

INTRODUCTION

As part of a desire to move towards renewable fuels, there has been increasing interest in the conversion of timber co-products (i.e. sawdust, wood chips, wood shavings and off-cuts) into fuel pellets. Fuel pellets (see Fig. 1) are a convenient, high density fuel that can be used in purpose built stoves and boilers. The supply of pellets made in the UK has been developing slowly, with focus tending to be on medium to large scale production plants. This leaflet focuses on small scale production systems.

Coed Cymru, one of the partners in CALU, with financial support from WDA, Glasu and Countryside Council for Wales, has been carrying out trials with a small, 10HP pellet mill that will convert wood co-products into fuel pellets. Sawdust is forced through holes in a die-ring to form cylindrical pellets. The process consists of: obtaining the raw material; shredding and granulating the raw material; pelleting in the pellet mill; bagging; and feeding into appropriate burners.

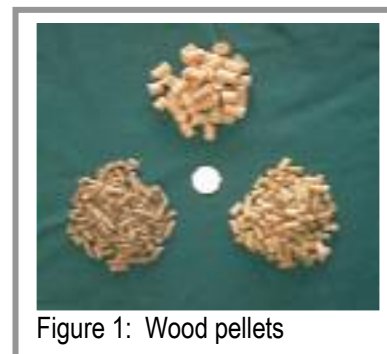


Figure 1: Wood pellets

THE RAW MATERIAL

It is possible to produce fuel pellets from a wide range of materials, but the focus here is timber. The operational flexibility of pellet mills means they can accommodate timber from different species and at differing moisture contents. Pellet mills are, therefore, particularly suitable for many wood-using SMEs.

Species: Fuel pellets have been made from different hardwoods (oak, beech) and softwoods (spruce, pine) all without bark. All resulting pellets will have the same density, calorific values and low ash content (iroko has a high ash content).

Moisture content: It is important that the raw material is relatively dry, but the moisture content can vary between 10 to 20% by weight.

Form: Starting material can be sawdust, wood chip, shavings and off-cuts derived from solid wood.

GRANULATION

Prior to pelleting, the raw material must be converted to a homogeneous consistency. Coed Cymru has been using a shredder/granulator manufactured by Dragon Machinery in Pencader, Carmarthenshire (01559 384303) (see Fig.2). The model is the smallest in the range and will process up to 60kg / hour of wood shavings, less for off-cuts. There is a range of similar equipment on the market, although it tends to cater for large quantities of material. In the past, hammer mills have been used and are often recommended to break down raw material for pelleting. Coed Cymru has found the Dragon Machinery equipment satisfactory for all materials tested particularly for off-cuts.



Figure 2: Shredder / granulator

THE PELLET MILL

The mill used for the trials by Coed Cymru is a 10HP motor geared down to cope with wood (see Fig. 3). It is manufactured by Farm Feed Systems in Cinderford (01594 825106), who produce a range of small to medium sized mills.

Two dies have been used: one producing pellets of 8mm diameter (for pellet stoves and boilers – see Fig.4); the other pellets of 11mm diameter which burn in unmodified solid fuel stoves.

The mill operates at constant speed. The feed system has been designed for experimental use: it is envisaged that a permanent installation would have a much larger feed hopper fed by the granulator with level monitoring and automated controls. The scale and degree of automation can be tailored to the client's needs.



Figure 3: Pellet mill

There is a range of other pellet mills on the market, but most are large scale originally developed for producing animal feeds. The smallest mill, from SPC, Sweden is rated 250kg per hour but Coed Cymru has no experience of this although a few have been imported into the UK.

OPERATION OF THE MILL

The operating conditions can be varied to suit the material being pelleted. Options and variables include:

- feed rate of sawdust;
- vegetable oil addition, at variable rate;
- water addition, at variable rate;
- steam addition;
- addition of powdered pelleting aids (binders) using a separate hopper with controllable feed rate.



Figure 4. Envirofire pellet stove

Good pellets can be made by selecting and regulating these different elements. For example, hardwoods tend to need oil to lubricate the flow; very dry material may need water or steam to help binding; material of high moisture content may also need oil. If consistent material is being processed and/or if a certain level of automation were added the mill would run unattended. The aim is to produce pellets of under 10% moisture and a density of greater than 0.6kg/litre.

The throughput of the pelleter will depend on the raw material being processed: whether it is hardwood or softwood; dense or light. The maximum rate of throughput obtained in the Coed Cymru trial was 180kg/hr (obtained using softwood and a large die). A throughput of up to 100kg/hr would seem to be realistic, although some hardwoods may achieve only half this.

ECONOMICS

With mill consumables (replacement die, rollers) currently costing £6.50 per tonne of pellets, rough estimates of the cost of production would range from £25 / tonne (at a very low throughput of 30kg/hour) to £12 / tonne (at a throughput of 120kg / hour). This excludes the granulator, labour, capital, oil (if used) and any raw material cost. Table 1 shows approximate production volumes and values for throughput rates of 30kg / hour and 120kg / hour based on a value of £120 / tonne for the final product. A fully automatic system should run considerably longer per day with a significantly increased throughput.

Table 1: Comparison of annual production for two different rates of throughput

Throughput (kg / hour)	Hours / day	Days / year	Annual output (tonnes)	Value at £120 / tonne
36	6	200	36	£4,230
120	6	200	144	£17,280

Those considering the manufacture of pellets need to satisfy themselves that a mill will be viable. The raw materials have to be relatively dry and in sufficient quantity. Generally, woodworking businesses producing a few hundred tonnes of dry shavings and sawdust a year will be good candidates, particularly where the material is free or its disposal represents a cost to the business. A number of farmers have diversified into timber processing and there will be slabwood that could be chipped and shredded for pellets, as long as sufficient time is allowed for drying. The resulting pellets may have a high bark / ash content.

MARKETS

The market for wood fuel pellets is growing steadily, with a number of larger installations appearing in public buildings. The rate of growth of this market in Wales is probably constrained by the current supply of pellets, and the reliance on imported pellets. As with all ventures, potential producers should thoroughly research their potential market. For further information it would be worth contacting the National Energy Foundation (www.logpile.co.uk) 01908 665555 or the British Pellet Club (www.british-pellet-club.org.uk) to discuss the market possibilities.