Complete Energy Consultancy

Tel: [redacted]
E [redacted]
www.completeenergyconsultancy.co.uk

11/10/24

Complete Energy Consultancy – Complete Building Regulation compliance under one roof.

Sustainability Statement – New dwelling at 11-13 High Street, Westbury on Trym, BS9 3BY

The suite of policy BCS13, 14 and 15 do apply in this case

Policy BCS13 sets out that development should contribute to both mitigating and adapting to climate change, and to meeting targets to reduce carbon dioxide emissions.

Policy BCS14 sets out that development in Bristol should include measures to reduce carbon dioxide emissions from energy use by minimising energy requirements, incorporating renewable energy sources and low-energy carbon sources. Development will be expected to provide sufficient renewable energy generation to reduce carbon dioxide emissions from residual energy use in the buildings by at least 20%.

Policy BCS15 sets out that sustainable design and construction should be integral to new development in Bristol. Consideration of energy efficiency, recycling, flood adaption, material consumption and biodiversity should be included as part of a sustainability or energy statement.

The policy aspiration is to achieve a 20% reduction in C02 emissions.

Sustainable Design and Construction

Waste and recycling

- Suitable provision has been made externally for the storage of refuse and recycling containers.

Materials

- The scheme will show consideration of the need to use materials with a reduced energy input e.g. considering the re-use of existing onsite materials, recycled materials, or through reference to BRE Green Guide. BRE Green Guide A rated materials will be specified wherever possible.

Flexibility and adaptability

- The scheme shows consideration of the need to design buildings which will be adaptable in future in terms of their use and the future incorporation of energy saving technologies.

ICT

- The new residential unit will be provided with a connection for Internet usage.

Reducing Surface Water Runoff

- Soakaways will be utilised wherever ground conditions allow.

Reducing Water Consumption

- The potable water usage will be restricted to 110l per person per day

Sustainable Energy

Solar water heating systems are one of the more familiar renewable technologies used at the moment.
They use the energy from the sun to heat water, most commonly for hot water needs. Solar heating systems use a heat collector that is usually mounted on a roof in which a fluid is heated by the sun. This fluid is used to heat water that is stored in either a

separate hot water cylinder or in a twincoil hot water cylinder (the second coil is used to provide additional heating from a boiler or other heat source). Solar hot water panels could not provide the 20% target.

Wind turbines convert the kinetic energy in wind into mechanical energy that is then converted to electricity. Turbines are available in a range of sizes and designs and can either be free-standing, mounted on a building or integrated into a building structure. For a development in this location only a building mounted turbine could be considered however due to the character, aesthetics and location of the building it would not be feasible. In addition, the windspeed in the area is under the advised minimum.

Biomass Heating Biomass is any plant-derived organic material that renews itself over a short period. Biomass energy systems are based on either the direct or indirect combustion of fuels derived from those plant sources. The most common form of biomass is the direct combustion of wood in treated or untreated forms. The use of biomass is becoming increasingly common in some European countries (some countries such as Austria are heavily dependent on biomass). The environmental benefits relate to the significantly lower amounts of energy used in biomass production and processing compared to the energy released when they are burnt. This can range from a four-fold return for biodiesel to an approximate 20-fold energy return for woody biomass. Biomass-fuels can be used to produce energy on a continuous basis (unlike renewables such as wind or solar energy) and it can be an economic alternative to fossil fuels as it is a potential source of both heat and electricity. However Biomass systems have particular design management and maintenance requirements associated with sourcing, transportation and storage and are therefore more commonly used in commercial developments rather than domestic installations. It can be less convenient to operate than mains-supplied fuels such as natural gas and are more management intensive and require expertise in facilities management. Sources of biomass can also fluctuate, so boilers should be specified to operate on a variety of fuels without risk of overheating or tripping out. A communal biomass system would not be feasible for this development due to use, space and maintenance issues. The system would be quite large and there is very little space around the property to locate the boiler, hopper and fuel store that is suitable for deliveries but also appropriate for feeding the boiler.

A heat pump is a device that takes up heat at a certain temperature and releases it at a higher temperature. The essential components of a heat pump are heat exchangers (through which energy is extracted and emitted) and a means of pumping heat between the exchangers. The effectiveness of the heat pump is measured by the ratio of the heating capacity to the effective power input, usually known as the coefficient of performance (COP).

Ground-source heat pumps (GSHP) extract heat from the ground. They are classified as either water to-air or water-to-water units depending on whether the heat distribution system in the building uses air or water. Ground source heat pumps either use long shallow trenches or deep vertical boreholes to take low grade heat

from the ground and then compress it to create higher temperatures. Ground source heat pumps would not be suitable due to the lack of land space around the property.

Air Source Heat pumps Air source heat pumps absorb heat from the outside air. This is usually used to heat radiators, under floor heating systems, or warm air convectors and hot water in your home. An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside. The system performs down to air temperatures of -20°c which means that they are more than suitable for installations within the UK. Hot water and Heating can be provided 365 days a year. The hot water is produced without the aid of electrical immersions and at 55°c is more than hot enough for baths and showers.

There are two main types of air source heat pump system: An air-to-water system distributes heat via your wet central heating system. Heat pumps work much more efficiently at a lower temperature than a standard boiler system would. So they are more suitable for under-floor heating systems or larger radiators, which give out heat at lower temperatures over longer periods of time. An air-to-air system produces warm air which is circulated by fans to heat your home. They are unlikely to provide you with hot water as well.

An Air Source heat pump would be feasible.

Photovoltaic (PV) modules convert sunlight directly to DC electricity. The solar cells consist of a thin piece of semiconductor material, in most cases of silicon. Through a process called doping, a very small amount of impurities are added to the semiconductor, which creates two different layers called n-type and p-type layers. Certain wavelengths of light are able to ionise the silicon atoms, which separates some of the positive charges (holes) from the negative charges (electrons). The holes move into the positive or p-layer and the electrons into the negative or n-layer. These opposite charges are attracted to each other, but most of them can only re-combine by the electrons passing through an external circuit, due to an internal potential energy barrier. This flow of electrons produces a DC current. PV panels could be mounted to roof slopes but would have an obvious visual impact.

In summary, only PV panels or an air source heat pump are suitable for installation on this site, air source heat pump has been selected.

NO DISTRICT HEAT CONNECTION	**Regulated Energy Demand (MWh/yr)**	**Regulated CO2 emissions (tonnes/yr)**	**CO2 saved (tonnes/yr)**	**% CO2 reduction**
Baseline - Part L TER *See Note 1*		908	-	-
Proposed scheme after energy efficiency measures *See Note 2*		908	0	0
Residual emissions Proposed scheme after energy efficiency measures and CHP (if using)		908	0	0
Proposed scheme after on-site renewables *See Note 4*		613	295	33% **(NOTE: THIS SHOULD BE MIN. 20% TO COMPLY WITH BCS14)** *See Note 5*
Total CO2 reduction beyond Part L TER *See Note 5*			295	33% **(NOTE: THIS SHOULD ALSO BE 20% TO COMPLY WITH BCS14)**

Note 1

The Part L TER figure should be used to calculate the baseline. For dwellings not connecting to an existing heat network, the Part L methodology sets the Notional Building heat source as gas boilers to calculate the TER. For buildings other than dwellings that are not connecting to an existing heat network, the Part L methodology sets the building heat source as the same type proposed in the design to calculate the TER with notional efficiencies.

Note 1a

The TER figure should be used to calculate the baseline. For buildings connecting to a heat network owned by Bristol Heat Networks Ltd. contact BristolBusDev@Vattenfall.com for a copy of 'Bristol Heat Networks Part L 2021 Guidance Note' for advice on how to calculate the TER figure for this step.

For buildings connecting to any other existing network, applicants should contact the Sustainable City team to agree the approach (sustainable.city@bristol.gov.uk).

For buildings connecting to a new heat network, the Part L methodology sets the Notional Building heat source as gas boilers to calculate the TER for dwellings, and as a heat network with notional carbon factor and primary energy factor for buildings other than dwellings.

Note 2

This is based on the Actual Building, including the proposed energy efficiency measures. It's understood that in some cases it may not be feasible for CO_2 emissions to meet or be lower than the Part L TER at this stage due to PV being included in the TER calculation. Energy efficiency measures will also be assessed through comparison of proposed measures to those set in the Notional Building specification and the information provided in the detailed energy tables.

See Note 5 below.

Note 3

Y = Proportion of heat network supplied heat classed as renewables. For buildings connecting to a heat network owned by Bristol Heat Networks Ltd. contact BristolBusDev@Vattenfall.com for a copy of 'Bristol Heat Networks Part L 2021 Guidance Note' for figures to enter into the calculations.

Note 3a

This is based on the Actual Building with a heat network as the heat source i.e. emissions after connecting to the network, including both renewable and non- renewable parts of the network. For buildings connecting to a heat network owned by Bristol Heat Networks Ltd. contact BristolBusDev@Vattenfall.com for a copy of 'Bristol Heat Networks Part L 2021 Guidance Note', for figures to enter into the calculations.

Note 4

This is based on the Actual Building for the proposed design, including all low carbon and renewable energy generation.

Note 5

In some cases where it can be demonstrated that it is not feasible for the 'residual emissions' to be lower than the TER, for the purpose of assessing compliance with BCS14, the 20% calculation will be assessed against the Part L TER.

Detailed energy tables

The following tables should be completed based on energy information in the SAP Worksheets and BRUKL documents.

- **Residential energy efficiency table**

The following table will be used to assess the energy efficiency of residential development.

The Notional Building TER without PV can be calculated using the 'Energy Saving/generation technologies' figure provided in the Building Regulations England Part L Compliance Report[6].

Notional Building TER without PV ($kg/CO_2/m^2$)	Emissions for the proposed building with energy efficiency alone ($kg/CO_2/m^2$)
908	908
U-values and air permeability must be provided in table 4.2.3 below	

Energy efficiency measures

Provide a summary table of U values taken from the SAP /SBEM calculations:

	Part L Values (2021 - or most current)				
Element or System	**Dwellings Limiting**	**Dwellings Notional**	**Non Dwellings Limiting**	**Non Dwellings Notional**	**Proposed**
Wall	0.26	0.18	0.26	0.18	0.18
Roof	0.16	0.11	0.18	0.15	0.13
Floor	0.18	0.13	0.18	0.15	0.18
Windows	1.6	1.2	1.6	1.4	1.4
Doors	1.6	1.0	1.6	1.6	1.4
Rooflights	2.2	1.7	2.2	2.1	1.4
Air permeability	8	5	8	3	15

- **On-site renewables**

Set out what renewable energy sources have been incorporated into the proposed development and the resulting estimated annual yield (kWh).

This can include emission savings from the use of renewable fuels to power CHP.

Renewable electricity – enter the total installed capacity (kW)	0
Renewable electricity – enter the estimated annual yield (kWh) from renewable measures generating electricity (where available apply recognised standard methodologies such as the Microgeneration Certification Scheme (MCS) methodology for Solar PV)	0
Renewable heat – enter the total installed capacity (kW)	6 kW
Renewable heat – enter the estimated annual yield (kWh) from renewable measures generating heat	3770 kWh

Report compiled by:

Mr. Richard Britton BSc (Hons)

SAP 10 WORKSHEET (Version 10.2, December 2021)
CALCULATION OF TARGET EMISSIONS

Date 11/10/2024

Complete Energy Consultancy Ltd
The Exchange
Brickrow
Stroud
Tel: 07771 964593

Property			
UPRN	UPRN-0000000000	Project Type	New dwelling created by change of use
Address	11-13 High Street, Westbury on Trym, BS9 3BY	Dwelling Type	Semi-detached house

1 Overall dwelling dimensions				
Ground floor	48.0000	0.0000	0.0000	(1b) - (3b)
First floor	70.4100	2.7800	195.7398	(1c) - (3c)
Second floor	40.1100	2.7000	108.2970	(1c) - (3c)
Total floor area			158.5200	(4)
Dwelling volume (mÂ³)			304.0368	(5)

2 Ventilation rate		
Number of chimneys	0	(6a)
Number of open flues	0	(6b)
Number of chimneys\/flues to closed fires	0	(6c)
Number of flues to solid fuel boilers	0	(6d)
Number of flues attached to other heaters	0	(6d)
Number of blocked chimneys	0	(6f)
Number of intermittent fans	40	(7a)
Number of passive vents	0	(7b)
Number of flueless gas fires	0	(7c)
Infiltration due to chimneys, flues and fans	0.1316	(8)
q50 measured in this dwelling	5.0000	(17)
Infiltration rate	0.3816	(18)
Number of sides sheltered	2	(19)
Shelter factor	0.8500	(20)
Infiltration rate incorporating shelter factor	0.3243	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4135	0.4054	0.3973	0.3568	0.3487	0.3081	0.3081	0.3000	0.3243	0.3487	0.3649	0.3811	(22b)
Effective ach	0.5855	0.5822	0.5789	0.5636	0.5608	0.5475	0.5475	0.5450	0.5526	0.5608	0.5666	0.5726	(25)

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

Calculated by Argyle Calculation Engine (ACE) using JPA Designer 10 2.0 | SAP Engine version v10.2.2.0

SAP 10 WORKSHEET (Version 10.2, December 2021)
CALCULATION OF TARGET EMISSIONS

Date 11/10/2024

Complete Energy Consultancy Ltd

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Brickrow
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3. Heat losses and heat loss parameter

	Net area (m^2)	U-value (W/m^2K)	A x U (W/K)	K Value kJ/m^2K	A x K (kJ/K)	
Windows (1)			4.5600	1.1450	5.2214	(27)
groundFloor	48.0000	0.1300	6.2400	110.0000	5280.0000	(28a)
exposeWall	3.4400	0.1800	16.8192	60.0000	5606.4000	(29a)
exposedRoof	24.0000	0.1100	2.6400	9.0000	216.0000	(30)
exposedRoof	44.0000	0.1100	4.8400	9.0000	396.0000	(30)
Total area of external elements:					214.0000	(31)
partyWall			37.0000	70.0000	2590.0000	(32)
Fabric heat loss:					35.7606	(33)
Heat capacity:					14088.4000	(34)
Thermal mass parameter:					250.0000	(35)
Thermal bridges:					10.7000	(36)
Total fabric heat loss :					46.4606	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Vent loss	58.7444	58.4113	58.0848	56.5511	56.2642	54.9285	54.9285	54.6811	55.4430	56.2642	56.8447	57.4515	(38)
Heat transfer coeff	105.2049	104.8718	104.5453	103.0117	102.7248	101.3891	101.3891	101.1417	101.9036	102.7248	103.3052	103.9121	(39)
Heat transfer coeff (average)												103.0103	(39)
HLP	0.6637	0.6616	0.6595	0.6498	0.6480	0.6396	0.6396	0.6380	0.6428	0.6480	0.6517	0.6555	(40)
HLP (average)												0.6498	(40)
Days in month	31.0000	28.0000	31.0000	30.0000	31.0000	30.0000	31.0000	31.0000	30.0000	31.0000	30.0000	31.0000	(41)
Heat losses and heat loss parameter												complete	

4. Water heating energy requirements

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy												2.9468	(42)
Average daily hot water use (litres\/day)												127.9611	(43)
Mixer shower usage	94.6089	93.1871	91.1152	87.1512	84.2258	80.9635	79.1091	81.1653	83.4192	86.9220	90.9712	94.2464	(42a)
Bath usage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Other usage	44.8083	43.1790	41.5496	39.9202	38.2908	36.6614	36.6614	38.2908	39.9202	41.5496	43.1790	44.8083	(42c)

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Daily hot water use	139.4172	136.3660	132.6648	127.0714	122.5166	117.6248	115.7705	119.4560	123.3394	128.4715	134.1501	139.0547	(44)
Energy content	220.8028	194.1834	203.9009	173.9543	164.9309	144.6335	140.0144	147.9115	152.0898	174.3346	191.1214	217.7261	(45)
Energy content(annual)												2125.6035	(45)
Distribution loss	33.1204	29.1275	30.5851	26.0931	24.7396	21.6950	21.0022	22.1867	22.8135	26.1502	28.6682	32.6589	(46)
Cylinder volume												210.0000	(47)
Measured cylinder loss (kWh\/day)												1.7016	(48)
Temperature factor												0.5400	(49)
Energy lost from water storage (kWh\/day)												0.9188	(50)
Energy lost from cylinder in kWh\/day												0.9188	(55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
Net storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total	272.5494	240.9223	255.6474	224.0317	216.6775	194.7108	191.7610	199.6581	202.1671	226.0812	241.1988	269.4727	(62)
WWHRS Saving	-43.2512	-38.2517	-40.0550	-33.1671	-30.9106	-26.4504	-24.7930	-26.3649	-27.3666	-32.2622	-36.5492	-42.4503	(63a)
PV Diverter Saving	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS Saving	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
WW heat rec.	-43.2512	-38.2517	-40.0550	-33.1671	-30.9106	-26.4504	-24.7930	-26.3649	-27.3666	-32.2622	-36.5492	-42.4503	(63)
Flue gas heat rec.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(G6)
Fghrs PV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Output from w\/h	229.2981	202.6705	215.5924	190.8645	185.7669	168.2604	166.9680	173.2932	174.8005	193.8190	204.6496	227.0224	(64)
Output from water heater(annual)												2333.0057	(64)
Instantaneous electric showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains (kWh)	114.8142	101.9571	109.1943	97.9017	96.2368	88.1525	87.9521	90.5779	90.6317	99.3635	103.6098	113.7912	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	(66)
Lighting	228.7833	253.2958	228.7833	236.4095	228.7833	236.4095	228.7833	228.7833	236.4095	228.7833	236.4095	228.7833	(67)
Appliances	329.6462	333.0669	324.4469	306.0958	282.9309	261.1592	246.6143	243.1936	251.8137	270.1647	293.3296	315.1014	(68)
Cooking	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	(69)

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Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	(71)
Water heating	154.3202	151.7218	146.7665	135.9746	129.3505	122.4340	118.2151	121.7444	125.8774	133.5531	143.9024	152.9452	(72)
Total internal	782.9520	808.2869	770.1990	748.6821	711.2670	687.2049	660.8150	660.9236	681.3028	702.7035	743.8438	767.0321	(73)

6. Solar gains

Windows (1)										4.5600	1.1450	5.2214	(27)
groundFloor							48.0000	0.1300	6.2400	110.0000	5280.0000		(28a)
exposeWall							3.4400	0.1800	16.8192	60.0000	5606.4000		(29a)
exposedRoof							24.0000	0.1100	2.6400	9.0000	216.0000		(30)
exposedRoof							44.0000	0.1100	4.8400	9.0000	396.0000		(30)
Total area of external elements:											214.0000		(31)
partyWall									37.0000	70.0000	2590.0000		(32)
Fabric heat loss:											35.7606		(33)
Heat capacity:											14088.4000		(34)
Thermal mass parameter:											250.0000		(35)
Thermal bridges:											10.7000		(36)
Total fabric heat loss :											46.4606		(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	15.7239	32.0064	57.6653	94.7030	127.2994	135.7146	126.9582	101.2126	70.2660	39.1143	19.7847	12.8409	(83)
Total gains	798.6758	840.2932	827.8643	843.3851	838.5664	822.9195	787.7732	762.1362	751.5688	741.8178	763.6284	779.8730	(84)

7. Mean internal temperature

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Living room temperature during heating periods Th1											21.0000	(85)
Heating system responsiveness											1.0000	
tau	104.6370	104.9694	105.2972	106.8649	107.1634	108.5752	108.5752	108.8407	108.0270	107.1634	106.5612	105.9389	
alpha	7.9758	7.9980	8.0198	8.1243	8.1442	8.2383	8.2383	8.2560	8.2018	8.1442	8.1041	8.0626	
external Temp	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
util living area	0.9990	0.9981	0.9964	0.9861	0.9393	0.7620	0.5640	0.6064	0.8594	0.9838	0.9972	0.9992	(86)
MIT 1	20.2884	20.3693	20.4869	20.6914	20.8752	20.9837	20.9987	20.9977	20.9573	20.7480	20.4984	20.2817	(87)
th2	20.3730	20.3749	20.3767	20.3854	20.3870	20.3945	20.3945	20.3959	20.3916	20.3870	20.3837	20.3803	(88)

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util rest	0.9987	0.9975	0.9952	0.9808	0.9162	0.7006	0.4877	0.5290	0.8088	0.9765	0.9961	0.9989	(89)
MIT 2	19.5225	19.6275	19.7794	20.0455	20.2685	20.3840	20.3940	20.3949	20.3598	20.1186	19.8000	19.5198	(90)
Living area fraction =												0.2221	(91)
MIT	19.6926	19.7923	19.9366	20.1890	20.4033	20.5172	20.5283	20.5288	20.4925	20.2584	19.9551	19.6891	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6926	19.7923	19.9366	20.1890	20.4033	20.5172	20.5283	20.5288	20.4925	20.2584	19.9551	19.6891	(93)

8. Space heated requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9967	0.9940	0.9787	0.9169	0.7136	0.5047	0.5462	0.8179	0.9746	0.9952	0.9985	(94)
Useful gains W	797.2318	837.5534	822.9266	825.3835	768.9054	587.2242	397.5696	416.2743	614.7099	722.9687	759.9427	778.7041	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1619.3800	1561.7792	1404.7298	1162.8964	894.0399	599.9417	398.2855	417.5941	651.4175	992.1586	1328.0037	1609.5004	(97)
Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating requirement for	611.6783	486.6797	432.8615	243.0093	93.1001	0.0000	0.0000	0.0000	0.0000	200.2773	409.0039	618.1125	(98a)
Solar space heating contribution	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Total space heating requirement	611.6783	486.6797	432.8615	243.0093	93.1001	0.0000	0.0000	0.0000	0.0000	200.2773	409.0039	618.1125	(98)
Space heating per m2												19.5226	(99)

9. Energy requirements

Fraction of space heat from secondary	0.0000	(201)
Fraction of space heat from main system	1.0000	(202)
Fraction of total space heat from main system 1	1.0000	(204)
Efficiency of main heating system 1	92.3000	(206)
Efficiency of water heater	79.8000	(216)
micro-CHP export	0.0000	(235d)
Space heating fuel - main system 1	3352.8956	(211)
Water heating fuel	2793.5576	(219)

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central heating pump	41.0000	(230c)
boiler flue fan	45.0000	(230e)
Electricity for pumps and fans	86.0000	(231)
Electricity for lighting	383.6481	(232)
PV generation	-3480.1907	(233)
Micro-CHP generation	0.0000	(235)
Total delivered energy for all uses	3135.9106	(238)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating efficiency (main heating system)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	662.7067	527.2803	468.9724	263.2820	100.8669	0.0000	0.0000	0.0000	0.0000	216.9852	443.1245	669.6777	(211)
Water heating requirement	229.2981	202.6705	215.5924	190.8645	185.7669	168.2604	166.9680	173.2932	174.8005	193.8190	204.6496	227.0224	(64)
Water heating efficiency	86.1508	85.9501	85.5906	84.6026	82.5947	79.8000	79.8000	79.8000	79.8000	84.1334	85.5811	86.1888	(217)
Water heating fuel detail	266.1591	235.8003	251.8879	225.6014	224.9138	210.8526	209.2330	217.1594	219.0483	230.3711	239.1294	263.4012	(219)
Space cooling fuel total	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
PV Generation in dwelling	63.1866	87.6438	123.8147	136.5658	144.8738	134.2213	132.5478	126.3917	115.0390	99.0842	68.9618	54.7975	(233a)
Wind Generation in dwelling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Hydro Generation in dwelling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
micro-CHP in dwelling	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(235c)
PV Generation export	39.9075	83.5261	165.3163	247.3116	326.1230	327.4804	323.6307	274.3666	201.5655	119.0936	53.1542	31.5871	(233b)
Wind Generation export	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Hydro Generation export	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

12. Carbon dioxide emmissions

Space heating - main system	3352.8956	0.2100	704.1081	(261)
Water heating	2793.5576	0.2100	586.6471	(264)
Space and water heating			1290.7552	(265)
Pumps and fans	86.0000	0.1388	11.9293	(267)
Energy for lighting	0.0000	0.1360	55.3723	(268)
Electricity generated - PVs	-3480.1907	1.6660	-450.0956	(269)
Electricity generated - wind	-0.0000	1.6660	-0.0000	(269)

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Electricity generated - hydro	-0.0000	1.6660	-0.0000	(269)
Electricity generated - mCHP	-0.0000	1.6660	-0.0000	(269)
Total kg\/year			907.9611	(272)

13. Primary energy				
Space heating - main system	3352.8956	13.5600	3788.7720	(275)
Water heating	2793.5576	13.5600	3156.7200	(278)
Space and water heating			6945.4921	(279)
Pumps and fans	86.0000	1.5133	130.1008	(281)
Energy for lighting	383.6481	1.5133	588.4522	(282)
Electricity generated - PVs	-3480.1907	18.1590	-2943.6965	(283)
Electricity generated - wind	-0.0000	18.1590	-0.0000	(283)
Electricity generated - hydro	-0.0000	18.1590	-0.0000	(283)
Electricity generated - mCHP	-0.0000	18.1590	-0.0000	(283)
Total kg\/year			4720.3486	(286)
EI value			94.0219	
Target Carbon Dioxide EmissionRate(TER)			5.73	(273)
Target Primary Energy Rate (TPER)			29.78	(287)

SAP 10 WORKSHEET (Version 10.2, December 2021)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

Date 11/10/2024

Complete Energy Consultancy Ltd
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Stroud
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Property			
UPRN	UPRN-0000000000	Project Type	New dwelling created by change of use
Address	11-13 High Street, Westbury on Trym, BS9 3BY	Dwelling Type	Semi-detached house

1 Overall dwelling dimensions				
Ground floor	48.0000	0.0000	0.0000	(1b) - (3b)
First floor	70.4100	2.7800	195.7398	(1c) - (3c)
Second floor	40.1100	2.7000	108.2970	(1c) - (3c)
Total floor area			158.5200	(4)
Dwelling volume (mÂ³)			304.0368	(5)

2 Ventilation rate		
Number of chimneys	0	(6a)
Number of open flues	0	(6b)
Number of chimneys\/flues to closed fires	0	(6c)
Number of flues to solid fuel boilers	0	(6d)
Number of flues attached to other heaters	0	(6d)
Number of blocked chimneys	0	(6f)
Number of intermittent fans	60	(7a)
Number of passive vents	0	(7b)
Number of flueless gas fires	0	(7c)
Infiltration due to chimneys, flues and fans	0.1973	(8)
q50 measured in this dwelling	15.0000	(17)
Infiltration rate	0.9473	(18)
Number of sides sheltered	2	(19)
Shelter factor	0.8500	(20)
Infiltration rate incorporating shelter factor	0.8052	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	1.0267	1.0066	0.9864	0.8858	0.8656	0.7650	0.7650	0.7448	0.8052	0.8656	0.9059	0.9462	(22b)
Effective ach	1.0267	1.0066	0.9865	0.8923	0.8747	0.7926	0.7926	0.7774	0.8242	0.8747	0.9103	0.9476	(25)

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3. Heat losses and heat loss parameter

	Net area (m^2)	U-value (W/m^2K)	A x U (W/K)	K Value kJ/m^2K	A x K (kJ/K)	
Windows (1)			4.5600	1.3258	6.0455	(27)
groundFloor	48.0000	0.1800	8.6400	110.0000	5280.0000	(28a)
exposeWall	3.4400	0.1800	16.8192	60.0000	5606.4000	(29a)
exposedRoof	24.0000	0.1500	3.6000	9.0000	216.0000	(30)
exposedRoof	44.0000	0.1300	5.7200	9.0000	396.0000	(30)
Total area of external elements:					214.0000	(31)
partyWall			37.0000	70.0000	2590.0000	(32)
Fabric heat loss:					40.8247	(33)
Heat capacity:					14088.4000	(34)
Thermal mass parameter:					250.0000	(35)
Thermal bridges:					42.8000	(36)
Total fabric heat loss :					83.6247	(37)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Vent loss	103.0095	100.9897	98.9791	89.5255	87.7568	79.5230	79.5230	77.9983	82.6946	87.7568	91.3349	95.0757 (38)
Heat transfer coeff	186.6341	184.6143	182.6038	173.1502	171.3815	163.1477	163.1477	161.6229	166.3192	171.3815	174.9596	178.7004 (39)
Heat transfer coeff (average)												173.1386 (39)
HLP	1.1774	1.1646	1.1519	1.0923	1.0811	1.0292	1.0292	1.0196	1.0492	1.0811	1.1037	1.1273 (40)
HLP (average)												1.0922 (40)
Days in month	31.0000	28.0000	31.0000	30.0000	31.0000	30.0000	31.0000	31.0000	30.0000	31.0000	30.0000	31.0000 (41)
heat pump calculation Output power												5390.0000
Design heat loss												4189.9533
Plant size ratio												1.2864
Service provision						space	and	water	heating	all	year	
DHW vessel										separate	specified	
Heating duration											variable	
Secondary fraction											0.0000	
Space heating thermal efficiency											345.8422	
Summer thermal efficiency											186.4615	

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Net space heating specific electricity generated	0.0000
Net water heating specific electricity generated	0.0000
Net annual electricity generated	0.0000
Heat losses and heat loss parameter	complete

4. Water heating energy requirements

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Assumed occupancy												2.9468	(42)
Average daily hot water use (litres\/day)												127.9611	(43)
Mixer shower usage	94.6089	93.1871	91.1152	87.1512	84.2258	80.9635	79.1091	81.1653	83.4192	86.9220	90.9712	94.2464	(42a)
Bath usage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Other usage	44.8083	43.1790	41.5496	39.9202	38.2908	36.6614	36.6614	38.2908	39.9202	41.5496	43.1790	44.8083	(42c)
Daily hot water use	139.4172	136.3660	132.6648	127.0714	122.5166	117.6248	115.7705	119.4560	123.3394	128.4715	134.1501	139.0547	(44)
Energy content	220.8028	194.1834	203.9009	173.9543	164.9309	144.6335	140.0144	147.9115	152.0898	174.3346	191.1214	217.7261	(45)
Energy content(annual)												2125.6035	(45)
Distribution loss	33.1204	29.1275	30.5851	26.0931	24.7396	21.6950	21.0022	22.1867	22.8135	26.1502	28.6682	32.6589	(46)
Cylinder volume												210.0000	(47)
Measured cylinder loss (kWh\/day)												1.8600	(48)
Temperature factor												0.5400	(49)
Energy lost from water storage (kWh\/day)												1.0044	(50)
Energy lost from cylinder in kWh\/day												1.0044	(55)
Total storage loss	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
Net storage loss	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total	275.2016	243.3178	258.2997	226.5983	219.3297	197.2775	194.4132	202.3103	204.7338	228.7334	243.7654	272.1249	(62)
WWHRS Saving	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV Diverter Saving	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS Saving	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
WW heat rec.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Flue gas heat rec.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(G6)

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Fghrs PV	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Output from w\/h	275.2016	243.3178	258.2997	226.5983	219.3297	197.2775	194.4132	202.3103	204.7338	228.7334	243.7654	272.1249	(64)
Output from water heater(annual)												2766.1055	(64)
Instantaneous electric showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains (kWh)	116.9360	103.8735	111.3161	99.9550	98.3586	90.2058	90.0738	92.6996	92.6850	101.4853	105.6631	115.9130	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	147.3408	(66)
Lighting	228.7833	253.2958	228.7833	236.4095	228.7833	236.4095	228.7833	228.7833	236.4095	228.7833	236.4095	228.7833	(67)
Appliances	329.6462	333.0669	324.4469	306.0958	282.9309	261.1592	246.6143	243.1936	251.8137	270.1647	293.3296	315.1014	(68)
Cooking	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	37.7341	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	-117.8726	(71)
Water heating	157.1720	154.5737	149.6184	138.8264	132.2024	125.2859	121.0670	124.5963	128.7292	136.4050	146.7543	155.7970	(72)
Total internal	782.8038	808.1387	770.0509	748.5339	711.1189	690.0567	663.6669	663.7755	684.1546	702.5553	743.6956	766.8840	(73)

6. Solar gains

Windows (1)										4.5600	1.3258	6.0455	(27)
groundFloor							48.0000	0.1800	8.6400	110.0000	5280.0000		(28a)
exposeWall							3.4400	0.1800	16.8192	60.0000	5606.4000		(29a)
exposedRoof							24.0000	0.1500	3.6000	9.0000	216.0000		(30)
exposedRoof							44.0000	0.1300	5.7200	9.0000	396.0000		(30)
Total area of external elements:												214.0000	(31)
partyWall									37.0000	70.0000	2590.0000		(32)
Fabric heat loss:												40.8247	(33)
Heat capacity:												14088.4000	(34)
Thermal mass parameter:												250.0000	(35)
Thermal bridges:												42.8000	(36)
Total fabric heat loss :												83.6247	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	15.7239	32.0064	57.6653	94.7030	127.2994	135.7146	126.9582	101.2126	70.2660	39.1143	19.7847	12.8409	(83)

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Total gains	798.5277	840.1450	827.7161	843.2369	838.4182	825.7713	790.6251	764.9880	754.4206	741.6696	763.4803	779.7248	(84)

7. Mean internal temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Living room temperature during heating periods Th1												21.0000	(85)
Heating system responsiveness												0.7500	
tau	58.9835	59.6288	60.2854	63.5768	64.2329	67.4747	67.4747	68.1112	66.1880	64.2329	62.9193	61.6022	
alpha	4.9322	4.9753	5.0190	5.2385	5.2822	5.4983	5.4983	5.5407	5.4125	5.2822	5.1946	5.1068	
external Temp	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
util living area	0.9991	0.9987	0.9980	0.9949	0.9838	0.9264	0.8025	0.8348	0.9620	0.9943	0.9983	0.9992	(86)
MIT 1	20.3692	19.8587	20.0147	20.2970	20.5463	20.7988	20.9004	20.8895	20.7248	20.4046	20.0863	19.9740	(87)
th2	19.9382	19.9484	19.9586	20.0071	20.0163	20.0591	20.0591	20.0671	20.0425	20.0163	19.9978	19.9786	(88)
util rest	0.9988	0.9982	0.9972	0.9925	0.9741	0.8762	0.6778	0.7225	0.9333	0.9910	0.9976	0.9990	(89)
MIT 2	19.3585	18.6096	18.8176	19.2167	19.5399	19.8755	19.9677	19.9686	19.7806	19.3618	18.9401	18.8215	(90)
Living area fraction =												0.2221	(91)
MIT	19.5830	18.8871	19.0835	19.4567	19.7634	20.0806	20.1749	20.1731	19.9903	19.5934	19.1947	19.0775	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5830	18.8871	19.0835	19.4567	19.7634	20.0806	20.1749	20.1731	19.9903	19.5934	19.1947	19.0775	(93)

8. Space heated requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9986	0.9975	0.9962	0.9906	0.9707	0.8777	0.6955	0.7376	0.9312	0.9890	0.9968	0.9987	(94)
Useful gains W	797.4492	838.0177	824.5592	835.2816	813.8117	724.7607	549.8989	564.2531	702.5297	733.5117	761.0290	778.6754	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2852.3210	2582.2113	2297.7892	1827.8889	1381.9242	894.1476	583.2358	609.8235	979.6717	1541.3078	2116.0780	2658.6105	(97)
Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating requirement for	1528.8246	1172.0981	1096.0831	714.6773	422.6757	0.0000	0.0000	0.0000	0.0000	601.0003	975.6353	1398.6717	(98a)
Solar space heating contribution	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Total space heating requirement	1528.8246	1172.0981	1096.0831	714.6773	422.6757	0.0000	0.0000	0.0000	0.0000	601.0003	975.6353	1398.6717	(98)
Space heating per m2												49.8970	(99)

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The Exchange
Brickrow
Stroud
Tel: 07771 964593

9. Energy requirements													
Fraction of space heat from secondary												0.0000	(201)
Fraction of space heat from main system												1.0000	(202)
Fraction of total space heat from main system 1												1.0000	(204)
Efficiency of main heating system 1												345.8422	(206)
Efficiency of secondary heating system												100.0000	(208)
Efficiency of water heater												186.4615	(216)
micro-CHP export												0.0000	(235d)
Space heating fuel - main system 1												2287.0738	(211)
Water heating fuel												1483.4728	(219)
Electricity for pumps and fans												0.0000	(231)
Electricity for lighting												356.9867	(232)
PV generation												-0.0000	(233)
Micro-CHP generation												0.0000	(235)
Total delivered energy for all uses												4127.5334	(238)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating efficiency (main heating system)	345.8422	345.8422	345.8422	345.8422	345.8422	0.0000	0.0000	0.0000	0.0000	345.8422	345.8422	345.8422	(210)
Space heating fuel (main heating system)	442.0585	338.9113	316.9316	206.6484	122.2163	0.0000	0.0000	0.0000	0.0000	173.7788	282.1042	404.4248	(211)
Water heating requirement	275.2016	243.3178	258.2997	226.5983	219.3297	197.2775	194.4132	202.3103	204.7338	228.7334	243.7654	272.1249	(64)
Water heating efficiency	186.4615	186.4615	186.4615	186.4615	186.4615	186.4615	186.4615	186.4615	186.4615	186.4615	186.4615	186.4615	(217)
Water heating fuel detail	147.5916	130.4923	138.5271	121.5255	117.6273	105.8006	104.2645	108.4998	109.7995	122.6706	130.7323	145.9416	(219)
Space cooling fuel total	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
PV Generation in dwelling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Wind Generation in dwelling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Hydro Generation in dwelling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)

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micro-CHP in dwelling	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(235c)
PV Generation export	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Wind Generation export	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Hydro Generation export	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)

12. Carbon dioxide emmissions				
Space heating - main system	2287.0738	0.1360	352.6080	(261)
Water heating	1483.4728	0.1360	209.0650	(264)
Space and water heating			561.6731	(265)
Energy for lighting	0.0000	0.1360	51.5242	(268)
Electricity generated - PVs	-0.0000	1.6660	-0.0000	(269)
Electricity generated - wind	-0.0000	1.6660	-0.0000	(269)
Electricity generated - hydro	-0.0000	1.6660	-0.0000	(269)
Electricity generated - mCHP	-0.0000	1.6660	-0.0000	(269)
Total kg\/year			613.1973	(272)

13. Primary energy				
Space heating - main system	2287.0738	18.1590	3592.4988	(275)
Water heating	1483.4728	18.1590	2256.5216	(278)
Space and water heating			5849.0204	(279)
Pumps and fans	0.0000	1.5133	0.0000	(281)
Energy for lighting	356.9867	1.5133	547.5582	(282)
Electricity generated - PVs	-0.0000	18.1590	-0.0000	(283)
Electricity generated - wind	-0.0000	18.1590	-0.0000	(283)
Electricity generated - hydro	-0.0000	18.1590	-0.0000	(283)
Electricity generated - mCHP	-0.0000	18.1590	-0.0000	(283)
Total kg\/year			6396.5786	(286)
EI value			95.9626	
Dwelling Carbon Dioxide Emission Rate (DER)			3.87	(273)\/(384)
Dwelling Primary Energy Rate (DPER)			40.35	(287)\/(484)

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