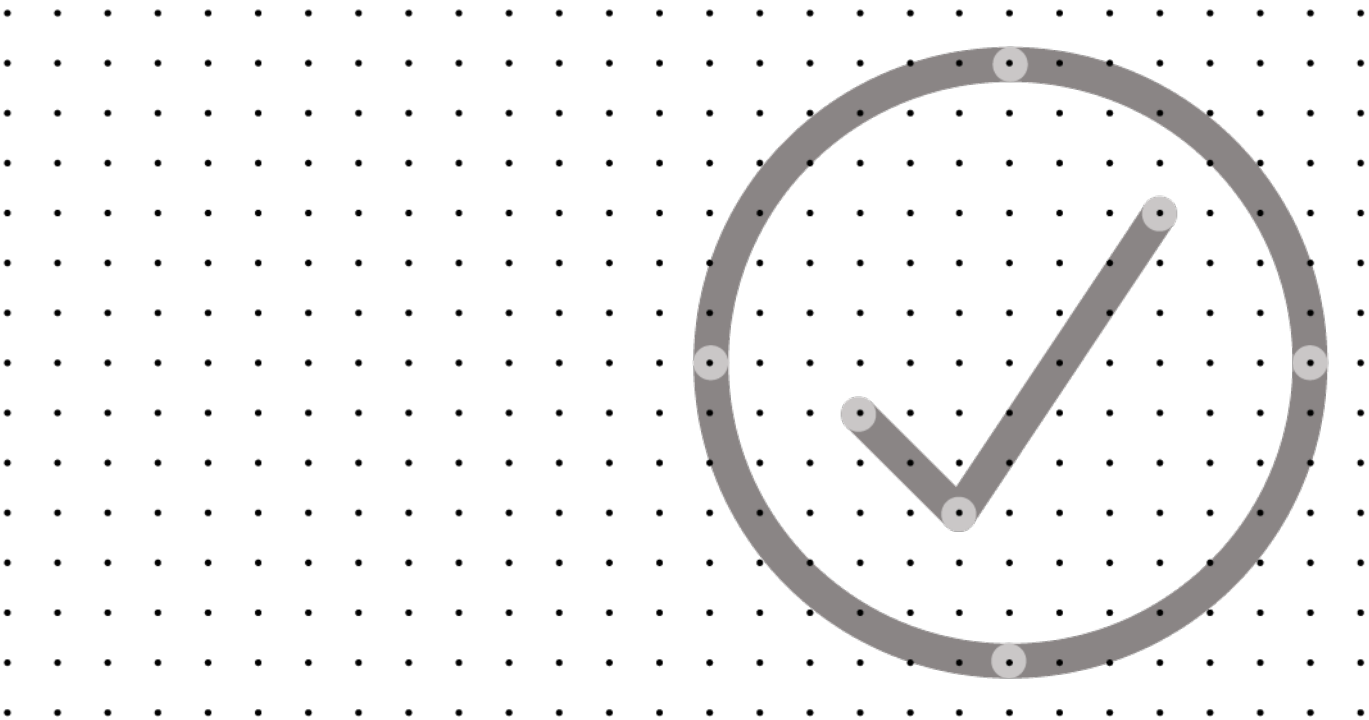




MCS 2025

Biomass: Pre-Sale Information and System Performance Estimate Standard

To be used in conjunction with the MCS Customer Commitment



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ABOUT MCS

MCS: Giving everyone confidence in home-grown energy

With energy costs constantly rising and climate change affecting us all – low-carbon technology has a bigger and bigger role to play in the future of UK energy. MCS is here to ensure it’s a positive one.

MCS is the UK’s quality mark for small-scale renewable energy technologies like solar PV, solar heating, heat pumps, biomass, and battery storage. We have two main roles – setting and maintaining standards, and providing consumer protection.

Our Standards define how certified renewable energy installations should be designed and installed using MCS certified products. They are a benchmark for quality developed in close consultation with industry through independent technical working groups.

The Standards are owned by The MCS Foundation (a charitable trust), but maintained and developed by MCS.

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CHANGES TO STANDARDS

When MCS Standards are revised, the issue number is also revised to indicate the nature of the changes. This can either be a whole new issue or an amendment to the current issue. Details will be posted online, www.mcscertified.com

Technical or other significant changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments.

The issue number is given on the left of the decimal point, and the amendment number on the right. For example, issue 3.2 indicates that it is the third significant version of the document which has had two sets of minor amendments.

Users of this Standard should ensure that they are using the latest issue.

Amendments issued since publication

Issue No.	Amendment details	Date
1.0	First publication for MCS:2025 1.0	01/01/2025

FOREWORD

Compliance with this Standard is mandatory for MCS Contractors certified to MCS: 2025.

The purpose of this Standard is to specify best practice in achieving high-quality low carbon technology installations. Whilst it is not possible to ensure safety, this Standard provides requirements which should help mitigate potential safety risks associated with the design and installation of this technology.

This document contains references to other documents which may be either normative or informative. At the time of publication any editions of those documents, where indicated, were valid. However, as all documents are subject to revision, any users of this document should apply the most recent editions of those referenced documents (unless a dated version is specified).

NOTE:

This MCS Standard makes use of the terms 'must', 'shall' and 'should' when prescribing certain requirements and procedures. In the context of this document:

- the term 'must' identifies a requirement by law at the time of publication;
- the term 'shall' prescribes a requirement or procedure that is intended to be complied with in full and without deviation;
- the term 'should' prescribes a requirement or procedure that is intended to be complied with unless reasonable justification can be given.

Compliance with this MCS Standard does not in itself confer immunity from legal obligations.

1 SCOPE

This Standard describes the methods for calculating the amount of estimated renewable energy which might be delivered by a Biomass system during a typical year to deliver the annual heating demand. This document is to be used in conjunction with the MCS Customer Care Commitment. The format in which this shall be presented to the customer is also given along with the technical information to accompany the estimate.

Performance estimates enable customers to compare different systems. The use of this MCS standard for performance estimates brings a comparable and consistent methodology for different solar heating configurations.

The estimates are based on the best knowledge of MCS of Biomass Heating applications.

This Standard and its associated requirements shall be complied with before a contract is awarded to the customer.

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2 METHOD

2.1 Site evaluation

Obtain:

- (a) The building space heating demand (kWh/year); and
- (b) The hot water demand (kWh/year).
- (c) Combine (a) and (b) to give the total heat to be supplied in kWh/year.
- (d) Where the biomass boiler is not intended to provide 100% of either the space heating and/or DHW, deduct the percentage of heat to be supplied by the other source(s) to leave heat to be supplied only by the Biomass Heating System (**BHS**) in kWh/year.

Using:

- A valid Energy Performance Certificate (EPC); or
- Where the building is being newly built or renovated, a Standard Assessment Procedure (SAP 2012) calculation; or
- Where it is not possible to obtain a valid EPC (or SAP assessment) an estimate of the annual space heating and hot water demands shall be made using a suitable method for the type of building. Such a method shall be clearly described and justified.

Notes:

A valid EPC is one which has not expired and where the given annual heat demand is not expected to change such as by, for example, an extension or refurbishment of the building, and where the BHS is intended to supply that changed heat demand. Where no valid EPC exists on the public register, but it is possible to obtain one through a Domestic Energy Assessment, then an EPC should be obtained and lodged.

EPCs for properties in England, Wales and Northern Ireland can be found at <https://www.gov.uk/find-energy-certificate>

EPCs for properties in Scotland can be found at <https://www.scottishepcregister.org.uk>

Neither the annual heat demand of the building, nor the annual energy performance of the system, are appropriate to be used in isolation for sizing of the system.

2.2 Fuel calculation

Calculate the minimum mass and volume of fuel required each year.

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- (e) For the specified biomass fuel type lookup the gross calorific value (H_M) in kWh/kg in **Appendix A, Table 1**.
- (f) For the specified biomass fuel type lookup the bulk density of the fuel (ρ_B) in kg/m³ in **Appendix A, Table 2**.
- (g) Identify the boiler seasonal efficiency (η_s) as a percentage as listed in either the Products Characteristics Database (as “SAP seasonal efficiency”) or the default value from Table 4a of SAP (see **Appendix A, Table 3**).
- (h) Calculate the estimate of **minimum** total fuel mass required (MA_{min}) in kg/yr as follows:

- a. Where η_s is taken from Table 4a of SAP:

$$MA_{min} = \frac{\text{Heat supplied by the BHS}}{(\eta_s \div 100) \times H_m}$$

- b. Where η_s is taken from the Products Characteristics Database:

$$MA_{min} = \frac{\text{Heat supplied by the BHS}}{(\eta_s \div 100) \times H_m \times 0.90}$$

Where:

- Heat supplied by the BHS is as identified in paragraph (d); and
- η_s is the seasonal efficiency of the boiler as identified in paragraph (g); and
- H_M is the gross calorific value of the specified fuel identified in paragraph (e).

Note: calculation b. includes a factor of 0.9 to account from overall system losses. System losses are already accounted for in Table 4a of SAP therefore no 0.9 factor is required in calculation a.

- (i) Calculate the estimate of fuel required minimum volume (V_{min}):

$$V_{min} = \frac{MA_{min}}{\rho_B}$$

Where:

- MA_{min} is the minimum total fuel mass required in kg/yr calculated in paragraph (h); and
- ρ_B is the bulk density of the fuel in kg/m³ identified for paragraph (f).

2.3 Calculate the utilisation factor

- (j) Identify the **Nominal Heat Output Rating** of the proposed boiler in kW (R_n) which best matches the peak heat loss of the property.

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Note: this can be determined either by undertaking a full heat loss calculation as described in MIS 3004 clause 5.5 or estimated using the optional method described in Section 3 of this document. Selection of the proposed boiler here is not intended to be the final design decision.

(k) Calculate the utilisation factor (UF) as a percentage of the hours in a year that the BHS is operating:

$$UF = \frac{\text{Heat supplied by the BHS} \div R_n}{8760} \times 100$$

Where:

- Heat supplied by the BHS is the total energy to be generated by the biomass system as identified in paragraph (d); and
- and R_n is the Nominal Heat Output Rating.

3 CAPACITY CALCULATION (OPTIONAL)

Note: this is included as a simple means to give the customer an approximation of the system that might be required ahead of completing a full system design. It is not a substitute for a system design.

To estimate the likely boiler heating capacity:

(l) Using the property postcode lookup in **Appendix A, Table 4**: the appropriate number of **Degree Days**; and the **Outdoor Low Temperature**.

(m) Calculate the **Property Specific Heat Loss** (P_{specific}) in W/K:

$$P_{\text{specific}} = \frac{1000 \times Q}{24 \times D}$$

Where:

- Q is the **Space Heating Demand** (kWh/year) identified in paragraph (a); and
- D is the **Degree Days**.

(n) Calculate the **Total Heat Loss** (P_t) in W:

$$P_t = P_{\text{specific}} \times (d_i - d_o)$$

Where:

- P_{specific} is the **Property Specific Heat Loss** and
- d_i is the design inside temperature at of 21°C; and

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- d_o is the **Outdoor Low Temperature** as looked up in paragraph (l) above. Where this is a negative number then, mathematically, subtracting a negative number becomes addition.

(o) Estimate the **boiler heating capacity**:

$$\text{Boiler heating capacity} = P_t \div 1000$$

(p) Use the result of paragraph (o) as the Nominal Heat Output Rating of the proposed boiler in kW (R_n).

Notes:

- Where the proposed boiler is not intended to provide 100% of the Total Heat Loss, use the **Heat Supplied by BHS** calculated in paragraph (d) at paragraphs (m) to calculate the reduced P_t at paragraph (o).
- The estimate of the Biomass capacity for Space Heating is indicative only and may change following the detailed heat loss assessment and system design stage.

4 PRE-SALE INFORMATION

4.1.1 This estimate shall be communicated in the prescribed format below to the customer before the point that the contract is awarded:

Biomass system performance estimate		
Your energy requirements		
Energy Required for Heating:		kWh
Energy Required for Hot Water:		kWh
Total Heat to be delivered by Biomass Boiler per annum:		kWh
Proposed system (subject to design)		
Nominal Heat Output Rating of the proposed boiler:		kW
Is your property in a smoke control area? (Delete as applicable)	Yes / No	
Any Biomass products installed in smoke control areas must be recorded as an 'exempt appliance.'		
Proposed boiler seasonal efficiency:		%
<i>Note: The proposed boiler's expected efficiency over the whole year. The higher the efficiency, the lower the running costs.</i>		
Biomass fuel type: (Select one)	Pellets Wood Chip Logs	
Source of exact fuel specification:		

Where you can find the specification of the fuel you must use in the boiler		
Gross calorific value of the specified fuel:		kWh/kg
Bulk density of the specified fuel:		Kg/m ³
Performance		
Estimate of Total Fuel Mass required each year (allowing for system losses)		kg
<i>Note: The estimated amount of fuel mass you will need per annum after allowance is made for system efficiency losses. Please see the 'key Information' accompanying this estimate.</i>		
Estimate of Total Fuel Volume required each year (minimum)		m ³
Biomass boiler utilisation		
Utilisation Factor (UF)		%
<i>Note: The UF is the estimate of time per year that the boiler will operate to generate heat. 20% or higher is considered ideal. Less than 15% may signal that the boiler is over-sized for the demand and should be avoided unless there are exceptional circumstances.</i>		

Note: Where site characteristics are unknown (e.g. where the contract may be signed when the property is pre-built), best assumptions can be made.

4.1.2 The following disclaimer shall be provided along with the estimate:

'The performance of Microgeneration Solid Biofuel Heating Systems is impossible to predict with certainty due to the variability of the climate and its subsequent effect on both heat supply and demand. This estimate is based upon the best available information but is given as guidance only and should not be considered as a guarantee.'

4.1.3 Additional estimates may be provided using an alternative methodology, including proprietary software packages, but:

- Such estimates shall clearly describe and justify the approach taken and factors used
- They shall not be given greater prominence than the standard MCS estimate
- They shall be accompanied by warning text stating that it should be treated with caution if it is significantly better than the result given by the standard method

5 KEY INFORMATION

The heat demand of a building, and therefore the performance and running costs of heating systems, is difficult to predict with certainty due to the variables discussed here. These variables apply to all types of heating systems, although the efficiency is sensitive to good system design and installation. For these reasons your estimate is given as guidance only and should not be considered as a guarantee.

Utilisation factor and oversizing

It is important that a biomass boiler is the right size for your home. If it is too small it may not be able to provide enough warmth on the coldest days. If it is too big this can lead to higher installation and running costs, it can be less reliable, and have increased maintenance costs.

The Utilisation Factor (UF) is an estimate of how much time per year that the biomass boiler will be operating. 20% or higher is considered ideal, but if the UF is 15% or less this can be a sign that the boiler might be oversized. Your installer must then provide you with the following statement in your contract:

“Note: the UF calculated may indicate the boiler is oversized and this may result in low efficiency. Consider design changes unless there are exceptional circumstances.”

If the boiler is oversized, resulting in a low UF, then it may not be able to turn down to a sufficiently low heat output leading to frequent on/off cycles. A biomass boiler tends to be less efficient whilst starting up and shutting down so burning more fuel. This is also when particulate emissions are higher.

As part of the design process your installer needs to carry out a heat loss calculation for your property. This will tell them the peak heating load which is the amount of heat needed to keep your property warm enough when it is very cold outside. They can then suggest a boiler with a heat output that is a close match to the peak heating load, helping to avoid oversizing.

There are circumstances where a low utilisation factor of 15% can be acceptable, and so we do suggest you discuss this with your installer.

Fuel store

Unlike gas or electricity biomass fuel does not come into your property through a pipe or a cable so you'll need a store large enough to hold enough fuel between deliveries. The store needs to be readily accessible with space around it to receive deliveries and undertake maintenance. The potential size of the delivery vehicles should be considered, as well as the likely means of moving the fuel to the boiler. Your local installer will be able to advise on the correct fuel store sizing to allow for a sizable inventory and compliant construction.

If you are considering a manually fed boiler then also consider how you'll carry the fuel from the store to the boiler when you're deciding where to locate the store. This is especially important if

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there are, or are anticipated to be, vulnerable members of the household. This applies typically with a log boiler or a hand-fed wood pellet boiler.

Keeping the fuel dry is very important - the fuel store should protect the fuel from both rain and moisture. Wet fuel, if it will burn at all, will not burn efficiently, resulting in reduced heat output, higher running costs, and higher particulate emissions. Wet fuel can also damage and corrode the boiler and its components, resulting in increased failures, higher maintenance costs, and potential periods without heating. Saturated wood pellets are completely unusable and your boiler will be unable to process them through the fuel delivery system.

If wood pellets are to be blown into the fuel store then care should be taken with the design of this aspect of the store so that the pellets are not damaged during this process. If they end up breaking due to impacts when they are blown in this can create large amounts of dust which can clog the delivery mechanisms, will be a waste of that fuel, and creates an inconsistent fuel which can lead to reduced efficiency, and higher maintenance costs.

It is also important to check, when safe to do so, the inside of your fuel store. Damp wood pellets can “clump” together and your local fuel supplier may offer a fuel store cleaning service or someone who can do this on their behalf.

Energy performance certificate

An energy performance certificate (EPC) is produced in accordance with a methodology approved by the government. As with all such calculations, it relies on the accuracy of the information input. Some of this information, such as the insulation and air tightness properties of the building may have to be assumed and this can affect the final figures significantly leading to uncertainty especially with irregular or unusual buildings.

Identifying the uncertainties of energy predictions for heating systems

MCS have identified 3 key types of factor that can affect how much energy a heating system will consume and how much energy it will deliver into a home. These are ‘Fixed’, ‘Variable’ and ‘Random’. Most factors are common to ALL heating systems regardless of the type (e.g oil, gas, solid fuel, heat pump etc.) although the degree of effect varies between different types of heating system as given in the following table.

The combined effect of these factors on energy consumption and the running costs makes overall predictions difficult however an accuracy $\pm 25-30\%$ would not be unreasonable in many instances. Under some conditions even this could be exceeded (e.g. considerable opening of windows). Therefore it is advised that when making choices based on mainly financial criteria (e.g. payback based on capital cost verses net benefits such as fuel savings and financial incentives) this variability is taken into account as it could extend paybacks well beyond the period of any incentives received, intended occupancy, finance agreement etc.

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Factor	Impact
'Fixed' which include:	
Equipment selection	System efficiency
Specification of a buffer or thermal store	System efficiency
Energy assessment via the EPC (e.g. assumptions as to fabric construction and levels of insulation; the variation in knowledge and experience of Energy Assessors)	Energy required
'Variable' which are affected by the system design and include:	
Accuracy of sizing of the biomass boiler - i.e. closeness of unit output selection (kW) to demand heat requirement (kW)	System efficiency
System settings	System efficiency
Design space and ambient (external) temperatures	Energy required
'Random' which cannot be anticipated and include:	
User behaviour:	
<ul style="list-style-type: none"> Room temperature settings 	Energy required
<ul style="list-style-type: none"> Hot water usage and temperature settings 	Energy required
<ul style="list-style-type: none"> Occupancy patterns/times 	Energy required
<ul style="list-style-type: none"> Ventilation (i.e. opening windows) 	Energy required
Annual climatic variations (i.e. warmer and colder years than average)	Energy required

Key:

The statement at the end of each item indicates the major factor affected as follows:

Energy Required: the heat energy output requirement of the system which directly impacts on running costs. This requirement exists regardless of the heating system chosen as it is the heat required to keep the space comfortable. Opening windows or increasing room temperatures will demand more heat output, which means more energy input but this would NOT directly affect the efficiency. Thus increased energy demand does NOT automatically mean reduced efficiency.

System Efficiency: the efficiency of the system has been directly affected and will therefore demand more input energy to achieve the same heat output thus increasing running costs. However, increased energy input does NOT necessarily mean lower system efficiency (see above).

APPENDIX A – LOOKUP DATA

Fuel type	Gross calorific value (H_M) kWh/kg
Pellets	4.8
Wood Chip	3.5
Logs	4.1

Table 1: Gross Calorific Value (Source: Forest Research)

Fuel type	Bulk density of the fuel (ρ_B) in kg/m ³
Pellets	650
Wood Chip (30% moisture)	250
Wood Chip (50% moisture)	300
Logs (stacked & air dried)	350
Logs (kiln dried)	400

Table 2: Bulk Density (Source: Forest Research)

Solid fuel boiler efficiency (Column (A) gives minimum values for HETAS approved appliances, use column (B) for other appliances.)	(A)	(B)
	Manual feed independent boiler	65
Auto (gravity) feed independent boiler	70	65
Wood chip/pellet independent boiler	75	70
Closed room heater with boiler to radiators	67	65
Stove (pellet-fired) with boiler to radiators	75	70

Table 3: Boiler efficiency (Source: SAP10)

Postcode index for degree days and outdoor low temperatures

Post-codes AB-HG	Low Temps (°C)	Degree days	Post-codes HP-S	Low Temps (°C)	Degree days	Post-codes SA-ZE	Low Temps (°C)	Degree days
AB	-5.4	2668	HA	-3	2033	PO	-4.8	2224
AL	-3	2033	HD	-4.5	2307	PR	-4.5	2388
B	-5.1	2425	HG	-3.3	2307	RG	-4.6	2033
BA	-4.6	1835	HP	-3	2033	RH	-3	2033
BB	-4.5	2228	HR	-5.1	2425	RM	-3	2033
BD	-3.3	2307	HS	-5.6	1800	S	-3.3	2228
BH	-4.8	2224	HU	-3.3	2307	SA	-3.1	2161
BL	-4.5	2228	HX	-4.5	2228	SE	-3	2033
BN	-4.8	2224	IG	-3	2033	SG	-3	2033
BR	-3	2255	IM	-4.5	2228	SK	-4.5	2228
BS	-3.1	1835	IP	-4.6	2254	SL	-3	2033
BT	-3.2	2360	IV	-5.6	2668	SM	-3	2033
CA	-3.7	2388	JE	-4.8	1800	SN	-4.6	2425
CB	-3	2033	KA	-5.6	2494	SO	-4.8	2224
CF	-3.1	1835	KT	-3	2033	SP	-4.8	2224
CH	-4.5	2228	KW	-5.4	2668	SR	-3.7	2370
CM	-3	2033	KY	-5.4	2577	SS	-3	2033
CO	-4.6	2254	L	-4.5	2228	ST	-5.1	2228
CR	-3	2224	LA	-4.5	2388	SW	-3	2033
CT	-3	2255	LD	-3.1	2161	SY	-5.1	2161
CV	-5.1	2425	LE	-3.9	2425	TA	-1.5	1835
CW	-4.5	2228	LL	-4.5	2228	TD	-5.4	2483
DA	-3	2255	LN	-3.9	2307	TF	-5.1	2425
DD	-5.4	2577	LS	-3.3	2307	TN	-3	2255
DE	-3.9	2228	LU	-3	2033	TQ	-1.5	1858
DG	-5.6	2483	M	-4.5	2228	TR	-1.5	1858
DH	-3.7	2370	ME	-3	2033	TS	-3.7	2370
DL	-3.7	2388	MK	-4.6	2425	TW	-3	2203
DN	-3.3	2307	ML	-5.4	2494	UB	-3	2203
DT	-4.8	2224	N	-3	2033	W	-3	2203
DY	-5.1	2425	NE	-3.7	2370	WA	-4.5	2228
E	-3	2033	NG	-3.9	2254	WC	-3	2203
EC	-3	2033	NN	-3.9	2425	WD	-3	2203
EH	-5.4	2577	NP	-3.1	2425	WF	-3.3	2307
EN	-3	2255	NR	-4.6	2254	WN	-4.5	2228
EX	-1.5	1858	NW	-3	2033	WR	-5.1	2425
FK	-5.6	2577	OL	-4.5	2228	WS	-5.1	2425
FY	-4.5	2388	OX	-4.6	2425	WV	-5.1	2425
G	-5.6	2494	PA	-5.6	2494	YO	-3.3	2307
GL	-4.6	2425	PE	-4.6	2254	ZE	-5.4	2668
GU	-3	2033	PH	-5.6	2668			
GY	-4.8	1800	PL	-1.5	1858			

Table 4: Postcode Index for Degree days and Outdoor Low Temperatures (Source: CIBSE Guide A)

APPENDIX B – WORKED EXAMPLE

An existing property in rural Wales (postcode CF) has a total space heating demand (taken from a valid EPC) of 25,500kWh/year and hot water demand of 2,900kWh/year. A pellet boiler is proposed to provide 100% of the space heating and hot water demand.

The calculations would be as follows:

(a) Space heating demand = 25,500kWh

(b) Hot water demand = 2,900kWh

(c) Total = 28,400 kWh

(d) Boiler intended to provide 100% = 28,400kWh

(e) Gross calorific value H_M from Table 1 = 4.8kWh/kg

(f) Bulk density ρ_B from Table 2 = 650kg/m³

(g) Boiler efficiency η_s from Table 4a = 75%

(h) Minimum total fuel mass =

$$MA_{min} = \frac{\text{Heat supplied by the BHS}}{(\eta_s \div 100) \times H_m}$$

$$MA_{min} = \frac{28400}{(75 \div 100) \times 4.8}$$

$$MA_{min} = 7889 \text{ kg/yr}$$

(i) Minimum total fuel volume =

$$V_{min} = \frac{MA_{min}}{\rho_B}$$

$$V_{min} = \frac{7889}{650}$$

$$V_{min} = 12.14 \text{ m}^3/\text{yr}$$

(j) Nominal Heat Output Rating R_n (calculated below) = 13.9kW

(k) Utilisation factor =

$$UF = \frac{\text{Heat supplied by the BHS} \div R_n}{8760} \times 100$$

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$$UF = \frac{28400 \div 13.9}{8760} \times 100$$

$$UF = 23.3\%$$

(l) Degree Days = 1835 and Outdoor Low Temperature -3.1°C

(m) Property Specific Heat Loss $P_{specific}$ =

$$P_{specific} = \frac{1000 \times 25500}{24 \times 1835}$$

$$P_{specific} = 579 \text{ W/K}$$

(n) Total Heat Loss P_t =

$$P_t = P_{specific} \times (d_i - d_o)$$

$$P_t = 579 \times (21 + 3.1)$$

$$P_t = 579 \times (24.1)$$

$$P_t = 13953 \text{ W}$$

(o) Boiler heating capacity =

$$\text{Boiler heating capacity} = P_t \div 1000$$

$$\text{Boiler heating capacity} = 13953 \div 1000$$

$$\text{Boiler heating capacity} = 13.9 \text{ kW}$$