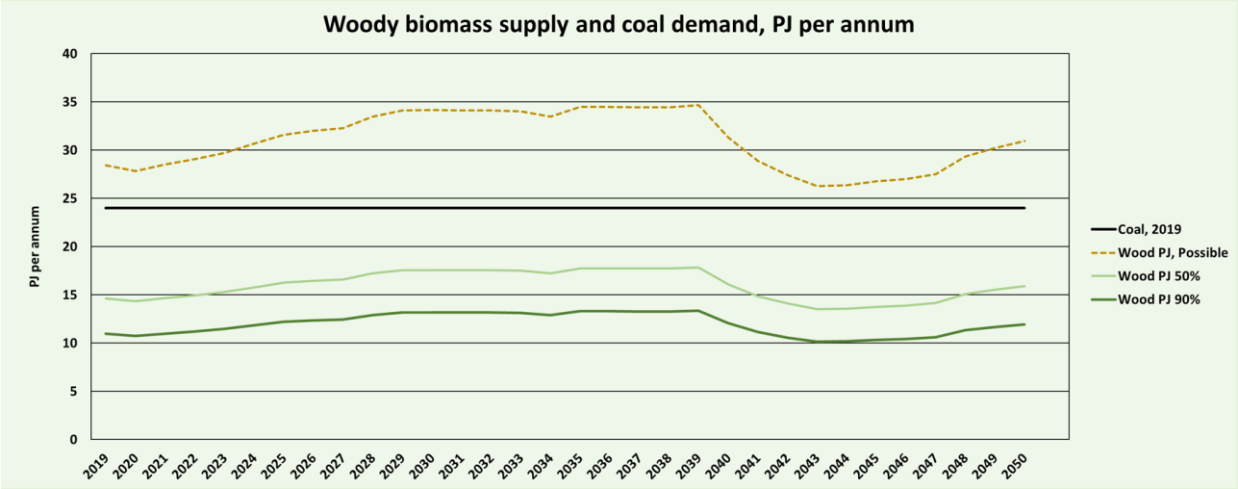
Biomass fuel resource availability projections

There is estimated to be 12 PJ per annum of biomass fuel available from current sources at a 1P (90% proven confidence level), 16 PJ per annum at a 2P (50% probable confidence level) and 32 PJ per annum at a 3P (10% possible confidence level). In addition there could be 1.7, 2.2 or 2.8 PJ per annum biomass fuel available at these confidence levels from farm shelterbelt/forestry and an unknown amount available from briquetting paper and cardboard and clean urban wood waste to be used as a boiler fuel.



Comparison is to the 24PJ per annum of coal which is currently mined.

Introduction

New Zealand is rich in biomass from wood and waste which can be used for combustion into energy. The biomass which can be made into heat plant fuel can be derived from in-forest residues, municipal wood waste, wood processing residues, orchard residues and straws / stover from arable cropping. The raw resource can be processed into and sold as pellets, briquettes of various sizes or chip / hog fuel[1].

[1] Chip fuel includes hog fuel, chopped herbaceous fuel and chipped wood

The benefits of using this natural renewable resource as fuel for production of heat are many, including the ability to significantly reduce site greenhouse gas (GHG's), reduce particulate emissions affecting resource consent compliance, and avoiding other issues that natural gas and coal fuel deliver.

While there are large areas of forest and farm woodlots harvested annually not all the potentially available raw biomass resource is recoverable and able to be converted into fuel. It is estimated that nationwide there is a gross supply of 5-6 million tonnes of biomass available per annum and from that 2-4 million tonnes per annum is currently economically recoverable and able to be produced as biomass fuel. This is enough biomass fuel to produce 19-32 million GJ of energy per annum.

Analysis by Scion[2] of the biomass resource available and estimates of the amount of combustible biomass residues suitable for heat fuel supply for 2017 and periods of 5, 10, 15, 20 and 25 years into the future (out to 2042); for gross supply and estimates of realisable / recoverable supply (tonnes and energy) at two levels of recovery are shown in Figure 1.

Figure 1: National volumes of biomass available and recoverable.

[2] *Residual biomass fuel projections for New Zealand*, P Hall, Scion, 2017

Assumptions

The estimates of biomass available and recoverable depend on the assumptions used. The assumptions used by Scion are set out in the full report. This allows others to apply their own assumptions to the base data on levels of recoverable biomass according to their own views of the biomass resource market.

The five key resources; in-forest residues, municipal wood waste, wood processing residues, orchard residues and straws / stover from arable cropping are described in terms of gross volumes (tonnes and energy) are estimated for two levels of recoverability (level 1 and level 2), with level 1 being more optimistic than level 2. The estimates of recoverable material vary by resource but are intended to allow for some material being unsuitable for recovery for accessibility, quality, financial or environmental reasons. The in-forest residues are assessed as three separate categories, landing, flat to rolling cutover and steep cutover.

These in-forest residues have differing levels of accessibility, cost of recovery and levels of recoverability. There are environmental limits which need to be applied to some resources (e.g. straw and stover and in-forest cutover residues) to maintain soil fertility and potentially mitigate soil erosion.

The characteristics (moisture content, ash content, gross calorific value and typical net calorific value) of the residues are described for each resource type.

Wood processing residue estimates do not include that material estimated as already being used by the wood processing industry for the production of on-site heat. Estimates of currently surplus quantities available from wood processing facilities are however included in the assessment.

Estimates of the amount of greenhouse gases (GHGs) that could be reduced by displacing coal with biomass are shown in the full report for national level data.

Bark from ports is a potential fuel resource. However, there are complicating issues around this material and its availability now and in the future;

- most of it is currently used for landscape mulch or composting
- predicting future volumes is difficult given the uncertainty around the impact of both phytosanitary regulations and log export markets / volumes.

Key resources

In-forest residues make up the bulk of the potential biomass residue supply. Growth in this supply will occur with a change in the economics of recovery or of forestry practices.

The cheapest biomass resource is municipal wood waste which currently attracts a gate fee averaging ~$100 per tonne depending on location[3].

There is only a small amount of wood residue available from wood processing operations as most of the wood processing residues are already used for energy by the wood processing operation or sold as other products (animal bedding, mulch etc.). The level of wood processing is assumed to continue at the current level.

Straw and stover could make a substantial contribution in some regions (especially Canterbury). However, these materials may not be suited to existing boiler infrastructure and may require purpose built boilers that are designed for straws. Otherwise densification (pelletisation) and co-firing at low percentages (>5%) in biomass/coal boilers may be possible

Details of the amounts of biomass recoverable over the next 25 years for each resource are set out in the full report.

Regional analysis

Scion have also undertaken analysis of the resource available on a regional basis and this is shown for all resources in Table 1 and for all resources for the level 1 recovery assumptions in Figure 2.

Table 1: All resources – recoverability level 1 (tonnes)

	2017	2022	2027	2032	2037	2042
Northland	236,385	207,221	154,680	105,886	162,382	227,588
Auckland	140,630	178,522	183,139	166,381	149,021	152,869
Waikato	175,179	285,957	235,244	127,511	137,402	168,032
Bay of Plenty	822,666	1,006,096	1,073,634	927,947	930,853	1,027,660
Gisborne	271,638	303,006	224,730	141,078	162,152	212,560
Hawkes Bay	218,989	305,203	249,721	185,750	152,210	157,549
Taranaki	55,396	61,658	42,532	30,662	27,468	29,206
Manawatu-Wanganui	216,266	267,234	178,832	95,784	84,931	96,276
Wellington	104,110	112,343	99,482	82,896	82,938	89,878
Tasman / Nelson	152,627	175,679	155,047	151,177	133,097	117,924
Marlborough	119,183	126,708	100,541	89,306	104,096	121,377
West Coast	52,863	52,848	56,999	55,115	48,525	40,913
Canterbury	229,097	264,675	217,398	143,466	119,133	126,406
Otago	215,887	278,218	245,932	192,046	181,959	179,232
Southland	108,028	180,358	174,981	118,363	94,742	92,290
Total	3,178,245	3,938,440	3,618,581	2,726,317	2,631,640	2,900,164

The 2037 column is highlighted (green) as this is a predicted low point in supply. Fluctuations in potential volume of forest harvest is driven by the uneven age class distribution of the forest resource.

[3] The volume is the amount recorded as being sent to municipal landfill. It does not capture material being used for other purposes or going to private landfills as this volume is not measured.

Figure 2 shows the total biomass (green tonnes) under recoverability level 1, by region[4] and resource type for the period 2032 to 2037. This period is chosen as it represents the low point in supply in the 25 year period assessed.

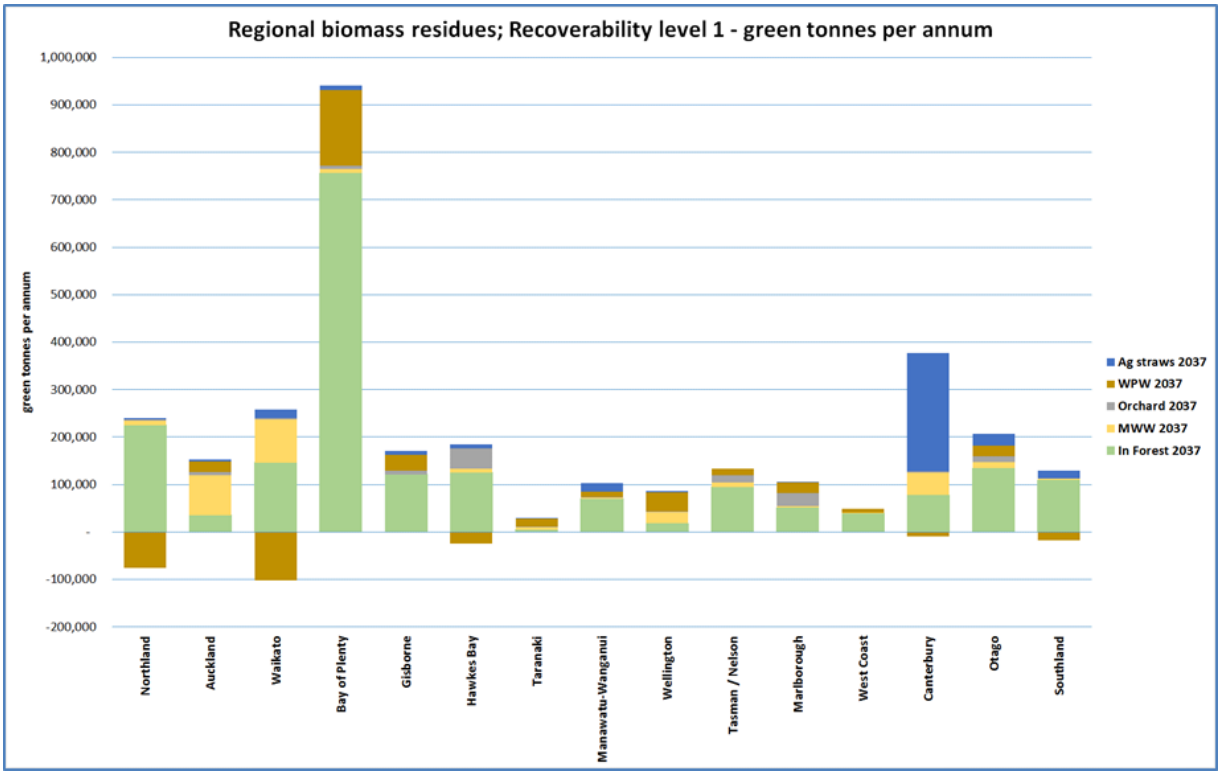


Figure 2: Regional biomass recoverable (level1) by type in 2037-

There are some standout items; in-forest residues occur in all regions - in proportion to the size of the forest estate and the slope of the land on which those forests occur. Hence the Bay of Plenty has a large volume of residues available and recoverable as it has a large forest resource, much of which is on flat to rolling terrain.

Canterbury is the one region that has a substantial resource coming from agricultural straws.

There are several regions where the wood processing residue volume is negative - this is in regions where there are several energy intensive (LVL, MDF, pulp and paper) wood processors drawing in biomass from some distance away. Auckland and Waikato have large quantities of municipal wood waste - which is largely population driven. Location of source, end-use and the ability to transport denser biomass sources (pellets) does allow for demand smoothing across adjacent regions.

[4] The net quantities by region are shown in the full report in appendix 5. There may be transfer between regions; e.g. wood processing residues from Bay of plenty going to the cogen plant at Kinleith (Waikato).

Use of the data

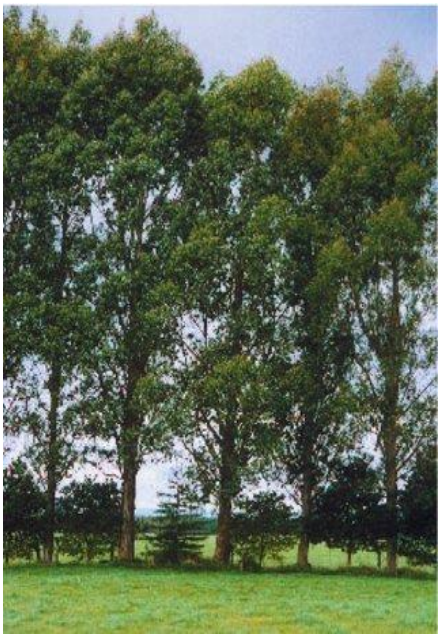
The Bioenergy Association has provided this data as a guide for the heat sector on the likely biomass that could be recovered and made available as saleable biomass fuel.

Whilst the gross levels of biomass availability are a useful start point, they should not be used as an estimate of commercially extractable biomass without further, more detailed examination of the resources at a site specific level.

Within any region the residuals resource is finite, and the first users to contract supply are likely to get the cheapest and / or best quality resources. Subsequent entrants to the market may find that the cost of supply is greater than the assumptions in this analysis.

As time progresses it is possible that the use of woody residues from a variety of sources will increase. This data on wood energy use needs to be captured and the information added to the data set here, so that true volumes are presented in future updates. For example, at the moment, there is very little use of in-forest residues, but if this changes and large volumes are extracted in a particular region, this should be noted so that the total availability is still accurate.

The development of new or expanded wood processing facilities will have an effect on the supply of harvest and wood processing residues. These changes are difficult to predict and therefore a review of the data at a regional level on a regular basis (bi-annual) is suggested.



Better, more up-to-date data on orchard and arable crop residues is potentially available and it is hoped that this be available for the next revision of this data set. The areas of arable cropping can change from year to year. Forest areas are not subject to change quite as quickly as the crop rotation length is ~25 years. However, there are still changes to the data on the forest resource and the Ministry of Primary Industries provides an annual update (National Exotic Forest Description(NEFD)) and any major changes in this should be noted and incorporated in any updates. The methods used to generate the NEFD are being reviewed and in the next 2 years it is possible that the data will be more spatially based. Data on bark at ports should be examined in more detail.

New Zealand is well poised to continue and expand its use of renewable biomass for its energy requirements and significantly reducing the demand for natural gas and coal fuels. This report highlights the availability of current streams of biomass but as demand, technology and the overall markets grow so can the biomass market to enable continued supply.

In theory biomass could replace around 60% of New Zealand's coal demand, with a greenhouse gas impact of up to ~1.0 million tonnes of CO_2e per annum.