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- Four software modules are available to aid the wood for energy community.
- The first module calculates the delivered price of wood chips, based on a comprehensive list of user adaptable variables.
- The second module calculates the delivered price of firewood, again based on a comprehensive list of variables
- The third module compares the present fuel costs of a user to alternative fuel costs and calculates the simple payback period of the new boiler installation based on the eventual savings in fuel.
- The fourth module takes the sting out of converting wood fuel units from one to another

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Department of Agriculture, Food and the Marine, Agriculture House, Kildare Street, Dublin 2, Ireland.
Telephone: +353 1 607 2487
Email: info@coford.ie
<http://www.coford.ie>



Software to help the wood for energy community

Pieter D. Kofman and Glen Murphy

Introduction

The trade of wood fuels, like firewood, wood chips and wood pellets, has increased a lot over the last few years and an even greater expansion is expected once the new Renewable Heat Incentive kicks off.

However the trade in many of these fuels is not an easy one. If we take wood chips first: the forest owner thinks in m³ solid wood or tonnes, the harvesting contractor also thinks in m³ solid, but when it comes to chipping the unit is suddenly m³ loose volume. The chips are transported per load, more or less independent of weight and volume. Finally the customer buying the chips is not interested in either volume or weight, but he wants to know how much energy he gets delivered. All of this is compounded by the fact that the moisture content of the wood changes over time. When the wood is harvested, it might have a very high moisture content (55 to 63%) but when it is finally delivered the moisture content should be around 30%. To add to all these problems, the wood species also has an influence on the amount of delivered energy.

For firewood, something similar can be recounted. Here there is large variation between tree species, in the way the volume is measured (m³ solid, m³ loose, m³ stacked volume). Besides firewood should not be delivered before the moisture content has dropped to an acceptable level of 20 to 25%. Firewood can either be seasoned (natural drying) or kiln dried to get to this level of moisture. Seasoning takes time and kiln drying costs energy and thus money.

If one wants to convert a present boiler system running on oil or natural gas to one on wood fuel, one has to do some calculations to see if it does pay to convert. The only savings in the conversion can come from a reduced price of the new fuel. Again we have to problem of conversion of units, because oil is sold by the litre and natural gas by the m³, but neither of these units can be used when dealing with wood fuels.x

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

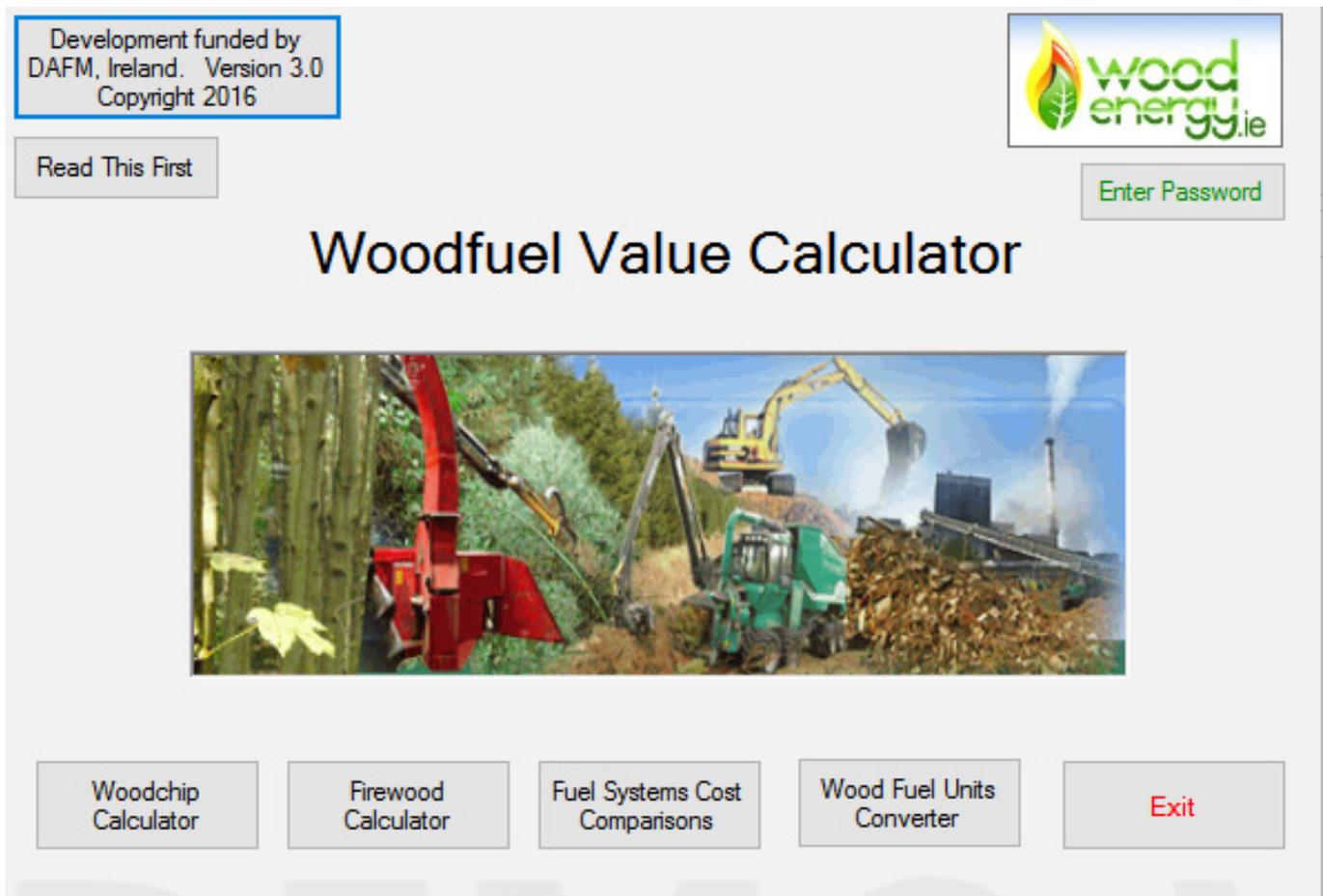
In general there is thus a problem in converting one unit to another.

To solve these problems, the Department of Agriculture, Food and the Marine has had four software modules developed to aid the wood for energy community. The four modules have been collated into a single package for ease of use and distribution:

- Woodchip calculator
- Firewood calculator
- Fuel systems cost comparisons
- Wood fuel units converter

The first two modules are for people and companies that sell fuel, and allows them to calculate the cost of the fuel (including profit) as delivered at the customer. The third module is meant for anyone who wants to know if it pays to change from one fuel to another. The final module brings clarity to converting units from the one to the other, and it also enables a cost comparison between wood fuels, because the fuels differ in moisture content and handling characteristics. The opening page of the total package is illustrated in Figure 1.

Figure 1: Opening page of the woodfuel value calculator



Woodchip calculator

The purpose of the woodchip calculator is to calculate the price of woodchip delivered to the final customer. The price depends on many factors, each of which can be changed and adapted according to your own data. The opening screen of the woodchip calculator is shown in Figure 2.

The screen has four columns:

- the left-hand column enables wood data to be entered, and where, what and how the wood is bought
- The second column details the moisture content of the wood along the supply chain and shows the unit conversions depending on moisture content. Default moisture content values have been entered, but can be changed by the user

- The third column is to enter harvesting and transport distances and costs
- The right-hand column provides detailed results and a financial overview.

Default values have been entered many places in the software: these are based on results from research in Ireland during the ForestEnergy programmes (Kent, Kofman and Coates, 2011).

If the result of the calculations shows a surplus, the final figure will turn green, otherwise it will turn red showing a loss – then one can look at the cost assumptions again to return a surplus or profit on top of the profit percentage specified at the top of the column, which is included in the total cost calculation.

Figure 2: Opening screen of the woodchip calculator

Firewood calculator

The principles behind the firewood module are much the same as in the woodchip module. However several refinements have been added, because the production chain for firewood tends to be more complicated.

The screen layout is shown in Figure 3.

In the firewood module, three blue boxes are visible. Behind each blue box there is a pop-up menu. We have already seen that the “select species” box will reveal a list of tree species and their basic densities. The “select delivery system” provides a number of choices: no delivery (collected at the yard), delivered loose, delivered in big bags, delivered in small bags on a pallet, delivered in small bags without a pallet. If one of the delivery systems requires packaging (big bags, small bags), remember to enter the cost of the packaging materials, which is done in the third drop down menu behind the “drying and packing data”.

Information about seasoning of the firewood (natural or kiln drying) can be entered in the “drying and packing data” drop-

down menu. One can choose between natural drying only, kiln drying only or a combination of both.

The firewood module can also be used to predict when firewood will be ready for sale, meaning when it arrives at maximum 25% moisture content. This can be done by entering the start month of the actual seasoning of the firewood, which can start already when the wood is stored as roundwood or as processed firewood. A list of default drying rates is given, based on the findings of the ForestEnergy project. If one is not satisfied with these numbers, they can be changed by the user (and reset to default by clicking on the reset to default values button). If kiln drying is selected, remember to enter the cost of the fuel to heat the material. The extra cost of handling should be added in the “other costs” field.

An additional feature of the firewood module is that one can indicate in the top left hand corner the amount of wet wood one has purchased. Based on the moisture content at sale, the module then calculates the saleable amount after seasoning or drying, because during the seasoning several tonnes of water will be lost.

Figure 3: Layout of the firewood module

Woodfuel Value Calculator

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Delivered Firewood Sales Value

Save to File Help

Purchase Type

- Standing in Forest
- Roundwood at Roadside
- Roundwood at Yard
- Firewood in Forest

Purchase Price (£/m²s) Purchased Amount (m²s)

Units m²s tonne

Moisture Content (%)

Roundwood in Forest

Units per tonne

m ² s	m ² st	m ² lv
0,82	1,16	1,82

Firewood in Forest

Units per tonne

m ² s	m ² st	m ² lv
1,00	1,42	2,22

Delivered Firewood

Units per tonne

m ² s	m ² st	m ² lv
1,36	1,94	3,03

Harvesting, Processing and Storage

Units m²s m²lv tonne

Harvesting Cost (£/m²s)

Processing Cost in Forest (£/m²s)

Processing Cost at Yard (£/m²s)

Other Storage Cost (£/m²s)

Drying Cost (£/m²s)

Drying and Packing Data

Transport and Processing Losses (%)

Storage Period (months)

Price, Profit and Interest Data

Sales Price £ per unit

£/tonne £/Big Bag £/m³lv £/Small Bag

Profit (%)

Interest (% per month)

Financial Results

	€ per tonne
Sales Price	0,00
Purchase Cost	0,00
Harvesting Cost	0,00
Transport Cost: R'wd	0,00
Transport Cost: F'wd	0,00
Processing Cost	0,00
Drying Cost	0,00
Storage Cost	0,00
Supplier's Profit	0,00
Net Value (£ per tonne)	0,00

Units £ per Big Bag £ per tonne £ per Small Bag £ per m³lv

Saleable Volume After Seasoning

Calculate Reset Form Exit

Wood Data

Species

Generic Hardwood

Basic Density (kg dry matter per m³s)

Conversion Factors

m³ stacked / m³ solid

m³ loose / m³ solid

Change Currency Symbol

Firewood Delivery System

Select Delivery System

Loose

Quantity

tonne m³lv

Customers per trip

Unloading Method

Tipping Throwing

Fuel systems cost comparisons

This module has been designed to find out if it pays (at current fuel prices) to change from one type of fuel to another. Most of the time, changing fuel also means changing boiler, since solid biofuels like wood chip, briquettes or wood pellets cannot be handled by oil or gas burners. The module is shown in Figure 4.

- This module is divided into three columns:
- The left most column lists a choice of existing fuels
- The right most column lists the possible future fuels
- The calculations are performed in the middle.

One starts by choosing the existing fuel from the left-hand column. The fuel then dictates which fields will appear in the middle. For example, if one chooses light oil, a choice will appear if one wants to enter the annual consumption in litres or in tonnes.

One then fills out the annual consumption and the price per unit. There are suggestions for boiler efficiency behind the boiler efficiency button. The system then calculates the amount of energy input based on the consumption.

One then chooses a future fuel and enters the fuel cost per unit (one can choose different units). Based on the calculated energy consumption, the system then calculates the amount of alternative fuel and the total cost of that fuel.

If one enters the expected investment in an eventual new boiler (including the fuel handling and storage system), the system will calculate the expected simple payback period of that investment, based solely on the possible savings in energy costs.

Any increase in time used to service and maintain a solid fuel boiler is not included in the calculations, for example removal of ash.

Figure 4: Screenshot of the fuel systems cost comparison module, shown with a comparison between light oil and wood chip

Fuel Systems Cost Comparisons Tool

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Fuel Systems Cost Comparisons

Save to File

Current Energy Source

- Light Oil
- Natural Gas
- Electricity
- LPG Propane
- LPG Butane
- Coal Anthracite
- Peat Briquettes
- Milled Peat
- Sod Peat
- Wood Chips
- Wood Pellets
- Wood Briquettes
- Firewood (H'wd)
- Firewood (S'wd)
- Torrefied Pellets

Current System

Annual Consumption (litre)

Boiler Efficiency (%)

Calculated Energy Consumption (GJ)

Units: litre ton

Fuel Cost (€ per litre)

Calculated Annual Cost (€)

Future Energy Source

- Wood Chips
- Wood Pellets
- Wood Briquettes
- Firewood (H'wd)
- Firewood (S'wd)
- Torrefied Pellets
- Light Oil
- Natural Gas
- Electricity
- LPG Propane
- LPG Butane
- Coal Anthracite
- Peat Briquettes
- Milled Peat
- Sod Peat

Future System

Expected Annual Consumption (ton)

Boiler Efficiency (%)

New Boiler Cost (€)

Calculated Annual Saving (€)

Units: ton GJ m³lv kWh

Moisture Content (%)

Fuel Cost (€ per ton)

Simple Payback Period (years)

Calculated Annual Cost (€)

Disclaimer
View and Update Conversion Factors
Change Currency Symbol
Help
Calculate
Reset
Exit

Quick wood fuel units converter

One of the trickiest parts of the wood for energy business is the conversion of units. Forest people measure in cubic metres solid wood or tonnes. When roundwood is chipped, it is often transported as cubic metres loose volume. To calculate the energy content you need the weight and the moisture content. The energy content can be expressed in GJ (Giga Joules - the preferred unit) or kWh (kilo Watt hours). Firewood is usually traded in cubic metres loose or stacked. So, one needs to be careful in the conversions.

The quick wood fuel units converter helps in this matter. The opening screen is illustrated in Figure 5.

If one wants to compare different wood fuels to each other or one wants to compare the wood fuel costs to the cost of

equivalent amounts of fossil fuel, that can be done in the “comprehensive converter”. Click on that box and the following screen will appear (see Figure 6).

One can choose one or more wood fuels. The chosen ones become highlighted and one can input values in the white boxes. If the boxes are grey, no input is possible.

At the right-hand side of the screen at the top there is a comparison between the wood fuels, while at the bottom the equivalent amounts of the alternate fossil fuels are shown with their costs.

Figure 5: Opening screen of the quick fuels converter

Wood Fuel Units Converter and Equivalent Volumes

Quick Wood Fuel Units Converter

wood energy.ie

Quick Wood Fuel Units Converter

Basic Density (kg dry matter per m3 s)	Moisture Content (%)	Selected unit for comparison is GJ			
<input type="text" value="500"/>	<input type="text" value="30"/>	<input checked="" type="radio"/> GJ	<input type="text" value="0,00"/>	<input type="radio"/> MWh	<input type="text" value="0,00"/>
Amount GJ	<input type="text" value="0"/>	<input type="radio"/> m3 s	<input type="text" value="0,00"/>	<input type="radio"/> tonne	<input type="text" value="0,00"/>
<input type="radio"/> m3 lv wc	<input type="text" value="0,00"/>	<input type="radio"/> m3 st fw	<input type="text" value="0,00"/>	<input type="radio"/> m3 lv fw	<input type="text" value="0,00"/>

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Comprehensive Converter

Exit

Figure 6: Screenshot of the comprehensive fuels converter

Wood Fuel Unit Converter and Equivalent Volumes

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Help



Comprehensive Fuels Converter

Select Wood Fuel

Wood Chips Wood Pellets Firewood

Firewood

Basic Density (kg dry matter per m3 s) Moisture Content (%) Hardwood

Select Units

tonne	Amount	€ per unit	Cost (€)
tonne	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Equivalent Volumes

tonne	m3 s	m3 lv	GJ	MWh
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0,00"/>	<input type="text" value="0,00"/>

Big Bag Size (litres) Small Bag Size (litres)

Conversion Factors and Prices Basic Densities

Change Currency Symbol Reset Form

Wood Chips

Basic Density (kg dry matter per m3 s) Moisture Content (%) Hardwood

Select Units

tonne	Amount	€ per unit	Cost (€)
tonne	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Equivalent Volumes

tonne	m3 s	m3 lv	GJ	MWh
<input type="text" value="0,0"/>	<input type="text" value="0,0"/>	<input type="text" value="0,0"/>	<input type="text" value="0,00"/>	<input type="text" value="0,00"/>

Wood Pellets

Select Units

tonne	Amount	€ per unit	Cost (€)
tonne	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Equivalent Volumes

tonne	m3 lv	GJ
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Big Bag Size (litres) Small Bag Size (litres)

Wood Fuel Summary

	Amount	Units	Cost (€)
Wood Chips	0	tonne	0
Wood Pellets	NA	NA	NA
Firewood	NA	NA	NA

Equivalent Alternative Fuels

Amounts below relate to 0 tonne of Wood Chips.

Alternative Fuels	Equivalent Amount	Traded Unit	Equivalent Cost (€)
Light Oil	0,0	litres	0
Natural Gas	0,0	kWh	0
Electricity	0,0	kWh	0
LPG Propane	0,0	litre	0
LPG Butane	0,0	litre	0
Coal	0,0	tonne	0
Peat Briquettes	0,0	tonne	0
Milled Peat	0,0	m3 lv	0
Sod Peat	0,0	tonne	0

Quick Converter Exit

Conclusions

The four wood fuel modules are designed to assist in developing the wood fuel market. It is designed to guide those preparing offers for fuel delivery and in converting from one unit to the other.

To purchase the package, please contact Orla Cashen at the Department of Agriculture, Food And the Marine (Orla.Cashen@agriculture.gov.ie).

Installation and Download Instructions

The package can be downloaded from a Dropbox link, which will be provided on payment. It costs €100 for residents of Ireland (including Northern Ireland) for a single user licence. For multiple licences and people living outside Ireland, please contact the author.

All modules display costs in euro, but if needed one can choose another currency by clicking on the “change currency symbol” button. **This only changes the currency symbol used in the modules and does not convert existing data from one currency to another.**

Another common property is that the mouse-over help is enabled for all modules. If one holds the cursor over a field on the screen, an explanation of the field will appear on the screen. The mouse-over help can be turned on or off by clicking on the help button.

References

Kent, T., Kofman, P., Coates, E. 2011. Harvesting wood for energy Cost-effective woodfuel supply chains in Irish forestry. COFORD Department of Agriculture, Food and the Marine Agriculture House Kildare Street Dublin 2¹.

¹ Report can be downloaded from www.coford.ie and woodenergy.ie.