EPS Group
Energy Consultancy and Compliance Services

Project No: 15690d

Bournemouth, Christchurch and Poole Council

Energy & Resources Statement

Proposed Construction of 8 No. Dwellings, Redhorn Close, Poole, BH16 5BE (Infill Site)

www.epsgroup.co.uk

Tel: 0115 7270599 Email: info@epsgroup.co.uk

SAP Calculations – SBEM Calculations – Renewable Energy Statements – Energy Performance Certificates
Air Tightness Testing – Extract Fan Testing – Water Calculations – DEC Assessments - Room Integrity Testing

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Project Contact Details

Client:

Poole Housing Partnership Ltd
Beech House
28-30 Wimborne Road
Poole
BH15 2BU

Report Prepared By:

Energy Performance & Sustainability Group Ltd
3C Pelham Court
Pelham Road
Nottingham
NG5 1AP

Tel: 0115 7270599

Lead Consultant: Mr Samuel Marks, MSc, BSc (Hons)

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Executive Summary

This report has been commissioned in response to the Sustainable and Low Carbon Planning Policy requirements of Bournemouth, Christchurch and Poole Council in respect to the proposed construction of 8 No. Dwellings at Redhorn Close (Infill Site), Poole, BH16 5BE.

The statement outlines an overall commitment to reducing energy consumption under occupancy through the adoption of enhanced insulation standards and system efficiencies in comparison to the standard requirements of Approved Document L1 2021 of the Building Regulations. Further improvements are then proposed through the installation of Air Source Heat Pumps.

SAP 10 calculations for the proposed development firmly demonstrate that **50.03%** of the proposed development's energy demand will be met through the use of on-site Low Carbon and renewable sources, which far exceeds the mandatory planning requirements of '*Policy PP37 Building sustainable homes and businesses*' of the Poole Local Plan (adopted November 2018).

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1.0 Introduction

1.1 EPS Group have been appointed to provide an Energy & Resources Statement in response to the Sustainable and Low Carbon Planning Policy requirements of Bournemouth, Christchurch and Poole Council in respect to the proposed construction of 8 No. Dwellings at Redhorn Close (Infill Site), Poole, BH16 5BE.

1.2 The planning application relates to the proposed construction of new dwellings which will therefore need to comply with the requirements of Approved Document L1 2021 of the Building Regulations, if the application is approved.

1.3 The energy consumption of the proposed dwellings has therefore been assessed using the National Calculations Method (NCM) - SAP 10 (Standard Assessment Procedure), in order to determine the predicted annual carbon dioxide (CO_2) emissions of the development and the associated reduction targets.

1.4 The following fuel emissions factors have been utilised within the supporting calculations as defined by the updated National Calculations Method:

Fuel	CO_2 emission factor ($kgCO_2/kWh$)
Natural gas	0.210
Grid supplied electricity	0.136
Grid displaced electricity	0.136

1.5 This document should be used for planning purposes only and should be reassessed and where necessary, resubmitted at the Building Control stage if alternative building specifications or proposed HVAC systems are adopted as oppose to those outlined within the report.

1.6 It is also highlighted that the SAP calculations utilised within the report rely on a number of standard operational parameters which may not ultimately match the actual measures adopted within the finalised dwellings. Whilst they provide a 'like for like' comparison for the purpose of this Energy & Resources Statement, they are not valid for Building Control applications or for the actual operation of the development post completion.

1.7 The dimensions for all dwellings that are referenced within this report are based upon SAP measurement conventions which may result in slight differences with other dimensions quoted elsewhere.

2.0 Planning Policy Context

2.1 National

The National Planning Policy Framework (NPPF) outlines the Government's planning policies for England and how these are expected to be applied by local authorities. Section 14 of this document details how local policies should address climate change through the promotion of energy efficiency and the adoption of low carbon and renewable technologies. It states:

"***14.0 Meeting the challenge of climate change, flooding and coastal change***

152. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

Planning for climate change

153. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

154. New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

155. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

156. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

157. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

158. When determining planning applications for renewable and low carbon development, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

b) approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas."

2.2 Local

Policy 'PP37 Building sustainable homes and businesses' of the Poole Local Plan (Adopted November 2018) states:

"(1) New development

Proposals for new homes and commercial development must contribute to tackling climate change by ensuring that:

(a) the orientation and design of the development uses passive design features to minimise the need for artificial light, heating and cooling and maximises solar gain;

(b) the layout of the development maximises opportunities for use of common walls to limit winter heat loss;

(c) the design, construction method and materials achieve an energy efficient building, including (but not limited to):

(i) low U-values for walls, floors and roof;
(ii) 'A' rated windows and doors;
(iii) lighting sensors, individual heating controls, metering equipment; and
(iv) adequate mechanical ventilation with heat recovery systems.

(d) the best practicable option is taken for securing renewable energy generation, either through on-site provision or by linking with/contributing to available local off-site renewable energy sources, where the opportunity to do so exists.

(2) Renewable energy

(a) where appropriate, new development should incorporate a proportion of future energy use from renewable energy sources with:

(i) a minimum of 10% for proposals of 1-10 homes (net) or under 1,000 sq. m (net) commercial floor space; and
(ii) a minimum of 20% for proposals of 11 or more homes or over 1,000 sq. m commercial floor space.

(b) the Council will support proposals for renewable energy (except wind turbines) provided that the technology is:

(i) suitable for the location; and

(ii) would not cause harm to residential amenity by virtue of noise, vibration, overshadowing or other harmful emissions.

(3) Commercial buildings

Proposals for new commercial development will be expected to meet the following BREEAM ratings:

(a) 'Very Good' up to 1,000 sq. m (net) floor space; and

(b) 'Excellent' over 1,000 sq. m (net) floor space."

2.3 Conclusions

On review of the above planning policies it is evident that there is a need to construct dwellings with an energy performance standard beyond the mandatory requirements of Approved Document L1 2021 of the Building Regulations.

As a minor development, the proposed development will need to utilise localised low carbon or renewable technologies to meet a minimum of 10% of its predicted energy demand.

Furthermore, the development should consider energy efficiency and resilience to climate change through all aspects of the design including orientation, internal layout and glazing.

3.0 Proposed Energy Strategy and Performance

3.1 The proposed dwellings will benefit from a range of passive design features including the amount of glazing which will provide beneficial solar gains to the dwellings during the winter months.

3.2 The risk of overheating has been reduced by adopting internal layouts that facilitate natural cross ventilation. This will reduce the likelihood of mechanical cooling being required to be installed in the future.

3.3 In accordance with the 'Lean' principles of the Energy Hierarchy, it is proposed to adopt the following minimum fabric, lighting and heating standards within the dwellings as a means of reducing the overall energy demand:

Table 1: Proposed Build Standards		
Element / Feature	**Approved Document L1 2021 Minimal Acceptable Standard**	**Proposed Development Target**
Ground Floors U-value	0.18 W/m^{2}K	**0.14 W/m^{2}K**
External Walls U-value	0.26 W/m^{2}K	**0.18 W/m^{2}K**
Party Walls U-value	0.20 W/m^{2}k	**0.00 W/m^{2}K**
Pitched Roofs U-value	0.16 W/m^{2}k	**0.13 W/m^{2}K**
Windows and Glazed Doors U-value	2.00 W/m^{2}K	**1.20 W/m^{2}K**
Entrance Doors U-value	3.00 W/m^{2}K	**1.30 W/m^{2}K**
Air Permeability	8.00 m^3/m^2.h	**4.00 m^3/m^2.h**
Thermal Bridging	-	**Use of Kingspan TEK Standard Detailing**
Lighting	Fixed Internal Lighting to have an Efficacy of 75 lm/W	**Fixed Internal Lighting to have an Efficacy of 80 lm/W**
Heating Controls	Programmer, Room Thermostat & TRV's	**Time & Temperature Zone Controls**
Ventilation	-	**Individual Mechanical Ventilation with Heat Recovery Units (Brink Renovent Sky 150 or equivalent)**

3.4 The build standards proposed above will ensure that the dwellings have a reduced energy demand in comparison to the minimum requirements of Approved Document L1 2021 of the Building Regulations, whilst also reducing the associated CO_2 emissions arising from occupancy.

3.5 It is also noted that with the amount of glazing proposed, the dwellings have been designed to maximise the amount of natural daylight available, which in conjunction with the highly efficient lighting proposed will reduce the amount of energy consumed through artificial lighting.

4.0 Review of Low Carbon & Renewable Technologies

4.1 In response to the local planning policy requirements, a number of different renewable technologies were reviewed in terms of their overall suitability for inclusion within the proposed dwellings.

4.2 Wind Turbine (Column or Roof Mounted)

Benefits	• When installed in optimum positions, wind turbines can generate a large amount of renewable electricity, the surplus of which can be exported at financial gain to the national grid via the Smart Export Guarantee Scheme.
Site Limitations / Restrictions	• Not aesthetically pleasing and will not be in keeping with the immediate local area. • The site is too sheltered as a result of its general urban location which would result in unreliable and insufficient outputs. • The council state that they will support proposals for renewable energy (except wind turbines) within their planning policy. • Require on-going maintenance which future occupants may neglect. • Can produce unacceptable levels of noise to occupants and neighbours.
Conclusion	• The technology is not deemed as being suitable for use within the proposed development.

4.3 Solar Photovoltaic

Benefits	• When installed in optimum positions, photovoltaic (PV) arrays can generate a large amount of renewable electricity which can be used locally or exported to the national grid via the Smart Export Guarantee Scheme. • South facing pitched roof is available to provide optimal positioning of PV panels in order to maximise their efficiency and generation capacity. • Minimal ongoing costs & maintenance issues following installation. • Easy to integrate into a conventional build specification.
Site Limitations / Restrictions	• PV panels are not always aesthetically pleasing and may detract from the visual appearance of the dwellings. • As a result of the rapid decarbonisation of the national grid, the amount of CO_2 savings with this technology is limited as the CO_2 emission factor for grid displaced electricity is relatively low.
Conclusion	• It is not currently proposed to utilise this technology within the proposed development. However, the client will consider the inclusion of PV panels at a later date if it proves to be cost effective to do so.

4.4 Solar Thermal

Benefits	• Solar hot water systems can provide an efficient way of contributing to a dwelling's overall hot water requirements. • South facing pitched roof space would provide an optimal location for the siting of the collectors. • Minimal on-going costs & maintenance issues following installation.
Site Limitations / Restrictions	• There is no benefit to producing more hot water than is used within a dwelling which can restrict the savings via this technology. • Solar collectors are not always aesthetically pleasing and may detract from the visual appearance of the dwellings.
Conclusion	• It is not proposed to utilise this technology within the proposed development.

4.5 Ground Source Heat Pump

Benefits	• High operating efficiencies (CoPs). • Flexible installation options for new build properties including trench and borehole installations. • Reliable and proven technology. • Generally low maintenance costs. • No visual impact on the property.
Site Limitations / Restrictions	• Detailed ground surveys required. • Minimal space to facilitate an installation • High capital installation costs rendering the technology financially unviable. • If sufficient capacity isn't available within the Distribution Network then local upgrades may be required which could render the technology financially unviable.
Conclusion	• The technology is not deemed as being suitable for use within the proposed development.

4.6 Air Source Heat Pump

Benefits	• High operating efficiencies (CoPs). • Reduced visual impact on the property. • Reliable and proven technology. • Generally low maintenance costs.
Site Limitations / Restrictions	• The external units can result in some minor background noise although this can be limited through the careful selection of models with low operating acoustic levels and the potential use of acoustic cabinets. • If sufficient capacity isn't available within the Distribution Network then local upgrades may be required which could render the technology financially unviable.
Conclusion	• **It is proposed to utilise this technology within the proposed development.**

4.7 Biomass Boilers

Benefits	• Reliable and proven technology.
Site Limitations / Restrictions	• Require large storage facilities for the fuel. • Ongoing cleaning, maintenance and management requirements. • Requires regular fuel deliveries. • Would contribute to poor urban air quality.
Conclusion	• The technology is not deemed as being suitable for use within the proposed development.

4.8 On review of the above technologies, the installation of Air Source Heat Pumps (ASHPs) is recommended as a means of generating heating and hot water from a low carbon source. This will provide an affordable and significant reduction in the energy consumed by these dwellings.

5.0 Calculated Energy Performance

5.1 SAP 10 has been utilised as an appropriate method for calculating the predicted energy consumption arising from the proposed dwellings. The benefit of this method is that it enables improvements in both build fabric and system efficiencies to be fully quantified. As such, it is consistent with the Energy Hierarchy approach to energy conservation.

5.2 A set of SAP Calculations were produced for the development based upon the proposed design parameters outlined within Section 3 of this report, together with the installation of Daikin Altherma 3 Air Source Heat Pumps (ASHPs).

5.3 These calculations detail the overall energy demand of each of the proposed dwellings. The key results of which are illustrated in Table 2 below with a selection of the full calculations detailed within Appendix 1 of this report for review (all other instances are available upon request):

Table 2: Development Regulated Energy Demand (kWh/Year)					
Dwelling	**No. of Iterations**	**Floor Area (m^2)**	**Space Heating**	**Hot Water**	**Lighting**
A	1	113.40	3,298.01	3,001.32	249.43
B	1	105.68	3,123.91	2,971.92	235.84
C	3	92.22	2,819.79	2,890.65	216.46
C - Mirrored	3	92.22	2,752.89	2,890.65	216.46
Total Regulated Energy Demand (kWh/Year)					**48,241.13**

5.4 The SAP Calculations also provide the predicted energy consumption of the dwellings. Whilst it is noted that the final performance of the flats will vary subject to the actual 'Air Leakage Rates' achieved upon completion, the key results are summarised in Table 3 below with the full calculations provided within Appendix 1 of this report for detailed review:

Table 3: Development Regulated Energy Consumption (kWh/Year)					
Dwelling	**No. of Iterations**	**Floor Area (m^2)**	**Space Heating (including any Auxillary consumption)**	**Hot Water**	**Lighting**
A	1	113.4	2,113.53	1,115.24	249.43
B	1	105.68	1,992.67	1,104.25	235.84
C	3	92.22	1,777.45	1,074.83	216.46
C - Mirrored	3	92.22	1,741.62	1074.93	216.46
Total Regulated Energy Consumption (kWh/Year)					**24,104.58**

5.5 The results of the SAP Calculations have been collated within Table 4 below as a means of comparison between the overall predicted energy demand and the consumption of the proposed development based upon the design specification outlined within Section 3 and the installation of Air Source Heat Pumps as detailed in paragraph 5.2:

Table 4: Overall Development Annual Energy Summary	
Total Regulated Energy Demand	48,241.13 kWh/Year
Total Regulated Energy Consumption	24,104.58 kWh/Year
Percentage Annual Energy Contribution From Low Carbon or Renewable Sources	**49.25%**

5.6 Upon review of the above, it is evident that **50.03%** of the proposed development's predicted energy demand will be met through the installation of on-site low carbon or renewable energy sources. This improvement far exceeds the mandatory planning requirements of '*Policy PP37 Building sustainable homes and businesses*' of the Poole Local Plan (adopted November 2018).

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Appendix 1:

Example Predicted DER Worksheets (SAP 10 Derived)

DER WORKSHEET

Dwelling Reference: 15690 RHA
Dwelling Type: New Dwelling Design Stage

Redhorn Close
Poole
BH16 5BE

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	56.7	(1a) x	2.5	(2a) =	141.75	(3a)
Ground Floor	56.7	(1b) x	2.8	(2b) =	158.76	(3b)
Total floor area TFA					113.4	(4)
Dwelling volume					300.51	(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	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		
Number of storeys in the dwelling (ns)	0	0	(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)	4	4	(17)
Air permeability value, AP4, (m³/h/m²)	0	0	(17a)
Air permeability value)	0.2	0.2	(18)
Number of sides on which dwelling is sheltered	1	1	(19)

Shelter factor	0.92	(20)
Infiltration rate incorporating shelter factor	0.19	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
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)													
0.24	0.23	0.23	0.2	0.2	0.18	0.18	0.17	0.19	0.2	0.21	0.22	2.43	(22b)

Calculate effective air change rate for the applicable case:

	0.5	(23a)
	0.5	(23b)
	42.5	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR)

0.52	0.52	0.51	0.49	0.49	0.46	0.46	0.46	0.47	0.49	0.5	0.5	(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

0.52	0.52	0.51	0.49	0.49	0.46	0.46	0.46	0.47	0.49	0.5	0.5	(25)

Effective air change rate from PCDB:

0.52	0.52	0.51	0.49	0.49	0.46	0.46	0.46	0.47	0.49	0.5	0.5	(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							2.6	(26)
Semi-glazed door							2.6	(26a)
Window							18.63	(27)
Roof window							0	(27a)
Basement floor				0			0	(28)
Ground floor				4252.5			7.94	(28a)
Exposed floor				0			0	(28b)
Basement wall				0			0	(29)
External wall				880.2			17.6	(29a)

Roof	510.3	7.37	(30)
Total area of external elements ∑A, m²		229.47	(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)		54.14	(33)
Heat capacity Cm = ∑(A x k)		7646.4	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		100	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		8.62	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		8.62	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		62.77	(37)

Ventilation heat loss calculated monthly

	51.9	51.44	50.98	48.69	48.23	45.94	45.94	45.48	46.86	48.23	49.15	50.07	(38)
Heat transfer coefficient, W/K													
	114.67	114.21	113.75	111.46	111	108.71	108.71	108.25	109.62	111	111.92	112.83	(39)
Heat loss parameter (HLP), W/m²K													
	1.01	1.01	1	0.98	0.98	0.96	0.96	0.95	0.97	0.98	0.99	1	(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	2.83	(42)

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

	98.63	97.15	94.99	90.86	87.81	84.41	82.47	84.62	86.97	90.62	94.84	98.25	(42a)
Hot water usage in litres per day for baths, Vd,bath (from Appendix J)													
	30.97	30.51	29.86	28.67	27.77	26.78	26.25	26.89	27.59	28.65	29.87	30.87	(42b)
Hot water usage in litres per day for other uses, Vd,other (from Appendix J)													
	43.65	42.06	40.48	38.89	37.3	35.71	35.71	37.3	38.89	40.48	42.06	43.65	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J)	159.59	(43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

	173.25	169.72	165.33	158.42	152.88	146.9	144.44	148.81	153.45	159.75	166.77	172.77	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)													
	274.39	241.69	254.11	216.86	205.81	180.64	174.68	184.26	189.21	216.77	237.6	270.52	(45)
Distribution loss (46) = 0.15 x (45)													
	41.16	36.25	38.12	32.53	30.87	27.1	26.2	27.64	28.38	32.52	35.64	40.58	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)

Water storage loss (or HIU loss)

a) If manufacturer's declared loss factor is known (kWh/day):	1.8	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	0	(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)	0.97	(55)

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

30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13	(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).

30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13	(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)

0	0	0	0	0	0	0	0	0	0	0	0	(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)

304.52	268.9	284.24	246.02	235.94	209.8	204.81	214.39	218.37	246.91	266.76	300.65	3001.32	(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)

304.52	268.9	284.24	246.02	235.94	209.8	204.81	214.39	218.37	246.91	266.76	300.65	3001.32	(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)]

91.24	80.36	84.49	72.11	68.43	60.06	58.08	61.27	62.91	72.08	79	89.95	(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

141.69	141.69	141.69	141.69	141.69	141.69	141.69	141.69	141.69	141.69	141.69	141.69	(66)

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

148.75 164.68 148.75 153.71 148.75 153.71 148.75 148.75 153.71 148.75 153.71 148.75 (67)

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

276.35 279.22 271.99 256.61 237.19 218.94 206.74 203.88 211.1 226.49 245.91 264.16 (68)

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

37.17 37.17 37.17 37.17 37.17 37.17 37.17 37.17 37.17 37.17 37.17 37.17 (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

-113.35 -113.35 -113.35 -113.35 -113.35 -113.35 -113.35 -113.35 -113.35 -113.35 -113.35 -113.35 (71)

Water heating gains (Table 5)

122.63 119.58 113.56 100.15 91.98 83.42 78.07 82.35 87.38 96.88 109.73 120.9 (72)

Total internal gains

613.23 629 599.81 575.97 543.42 521.57 499.06 500.48 517.7 537.62 574.84 599.31 (73)

6. Solar gains

Solar gains in watts, calculated for each month

160.37 271.14 367.81 454.08 509.75 507.27 488.5 446.33 397.34 298.59 191.66 137.55 (83)

Total gains – internal and solar (watts)

773.61 900.13 967.62 1030.05 1053.17 1028.83 987.57 946.8 915.04 836.21 766.51 736.86 (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)

0.95 0.93 0.9 0.83 0.74 0.59 0.45 0.48 0.67 0.85 0.93 0.96 (86)

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

19.86 19.1 19.52 20.06 20.51 20.82 20.94 20.93 20.72 20.15 19.39 19.06 (87)

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

20.07 20.08 20.08 20.1 20.1 20.12 20.12 20.12 20.11 20.1 20.09 20.09 (88)

Roof

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

0.95 0.92 0.88 0.81 0.7 0.53 0.37 0.4 0.61 0.82 0.92 0.95 (89)

Roof

Mean internal temperature in the rest of dwelling T2

19.03 17.88 18.4 19.08 19.61 19.97 20.08 20.07 19.87 19.2 18.26 17.91 (90)

Living area fraction 0.17 (91)

Mean internal temperature (for the whole dwelling)

19.17 18.08 18.59 19.25 19.76 20.12 20.23 20.22 20.02 19.36 18.45 18.1 (92)

Adjusted mean internal temperature:

19.17 18.08 18.59 19.25 19.76 20.12 20.23 20.22 20.02 19.36 18.45 18.1 (93)

8. Space heating requirement

Utilisation factor for gains,

0.94	0.89	0.85	0.78	0.68	0.53	0.38	0.41	0.61	0.8	0.89	0.94	(94)

Useful gains, mGm , W

726.25	802.57	825.36	806.45	716.13	541.42	377.79	392.12	554.96	665.79	683.75	689.3	(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

1705.59	1505.82	1375.16	1153.4	895.14	599.85	394.28	413.28	648.45	972.5	1270.41	1568.57	(97)

Space heating requirement for each month

728.63	472.58	409.06	249.8	133.19	0	0	0	0	228.19	422.39	654.17	(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

728.63	472.58	409.06	249.8	133.19	0	0	0	0	228.19	422.39	654.17	(98c)

Space heating requirement in kWh/m²/year 29.08 (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 %),												191.81	(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	
379.87	246.38	213.26	130.23	69.44	0	0	0	0	118.97	220.21	341.05		(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				269.12	(216)
Efficiency of water heater													
269.12	269.12	269.12	269.12	269.12	269.12	269.12	269.12	269.12	269.12	269.12	269.12		(217)
Fuel for water heating													
113.16	99.92	105.62	91.42	87.67	77.96	76.11	79.66	81.14	91.75	99.12	111.72	1115.24	(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												1719.41	(211)
Space heating fuel used, main system 2												0	(213)
Space heating fuel used, secondary												0	(215)
Water heating fuel used												1115.24	(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		394.12	(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												394.12	(231)
Electricity for lighting												249.43	(232)

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

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

0	0	0	0	0	0	0	0	0	0	0	0	0	(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)

0	0	0	0	0	0	0	0	0	0	0	0	0	(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			3478.21	

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		283.53	(240a)
Low-rate fraction	0		283.53	(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		283.53	(241a)
Low-rate fraction	0		283.53	(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		283.53	(242a)

Low-rate fraction	0		283.53	(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		183.9	(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		64.99	(249)
Energy For lighting	0		41.13	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		0	(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		573.56	(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)		1.3	(257)
SAP rating		78.87	(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			266.78	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			157.52	(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		54.67	(267)
Electricity for lighting		36	(268)
energy saved or generated	0	0	(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		514.97	(272)
Dwelling CO2 Emission Rate		4.54	(273)
EI rating		96	(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			2707	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1697.7	(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			596.22	(281)
Electricity for lighting			382.59	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			5383.51	(286)
Dwelling PE Rate			47.47	(287)

DER WORKSHEET

Dwelling Reference: 15690 RHB
Dwelling Type: New Dwelling Design Stage

Redhorn Close
Poole
BH16 5BE

1. Overall dwelling dimensions

	Area(m^2)		Av. Height(m)		Volume(m^3)	
Basement	52.84 (1a)	x	2.5	(2a) =	132.1	(3a)
Ground Floor	52.84 (1b)	x	2.8	(2b) =	147.95	(3b)
Total floor area TFA					105.68	(4)
Dwelling volume					280.05	(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	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		
Number of storeys in the dwelling (ns)	0	0	(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, ($m^3/h/m^2$)	4	4	(17)
Air permeability value, AP4, ($m^3/h/m^2$)	0	0	(17a)
Air permeability value)	0.2	0.2	(18)
Number of sides on which dwelling is sheltered	1	1	(19)

Shelter factor	0.92	(20)
Infiltration rate incorporating shelter factor	0.19	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
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)													
0.24	0.23	0.23	0.2	0.2	0.18	0.18	0.17	0.19	0.2	0.21	0.22	2.43	(22b)

Calculate effective air change rate for the applicable case:

	0.5	(23a)
	0.5	(23b)
	42.5	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR)

0.52	0.52	0.51	0.49	0.49	0.46	0.46	0.46	0.47	0.49	0.5	0.5	(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

0.52	0.52	0.51	0.49	0.49	0.46	0.46	0.46	0.47	0.49	0.5	0.5	(25)

Effective air change rate from PCDB:

0.52	0.52	0.51	0.49	0.49	0.46	0.46	0.46	0.47	0.49	0.5	0.5	(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							2.6	(26)
Semi-glazed door							2.6	(26a)
Window							18.63	(27)
Roof window							0	(27a)
Basement floor				0			0	(28)
Ground floor				3963			7.4	(28a)
Exposed floor				0			0	(28b)
Basement wall				0			0	(29)
External wall				836.28			16.73	(29a)

Roof	475.56	6.87	(30)
Total area of external elements ∑A, m²		216.87	(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)		52.22	(33)
Heat capacity Cm = ∑(A x k)		7278.24	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		100	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		8.82	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		8.82	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		61.04	(37)

Ventilation heat loss calculated monthly

48.37	47.94	47.51	45.38	44.95	42.81	42.81	42.38	43.67	44.95	45.8	46.66	(38)

Heat transfer coefficient, W/K

109.41	108.98	108.56	106.42	105.99	103.86	103.86	103.43	104.71	105.99	106.85	107.7	(39)

Heat loss parameter (HLP), W/m²K

1.04	1.03	1.03	1.01	1	0.98	0.98	0.98	0.99	1	1.01	1.02	(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	2.79	(42)

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

97.54	96.07	93.94	89.85	86.83	83.47	81.56	83.68	86	89.61	93.79	97.16	(42a)

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

30.63	30.17	29.53	28.35	27.47	26.49	25.96	26.59	27.29	28.33	29.54	30.52	(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

43.16	41.59	40.02	38.46	36.89	35.32	35.32	36.89	38.46	40.02	41.59	43.16	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J)	157.82	(43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

171.33	167.84	163.49	156.66	151.19	145.27	142.83	147.16	151.74	157.97	164.92	170.85	1891.25	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

271.34	239	251.28	214.45	203.52	178.63	172.74	182.21	187.11	214.37	234.96	267.51	2617.14	(45)

Distribution loss (46) = 0.15 x (45)

40.7	35.85	37.69	32.17	30.53	26.79	25.91	27.33	28.07	32.15	35.24	40.13	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)

Water storage loss (or HIU loss)

a) If manufacturer's declared loss factor is known (kWh/day):	1.8	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	0	(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)	0.97	(55)

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

30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13	(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).

30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13	(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)

0	0	0	0	0	0	0	0	0	0	0	0	(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)

301.48	266.22	281.41	243.61	233.66	207.79	202.87	212.34	216.27	244.5	264.12	297.64	2971.92	(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)

301.48	266.22	281.41	243.61	233.66	207.79	202.87	212.34	216.27	244.5	264.12	297.64	2971.92	(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)]

90.22	79.47	83.55	71.31	67.67	59.39	57.44	60.58	62.22	71.28	78.12	88.95	(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

139.31	139.31	139.31	139.31	139.31	139.31	139.31	139.31	139.31	139.31	139.31	139.31	(66)

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

140.64	155.71	140.64	145.33	140.64	145.33	140.64	140.64	145.33	140.64	145.33	140.64	(67)

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

265.2	267.95	261.01	246.25	227.61	210.1	198.4	195.65	202.58	217.34	235.98	253.5	(68)

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

36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	(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

-111.45	-111.45	-111.45	-111.45	-111.45	-111.45	-111.45	-111.45	-111.45	-111.45	-111.45	-111.45	(71)

Water heating gains (Table 5)

121.27	118.26	112.3	99.04	90.96	82.49	77.2	81.43	86.41	95.8	108.51	119.55	(72)

Total internal gains

591.89	606.7	578.75	555.41	524	502.71	481.03	482.51	499.11	518.58	554.61	578.48	(73)

6. Solar gains

Solar gains in watts, calculated for each month

150.99	256.52	351.45	439.86	499.32	499.33	479.85	434.47	381.66	283.42	180.67	129.36	(83)

Total gains – internal and solar (watts)

742.88	863.23	930.19	995.26	1023.32	1002.04	960.87	916.98	880.77	802	735.28	707.84	(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)

0.95	0.92	0.89	0.83	0.73	0.58	0.44	0.48	0.66	0.84	0.93	0.96	(86)

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

19.85	19.08	19.5	20.05	20.51	20.82	20.94	20.92	20.72	20.13	19.37	19.03	(87)

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

20.05	20.06	20.06	20.08	20.08	20.1	20.1	20.1	20.09	20.08	20.07	20.07	(88)

Roof

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

0.94	0.91	0.88	0.8	0.69	0.52	0.36	0.4	0.61	0.82	0.91	0.95	(89)

Roof

Mean internal temperature in the rest of dwelling T2

19	17.83	18.36	19.06	19.59	19.95	20.06	20.05	19.85	19.17	18.22	17.86	(90)

Living area fraction 0.17 (91)

Mean internal temperature (for the whole dwelling)

19.14	18.04	18.55	19.22	19.75	20.1	20.21	20.2	19.99	19.33	18.41	18.06	(92)

Adjusted mean internal temperature:

19.14	18.04	18.55	19.22	19.75	20.1	20.21	20.2	19.99	19.33	18.41	18.06	(93)

8. Space heating requirement

Utilisation factor for gains,

0.94	0.89	0.85	0.77	0.67	0.52	0.37	0.41	0.6	0.79	0.89	0.93	(94)

Useful gains, mGm , W

694.9	765.65	788.01	771.19	685.01	516.47	359.19	372.77	528	633.88	652.43	659.54	(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

1624.09	1432	1308.46	1098.63	852.88	571.18	374.71	392.86	617.02	925.31	1208.45	1492.53	(97)

Space heating requirement for each month

691.32	447.79	387.22	235.76	124.9	0	0	0	0	216.83	400.34	619.75	(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

691.32	447.79	387.22	235.76	124.9	0	0	0	0	216.83	400.34	619.75	(98c)

Space heating requirement in kWh/m²/year 29.56 (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 %),													192.19	(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	
359.7	232.99	201.47	122.67	64.98	0	0	0	0	112.82	208.3	322.46			(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					269.13	(216)
Efficiency of water heater														
269.13	269.13	269.13	269.13	269.13	269.13	269.13	269.13	269.13	269.13	269.13	269.13			(217)
Fuel for water heating														
112.02	98.92	104.56	90.52	86.82	77.21	75.38	78.9	80.36	90.85	98.14	110.59		1104.25	(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													1625.38	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													1104.25	(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			367.29	(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													367.29	(231)
Electricity for lighting													235.84	(232)

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

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

0	0	0	0	0	0	0	0	0	0	0	0	0	(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)

0	0	0	0	0	0	0	0	0	0	0	0	0	(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			3332.76	

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		268.03	(240a)
Low-rate fraction	0		268.03	(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		268.03	(241a)
Low-rate fraction	0		268.03	(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		268.03	(242a)

Low-rate fraction	0		268.03	(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		182.09	(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		60.57	(249)
Energy For lighting	0		38.89	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		0	(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		549.57	(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)	1.31	(257)
SAP rating	78.72	(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			252.21	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			155.96	(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		50.95	(267)
Electricity for lighting		34.04	(268)
energy saved or generated	0	0	(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		493.16	(272)
Dwelling CO2 Emission Rate		4.67	(273)
EI rating		96	(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			2559.04	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1680.96	(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			555.63	(281)
Electricity for lighting			361.73	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			5157.36	(286)
Dwelling PE Rate			48.8	(287)

DER WORKSHEET

Dwelling Reference: 15690 RHC
Dwelling Type: New Dwelling Design Stage

Redhorn Close
Poole
BH16 5BE

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	46.11 (1a)	x	2.5	(2a) =	115.28	(3a)
Ground Floor	46.11 (1b)	x	2.8	(2b) =	129.11	(3b)
Total floor area TFA					92.22	(4)
Dwelling volume					244.38	(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	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		
Number of storeys in the dwelling (ns)	0	0	(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)	4	4	(17)
Air permeability value, AP4, (m³/h/m²)	0	0	(17a)
Air permeability value)	0.2	0.2	(18)
Number of sides on which dwelling is sheltered	1	1	(19)

Shelter factor	0.92	(20)
Infiltration rate incorporating shelter factor	0.19	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
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)													
0.24	0.23	0.23	0.2	0.2	0.18	0.18	0.17	0.19	0.2	0.21	0.22	2.43	(22b)

Calculate effective air change rate for the applicable case:

	0.5	(23a)
	0.5	(23b)
	42.5	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR)

0.52	0.52	0.51	0.49	0.49	0.46	0.46	0.46	0.47	0.49	0.5	0.5	(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

0.52	0.52	0.51	0.49	0.49	0.46	0.46	0.46	0.47	0.49	0.5	0.5	(25)

Effective air change rate from PCDB:

0.52	0.52	0.51	0.49	0.49	0.46	0.46	0.46	0.47	0.49	0.5	0.5	(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							2.6	(26)
Semi-glazed door							2.6	(26a)
Window							16.16	(27)
Roof window							0	(27a)
Basement floor				0			0	(28)
Ground floor				3458.25			6.46	(28a)
Exposed floor				0			0	(28b)
Basement wall				0			0	(29)
External wall				775.62			15.51	(29a)

Roof	414.99	5.99	(30)
Total area of external elements ∑A, m²		194.51	(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)		46.72	(33)
Heat capacity Cm = ∑(A x k)		6723.81	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		100	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		8.07	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		8.07	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		54.79	(37)

Ventilation heat loss calculated monthly

	42.21	41.84	41.46	39.6	39.22	37.36	37.36	36.99	38.11	39.22	39.97	40.72	(38)

Heat transfer coefficient, W/K

	97	96.62	96.25	94.39	94.01	92.15	92.15	91.78	92.89	94.01	94.76	95.51	(39)

Heat loss parameter (HLP), W/m²K

	1.05	1.05	1.04	1.02	1.02	1	1	1	1.01	1.02	1.03	1.04	(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 2.65 (42)

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

	94.51	93.09	91.02	87.06	84.14	80.88	79.03	81.08	83.33	86.83	90.88	94.15	(42a)

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

	29.68	29.24	28.62	27.47	26.62	25.67	25.15	25.77	26.44	27.46	28.63	29.58	(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

	41.82	40.3	38.78	37.26	35.74	34.22	34.22	35.74	37.26	38.78	40.3	41.82	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J) 152.92 (43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

	166.01	162.63	158.42	151.79	146.49	140.76	138.4	142.59	147.03	153.07	159.8	165.55	1832.52 (44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

	262.92	231.58	243.48	207.79	197.2	173.08	167.38	176.55	181.3	207.71	227.66	259.21	2535.87 (45)

Distribution loss (46) = 0.15 x (45)

	39.44	34.74	36.52	31.17	29.58	25.96	25.11	26.48	27.2	31.16	34.15	38.88	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

Water storage loss (or HIU loss)

a) If manufacturer's declared loss factor is known (kWh/day):	1.8	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	0	(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)	0.97	(55)

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

30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13	(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).

30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13	(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)

0	0	0	0	0	0	0	0	0	0	0	0	(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)

293.05	258.79	273.61	236.95	227.34	202.24	197.51	206.68	210.46	237.84	256.82	289.34	2890.65	(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)

293.05	258.79	273.61	236.95	227.34	202.24	197.51	206.68	210.46	237.84	256.82	289.34	2890.65	(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)]

87.42	77	80.96	69.09	65.57	57.55	55.65	58.7	60.28	69.06	75.7	86.19	(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

132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	(66)

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

129.09	142.92	129.09	133.39	129.09	133.39	129.09	129.09	133.39	129.09	133.39	129.09		(67)

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

243.1	245.63	239.27	225.74	208.65	192.6	181.87	179.35	185.7	199.24	216.32	232.38		(68)

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

36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27		(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

-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2		(71)

Water heating gains (Table 5)

117.5	114.58	108.81	95.96	88.13	79.93	74.8	78.9	83.73	92.83	105.14	115.84		(72)

Total internal gains

552.51	565.95	539.99	517.91	488.69	468.74	448.58	450.16	465.64	483.97	517.67	540.13		(73)

6. Solar gains

Solar gains in watts, calculated for each month

100.05	172.03	243.44	321.36	382.44	390.77	372.04	323.98	269.62	191.94	120.04	85.54		(83)

Total gains – internal and solar (watts)

652.56	737.98	783.43	839.27	871.14	859.51	820.62	774.14	735.26	675.91	637.71	625.67		(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)

0.95	0.93	0.9	0.84	0.74	0.59	0.46	0.5	0.69	0.86	0.93	0.95		(86)

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

19.83	19.01	19.42	19.99	20.47	20.81	20.93	20.91	20.68	20.07	19.32	19.01		(87)

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

20.04	20.04	20.05	20.06	20.07	20.08	20.08	20.09	20.08	20.07	20.06	20.05		(88)

Roof

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

0.94	0.92	0.89	0.81	0.7	0.53	0.37	0.41	0.63	0.83	0.92	0.95		(89)

Roof

Mean internal temperature in the rest of dwelling T2

18.97	17.74	18.25	18.97	19.54	19.93	20.04	20.03	19.8	19.09	18.15	17.82		(90)

Living area fraction 0.16 (91)

Mean internal temperature (for the whole dwelling)

19.11	17.93	18.43	19.13	19.69	20.06	20.18	20.17	19.94	19.24	18.34	18.01		(92)

Adjusted mean internal temperature:

19.11	17.93	18.43	19.13	19.69	20.06	20.18	20.17	19.94	19.24	18.34	18.01		(93)

8. Space heating requirement

Utilisation factor for gains,

0.93	0.89	0.86	0.79	0.68	0.53	0.38	0.42	0.62	0.8	0.89	0.93	(94)

Useful gains, mGm , W

610.04	657.65	670.67	660.21	593.18	451.6	314.96	325.98	455.31	541.85	566.81	581.96	(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

1436.27	1259.45	1148.66	965.21	750.72	503.59	330.09	345.98	542.39	812.58	1064.81	1318.83	(97)

Space heating requirement for each month

614.72	404.41	355.62	219.6	117.21	0	0	0	0	201.43	358.57	548.23	(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

614.72	404.41	355.62	219.6	117.21	0	0	0	0	201.43	358.57	548.23	(98c)

Space heating requirement in kWh/m²/year 30.58 (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 %),												193.54	(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	
317.61	208.95	183.74	113.46	60.56	0	0	0	0	104.07	185.26	283.26		(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					268.94	(216)
Efficiency of water heater													
268.94	268.94	268.94	268.94	268.94	268.94	268.94	268.94	268.94	268.94	268.94	268.94		(217)
Fuel for water heating													
108.96	96.23	101.74	88.11	84.53	75.2	73.44	76.85	78.26	88.44	95.5	107.58	1074.83	(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												1456.94	(211)
Space heating fuel used, main system 2												0	(213)
Space heating fuel used, secondary												0	(215)
Water heating fuel used												1074.83	(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			320.51	(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												320.51	(231)
Electricity for lighting												216.46	(232)

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

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

0	0	0	0	0	0	0	0	0	0	0	0	0	(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)

0	0	0	0	0	0	0	0	0	0	0	0	0	(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			3068.74	

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		240.25	(240a)
Low-rate fraction	0		240.25	(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		240.25	(241a)
Low-rate fraction	0		240.25	(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		240.25	(242a)

Low-rate fraction	0		240.25	(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		177.24	(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		52.85	(249)
Energy For lighting	0		35.69	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		0	(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		506.04	(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)		1.33	(257)
SAP rating		78.48	(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			225.84	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			151.79	(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		44.46	(267)
Electricity for lighting		31.24	(268)
energy saved or generated	0	0	(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		453.33	(272)
Dwelling CO2 Emission Rate		4.92	(273)
EI rating		96	(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			2292.97	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1636.13	(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			484.86	(281)
Electricity for lighting			332.02	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			4745.98	(286)
Dwelling PE Rate			51.46	(287)

DER WORKSHEET

Dwelling Reference: 15690 RHCM
Dwelling Type: New Dwelling Design Stage

Redhorn Close
Poole
BH16 5BE

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	46.11 (1a)	x	2.5	(2a) =	115.28	(3a)
Ground Floor	46.11 (1b)	x	2.8	(2b) =	129.11	(3b)
Total floor area TFA					92.22	(4)
Dwelling volume					244.38	(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	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		
Number of storeys in the dwelling (ns)	0	0	(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)	4	4	(17)
Air permeability value, AP4, (m³/h/m²)	0	0	(17a)
Air permeability value)	0.2	0.2	(18)
Number of sides on which dwelling is sheltered	2	2	(19)

Shelter factor													0.85	(20)
Infiltration rate incorporating shelter factor													0.17	(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)														
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2	2.23	(22b)
Calculate effective air change rate for the applicable case:														
													0.5	(23a)
													0.5	(23b)
													42.5	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)														
	0.5	0.5	0.5	0.47	0.47	0.45	0.45	0.44	0.46	0.47	0.48	0.49		(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														
	0.5	0.5	0.5	0.47	0.47	0.45	0.45	0.44	0.46	0.47	0.48	0.49		(25)
Effective air change rate from PCDB:														
	0.5	0.5	0.5	0.47	0.47	0.45	0.45	0.44	0.46	0.47	0.48	0.49		(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							2.6	(26)
Semi-glazed door							2.6	(26a)
Window							16.16	(27)
Roof window							0	(27a)
Basement floor				0			0	(28)
Ground floor				3458.25			6.46	(28a)
Exposed floor				0			0	(28b)
Basement wall				0			0	(29)
External wall				775.62			15.51	(29a)

Roof	414.99	5.99	(30)
Total area of external elements ∑A, m²		194.51	(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)		46.72	(33)
Heat capacity Cm = ∑(A x k)		6723.81	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		100	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		8.07	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		8.07	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		54.79	(37)

Ventilation heat loss calculated monthly

40.67	40.32	39.98	38.27	37.92	36.21	36.21	35.87	36.9	37.92	38.61	39.29	(38)

Heat transfer coefficient, W/K

95.45	95.11	94.77	93.06	92.71	91	91	90.66	91.68	92.71	93.4	94.08	(39)

Heat loss parameter (HLP), W/m²K

1.04	1.03	1.03	1.01	1.01	0.99	0.99	0.98	0.99	1.01	1.01	1.02	(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 2.65 (42)

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

94.51	93.09	91.02	87.06	84.14	80.88	79.03	81.08	83.33	86.83	90.88	94.15	(42a)

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

29.68	29.24	28.62	27.47	26.62	25.67	25.15	25.77	26.44	27.46	28.63	29.58	(42b)

Hot water usage in litres per day for other uses, Vd,other (from Appendix J)

41.82	40.3	38.78	37.26	35.74	34.22	34.22	35.74	37.26	38.78	40.3	41.82	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J) 152.92 (43)

Hot water usage in litres per day for each month Vd,m = (42a) + (42b) + (42c)

166.01	162.63	158.42	151.79	146.49	140.76	138.4	142.59	147.03	153.07	159.8	165.55	1832.52	(44)

Energy content of hot water used = 4.18 x Vd,m x nm x DTm / 3600 kWh/month (from Appendix J)

262.92	231.58	243.48	207.79	197.2	173.08	167.38	176.55	181.3	207.71	227.66	259.21	2535.87	(45)

Distribution loss (46) = 0.15 x (45)

39.44	34.74	36.52	31.17	29.58	25.96	25.11	26.48	27.2	31.16	34.15	38.88	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

Water storage loss (or HIU loss)

a) If manufacturer's declared loss factor is known (kWh/day):	1.8	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	0	(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)	0.97	(55)

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

30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13	(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).

30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13	(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)

0	0	0	0	0	0	0	0	0	0	0	0	(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)

293.05	258.79	273.61	236.95	227.34	202.24	197.51	206.68	210.46	237.84	256.82	289.34	2890.65	(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)

293.05	258.79	273.61	236.95	227.34	202.24	197.51	206.68	210.46	237.84	256.82	289.34	2890.65	(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)]

87.42	77	80.96	69.09	65.57	57.55	55.65	58.7	60.28	69.06	75.7	86.19	(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

132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	132.75	(66)

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

129.09	142.92	129.09	133.39	129.09	133.39	129.09	129.09	133.39	129.09	133.39	129.09		(67)

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

243.1	245.63	239.27	225.74	208.65	192.6	181.87	179.35	185.7	199.24	216.32	232.38		(68)

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

36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27	36.27		(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

-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2	-106.2		(71)

Water heating gains (Table 5)

117.5	114.58	108.81	95.96	88.13	79.93	74.8	78.9	83.73	92.83	105.14	115.84		(72)

Total internal gains

552.51	565.95	539.99	517.91	488.69	468.74	448.58	450.16	465.64	483.97	517.67	540.13		(73)

6. Solar gains

Solar gains in watts, calculated for each month

100.05	172.03	243.44	321.36	382.44	390.77	372.04	323.98	269.62	191.94	120.04	85.54		(83)

Total gains – internal and solar (watts)

652.56	737.98	783.43	839.27	871.14	859.51	820.62	774.14	735.26	675.91	637.71	625.67		(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)

0.95	0.93	0.9	0.84	0.74	0.59	0.45	0.49	0.68	0.85	0.93	0.95		(86)

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

19.85	19.05	19.45	20.01	20.49	20.82	20.93	20.92	20.7	20.1	19.36	19.04		(87)

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

20.05	20.06	20.06	20.08	20.08	20.09	20.09	20.1	20.09	20.08	20.07	20.07		(88)

Roof

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

0.94	0.92	0.88	0.81	0.7	0.52	0.37	0.41	0.63	0.83	0.92	0.95		(89)

Roof

Mean internal temperature in the rest of dwelling T2

19.01	17.8	18.31	19.01	19.57	19.94	20.06	20.04	19.82	19.12	18.2	17.88		(90)

Living area fraction 0.16 (91)

Mean internal temperature (for the whole dwelling)

19.14	17.99	18.49	19.17	19.71	20.08	20.19	20.18	19.96	19.28	18.38	18.06		(92)

Adjusted mean internal temperature:

19.14	17.99	18.49	19.17	19.71	20.08	20.19	20.18	19.96	19.28	18.38	18.06		(93)

8. Space heating requirement

Utilisation factor for gains,

0.93	0.89	0.86	0.79	0.68	0.52	0.38	0.42	0.62	0.8	0.89	0.93	(94)

Useful gains, mGm , W

609.78	657.27	669.97	658.87	590.93	448.95	312.64	323.75	453.27	540.92	566.49	581.82	(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

1416.52	1245.35	1135.98	955.29	742.93	498.72	326.98	342.79	537.11	804.53	1053.93	1303.83	(97)

Space heating requirement for each month

600.22	395.19	346.71	213.42	113.09	0	0	0	0	196.13	350.95	537.18	(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

600.22	395.19	346.71	213.42	113.09	0	0	0	0	196.13	350.95	537.18	(98c)

Space heating requirement in kWh/m²/year 29.85 (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 %),													193.71	(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	
309.85	204.01	178.98	110.17	58.38	0	0	0		0	101.25	181.17	277.3		(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					268.92	(216)
Efficiency of water heater														
268.92	268.92	268.92	268.92	268.92	268.92	268.92	268.92		268.92	268.92	268.92	268.92		(217)
Fuel for water heating														
108.97	96.24	101.75	88.11	84.54	75.21	73.45	76.86		78.26	88.44	95.5	107.59	1074.93	(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													1421.11	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													1074.93	(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			320.51	(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													320.51	(231)
Electricity for lighting													216.46	(232)

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

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

0	0	0	0	0	0	0	0	0	0	0	0	0	(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)

0	0	0	0	0	0	0	0	0	0	0	0	0	(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			3033.01	

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		234.34	(240a)
Low-rate fraction	0		234.34	(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		234.34	(241a)
Low-rate fraction	0		234.34	(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		234.34	(242a)

Low-rate fraction	0		234.34	(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		177.26	(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		52.85	(249)
Energy For lighting	0		35.69	(250)
Additional standing charges	0		0	(251)
Energy saving/generation technologies	0		0	(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		500.14	(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)		1.31	(257)
SAP rating		78.73	(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			220.32	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			151.81	(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		44.46	(267)
Electricity for lighting		31.24	(268)
energy saved or generated	0	0	(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		447.83	(272)
Dwelling CO2 Emission Rate		4.86	(273)
EI rating		96	(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			2236.72	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			1636.28	(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			484.86	(281)
Electricity for lighting			332.02	(282)
energy saved or generated	0		0	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			4689.88	(286)
Dwelling PE Rate			50.86	(287)