

Country Report

New Zealand

November 2014



Kirk Torr, Scion

Content

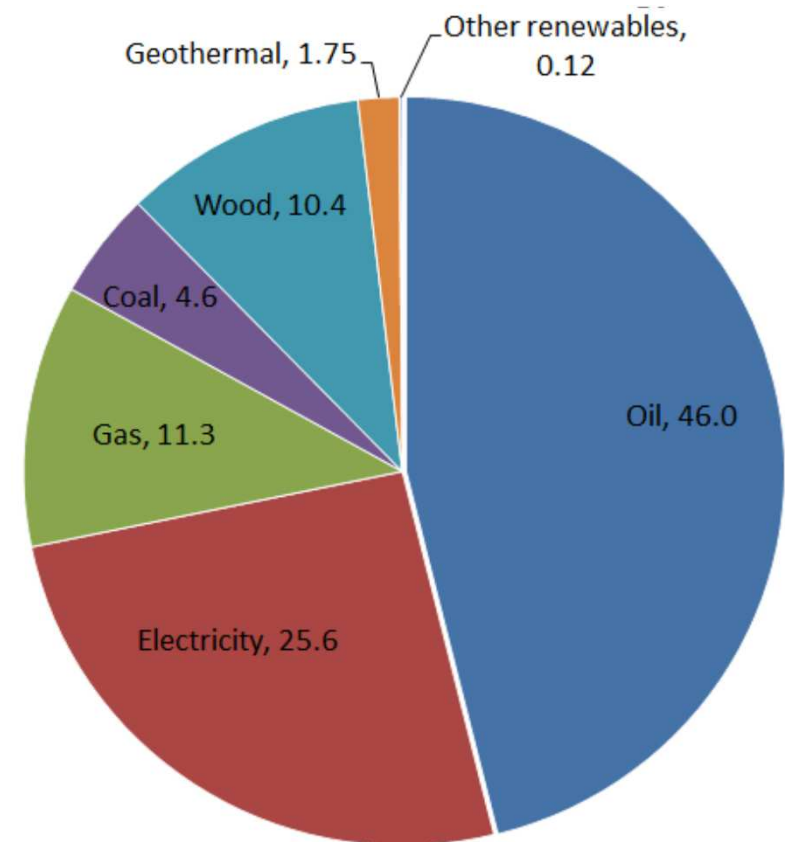
- Country specific energy consumption
- Biomass use for energy and non-energetic applications
- Biomass related policy issues
- Biomass related sustainability aspects
- Bio(based) Economy strategy
- Running commercial biorefineries
- Biorefinery pilot plants
- Major R&D projects
- Major national stakeholders interested in biorefining

Country specific energy consumption

- Total consumer energy = 544 PJ
- Oil consumption (249 PJ) almost all imported
 - Oil production (74 PJ) all exported
- Electricity (140 PJ) - 75% renewables
 - (hydro 55%, geothermal 15%)
- Woody biomass (58 PJ)
 - direct-use heating 91%
 - heat & power 9%
- Biofuels <0.1% of total transportation energy

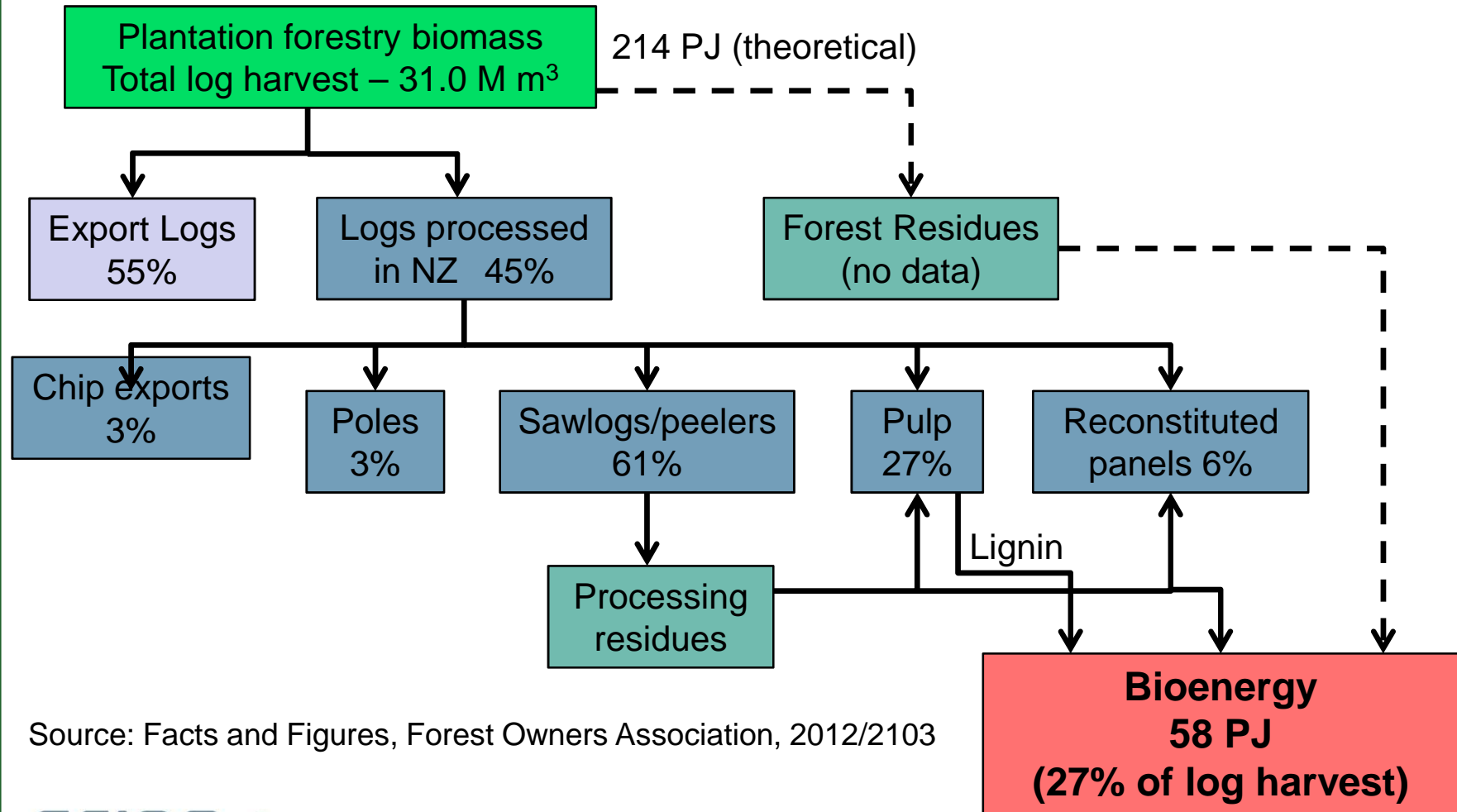
Source: Energy in New Zealand, 2014, Ministry Business Innovation and Employment

Consumer energy, %



Biomass use for energy and non-energetic applications

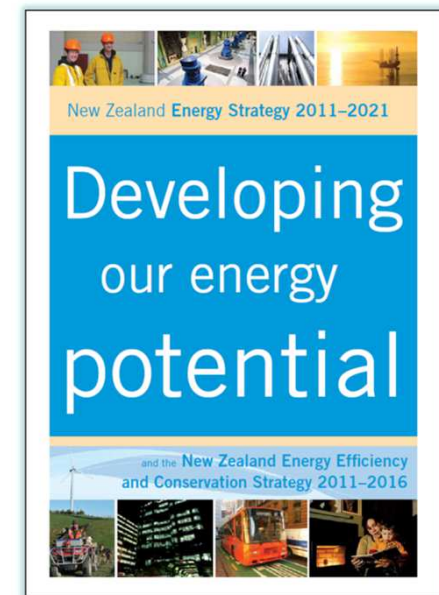
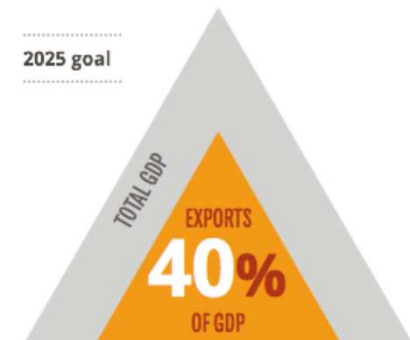
Woody biomass is the only significant biomass feedstock used for energy



Source: Facts and Figures, Forest Owners Association, 2012/2103

Biomass related policy issues

- Government Business Growth Agenda
 - Build a more productive economy with a goal to increase the ratio of exports to GDP to 40% by 2025
 - Bioeconomy contributes to ~70% of NZ's exports
 - Wood is NZ's third largest export earner
 - Increasing forestry exports will require more on-shore wood processing → role for wood-to-energy projects
 - Government Energy Strategy
 - Encourage biomass-to-energy development
 - Support industry's bioenergy strategy
 - Embrace new technologies - support bioenergy R&D
 - Biofuels part of strategy, but only limited encouragement to implementation
 - Tax exemption for ethanol in transport fuels
 - Biodiesel grants scheme ended June 2012
- (<http://www.med.govt.nz/sectors-industries/energy/strategies>)



Biomass related sustainability aspects

- Greenhouse gas emissions
 - Government target to reduce emissions by 50% from 1990 levels by 2050
 - Two largest contributors are agriculture (46%) and energy (42%)
 - Policies to reduce emissions
 - Emissions Trading Scheme
 - Promoting renewable energy and energy efficiency
- Operational Emissions Trading Scheme
 - All sectors included, but different phase-in dates
 - Forestry (2008)
 - Transport, energy & industrial (2010)
 - Waste, synthetic gases (2013)
 - However, currently the price for carbon is very low

Bio(based) Economy Strategy

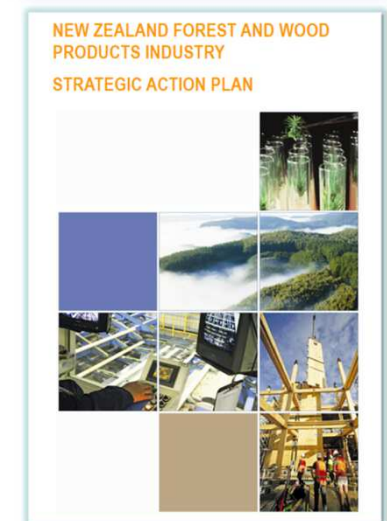
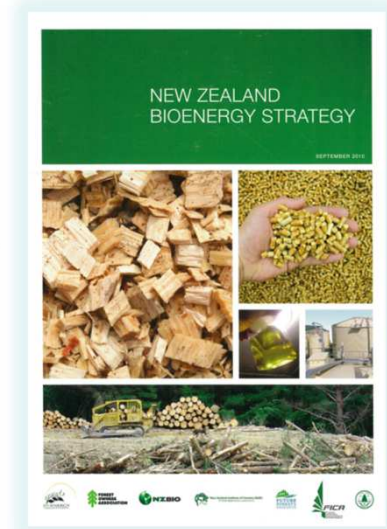
- NZ Bioenergy Strategy – jointly developed by forestry and bioenergy sectors

Vision: Economic growth and employment built on NZ's capability and expertise in forestry, wood processing and bioenergy production - leading to new business opportunities which by 2040 supply more than 25% of the country's energy needs, including 30% of the country's transport fuel.
(<http://www.bioenergy.org.nz/resources.asp>)

- NZ Forest and Wood Products Industry – Strategic Action Plan

Vision: By 2022 double annual export earnings to \$12 billion from the forest and wood products sector by significantly increasing the volume of wood processed in New Zealand.

- Includes manufacturing a range of high-value, fibre-based products including biochemicals and biofuel values streams.
(<http://www.woodco.org.nz/strategic-plans>)



Bio(based) Economy Strategy

- Thinking strategically about biofuels – NZ Parliamentary Commissioner for the Environment
 - Only wood can be grown in sufficient quantities to make biofuels mainstream
 - Target drop-in biofuel substitutes for diesel
(<http://www.pce.parliament.nz/publications/all-publications/some-biofuels-are-better-than-others-thinking-strategically-about-biofuels>)
- Bioenergy Options for New Zealand - Scion

“ There is an environmentally and economically beneficial, national scale opportunity for energy production, particularly transport fuels, both from existing forests and new forests on marginal land”
(<http://www.scionresearch.com/general/publications/technical-reports/bioenergy>)



SCION 
Next generation innovation



Running commercial biorefineries

Kinleith Pulp Mill

Type of biorefinery: A 3-platform (pulp, black liquor, electricity/heat) biorefinery producing pulp/paperboard products, electricity and heat, and chemicals from wood.

Location: Tokoroa, New Zealand

Owner: Carter Holt Harvey (to be purchased by Oji Oceania Management (NZ) Ltd)

Description of the plant: New Zealand's largest pulp and paper mill producing bleached softwood kraft pulp and paperboard products from *Pinus radiata* wood. Black liquor and waste wood are burnt to generate electricity and heat. Chemical by-products including crude tall oil, crude turpentine and terpene extracts.



Running commercial biorefineries

Edgecumbe Milk Processing Plant

Type of biorefinery: A 2-platform (whey/protein) biorefinery producing food products and bioethanol from milk

Location: Edgecumbe, New Zealand

Owner: Fonterra Cooperative Group Ltd

Description of the plant: Fonterra's Edgecumbe milk processing plant processes 3.2 million litres of milk per day. Anchor Ethanol Limited (a subsidiary of Fonterra) produces ethanol from the whey/permeate by-product from the manufacture of cheese and protein products. The Edgecumbe plant, together with two other plants (Tirau, Reporoa) can produce 15 million litres of ethanol/year.



Biorefinery pilot plants

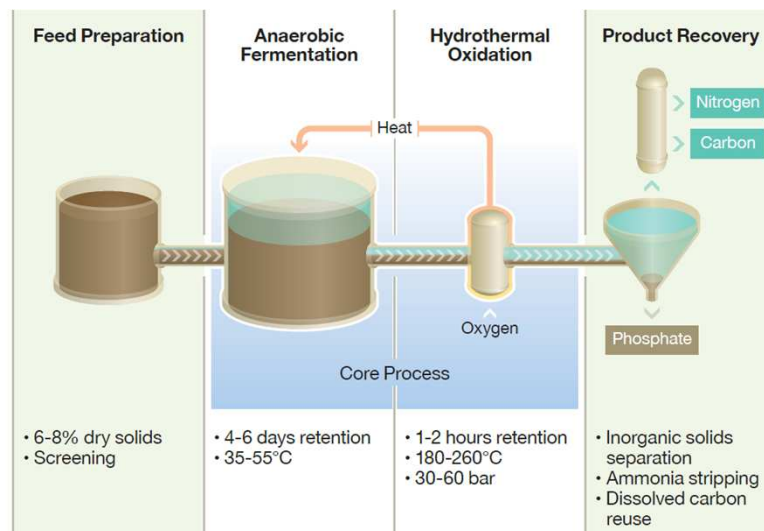
Terax™ Pilot Plant (<http://www.terax.co.nz>)

Type of biorefinery: A biorefinery pilot plant producing chemicals and fertilizer from wastewater treatment biosolids or municipal organic waste

Location: Rotorua, New Zealand

Owner: Rotorua District Council

Description of the plant: The core TERAX™ technology is a two stage process involving anaerobic fermentation followed by hydrothermal oxidation for treatment of waste biosolids. The process produces acetic acid, ammonium sulphate and a phosphate-rich ash.



Major R&D projects

Stump to Pump Project - forest waste to liquid biofuels

Partners:

- Norske Skog Tasman (wood processing)
 - Z Energy (fuel refining, distribution and sales)
- supported by Ministry for Primary Industries



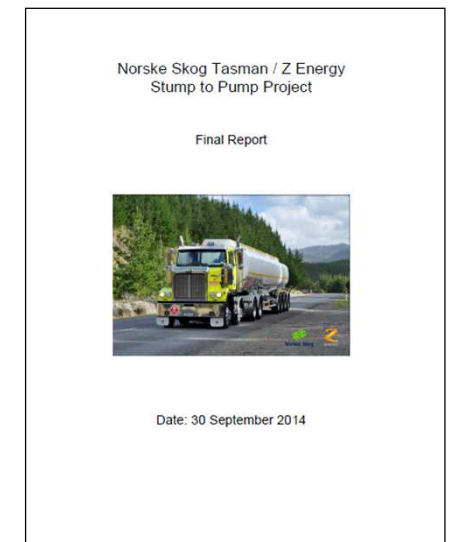
Stage 1 - determine viability of biofuel business in NZ from radiata pine residues

- NZD 13.25 M, 50% Govt-funded
- completed Sept 2014

Stage 2 was to be a 50,000 tpa modular test plant

- on-hold as industry partners conduct testing on fuel quality and certification

(<http://www.mpi.govt.nz/agriculture/funding-programmes/primary-growth-partnership/stump-to-pump-forest-waste-to-liquid-biofuels>)



Scion's Biorefinery Research

Scion is a NZ Crown Research Institute undertaking biorefinery R&D in:

- Softwood feedstocks
- Softwood pretreatment
- Saccharification and fermentation to biochemicals/bioplastics
- Thermochemical technologies to liquid fuels and chemicals
- Biorefinery co-products – extractives, lignin and hemicelluloses
- Wood/bioplastic composites
- Waste biomass utilisation
- System analysis and modelling

(<http://www.scionresearch.com/general/home>)

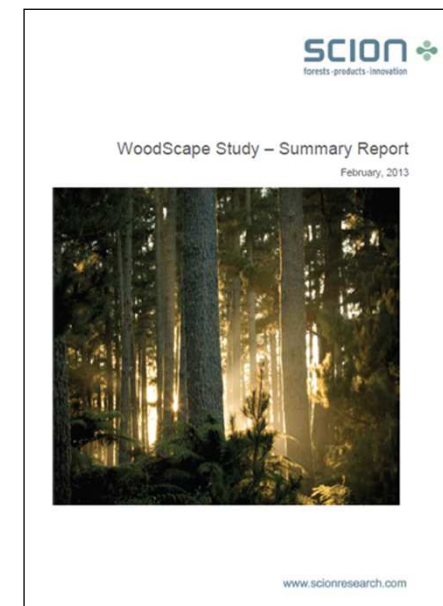
Scion is also the NZ representative of IEA Bioenergy Task 39 Commercializing Liquid Biofuels



Major R&D projects

Woodscape Study

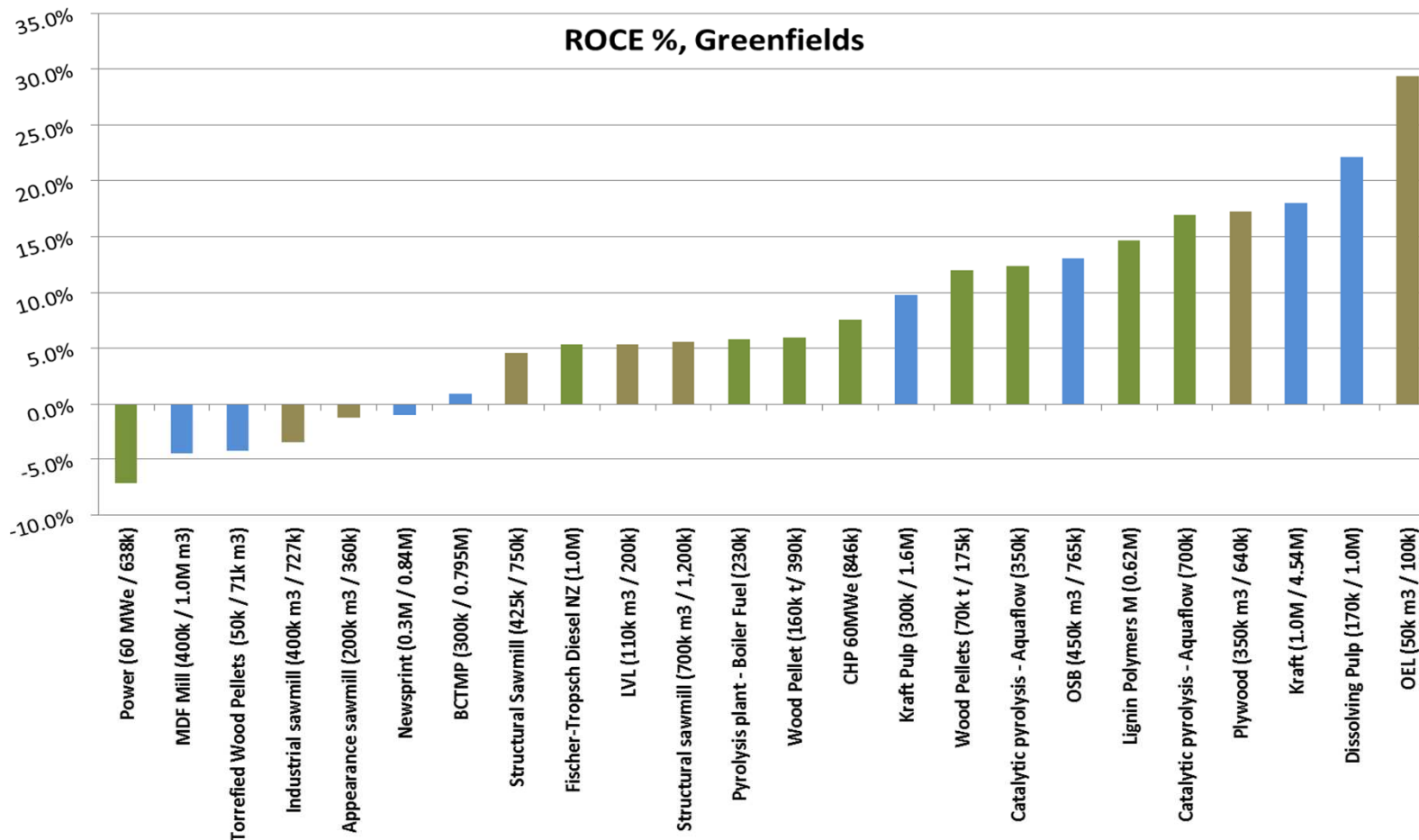
- Goal to identify wood processing options for the sector by identifying resource, market and technology opportunities
- National level financial modelling analysis and market review
- Based on earlier successful Canadian BioPathways study by FPInnovations
- Extensive industry input/review
- Reports: <http://www.woodco.org.nz/strategic-plans/woodscape>



Woodscape Study Results

M Jack, P Hall, A Goodison, L Barry: WoodScape Study – Summary Report (2013)

(http://www.woodco.org.nz/images/stories/pdfs/woodscape/woodscapecsummaryreportfinal1_web.pdf)



Major R&D projects

University of Canterbury (UC) Bioenergy Research

UC's Wood Technology Research Centre is undertaking bioenergy research including:

- Biomass gasification
- Biomass pyrolysis
- Syngas cleaning for Fischer-Tropsch synthesis
- Micro-channel Fischer-Tropsch synthesis for liquid fuels

(<http://www.woodtech.canterbury.ac.nz>)

Major national stakeholders interested in biorefining

| Organisation | Website | Organisation | Website |
|---|--|------------------------------|--|
| Ministry of Primary Industries | www.mpi.govt.nz | University of Canterbury | www.woodtech.canterbury.ac.nz/ |
| Ministry of Business, Innovation and Employment | www.mbie.govt.nz | Plant and Food Research | www.plantandfood.co.nz |
| Energy Efficiency and Conservation Authority | www.eeca.govt.nz | Carbonscape | carbonscape.com |
| Bioenergy Association of New Zealand | www.bioenergy.org.nz | LignoTech Developments | www.lignotech.co.nz |
| NZBIO | www.nzbio.org.nz | NZ Forest Owners Association | www.nzfoa.org.nz |
| Scion | www.scionresearch.com | WoodCo - Wood Council on NZ | www.woodco.org.nz |
| Advanced Biofuels Research Network | http://abrn.org.nz | Carter Holt Harvey | http://chh.com/ |
| Biopolymer Network | www.biopolymernetwork.com | Norske Skog Tasman | www.norskeskog.com/ |
| Bioresource Processing Alliance | bioresourceprocessing.co.nz | Z Energy | z.co.nz/ |
| NIWA | www.niwa.co.nz | Anchor Ethanol/Fonterra | www.fonterra.com/ |

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www.IEA-Bioenergy.Task42-Biorefineries.com