0	(230f)
Pump for solar water heating															0	(230g)
Pump for storage WWHRS															0	(230h)
Total electricity for the above															205.78	(231)
Electricity for lighting															187.77	(232)

Energy saving/generation technologies (Appendices M, N) - Energy used in dwelling

Electricity generated by PVs (Appendix M) (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)
Electricity generated by wind turbines (Appendix M) (negative quantity)														
	0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)
Electricity generated by hydro-electric generators														
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)
Electricity used or net electricity generated by micro-CHP														
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235c)

Energy saving/generation technologies (Appendices M, N) - Energy exported

Electricity generated by PVs (Appendix M) (negative 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 generated by wind turbines (Appendix M) (negative quantity)														
	0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)
Electricity generated by hydro-electric generators														
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)
Electricity used or net electricity generated by micro-CHP														
	0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)

Appendix Q items: annual energy

	Fuel	kWh/year		
Appendix Q, <item 1 description>				
energy saved			0	(236a)
energy used			0	(237a)
Total delivered energy for all uses			1618.61	

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 (247)				
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>	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 KWh/year	Emission factor kg	Emissions 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)
EI rating			97	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr 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)

TFEE WORKSHEET

Dwelling Reference:	RS1745
Dwelling Type:	New Dwelling Design Stage

10a Havelock Road
Oxford
OX4 3EP

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)			Volume(m³)	
Basement	45.92 (1a)	x	2.3	(2a)	=	105.62	(3a)
Ground Floor	34.65 (1b)	x	2.56	(2b)	=	88.7	(3b)
Total floor area TFA						80.57	(4)
Dwelling volume						194.32	(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	35	=	0	(6e)
Number of blocked chimneys	0	x	20	=	0	(6f)
Number of intermittent extract fans	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 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)
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)
Window infiltration	0	0	(15)
Infiltration rate	0	0	(16)
Air permeability value, AP50, (m³/h/m²)	3	3	(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 factor	0.85	(20)
Infiltration rate incorporating shelter 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 speed from Table U2	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	52.5	(22)
Wind Factor	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	13.13	(22a)
Adjusted infiltration rate (allowing for shelter and wind speed)	0.33	0.32	0.32	0.28	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.3	3.4	(22b)

Calculate effective air change rate for the applicable case:

	0.5	(23a)
	0.5	(23b)
	46.5	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
a) If balanced mechanical ventilation with heat recovery (MVHR)	0.6	0.59	0.58	0.55	0.55	0.51	0.51	0.51	0.53	0.55	0.56	0.57	(24a)
b) If balanced mechanical ventilation without heat recovery (MV)	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
c) If whole house extract ventilation or positive input ventilation from outside	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
d) If natural ventilation or whole house positive input ventilation from loft	0	0	0	0	0	0	0	0	0	0	0	0	(24d)
Effective air change rate	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)
Effective air change rate from PCDB:	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	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Solid door							2.07	(26)
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 elements ∑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 floor		0	(32e)
Fabric heat loss, W/K = ∑ (A x U)		45.56	(33)
Heat capacity Cm = ∑(A x k)		0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		15.92	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		15.92	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		61.47	(37)

Ventilation heat loss calculated monthly

38.31	37.89	37.48	35.4	34.99	32.92	32.92	32.5	33.74	34.99	35.82	36.65	(38)

Heat transfer coefficient, W/K

99.78	99.37	98.95	96.88	96.46	94.39	94.39	93.98	95.22	96.46	97.29	98.12	(39)

Heat loss parameter (HLP), W/m²K

1.24	1.23	1.23	1.2	1.2	1.17	1.17	1.17	1.18	1.2	1.21	1.22	(40)

Number of days in month (Table 1a)

31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement

Assumed occupancy, N	2.47	(42)

Hot water usage in litres per day for mixer showers, Vd,shower (from Appendix J)

90.33	88.97	86.99	83.21	80.42	77.3	75.53	77.49	79.65	82.99	86.86	89.98	(42a)

Hot water usage in litres per day for baths, Vd,bath (from Appendix J)

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 usage in litres per day for other uses, Vd,other (from Appendix 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 hot water usage in litres per day Vd,average (from Appendix J)	146.15	(43)

Hot water usage in litres per day for each month Vd,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 of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

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)

Distribution loss (46) = 0.15 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)

Storage volume (litres) including any solar or WWHRS storage within same vessel	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) × (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		(56)

If the vessel contains dedicated solar storage or dedicated WWHRS storage,
(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		(57)

Primary circuit loss for each month from Table 3
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	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)

0	0	0	0	0	0	0	0	0	0	0	0		(61)

Total heat required for water heating calculated for each month (62) = 0.85 × (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	3109.51	(62)

CWWHRS DHW input calculated using Appendix G (negative quantity) (enter 0 if no WWHRS contribution to water heating)

0	0	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	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		(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	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	3109.51	(64)

Output from water heater for each month, kWh/month (64) = (62) + (63a) + (63b) + (63c) + (63d)

0	0	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		(65)

include (57) m in calculation of (65) m only if hot water store is in the dwelling or hot water is from heat network

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		(66)

Item													Ref
Lighting gains (calculated in Appendix L, equation L12 or L12a), also see Table 5	26.58	23.61	19.2	14.54	10.87	9.17	9.91	12.88	17.29	21.96	25.63	27.32	(67)
Appliances gains (calculated in Appendix L, equation L16 or L16a), also see Table 5	329.3	332.71	324.1	305.77	282.63	260.88	246.35	242.93	251.55	269.88	293.02	314.77	(68)
Cooking gains (calculated in Appendix L, equation L18 or L18a), also see Table 5	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	52.32	(69)
Pumps and fans gains (Table 5a)	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5	-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 gains (Table 5)	174.94	172.15	166.63	154.35	146.87	139.03	134.13	138.05	142.66	151.35	163.12	173.35	(72)
Total internal gains	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

Item													Ref
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 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. Mean internal temperature (heating season)

Item														Ref
Temperature during heating periods in the living area from Table 9, Th1 (°C)													21	(85)
Utilisation factor for gains for living area, □1,m (see Table 9a)	0.99	0.98	0.95	0.87	0.72	0.53	0.39	0.44	0.69	0.92	0.98	0.99		(86)
Mean internal temperature in living area T1 (follow steps 3 and 4 in Table 9c)	20.5	20.16	20.39	20.68	20.86	20.92	20.94	20.93	20.89	20.65	20.29	20.14		(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)	19.89	19.89	19.9	19.92	19.92	19.94	19.94	19.95	19.93	19.92	19.91	19.91		(88)
Roof Utilisation factor for gains for rest of dwelling, □2,m (see Table 9a)	0.98	0.97	0.94	0.84	0.66	0.44	0.29	0.34	0.6	0.88	0.97	0.99		(89)
Roof Mean internal temperature in the rest of dwelling T2	19.44	18.95	19.24	19.59	19.78	19.86	19.86	19.87	19.83	19.57	19.13	18.96		(90)
Living area fraction													0.14	(91)
Mean internal temperature (for the whole dwelling)	19.58	19.11	19.4	19.74	19.93	20	20.01	20.01	19.97	19.72	19.29	19.12		(92)
Adjusted mean internal temperature:	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,														
	0.98	0.97	0.93	0.83	0.66	0.45	0.3	0.34	0.61	0.88	0.96	0.98		(94)
Useful gains, mGm , W														
	727.26	801.5	863.68	868.27	745.43	504.23	321.09	338.2	535.73	681.76	689.18	695.67		(95)
Monthly average external temperature from Table U1														
	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature														
	1525.07	1412.31	1276.25	1050.18	793.52	509.82	321.67	339.34	558.93	879.59	1185.87	1464.34		(97)
Space heating requirement for each month														
	593.57	410.47	306.95	130.97	35.78	0	0	0	0	147.18	357.62	571.89		(98a)
Solar space heating calculated using Appendix H (negative quantity)														
	0	0	0	0	0	0	0	0	0	0	0	0		(98b)
Space heating requirement for each month after solar contribution														
	593.57	410.47	306.95	130.97	35.78	0	0	0	0	147.18	357.62	571.89		(98c)
Space heating requirement in kWh/m²/year													31.7	(99)

8c. Space Cooling requirement

Heat loss rate,														
	0	0	0	0	0	0	0	0	0	0	0	0		(100)
Utilisation factor for loss														
	0	0	0	0	0	0	0	0	0	0	0	0		(101)
Useful loss, mLm (watts)														
	0	0	0	0	0	0	0	0	0	0	0	0		(102)
Gains														
	0	0	0	0	0	0	0	0	0	0	0	0		(103)
Space cooling requirement for month, whole dwelling, continuous (kWh)														(104)
	0	0	0	0	0	0	0	0	0	0	0	0		(104)
Cooled fraction													0	(105)
Intermittency factor														
	0	0	0	0	0	0	0	0	0	0	0	0		(106)
Space cooling requirement for month								0					0	
	0	0	0	0	0	0	0	0	0	0	0	0		(107)
Space cooling requirement in kWh/m²/year													0	(108)

8f. Space heating requirement

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 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 secondary/supplementary heating system, %,															0	(208)
Cooling System Seasonal Energy Efficiency Ratio,													0		0	(209)
Space heating requirement (calculated above),																
	0	0	0	0	0	0	0	0	0	0	0	0				(210)
Space heating fuel (main heating system 1), kWh/month													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 fuel (main heating system 2), kWh/month													0		0	
	0	0	0	0	0	0	0	0	0	0	0	0				(213)
Space heating fuel (secondary), kWh/month													0		0	
	0	0	0	0	0	0	0	0	0	0	0	0				(215)
Output from water heater),													0		282.03	(216)
Efficiency of water heater																
	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03	282.03				(217)
Fuel for water heating																
	109.75	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)
Space Cooling																
	0	0	0	0	0	0	0	0	0	0	0	0				(221)
Annual totals													kWh/year	kWh/year		
Space heating fuel used, main system 1															724.91	(211)
Space heating fuel used, main system 2															0	(213)
Space heating fuel used, secondary															0	(215)
Water heating fuel used															1102.56	(219)
Electricity for instantaneous electric shower(s)															0	(64a)
Space cooling fuel used															0	(221)
Electricity for pumps, fans and electric keep-hot																
Mechanical vent fans - balanced, extract or positive input from outside													0	0	205.78	(230a)
warm air heating system fans															0	(230b)
Heating circulation pump or water pump within warm air heating unit															0	(230c)
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)															0	(230d)
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)															0	(230e)
Maintaining electric keep-hot facility for gas combi boiler															0	(230f)
Pump for solar water heating															0	(230g)
Pump for storage WWHRS															0	(230h)
Total electricity for the above															205.78	(231)
Electricity for lighting															187.77	(232)

Energy saving/generation technologies (Appendices M, N) - Energy used in dwelling

Electricity generated by PVs (Appendix M) (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)

Electricity generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(234a)

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	(235a)

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	(235c)

Energy saving/generation technologies (Appendices M, N) - Energy exported

Electricity generated by PVs (Appendix M) (negative 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 generated by wind turbines (Appendix M) (negative quantity)

0	0	0	0	0	0	0	0	0	0	0	0	0	(234b)

Electricity generated by hydro-electric generators

0	0	0	0	0	0	0	0	0	0	0	0	0	(235b)

Electricity used or net electricity generated by micro-CHP

0	0	0	0	0	0	0	0	0	0	0	0	0	(235d)

Appendix Q items: annual energy

Appendix Q, <item 1 description>	Fuel	kWh/year		
energy saved			0	(236a)
energy used			0	(237a)
Total delivered energy for all uses			1618.61	

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 (247)				
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>	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 KWh/year	Emission factor kg	Emissions 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)
EI rating			97	(274)

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

	Energy KWh/year	Emission factor kg	Emissionsr 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)