Opportunities on the Bioenergy Wave

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Introduction

The New Zealand bioenergy sector is approaching a period of potential significant growth which can provide a number of opportunities for the metals and engineering industries. Securing the opportunities requires leadership and encouragement of entrepreneurs. The technology is often well understood but until now has been constrained by the relative economics of bioenergy compared to conventional energy sources. Other technologies, particularly for the production of liquid biofuels are emerging and will need to be developed further before full uptake is possible.

Increasing Sources of Bioenergy

There are very large amounts of a wide range of biomass feedstocks. New Zealand is energy rich. Sources of biomass for conversion to energy are;

- Woody biomass
  - Wood processing residues
  - Forest harvest residues
  - Purpose grown crops
- Municipal waste
  - Solid domestic refuse
  - Commercial refuse
  - Sewage
- Agricultural and horticulture
  - Processing residues
  - Harvest residues
- Algae

Many of these potential energy resources are residues from forest or crop production and harvesting, or from processing activities (figure 1). What is often a valuable residue with potentially a rich revenue stream is wasted by the way it is then handled.

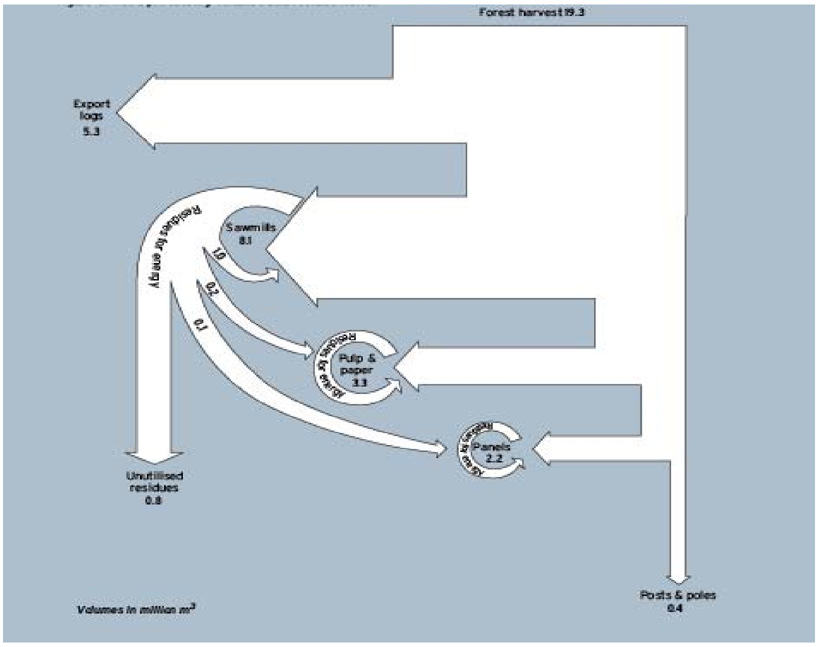

Figure 1: National wood processing volumes and resdue flows Source: Bioenergy Options for NZ, Scion

Many of the biomass sources are also increasing in the amount available, or becoming more economic to use as an energy source. Figure 2 shows the current estimated cost of production of chip from forest residues in the Central North Island.

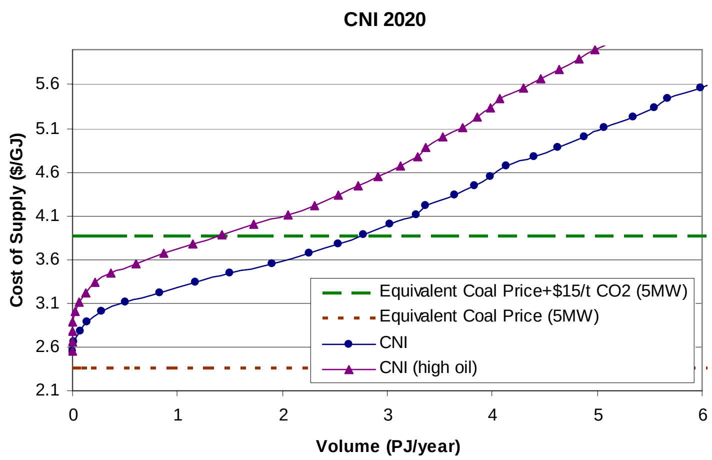

Figure 2: Cost of chip from forest residues

The relative economics of bioenergy resources are improving as there are economies of scale. Eg forest residue extraction and distribution costs reduce as improved mechanisation is adopted because of increased volumes being processed.

Demand for Bioenergy

The opportunities for utilisation of bioenergy are increasing as bioenergy becomes relatively more economic compared to conventional energy sources. This is leading to opportunities for fuel substitution as well as adoption of new uses.

The wood processing sector is near fully self sufficient in extracting heat from wood processing residues so opportunities must occur in other sectors.

Heat plant currently provide the greatest number of opportunities for utilisation of bioenergy;

- Most people focus on electricity and forget heat
- Heat opportunities are local
- Bioenergy, geothermal and solar heat is economic now
- Heat and cooling information is poor
- Few published role models or case studies

Woody biomass is also a very attractive fuel for heat;

- Fuel most within control of wood processors
- Uses waste materials
  - Forest residue
  - Process waste
- May require backup from coal, gas, forest residue or imported fuel
- Need to focus on fuel handling and processing
- Economics improved when biomass processed to be homogenous fuel

Transport fuel is New Zealand's largest energy use and this provides an opportunity for new technological developments for the metals manufacturing industry.

Wood fuel trading
The range of wood fuels extends from low grade forest residues to high grade wood pellets.

As suppliers and users distinguish between the different wood fuel characteristics a wood fuel trade is evolving. Trade by 2020/2030 is assessed to be as shown in Figure 3.

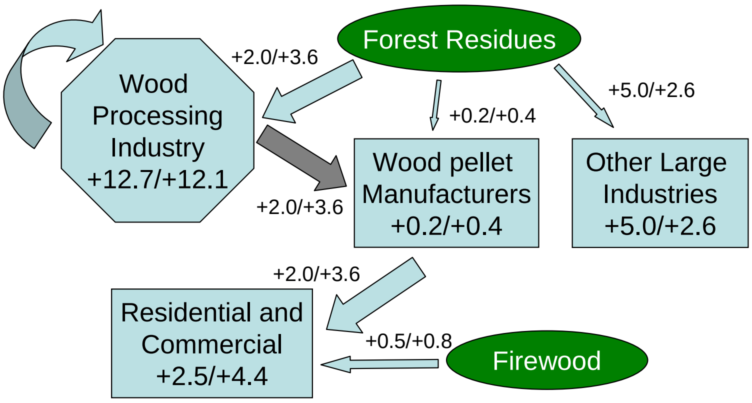

Figure 3: Assessed 2020/2030 wood fuel trading

The high grade residues are turned into valuable commodities such as wood pellets and chip while low grade fuel such as from forest residues is imported to a wood processing site and used for heat production in a boiler.

- Pellets
  - Has all the good characteristics of coal
- Chipping and hogging in the forest
  - Already economic
  - Ease of handling and transport
  - Reduced transport costs

Wood Pellets and chip are the premium wood fuel with;

- Wide range of applications – schools, hotels, institutions
- Ease of residential use
- Has the good characteristics of coal
- Can be combusted in low cost burners

The barriers to greater uptake are;

- Access to fuel
- Experience
- Cost of alternative fuels

Biogas Opportunities

Biogas can be obtained by anaerobic digestion of wet organic matter such as is produced from dairy shed wash down, food processing residues, and dairy sector processing. While there will be limited opportunities because of scale the technology is simple but needs more involvement from equipment suppliers.

Liquid Biofuel Feedstock Options

The greatest opportunity and at the same time the greatest technical challenge comes form pursuit of opportunities for the production of liquid biofuels. Primary sources of liquid biofuel are;

- Ethanol
  - Whey
  - Grain, grass and sugar crops
  - Woody biomass
- Biodiesel
  - Cooking oils / Tallow
  - Algae
  - Oil seed crops
  - Woody biomass -> bio-oil

The opportunities ahead for production of liquid biofuels from the wide range of sources are large provided the research and development is pursued;

- Whey
  - As a by-product limited by dairy processing
- Tallow
  - As a by-product limited by animal processing
  - Price set by export market
- Used cooking oil
  - Contamination from different oils
- Straw
  - Avoids emissions from burning
- Waste paper
  - Contamination
  - Zero additional collection costs
- Food processing residues
  - Seasonal supply
  - Competition from other uses

Arable Crops will be a valuable source of liquid biofuels

- Currently well established cropping industry
  - Existing equipment for growing and harvesting
  - Experienced in efficient growing techniques
  - Established distribution and storage arrangements
- Liquid biofuel crops value to farmers
  - Provides an additional revenue stream
  - Extends number of crops in a rotation
  - Improves land management
  - Can provide a secure market
- However competition from other land uses

Liquid biofuels are currently being produced in limited quantities but greater uptake is constrained by;

- Woody biomass is the biggest opportunity but also most difficult
- Whey, cooking oils, tallow are economic now but limited supply
- Crops economic and extensive availability

There is a wide range of technology options available as shown in Figure 4;

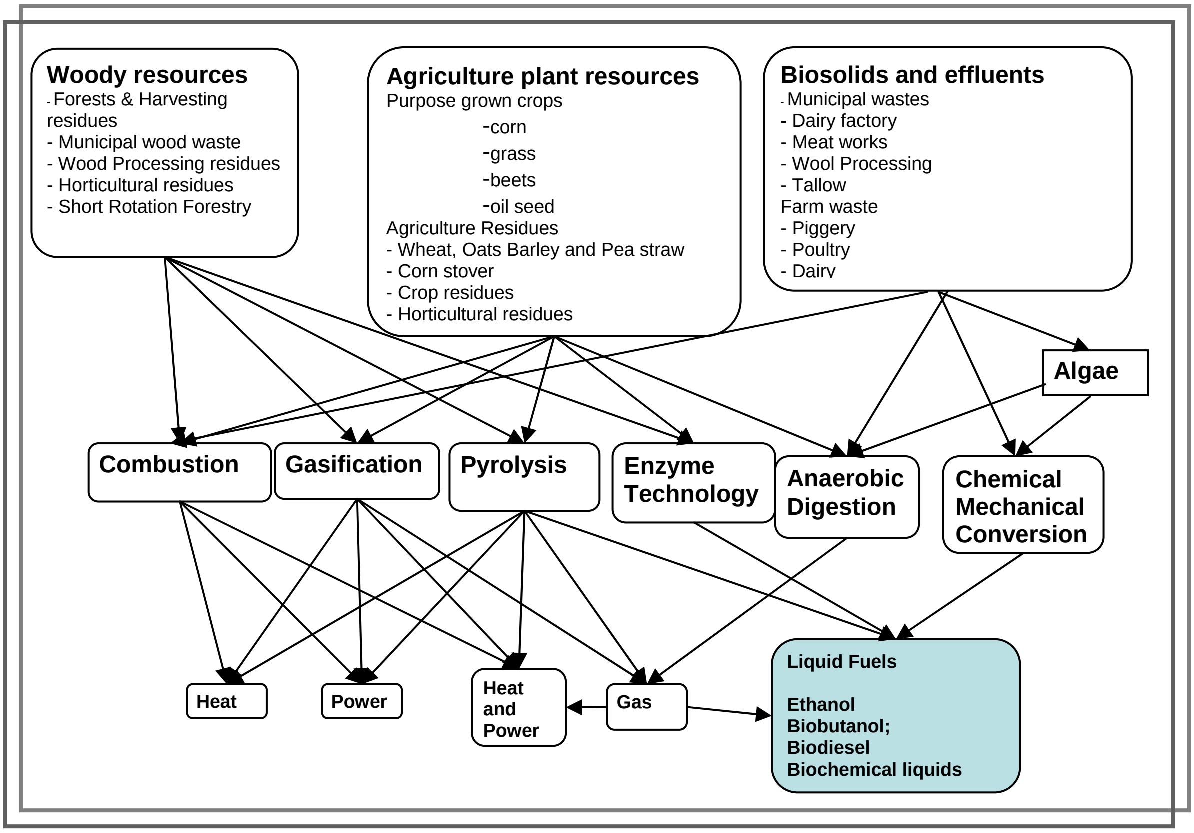

Figure 4: Processing of biomass to liquid biofuels

Production of ethanol is evolving at a gradual rate;

- NZ has well established industry based on whey
- Sugar crops have been grown in southland
- Well established 1st generation technologies
- Significant international research
- 2nd generation technologies => grasses, straw, stover

Biodiesel on the other hand is developing at a faster rate;

- NZ has small but established industry
  - used cooking oil
  - Tallow
- Biodiesel production is already underway
  - Biodiesel NZ – rape seed oil
  - Large scale processing plant underway
  - Already >6,000ha of oilseed rape is in the ground in NZ

Algae growing is a potential source of liquid biofuels;

- Laboratory scale is proven
- Issues of scale for move to commercial operation
- Need to focus on technologies that use less land
- Issues of harvesting
- Energy intensive conversion to liquid biofuels

The quality and consistency of supply of feedstock is critical if the fuel is to be used as a transport fuel where lives can be affected if there is a fuel failure.

What Is The Barrier To Using Bioenergy

Currently greater uptake of bioenergy is not occuring because;

- Alternative energy sources are still cheaper
- Few role models
- Unknown cost structure
- Lack of long term contracts for fuel supply
- Reliable known fuel quality
- No leaders
- No entrepreneurs