

Wood pellets - a cleaner kind of fuel

By George Estcourt¹

Wood pellets are a form of combustion fuel that is clean-burning, convenient and cost-effective. They are made from natural wood residues, which are dried and compressed.

Wood pellets are relatively new to New Zealand, but are fast gaining popularity, due to their clean burning nature, their convenience and their cost effectiveness. Wood pellets are made from dried, natural wood residues, which are compressed into small cylinders. This fuel is clean burning, convenient and cost effective.

Pellets have very low ash content. Wood pellets are sold and distributed in bulk or in convenient 10-20kg bags. The first pellet mill was established in Canterbury, nearly a decade ago, and there are now eight pellet mills throughout New Zealand.

The wood pellet industry is well established in Europe and North America. Today over 1.2 million pellet fires are in use throughout North America. In New Zealand, the largest plants involved in wood pellet production are in Rotorua and Christchurch. The wood pellets are mainly consumed in these centres, with a proportion of the pellets transported for use in other centres. The manufacturing capacity is above 100,000 tonnes per year on eight wood pellet plants, with plans under way to double this volume in the next few years. The present consumption of pellets is significantly lower - approximately 25,000 tonnes in 2008.

The Manufacturing Process

Green sawdust or dry shavings are the most common feedstock for the pelleting process so most of the wood pellets produced in New Zealand rely on sawmills to supply their raw material.

The pellet manufacturing process requires a low moisture content of feedstock (10% m.c wet basis) to create a high quality pellet. The final pellet must meet a certain criteria, so manufacturers aim for the following standard:



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<i>Length</i>	<i>max. 38 mm</i>
<i>Diameter</i>	<i>max. 10 mm</i>
<i>Calorific value</i>	<i>18 - 21 MJ/kg</i>
<i>Density</i>	<i>not specified</i>
<i>Piled weight</i>	<i>min. 640 kg/m³</i>
<i>Water content</i>	<i>max 8%</i>
<i>Ash content</i>	<i>max. 0.5%</i>
<i>Abrasion</i>	<i>not specified</i>
<i>Sulphur content</i>	<i>not specified</i>
<i>Nitrogen content</i>	<i>not specified</i>
<i>Chlorine content</i>	<i>not specified</i>
<i>Pressing additives</i>	<i>none</i>

The feedstock is collected from surrounding mills and delivered to the pellet plant. If wet sawdust is the main source then a drying plant is required. Green sawdust is around 50% m.c (wet basis) and needs to be taken down to 10% m.c (wet basis) prior to pelletising. All drying plants in New Zealand pellet mills are using biomass to produce the heat for drying. Plants that are able to purchase dry feedstock are at an advantage and only require dry storage for the wood shavings.

The dried product is screened and sieved for contaminants such as steel, soil and oversized material. The woody material is then put through a hammer mill to produce a uniform and small particle size. These particles are then fed into a pelletiser where they are pushed through a die with tapered holes. The shape of the die and the roller system creates huge pressures (5,000-15,000psi) within the woody material. This enables the lignin within the woody material to soften and flow. As the pellet exits the die it is cooled, solidifying the lignin which bonds the material together. There are no additives used in the manufacture of wood pellets in New Zealand.

Burning the Pellets

The most common means for burning wood pellets in New Zealand is the wood pellet stove used for residential heating. A variety of models are available in New Zealand - some locally made and others imported from Canada or Europe.

The benefit of the wood pellet stove is the simplicity of use. The wood pellets are poured into the back of the stove where it is stored and fed into the combustion area. Most pellet fires are capable of holding 20kgs of wood pellets at a time. This will require filling once every few days depending on usage. The wood pellets are augered into a crucible where the correct amount of fuel and combustion air is mixed to produce the best heat and emissions possible. Because the wood pellets have a guaranteed moisture content, the emissions from a well maintained wood pellet



Figure 1: Pellet fire

stove will always be within the design specs of the unit. This is untrue for wood fireplaces as the moisture content will be varied and the air for combustion can be altered manually.

Most wood pellet stoves have an auto ignition system and timers installed in them. They can be set to turn on prior to getting home in the evening or before waking in the morning.

The next step up from a stove is the wood pellet boiler. Boilers are suited to larger homes that require hot water for heating systems or large domestic hot water usage.

There are locally made units available, as well as many imported models. These units are between 25 and 50kW output and are ideal for underfloor heating or wall mounted radiators. Again these boilers are design specifically around the wood pellet fuel and produce minimal emissions. Over thirty schools have converted from coal to wood pellets in the last two years using this type of boiler system.

Fuel hoppers that can hold more than 100kgs of fuel are required when using this size of plant. Most hoppers can be located outside for ease of access. Boilers usually have auto ignition and are thermostatically controlled. Timers

can also be used to operate these boilers.

Fuel Efficiency

Wood pellets are one of the best ways to burn wood fibre for heat. Standard fireplaces range from 65 to 75% efficiency whereas wood pellet stoves are above 80% and up to 90% efficient. This means for the fuel that you purchase you will receive up to 20% more heat delivered to your home. This directly equates to spending less on fuel as you will burn less wood pellets in comparison to the firewood.

The Bulk density of the fuel is also important. Firewood when thrown is approx 250kg/m³ whereas wood pellets are around 660m³/kg. This is useful when you have limited space to store your fuel. For the same energy content in the fuel you will require about a 1/3 of the space to store your wood pellets in.

In terms of value for money, wood pellets have a much varied purchase price depending on where you are in New Zealand. If we use \$450/tonne for wood pellets and recover 5000kWh of heat for that tonne, we spend around 9 cents/kWh for heating.

When compared to 20cents/kWh for electricity, this is very competitive, although heat pumps do improve the efficiency of using electricity considerably. Gas can cost anything from 9 cents/kWh to 25 cents/kWh depending on whether you are on mains or bottled.

Coal to Wood Pellet Boiler Conversions

One of the advantages of wood pellets is the reduction in ash compared to coal. The wood pellet ash is also certified as a soil conditioner and can be applied to gardens as compost rather than landfilled. The clinker that is formed with burning coal is no longer an issue and the amount of cleaning of the boiler is also reduced considerably.

What does this mean for Forest Growers?

As previously mentioned, the ideal feedstock is a sawmill by-product. The wood pellet market is growing rapidly and the manufacturers of wood pellets are doing their best to keep ahead of this demand. An increase in the amount of sawmilling and processing is the key to continued supply of sawdust and shavings for this process. At some time in the future the use of forest residues will most likely become feasible as a feedstock for wood pellets.

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