scion™
FORESTS ■ PRODUCTS ■ INNOVATION

Bioenergy

Bioenergy use promotes cleaner environments, stronger economies and employment.

Scion integrates the skills and technologies in wood processing and biorefining to support the development and implementation of large scale, renewable production of bioenergy from forestry resources.

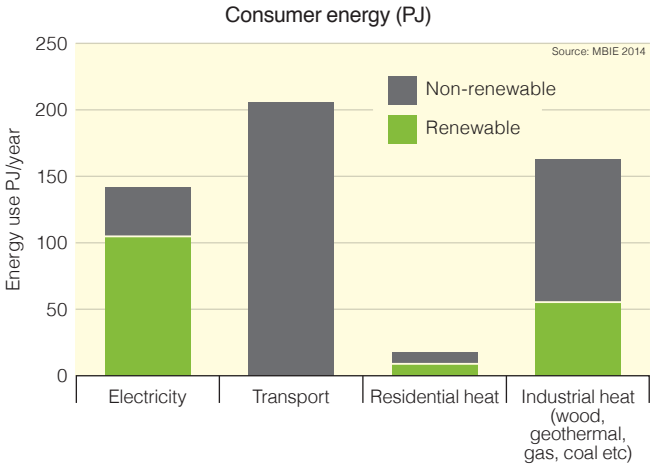
Converting biomass into energy

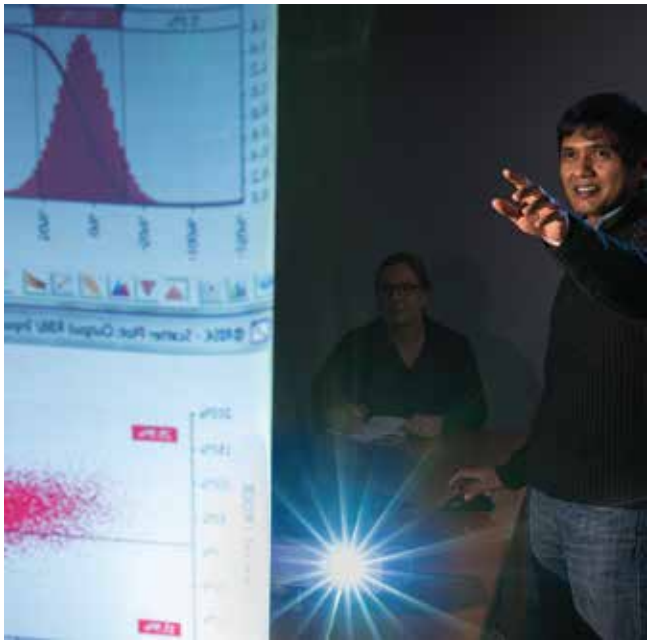
Increasing the use of bioenergy from sustainable resources in New Zealand will reduce greenhouse gas (GHG) emissions, increase energy security, reduce spending on imported fuels and grow regional economies.

With woody biomass recognised as the largest potential biomass resource, Scion's expertise in production forestry and bioenergy makes us well placed to shape the country's ability to produce sustainable bioenergy and liquid biofuels and to secure New Zealand's energy future.

Scion's bioenergy research programme focuses on:

- Wood-based (lignocellulosic) replacements for transport biofuels and industrial energy, both of which currently use large amounts of non-renewable resources.
- Identifying, adopting and adapting the best of international technologies, ensuring they are cost effective, risk is managed, a good "fit" to New Zealand, and building the capability for large scale uptake and deployment.





The evaluation and implementation of bioenergy options and technologies are underpinned by techno-economic, thermodynamic and process modelling.

Forestry feedstocks for bioenergy

Woody biomass from plantation forests is the most promising feedstock for large scale bioenergy production in New Zealand. Increasing the area of planted forest by 1.8 million hectares could supply around 60% of the country's transport fuels by 2040. Planted on low to medium quality land, energy forests would also provide ecosystem services such as erosion and flood prevention.

A Geographic Information Systems-based biomass supply model has been developed by Scion. The model can be used for optimising the site and size of a bioenergy plant, and for understanding and planning long term feedstock supply.

Solid biofuels

Forestry residues, bark, sawdust, and other byproducts of wood processing are potential solid fuels to replace coal, but "as is" they can be difficult to transport and use. Scion is working to improve the usability of woody residue by compressing it into pellets, briquettes or logs either with or without torrefaction (heating in the absence of oxygen to remove water and volatile components to give an energy-dense wood "coal").

Liquid biofuels

New Zealand uses almost 8.5 billion litres of fossil transportation fuels every year. These fuels are responsible for around 17% of New Zealand's GHG emissions.

Renewable resources can be converted into biofuels. Ideally, new biofuels will be "drop in" – be able to be used in vehicles without engine modifications and be distributed via existing systems.

Scion is developing thermochemical technologies to produce biofuels from renewable lignocellulosic materials. This includes evaluating the potential of fast pyrolysis for crude bio-oil production on a pilot-plant scale.

Fast pyrolysis

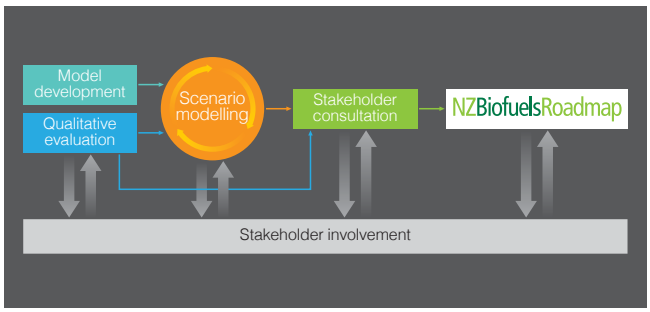
Scion's fast pyrolysis pilot plant can convert 1 kg of wood into around 700 g of pyrolysis oil an hour. When wood particles are heated to around 500°C in the absence of oxygen they vapourise. The condensed vapours form a crude bio-oil and the remaining solids form char. The bio-oil can be upgraded and blended with fossil fuels and directly "dropped" in to use.

Biofuels Roadmap

The implementation pathway for large scale production and use of liquid biofuels to replace fossil fuels is unclear due to the multiple options available along the value chain.

The Biofuels Roadmap project aims to determine the optimum pathways by considering the whole value chain, carrying out quantitative scenario analysis, and involving key stakeholders.

A model will be used to optimise the combinations of feedstocks, where the feedstocks can be grown, feedstock transportation, conversion technologies and fuel types for a given level of biofuel production.



Sugars from wood for fuel and chemicals

Cellulose from woody biomass can be converted into simple sugars (saccharification) that can be fermented into ethanol and other liquid biofuels.

Scion has developed physical and enzyme pre-treatments to help break down softwoods, including biochemical processes to saccharify cellulose and ways to convert hemicellulose into simple sugars.

This work is supported by Scion's industrial scale pulp processing and fermentation equipment and expertise, plus a wide range of support capabilities and collaboration with commercial partners.

Biorefining

A biorefinery converts biomass into fuels, power, and value-added chemicals; the concept is analogous to a petroleum refinery.

The forestry, sawmilling and pulp and paper manufacture infrastructure in New Zealand is well positioned to support biorefineries. Scion's bioenergy research, along with other work looking at biopolymers, biochemicals and extractives, is making biorefining a reality.

Industrial symbiosis

Industrial symbiosis is the association between two or more industrial facilities in which the wastes or byproducts of one company become the raw materials for another. Acting co-operatively, operating costs can be reduced and new business and job opportunities open up.

Scion is quantifying opportunities for greater industrial symbiosis utilising geothermal energy and wood processing capabilities in the central North Island.

Contact information

Dr Paul Bennett
Science Leader Clean Technologies
Email paul.bennett@scionresearch.com
Phone +64 7 343 5601

About Scion

Scion is the Crown research institute dedicated to building a stronger bio-based economy for New Zealand. Renewable energy systems, in their various forms, play a vital role in future developments.

Scion's research capabilities cover the areas of new forests and forestry science, and bioproduct development.

Te Papa Tipu Innovation Park,
Tītokorangi Drive, Rotorua
Private Bag 3020, Rotorua 3046,
New Zealand

Telephone +64 7 343 5899
Facsimile +64 7 348 0952
Email enquiries@scionresearch.com
www.scionresearch.com

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