

Wood as fuel technical supplement

This document is a technical supplement to 'Wood as fuel, a guide to choosing and drying logs' for use by log suppliers.
For further information, contact the Biomass Energy Centre on 01420 526197.

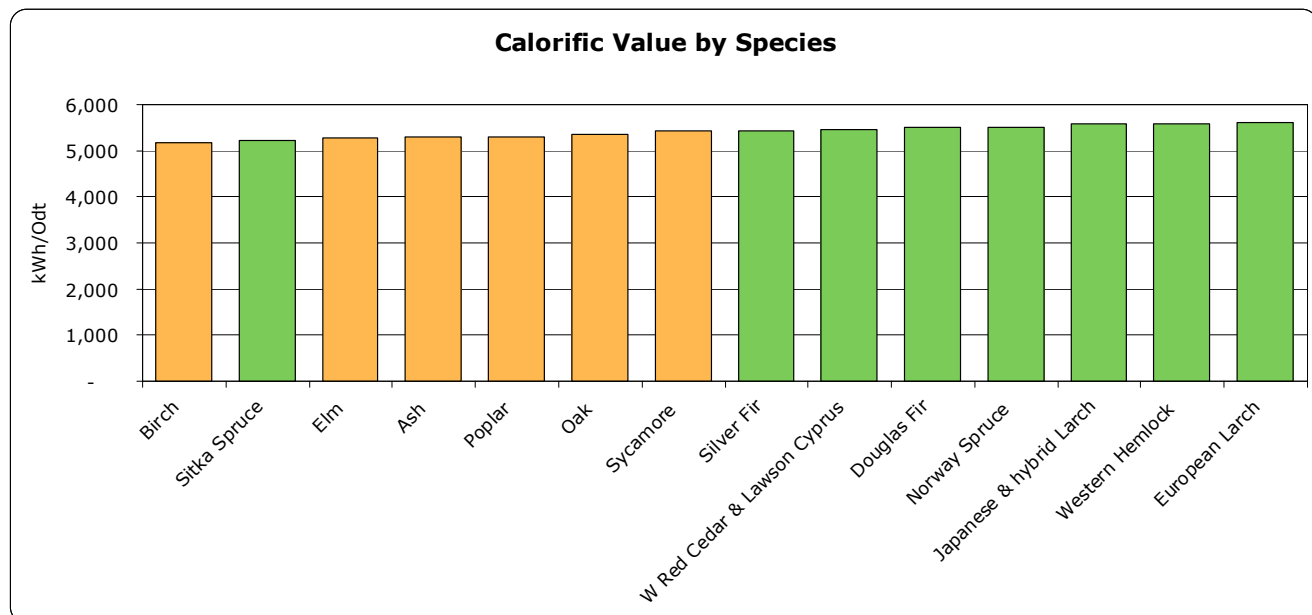
Wood Calorific Value

When choosing wood for burning there are three factors which have an effect on the calorific value (CV) or the amount of available heat per unit of fuel:

1. Species choice
2. Wood density
3. Moisture content

Species choice

The general differences are that hardwoods (deciduous, broadleaved tree species) tend to be denser, and softwoods (evergreen, coniferous species) tend to contain more resins. There is little difference between the CV of difference of different species when tested at the same moisture content. The main difference between species is the moisture content when the timber is green, and the rate of drying.



Hardwood Species
Softwood Species

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Wood density

As hardwood species are generally denser than softwood species, a tonne of hardwood logs will occupy a smaller space than a tonne of softwood logs. Dense woods tend to burn for a longer period of time than softwood meaning fewer 'top ups' are required to keep a log stove burning for a given length of time. If you measure wood by volume you will receive more kilo-Watt hours (kWh) of heat from a cubic metre (m³) of hardwood than softwood, though this will tend to be offset to some extent by the higher calorific value of many softwoods.

Moisture content

The moisture content of wood has the greatest effect on CV of any of the variables. Any water in the timber has to evaporate away before the wood will burn, and this will reduce the net energy released as useful heat (as opposed to steam up the chimney).

Determining moisture content

How to calculate moisture content

The moisture content (MC) of a piece of wood is defined as the weight of water expressed as a percentage of the weight of the wood. This can be expressed as either 'dry basis' or 'wet basis'.

To calculate a **dry basis** MC

Dry basis is expressed as the percentage of the oven dry weight of the wood. For example, if the wood in a piece of timber weighs 50kg and the water also weighs 50kg then the dry basis moisture content is 100%. The main advantage of this method is that the oven dry weight of the wood remains constant. This method is the standard used by many of the organisations doing research on wood.

$$\frac{\text{Weight of water in a given sample}}{\text{Total oven dry weight of the sample}} \times 100 = \text{MC\% (dry basis)}$$

To calculate a **wet basis** MC

Wet basis is the most commonly used measurement when calculating for fuel. This measurement is expressed as a proportion of the sample which is water. For example if the wood in a sample weighs 50kg and the water in the sample also weight 50kg, then the total MC of the sample would be 50% as half of the sample is water.

$$\frac{\text{Weight of water in a given sample}}{\text{Total weight of the sample}} \times 100 = \text{MC\% (wet basis)}$$

Moisture Meters and testing

Moisture meters may well be a useful tool for assessing the moisture content of fuel, but they will only ever give an indication of MC. For an accurate measurement you should assess moisture content by oven drying the fuel and applying the calculations above; to date oven dry method is the most reliable method, and the only one validated by the standards in their current form.

Methodology on how to determine moisture content and other physical properties of woodfuel has been published in the European standard TS/CEN 335, this is expected to be adopted by the BSI as an EN standard later in 2010. For further details go to <http://www.bsigroup.co.uk/>

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HETAS Solid Biomass Assurance Scheme

HETAS is the official body recognised by government to approve solid fuel domestic heating appliances, fuels and services. Its work in approving products covers boilers, cookers, open fires, stoves, and room heaters. The HETAS biomass fuel quality scheme covers logs, wood chip, pellets and briquettes.

The aim of the scheme is to enable the public to identify woodfuel of the appropriate quality for a specific use. Increasing customer confidence in the woodfuel supply chain and ensuring that they are using the correct type of fuel for their heating appliances.

Benefits of assurance schemes can include:

- The woodfuel customer will be assured that (s)he is buying the right product for their installation.
- If product labelling is consistent across suppliers, the consumer can make an informed choice.
- Producers may be able to earn higher returns on fuel that conforms to an assurance scheme.
- An assurance scheme will help enhance the reputation of woodfuel heating.

For further information on this scheme and how to apply, contact

HETAS Ltd,
Orchard Business Centre,
Stoke Orchard,
Cheltenham,
Gloucestershire
GL52 7RZ

Tel.: 0845 634 5626
Email: info@hetas.co.uk
Web: www.hetas.co.uk



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Minimum information to be displayed when a logs are being sold under the Solid Biomass Assurance Scheme.

Approximately compliant with FprEN 14961-5 Solid biofuels (Fuel specifications and classes) Part 5: Firewood for non-industrial use

Information	Category	Notes
Ready to burn	<ul style="list-style-type: none"> Ready to burn if kept dry 	Only dry firewood can be sold within the scheme
Moisture	<ul style="list-style-type: none"> <xx%_{wb}[†] 	The maximum moisture content must be <25% _{wb} [†] or better
Length	<ul style="list-style-type: none"> E.g. 10 inches / 25cm / L25* 	can be +/- 2cm and 15% can be shorter than the minimum
Species	<ul style="list-style-type: none"> Ash, Beech and birch All hardwood species All softwood species Mixed hardwood and softwood 	Species must be listed in order of highest proportion, the first species must always be present, the others may not always occur in a sale pack
UK country of origin	<ul style="list-style-type: none"> England, Scotland, or Wales (with further detail optional e.g. England: Yorkshire) 	Country of origin is where the tree was growing, unless the firewood is a by-product or residue from a wood process which uses more than 50% of the stem wood (eg a sawmill), in which case the county of origin is as the site where it became a by-product/ residue.
Volume & price	<ul style="list-style-type: none"> Loose volume in m³ Price per load/pack in £ 	Stacked volume ≈ 2/3 of loose volume. Smaller packs may be described by their pack dimensions or the solid volume of wood.
[Optional] Drying Method	<ul style="list-style-type: none"> Kiln dried Natural air dried 	If kiln dried, you may wish to state whether the kiln was heated with fossil fuels or renewable energy
[optional] Diameter	<ul style="list-style-type: none"> 2 to 6 inches / 5 to 15 cm / D10 and D15* 	15% can be less than the minimum, small portions of a log can exceed the maximum
[Optional] Calorific Value	<ul style="list-style-type: none"> kWh energy content per unit of sale 	

[†] All Moisture contents are Wet Basis (%_{wb})

* Refers to CEN standard

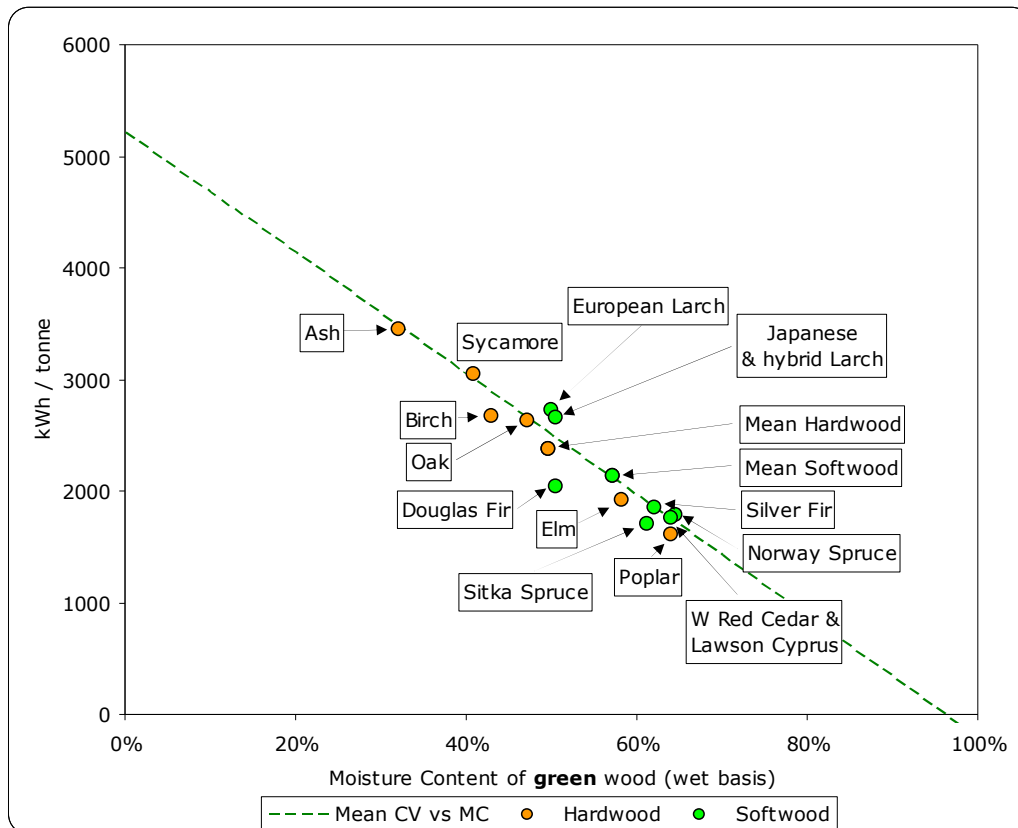
N.B You should not sell decayed wood without being clearly described and marked; you should be pragmatic about the level of decay acceptable in high quality logs.

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The effect of drying on CV

This graph shows the different CV of tree species when felled. It shows that most of the variation in CV between species is to do with the amount of water naturally present in the wood when felled. Therefore fresh Poplar timber will have about half of the CV of fresh Ash, but if both are dried to the same moisture content they will have a very similar CV (per weight, the volume of material will still differ, as the species have different densities).



Species	Green MC (wet basis)	kWh per Green tonne
Ash	32%	3448
Sycamore	41%	3044
Birch	43%	2668
Oak	47%	2635
European Larch	50%	2722
Douglas Fir	51%	2596
Japanese & hybrid Larch	51%	2653
Elm	58%	1915
Sitka Spruce	61%	1705
Western Hemlock	61%	2040
Silver Fir	62%	1855
Poplar	64%	1610
W Red Cedar & Lawson Cypress	64%	1755
Norway Spruce	65%	1787

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Contamination

You should not sell or use firewood that has been produced from wood contaminated or treated with:

Contamination includes:

- varnished or plastic-coated wood,
- wood treated with wood preservatives (including stains, and creosote)
- household waste

Contamination can affect the amount of tar and deposits building up in the flue, and release noxious chemicals into the smoke, it often leaves melted debris in the ash, and can have serious health implications when burnt.

Disposal of contaminated material is regulated by the Environment Agency (in England and Wales) and by the Scottish Environment Protection Agency (in Scotland). To handle it you will need a waste handling license, and to burn it you will need an incinerator that is compliant with the Waste Incineration Directive (WID) for more information, contact your national Environment Agency. While it is not covered by the WID, large amounts of earth, stones and other inert matter may have a serious effect on the operation of many wood fired systems, particularly those with automatic feed systems.

Online Woodfuel Suppliers Directory

If you supply any kind of woodfuel we would be happy to include you on the Biomass Woodfuel Suppliers Directory available at www.biomassenergycentre.org.uk, downloading the form and returning it to either biomass.centre@forestry.gsi.gov.uk or:

Biomass Energy Centre,
Forest Research,
Alice Holt Lodge,
Farnham,
Surrey,
GU10 4LH