

The demand for biofuels is changing the value of trees

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Figure 1: Processing logs into energy chip

Abstract

The demand for solid, gaseous and liquid biofuels throughout New Zealand is driven by government policies, particularly as a tool for reducing greenhouse gas emissions from energy use. The Government is also wanting to encourage the transformation of the forestry and wood processing sector so that greater value is derived from wood and a wider bioeconomy is established.

In the last 12 years the market for trading between unrelated parties of solid biofuel from forest and wood processing residues has developed, and in some regions of New Zealand is now well established. The demand for biomass residues has been driven by heat plant owners transitioning from fossil to solid biofuels. In these areas, demand for biomass has forced parties to become much more efficient at sourcing and preparing residues to be a quality fuel. As a consequence of increased demand for biomass residues for energy, the value of trees is increasing and financial returns are

encouraging forestry and agriculture to plant more trees and investigate new markets for the biomass.

Focus on quality

Residues as sourced from the forest or sawmill generally require some treatment to get the biomass size or moisture content to meet boiler fuel specifications. Wood fuel suppliers are aggregators of biomass from many variable sources, so need quality assured treatment processes for getting the collected biomass meeting the relevant fuel specifications.

To meet large fuel supply contracts, fuel suppliers are establishing hubs within the forest or elsewhere where the wood can be air dried and stored ready for chipping into specification compliant fuel close to when required. Recovery techniques are being improved as residue recovery is better integrated into harvest practices.

Most biomass sources are not homogenous, yet consistency of fuel quality is critical for good heat plant equipment operation. Buyers of wood fuel are insisting that suppliers have quality assurance systems. The Bioenergy Association Wood Fuel Supplier Accreditation Scheme meets that requirement, and also saves suppliers having to sample and test every load of fuel supplied. A focus on selling quality solid biofuels is increasing the value of residues.

Increasing demand for biofuels

The demand for solid biofuels is being driven by the Government's policies for transitioning from fossil fuels to bioenergy or electricity for stationary heat. The Government's Emissions Reduction Plan proposes banning new low- and medium-temperature coal boilers and phasing out existing ones by 2037. With coal no longer being able to be used, and natural gas having supply and cost issues, the options are principally biomass or electricity. Current users of coal have indicated a preference for using wood fuel over electricity, provided they can be confident that there will be a continuous and consistent supply.

Forestry owners near areas with large heat producers are recognising this opportunity and are working with accredited wood fuel suppliers to ensure there is a continuous supply of residues for the next three decades at least. Heat plants based on boiler systems generally have an economic life of around 30 years, so the supply of fuel should match the life of the equipment.

While the market for solid biofuels is now well established in some regions (Southland, Otago and

Canterbury) and moving into a mature phase, the opportunities for supplying biomass residues to produce gaseous and liquid biofuels are not being pursued by residue owners with the same intent. Yet these markets are immense, but they need investors.

The natural gas and liquefied petroleum gas (LPG) supply sectors are seriously investigating obtaining renewable gases from biomass (biogas) or hydrogen. The gas sector is concerned that they will be left with stranded assets unless they can obtain renewable gases. While the technologies for producing a biogas from wood are still in their infancy, this simply indicates that this should be an area for research.

Internationally, the demand for biocoal (torrefied wood) for replacing coal in steel works and electricity power stations is high, and this would be an opportunity for gaining additional value from biomass residues. New Zealand has enough biomass in our less populated areas where there is little demand for residues (e.g. Gisborne, Taumarunui/Te Kuiti, Northland and Westland), so that owners of unused residues in these regions should be trying to attract investors of biocoal manufacturing plant. There is a high interest from Asia in purchasing biocoal from New Zealand if it were produced here.

With the electricity sector having to invest in dry year firming solutions because of increased wind and solar electricity generation, and the cost of this being pegged to building the Lake Onslow pumped hydro scheme, the alternative of using biomass for Huntly Power Station to continue to fill that role has become much more economically attractive. Huntly operating in a dry year firming role would require significant amounts of biocoal to replace existing coal use.



Figure 2: Shelterbelt clearance with direct chipping into trucks

Table 1: A scenario of projected bioenergy demand by 2050

Application areas	Energy from bioenergy or biofuels (PJ)
Solid biofuels	
Residential/commercial	7
Wood processing (existing)	43
Stationary heat (fuel switching)	24
Electricity firming	15
	89
Liquid biofuels	
Domestic aviation	4
Domestic marine	2
International aviation	6
International marine	6
Heavy land transport	10
Rail	1
Off-road land transport	15
Stationary heat (fuel switching)	1
	45
Gaseous biofuels	
Electricity	3
Heat users (circular own use)	5
Transport	1
rLPG	1
Biomethane to gas network	6
	16
	150

Source: Information Sheet 61 (Bioenergy Association of NZ, 2022a)

Considering all these growing demands for biomass residues, analysis by the Bioenergy Association of NZ indicates that the current 9% of New Zealand's consumer energy that is produced from biomass could treble to 150 PJ p.a. by 2050, which will require a lot of biomass residues.

Table 1 provides a scenario of the possible demand for bioenergy and biofuels by 2050. This is a conservative scenario, and if drop-in transport biofuels were to be produced from wood the demand could be higher, thus requiring even more biomass to be available (Scion, 2022).

Sourcing biomass

Forest harvesting and wood processing residues are not waste. Residues are unused biomass that is often wasted because there has been no perceived market for the biomass. As the demand for biomass to produce biofuels increases, then so do the opportunities for gaining income from the residues.

Wood processors have a history of recovering and using residues to produce heat for timber drying, selling

bark, or using the material to manufacture engineered wood products. The forest growers in New Zealand do not have such developed practices for using residues.

In most businesses, if there is an assessed 15–20% of production not producing revenue then the business owners look for opportunities for turning the material, which is often being wasted, into a product. The forestry sector has ignored best business practice and not looked for commercial opportunities for its residues. However, that is now changing, and many forestry parties are looking to how their residues can most efficiently be recovered and turned into income by supplying the biomass to produce biofuels.

The demand for biomass residues has increased the revenue opportunities for forest owners, and with the withdrawal of coal from the market and the lack of availability of natural gas, the marginal price for heating fuel for stationary heat is now being set by higher-priced electricity.

The value of residues has also now reached the level where in some regions the diversion of low-grade logs from export, to use as an energy fuel, is commercially viable. The financial returns for lower-grade logs are enhanced when they no longer have to be cut to export size, thus allowing 100% of the log to be sold.

The Bioenergy Association has assessed a scenario of the ability for the market to supply the amount of biomass that would be required to supply 150 PJ p.a. of energy from it (Table 2), which shows that it is not even a stretch for this to occur.

The Table 2 scenario indicates that a trebling of the supply of biomass for energy does not require a lot of new plantation planting. Significant quantities of biomass could be available from extracting greater levels of residues from existing forestry and agricultural land uses.

If the targets for biomass availability set out in Table 2 are achieved by 2050 or earlier, then it is likely that the full potential from bioenergy and biofuels could be achieved by a doubling of biomass supply, but this would require additional forest planting. The quantities in Table 2 are essentially enough for kick-starting an expanded bioeconomy and changing land use to have a greater integration of forestry and agriculture.

Investment planning

Planting a tree is an investment. Like any investment, good research and planning can provide higher returns. Trees are a long-term investment wherever they are planted, and whatever species, so good planning and management will produce significantly higher returns.

Investment is also based on risk management, so thinking about what species, how and where a tree is planted regarding its performance while growing, and optimal recovery at end of service are critical decisions

Table 2: Scenario of the sources of biomass supply to treble bioenergy to 150 PJ p.a. by 2050

	2050	
	Energy PJ	Quantity
Biomass		
Municipal		
Municipal wood wastes	2.4	266,000 t p.a.
Arborist	0	158,000 t p.a.
Agriculture and horticulture		
Horticulture	0.9	126,000 t p.a.
Agriculture crop residues	6.2	351,000 t p.a.
Shelterbelt	0.6	82,000 m ³ p.a.
New farm forestry	16.9	
Wood processing		
Existing wood processing	43	
Port bark	1.8	262,000 t p.a.
Pulp log	5.6	817,000 m ³ p.a.
New wood processing residues	13.1	
Forestry		
Harvested carbon forest	2	
Production thinnings	1.6	232,000 m ³ p.a.
Waste thinnings	3.6	192,000 odt p.a.
Pruning residues	0.5	25,000 odt p.a.
Inforest landing residues	11.3	1,643,000 m ³ p.a.
Cutover – ground-based	8	1,164,000 m ³ p.a.
Cutover – hauler/cable	1	145,000 m ³ p.a.
Wilding forest	0.2	
New plantation forestry residues	10	
Non-residual sources		
Sawmill chip	11.6	1,688,000 t p.a.
Diversion from export K grade logs	31.4	4,546,000 t p.a.
Douglas fir production thinnings	0.9	
Energy crops	0	
	172.6	

Source: Information Sheet 61 (Bioenergy Association of NZ, 2022a)

to be made. Whether planted in a plantation/woodlot or for erosion control the right tree in the right place will provide greater financial returns.

With the increasing demand for biomass to produce solid, gaseous or liquid biofuels, the investment practices traditionally used need to be modified to optimise the financial return from selling the biomass to be used as an energy fuel.

Providing value from farm forestry

Integrating trees into farm operations can provide significant value to farmers, such as providing animal shelter, soil retention and the trees being a source of biomass to be supplied as an energy fuel.

Farm forestry is extensively practised throughout New Zealand by some farmers. There are, however, significant areas where the farms have few trees yet have ideal areas for planting. A number of sources suggest that around 6–9% of a farm is not highly productively used for production. These are the gullies, steep slopes and areas of limited soil productivity.

There are also the shelterbelts and erosion-prone areas where trees are often planted with limited consideration of end-of-life harvest ability. Integrating trees and farms to optimise soil management for farm production and forest production can result in multiple new revenue streams for the farm, thus potentially contributing to improved farm financial viability.

Existing farm forestry practices tend to focus on the biomass being sold only in the form of logs and the residues are left behind. The opportunities now being made available by biofuels provide an opportunity for farm foresters to look at how they can provide biomass for the full range of manufactured bio-based products that a bioeconomy opens up.

Areas of planting, such as shelter belts, are often planted with little thought of the trees also being a crop and harvested at an optimal age. The new design of shelterbelts (e.g. three row instead of single row) can increase the value of the trees planted and produce income.

In many rural areas, waiting for the biofuel opportunity investors to come seeking sources of biomass will be slow. However, by proactively working together in clusters to provide economies of scale, farm foresters will be able to encourage new biofuel production initiatives to come to them. An example is in the Upper Waitaki where a cluster of landowners have worked collectively to turn a problem (wilding pines) into an income stream, as the biomass from the wilding pines is now being harvested and supplied as a solid biofuel for heating.

To ensure security of biomass supply some heat plant owners are now entering into direct long-term contracts with nearby landowners to grow trees that will be available if at any time there are issues with biofuel supply contracts.

The Forestry and Wood Processing Industry Transformation Plan is a strong signal from the Government that it wants to assist the development of a bioeconomy. If farm forester clusters signal to the biofuels industry that there is biomass available, then this will incentivise biofuel investors to locate close to the source of biomass.

Some of the emerging liquid biofuel manufacturing technologies are modular (IEA Bioenergy, 2020). This



Figure 3: Small woodlot planted on gully slopes in coastal Taranaki

makes it easier for them to have a number of preliminary processing units spread around the country in different regions to process low-energy density biomass material into a semi-processed feedstock that can be taken to bigger biorefineries for processing into a final product.

Bioenergy a foot-in-the-door to a bioeconomy

While ‘conventional’ wood processing into bio-based products (such as building timber, mouldings and other engineered wood products) will provide the main structure and substance of a bioeconomy, it is the secondary processing of residues into energy and other bioproducts which is where a lot of new business will evolve. This can be seen internationally where the forestry sector has been instrumental in getting additional research funding for the manufacture of bio-based products from wood residues.

The development of the biomass residues supply chain for the production and supply of solid biofuels will also be able to be used for the supply of these residues for the manufacture of other bioproducts. In essence, the development of the solid biofuels market is providing the foundation for the supply of biomass residues to the widening bioeconomy.

As the bioeconomy expands there will be growing demand for biomass residues for a wide range of energy and other bioproducts. That competition for biomass is already in evidence throughout New Zealand where there is demand for biomass for pulp and paper, engineered wood products, animal bedding, landscape mulches and biofuels. These market pressures will ensure that biomass growers are always maximising its value and thus their financial returns.

The expansion of demand for biomass will require that it is sustainably produced. For plantation sources, this is expected to be residuals from FSC certified forests. For smaller area woodlot sources, where FSC certification cannot be justified, buyers will be expected to follow the Bioenergy Association Biofuel Sustainability Criteria, which require that the biomass is sourced from sustainably managed forests (Bioenergy Association of NZ, 2022b).

The investors in bioenergy using facilities will also require there to be a sustained (and known) volume of material available in the long term. This may require coordination and communication between fuel users and forests growers.



Figure 4: Gully slopes in coastal Taranaki ideal for small woodlots and where tree recovery at harvesting is easy and low cost

Tree growers can be confident that their wood production will always be in demand, but they will need to plan species and planting regimes so that as much as possible they produce the right wood for the most valuable use. However, if they get it wrong the biomass will always have a market – it may just not be what they originally thought it might be.

New business opportunities

Because New Zealand's manufacturing sector is so small it is going to need the push from the owners of biomass residues to develop new business bioproducts from their residues. An example is how the forestry company, Port Blakely, have developed a business in North Otago extracting essential oils from their Douglas fir forests. They harvest the foliage from the trees and remove the essential oils in their own on-site distillery. This is a role model that other forest owners are now looking to emulate. It is also a model of what the Forestry and Wood Processing Industry Transformation Plan is trying to encourage.

The stars are aligning and now it is up to each of us to think laterally and identify the products from wood that maximises its value, and biofuels is a good place to start.

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