



Harvesting / Transportation No. 5

- ▶ Firewood from hardwood has a higher heating value per m³ than softwood, due to higher density, but on a dry weight-for-weight basis softwood is just as good a fuel. More cubic metres of softwood is needed to achieve the same energy output as hardwood, so the price (per cubic metre) for softwood firewood should be lower than that of hardwood.
- ▶ Firewood should be as dry as possible (around 20% moisture content) before use.
- ▶ Ideally firewood should be cut and split at least 6-9 months before use, preferably longer.
- ▶ Firewood should be stored under cover, preferably under a roof.
- ▶ Firewood can be bought by weight or by volume (cubic metre loose, stacked, or solid). The main difference between the three volume measurements is the price per unit. The price for a cubic metre solid should be much higher than a cubic metre stacked and very much higher than for the same volume of loose firewood.
- ▶ Wood should be split for firewood as soon as possible after the trees are felled, to facilitate drying.
- ▶ A splitting hammer is recommended when manually cutting small amounts of firewood. Machines are available for commercial production of firewood.

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Firewood

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Characteristics of firewood

Wood has been used for millennia as a source of heat for a wide variety of uses. Firewood is usually sourced from hardwoods such as ash, beech, oak and sycamore, and to a lesser degree from softwoods like spruce and pine.

The heating value of a tonne of dry hardwood and softwood is very similar - in fact, the heating value of softwoods is slightly higher because of the resin content. However, firewood is sold by weight in Ireland and this complicates the situation. Table 1 shows the amount of dry matter per cubic metre solid wood for a number of species. The amount of dry matter determines the energy content of the wood. Thus firewood from beech has a much higher energy content than that from spruce, at the same moisture content.

Table 1: Dry matter content of firewood from various species.

Species	Kg dry matter/m ³ solid
Hardwoods	
Ash	550-590
Beech/oak	560-600
Birch	500-520
Poplar	340-390
Sycamore	520-560
Softwoods	
Pine	440-480
Spruce	350-400



↑ RAIS stove - courtesy of Imperative Energy Ltd.

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Moisture content

Hardwoods generally have natural moisture content of between 40 and 50%, while softwoods have a moisture content of between 50 and 60%. Wood ready for the fireplace should be as dry as possible, preferably around 20% moisture content. Firewood with higher moisture content causes a buildup of tar and soot in the chimney and it burns with much lower efficiency and increases smoke pollution.

Bark insulates the stem against loss of moisture, so roundwood dries much slower than wood that has been cut and split. The golden rule is to prepare firewood in the winter prior to the one during which it will be used - even better would be to leave the firewood until the second winter.

How to split wood?

Wood should be split as soon as possible after felling, as this will greatly facilitate drying. Generally speaking, hardwoods like ash, beech, and birch are easy to split; oak is not always as easy. Softwoods tend to be more difficult to split because of the knots in the wood.

The most difficult part of splitting wood is breaking the log for the first time. With large diameter wood it is best to first split the log into big wedges that can then be cut into smaller pieces more easily.

There are three ways to split wood:

- by hand;
- by a splitting machine;
- by a combined cutting and splitting machine.



By hand

This is the most common method used for small amounts of firewood. Splitting with a normal axe is not ideal as they tend to have a narrow blade, which is sometimes ground slightly concave to facilitate slicing across the grain. The same axe will get stuck when trying to split wood along the grain. With almost every stroke, the axe has to be freed from the block of wood. One should not use a normal axe to try to drive wedges when splitting - the housing of the axe is not made for this purpose and will easily buckle, resulting in a loose shaft and the head coming off.

It is preferable to use a splitting axe; better still one should use a splitting hammer which is pointed on one side and flat at the other. The flat side can be used to drive wedges into large pieces of wood. The wider head passes a lateral force to the piece of wood, which makes it easier to split. A good quality splitting hammer is needed to drive wedges, as cheap hammers quickly begin to fray and deform (Figure 1).

Care is needed when using either tool as a wooden shaft can break if it hits off the block being split (Figure 1).

After some use, wedges will also begin to fray and should be rounded off using a grinder (Figure 2). If the fray is left unattended, small particles of iron can fly off and cause serious injury. Only use good quality steel wedges (aluminium or plastic are too soft for this work and are only recommended for felling work where steel wedges might damage the chainsaw).

Figure 1: This splitting hammer hit the log with the shaft. Note the frayed head.



Figure 2: Steel splitting wedge. The head has been rounded after use to prevent splinters from flying off.

By splitting machine

The most common splitting machines have a hydraulic ram that pushes the splitting head through the wood. They can work either horizontally or vertically, are available in a variety of makes and at different prices, and can be powered by a petrol engine or electrically.

The smallest machines can split short logs up to 30 cm in length, medium ones can split wood up to 60 cm in length, while the largest can split wood up to several metres long. As these machines are expensive, these are often shared between users or rented.

Machines can be equipped with a single blade for splitting wood into two pieces, or with a cross knife for splitting into four. Blades for splitting into more than four pieces also exist, but they become increasingly impractical. The diameter of the wood to be split should fit the type of wedge to be used, as well as the size of the firewood required.

To prevent injuries to hands it is recommended that firewood splitters that operate only when both hands are pressing the handles, be used.

Combined cutting and splitting machines

For those who want to produce firewood commercially a firewood processor is recommended. These machines first cross-cut the wood into suitable lengths. The pieces fall in front of the splitting ram that drives them through the wedge. The split pieces are then carried away on a conveyor



A combined cutting and splitting machine with conveyor belt.



Some examples of the variety of splitting machines available.

belt. In many cases the machine can be equipped with a two-way or a four-way blade, which can be lowered or raised, depending on the size of the log to be split. Very large machines can have splitting blades for more than four pieces at a time. In order to speed up the process, many machines can be equipped with a feed table, so that a supply of logs can be kept ready to feed into the cutting part of the machine.

Trading firewood

Firewood is usually sold by the tonne. Freshly felled wood has a much higher weight per unit of volume than dried wood. For example, a tonne of fresh Sitka spruce will contain 55% moisture, while a tonne of fresh beech typically contains 45%. Natural drying of both softwood and hardwood can reduce the moisture content down to levels as low as 25%. During this process, the energy content (per tonne) increases by 120% for softwood and by 45% for hardwood. It is thus very important to know the moisture content of the firewood that is being sold or bought, and to aim for a low moisture content. Ideally, the price of the firewood should be directly related to the moisture content (or energy value): low moisture content would dictate a high price, while a high moisture content should give a low price.

The moisture content of firewood can easily be measured. Take some typical pieces of firewood and split them into kindling. Select some pieces and weigh them with a kitchen scales and note the fresh weight. Dry the pieces in an oven at 100°C for at least 6 hours. Weigh the pieces again. Divide the difference between the fresh weight and the dry weight (= moisture) by the fresh weight and

multiply by 100 to obtain an indication of the moisture content of the pieces of kindling.

So: $(\text{fresh weight} - \text{dry weight}) / \text{fresh weight} * 100 =$
moisture content of the firewood

Firewood can also be sold in the wood using a volume estimate. The solid content of wood is calculated from the measurement of the length and the diameters of the log(s). This is however rarely if ever justified for firewood, and it is best sold as a stack. Of course the straighter and shorter the logs are, the greater the amount of wood in a stack. Typical conversion factors for stacked timber range from 40 to 70% depending on stacking precision, log straightness and log length. Figure 3 shows a pile of roundwood measuring 2 m in length, 0.5 m in height and 1 m wide: a pile of 1 m³ stacked volume. This pile contains about 65% solid wood. If the logs were 3 m long, the conversion factor would drop to 55%.

It is also possible to buy firewood which has been cut and split and which is ready to use in the fireplace. With loosely piled blocked or split logs approximately 50% of the volume is wood, the rest is space. Obviously, with more regularly shaped and neatly stacked pieces this conversion factor will increase. For example, in Figure 4 the pieces of wood are placed loosely in the box, so the box contains only 45% wood and the rest is air. If the wood was stacked neatly in rows, the pile would contain between 75 and 80% wood, as shown in Figure 5.

Ordering firewood on a cubic metre basis can result in the delivery of newly felled wood that is too wet to be burned for 6-9 months. Nearly all wood will burn fresh (some species better than others, e.g. ash) particularly if it is burned with other fuels such as peat and coal. However, the efficiency of the burning will undoubtedly improve with drying.

Storage

Firewood should be stored under cover, to allow it to dry out and prevent it rewetting. The cover can consist of a strip of tarpaulin or plastic, but it is best to store it under roof, in a well-ventilated shed, sheltered lean-to or outhouse.

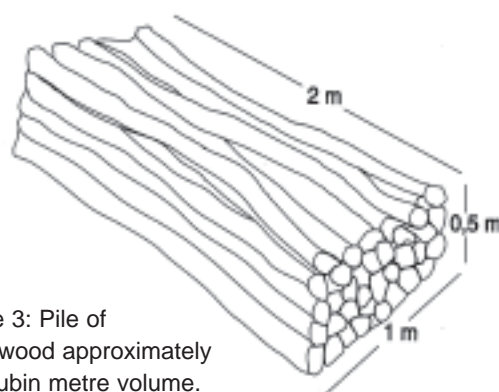


Figure 3: Pile of roundwood approximately one cubic metre volume.

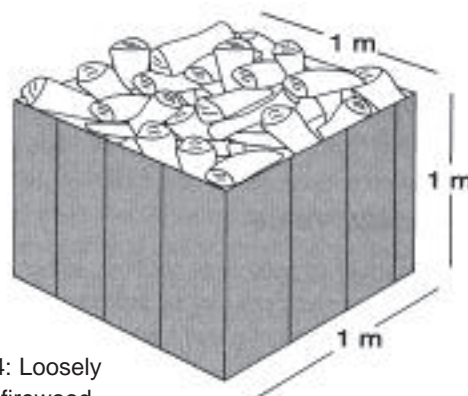


Figure 4: Loosely packed firewood.

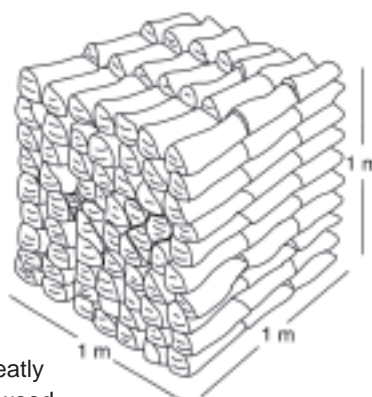


Figure 5: Neatly stacked firewood.

- The information for this note has been extracted from the report *Wood for energy production, Irish Edition*, published in 2005 by COFORD.
- For information and a free on-line advisory service on the wood energy supply chain, the quality of wood fuels and internal handling visit www.woodenergy.ie.
- See also http://www.aie.org.uk/aie_data/aie_firewood.html