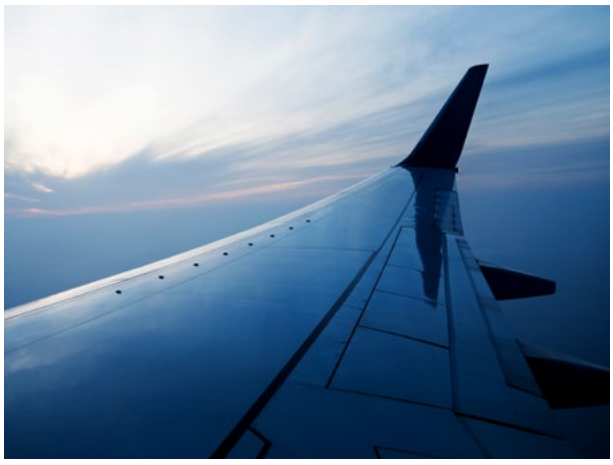
Bioeconomy Science Institute™
Maiangi Taiao

Energy potential of New Zealand's residual biomass resources

Energy demand is a frequent topic in the news, particularly around cost, carbon emissions and availability. Woody or ligno-cellulosic biomass is a significant untapped resource widely available in New Zealand. It could make a much larger contribution to New Zealand's energy needs than it does now.



A large biomass resource is derived from post-harvest residues from our planted forests.

Woody biomass is a low carbon option but, in the past, it was unfavoured as the costs were not competitive with traditional fossil sources. Changing to wood often has associated capital costs.

More recently there have been significant market changes; the price of gas has risen sharply as there have been shortages of electricity, causing price spikes.

The Bioeconomy Science Institute Maiangi Taiao has updated its residual biomass resources summary to describe the size, location, type and timing of the availability of a range of woody biomass resources. This info sheet presents a high-level summary of this data.

Type of residues

- In-forest residues (post-harvest)*
- Municipal wood waste (MWW)
- Wood processing residues (WPR)
- Orchard residues (removal of over-mature trees)
- Straws / stover from arable cropping,
- Port bark
- Shelter belt turnover / harvest residues
- *Pinus Radiata* and Douglas-fir production thinnings
- Waste thinnings
- Pruning residues
- Pulp logs (surplus to domestic demand)
- KIS, KS, KZ logs

* These residues are assessed based on location (landings, flat to rolling cutovers (CO GB), steep cutovers (CO Hauler). (Table 1).

The fuel characteristics of the residues are described (moisture content, ash content, gross calorific value and typical net calorific value). (Table 3).

Table 1: volume of residual biomass

	2024-2028	2029-2033	2034-2038	2039-2043	2044-2048	2049-2053
In-forest post-harvest*	3,842,944	2,785,329	2,353,087	2,387,255	2,505,697	2,971,222
MWW	235,710	253,414	272,779	293,980	317,213	342,698
Orchard	121,511	123,942	126,420	128,949	131,528	134,158
Straw and stover	294,782	300,678	306,691	312,825	319,081	325,463
Shelter belt	81,920	81,920	81,920	81,920	81,920	81,920
Thin to waste	488,544	477,446	332,923	343,142	359,854	392,278
Production thin residues	28,732	26,328	195,881	275,250	146,012	69,047
Port bark	227,928	205,135	193,739	227,928	227,928	227,928
Prunings	13,764	61,356	34,909	19,868	14,435	13,764
Douglas fir production thinnings	438,192	470,512	101,744	108,498	-	-
Sawmill chip surplus	569,085	569,085	569,085	569,085	569,085	569,085
Pulp log (surplus to domestic demand)	2,120,926	368,845	-202,915	-101,579	21,617	257,422
KIS, etc grade logs**	4,211,674	3,247,273	2,843,215	2,953,903	3,643,362	4,497,075
Total	**12,675,712**	**8,971,263**	**7,209,478**	**7,601,024**	**8,337,732**	**9,882,060**

* data in cubic metres per annum, **excludes K grade, includes, KIS, KS and KI

Size of biomass resources

An estimate of current use of these residual woody resources around 290,000 green tonnes per annum. However, this figure is likely to increase in the future as coal burning operations look to low carbon alternatives for their heat supply. The declining supply of natural gas from domestic sources along with the associated rising prices for gas may also lead to increased interest in wood as a process heat fuel. This use of the residuals needs to be tracked and publicly reported to give confidence to potential wood fuel users around available supply at a local level.

Based on our latest summary, New Zealand will produce a cumulative total of 12,675,712 green tonnes in 2024-2028, far in excess of current usage. (Table 1). This includes low grade logs such as KIS etc. that are not required by wood processors in New Zealand and are exported.

In addition to residual biomass, there are potential non-residue resources not being used. This includes K-grade logs, stumps and wood from Eucalyptus nitens (SRF eucalyptus forests) currently exported as chip. Including this volume would add 340,000 green tonnes per annum to New Zealand's available biomass.

Table 2: volume of non-residue biomass resources (green tonnes per annum)

	A grade logs	Stumps	SRF eucalyptus forests
2024-2028	6,438,550	250,296	340,000
2029-2033	11,008,204	175,200	340,000
2034-2038	8,500,522	133,641	340,000
2039-2043	6,742,599	133,427	340,000
2044-2048	6,798,078	146,243	340,000
2049-2053	7,340,516	158,162	340,000

Location Recoverability

The estimates of recoverable material vary by resource but are intended to allow for some material being unsuitable for recovery for quality, financial or environmental reasons.

The availability of post-silvicultural treatment residues such as waste thinnings and prunings are affected by slope. The split of forest where logging operations require hauler-based operations versus ground based operations are estimated from geographic information system analysis at a territorial authority level.

Timing of availability

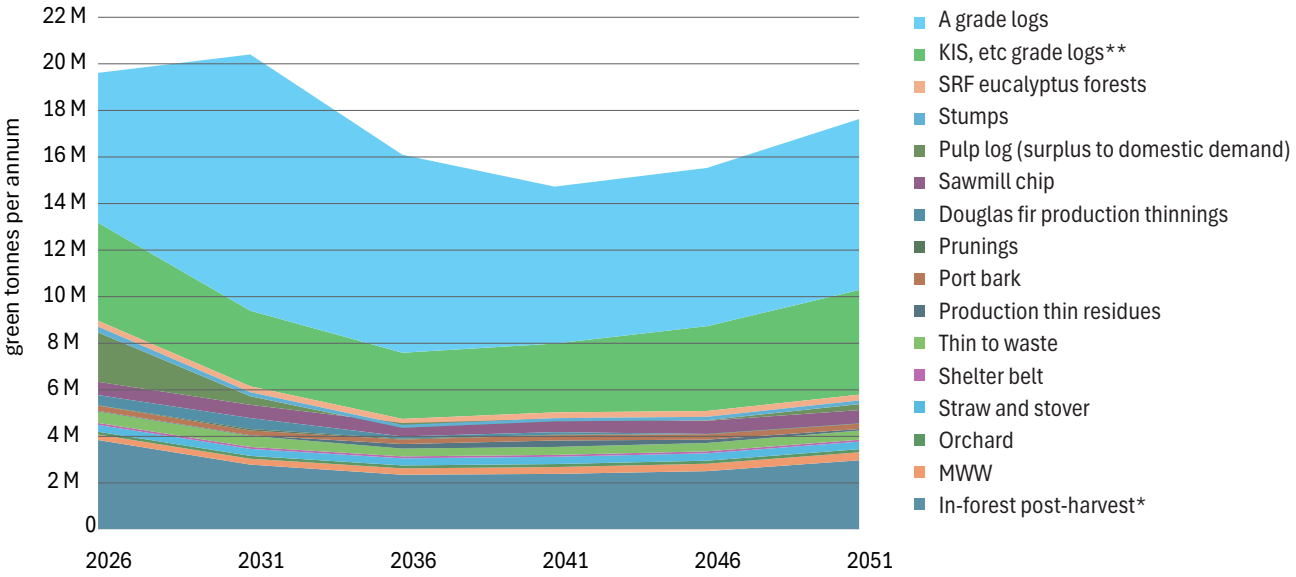
Taking all available types of biomass residues and low grade logs, New Zealand is projected to produce between 15 to 20 million green tonnes per annum until 2051. Allowing for the anticipated rise in demand for sustainable fuels, we don't necessarily need to plant more trees, but utilise our existing resources.

Table 3: Biomass residue fuel properties; by type

	Moisture Content % wet basis	Ash Content % dry weight	NCV, GJ per tonne
Landing stem	56.5	1.8	6.8
CO GB stem	51.5	0.9	7.7
CO mixed	51.5	4.8	7.4
MWW	31.5	4.5	11.0
WPR Wood**	58.0	0.5	7.3
WPR Bark debarker	53.0	3.0	7.4
Logs, K, SRF & A	58.0	0.3	7.1

**includes a mix of residues (sawdust, off-cuts and dry shavings)

Figure 1 – volume by resource over time



Costs

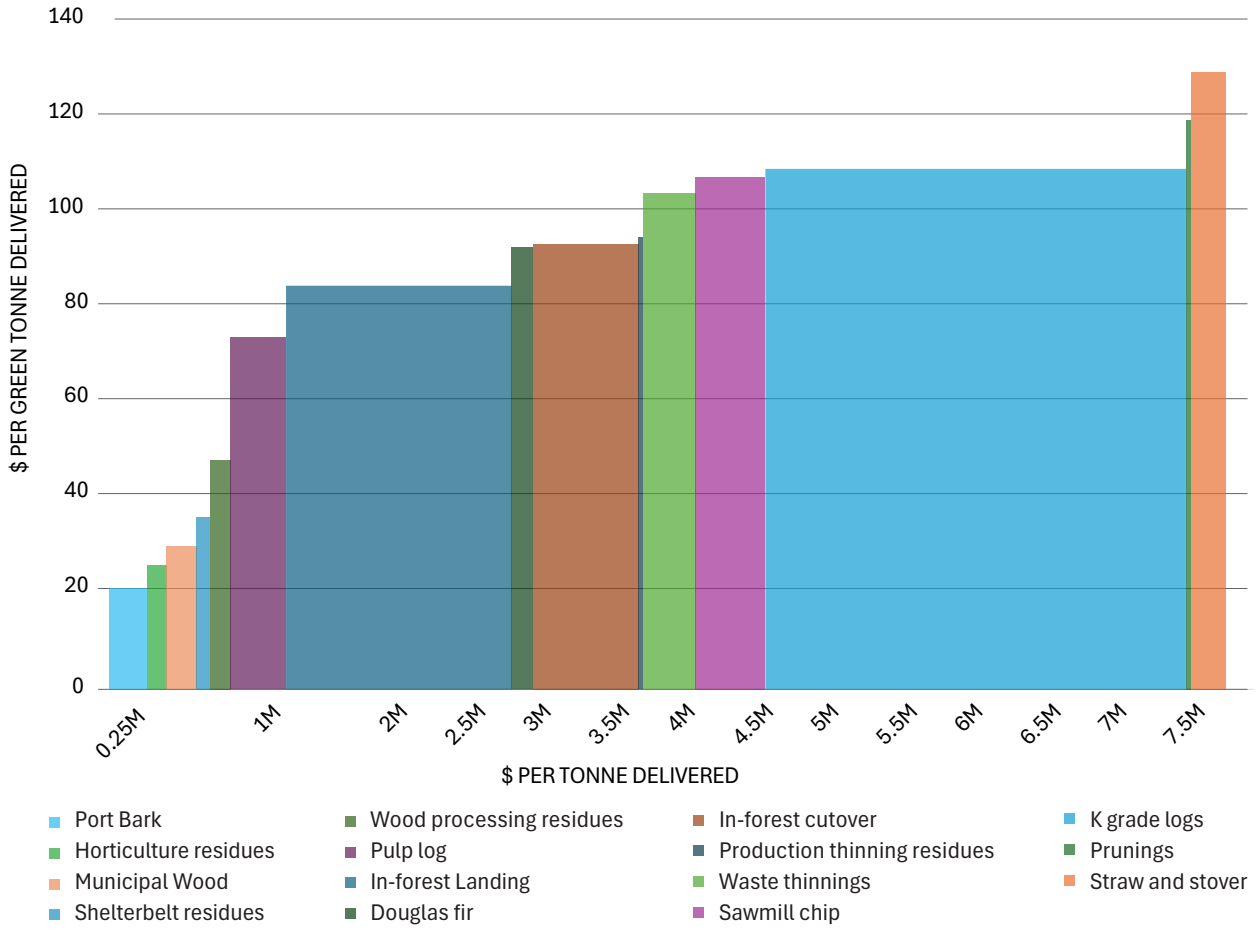
The costs of the various resources including; any fees for accessing the materials, recovery / harvesting, hogging, screening, loading and transport are estimated based on 2024 costs for capital, fuel, labour etc. (Table 4). These costs are an estimate and are not intended to indicate market prices but as an indicator of where prices might start.

Table 4: Estimated costs for various biomass resources delivered (90 km) in fuel form;

Residue type	Biomass owners fee: $ per green tonne	Cost $ per green tonne	Cost $ per GJ
In-forest residues - landings	25	85	12.32
In-forest residues - cutover	20	94	13.62
Wood processing residues	20	48	7.02
Municipal wood waste	10	30	4.35
Port bark	5	21	3.04
Horticultural residues	10	26	3.77
Straw and Stover*	100	130	11.82
Shelter belt residuals	20	36	3.27
Production thinnings residuals	20	95	13.77
Waste thinnings	20	105	15.22
Prunings	5	120	17.39
Pulp log	59	59	8.55
Sawmill chip	80	108	15.71
K grade logs	95	95	13.77
A grade logs	117	117	16.96
Douglas-fir production thinnings	65	93	13.48
Stumps	25	145	21.07

*Straw is assumed to have a "green" moisture content of 15% wet basis
Cost ($ per GJ) supply curve for national amounts (GJ per annum) of biomass by resource type

Figure 2 – national level cost supply curve for the various biomass resources



Summary

The woody biomass resource in New Zealand is substantial. These figures are for a variable percentage (1st recovery level) of the gross resources estimated to be available. Full details on the percentages and the gross resources are presented in the full report.

The long run supply of material that could be considered for wood and other lignocellulosic biomass fuels is around 7.3 million green tonnes per annum based on the low point in supply around 2037 caused by historic variation in forest plantings. If the materials that currently have a market (sawmill chip, pulp logs that are utilised domestically and export K grade logs) are excluded the total is around 4.1 million green tonnes per annum.

Acknowledgements

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MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Resources

A full version of the report on New Zealand biomass resources is available from the the Bioeconomy Science Institute, BANZ, or IEA Bioenergy Task 43 websites.

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