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# New Zealand

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# Biofuels Voluntary Report

**Report Categories:**

Bio-Fuels

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**Report Highlights:** Compared to the international biofuels market, the New Zealand market is relatively small with a few leading players and a handful of emerging players. Current biodiesel production capacity is an estimated 70 million liters and current ethanol production capacity is estimated at between 15 and 20 million liters. New Zealand generates about 70% of its electricity from renewable (mainly hydro) resources and has significant unexploited wind and geothermal resources. In the case of transport fuels, the country relies mainly on imported oil, which has raised concerns regarding long-term energy security, economic sustainability and the country's greenhouse gas emission profile. New Zealand is entering an era where production of transport fuels from natural biomass resources is becoming economically viable. The country has highly favorable growing conditions that are conducive to biomass production. The most significant potential comes from

producing biomass from purpose-grown forests on marginal land.

## Overview

New Zealand is a small island country with a population of just over four million people. It generates about 70% of its electricity from renewable (mainly hydro) resources and has significant unexploited wind and geothermal resources. In the case of transport fuels, the country relies mainly on imported oil, which has raised concerns regarding long-term energy security, economic sustainability and the country's greenhouse gas emission profile.

Compared to the international biofuels market the New Zealand market is relatively small with a few leading players and a handful of emerging players. Current biodiesel production capacity is an estimated 70 million liters and current ethanol production capacity is estimated at between 15 and 20 million liters.

The New Zealand Government has put in place policies to encourage a shift toward renewable transport fuels including a biodiesel subsidy of up to NZ $0.425 per liter and a Biodiesel Grants Scheme. Announced in May 2009, the three-year scheme is funded at NZ $436 million. The program provides grants of up to NZ $9 million during the first year, which began July 2009, up to NZ $12 million the second year, and up to NZ $15 million in the third year. The grants are available for domestically produced biodiesel sold to New Zealand consumers but are limited to use as a fuel in compression ignition internal combustion engines, and a blend up to B20. (Further information about the scheme is available here: http://www.eeca.govt.nz/node/3056.)

While the New Zealand biofuels industry is supportive of the Biodiesel Grants Scheme, some in the fledging industry have expressed concern that abrupt changes in governmental policy, such as the repeal of the Biofuel Sales Obligation that was passed by the former Labour-led Government, have added uncertainty to the market making it more difficult to produce and market biofuels in New Zealand.

New Zealand is entering an era where production of transport fuels from natural biomass resources is becoming economically viable. The country has highly favorable growing conditions that are conducive to biomass production. Oil crops such as canola can be grown for biodiesel and algal biomass grown on wastewater can be used to produce biofuels. However, the most significant potential in New Zealand comes from producing biomass from purpose-grown forests on marginal land. Studies completed under the Bioenergy Options project led by Scion, a crown research institute, indicate that,

by 2030, New Zealand could theoretically supply 100% of its transport fuel demand from biofuels produced from purpose-grown forests on marginal lands.

According to a report released by the New Zealand Ministry of Economic Development, New Zealand could source approximately 25% of its energy from bioenergy by 2040. This would require 30% of transport fuels coming from biofuels by 2040 as well as a doubling in the use of bioenergy for heat. However, the demand for transport biofuels in New Zealand is tempered by many factors, including the fact that many cars in New Zealand's vehicle feet can take a maximum of 10 percent ethanol.

In September 2008, New Zealand implemented the Emissions Trading Scheme (ETS), an "all-sectors, all-greenhouse-gases" policy initiative. Initially, only the forestry sector fell under the scheme as the entry of other sectors was postponed. (Agriculture is expected to be brought under the scheme in 2015.) The transport, energy, fishing and industrial sectors entered the scheme on July 1, 2010. Under a two-year transition period, participants in these sectors will only be obliged to surrender one NZ unit for every two tons of CO2 actually emitted and will be able to purchase units at a fixed price of NZ $25 per ton.

## Overview of the New Zealand's Liquid Biofuel Sector

New Zealand companies produce both biodiesel and ethanol. The primary current feedstock for bioethanol is whey. Emerging feedstocks include lignocellulose from forest residues; lignocellulose from purpose grown crops such as salix and miscanthus; waste gases (eg carbon monoxide); and food waste. The current feedstocks for biodiesel are tallow, waste cooking oil and rapeseed oil. Emerging feedstocks include jatropha seeds, algae, bio-oil from forest residues, and bio-oil from purpose grown crops such as salix and miscanthus.

Compared to the international biofuels market, the New Zealand market is relatively small with a few leading producers. Anchor Ethanol Limited, a subsidiary of Fonterra Cooperative Group, is the single biggest player in the bioethanol market. For thirty years, it has been producing anhydrous ethanol for industrial purposes from whey, a by-product of manufacturing cheese and protein from milk. The company produces approximately 15-20 million liters of fuel grade ethanol per year. Supply tends to be limited as Anchor can generally achieve higher returns using whey as a beverage ingredient or as an ingredient for pharmaceuticals.

While there are no really large producers in the biodiesel market, the larger companies are Biodiesel

New Zealand Ltd., Ecodiesel Ltd., Biodiesel Oils Ltd., and Flo-Dry Engineering.

Biodiesel New Zealand Ltd. is a subsidiary of Solid Energy, which is a state-owned enterprise mainly involved with coal mining. The company has been making and selling biodiesel derived from vegetable oil for over three years. More recently, the company has been involved in growing rapeseed for biodiesel production. The company produces an estimated 4.0 million liters per year but plans to significantly supplement current production with purpose-grown rapeseed by 2011. It recently completed its first commercial-scale harvest of rapeseed grown by South Island farmers and has recently completed the first stage of a new facility at Rolleston, near Christchurch, enabling the drying, cleaning and storage of up to 10,000 tons of rapeseed.

Ecodiesel Ltd. is an Auckland-based company that operates a pilot plant using tallow as the feedstock. In March 2009, Ecodiesel Ltd. achieved a New Zealand first when their product became the first New Zealand produced biodiesel to be blended by major oil companies for sale at the pump to New Zealand retail consumers. The company currently produces commercial quantities of biodiesel at their Auckland demonstration plant while building a commercial-scale, biodiesel factory. When the new Auckland plant opens in late 2010, the company will be New Zealand's largest commercial-scale, biodiesel manufacturing operation. It will initially produce 20 million liters of biodiesel annually increasing to 40 million liters annually by 2012.

Additional players include NZ Ester Fuels, Environfuels and Kiwifuels. NZ Ester Fuels is based in Auckland and produces biodiesel from used cooking oil, tallow, and materials rich in free fatty acids. Environfuels, based in Te Kuiti, Waikato, produces biodiesel from used vegetable oil. It is reportedly expanding to utilize seed oil grown on marginal land. Kiwifuels is based in Rangiora and produces biodiesel from rapeseed oil.

**Estimated Production Capacity in the New Zealand Liquid Biofuels Market**

| Company | Feedstock | Estimated Production Capacity |
|---|---|---|
| **Biodiesel** | | |
| Ecodiesel | Tallow | 20 million liters |
| Biodiesel Oils | Tallow | 40 million liters |
| Flo-dry Engineering | Tallow | 4 million liters |
| Biodiesel New Zealand | Rapeseed oil; used cooking oil | 4 million liters |
| New Zealand Ester Fuels | Tallow; used cooking oil; other feedstocks | 2 million liters |
| Environfuels | Used vegetable oil | Not known |
| Kiwifuels | Rapeseed oil | Not known |
| **Ethanol** | | |
| Anchor Ethanol | Whey | 15 -20 million liters |

## Summary of Biofuel Legislation and Regulations in New Zealand

- September 3, 2008 – The legislation to bring into force the Biofuel Sales Obligation, the Biofuel Bill, was passed through Parliament.
- October 1, 2008 – The Biofuel Sales Obligation commenced under the then Labour-led Government
- November 19, 2008 – The new National-led Government was formed. The Government signaled its intention to repeal the previous Government's policies on biofuels.
- December 11, 2008 – Energy and Resources Minister Gerry Brownlee tabled in Parliament a bill to repeal the obligation placed on oil companies to sell a certain proportion of biofuel.
- December 17, 2008 – The Biofuel Sales Obligation and associated regulations were repealed.
- May 19, 2009 – The New Zealand Government announced the introduction of the Biodiesel Grant Scheme.

The Government Ministries involved in the regulation of liquid biofuels in New Zealand are:

- The Ministry of Economic Development (MED);
- The Energy Efficiency and Conservation Authority (EECA); and,
- The Ministry of Transport (MoT).

## An Overview of Biofuels Research and Development in New Zealand

### Lignocellulosic Biofuels

In New Zealand, it is becoming increasingly evident that liquid fuels from woody biomass could contribute to meeting future demand for sustainable transport fuels. Several new technologies are currently under development.

Three crown research institutes, GNS, AgResearch, and Scion, are members of the New Zealand Renewable Energy Transformation Research Science and Technology group. This group is sponsored by the Ministry of Research Science and Technology to accelerate the research and development effort on renewable energy technologies and their integration into the New Zealand energy system. There is a strong focus on lingo-cellulosic biofuel as part of the overall effort of making renewable energy work for New Zealand.

Scion

Scion specializes in forestry and biomaterials research, including creating energy from woody biomass. They undertake a range of bioenergy and bio-refinery research and development activities across the whole production chain, from resource establishment through to product development.

Scion is a key partner in the New Zealand Lignocellulosic Bioethanol Initiative (NZLBI), a partnership formed to address the challenges of using softwoods as a feedstock for bioethanol production. Scion, Carter Holt Harvey, AgResearch, Verenium, and associated sub-contractors produced a study for NZLBI that supported continued development of woody biomass for energy. The current aim of the program is to evaluate the economic viability of Scion's bioethanol production technology. Scion's technology is a combination of a thermomechanical and enzymatic process that can produce high yields of monomeric sugars and functional lignin from New Zealand's softwood forest resource (radiata pine). They are currently in the process of demonstrating their biofuel production process at pilot scale with the long-term goal of developing a 90 million liter per year commercial facility in New Zealand. SCION is working with JBEI, the Joint Bio Energy Institute at Lawrence Berkeley Laboratory and with Sandia Labs, both U.S. Department of Energy entities, on a project in Rotorua aimed at turning trees into biofuel using U.S.-developed enzymes.

AgResearch

AgResearch is New Zealand's largest crown research institute focusing on research and development for the pastoral and biotechnology sectors. A key biofuel program is investigating an "*in planta"* enzyme manufacture technology capable of cost effectively producing enzymes using a seed crop to harvest the high value proteins for use in large-scale biorefineries. This technology is expected to be compatible with the full range of cellulosic feedstocks such as trees, grasses, and municipal solid waste, and with algal, yeast or bacteria-based bio-refinery processes. High merit enzymes are being sourced from rumen microbes, geothermal vent microbes, and commercial sources, and are tailored for manufacture "*in planta"* and to act on a range of feedstocks. Selected enzymes will be linked to a proprietary protein that will stabilize the enzyme in the seed, and aid purification and emulsification properties of the enzyme while maintaining its efficacy.

Scion and AgResearch have partnered with San Diego-based Diversa on a feasibility study to determine whether or not a pulp and paper mill can be converted to turn its waste into biofuel.

**Algal Biomass to Usable Energy**

In addition to woody biomass, there is ongoing research into generation biofuels from switch grass, jatropha, algae, and solid waste. Algal biomass has been getting a lot of attention in New Zealand for

its potential to become an important biofuel feedstock. Some of the work going on in New Zealand is summarized below.

NIWA

NIWA is a crown research instate focusing on water and atmospheric research. NIWA's research program involves laboratory and pilot-scale studies that specifically address: algal production and harvest from wastewater treatment high rate algal ponds (HRAPs); and, the efficiencies of different pathways of biofuel production from wastewater grown algae.

NIWA is currently operating a five-hectare demonstration system in Christchurch, which is the largest wastewater treatment HRAP that is augmented with CO2 in the world. The HRAP was built especially for Solray Energy Ltd. Solray is converting the whole algal biomass to pure algal crude, rather than ethanol or biodiesel. This algal crude oil can be refined using conventional methods.

Aquaflow Bionomic Corporation

Aquaflow was founded in October 2005 to develop economic and sustainable production of clean water and biocrude oil from wild micro algae. The algae are predominantly sourced from municipal wastewater treatment sites and provide a continuous biomass feedstock at low cost. The algae extractin process improves waste water quality by significantly reducing nitrogen and phosphorous loadings and coliform levels. The biomass can then be used in agricultural/aquaculture applications, cogeneration/methanol fuel, or biofuels feedstock production.

Aquaflow has a memorandum of understanding with U.S.-based UOP LLC, a Honeywell company, and Aquaflow's first jet and diesel fuel samples were produced by UOP in December 2008. This work is the result of a United States Department of Energy grant of $US1.5 million to UOP. Aquaflow announced in May 2010 that it will collaborate with the United States Gas Technology Institute (GTI) on an advanced biomass conversion technology program worth $US3.1 million ($NZ4.2m), which will be part-funded by the US Department of Energy (DoE). In November 2009, Aquaflow announced it had teamed up with Greenleaf Environmental of Sichuan to look at sites in China to harvest wild algae for biodiesel.

In New Zealand, there are two key sources of funds available specifically to promote the development of biofuels: The Foundation for Research, Science and Technology (FRST), and New Zealand Trade and Enterprise (NZTE). FRST administers the Low Carbon Energy Technologies Fund, which assists private and public organizations that have completed basic research and have demonstrated the potential of a new technology at the proof of concept stage to move through to the pilot/demonstration plant stage. FRST funded the Bioenergy Options Project that was undertaken by Scion. NZTE

provides Enterprise Development Grants and general support for business developments. The Government also supports industry activities and initiatives through its Energy Efficiency and Conservation Authority (EECA) – the leading government agency on renewable fuels. The Bioenergy Association of New Zealand (BANZ) is the leading industry body representing the views and championing the needs of the biofuels sector in New Zealand.

## Information Sources

**Biodiesel Grants Announcement**

**http://www.beehive.govt.nz/release/budget+2009+gerry+brownlee+-+biodiesel+boost**

**http://www.thebioenergysite.com/news/3751/biodiesel-boost-announced-by-government**

**Bio Energy Association of NZ**

**http://www.bioenergy.org.nz/**

**Biodiesel Grants Scheme**

**http://www.eeca.govt.nz/node/3056**

**Bioenergy Options Report**

**http://www.scionresearch.com/bioenergy+report.aspx**