Energy Statement

Development: 1 new dwelling
Site address: Woodrising, Bleadon, BS24 0AA

Local Authority: North Somerset Council
Policy: Core Strategy CS2 – 10% of predicted energy to be from renewables

Report reference: BA-30

Date: 10th February 2023

Core Strategy CS2

Living within environmental limits

CS2: Delivering sustainable design and construction

New development both residential (including conversions) and non-residential should demonstrate a commitment to sustainable design and construction, increasing energy efficiency through design, and prioritising the use of sustainable low or zero carbon forms of renewable energy generation in order to increase the sustainability of the building stock across North Somerset.

The greatest potential for energy saving opportunities is likely to be at larger scale developments particularly at the Weston Villages and Weston town centre. In addition these areas are expected to demonstrate exemplar environmental standards contributing to the objectives of Policy CS1, and adding value to the local economy.

When considering proposals for development the council will:

1) require designs that are energy efficient and designed to reduce their energy demands;

2) require the use of on-site renewable energy sources or by linking with/contributing to available local off-site renewable energy sources to meet a minimum of 10% of predicted energy use for residential development proposals involving one to nine dwellings, and 15% for 10 or more dwellings; and 10% for non-residential developments over 500m² and 15% for 1000m² and above;

Source: https://www.n-somerset.gov.uk/sites/default/files/2020-07/core%20strategy.pdf (Page 26).

Introduction

Therm Energy Ltd has been instructed to produce an Energy Statement for a proposed development at the above site. North Somerset Council requires an Energy Statement to be submitted to address the above planning condition.

SAP energy calculations have been prepared to determine the Baseline energy requirements based on the dwelling satisfying Building Regulation Part L1A (2021) Standards.

The Development

The residential development comprises of 1 detached house. See SAP reports for details.

Energy Efficiency Measures

This Development will benefit from energy efficiency measures to reduce the energy consumption and CO_2 emissions over and above those required to comply with Building Regulations Part L1A. The following section gives a breakdown of the improved fabric standards/detailing being adopted and highlights the additional energy efficiency measures which are being implemented at this development.

Element	Area weighted limiting U-Values AD Part L 2021	Proposed Specification
External Walls	0.26 W/m²K	0.16W/m²K
Ground Floor	0.18 W/m²K	0.16W/m²K
Roof Insulation	0.16 W/m²K	0.16W/m²K
Windows	1.4W/m²K	1.2W/m²K
Doors	1.4W/m²K	1.4W/m²K
Y-Value	0.15 W/m²K	0.04W/m²K
Air Permeability	8m³/h.m² at 50 pa	5m³/h.m² at 50 pa

Table 1 - Fabric Specification

Table 1 details the limiting values for fabric insulation set out in Approved Document L1A 2021 and the proposed specification values for the new residential units on this site. The proposed specification incorporates fabric standards that exceed Part L1A Building Regulations minimum requirements.

10% of predicted energy from onsite renewable energy

Energy	Predicted energy use BASE	Dwelling energy use ACTUAL	Percentage of energy from renewables
Energy demand	10726 kWh/year	7579 kWh/year	10726 – 7579 = 3147 3147/10726 = 0.29 x 100 = **29%**
The >10% of predicted energy from onsite renewable energy is achieved through the installation of an ASHP (air source heat pump).			

Design

Energy & CO2 Emissions

> Fabric insulation standards (including glazing), and airtightness, will meet or exceed current (2021) Building Regulations Part L standards.

> Attention to be paid to minimize thermal bridging and air leakage at junctions.

> 100% of new internal fixed lighting and external lighting will be low energy.

> Advanced heating controls

> Where supplied, white goods will be energy efficient (A+ or A rated).

Materials

> Consideration will be given to using materials and construction that have a low environmental impact, such as those achieving an A+ or A rated under BRE's Green Guide.

> Where possible, materials will be chosen that are responsibly sourced (such as FSC timber), recycled or reclaimed.

> All insulation materials will have a GWP (Global Warming Potential) of 5 or less.

Water Use

> Indoor water use will be restricted by use of fittings with lower flow rates, baths with smaller capacity (if applicable), dual-flush toilets, and (where applicable) washing machines and dishwashers with low water usage.

Surface Water & Flood Risk

> Where possible, Sustainable Drainage Systems will be used to avoid, reduce, and delay the discharge of rain-fall run-off to public watercourses and sewers.
> Measures are to be undertaken to reduce the risk of flooding where developments are in medium or high-risk flood zones.

Waste

> Construction site waste is to be minimized (diverted from landfill) by re-using materials on site (or to/from other sites), returning to the supplier where possible/practical recovery/recycling, and composting.
> Hazardous waste will be avoided (or minimized where unavoidable).
> If available, the kitchen design will incorporate fixed bin(s) in the kitchen cupboards to encourage recycling.

Health & Wellbeing

> Key rooms have reasonably good levels of daylighting, and décor will enhance this (the need for artificial lighting will also be reduced).
> Sound insulation (between dwelling and adjoining buildings, where applicable), and within the dwelling, will meet or exceed current Building Regulation standards.
> To ensure the dwelling is usable/adaptable for all potential existing and future owners or occupiers, as many as possible/practical of the 16 no Lifetime Homes criteria will be incorporated into the design and construction of the dwelling.

Management

> Guidance will be provided to the end owner/occupier of the dwelling, providing information on the correct and efficient use of their home.
> Security measures will be incorporated into the design and construction of the dwelling.

Lighting

Lighting will be improved above and beyond the current Building Regulations Part L minimum standards of 100% low energy fittings.

Heating

Main Heating: ASHP (Air Source Heat Pump).

Heating Controls

Heating controls will meet current Building Regulations Part L1A minimum standards. Fully independent time and temperature zone controls (note: separate plumbing circuits required, either with its own programmer, or separate channels in the same programmer).

Using on-site low or zero carbon renewable technology

To meet the Core Strategy CS2 '10% of predicted energy from renewables', the introduction of low and zero carbon (LZC) generation technologies has been investigated following the assessment of the building efficiency and fabric improvements detailed above. The table below gives a summary of the suitability of different low carbon and renewable energy technologies at the site ranked 1 (most suitable) to 7 (least suitable).

Technology	Feasibility	Rank
Air Source Heat Pumps (ASHP)	ASHP is an alternative renewable technology. This technology is suited to this Development as it meets the required reduction in carbon emissions.	1
Photovoltaic (PV) Panels	The dwelling should have a sufficiently large roof areas able to accommodate the installation of solar photovoltaic panels. The introduction of the Feed in Tariff (FIT) in 2010 has resulted in a significant reduction in the capital cost of the installation of PV systems, although tariff subsidies have since been reduced. Either roof mounted or building integrated systems (solar slates) can be used. The panels should be installed to face South or East.	2
Solar Thermal Hot Water (SHW)	Solar thermal hot water systems are a proven and mature technology in the UK and well suited to year-round domestic demand for hot water. Systems are restricted to only meeting a proportion of domestic hot water demand (typically in the region of 60%). This does limit the technologies' ability to achieve high levels of emission reduction. However, it is envisaged that this technology alone will not be sufficient to meet the 40% reduction in carbon emissions.	3
Ground Source Heat Pumps (GSHP)	Subject to investigation, a ground source heating systems could be considered at the site. This would involve horizontal ground loop collectors installed in the garden or alternatively vertical boreholes would be required. Spatial restrictions and any existing or future below ground constraints such as buried services and sewerage infrastructure could constrain deployment. Systems can be very expensive particularly vertical boreholes. In practice we feel that a GSHP is not ideally suited to a development of this scale.	4
Combined Heat and Power (CHP) and CHP District Heating	Although natural gas CHP or cogeneration is an efficient method of generating and utilising electricity and heat, the increased thermal efficiency due to fabric efficiency of new homes prohibits the application of domestic Micro-CHP systems such as the Baxi Whispergen. This development would call into question the viability of district heating and the effective operation of any communal CHP engine.	5
Wind Turbines	The wind speed at the site is estimated at 4.6m/s at 10m above ground level through to 6.1m/s at 45m above ground level, which is relatively modest and not conducive to a very high energy yield. Further, the associated landscape and visual impact implication, given the site's location, would restrict the inclusion of larger scale wind turbines (>1MWe).	6
Biomass Heating	It may not be practical or technically feasible to install biomass wood pellet boilers or stoves with supplementary heating. However, this would hinge on a local biomass fuel supply source being available to the site and appropriate storage for the pellets including automatic feed to the boiler.	7

Proposed Strategy

Based on the above findings it recommended that an ASHP (Air Source Heat Pump) is installed. A high fabric efficient specification is also recommended. The above u-values and specification will need to be followed to meet the planning condition.

Conclusions

This Energy Statement has been prepared to demonstrate compliance with the Core Strategy CS2 '10% of predicted energy from renewables.'

The dwelling is to be designed to high levels of fabric insulation and air tightness, in line with current requirements (Part L 2021) to reduce energy use and CO2 emissions through the installation of renewable sources of energy.

This Energy Statement describes how the Development proposes to meet the Planning Condition using good levels of fabric insulation and ASHPs. This Energy Statement shows the summary data derived from SAP energy calculations to support compliance with the Planning Condition.

TER WORKSHEET

Dwelling Reference: BA-30
Dwelling Type: New Dwelling Design Stage

Woodrising
Hillside Road
WESTON-SUPER-MARE
BS24 0AA

1. Overall dwelling dimensions

	Area(m^2)		Av. Height(m)		Volume(m^3)	
Ground Floor	127.7	(1a) x	2.4	(2a) =	306.48	(3a)
First Floor	115	(1b) x	2.7	(2b) =	310.5	(3b)
2nd Floor	98.9	(1c) x	3	(2c) =	296.7	(3c)
Total floor area TFA					341.6	(4)
Dwelling volume					913.68	(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	4	x	10	=	40	(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)	0.04	0.04	(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, ($m^3/h/m^2$)	5	5	(17)
Air permeability value, AP4, ($m^3/h/m^2$)	0	0	(17a)
Air permeability value)	0.29	0.29	(18)
Number of sides on which dwelling is sheltered	0	0	(19)

Shelter factor												1	(20)
Infiltration rate incorporating shelter factor												0.29	(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)														
	0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35	3.86	(22b)
Calculate effective air change rate for the applicable case:														
													0	(23a)
													0	(23b)
													0	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)														
	0	0	0	0	0	0	0	0	0	0	0	0		(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														
	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(24d)
Effective air change rate														
	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
Effective air change rate from PCDB:														
	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)

3. 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							2.1	(26)
Semi-glazed door							2.1	(26a)
Window							44.3	(27)
Roof window							7.6	(27a)
Basement floor				0			0	(28)
Ground floor				9577.5			16.6	(28a)
Exposed floor				0			0	(28b)
Basement wall				0			0	(29)
External wall				17259.09			52.27	(29a)

Roof	1315.08	16.07	(30)
Total area of external elements ∑A, m²		610.38	(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)		138.95	(33)
Heat capacity Cm = ∑(A x k)		28151.67	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		30.52	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		30.52	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		169.47	(37)

Ventilation heat loss calculated monthly

171.91	171.09	170.28	166.5	165.79	162.5	162.5	161.89	163.77	165.79	167.22	168.72	(38)

Heat transfer coefficient, W/K

341.37	340.55	339.75	335.97	335.26	331.97	331.97	331.36	333.23	335.26	336.69	338.19	(39)

Heat loss parameter (HLP), W/m²K

1	1	0.99	0.98	0.98	0.97	0.97	0.97	0.98	0.98	0.99	0.99	(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	3.19	(42)

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

77.64	76.47	74.77	71.52	69.12	66.44	64.92	66.61	68.46	71.33	74.65	77.34	(42a)

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

33.51	33.01	32.31	31.02	30.05	28.98	28.4	29.1	29.85	31	32.32	33.4	(42b)

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

47.26	45.54	43.82	42.1	40.38	38.67	38.67	40.38	42.1	43.82	45.54	47.26	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J)	145.82	(43)

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

158.41	155.02	150.9	144.64	139.55	134.09	131.98	136.09	140.41	146.15	152.51	158	1747.76	(44)

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

250.88	220.75	231.94	198.01	187.87	164.87	159.62	168.5	173.14	198.33	217.28	247.38	2418.58	(45)

Distribution loss (46) = 0.15 x (45)

37.63	33.11	34.79	29.7	28.18	24.73	23.94	25.28	25.97	29.75	32.59	37.11	(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):	1.65	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	0.89	(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)	0.89	(55)

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

27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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).

27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss for each month from Table 3
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only heat networks)

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)

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

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

301.8	266.75	282.86	247.29	238.79	214.16	210.55	219.43	222.43	249.25	266.57	298.31	3018.19	(62)

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

35.49	31.39	32.87	27.22	25.37	21.71	20.35	21.64	22.46	26.48	29.99	34.84	(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)

266.31	235.36	249.99	220.07	213.43	192.45	190.2	197.79	199.97	222.78	236.57	263.47	2688.4	(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)]

124.16	110.2	117.86	105.26	103.21	94.25	93.82	96.77	97	106.69	111.67	123	(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

159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	(66)

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

269.13	297.96	269.13	278.1	269.13	278.1	269.13	269.13	278.1	269.13	278.1	269.13	(67)

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

491.14	496.24	483.39	456.05	421.54	389.1	367.43	362.34	375.18	402.52	437.03	469.47	(68)

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

38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	(69)

Pumps and fans gains (Table 5a)

3	3	3	3	3	0	0	0	0	3	3	3	(70)

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

-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	(71)

Water heating gains (Table 5)

166.88	163.99	158.41	146.2	138.72	130.9	126.1	130.06	134.72	143.39	155.1	165.32	(72)

Total internal gains

1000.94	1031.98	984.72	954.14	903.18	868.89	833.45	832.32	858.78	888.83	944.02	977.71	(73)

6. Solar gains

Solar gains in watts, calculated for each month

550.05	930.36	1255.81	1527.78	1685.86	1662.61	1607.53	1491.22	1350.22	1023.59	657.62	471.51	(83)

Total gains – internal and solar (watts)

1550.98	1962.33	2240.53	2481.92	2589.04	2531.49	2440.97	2323.53	2209	1912.42	1601.65	1449.21	(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)

1	1	0.99	0.98	0.92	0.77	0.59	0.63	0.87	0.99	1	1	(86)

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

19.66	19.86	20.13	20.47	20.76	20.94	20.99	20.98	20.88	20.48	20	19.63	(87)

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

20.08	20.09	20.09	20.1	20.1	20.11	20.11	20.11	20.1	20.1	20.1	20.09	(88)

Roof

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

1	1	0.99	0.97	0.88	0.69	0.47	0.52	0.81	0.98	1	1	(89)

Roof

Mean internal temperature in the rest of dwelling T2

18.49	18.75	19.1	19.53	19.88	20.07	20.1	20.1	20.01	19.55	18.94	18.46	(90)

Living area fraction 0.08 (91)

Mean internal temperature (for the whole dwelling)

18.59	18.85	19.18	19.61	19.95	20.14	20.18	20.18	20.09	19.63	19.03	18.56	(92)

Adjusted mean internal temperature:

18.59	18.85	19.18	19.61	19.95	20.14	20.18	20.18	20.09	19.63	19.03	18.56	(93)

8. Space heating requirement

Utilisation factor for gains,

1	1	0.99	0.96	0.88	0.69	0.48	0.53	0.81	0.97	1	1		(94)

Useful gains, mGm , W

1549.32	1954.47	2213.54	2381.14	2273.08	1750.09	1178.29	1235.08	1778.37	1859.05	1596.53	1448.15		(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

4879.51	4750.19	4308.98	3598.32	2767.55	1840.58	1187.97	1251.56	1994.74	3027.86	4017.6	4857.24		(97)

Space heating requirement for each month

2477.66	1878.73	1559	876.37	367.89	0	0	0	0	869.6	1743.17	2536.36		(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

2477.66	1878.73	1559	876.37	367.89	0	0	0	0	869.6	1743.17	2536.36		(98c)

Space heating requirement in kWh/m²/year 36.03 (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 %),													92.3	(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			(210)
Space heating fuel (main heating system 1), kWh/month								0					0	
2684.35	2035.46	1689.06	949.48	398.58	0	0	0		0	942.14	1888.59	2747.96		(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					79.8	(216)
Efficiency of water heater														
87.84	87.7	87.44	86.83	85.27	79.8	79.8	79.8		79.8	86.8	87.62	87.87		(217)
Fuel for water heating														
303.18	268.37	285.91	253.44	250.3	241.17	238.35	247.86		250.59	256.65	270	299.85	3165.67	(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													13335.62	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													3165.67	(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			0	(230a)
warm air heating system fans													0	(230b)
Heating circulation pump or water pump within warm air heating unit													41	(230c)
Oil boiler auxiliary (oil pump, flue fan, etc; excludes circulation pump)													0	(230d)
Gas boiler auxiliary (flue fan, etc; excludes circulation pump)													45	(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													86	(231)
Electricity for lighting													451.3	(232)

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

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

107.54	145.87	201.63	217.46	226.62	208.34	205.35	197.41	182.69	161.92	115.99	93.63	2064.45	(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)

79.44	164.58	322.76	478.76	627.61	629.03	622.01	529.43	391.52	233.78	105.49	63.05	4247.45	(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		10726.7	

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		485.42	(240a)
Low-rate fraction	0		485.42	(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		485.42	(241a)
Low-rate fraction	0		485.42	(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		485.42	(242a)

Low-rate fraction	0		485.42	(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		115.23	(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		14.18	(249)
Energy For lighting	0		74.42	(250)
Additional standing charges	0		92	(251)
Energy saving/generation technologies	0		-578.17	(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		203.08	(255)
11a. SAP rating – Individual heating systems including micro-CHP				
Energy cost deflator	0		0	(256)
Energy cost factor (ECF)	0		0	(257)
SAP rating	0		0	(258)

11a. SAP rating – Individual heating systems including micro-CHP

Energy cost deflator	0.36		(256)
Energy cost factor (ECF)	0.19		(257)
SAP rating	96.93		(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			2800.48	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			664.79	(264)
Energy for instantaneous electric shower(s)			0	(264a)

Space and water heating		3465.27	(265)
Space cooling		0	(266)
Electricity for pumps, fans and electric keep		11.93	(267)
Electricity for lighting		65.14	(268)
energy saved or generated	0	-815.97	(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		2726.37	(272)
Dwelling CO2 Emission Rate		7.98	(273)
EI rating		91	(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			15069.25	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			3577.21	(278)
Energy for instantaneous electric shower(s)			0	(278a)
Space and water heating			18646.46	(279)
Space cooling			0	(280)
Electricity for pumps, fans and electric keep			130.1	(281)
Electricity for lighting			692.22	(282)
energy saved or generated	0		-5066.8	
Appendix Q items				
energy saved	0		0	
energy used	0		0	
energy saved	0		0	(284b)
energy used			0	(285b)
Total PE, kWh/year			14401.97	(286)
Dwelling PE Rate			42.16	(287)

DER WORKSHEET

Dwelling Reference: BA-30
Dwelling Type: New Dwelling Design Stage

Woodrising
Hillside Road
WESTON-SUPER-MARE
BS24 0AA

1. Overall dwelling dimensions

	Area(m^2)		Av. Height(m)		Volume(m^3)	
Ground Floor	127.7	(1a) x	2.4	(2a) =	306.48	(3a)
First Floor	115	(1b) x	2.7	(2b) =	310.5	(3b)
2nd Floor	98.9	(1c) x	3	(2c) =	296.7	(3c)
Total floor area TFA					341.6	(4)
Dwelling volume					913.68	(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, ($m^3/h/m^2$)	5	5	(17)
Air permeability value, AP4, ($m^3/h/m^2$)	0	0	(17a)
Air permeability value)	0.25	0.25	(18)
Number of sides on which dwelling is sheltered	0	0	(19)

Shelter factor													1	(20)
Infiltration rate incorporating shelter factor													0.25	(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)														
	0.32	0.31	0.31	0.28	0.27	0.24	0.24	0.23	0.25	0.27	0.28	0.29	3.28	(22b)
Calculate effective air change rate for the applicable case:														
													0.5	(23a)
													0.5	(23b)
													0	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR)														
	0	0	0	0	0	0	0	0	0	0	0	0		(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														
	0.57	0.56	0.56	0.53	0.52	0.5	0.5	0.5	0.5	0.52	0.53	0.54		(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														
	0.57	0.56	0.56	0.53	0.52	0.5	0.5	0.5	0.5	0.52	0.53	0.54		(25)
Effective air change rate from PCDB:														
	0.57	0.56	0.56	0.53	0.52	0.5	0.5	0.5	0.5	0.52	0.53	0.54		(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							2.94	(26)
Semi-glazed door							2.94	(26a)
Window							44.3	(27)
Roof window							6.15	(27a)
Basement floor				0			0	(28)
Ground floor				9577.5			20.43	(28a)
Exposed floor				0			0	(28b)
Basement wall				0			0	(29)
External wall				17259.09			44.2	(29a)

Roof	1315.08	22.65	(30)
Total area of external elements ∑A, m²		610.38	(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)		140.68	(33)
Heat capacity Cm = ∑(A x k)		28151.67	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K		250	(35)
Linear Thermal bridges: ∑ (L x Ψ) calculated using Appendix K		18.31	(36)
Point Thermal bridges: ∑χ (W/K) if significant point thermal bridge present and values available		18.31	(36a)
Total fabric heat loss H = ∑(A × U) + ∑(L × Ψ) +∑χ		158.99	(37)

Ventilation heat loss calculated monthly

171.49	169.6	167.72	158.3	156.41	150.76	150.76	150.76	150.76	156.41	160.18	163.95	(38)

Heat transfer coefficient, W/K

330.47	328.59	326.71	317.28	315.4	309.75	309.75	309.75	309.75	315.4	319.17	322.94	(39)

Heat loss parameter (HLP), W/m²K

0.97	0.96	0.96	0.93	0.92	0.91	0.91	0.91	0.91	0.92	0.93	0.95	(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 3.19 (42)

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

75.68	74.52	72.81	70.18	67.83	64.54	61.93	64.98	66.51	69.77	73.17	75.61	(42a)

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

32.76	32.27	31.57	30.51	29.56	28.25	27.26	28.48	29.11	30.41	31.75	32.74	(42b)

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

47.26	45.54	43.82	42.1	40.38	38.67	38.67	40.38	42.1	43.82	45.54	47.26	(42c)

Annual average hot water usage in litres per day Vd,average (from Appendix J) 143.31 (43)

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

155.7	152.33	148.2	142.8	137.78	131.46	127.86	133.84	137.72	144	150.46	155.6	1717.75	(44)

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

229.22	201.56	211.77	186.53	177.54	152.03	141.29	157.53	159.75	185.56	203.35	228.52	2234.65	(45)

Distribution loss (46) = 0.15 x (45)

34.38	30.23	31.77	27.98	26.63	22.8	21.19	23.63	23.96	27.83	30.5	34.28	(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):	2	(48)
Temperature factor from Table 2b	0.54	(49)
Energy lost from water storage, kWh/day (48) x (49) =	1.08	(50)
b) If manufacturer's declared loss factor is not known :		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)
Energy lost from water storage, kWh/day	0	(54)
Enter (50) or (54) in (55)	1.08	(55)

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

33.48	30.24	33.48	32.4	33.48	32.4	33.48	33.48	32.4	33.48	32.4	33.48	(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).

33.48	30.24	33.48	32.4	33.48	32.4	33.48	33.48	32.4	33.48	32.4	33.48	(57)

Primary circuit loss for each month from Table 3
modified by factor from Table H4 if there is solar water heating and a cylinder thermostat, although not for DHW-only heat networks)

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss for each month from Table 3a, 3b or 3c (enter 0 if not a combi boiler)

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

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

285.96	252.81	268.51	241.44	234.28	206.94	198.03	214.27	214.67	242.3	258.26	285.26	2902.74	(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)

285.96	252.81	268.51	241.44	234.28	206.94	198.03	214.27	214.67	242.3	258.26	285.26	2902.74	(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)]

121.61	108.02	115.81	105.95	104.43	94.48	92.37	97.77	97.05	107.09	111.54	121.38	(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

159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	159.3	(66)

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

269.13	297.96	269.13	278.1	269.13	278.1	269.13	269.13	278.1	269.13	278.1	269.13	(67)

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

491.14	496.24	483.39	456.05	421.54	389.1	367.43	362.34	375.18	402.52	437.03	469.47	(68)

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

38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	38.93	(69)

Pumps and fans gains (Table 5a)

3	3	3	3	3	0	0	0	0	3	3	3	(70)

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

-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	-127.44	(71)

Water heating gains (Table 5)

163.45	160.74	155.66	147.15	140.36	131.22	124.16	131.42	134.79	143.94	154.92	163.14	(72)

Total internal gains

997.51	1028.73	981.97	955.1	904.81	869.21	831.51	833.67	858.85	889.38	943.84	975.53	(73)

6. Solar gains

Solar gains in watts, calculated for each month

550.05	930.36	1255.81	1527.78	1685.86	1662.61	1607.53	1491.22	1350.22	1023.59	657.62	471.51	(83)

Total gains – internal and solar (watts)

1547.56	1959.09	2237.77	2482.88	2590.68	2531.82	2439.03	2324.88	2209.08	1912.97	1601.47	1447.04	(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)

1	1	0.99	0.97	0.9	0.74	0.55	0.6	0.84	0.98	1	1	(86)

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

19.98	20.13	20.33	20.6	20.8	20.92	20.94	20.94	20.88	20.6	20.25	19.97	(87)

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

20.11	20.12	20.12	20.14	20.15	20.16	20.16	20.16	20.16	20.15	20.14	20.13	(88)

Roof

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

1	1	0.99	0.96	0.87	0.66	0.45	0.5	0.78	0.98	1	1	(89)

Roof

Mean internal temperature in the rest of dwelling T2

18.89	19.09	19.35	19.71	19.95	20.08	20.1	20.09	20.05	19.72	19.27	18.9	(90)

Living area fraction 0.08 (91)

Mean internal temperature (for the whole dwelling)

18.98	19.18	19.44	19.78	20.02	20.15	20.17	20.17	20.12	19.8	19.35	18.99	(92)

Adjusted mean internal temperature:

18.98	19.18	19.44	19.78	20.02	20.15	20.17	20.17	20.12	19.8	19.35	18.99	(93)

8. Space heating requirement

Utilisation factor for gains,

1	1	0.99	0.96	0.86	0.66	0.45	0.5	0.78	0.97	1	1	(94)

Useful gains, mGm , W

1546.14	1951.96	2211.76	2375.15	2235.93	1663.7	1100.09	1157.76	1716.98	1856.62	1596.81	1446.16	(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

4852.99	4693.1	4226.31	3452.55	2625.34	1719.16	1104.91	1166.44	1864.41	2900.29	3909.66	4777.12	(97)

Space heating requirement for each month

2460.29	1842.04	1498.82	775.73	289.72	0	0	0	0	776.49	1665.25	2478.24	(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

2460.29	1842.04	1498.82	775.73	289.72	0	0	0	0	776.49	1665.25	2478.24	(98c)

Space heating requirement in kWh/m²/year 34.5 (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 %),													249.9	(206)
Efficiency of main space heating system 2 (in %),													0	(207)
Efficiency of secondary/supplementary heating system, %,													65	(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	
984.51	737.11	599.77	310.41	115.94	0	0	0	0	310.72	666.37	991.69			(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					175.1	(216)
Efficiency of water heater														
175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1			(217)
Fuel for water heating														
163.31	144.38	153.35	137.89	133.8	118.18	113.1	122.37	122.6	138.38	147.5	162.91		1657.76	(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													4716.52	(211)
Space heating fuel used, main system 2													0	(213)
Space heating fuel used, secondary													0	(215)
Water heating fuel used													1657.76	(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			724.55	(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													724.55	(231)
Electricity for lighting													480.43	(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			7579.27	

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		777.75	(240a)
Low-rate fraction	0		777.75	(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		777.75	(241a)
Low-rate fraction	0		777.75	(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		777.75	(242a)

Low-rate fraction	0		777.75	(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		273.37	(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		119.48	(249)
Energy For lighting	0		79.22	(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		1249.82	(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)	1.16	(257)
SAP rating	81.13	(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			734.4	(261)
Space heating - main system 2			0	(262)
Space heating - secondary			0	(263)
Energy for water heating			233.61	(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		100.5	(267)
Electricity for lighting		69.34	(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		1137.85	(272)
Dwelling CO2 Emission Rate		3.33	(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			7435.37	(275)
Space heating - main system 2			0	(276)
Space heating - secondary			0	(277)
Energy for water heating			2521.56	(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			1096.1	(281)
Electricity for lighting			736.9	(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			11789.93	(286)
Dwelling PE Rate			34.51	(287)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Tue 07 Feb 2023 11:20:50

Project Information			
Assessed By	Dominic Bibby	Building Type	House, Detached
OCDEA Registration	STRO034470	Assessment Date	2023-02-07

Dwelling Details			
Assessment Type	As designed	Total Floor Area	342 m^2
Site Reference	BA-30	Plot Reference	BA-30
Address	Woodrising, Hillside Road, Bleadon, WESTON-SUPER-MARE, BS24 0AA		

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided, WF10 5QU

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*7.98 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.33 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*42.16 kWh_{PE}/m^2*	
Dwelling primary energy	34.51 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*39.1 kWh/m^2*	
Dwelling fabric energy efficiency	37.4 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.15	Ext wall (0.16)	**OK**
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.16	L Ground floor (0.16)	**OK**
Roofs	*0.16*	0.16	Sloped (0.16)	**OK**
Windows, doors, and roof windows	*1.6*	1.21	1 (1.4)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Ext wall	240.09	0.16
Exposed wall: Stud walls_rafters 0.72	50.31	0.115 **(!)**
Ground floor: L Ground floor	127.7	0.16
Exposed roof: Sloped	101.69	0.16
Exposed roof: Flat	21	0.16
Exposed roof: exp roof flat roof	12.7	0.16
Exposed roof: void_rafters 0.72	16.1	0.115

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.1	North	N/A	1.4
2, Windows (1)	2.8	North	0.7	1.2
3, Windows (1)	31.84	South	0.7	1.2
4, Windows (1)	3.01	East	0.7	1.2
5, Windows (1)	1.04	West	0.7	1.2
6, Roof windows (1)	0	South	0.7	1.2
7, Roof windows (1)	0	East	0.7	1.2
8, Roof windows (1)	0	West	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
			(!)	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	5 m^3/hm^2, Design value	**OK**
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	249.9%
Emitter type	Both radiators and underfloor
Flow temperature	
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: Closed room heater	
Fuel	Dual fuel appliance (mineral and wood)
Efficiency	65.0%
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	200 litres
Declared heat loss	2 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	80 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Centralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.5 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence

N/A

12 Declarations

a. Assessor Declaration

This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration

N/A