WOODFUEL

CALCULATING ENERGY IN WOODLANDS

CALU FACTSHEET
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INTRODUCTION

If you own a woodland, or are thinking of buying one, with a view to harvesting fuel wood from it, one of the first questions you will want answered is: how much energy is contained in this parcel of woodland? In fact, there isn't one simple "correct" answer to this question as many variables are involved, including: tree species; the form or shape of the trees; how much of the wood would be used, etc.

The method below gives an indication of the process for making a rough estimate of the potential energy in the standing wood. It demonstrates the principles involved, and in many cases it will provide a usable guesstimate.

Of equal (or more) importance than the energy currently standing in a woodland is the prediction of future harvests. This is touched on at the end of the factsheet.

HOW MUCH ENERGY IS IN ONE HECTARE OF WOODLAND?

Step 1	Assess the standing volume of wood (CALU is writing a factsheet to help with this)
Step 2	Convert this to tonnes (a rule of thumb is 1.4m^3 per tonne, but if you have more accurate information you should use this). This value will be "green" tonnes – i.e. wet
Step 3	Convert wet weight to oven dry weight (a rule of thumb is 50% of the weight will be water, but this is very arbitrary – again, if you have more accurate information you should use it).
Step 4	You now know the oven dry weight of wood on your hectare of land. Make sure this is in tonnes. Multiply tonnes by 18 (because roughly 18GJ / tonne) and you have the energy value of your wood in GJ.
Step 5	If you want to convert from GJ to more meaningful (for most people) kWh: divide by 60 (because 60 seconds per minute), then by 60 again (because 60 minutes per hour), then by 1,000 (because 1,000 watts in a kilowatt). Hey presto, you now know how many kWh of energy there is standing in the timber on your hectare of woodland

WORKED EXAMPLE:

Step 1	One hectare of broadleaved woodland was estimated to have 200m^3 standing timber on it
Step 2	200 ÷ 1.4 ≅ 143 tonnes (fresh weight)
Step 3	143 ÷ 2 ≅ 71 oven dry tonnes
Step 4	71 x 18 ≅ 1,278GJ
Step 5	1,278,000,000,000 ÷ (60 x 60 x1,000) = 355,000kWh

Cronfa Amaethyddol Ewrop ar gyfer Datblygu Gwledig: Ewrop yn Buddsoddi mewn Ardaloedd Gwledig
The European Agricultural Fund for Rural Development: Europe Investing in Rural Areas

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Centre for Alternative Land Use
Canolfan Defnydd Tir Amgen

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

If an "average" UK three bedroom house uses approximately 25,000kWh of energy a year, the energy from one hectare of wood, could, theoretically, provide enough energy for 14 houses for one year.

However, not all energy is used for space and water heating, and realistically, it is heat energy that is most suitable for domestic wood fuel to provide.

Another factor which needs to be considered is the conversion efficiency of the appliance used to burn the wood (good modern stoves have efficiencies of around 80%).

For the purpose of this exercise, we'll assume that these two factors cancel each other out: i.e. only 75% of total domestic energy used is for heat purposes; but the boiler used to provide the heat would also have an efficiency of 75%.

BUT HOW SUSTAINABLE IS THIS?

Say the woodland has taken 50 years to grow this volume of timber standing on it. If it were all chopped down in one go, it would take another 50 years to replace it (if a similar type of woodland and management was used).

The woodland could, theoretically, be replaced with a more productive species mix and management regime. In that case, perhaps it would only take 15 years to yield the same volume of wood.

Nevertheless, this means that if the houses were dependent on this one hectare of woodland they would have 14 years without fuel. Obviously this is untenable.

For a sustainable annual cut, the total area needs to be the number of years in the rotation length multiplied by the area required each year. In this example it would be 50 x 1ha = 50ha for the original woodland; or 15 x 1ha = 15ha for the alternative one.

When planning a woodland for fuel production (whether as a primary or secondary product) it is essential to consider the continuity of supply: both in terms of supply through the seasons and over a period of years.

Consideration needs to be given to the impact that the woodland and management / harvesting regimes may have on wildlife and on water flows and quality. The aesthetic changes that woodlands and their management bring should not be forgotten. There are legislative constraints in place (e.g. Felling Licences) to ensure these considerations are made.

nb the example is theoretical and should not be taken as an indication of "average" woodlands. All woodlands are different, all need to be assessed on their own merits.

SOURCES OF FURTHER INFORMATION

The two classic texts on assessing the volume of wood in single trees and stands of trees are the Forestry Commission's: Forest Mensuration – a handbook for practioners, ISBN 0855386215; and Field Guide - Timber Measurement, ISBN 9780855387495

For further information on wood fuel and bio-energy in general: www.biomassenergycentre.org.uk

For advice and information on managing broadleaved woodlands in Wales: www.coedcymru.org.uk