

Woodfuel Facts and Figures

Compiled by



Measuring Energy

Energy quantities are expressed in many different types of units: therms (gas); Btu - British Thermal Units (gas and oil boiler ratings); mtoe – millions of tones of oil equivalent (official DTI statistics); megajoules (MJ); and kilowatt-hours (kWh). The principal units for wood-fuel are MJ and kWh and multiples of these.

The way energy use is described is:

Power x Time = Energy
i.e. [kW x hr = kWh]

Units

A kWh therefore describes the amount of power used over an hour. Many people will be more familiar with the British Thermal Unit (Btu) in which the output rating of many boilers were rated. Today however all new boilers are rated in kWh.

Conversions

1 Btu = 0.00029 kWh

1 kWh = 3,412 Btu

1 kWh = 3.6 MJ

1MJ = 948.45 Btu

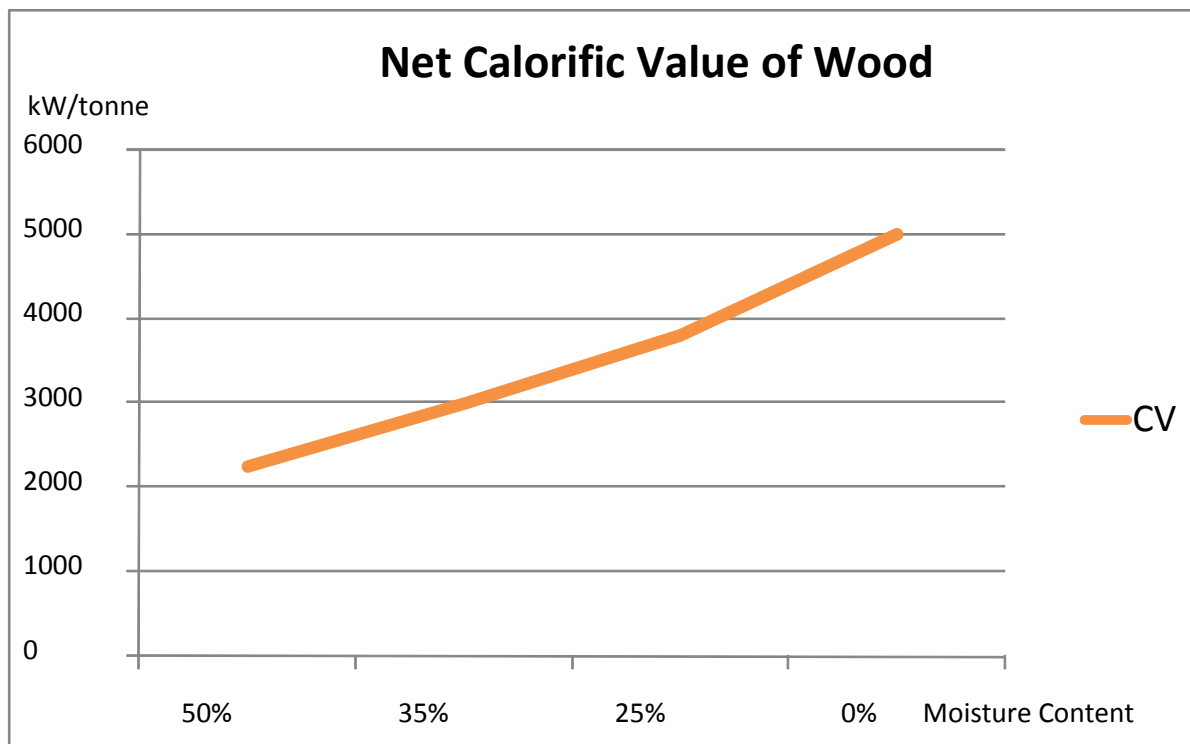
Energy content

The energy content of fuel can be expressed as Gross Calorific Value (GCV), but the usable energy content is the Net Calorific Value(NCV); the difference is the energy lost, as hydrogen in the fuel combines with oxygen in combustion to form steam. The steam is lost in the flue gases from the boiler.

Moisture Content*

In the woodfuel business, moisture content is defined on a wet sample basis: the water content is given as a percentage of the original sample mass. In forestry, the convention is to express moisture content on a dry sample basis, where the water content is given as a percentage of the dry fibre mass. Consequently, in woodfuel, moisture content varies from a maximum of about 60% (freshly harvested) to 0% (oven-dried). In forestry terms, the maximum moisture content would be about 150% (equivalent to 60% on the wet sample basis).

(*With acknowledgments to the NIFES Consulting Group commissioned by EC OPET Programme)



The above graph shows net calorific value against moisture content (wet sample basis). It shows that at:

- 0%MC calorific value (CV) is approximately 5000kW/tonne.
- 25%MC CV is approximately 3800kW/tonne
- 35%MC CV is approximately 3000kW/tonne
- 50% the CV is only about 2250kW/tonne

So the drier the material, the higher the energy value and the more valuable the fuel per tonne.

Wood fuel considerations

	Wholewood and stemwood	Logging residue chip	Pellets (sawdust)	Recovered wood
Moisture Content %	40 -55	50 -60	7 - 12	<30
NCV of dry matter (MJ/kg)	18.5 - 20	18.5 - 20	18.5 - 20	18.5 - 20
NCV as received MJ/kg	7 - 11	6 - 9	16.9 – 17.9	13
Bulk density as received (kg/m ³)	250 -350	250 -400	650 -700	
Energy density (MWh/m ³)	0.7 – 0.9	0.7 – 0.9	3.0 – 3.4	0.9 – 1.26

The above table shows that while any type of wood has around the same amount of energy value as dry matter (Row 3) the NCV depends upon its condition at time of use (therefore the low moisture content of pellets is noticeable at Row 4) and the bulk of the material is dependent upon its processed state (Row 5).

How much energy is in woodfuel?

1 oven dry tonne of woodfuel	=	approx 5MWh of energy
1 green tonne of woodfuel (35% mc)	=	approx 3Mwh of energy
1 green tonne of woodfuel (50% mc)	=	approx 2MWh of energy
1 loose cubic metre of chip (35% mc)	=	approx 1MWh of energy

Pence per kilowatt hours compared to price per tonne

In order to help estimate wood value based on pence per kWh, we have translated p/kWh into £/tonne at certain moisture contents. All figures are approximate. We have already factored in that the boiler will annually put 15% of the heat up the chimney before it gets to the heat meter, therefore this is the price you would receive.

1.5 p/kWh

Fuel moisture content	Price per tonne delivered (factoring in 85% boiler efficiency)
Dry wood (8% mc)	£59.85 / tonne (assuming 3.99MWh/tonne at meter)
Well seasoned wood (20%)	£52.35 / tonne (assuming 3.49MWh/tonne at meter)
6-9 months seasoned (35%)	£40.80 / tonne (assuming 2.72MWh/tonne at meter)
Green wood(50% mc)	£29.10 / tonne (assuming 1.94MWh/tonne at meter)

1.7 p/kWh

Fuel moisture content	Price per tonne delivered (factoring in 85% boiler efficiency)
Dry wood (8% mc)	£67.83 / tonne (assuming 3.99MWh/tonne at meter)
Well seasoned wood (20%)	£59.33 / tonne (assuming 3.49MWh/tonne at meter)
6-9 months seasoned (35%)	£46.24 / tonne (assuming 2.72MWh/tonne at meter)
Green wood(50% mc)	£32.98 / tonne (assuming 1.94MWh/tonne at meter)

2.0 p/kWh

Fuel moisture content	Price per tonne delivered (factoring in 85% boiler efficiency)
Dry wood (8% mc)	£79.80 / tonne (assuming 3.99MWh/tonne at meter)
Well seasoned wood (20%)	£69.80 / tonne (assuming 3.49MWh/tonne at meter)
6-9 months seasoned (35%)	£54.40 / tonne (assuming 2.72MWh/tonne at meter)
Green wood(50% mc)	£38.80 / tonne (assuming 1.94MWh/tonne at meter)

2.2 p/kWh

Fuel moisture content	Price per tonne delivered (factoring in 85% boiler efficiency)
Dry wood (8% mc)	£87.78 / tonne (assuming 3.99MWh/tonne at meter)
Well seasoned wood (20%)	£76.78 / tonne (assuming 3.49MWh/tonne at meter)
6-9 months seasoned (35%)	£59.84 / tonne (assuming 2.72MWh/tonne at meter)
Green wood(50% mc)	£42.68 / tonne (assuming 1.94MWh/tonne at meter)

For example if you were being paid 1.5 p/kwh and you were delivering 20% mc chip you would receive approximately £52.35 per tonne.

Questions on the subject of fuel- We have the answers!

Pellets

1. What are pellets?

Wood pellets are cylindrical pellets from dry, natural wood remnants (sawdust and shavings) with a diameter of 5-6 mm and a length of 10-25 mm. They are pressed under high pressure (without chemical binders) and have an extremely low water content. Wood pellets are offered in kilograms. 1 m³ pellets weigh about 650 kg.

To compare

2 kg pelletsapprox. 1 litre of oil

1 m³ pelletsapprox. 320 litres of oil

2. What is the calorific value of pellets?

The calorific value is standardized at 4.9 kWh/kg. Quality is important! For the optimal operation of pellet heating you should use pellets compliant to national standards and fuel quality assurances.

3. How can you compare the calorific value of pellets with oil and gas?

The calorific value of one litre of oil extra light amounts to 10 kWh per litre and that of 1 m³ gas. Therefore, 2 kg pellets ~ 1 litre oil extra light ~ 1 m³ gas.

4. How long can pellets be stored?

With dry storage, pellets can be stored indefinitely. If pellets come in contact with water, they will expand and will be ruined.

5. Where do I get the pellets and where are they stored?

There is a list of pellet suppliers in our Woodfuel Fact Sheet A4 Autumn 08. Pellets should be stored in a dry, well ventilated space.

6. What is the energy consumption for pelleting and transport?

The energy consumption for the production and transport of pellets is approximately 2.5 % of the heating load.

7. How will you identify the high quality of pellets?

For pellets there are industry norms, which set quality criteria and standards for wood pellets! They include not only the heating load but also the compactness, water content, the part of ash, length and diameter, abrasion resistance and the capacity defined. When buying pellets note the designation of pellets with national quality assurance marks such as Ö-norm in Austria or the DIN-quality mark in Germany. The UK is soon to adopt the new Europe wide CEN Solid Biofuels standards.

8. Can supply be guaranteed?

There are a number of UK manufacturer and importers of wood pellets and the market place is growing, particularly since the rises in fossil fuel prices during the mid part of 2008. The prices for wood-pellets have been, despite rising oil and gas prices, very stable for years and have even fallen slightly.