

Innovation, Skills and Knowledge in Liquid Biofuels in New Zealand

An overview of the key players in the New Zealand Liquid Biofuels Sector –
Producers, Retailers, Wholesalers, Researchers and Consultants – and details
on Sector Production and Capacity

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By
The Bioenergy Association of New Zealand (BANZ)
PO Box 11 595
Wellington

www.bioenergy.org.nz
www.liquidbiofuels.org.nz



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1. Overview of the New Zealand Liquid Biofuels Sector - Introduction

The New Zealand liquid biofuels sector ranges from well established researchers and suppliers of ethanol from whey, and biodiesel from tallow and used cooking oil, through to internationally leading researchers working in new emerging technologies such as the production of liquid biofuels from lignocellulose or algae. There are close to 30 medium to large sized operators that have a host of skills to offer whether it's in research and development, plant design and operation, technology development or in processing and conversion technologies. New Zealand has all aspects of 1st, 2nd and 3rd generation biofuels covered and New Zealand is blessed with large volumes of unused sustainable source materials whether it's whey from dairy processing, tallow from meat processing, rape seed or lignocellulose from our extensive forestry resources.

There are significant opportunities in New Zealand to use residues, which we may currently waste, as valuable feedstock for transport fuel. We can establish a revenue stream from the residue so that it is not the waste that that would otherwise go to a landfill at cost.

Unlike overseas, in New Zealand, the bioethanol and biodiesel producers work together to develop the liquid biofuels market, particularly for use as transport fuel.

This note presents details as follows:

- Feedstocks
- Market Size (Production Capacity)
- Research
- Consultants
- Innovation, Investment and the World Stage – NZ's Leading Edge
- Employment – current and potential
- Support to the Sector

2. Feedstocks

The New Zealand biofuel feedstocks can be separated into the two product categories:

Bioethanol

- **Current feedstocks**
 - Whey
- **Emerging feedstocks**
 - lignocellulose from forest harvest residues
 - lignocellulose from purpose grown crops such as salix and miscanthus
 - waste gases (eg carbon monoxide)
 - Putrescible food waste

Biodiesel

- **Current feedstocks**
 - tallow
 - waste cooking oil
 - oil seed rape
- **Emerging feedstocks**
 - jatropha seeds
 - algae
 - bio-oil from forest harvest residues
 - bio-oil from purpose grown crops such as salix and miscanthus

For details of New Zealand feedstocks click [here](#).

3. Market Size (Production Capacity)

Compared to the international biofuels market the New Zealand market is relatively small with a few leading producers and a number of emerging players. [Anchor Ethanol](#) is a single large player in the bioethanol market. While there are no really large producers in the biodiesel market the larger companies are [Flo-Dry Engineering](#), [Ecodiesel](#), Biodiesel Oils and [Biodiesel New Zealand](#).

The emerging biodiesel producers are using tallow or used cooking oils while Biodiesel New Zealand's development strategy has focused on the growth of rape seed evolving from its production from an extensive used cooking oil collection network. The firm recently completed its first commercial-scale harvest of rapeseed grown by South Island farmers and that oil will make up an increasing proportion of the bio diesel feedstock. Production capacity from Biodiesel New Zealand is expected to be 4 million litres from July 2009.

[Alternative Energy Solutions](#) is currently trialing the use of mobile pyrolysis plant to produce bio-oil from wood residues.

Table 1 below summarizes the potential production capacity of the leading biodiesel players. It's estimated at around 70 million litres annually.

Company	Feedstock	Production Capacity
Ecodiesel	Tallow	18 million tonnes
Biodiesel Oils ¹	Tallow	40 million litres (est)
Flo-dry Engineering	Tallow	4 million litres
Biodiesel New Zealand	Rape Seed Oil; Used Cooking Oil	4 million litres
NZ Ester Fuels	Tallow; Used Cooking Oil; other degraded feedstocks	2 million litres
Estimated Annual Production Capacity - Biodiesel		Est. potential is around 70 million litres annually 2010

Table 1 – New Zealand's leading biodiesel producers- Estimated Annual Production Capacity

In the ethanol sector, production is dominated (as noted above) by [Anchor Ethanol](#). Anchor Ethanol is producing bioethanol from whey – a by-product from its cheese making activities. The company estimates its production capacity at around 15 million litres produced during the 2008 - 2009 manufacture season. Table 2 sets out the capacity for bioethanol production in New Zealand. Notably there are a few emerging 'innovative' players in this sector. They are not producing currently but are at the production development stage – [Lanzatech](#) and [Pure Power Technology](#).

Company	Feedstock	Production Capacity	Comment
Anchor Ethanol	Dairy Whey	15 million litres	
Lanzatech	biomass syngas and industrial waste gas; syngas that can be produced from waste cellulosic biomass (woody biomass) and municipal waste by gasification to produce ethanol.	not disclosed	n/a (Process in development)
Pure Power Technology	Non-food – cellulose	Potential not disclosed	Demonstration and research stage
Estimated Annual Production Capacity - Bioethanol		Est. around 15 million litres annually 2010 Beyond 2010	

Table 2 – New Zealand's leading bioethanol producers- Estimated Annual Production Capacity

¹ No details provided by the company on request.

The Crown Research Institute [Scion](#) is involved with an international research consortia researching the conversion of lignocelluloses from forest harvest residues into ethanol.

Algae oils are the focus of a number of the smaller players in the biofuels market with algae as the feedstock. [Solray Energy](#), [Aquaflow Bionomics](#), [Maxall Energy](#) and [Carbonscape](#) are leaders in this field and have gained much interest internationally. Table 3 below sets out a brief summary of the feedstocks and productions capacities (where provided).

Company	Feedstock	Production Capacity	Comment
Solray Energy	Algae, sewage sludge, seaweed	200 tonnes crude oil per annum	Current focus on performance trials
Aquaflow Bionomic Corporation	Wild Algae – waste water facilities	2 tonnes biomass harvesting / day (est 720 tonnes per annum)	
Maxall Energy	biomass		Biorefinery production capacity in feasibility phase
Carbonscape	wood biomass	5,000 tonnes per annum by 2011	Commercial demonstration - currently
Alternative Energy Solutions	Wood biomass		
		Potential is attractive but exact volumes are difficult to predict	

Table 3 – New Zealand's leading bio-oil and alga oil producers- Estimated Annual Production Capacity

Profiles of the industry participants are available [here](#)

4. Research

New Zealand is also served well on the research front with established researchers including privately funded company researchers, Crown Research Institutes and some Universities. The focus of research is broad with an obvious slant towards New Zealand's wealth of natural feedstock resources such as 2nd generation cellulose feedstocks and enzymes, algae, organic waste and wastewater.

Researchers

Company/Organisation	Feedstock Focus	Product Focus	Activity
AgResearch	2 nd generation ligno-cellulosic feedstocks; Plant-manufactured industrial enzymes	Bioethanol, biodiesel or biobutanol	Cost-effective, scalable, biofuel enzyme production
Scion	Second generation feedstocks (woody biomass)	Bioethanol and next generation fuels.	Research and development across the entire biofuel value chain
NIWA	Algal biofuel feedstock using wastewater biomass	Biogas; Bio-oil; Biodiesel; Bioethanol	Pilot and Large-scale demonstrations of High Rate Algal Pond (HRAP) and Covered Anaerobic Pond (CAP) technologies
Pure Power Technology	2 nd generation (from non-food crops such as coppiced willow) biofuels and bioproducts	High-value specialty chemicals, such as high-quality natural lignin and xylose, to replace petrochemical feedstocks; Bioethanol	Design, construction and operation of a commercial demonstration plant (10 tonnes biomass/day)

LanzaTech	Biofuel from biomass syngas; Biofuel from industrial waste gas feedstocks	Bioethanol	Operation of a pilot-scale demonstration of its fuel ethanol production from both biomass syngas and industrial waste gas feedstocks. Pilot plant – Auckland Steel Mill
Aquaflow Bionomic Corporation	Algae	Biodiesel	Pilot Plant Blenheim: Continuous Algae harvesting and waste water remediation Pilot Plant Nelson: Continuous Green Crude process development.
Flo-dry Engineering	Tallow (and potentially other low cost feedstocks)	Biodiesel and process plant expertise	Conversion of difficult lipid substrates, such as tallow to Biodiesel at a low capital cost. Development of standalone plants attractive to small or remote markets.
GNS Science	cellulose	Bioethanol and value-adding by-products Focus on second and third generation biofuels	Targeted enrichment and isolation of novel cellulose and lignin degrading enzymes and/or microorganisms. Genomics of thermophilic cellulose degradation.
Massey University	Various activities on 1 st , 2 nd and 3 rd generation biofuels	Biofuels Research	Process development and optimization Energy analysis Techno-economic assessment Infrastructure planning.
University of Canterbury	wood residues, agricultural residues and biosolid wastes	2 nd generation focus. Biodiesel.	Advanced biomass gasification, pyrolysis and Fischer-Tropsch synthesis of liquid fuel.
Uniservices	Not specified	1 st , 2 nd and 3 rd generation focus bioethanol and biodiesel	Production technology Engine testing and design

Table 4 - Researchers – their interests and activities

Profiles of all the leading industry participants are available [here](#)

5. Consultants

There are a number of sector energy, engineering and environmental consultancies working in the sector.

Company	Areas of expertise
URS	URS staff have specialist knowledge of sustainability issues surrounding biofuels and have wide industry contacts in New Zealand. Core activities include:

	<ul style="list-style-type: none">• Life Cycle Analysis• Sustainability assessment and labeling• Carbon footprints• Environmental impact assessments• Process engineering• Chemical engineering
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Profiles of all the industry participants are available [here](#)

6. Innovation, Investment and the World Stage – NZ’s Leading Edge

Investment both nationally and internationally by the leading players in the liquid biofuels sector is strong and encouraging. Of particular note is the degree of overseas investors who see the potential in the innovative New Zealand companies making solid progress in the 2nd generation biofuels area. Several companies/organization report investors based in the US and Canada with some investors listed as far away as Chile and Brazil.

The New Zealand economy is currently creating the conditions that attract investors in liquid biofuels to New Zealand. Some of the key players have only a small foothold in New Zealand with larger bases in the US for example. However these attractive conditions are providing a foothold into a strong foundation for growth’.

Several of the companies with strong innovation are already being noticed on the world stage. Particular focus appears to be on the innovative 2nd and 3rd generation sources. Recent coverage for example in the UK press of [Carbonscape](#) is a prime example. Earlier this year, Carbonscape was one of five semifinalists shortlisted from 300 international entries for the Climate Change Challenge, run by The Financial Times. It picked up the Judge's Choice award in the competition. Carbonscape is producing bio-oil and syngas.

[Lanzatech](#) have been equally successful in attracting US investment funds (US \$3.5 M) through an alliance with Khosla Ventures, a Silicon Valley based investor that has invested in more than a dozen start-ups involved in "clean fuel" technologies. Lanzatech focuses on the production of ethanol from wastes gases, such a carbon monoxide.

[Aquaflow Bionomics](#) too are no stranger to the international area. US based UOP (a Honeywell Company) have been working with Aquaflow Bionomics on the production of fuels made from algae. Aquaflow has been linked to trials with a number of airlines. ClimateChangeCorp.com, an independent news website named Aquaflow as one of the top 10 eco-innovators to watch in 2008. Their focus is in algae production.

Other innovative companies to watch include Flo-dry Engineering and Pure Power Technology.

[Flo-dry](#) is focused fairly and squarely on 1st generation biofuels – biodiesel from tallow. Their innovation is in the design and production of processing plants with continuous reactive distillation process, paramount in the production of high quality (and reproducible quality) fuel. Investors in destinations as far as Chile and India, Brazil and Korea are named by the company.

[Pure Power Technology](#) are also courting international interest in their activities most recently successfully winning research contracts in Canada. Their focus is on the production of ethanol from cellulose.

Others quietly working away, and ones to watch include [Maxall Energy](#) and [Solray Energy](#).

7. So just what is the sector’s leading edge?

Members of the sector have indicated the following as their ‘leading edge’

Company Name / contact	Leading Edge
(Anchor Ethanol) Fonterra	<i>Whey fermentation – an opportunity to further process a waste material into ethanol.</i>
AECOM	<i>AECOM has an established reputation for excellence for professional support services in both engineering/technology and management to a broad range of markets, including renewable energy, established energy, transportation, facilities and environmental.</i>
AES	<i>AES has working demonstration technology for bio-oil in New Zealand. We can practically demonstrate, using your feed stock, the manufacture both of bio-oil and biochar in an actual, commercially scaled plant.</i>
Ag Research	<i>AgResearch’s biofuel enzyme manufacture technology will be compatible with the full range of ligno-cellulosic feedstocks coupled with algal, yeast or bacteria-based biorefinery processes. Using plants to produce enzymes will be more cost-effective, require minimal capital investment and be rapidly scalable in response to demand compared to building new, high-cost infrastructure for fermentation-based enzyme manufacture.</i>
Aquaflow Bionomic Corporation Limited	<i>Aquaflow provides a low cost method of wild algae biomass extraction from existing waste water facilities. The algae extraction process improves the waste water quality by significantly reducing nitrogen and phosphorous loadings, BOD and coliform levels. The biomass can then be used in agricultural/ aquaculture applications, co-generation / methanol fuel, or biofuels feedstock production.</i>
Biodiesel New Zealand Ltd	<i>Biodiesel New Zealand has been making and selling high quality bio diesel derived from used vegetable oil (UCO) for over three years. More recently, we have been growing oilseed rape (OSR) for bio diesel production. We are the leading supplier of bio diesel in NZ having a multiple feedstock, fully integrated, market led strategy to increasingly supply the New Zealand diesel market with quality bio diesel promoting benefits & scale relevant to today’s key markets.</i>
Carbonscape	<i>Carbonscape's state of the art process has advantages over traditional pyrolysis methods by rapidly producing high grade charcoal efficiently and economically. The process also produces valuable byproducts of bio-oil fuel and syngas, which can be combusted to release industrial heat or electricity energy.</i>
Cawthron Institute	<i>Selection and husbandry of micro algae for fuel generation and CO₂ capture</i>
Ecodiesel	<i>“Ecodiesel specialises in the conversion of difficult lipid substrates, such as tallow to Biodiesel at a low capital cost. Ecodiesel uses tallow but the technology also allows the conversion of other low cost feedstocks. Ecodiesel plants are standalone and do not require any downstream service providers as all byproducts are effectively processed in the plant. This makes the technology particularly attractive to small or remote markets.”</i>

<u>Flo-Dry Engineering Ltd</u>	<i>In-house developed continuous <u>Reactive Distillation Process</u> based Biodiesel plant capable of converting most difficult feedstocks at a competitive economic conversion cost.</i>
<u>GNS Science</u>	<i>The Geomicrobiology group targets and isolates novel bacterial isolates from NZ's unique geothermal systems. Because of our location and pre-existing legal agreements with landowners for the biodiscovery and application of novel microorganisms, we are able to easily refine enrichments while providing the security of legal agreement to conduct these activities.</i>
<u>IPL/Biofuel Testing New Zealand</u>	<ul style="list-style-type: none"> • <i>BTNZ is involved with the development and amendment of methods for the analysis of NZ biofuels.</i> • <i>BTNZ is a member of the Bioenergy Association of New Zealand</i>
<u>Lanzatech</u>	<i>A key advantage of the LanzaTech process is that it is "feedstock agnostic" i.e. It can use almost any organic waste or biomass allowing it to focus on those that are available in high volumes, are low value and are non food (e.g. municipal waste, organic industrial waste (tyres), waste wood).</i>
<u>Massey University</u>	<i>Massey University Centre for Energy Research (MUCER) and Massey University at large represent a leading knowledge bases on bio-energy engineering.</i>
<u>Maxall Energy</u>	<ul style="list-style-type: none"> • <i>Leading edge biomass to bio-oil technology partner.</i> • <i>Multi-national biorefinery partner.</i>
<u>NIWA</u>	<i>NIWA has pioneered CO₂ addition to wastewater HRAP for enhanced treatment and algal production and has over 12 years experience with the design and operation of HRAP in New Zealand. NIWA has developed the Covered Anaerobic Pond (CAP) to cost-effectively recover energy from wastewater biomass as biogas methane and has 5 years experience with working with end-users to apply this simple technology.</i>
<u>NZ Ester Fuels</u>	<i>Strong technical team with proven ability to deliver practical and cost effective solutions.</i>
<u>Pure Power Technology</u>	<i>Proprietary process for producing high-value specialty chemicals and ethanol from woody biomass, as opposed to other "cellulosic ethanol" processes that destroy or degrade the most valuable components of biomass in the singular pursuit of ethanol.</i>
<u>Scion</u>	<p><i>Scion's key advantage is the ability to carry out research and development across the entire biofuel production value chain including:</i></p> <ul style="list-style-type: none"> ○ <i>Woody biomass resources development and logistics</i> ○ <i>Pretreatment and conversion technologies for biofuels and co-products</i> <p><i>Assessment and mitigation technologies for improved environmental footprints of biofuels operations</i></p>
<u>Solvent Rescue / Solray</u>	<i>Solray's key advantage is that the crude oil we produce is fully interchangeable with crude oil from normal fossil sources. Therefore</i>

	<i>no existing infrastructural changes to refineries, delivery systems, or end users are required. This feature is important to transport and aviation operators. Blends are not necessary.</i>
The Proprietors Of Taharoa C Block	<ul style="list-style-type: none"> • Propagation Technologies • Scale production
UniServices Limited	<p><i>In keeping with University goals the intent of activity in the biofuels area is to be at the forefront of research.</i></p> <p><i>Developed technology and other capabilities will be made available to NZ industry to maximize the efficient use of biofuels in NZ.</i></p>
University of Canterbury	<p><i>A 100 kW advanced steam-blown biomass gasifier has been developed and constructed. Hydrogen-rich (40vol%) syngas is produced. Cold model of the above gasifier is built for fluidynamics studies.</i></p> <p><i>A Fischer-Tropsch reactor is available for liquid fuel synthesis. Pyrolysis reactor is available for biofuel production.</i></p>
URS	<i>URS staff have specialist knowledge of sustainability issues surrounding biofuels and have wide industry contacts in New Zealand.</i>

8. Employment – current and potential

Currently the numbers of employees in the sector are typically small (up to the mid 20's in many cases. The larger and more established researchers boast several hundred staff but only a small proportion will be focused directly on liquid biofuels. For many, the announcement by the Government of the 3 years [Biodiesel Grants Scheme](#) in May 2009 gave a long awaited signal that many needed to be able to invest in their own future and plan to grow staff numbers. [Ecodiesel](#) is one such example noting 5 employees in 2009 with a predicted 340% increase in staff in 2010. At the time of the announcement of the Grant Scheme, the major industry players indicated that the prompt action by the Minister has provided immediate security to 40 direct jobs and 200 indirect jobs. The implementation of investment plans will provide a further 100 jobs in the first year. It is expected that the industry will grow to provide at least 55 direct jobs in year 3.

9. Support to the Sector

9.1 Government

Support to the sector from Government typically comes in the form of research grants, capital grants and grants in the form of fuel production tax subsidies - specifically targeting the biodiesel producers and excise tax abatement - specifically targeting the bioethanol producers.

The government's focus is on ensuring the development of leading edge technologies in New Zealand, providing an attractive investment base for oversea investors and to ensuring that biofuels produced in New Zealand are done so sustainably and to a quality that is expected internationally.

Recent efforts highlighted in the media have focused on incentivizing the sustainable production of biodiesel and the [Biodiesel Grant Scheme](#).

Other government investments through the [Foundation for Science Research and Technology \('FRST'\)](#) are directing funds to innovative research such as that focusing on waste gases, waste water, algae and cellulose. FRST have also funded the [Bioenergy Options Project](#) (undertaken by Scion) to establish what the next steps should be that lead on from the research to the demonstration stage and beyond.

The government also supports industry activities and initiatives through its [Energy Efficiency and Conservation Authority](#) ('EECA') – the leading government agency on renewable fuels.

[New Zealand Trade and Enterprise](#) works with individual members of the sector to assist them grow their business and to develop national and international markets for their products and services.

9.2 Industry

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. BANZ's Liquid Biofuels Interest Group leads the biofuel activities within the Association.

10. Individual Profiles

10.1 Summary Table

Company Name / contact	Core Skill	Biofuel Focus	Core Product /Activity	Leading Edge	Production Capacity
(Anchor Ethanol) Fonterra Peter Motion +64 9 374 9000 Anchor Ethanol web-link	<ul style="list-style-type: none"> • Fermentation Technology • Distillation Technology • Marketing 	<ul style="list-style-type: none"> • 1st Generation • Ethanol 	Ethanol from Dairy Whey	<i>Whey fermentation – an opportunity to further process a waste material into ethanol.</i>	15 Million Litres produced during the 2008 - 2009 manufacture season.
AECOM Alec van Rossen +64-9-379-1200 www.aecom.com	Engineering Services for planning and construction of renewable fuels facilities. <ul style="list-style-type: none"> • Production technology. • Plant design. • Plant construction. • Full project support. 	Engineering and management services for a wide range of biofuels technologies.	Engineering Services for planning and construction.	<i>AECOM has an established reputation for excellence for professional support services in both engineering/technology and management to a broad range of markets, including renewable energy, established energy, transportation, facilities and environmental.</i>	AECOM NZ Ltd has provided engineering services in NZ for 90 years and operates internationally.
AES Gavin Hedley Ph: +64 (0) 9 238 0683 Mobile: +64 21 740490	<ul style="list-style-type: none"> • Technical Skills and marketing of Pyrolysis • Bioenergy technologies for forest and other residues recovery and utilization. 	Bio-oil	Ankur Gasification representation <ul style="list-style-type: none"> • 10Kw to 2.2 Mw Electrical generation • 30Kw to 5.6 Mw Heat Energy. ABRItch Bio oil/bio char systems - 1-100 TPD	<i>AES has working demonstration technology for bio-oil in New Zealand.</i> <i>We can practically demonstrate, using your feed stock, the manufacture both of bio-oil and biochar in an actual, commercially scaled plant.</i>	-
Ag Research	• Recombinant protein	• 2 nd generation ligno-	Cost-effective,	<i>AgResearch's biofuel enzyme</i>	Technology

<p>Heather Went 06 351 8035 www.agresearch.co.nz</p>	<p>expression</p> <ul style="list-style-type: none"> • Enzyme characterization & enhancement • Plant technology and product development 	<p>cellulosic feedstocks</p> <ul style="list-style-type: none"> • Bioethanol, biodiesel or biobutanol 	<p>scalable, biofuel enzyme production</p>	<p>manufacture technology will be compatible with the full range of ligno-cellulosic feedstocks coupled with algal, yeast or bacteria-based biorefinery processes.</p> <p>Using plants to produce enzymes will be more cost-effective, require minimal capital investment and be rapidly scalable in response to demand compared to building new, high-cost infrastructure for fermentation-based enzyme manufacture.</p>	<p>development and licensing</p>
<p>Aquaflow Bionomic Corporation Limited Paul Dorrington (CTO) +96 (3) 543 8227 www.aquaflowgroup.com</p>	<ul style="list-style-type: none"> • Wild Algae harvesting technology • Pond water quality remediation • Processing plant design • Green Crude processing technology • High value chemicals 	<ul style="list-style-type: none"> • 2nd generation focus • biodiesel 	<ul style="list-style-type: none"> • Remediated water • Partnered Bio diesel from Algae Bio mass 	<p>Aquaflow provides a low cost method of wild algae biomass extraction from existing waste water facilities. The algae extraction process improves the waste water quality by significantly reducing nitrogen and phosphorous loadings, BOD and coliform levels. The biomass can then be used in agricultural/ aquaculture applications, co-generation / methanol fuel, or biofuels feedstock production.</p>	<p>2 tonnes biomass harvesting / day</p>
<p>Biodiesel New Zealand Ltd Andrew Simcock +64-21-667-199 www.biodiesel-nz.co.nz</p>	<ul style="list-style-type: none"> • Used oil collection • Agronomy and agricultural activities supporting oil seed rape (OSR) • Production technology & design • Logistics and operational support • Sales & Market Development 	<ul style="list-style-type: none"> • Viable bio fuel feed stock commercialization • Bio diesel manufacturing and supply 	<p>Bio Diesel, oil seed rape, used cooking oil and related products and markets</p>	<p>Biodiesel New Zealand has been making and selling high quality bio diesel derived from used vegetable oil (UCO) for over three years. More recently, we have been growing oilseed rape (OSR) for bio diesel production. We are the leading supplier of bio diesel in NZ having a multiple feedstock, fully integrated, market led strategy to increasingly supply the New Zealand diesel market with quality bio diesel promoting benefits & scale</p>	<p>4 Million litres from July 2009</p>

				<i>relevant to today's key markets.</i>	
<p>Carbonscape Forrest Tyrrell-Baxter www.carbonscape.com +64 (3) 579 2274</p>	<ul style="list-style-type: none"> • New Process Development • Clean Technology Commercialisation • Emerging carbon emissions reduction GHG, CDM markets • Industrial Microwave Systems 	Bio-oil, sustainable industrial fuel oils	<ul style="list-style-type: none"> • Biochar, Biooil, Syngas, Activated Charcoal 	<p><i>Carbonscape's state of the art process has advantages over traditional pyrolysis methods by rapidly producing high grade charcoal efficiently and economically. The process also produces valuable byproducts of biooil fuel and syngas, which can be combusted to release industrial heat or electricity energy.</i></p>	Commercial demonstration, 5000 tonnes per annum by 2011
<p>Cawthron Institute Mike Packer</p>	<ul style="list-style-type: none"> • Algal Production Technology • Algal Strain Identification • Algal biomass generation • Waste to Fuel generation 	Anything involving Algae	<ul style="list-style-type: none"> • Biocrude from integrated CO₂ capture 	<p><i>Selection and husbandry of micro algae for fuel generation and CO₂ capture</i></p>	n/a
<p>Ecodiesel Gary Brockett +64 (0) 9 636 4740 www.goecodiesel.com</p>	<ul style="list-style-type: none"> • Production Technology • Plant Design • Plant Construction 	1 st generation focus; biodiesel	<ul style="list-style-type: none"> • Biodiesel from Tallow • Small scale standalone plants 	<p><i>"Ecodiesel specialises in the conversion of difficult lipid substrates, such as tallow to Biodiesel at a low capital cost. Ecodiesel uses tallow but the technology also allows the conversion of other low cost feedstocks. Ecodiesel plants are standalone and do not require any downstream service providers as all byproducts are effectively processed in the plant. This makes the technology particularly attractive to small or remote markets."</i></p>	18 Million tonnes in 2010
<p>Flo-Dry Engineering Ltd Tissa Fernando +64 (0) 9 415 2330 www.flo-dry.com</p>	<ul style="list-style-type: none"> • Research & Development • Basic Design & Detailed Engineering • Plant Design • Plant Construction / 	Biodiesel from Animal Tallow	<ul style="list-style-type: none"> • Rendering Plant Packages • Waste Water Plant Packages • Biodiesel Plant Packages 	<p><i>In-house developed continuous Reactive Distillation Process based Biodiesel plant capable of converting most difficult feedstocks at a competitive economic conversion cost.</i></p>	Biodiesel Demonstration Plant- 4,000,000 Litre per annum at Albany, Auckland, New

	Maintenance / Operation		• FEDW Plant Packages		Zealand
GNS Science Matthew Stott http://www.gns.cri.nz +64-7-374 8211	<ul style="list-style-type: none"> • Enrichment and isolation of novel extremophilic bacteria with current focus on cellulolytic thermophiles 	<ul style="list-style-type: none"> • Bioethanol and value-adding by-products • Focus on second and third generation biofuels 	<ul style="list-style-type: none"> • Fundamental research into thermophilic bacterial cellulolytics. 	<p><i>The Geomicrobiology group targets and isolates novel bacterial isolates from NZ's unique geothermal systems. Because of our location and pre-existing legal agreements with landowners for the biodiscovery and application of novel microorganisms, we are able to easily refine enrichments while providing the security of legal agreement to conduct these activities.</i></p>	n/a
IPL/Biofuel Testing New Zealand Ivor Reyes +64 9 432 7744 www.biofueltesting.co.nz	<ul style="list-style-type: none"> • Biofuel analysis and testing to regulatory limits • Method Development 	Biodiesel, bioethanol and second generation biofuels	<ul style="list-style-type: none"> • Biofuel analysis and testing to regulatory limits • Biofuel blend test runs 	<ul style="list-style-type: none"> • <i>BTNZ is involved with the development and amendment of methods for the analysis of NZ biofuels.</i> • <i>BTNZ is a member of the Bioenergy Association of New Zealand</i> 	n/a
Lanzatech Sean Simpson +64 (0) 9 373 4929 www.lanzatech.co.nz	<ul style="list-style-type: none"> • Fermentation Technology • Technology Innovation • Plant Design • Waste to Fuel generation 	2 nd generation Biofuel	<ul style="list-style-type: none"> • Biofuel from biomass syngas • Biofuel from industrial waste gas feedstocks 	<p><i>A key advantage of the LanzaTech process is that it is "feedstock agnostic" i.e. It can use almost any organic waste or biomass allowing it to focus on those that are available in high volumes, are low value and are non food (e.g. municipal waste, organic industrial waste (tyres), waste wood).</i></p>	n/a (Process in development)
Massey University Atillio Pigneri +64 (0)6 3505600 http://energy.massey.ac.nz	<ul style="list-style-type: none"> • Process development and optimization • Energy analysis • Techno-economic assessment • Infrastructure planning 	<ul style="list-style-type: none"> • Various activities on 1st, 2nd and 3rd generation biofuels 	Biofuels Research	<p><i>Massey University Centre for Energy Research (MUCER) and Massey University at large represent a leading knowledge bases on bio-energy engineering.</i></p>	n/a
Maxall Energy Ian Maxwell	<ul style="list-style-type: none"> • Biomass conversion technologies 	<ul style="list-style-type: none"> • 3rd generation focus. • Renewable diesel, jet 	<ul style="list-style-type: none"> • Biomass conversion to 	<ul style="list-style-type: none"> • <i>Leading edge biomass to bio-oil technology partner.</i> 	Biorefinery production

<p>+64 (9) 520 0642 ianmaxwell@maxco.co.nz</p>	<ul style="list-style-type: none"> • Bio-oil processing technology • Renewable transportation fuels 	<p>fuel and gasoline</p>	<p>bio-oil</p> <ul style="list-style-type: none"> • Bio-oil processing to renewable fuels. 	<ul style="list-style-type: none"> • Multi-national biorefinery partner. 	<p>capacity in feasibility phase</p>
<p>NIWA Rupert Craggs http://www.niwa.co.nz +64-27-681-1926</p>	<ul style="list-style-type: none"> • Fundamental research on algal production, harvest and biofuel conversion • Desk-top studies on suitability and economics of HRAP for wastewater treatment, CO₂ biofixation and biomass use as fuel, feed or fertilizer. • Pilot and Large-scale demonstration of HRAP and CAP technologies with industry partners • Design of HRAP for wastewater treatment and or algal production • Design of CAP for biogas recovery from wastewater 	<ul style="list-style-type: none"> • Biogas • Bio-oil • Biodiesel • Bioethanol 	<ul style="list-style-type: none"> • Integrated energy efficient wastewater treatment and resource recovery systems • High Rate Algal Ponds • Covered Anaerobic Ponds 	<p>NIWA has pioneered CO₂ addition to wastewater HRAP for enhanced treatment and algal production and has over 12 years experience with the design and operation of HRAP in New Zealand. NIWA has developed the Covered Anaerobic Pond (CAP) to cost-effectively recover energy from wastewater biomass as biogas methane and has 5 years experience with working with end-users to apply this simple technology.</p>	<p>Algal biofuel feedstock</p>
<p>NZ Ester Fuels Andre Hamman http://www.nzef.co.nz</p>	<ul style="list-style-type: none"> • Production Technology • Plant Design & Fabrication • Plant Construction & Commissioning • Development of innovative pilot scale concepts to industrial scale operation 	<ul style="list-style-type: none"> • 1st Generation coupled with process intensification techniques • Sustainable Biodiesel manufacture 	<ul style="list-style-type: none"> • Biodiesel (Used Cooking Oil & Tallow) • Conversion of degraded feedstocks using novel technologies 	<p>Strong technical team with proven ability to deliver practical and cost effective solutions.</p>	<p>2 million litre pa</p>
<p>PurePower Technology Ross Prestidge +64 (9) 632 1007</p>	<ul style="list-style-type: none"> • Processing technology development • Biomass production, harvesting and 	<ul style="list-style-type: none"> • 2nd generation (from non-food crops such as coppiced willow) biofuels and 	<ul style="list-style-type: none"> • Technology development 	<p>Proprietary process for producing high-value specialty chemicals and ethanol from woody biomass, as opposed to other "cellulosic</p>	<p>n/a</p>

	transformation to specialty chemicals and biofuels	bioproducts <ul style="list-style-type: none"> • High-value specialty chemicals, such as high-quality natural lignin and xylose, to replace petrochemical feedstocks, • Bioethanol 		<i>ethanol” processes that destroy or degrade the most valuable components of biomass in the singular pursuit of ethanol.</i>	
Scion Michael Jack +64 (0) 7 343 5601 www.scionresearch.com	<ul style="list-style-type: none"> • NZ woody biomass resource • Feedstock pretreatment technologies • Biomass conversion technologies • Energy modeling and life cycle assessment • Plant and industrial biotechnology • Biomaterials development • Water and waste management technologies 	<ul style="list-style-type: none"> • Second generation feedstocks • Economic / engineering models for biofuels production plants • Bioethanol and next generation fuels – biological and thermal conversion platforms • Co-products from lignin • Water recycling processes 	Research and Development	<i>Scion’s key advantage is the ability to carry out research and development across the entire biofuel production value chain including:</i> <ul style="list-style-type: none"> ○ <i>Woody biomass resources development and logistics</i> ○ <i>Pretreatment and conversion technologies for biofuels and co-products</i> <i>Assessment and mitigation technologies for improved environmental footprints of biofuels operations</i>	The Lignocellulosic Bioethanol Initiative programme is aiming to realise a 90 ML/year commercial plant in the Central North Island.
Solvent Rescue / Solray Wayne Harpur +64 21 356 794 www.solrayenergy.co.nz	<ul style="list-style-type: none"> • High temperature water conversion • Continuous Energy Efficient reactor • Modular fully Scalable. • Mark 2 plant operating and planning Mark 3 	<ul style="list-style-type: none"> • 3rd Generation • Crude Oil ready for any refinery 	Production of Crude Oil from Algae, Seaweed, Pulp, or Sewage Sludge	<i>Solray’s key advantage is that the crude oil we produce is fully interchangeable with crude oil from normal fossil sources. Therefore no existing infrastructural changes to refineries, delivery systems, or end users are required. This feature is important to transport and aviation operators. Blends are not necessary.</i>	200 tonnes crude oil per annum at mark 2 level. Scalable indefinitely after completion of performance trials.
The Proprietors Of Taharoa C Block Ken Hulls kenhulls@xtra.co.nz	<ul style="list-style-type: none"> • Rapid propagation of using advanced laboratory based technologies • Horticultural 	<ul style="list-style-type: none"> • Production of 2nd generation ligno cellulosic biomass giving high yields. • Large scale 	<ul style="list-style-type: none"> • Propagation for own use and for export • Commercial provider of long 	<ul style="list-style-type: none"> • <i>Propagation Technologies</i> • <i>Scale production</i> 	One million dry tonnes p.a

+64-7-849 4911	<ul style="list-style-type: none"> propagation Crop yield trials 	<p>production for: bio ethanol, for co firing with coal, and as a standalone thermal fuel.</p>	<p>term bio mass (for energy) supplies.</p>		
<p>UniServices Limited Keith Jones http://www.uniservices.co.nz +64 (9) 373 7522</p>	<ul style="list-style-type: none"> Production technology Engine testing and design 	<ul style="list-style-type: none"> 1st, 2nd and 3rd generation focus bioethanol and biodiesel 	<ul style="list-style-type: none"> Biodiesel production techniques (1st generation) Biofuel performance (engine) testing 	<p><i>In keeping with University goals the intent of activity in the biofuels area is to be at the forefront of research. Developed technology and other capabilities will be made available to NZ industry to maximize the efficient use of biofuels in NZ.</i></p>	n/a
<p>University of Canterbury Shusheng Pang www.canterbury.ac.nz +64 (3) 3642538</p>	<ul style="list-style-type: none"> Advanced biomass gasification, pyrolysis and Fischer-Tropsch synthesis of liquid fuel. Fundamental research and process simulation. Process optimization and design. Feasibility studies. 	<ul style="list-style-type: none"> 2nd generation focus. Biodiesel. 	<p>Education and research.</p>	<p><i>A 100 kW advanced steam-blown biomass gasifier has been developed and constructed. Hydrogen-rich (40vol%) syngas is produced. Cold model of the above gasifier is built for fluidynamics studies. A Fischer-Tropsch reactor is available for liquid fuel synthesis. Pyrolysis reactor is available for biofuel production.</i></p>	n/a
<p>URS Gael Ogilvie +64 9 355 1330 http://www.urscorp.co.nz</p>	<ul style="list-style-type: none"> Project management Systems thinking Engineering 	<ul style="list-style-type: none"> Feedstock production Biofuel supply chain Plant design 	<ul style="list-style-type: none"> Life Cycle Analysis Sustainability assessment and labeling Carbon footprints Environmental impact assessments Process engineering Chemical engineering 	<p><i>URS staff have specialist knowledge of sustainability issues surrounding biofuels and have wide industry contacts in New Zealand.</i></p>	n/a
<p>Biodiesel Oils Tom McNicoll</p>	No details provided by the company yet.				
<p>Biorefineries</p>	No details provided by the company yet.				

Limited	
Converttech Limited	No details provided by the company yet.
Environfuels Warren Holden	No details provided by the company yet.
NZ Green Fuel Technologies Limited	No details provided by the company yet.
Pukeawa Biofuel Limited	No details provided by the company yet.

10.2 Individual One-page Profile for Each Company listed

covering:


- Company Name and Contact Details
- Core Skill(s)
- Biofuel Focus
- Core Product/Activity
- Key Project Activities
- Leading Edge
- Investment Base
- Employees
- Production Capacity


For the following companies


(Anchor Ethanol) Fonterra	Flo-Dry Engineering Ltd	Scion
AECOM	GNS Science	Solvent Rescue / Solray
AES	IPL/Biofuel Testing New Zealand	The Proprietors Of Taharoa C Block
Ag Research	Lanzatech	UniServices Limited
Aquaflow Bionomic Corporation Limited	Massey University	University of Canterbury
Biodiesel New Zealand Ltd	Maxall Energy	URS

Last updated 2nd November 2009


Carbonscape	NIWA	
Cawthron Institute	NZ Ester Fuels	
Ecodiesel	Pure Power Technology	


Company Name and Contact Details:	
Anchor Ethanol Limited General Manager - Peter Motion Peter.motion@fonterra.com Anchor Ethanol web-link +64 9 374 9000	
<p>Anchor Ethanol Limited now operates as part of the Fonterra Co-operative Group and has three ethanol plants situated at strategic Dairy sites in the Waikato, Bay of Plenty area.</p> <p>Ethanols manufactured from the various sites are both potable and Industrial, with two of the plants having the ability to produce anhydrous ethanol for Industrial and fuel grade markets.</p> <p>Historically the disposal of whey has been a world wide issue due to large quantities of whey produced by the manufacture of cheese and protein products. The resulting whey must be disposed of or reprocessed in an environmentally acceptable way. Due to whey having a high chemical oxygen demand (COD) disposal directly into water ways is not allowable. Disposal options for whey/permeate are stock food, lactose powder, ethanol production and spray drying it into whey/permeate powder.</p> <p>Technology for processing whey/permeate into ethanol was developed in the 1970's in Europe. Anchor Ethanol Ltd purchased this technology in the late 1970's and has been successfully manufacturing and marketing ethanol for the past 29 years.</p> <p>With the global demand for alternative fuels growing dramatically this has opened up new opportunities for Anchor Ethanol Limited to market our Anhydrous grade ethanol for Biofuel.</p>	Core Skill(s):
	<ul style="list-style-type: none"> • Fermentation Technology • Distillation Technology • Marketing
	Biofuel Focus:
	<ul style="list-style-type: none"> • 1st Generation • Ethanol
	Core Product/Activity:
	<ul style="list-style-type: none"> • Ethanol from Dairy Whey
	Key Project Activities:
	n/a
	Leading Edge:
	<p><i>Whey fermentation – an opportunity to further process a waste material into ethanol.</i></p>
Investment Base:	
<ul style="list-style-type: none"> • New Zealand 	
Employees:	
<ul style="list-style-type: none"> • Skilled (Degree level) • Skilled 	
Production Capacity	
15 Million Litres produced during the 2008 - 2009 manufacture season.	


<p>Company Name and Contact Details:</p>	
<p>AECOM New Zealand Limited Alec van Rossen, Director – Power & Energy www.aecom.com alec.vanrossen@aecom.com Phone: +64-9-379-1200</p>	
<p>AECOM (NYSE: ACM) is a global provider of professional technical and management support services to a broad range of markets, including energy, transportation, facilities and environmental. With 43,000 employees around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation, and technical excellence in delivering solutions that enhance and sustain the world's built, natural and social environments. A <i>Fortune 500</i> company, AECOM serves clients in more than 100 countries and had revenue of \$5.6 billion during the 12-month period ended December 31, 2008. More information on AECOM and its services can be found at www.aecom.com.</p> <p>Our team at AECOM New Zealand has developed a specialist service offering renewable energy technologies including liquid biofuel technology, biogas, biomass, and landfill gas, wind, hydro, geothermal and solar.</p> <p>AECOM employees have been involved in liquid biofuels for transportation including commercial facilities for first generation renewables from agriculture such biodiesel and bioethanol. They have also experience with second generation biofuels such as biobutanol and others from wood, which are soon to become a reality.</p> <p>AECOM has demonstrated the capability to participate, from conception through planning to supervision roles in completed energy projects including biogas cogeneration, biogas, wood combustion and gasification, tire derived fuels, and landfill gas.</p> <p>Other renewable experience has been demonstrated by AECOM in a number of wind farm projects for New Zealand and International clients, and our team has world leading expertise in the hydropower and geothermal markets.</p> <p>AECOM offers a powerful resource for management and engineering expertise evaluating energy supply and demand alternatives. We have an impressive depth of expertise in the production, supply, conversion and use of energy including biogas utilisation of human and animal wastes and landfill gas utilization and the promotion of substitute biomass fuels for household and industrial purposes. In addition to this, we have nearly 30 years experience working in the natural gas, LPG, CNG and alongside biofuels sectors.</p>	<p>Core Skill(s):</p>
	<p>Engineering Services for planning and construction of renewable fuels facilities.</p> <ul style="list-style-type: none"> • Production technology. • Plant design. • Plant construction. • Full project support.
	<p>Biofuel Focus:</p>
	<p>Engineering and management services for a wide range of biofuels technologies.</p>
	<p>Core Product/Activity:</p>
	<p>Engineering Services for planning and construction.</p>
	<p>Key Project Activities:</p>
	<p>Planning and design of engineering facilities.</p>
	<p>Leading Edge:</p>
	<p><i>AECOM has an established reputation for excellence for professional support services in both engineering/technology and management to a broad range of markets, including renewable energy, established energy, transportation, facilities and environmental.</i></p>
<p>Investment Base:</p>	
<p>AECOM globally has an annual revenue of US\$5.6b (AECOM is a listed company).</p>	
<p>Employees:</p>	
<ul style="list-style-type: none"> • 400 employees (NZ). • 4,000 employees (Australasia). • 43,000 employees (Global). 	
<p>Production Capacity</p>	
<p>AECOM NZ Ltd has provided engineering services in NZ for 90 years and operates internationally.</p>	


<p>Company Name and Contact Details:</p>	
<p>Alternative Energy Solutions Ltd G L Hedley, Director & Manager 15 Nelson Street, Pukekohe, New Zealand +64 (9) 238 0683 or +64 (21) 740490 gavin@aesbioenergy.co.nz</p>	
<p>AES has <i>working</i> demonstration technology for bio-oil in New Zealand.</p> <p>We can practically demonstrate, using your feed stock, the manufacture both of bio-oil and biochar in an actual, commercially scaled plant.</p> <p>The New Zealand demonstration plant will turn one tonne of waste wood material into 600kg of bio-oil and 200kg of biochar, with the remainder given off as heat which will be used to run the plant. AES proposes building bio-oil plants near the forests where that waste wood is produced, drastically cutting down transport costs and providing distributed power for rural and provincial communities.</p> <p>We can present and discuss opportunities for these products and commercial considerations. We are on the leading edge of fast pyrolysis technology, and are able to present on the emerging industries of Green power generation, combustion applications, chemical separation and derived fuels.</p> <p>ABRItech/AES fast pyrolysis systems offer unique <i>continuous</i> biomass processing –typical conversion is 1 ton of feed stock produces Bio oil, Bio char, and Syn gas 60/20/20% in a plant that is portable, self powered, and demonstratable, <i>now</i>, in NZ.</p> <p>AES Relationships formed also mean we have access to power generation equipment, the technical skills and services to install and run distributed generation systems.</p> <p>The skills and engineering base to develop and supply large recip and turbine generators and the paths for development and advanced uses of bio-oil.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Technical Skills and marketing of Pyrolysis • Bioenergy technologies for forest and other residues recovery and utilization.
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • Bio-oil
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Ankur Gasification representation <ul style="list-style-type: none"> ○ 10Kw to 2.2 Mw Electrical generation ○ 30Kw to 5.6 Mw Heat Energy. • ABRItech Bio oil/bio char systems - 1-100 TPD
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Pukekohe plant - wood-to-bio-oil plant using a pyrolysis process
	<p>Leading Edge:</p>
	<p><i>AES has working demonstration technology for bio-oil in New Zealand.</i></p> <p><i>We can practically demonstrate, using your feed stock, the manufacture both of bio-oil and biochar in an actual, commercially scaled plant.</i></p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • NZ and International 	
<p>Employees:</p>	
<p>Production Capacity</p>	


<p>Company Name and Contact Details:</p>	
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<p>AgResearch Unlocking Cellulosic Biofuels Program Heather Went – Business Development Manager www.agresearch.co.nz heather.went@agresearch.co.nz 06 351 8035</p>	 <p>Farming, Food and Health. First</p>
<p>AgResearch is New Zealand’s largest Crown Research Institute (CRI) with a mission to create sustainable wealth in the pastoral and biotechnology sectors through innovation.</p> <p>In 2008, AgResearch won funding from the Foundation for Research, Science and Technology (FRST) for the six year “Unlocking Cellulosic Biofuels” program. The key output from this program will be an <i>in planta</i> 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.</p> <p>Biofuel enzymes are currently produced by fermentation. However, in order to produce the volumes of enzymes required to generate significant amounts of 2nd generation biofuels, there will need to be prohibitively high levels of investment in new enzyme production facilities, or an alternative way of producing the enzymes. Producing enzymes <i>in planta</i> will be cost-effective, require minimal capital investment and be rapidly scalable in response to demand compared to building new, high-cost infrastructure for fermentation-based enzyme manufacture.</p> <p>This key enabling technology will be compatible with the full range of cellulosic feedstocks (trees, grasses, municipal solid waste) and with algal, yeast or bacteria-based biorefinery processes yielding a range of liquid biofuels. High merit enzymes are being sourced from rumen microbes, geothermal vent microbes, and commercial sources; and tailored for manufacture <i>in planta</i> and to act on a range of feedstocks. Selected enzymes will be linked to a proprietary protein that will stabilise the enzyme in the seed, and aid purification and emulsification properties of the enzyme while maintaining its efficacy.</p> <p>Technology development is being undertaken by proven science teams from AgResearch and Waikato University with strong track records in delivering outcomes from collaborative networks. We are building on prior work in the areas of recombinant protein expression, enzyme characterization and enhancement, and plant-based product development and commercialisation.</p> <p>AgResearch is a member of the Ministry of Research, Science & Technology (MoRST)-sponsored NZ Renewable Energy Transformation Research Science and Technology (TRST) group, alongside Scion and GNS.</p>	<p>Core Skill(s):</p> <ul style="list-style-type: none"> • Recombinant protein expression • Enzyme characterization & enhancement • Plant technology and product development <p>Biofuel Focus:</p> <ul style="list-style-type: none"> • 2nd generation ligno-cellulosic feedstocks • Bioethanol, biodiesel or biobutanol <p>Core Product/Activity:</p> <ul style="list-style-type: none"> • Cost-effective, scalable, biofuel enzyme production <p>Key Project Activities:</p> <ul style="list-style-type: none"> • Plant-manufactured industrial enzymes <p>Leading Edge:</p> <p><i>AgResearch’s biofuel enzyme manufacture technology will be compatible with the full range of ligno-cellulosic feedstocks coupled with algal, yeast or bacteria-based biorefinery processes. Using plants to produce enzymes will be more cost-effective, require minimal capital investment and be rapidly scalable in response to demand compared to building new, high-cost infrastructure for fermentation-based enzyme manufacture.</i></p> <p>Investment Base:</p> <ul style="list-style-type: none"> • New Zealand Crown Research Institute <p>Employees:</p> <ul style="list-style-type: none"> • Over 1000 staff at four campuses <p>Production Capacity</p> <ul style="list-style-type: none"> • Technology development and licensing



<p>Company Name and Contact Details:</p>	
<p>Aquaflow Bionomic Corporation Limited CTO - Paul Dorrington www.aquaflowgroup.com gill@aquafllowgroup.com +64 (3) 543 8227</p>	
<p>Aquaflow Bionomic Corporation Limited was founded in Oct 2005 to develop economic and sustainable production of clean water and biocrude oil from wild micro algae.</p> <p>The company was founded by three partners, Nick Gerritson, Vicki Buck and Barrie Leay who also established a match funded Government Technology Assessment Grant with other private shareholders. In 2007 \$3.5 M was raised by a public prospectus and Pure Power Asia became a 19 % cornerstone shareholder.</p> <p>The wild micro algae are predominantly sourced from municipal waste water treatment sites and provide a continuous biomass feedstock from these existing municipal infrastructures at a low feedstock supply cost.</p> <p>Algae feed on a combination of nitrogen, phosphorous and carbon during the process of photosynthesis while they are in suspension in the waste water environment. The physical removal of the algae bio mass is a process that removes these nutrients, with the resulting water cleaned of these contaminants with improved coliform counts and lower BOD levels in the water body. Local water authority pollutant consent levels can often be achieved to allow water discharge compliance, by the managed use of ponds and the harvesting of wild algae.</p> <p>The algae biomass provides several different options for use including agricultural fertilizer / livestock feed derivatives and gasification/ pyrolysis process for bio fuel development.</p> <p><u>Achievements:</u> The first Aquaflow derived biodiesel was used in a vehicle that was driven around Parliamentary grounds in Dec 2006</p> <p>A continuous harvesting process of 70 m³/hr capability was initiated at the Blenheim city waste water facility in Feb 2008 to supply algae to the continuous green crude pilot plant processor which was commissioned in May 2008.</p> <p>Following this, the first 8 liters of algae oil was supplied to UOP in Oct 2007 for refining trials and process development. Following the signing of an MOU between Aquaflow and UOP , Aquaflows first jet and diesel fuel samples were produced by UOP in Dec 2008.</p> <p>Aquaflow continues to work with potential clients for water remediation and green crude development from algal biomass, subject to their site specific situation.</p> <p>In many cases this involves an integrated solution approach to enable the resources to be best used subject to the situation environment. These solutions are advised by professionally engaged Aquaflow employees who hold a range of chemical and water engineering degrees with extensive collective experience.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Wild Algae harvesting technology • Pond water quality remediation • Processing plant design • Green Crude processing technology • High value chemicals
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • 2nd generation focus • biodiesel
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Remediated water • Partnered Bio diesel from Algae Bio mass
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Pilot Plant Blenheim: Continuous Algae harvesting and waste water remediation • Pilot Plant Nelson: Continuous Green Crude process development.
	<p>Leading Edge:</p>
	<p><i>Provide a low cost method of wild algae biomass extraction from existing waste water facilities. The algae extraction process improves the waste water quality by significantly reducing nitrogen and phosphorous loadings, BOD and coliform levels. The biomass can then be used in agricultural/ aquaculture applications, co-generation / methanol fuel, or biofuels feedstock production.</i></p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • NZ Investors • 19% Offshore cornerstone Investor 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • 5 : Skilled: - degree status • 3 : Other skilled • 1 : Unskilled 	
<p>Production Capacity</p>	
<ul style="list-style-type: none"> • 2 tonnes biomass harvesting / day 	

<p>Company Name and Contact Details:</p>	
<p>Biodiesel New Zealand Andrew Simcock, General Manager andrew.simcock@biodiesel-nz.co.nz +64-21-667-199 or +64-3-345-6290</p>	
<p>Biodiesel New Zealand and parent company Solid Energy want our bio diesel business to grow and prosper, for the benefit of the country, its customers and suppliers.</p> <p>Sustainability is central to the fuel's appeal and sustainability is central to the way we aim to do business. Every litre of fuel produced locally is one we no longer need to import.</p> <p>Biodiesel New Zealand's high-quality product runs well in almost any diesel vehicle; no conversion kit or additional equipment required. Our customers are fleet operators, tourism businesses, fishing trawlers and businesses using it to run a range of applications including generators, process heat, and vehicles.</p> <p>They value the product because it:</p> <ul style="list-style-type: none"> • Is a sustainable, renewable fuel • Is non-toxic, safer and simpler to store and handle • Is biodegradable (eg in marine applications) • Is easier on engines, delivering far less wear • Greatly reduces engine emissions • Mixes safely with mineral diesel • Much lower temperature use than other types of bio diesel • Is New Zealand-made and backed by Solid Energy <p>Biodiesel New Zealand is now producing at a rate of 3-4 million litres of bio diesel a year, primarily from recycled cooking oil. The firm recently completed its first commercial-scale harvest of rapeseed grown by South Island farmers and that oil will make up an increasing proportion of the bio diesel feedstock.</p> <p>The business 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 tonnes of rapeseed.</p> <p>As a result of the steep fall in the price of transport fuel from late 2008, the company decided to take more time to consider the timing and size of the future bio diesel production facility, deciding to expand production capacity at its existing plant in Christchurch from 1 to 4 million litres a year.</p> <p>Solid Energy, the energy company which owns Biodiesel New Zealand, is also developing other promising energy solutions that will help to power New Zealand's future.</p> <p>Alongside our bio diesel made from used cooking oil and locally-grown rapeseed oil, these include wood pellets for commercial and household use, solar water heating and new, cleaner ways of using coal.</p>	<p>Core BioDiesel Business Skill(s):</p>
	<ul style="list-style-type: none"> • Used oil collection • Agronomy and agricultural activities supporting oil seed rape (OSR) • Production technology & design • Logistics and operational support • Sales & Market Development
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • Viable bio fuel feed stock commercialization • Bio diesel manufacturing and supply
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Bio Diesel, oil seed rape, used cooking oil and related products and markets
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Feed stock development, manufacturing, logistics, local market development initiatives
	<p>Leading Edge:</p>
	<p><i>Biodiesel New Zealand has been making and selling high quality bio diesel derived from used vegetable oil (UCO) for over three years. More recently, we have been growing oilseed rape (OSR) for bio diesel production. We are the leading supplier of bio diesel in NZ having a multiple feedstock, fully integrated, market led strategy to increasingly supply the New Zealand diesel market with quality bio diesel promoting benefits & scale relevant to today's key markets.</i></p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • New Zealand 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • 20 	
<p>Production Capacity</p>	
<p>4 Million litres from July 2009</p>	


<p>Company Name and Contact Details:</p>	
<p>Carbonscape Forrest Tyrrell-Baxter www.carbonscape.com info@carbonscape.com +64 (3) 579 2274</p>	
<p>Carbonscape is developing proprietary processes to efficiently convert wood biomass into higher value carbon-rich products for use in a variety of energy, agricultural and emission's trading markets.</p> <p>Carbonscape was formed in late 2006. The company has developed a series of prototype machines to demonstrate its novel process that utilises microwave heating.</p> <p>Carbonscape's state of the art process has advantages over traditional pyrolysis methods by rapidly producing high grade charcoal efficiently and economically. The process also produces valuable byproducts of biooil fuel and syngas, which can be combusted to release industrial heat or electricity energy.</p>	<p>Core Skill(s):</p>
	<p>For example:</p> <ul style="list-style-type: none"> • New Process Development • Clean Technology Commercialisation • Emerging carbon emissions reduction GHG, CDM markets • Industrial Microwave Systems
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • Biooil, sustainable industrial fuel oils
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Biochar, Biooil, Syngas, Activated Charcoal
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Research and Development • New Technology Commercialisation
	<p>Leading Edge:</p>
	<p><i>Carbonscape's state of the art process has advantages over traditional pyrolysis methods by rapidly producing high grade charcoal efficiently and economically. The process also produces valuable byproducts of biooil fuel and syngas, which can be combusted to release industrial heat or electricity energy.</i></p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • NZ, Australia, US, UK 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • 8 	
<p>Production Capacity:</p>	
<p>Commercial demonstration, 5000 tonnes per annum by 2011</p>	


Company Name and Contact Details:	
<p>CAWTHRON Institute Mike Packer – Senior Scientist 98 Halifax Street East Nelson 7010, Private Bag 2 Nelson 7042. NEW ZEALAND Tel +64 3 548 2319 Fax + 64 3 546 9464 www.cawthron.org.nz</p>	Core Skill(s):
<p>Cawthron provides research based solutions to enable the sustainable management and development of New Zealand's coastal and freshwater systems and resources.</p> <p>Cawthron's funding comes from the Foundation for Research, Science & Technology and a range of commercial clients to which it provides consulting and analytical services. Cawthron employs over 180 scientific and technical staff based in Nelson and Marlborough.</p> <p>Cawthron has extensive knowledge of freshwater and marine micro-algae and Cawthron's activities in Biofuels relate to its expertise in this field.</p> <p>Cawthron is involved with. Isolating, culturing and optimizing growth condition for algae with intended utility in</p> <ul style="list-style-type: none"> • CO₂ sequestration and capture • High value products • Biofuel production 	<ul style="list-style-type: none"> • Algal Production Technology • Algal Strain Identification • Algal biomass generation • Waste to Fuel generation
	Biofuel Focus:
	Core Product/Activity:
	Key Project Activities:
	Leading Edge:
	<p><i>Selection and husbandry of micro algae for fuel generation and CO₂ capture</i></p>
	Investment Base:
	Employees:
	Production Capacity:
	<p>n/a</p>


<p>Company Name and Contact Details:</p>	
<p>Ecodiesel Gary Brockett, CEO www.goecodiesel.com gary.brockett@goecodiesel.com 64 9 6364740</p>	
<p>Ecodiesel produces biodiesel fuel from Tallow - a sustainable resource. Ecodiesel is constructing a 20 million litre biodiesel plant, which will be completed by February 2010. The plant will be the first commercial-scale plant in New Zealand capable of producing biodiesel that meets the technical specifications required by major oil companies. Ecodiesel is in the process of raising its final funding to complete the plant and begin full scale commercial production.</p> <p>Ecodiesel Limited has developed a proprietary manufacturing process to convert tallow into biodiesel. The company's demonstration plant has proven various aspects of the technology by producing product meeting the New Zealand fuel standards. Ecodiesel's product has been sold both commercially and at the retail level in New Zealand.</p> <p>Ecodiesel technology utilises low temperature and low pressure processing of Biodiesel, resulting in low cost, low energy plants. The plants are designed as standalone units and can operate in remote locations with limited infrastructure. Low quality feedstocks are no problems and plants can be custom designed for specific input oils or fats.</p> <p>Ecodiesel plants are generally economic to run at capacities as low as 10 million litres per year and produce high quality biodiesel from low quality feedstocks at high yield rates. High yields and low process costs are achieved through internal processing of all byproducts produced.</p> <p>Ecodiesel has plans to expand its Auckland plant to 40 million litres within two years.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Production Technology • Plant Design • Plant Construction
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • 1st generation focus • biodiesel
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Biodiesel from Tallow • Small scale standalone plants
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Pilot plant Onehunga • Full-scale plant Onehunga
	<p>Leading Edge:</p>
	<p><i>"Ecodiesel specialises in the conversion of difficult lipid substrates, such as tallow to Biodiesel at a low capital cost. Ecodiesel uses tallow but the technology also allows the conversion of other low cost feedstocks. Ecodiesel plants are standalone and do not require any downstream service providers as all byproducts are effectively processed in the plant. This makes the technology particularly attractive to small or remote markets."</i></p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • 100% New Zealand 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • 2009 - 5 full time • 2010 - 22 full time 	
<p>Production Capacity</p>	
<p>18 Million tonnes in 2010</p>	


<p>Company Name and Contact Details:</p>	 
<p>Flo-Dry Engineering Limited Tissa Fernando, Managing Director www.flo-dry.com info@flo-dry.com +64 9 4152330; +64 9 415 2190</p>	<p>Core Skill(s):</p>
<p>Flo-Dry Engineering Ltd (FDEL) was established in 1985 as a design and manufacturing company for the Flo-Dry direct fired rotary driers and complete processing systems. In 1990, Tissa and Nele Fernando bought the Company from other owners that included Auckland Farmer’s Freezing Co. Ltd, which held 60% of the shares.</p> <p>Projects executed by FDEL have ranged from animal by-products processing to wastewater treatment within both- industrial and municipal plants. Today, main focus of the company is on developing, constructing and delivering Biodiesel Plants, Flo-Dry Electro Dewatering(FEDW) plants & Sludge Drying Plants for municipal sewage sludge treatment plants.</p> <p>FDEL has demonstrated the ability to manage projects in Australia, New Zealand and in more distant locations like UK, Chile and India. Quality and reliability of the plants is evidenced by the number of repeat client orders being received over the years.</p> <p>The company employs a team of eight engineers, and two support staff to develop, design, install and commission the plants. Comprehensive after-sales service ensures smooth operation of plants and equipment supplied. Association of the company with the client is viewed as a long-term partnership.</p> <p>FDEL is driven by one priority – to provide a responsive, competent and comprehensive service to industry. The company’s capabilities extend from initial customer requirements to developing specific packaged system, technical development and manufacture of specialized equipment for a large portfolio of customers in many industry sectors.</p> <p>FDEL has recently developed, based on intensive laboratory experimentation, packaged systems for FRDB (Flo-Dry Reactive Distillation Biodiesel) based on continuous Reactive Distillation Process. Patent for this unique process has already been applied. FDEL now plans to venture in the manufacture of standardized packages for rendering plants and other end users as forward integration. Reactive Distillation Process can employ a wide range of raw materials including animal tallow and waste vegetable oil to produce Biodiesel-named EVERDIESEL, meeting New Zealand, Australia, National and International Standards.</p> <p>Another packaged system developed by FDEL is Electro Dewatering of Municipal Sludge, termed as FEDW- Flo-Dry Electro De Watering package. This package developed in-house based on intensive laboratory tests and demonstration plant runs, is also awaiting commercialization. Patent application has also been lodged. Process uses very low voltage potential applied across electrodes dipped in conductive sludge. With controlled conditions of flow, current, pH, temperature, polymer, etc an increase of DS (dry solids) of around 30 % can be guaranteed over the achievable DS by polymer addition only.</p> <p>Both of these packaged processes are now part of business line, thus are included in the Quality Management System- ISO 9001: 2008.</p> <p>FDEL’s strengths lie in the team, comprising of specialists from industrial backgrounds. They understand the priorities, problems and constraints that clients often have to deal with, and therefore provide more effective support.</p>	<ul style="list-style-type: none"> • Research & Development • Basic Design & Detailed Engineering • Plant Design • Plant Construction / Maintenance / Operation
<p>Biofuels Focus:</p>	<ul style="list-style-type: none"> • Biodiesel from Animal Tallow
<p>Core Product/Activity:</p>	<ul style="list-style-type: none"> • Rendering Plant Packages • Waste Water Plant Packages • Biodiesel Plant Packages • FEDW Plant Packages
<p>Key Project Activities:</p>	<ul style="list-style-type: none"> • Complete Plant Design from concept to commissioning
<p>Leading Edge:</p>	<p><i>In-house developed continuous Reactive Distillation Process based Biodiesel plant capable of converting most difficult feedstock at most competitive economic conversion cost.</i></p>
<p>Investment Base:</p>	<ul style="list-style-type: none"> • New Zealand /Australia • UK/ Chile /India • Brazil/Korea
<p>Employees:</p>	<ul style="list-style-type: none"> • Specialized / Engineering-11 • Technical / Support - 3
<p>Production Capacity</p>	<p>Biodiesel Demonstration Plant- 4,000,000 Litre per annum at Albany, Auckland, New Zealand</p>


<p>Company Name and Contact Details:</p>	
<p>GNS Science Dr Matthew Stott, Geomicrobiology Team Leader www.gns.cri.nz/extremophiles extremophiles@gns.cri.nz T +64-7-374 8211</p>	
<p>GNS Science is the leading Earth Sciences provider in New Zealand. We are the government's principal earth systems and isotope science researcher and advisor, and our purpose is to understand earth systems and technologies and to transform this knowledge into economic, environmental, and social benefits for New Zealand.</p> <p>The Geomicrobiology Group at GNS science was established in 2004 with the principle aim to investigate the distribution and abundance of microorganisms from New Zealand's extreme environments, as well as the interactions between the organisms and their surroundings.</p> <p>One feature that makes New Zealand unlike any other place on Earth is the presence of a vast array of extreme environments in a small geographical area. The majority of these environments are found in the Taupo Volcanic Zone (TVZ) in which the Geomicrobiology Group is centrally located. The Geomicrobiology Group specializes in the enrichment and isolation of novel microorganisms. The laboratory uses both cultivation-dependent and -independent techniques to investigate microbial communities in NZ geothermal areas.</p> <p>Since 2007, Geomicrobiology Group has focused on the isolation of novel cellulolytic and thermophilic bacteria. The use of thermophilic microorganisms, and/or enzymatic preparations derived from thermophiles are strategies to increase the rate of cellulose degradation, and therefore production efficiency. Our novel microbial isolates represent an important step in understanding and improving bioethanol production. Amongst our database of cellulose-degrading bacteria are a number of highly novel bacterial isolates including the first isolate from candidate division OP10 and thermophilic <i>Chloroflexi</i>-like species that effectively breakdown cellulose and hemicellulose compounds to form sugars for fermentation to ethanol.</p> <p>In early 2009, the Geomicrobiology Group received a grant from the Foundation for Research Science and Technology (FRST) to investigate the use of thermophilic bacteria in bioethanol production. The Group also has collaborative projects with Scion Research and also the University of Manitoba as part of the Genomes Canada programme. GNS is a member of the Ministry of Research, Science & Technology (MoRST)-sponsored NZ Renewable Energy Transformation Research Science and Technology (TRST) group, alongside Scion and AgResearch.</p> <p>The Geomicrobiology Group has legally binding agreements with landowners of geothermal areas to isolate and develop novel microbes for use in research and commercial processes. This provides ongoing and secure access to geothermal features for on-going refinement for targeted biodiscovery and research, as well as surety that biodiscovery is being conducted in a consented and sustainable process.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Enrichment and isolation of novel extremophilic bacteria with current focus on cellulolytic thermophiles
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • Bioethanol and value-adding by-products • Focus on second and third generation biofuels
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Fundamental research into thermophilic bacterial cellulolytics.
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Targeted enrichment and isolation of novel cellulose and lignin degrading enzymes and/or microorganisms. • Genomics of thermophilic cellulose degradation.
	<p>Leading Edge:</p>
	<p><i>The Geomicrobiology group targets and isolates novel bacterial isolates from NZ's unique geothermal systems. Because of our location and pre-existing legal agreements with landowners for the biodiscovery and application of novel microorganisms, we are able to easily refine enrichments while providing the security of legal agreement to conduct these activities</i></p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • NZ government & internal funding. • Co-funding from a small NZ commercial operation. • Collaborations with international university & government institutes. 	
<p>Employees:</p>	
<p></p>	
<p>Production Capacity</p>	
<p>n/a</p>	


<p>Company Name and Contact Details:</p>	
<p>Biofuel Testing New Zealand (BTNZ) Ivor Reyes - BTNZ Customer Focal Point Brendan Oakden - IPL Distribution Team Leader BioFuel Testing New Zealand info@biofueltesting.co.nz +64 9 432 7744</p>	
<p>Biofuel Testing New Zealand (BTNZ) offers biofuel Producers and Receivers accredited cost effective biofuel testing right here in New Zealand.</p> <p>Based in Northland, the team at BTNZ can complete full biofuel analyses to Engine Fuels Regulations methods.</p> <p>The BTNZ team are skilled experts with more than 25 years of experience in the fuel testing industry.</p> <p>BTNZ aims to provide testing services of the highest quality to all clients, in a timely and efficient way.</p> <p>The team prides itself on its core values of Quality, Service and Expertise.</p> <p>Biofuel Testing New Zealand is a division of IPL, which has been New Zealand's leading fuel tester for almost a decade.</p> <p>IPL and BTNZ are accredited by International Accreditation New Zealand (IANZ), with over 15 staff holding Key Technical Personnel (KTP) status. The staff at IPL and BTNZ have strict Quality Management Systems and a high commitment to ISO/IEC 17025:2005 principles.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Biofuel analysis and testing to regulatory limits • Method Development
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • Biodiesel, bioethanol and second generation biofuels
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Biofuel analysis and testing to regulatory limits • Biofuel blend test runs
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • IANZ accreditation of all biofuel methods
	<p>Leading Edge:</p>
	<ul style="list-style-type: none"> • <i>BTNZ is involved with the development and amendment of methods for the analysis of NZ biofuels.</i> • <i>BTNZ is a member of the Bioenergy Association of New Zealand</i>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • Asia Pacific 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • IPL and BTNZ employs over 40 staff a number which are dedicated to biofuel analysis 	
<p>Production Capacity</p>	
<p>n/a</p>	


<p>Company Name and Contact Details:</p>	
<p>LanzaTech NZ Ltd Sean Simpson, CSO www.lanzatech.co.nz Barbara@lanzatech.co.nz + 64 (0) 9 373 4929</p>	
<p>LanzaTech was founded in early 2005 to develop, and commercialize proprietary technologies for the production of lowest cost fuel ethanol from the carbon monoxide in low-hydrogen waste gases produced by the steel industry. The company is now ready to undertake the next stage on this critical path, the pilot-scale demonstration of its fuel ethanol production from both biomass syngas and industrial waste gas feedstocks. A pilot plant design has been developed that will allow ethanol production from each of these feedstocks to be demonstrated at scale over the next 12 months.</p> <p>The company attracted series A investment from a US investor consortium led by Khosla Ventures. LanzaTech was the only non-US company to attract funding, highlighting the potential of our technology in the field of ethanol production. With the increased funding, we were able to expand the focus of our process development program to include biomass-derived syngas (this contains elevated levels of hydrogen gas). Thus, our gas fermentation technology can be applied commercially to enable the production of fuels from either industrial waste gas or biomass derived syngas.</p> <p>Specifically, our plan is to develop an ethanol production process that can be retrofitted to industrial facilities to generate ethanol from the carbon monoxide component of waste flue gases.</p> <p>Last year we received additional funding from the Foundation for Research, Science and Technology. We have now been able to scale up our process, running a world first pilot plant at a steel mill in South Auckland. There is huge global potential in making fuel from waste gases, which are already being produced in big volumes and going to waste.</p> <p>LanzaTech is also able to use syngas that can be produced from waste cellulosic biomass (woody biomass) and municipal waste by gasification to produce ethanol.</p> <p>The clear advantage of this approach to capturing the energy in biomass is that through gasification over 90% of the energy is made available for fermentation whereas more conventional technologies (for instance cellulose fermentation), may only access the carbohydrate portion of the biomass.</p> <p>The LanzaTech process addresses the global need for cost-competitive low carbon transport fuel, has the flexibility to either be used to reduce GHG emissions from steel manufacture or through the direct displacement of fossil fuels with biomass derived ethanol.</p> <p>Today the company employs a large team, has a strong, rapidly growing patent portfolio, and has adopted an aggressive stage-gated critical path through process piloting to commercialization.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> ● Fermentation Technology ● Technology Innovation ● Plant Design ● Waste to Fuel generation
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> ● 2nd generation Biofuel
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> ● Biofuel from biomass syngas ● Biofuel from industrial waste gas feedstocks
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> ● Pilot plant – Auckland Steel Mill
	<p>Leading Edge:</p>
	<p><i>A key advantage of the LanzaTech process is that it is “feedstock agnostic” i.e. It can use almost any organic waste or biomass allowing it to focus on those that are available in high volumes, are low value and are non food (e.g. municipal waste, organic industrial waste (tyres), waste wood).</i></p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> ● US Investors ● NZ Investors 	
<p>Employees:</p>	
<ul style="list-style-type: none"> ● 24 skilled (Degree level and above) ● 2 part-time (Degree level) ● 1 Master student 	
<p>Production Capacity:</p>	
<p>n/a (Process in development)</p>	

<p>Company Name and Contact Details:</p>	 <p>Massey University CENTRE FOR ENERGY RESEARCH</p>
<p>Massey University Centre for Energy Research (MUCER) Dr. Attilio Pigneri, Associate Director http://energy.massey.ac.nz A.Pigneri@massey.ac.nz +64 (0)6 3505600</p>	
<p>The Massey University Centre for Energy Research (MUCER) was established in 1996 following more than 25 years of research and education in the fields of renewable energy, energy management and climate change mitigation under the leadership of Professor Ralph Sims.</p> <p>MUCER bioenergy research highlights</p> <p><u>Biofuels</u> Professor Ralph Sims' seminal work in the area of biofuels, started under the auspices of the of the Liquid Transport Fuel Board in the late 1970s, has brought forward the development of the basic and applied technology for two distinctively New Zealand biofuel pathways, bioethanol from whey and biodiesel from tallow.</p> <p><u>Massey University Biochar Initiative</u> Dr. Pigneri has led, along with Prof. Mike Hedley from the Soil and Earth Sciences Group at Institute of Natural Resources, the development of the successful proposal to MAF for the establishment of the Massey University Biochar Initiative, a 3.3 mNZD, multi-year RD&D programme aimed at advancing the understanding of biochar as a GHG mitigation solution for New Zealand's primary sectors</p> <p><u>GHG accounting and Footprinting</u> An integrated GHG accounting model for the City of Palmerston North is currently being developed by Dr Attilio PIGNERI for the Palmerston North City Council (Water and Waste services) as a planning tool for GHG mitigation activities. Prof. Don Cleland has contributed to the development of the footprinting efforts for the dairy and kiwifruit industries, under the auspices of MAF.</p> <p>Other bioenergy research activities at Massey University MUCER is an aggregator of capabilities in the wider energy area within Massey. The work of the Centre is complemented by a number of other Centres.</p> <p><u>Centre for Environmental Technologies and Engineering (CETE)</u> The Centre established under the leadership of Prof. Andy SHILTON, is the leading NZ centre of expertise in environmental bioprocessing technology for water and land treatment. The work on the design and characterization of anaerobic digestion processes enhances greatly the capabilities held at Massey in the area of biogas power generation.</p> <p><u>Biochemical Engineering and Process Biotechnology Research Centre</u> - The Centre, led by Prof. Yusuf Chisti, is host to a wide range of research activities in bioprocesses, some of extreme relevance to the energy area, particularly his most recent work on biodiesel production from algae feedstocks.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Process development and optimization • Energy analysis • Techno-economic assessment • Infrastructure planning
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • Various activities on 1st, 2nd and 3rd generation biofuels
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Biofuels Research
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Sustainability guidelines for Bioenergy Plants (OECD/IEA) • Commercialization of 1st and 2nd generationm (OECD/IEA) • Biochar Initiative (MAF) • Review of the biofuel industry (Fulbright commission NZ)
	<p>Leading Edge:</p>
	<p>Massey University Centre for Energy Research (MUCER) and Massey University at large represent a leading knowledge bases on bio-energy engineering.</p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • NZ 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • 4 full-time MUCER faculty • several researchers and graduate students from Massey University 	
<p>Production Capacity</p>	
<p>N/A</p>	


<p>Company Name and Contact Details:</p>	
<p>Maxall Energy Dr Ian E Maxwell, CEO ianmaxwell@maxco.co.nz +64 (9) 520 0642 and 021-545 086</p>	
<p>Maxall Energy is a new company with a focus on developing renewable transportation fuels based on bio-oils produced from sustainable biomass resources.</p> <p>Renewable transportation fuels have the considerable advantage of being hydrocarbon based and are therefore “drop-in” fuels with characteristics very similar to their fossil fuel equivalents.</p> <p>Renewable fuels require no adaptation of the fuels distribution infrastructure or engine modifications and have therefore effectively no limitations on the percentage that can be blended into fossil derived transportation fuels.</p> <p>New Zealand is potentially well placed to develop both the biomass sources and the process technology to produce renewable fuels on a large commercial scale.</p> <p>Such a transportation fuels development would enable New Zealand to substantially reduce eliminate crude oil imports as well as carbon emissions.</p> <p>Maxall Energy is focused on technology and business partnerships that will enable these crude oil independence and carbon reduction goals for New Zealand to be attained.</p>	
	<ul style="list-style-type: none"> • Biomass conversion technologies • Bio-oil processing technology • Renewable transportation fuels
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • 3rd generation focus • Renewable diesel, jet fuel and gasoline
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Biomass conversion to bio-oil • Bio-oil processing to renewable fuels
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Biomass conversion partners • Feasibility study for biorefinery with partner
	<p>Leading Edge:</p>
	<ul style="list-style-type: none"> • Leading edge biomass to bio-oil technology partner. • Multi-national biorefinery partner.
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • NZ, Australian and Canadian investors/partners 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • About 25 direct and indirect including technology and business partners 	
<p>Production Capacity</p>	
<ul style="list-style-type: none"> • Biorefinery production capacity in feasibility phase 	


<p>Company Name and Contact Details:</p>	
<p>NIWA Dr Rupert J. Craggs +64-27-681-1926 r.craggs@niwa.co.nz http://www.niwa.co.nz</p>	
<p>The National Institute of Water and Atmospheric Research (NIWA) is a Crown Research Institute focusing on water and atmospheric research. The Aquatic Pollution Group at NIWA Hamilton has conducted research on improved pond systems for wastewater treatment for over 20 years. For the last 12 years they have developed and calibrated the High Rate Algal Pond (HRAP) wastewater treatment and algal production technology for New Zealand conditions. These shallow, paddlewheel-mixed open raceway ponds achieve far more efficient wastewater treatment than conventional oxidation ponds primarily as a result of intense algal photosynthesis providing saturated oxygen to drive aerobic treatment and assimilation of wastewater nutrients into algal biomass. The shallow pond depth and continuous mixing of HRAP assist with disinfection of the wastewater by sunlight. HRAP are also much more cost-effective than energy intensive mechanical wastewater treatment systems providing similar wastewater treatment.</p> <p>Over 90% of worldwide commercial microalgal production is produced in HRAP. NIWA has pioneered CO₂ addition to wastewater HRAP for enhanced treatment and algal production. NIWA is presently conducting fundamental research on algal production, harvest and biofuel conversion (biogas, bioethanol, biodiesel and bio-oil) with industry partners. A 5 ha demonstration-scale HRAP with carbon dioxide addition will be monitored over the next 3 years at Christchurch wastewater treatment plant. Algae will be converted to bio-oil in conjunction with Solray Energy Ltd.</p> <p>NIWA has also developed the Covered Anaerobic Pond (CAP) to cost-effectively recover energy from wastewater biomass as biogas methane. Research on CAPs over the last 5 years has demonstrated equivalent biogas production to more expensive heated, mixed digesters. CAPs can be easily used to retrofit existing anaerobic ponds used on farms or by industry. CAPs can be combined with the most appropriate biogas use option at a site, which depending on the size of the installation, could be one or a combination of: heating/cooling; combined heat and power; vehicle use.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Fundamental research on algal production, harvest and biofuel conversion • Desk-top studies on suitability and economics of HRAP for wastewater treatment, CO₂ biofixation and biomass use as fuel, feed or fertilizer. • Pilot and Large-scale demonstration of HRAP and CAP technologies with industry partners • Design of HRAP for wastewater treatment and or algal production • Design of CAP for biogas recovery from wastewater
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • Biogas; Bio-oil; Biodiesel; Bioethanol
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Integrated energy efficient wastewater treatment and resource recovery systems • High Rate Algal Ponds • Covered Anaerobic Ponds
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Pilot and Large-scale demonstrations of HRAP and CAP technologies
	<p>Leading Edge:</p>
	<p><i>NIWA has pioneered CO₂ addition to wastewater HRAP for enhanced treatment and algal production and has over 12 years experience with the design and operation of HRAP in New Zealand. NIWA has developed the Covered Anaerobic Pond (CAP) to cost-effectively recover energy from wastewater biomass as biogas methane and has 5 years experience with working with end-users to apply this simple technology.</i></p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • New Zealand 	
<p>Employees:</p>	
<p>Production Capacity</p>	
<p>Algal biofuel feedstock</p>	


<p>Company Name and Contact Details:</p>	
<p>NZ Ester Fuels Andre' Hamman - Managing Director www.nzef.co.nz andre@nzef.co.nz +64 274 720 964</p>	<p>Core Skill(s):</p>
<p>New Zealand Ester Fuels Ltd is a Biodiesel manufacturing company that was created to culminate a 2 year preparation period of business planning and process development. A decision to commence construction was made in February 2008.</p>	<ul style="list-style-type: none"> ● Production Technology ● Plant Design & Fabrication ● Plant Construction & Commissioning ● Development of innovative pilot scale concepts to industrial scale operation
<p>A salient feature of the process design is that the plant has neither a fresh water nor a trade waste connection. The use of the Magnesol™ Dry Wash technique allows for the process to be totally water free, thus having a negligible environmental footprint. All fats & oil feedstock used in the process are sourced from sustainable origins. The NZEF facility is designed to process a wide range of feedstocks. Key components of plant are computer controlled with online instrumentation for quality management.</p>	<p>Biofuel Focus:</p>
<p>The plant design includes a range of process safety features that are commonly deployed in hazardous area applications. Following 200 days of construction, the plant commissioning was successfully completed during November 2008. We are now committed to preferentially distribute our product to applications that result in a discerning performance difference.</p>	<ul style="list-style-type: none"> ● 1st Generation coupled with process intensification techniques ● Sustainable Biodiesel manufacture
<p>The NZEF team represents a unique combination of diverse and complementary skills and is characterized by strong comradeship and a desire to succeed. Key players in the team as follows:</p>	<p>Core Product/Activity:</p>
<p>John Zamick - Alternative Director, spent 25 years in both small and large enterprises, mainly in the IT industry but also in the leisure and restaurant business. Over the last four years, John's focus has shifted to Renewable Energy. In the last 14 years, John has founded and run six businesses in the UK, the US and New Zealand including Extraxi Ltd (www.extraxi.com), IP-Performance Ltd (www.ip-performance.co.uk), BioFuelBox Inc (www.biofuelbox.com).</p>	<ul style="list-style-type: none"> ● Biodiesel (Used Cooking Oil & Tallow) ● Conversion of degraded feedstocks using novel technologies
<p>Andre' Hamman – Managing Director NZEF, a chemical engineer with over 25 years experience within heavy industry, mostly in the Pulp & Paper sector. Andre has provided leadership to teams within the operations and maintenance, technical and environment areas.</p>	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> ● Commissioning of 2 million litre pa Biodiesel facility in Auckland ● Export of Magnesol Dry Wash System to Australia
	<p>Leading Edge:</p>
	<p>Strong technical team with proven ability to deliver practical and cost effective solutions.</p>
	<p>Investment Base:</p>
	<ul style="list-style-type: none"> ● UK Investors ● NZ Investors
	<p>Employees:</p>
	<ul style="list-style-type: none"> ● 4
	<p>Production Capacity</p>
	<p>2 million litre pa</p>


<p>Company Name and Contact Details:</p>	
<p>Name Pure Power Technology contact and position Ross Prestidge, Senior Staff Scientist web-site www.purepowerglobal.com e-mail ross.prestidge@purepowerglobal.com phone (64) (9) 632 1007</p>	
<p>Pure Power Technology is the New Zealand operating subsidiary of Pure Power Global, a resource-based company that is commercialising technology to convert biomass into high-value specialty chemicals. Specifically, Pure Power owns a process for manufacturing high-quality natural lignin, xylose and fuel ethanol from woody feedstocks, including <i>Salix</i> (willow), <i>Eucalyptus</i>, and other types of hardwoods. Pure Power has applied for international patent protection on its process and on the products derived from it.</p> <p>In the first step of the Pure Power process, hardwood crops such as plantation-grown coppiced willow are chipped and digested with ethanol at high temperature and pressure in order to remove lignin. The lignin is then precipitated and sold as a chemical feedstock. Natural lignin has been shown to be a very suitable feedstock for manufacturing a variety of products. For example, lignin can be used as a phenol substitute in the manufacture of phenolic resins, as a polyol substitute in the preparation of polyurethane foam, or as a precursor for carbon fiber manufacture.</p> <p>In a second step, the hemicellulose component of the feedstock is extracted with water at high temperature and pressure to yield a product stream rich in the 5-carbon sugar, xylose. Xylose is a platform chemical used in the food and pharmaceutical industries. Among other products, xylosed can be converted into xylitol, a natural sweetener that is low-energy, suitable for consumption by diabetics, and does not cause tooth decay. Xylitol is currently used globally in the manufacture of chewing gum, toothpaste, and many other products.</p> <p>The cellulose remaining after the extraction of lignin and hemicellulose is easily digested with cellulase enzymes to give glucose, which can then be fermented and distilled to provide fuel-grade ethanol. The same distillation module is used to recover the process ethanol used in the first extraction step.</p> <p>In addition to the Pure Power process, the company has developed nurseries of various willow species to provide the planting stocks for large-scale commercial coppiced willow plantations. An engineering study on the process has been carried out by AMEC Engineering, with a view to establishing a commercial demonstration plant either in NZ or in other territories which have sustainable supplies of hardwood feedstocks.</p> <p>Pure Power currently plans to build a flexible commercial demonstration plant in order to establish the optimal processing conditions for a variety of feedstocks. Production biorefineries able to process 250 tonnes/day or more of biomass will then be rolled out in various locations where feedstock is available.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Processing technology development • Biomass production, harvesting and transformation to specialty chemicals and biofuels
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • 2nd generation (from non-food crops such as coppiced willow) biofuels and bioproducts • High-value specialty chemicals, such as high-quality natural lignin and xylose, to replace petrochemical feedstocks, • Bioethanol
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Technology development
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Design, construction and operation of a commercial demonstration plant (10 tonnes biomass/day)
<p>Leading Edge:</p>	
<p><i>Proprietary process for producing high-value specialty chemicals and ethanol from woody biomass, as opposed to other “cellulosic ethanol” processes that destroy or degrade the most valuable components of biomass in the singular pursuit of ethanol.</i></p>	
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • New Zealand, International 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • Ten (8 with tertiary qualifications in science, engineering or business administration) 	


Company Name and Contact Details:	
Scion Michael Jack, Theme Leader michael.jack@scionresearch.com (07) 343 5899, www.scionresearch.com	
<p>Crown-owned research institute Scion has a long history in renewable energy research and development activities dating back to the 'Wood-to-Ethanol Programme', which was commissioned by the Liquid Fuels Trust Board in the 1970's. Scion is currently undertaking a range of bioenergy and biorefinery research and development activities across the whole production chain, from resource establishment through to product development.</p> <p>Scion was the lead organisation in the 'Bioenergy Options for New Zealand' study, which assessed New Zealand's bioenergy potential and developed a strategy for the future. Scion has research programs focused on multi-use forests, which can produce a range of products including feedstocks for energy and biofuels, pulp and paper, and new chemical platforms. Scion is also investigating the application of biotechnologies to alter the growth rate and chemical properties of trees so they are more suitable for as a biomass feedstock.</p> <p>Scion has developed a Geographic Information Systems (GIS) model for biomass recovery that calculates feedstock supply costs and delivery costs of the biomass to an energy plant. This model has been used to assess the economic feasibility of a biofuel plant in the Central North Island and can be used to optimise energy plant scale, siting, and long-term feedstock supply security. Other models are being developed to generate materials/energy balances and life cycle assessments across such operations and direct strategies for improved energy and carbon efficiencies in lignocellulosic-to-biofuels processes.</p> <p>A significant research programme at Scion at present is the 'New Zealand Lignocellulosic Biofuel Initiative', which is focused on developing a bioethanol pilot plant using New Zealand softwood feedstocks. This research programme is focused on the pre-treatment phase of the bioethanol conversion process, with the aim of making wood fibres more susceptible to enzymatic conversion and development of co-products. Scion has partnered with BP New Zealand and United States (US)-based bioethanol production company, Verenium Corporation on this programme. This project aims to reach pilot plant scale by 2012. The biorefinery concept is a central focus of Scion's research in this area. For example, Scion is involved in developing high-value products and chemical intermediates from lignin, which is a by-product of conversion processes from wood-to-liquids. These lignin-based products would be renewable replacements for current petroleum-based products, such as, resins, adhesives and plastics.</p> <p>Other current research includes the development of novel thermo-chemical processes to enhance energy generation from municipal wastes and woody biomass resources and technologies for water treatment and re-use within a biofuels or biorefinery plant.</p>	<p>Core Skill(s):</p> <ul style="list-style-type: none"> • Understanding NZ's current and potential woody biomass resources • Biological and thermal biomass conversion technologies • Energy modeling and life cycle assessment • Plant and industrial biotechnology • Biomaterials development • Water and waste management technologies <p>Biofuel Focus:</p> <ul style="list-style-type: none"> • Second generation feedstocks (woody biomass) • Economic and engineering models for biofuel production chains • Bioethanol and next generation fuels – biological and thermal conversion • Co-products from lignin • Water recycling processes <p>Core Product/Activity:</p> <ul style="list-style-type: none"> • Research and Development <p>Key Project Activities:</p> <ul style="list-style-type: none"> • Lignocellulosic Bioethanol Initiative • Bioenergy Options for NZ • Waterproofing Biorefineries • Future Forest Systems <p>Leading Edge:</p> <p><i>The ability to carry out research and development across the entire biofuel value chain including:</i></p> <ul style="list-style-type: none"> ○ <i>Woody biomass resource development and logistics</i> ○ <i>Pretreatment and conversion technologies for biofuels and co-products</i> ○ <i>Assessment and mitigation technologies for improved environmental footprints of biofuels operations</i> <p>Investment Base:</p> <ul style="list-style-type: none"> • NZ government and industry investors • US industry investors • European government investors <p>Employees:</p> <p>320</p> <p>Production Capacity:</p> <p>The Lignocellulosic Bioethanol Initiative is aiming to realise a 90 ML/year commercial plant in the Central North Island.</p>

<p>Company Name and Contact Details:</p>	
<p>Solray Energy Ltd Wayne Harpur, Director www.solrayenergy.co.nz Wayne@solrayenergy.co.nz +64 21 356 794</p>	
<p>Solray Energy Ltd has built and is operating a revolutionary processing plant that converts Algae and other organics to crude oil. While many others working in this space are recovering oil from algae lipid, Solray is converting the whole algae biomass so it does not need to culture specific species of algae.</p> <p>Algae can be grown in open air ponds or in bioreactors using photosynthesis and Carbon dioxide. Once harvested we process the algae to produce a renewable crude oil that is a genuine replacement for fossil petroleum.</p> <p>Solray's technology is truly "plug and play" and our team of scientists and engineers have given the company a unique proposition with proven scalability that produces long chain carbon length transportation fuels and are completely compatible with existing refining, distribution and fleet infrastructure.</p> <p>Thee product is pure algae crude, not an ethanol or a biodiesel.</p> <p>The mark 2 conversion plant is installed at the Christchurch Waste Water Treatment Plant and is supplied by the NIWA "state of the art" High Algae Growth Rate ponds fed by waste carbon dioxide and harvested without chemicals. These are the largest such ponds in the world, and built especially for Solray.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • High temperature water conversion • Continuous Energy Efficient reactor • Modular fully Scalable. • Mark 2 plant operating and planning Mark 3
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • 3rd Generation • Crude Oil ready for any refinery
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Crude Oil from Algae, Seaweed, Pulp, or Sewage Sludge
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Extensive mark 2 production trials
	<p>Leading Edge:</p>
	<p><i>Solray's key advantage is that the crude oil we produce is fully interchangeable with crude oil from normal fossil sources. Therefore no existing infrastructural changes to refineries, delivery systems, or end users are required. This feature is important to transport and aviation operators. Blends are not necessary.</i></p>
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • New Zealand (at present). 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • Eight personnel, 4 degree level and 4 skilled, fully occupied with Solray trialling and developments. Many others part time. 	
<p>Production Capacity</p>	
<p>200 tonnes crude oil per annum at mark 2 level. Scalable indefinitely after completion of performance trials.</p>	

<p>Company Name and Contact Details:</p>	 <p><i>The Proprietors of Taharoa C Block</i></p>
<p>The Proprietors Of Taharoa C Block Ken Hulls kenhulls@xtra.co.nz +64-7-849 4911 +64-21 188 5633</p>	
<p>The Proprietors Of Taharoa C Block (Taharoa C) is a Maori Incorporation which has been successfully engaged in commercial business operations since 1970. In 2004 it commenced investigations into renewable energy based on the sustainable development and use of its landholdings. This initially involved wind power where it has now, using entirely its own resources, successfully consented and is in the final stages of planning of a 40MW wind farm.</p> <p>In 2006 Taharoa C added the development of an “energy crop” capability to complement its work on wind and provide a second technology for its developing renewable energy business. After a global review the incorporation selected <i>Miscanthus x Giganteus</i> (<i>Miscanthus</i>) as the energy biomass most likely to provide the basis for commercial development in NZ.</p> <p>Taharoa C, using its own resources and contacts consented the growing of the crop in NZ via approvals from ERMA and MAF. This major development was achieved in late 2008.</p> <p>Working with a partner laboratory, Taharoa C developed propagation techniques based on organogenesis and somatic embryogenesis which is making it possible for the first time to propagate plants of this (sterile) hybrid through laboratory based, as opposed to agricultural based, techniques. Together with its partner laboratory Taharoa C now offers to produce plants on a commercial basis domestically, and for export and recently completed its first export order to the USA. Part of this order was produced in NZ and part in a laboratory in the USA under license.</p> <p>Taharoa C’s primary business objective is the large scale growing of <i>Miscanthus</i> in NZ, for domestic and export markets. This is for <i>Miscanthus</i> as a feedstock for bio ethanol production and also for use as a thermal fuel for dedicated biomass plants or co firing with coal. In the UK alone some 400,000 tonnes per annum is used in co firing and stand alone thermal operations. With regard to its use as a feedstock for bio ethanol, <i>Miscanthus</i> is identified by Verenum Inc and their partner BP Biofuels as a prime feedstock for their biomass to bio ethanol process. The ability to provide long term, consistent quantity and quality are key attributes in the use of <i>Miscanthus</i> for these purposes. Other industrial processes which can use <i>Miscanthus</i> to substitute for fossil fuel feed stocks are being investigated jointly with other industrial partners in NZ.</p> <p>Taharoa C has early stage agreements with two energy companies in New Zealand to explore <i>Miscanthus</i> as a biofuel feedstock.</p> <p>Taharoa C is at the early stages of commercialization and is seeking partners with marginal land suitable for growing <i>Miscanthus</i>, and partners in the overall business of supply to end users.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Rapid propagation of using advanced laboratory based technologies • Horticultural propagation • Crop yield trials
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • Production of 2nd generation ligno cellulosic biomass giving high yields. • Large scale production for: bio ethanol, for co firing with coal, and as a standalone thermal fuel.
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Propagation for own use and for export • Commercial provider of long term bio mass (for energy) supplies.
	<p>Key Project Activities:</p>
	<ul style="list-style-type: none"> • Currently :1) plant propagation 2) licensing of technologies 3) crop yield trials on sites throughout NZ • Long term fuel supply operations to bio ethanol production and thermal power applications
	<p>Leading Edge:</p>
	<ul style="list-style-type: none"> • Propagation Technologies • Scale production
<p>Investment Base:</p>	
<ul style="list-style-type: none"> • Taharoa C • Soon to seek other partners 	
<p>Employees:</p>	
<ul style="list-style-type: none"> • 3 	
<p>Production Capacity</p>	
<p>One million dry tonnes p.a</p>	

<p>Company Name and Contact Details:</p>	 <p>niServices Auckland UniServices Limited</p>
<p>Auckland UniServices Limited Keith Jones - Business Manager http://www.uniservices.co.nz k.jones@auckland.ac.nz +64 (9) 373 7522</p>	
<p>Auckland UniServices Limited is the commercialization company of the University of Auckland. It was formed in 1988 to satisfy the needs of the University for an organization to manage the increasing amount of research and consulting being undertaken by University staff for industry and also to commercialize inventions by academic staff.</p> <p>UniServices currently manages around 2500 projects at any one time, and undertook over 500 new projects for the Engineering sector in 2008. Total revenues in 2008 exceeded \$100 million.</p> <p>The University's /UniServices main activities in the biofuels area have been on biodiesel production techniques and in the testing of biofuelled engines, both ethanol and biodiesel.</p> <p>As part of a student PhD project in the Department of Chemical and Materials Engineering project a novel process for biodiesel production from tallow has been developed and patented. This process is continuous and much faster and more efficient than conventional batch processes. It is applicable to any fat or oil feedstock.</p> <p>The University has the most comprehensive testing and research facilities in NZ for measuring engine performance and exhaust emissions and studying combustion characteristics. It was responsible for the recent study by the Ministry of Transport leading to the introduction of the Land Transport Rule on vehicle exhaust emissions.</p> <p>Extensive studies have also been undertaken for both central and local government agencies on the effects of biofuel blends on exhaust emissions. Subject to funding being obtained, research is planned on particulates from biodiesel, studying sizes, composition and health effects.</p> <p>A newly established group in the biotechnology area, the Centre for Microbial Innovation, is planning to undertake research into 2nd and 3rd generation biofuels.</p>	<p>Core Skill(s):</p>
	<ul style="list-style-type: none"> • Production technology • Engine testing and design
	<p>Biofuel Focus:</p>
	<ul style="list-style-type: none"> • 1st, 2nd and 3rd generation focus • bioethanol and biodiesel
	<p>Core Product/Activity:</p>
	<ul style="list-style-type: none"> • Biodiesel production techniques (1st generation) • Biofuel performance (engine) testing
	<p>Key Project Activities:</p>
	<p>Leading Edge:</p>
	<p><i>In keeping with University goals the intent of activity in the biofuels area is to be at the forefront of research.</i></p> <p><i>Developed technology and other capabilities will be made available to NZ industry to maximize the efficient use of biofuels in NZ.</i></p>
<p>Investment Base:</p>	
<p>n/aA</p>	
<p>Employees:</p>	
<ul style="list-style-type: none"> • 750, mostly degree level and above. 	
<p>Production Capacity</p>	
<p>n/a</p>	

Company Name and Contact Details:	 <p>UC UNIVERSITY OF CANTERBURY <i>Te Whare Wānanga o Waitaha</i> CHRISTCHURCH NEW ZEALAND</p>
<p>University of Canterbury Professor and Director - Shusheng Pang www.canterbury.ac.nz shusheng.pang@canterbury.ac.nz (03) 3642538</p>	Core Skill(s):
<p>The Bioenergy Research Group in Department of Chemical and Process Engineering (CAPE), University of Canterbury, has been undertaking research on biomass energy and bioliquid fuel over the last two decades. The research interests include combustion and gasification for thermal energy and electricity, fermentation for ethanol and methanol, and Fischer-Tropsch synthesis of syngas for biodiesel. Studies have mainly been focused on technology development and improvements, involving fundamental and experimental studies on the conversion processes. Various laboratory and pilot facilities have been constructed and tested. Teaching courses and research projects have been offered to both undergraduate and postgraduate students.</p>	<ul style="list-style-type: none"> • Advanced biomass gasification, pyrolysis and Fischer-Tropsch synthesis of liquid fuel. • Fundamental research and process simulation. • Process optimization and design. • Feasibility studies.
<p>Since 2004, Professor Pang and his research team have focussed on development of thermo-chemical technologies to convert biomass (wood residues, agricultural residues and biosolid wastes in NZ) to hydrogen-rich syngas for combined heat and power (CHP) which can be integrated to NZ wood processing plants.</p>	Biofuel Focus:
<p>Currently, Professor Pang is leading a new research programme to convert the above biomass resources to syngas and liquid fuel aimed at increasing efficiency and reducing costs. The technologies include an advanced gasification process developed by the same research team to produce syngas followed by gas cleaning and FT synthesis to biodiesel. The programme also investigates co-gasification of biomass with coal and gasification of energy-densified biomass slurry through pyrolysis processing. New biomass resources from both forestry and agriculture is also explored. Feasibility studies are also performed.</p>	<ul style="list-style-type: none"> • 2nd generation focus. • Biodiesel.
<p>All of these technologies which are being developed for NZ resources are at the international leading edge. The ultimate objective of the programme is to increase transport biofuel supply using NZ renewable energy resources with benefit of zero net carbon emission over the whole tree-waste-biofuel chain.</p>	Core Product/Activity:
<p>The above programmes are co-funded by NZ Foundation for Research, Science and Technology and industry. The research team consists of international collaborators, NZ research institutes and industry partners. The research team at the University of Canterbury consists of four academic staff, two research associates and six postgraduate students.</p>	<ul style="list-style-type: none"> • Education and research.
	Key Project Activities:
	<ul style="list-style-type: none"> • Biomass gasification for clean, hydrogen-rich syngas using advanced steam gasification technology. • Cold model of the advanced gasifier for fluidynamics studies. • Pyrolysis reactor for biomass densification and liquid fuel. • FT reactor for liquid fuel synthesis.
	Leading Edge:
	<p><i>A 100 kW advanced steam-blown biomass gasifier has been developed and constructed. Hydrogen-rich (40vol%) syngas is produced. Cold model of the above gasifier is built for fluidynamics studies.</i></p>
	<p><i>A Fischer-Tropsch reactor is available for liquid fuel synthesis. Pyrolysis reactor is available for biofuel production.</i></p>
	Investment Base:
	New Zealand
	Employees:
	n/a
	Production Capacity
	n/a

<p>Company Name and Contact Details:</p>	
<p>URS New Zealand Ltd Gael Ogilvie, Senior Principal www.urscorp.co.nz gael_ogilvie@urscorp.com +64 (9) 355 1330</p>	
<p>URS New Zealand is a fully owned subsidiary of URS Corporation – a multidisciplinary environmental and engineering consultancy employing more than 55,000 staff worldwide. Within New Zealand we have approximately 300 engineers and scientists engaged in a range of policy development, environmental protection and engineering design work. URS has a dedicated environmental practice within New Zealand and has strong international links through the international offices of URS.</p>	<p>Core Skill(s):</p>
<p>Members of URS’ sustainability team (Gael Ogilvie, Vanessa Browne, June Gibbons & Maurice Marquardt) have undertaken carbon footprints and life cycle assessments of biodiesel, bioethanol and other bioenergy products in New Zealand. On behalf of the Energy Efficiency and Conservation Authority we developed a model to enable New Zealand biodiesel producers to easily estimate their supply chain carbon emissions based on the UK RFTO model. We have provided technical advice to Fonterra to assist their calculation of GHG emissions from whey-to-ethanol, and provided advice to an energy company to compare emissions from a new bioenergy product with existing comparable energy products. Gael recently completed a carbon footprint for Ecodiesel Ltd, a tallow based biodiesel producer.</p>	<ul style="list-style-type: none"> • Project management • Systems thinking • Engineering
<p>URS’ engineers have worked on biofuel plant design projects. This included a project led by Barry Lawrence providing advice to Ecodiesel Ltd. Steve Vaughan, an environmental and risk specialist, has a substantial chemical engineering background in lignocellulose conversion to ethanol.</p>	<p>Biofuel Focus:</p>
<p>URS is a member of the New Zealand Business Council for Sustainable Development (NZBCSD). Our Chief Executive, Mark Drury, is on the Executive Committee. URS has been actively involved in a number of NZBCSD work programmes including Facilitating the Greening of Vehicle Fleets, Sustainable Development Reporting, Guide to Zero Waste, Climate Change, Successful Business School Partnerships, Sustainable Building and Fresh Water Allocation. URS is an active member of the Sustainable Business Network (SBN), the Resource Management Law Association and the NZ Society for Sustainability Engineering and Science, an IPENZ technical interest group. We have found that innovation and challenging ‘business as usual’ approaches is a cornerstone in cultivating sustainable behaviour change. Our 3i model asks that URS personnel consider the three components of sustainability; social, environmental and economic and the three ‘i’s of involvement, innovation and integration at all stages during project delivery.</p>	<ul style="list-style-type: none"> • Feedstock production • Biofuel supply chain • Plant design
<p>URS’ engineers have worked on biofuel plant design projects. This included a project led by Barry Lawrence providing advice to Ecodiesel Ltd. Steve Vaughan, an environmental and risk specialist, has a substantial chemical engineering background in lignocellulose conversion to ethanol.</p>	<p>Core Product/Activity:</p>
<p>URS is a member of the New Zealand Business Council for Sustainable Development (NZBCSD). Our Chief Executive, Mark Drury, is on the Executive Committee. URS has been actively involved in a number of NZBCSD work programmes including Facilitating the Greening of Vehicle Fleets, Sustainable Development Reporting, Guide to Zero Waste, Climate Change, Successful Business School Partnerships, Sustainable Building and Fresh Water Allocation. URS is an active member of the Sustainable Business Network (SBN), the Resource Management Law Association and the NZ Society for Sustainability Engineering and Science, an IPENZ technical interest group. We have found that innovation and challenging ‘business as usual’ approaches is a cornerstone in cultivating sustainable behaviour change. Our 3i model asks that URS personnel consider the three components of sustainability; social, environmental and economic and the three ‘i’s of involvement, innovation and integration at all stages during project delivery.</p>	<ul style="list-style-type: none"> • Life Cycle Analysis • Sustainability assessment and labeling • Carbon footprints • Environmental impact assessments • Process engineering • Chemical engineering
<p>URS is a member of the New Zealand Business Council for Sustainable Development (NZBCSD). Our Chief Executive, Mark Drury, is on the Executive Committee. URS has been actively involved in a number of NZBCSD work programmes including Facilitating the Greening of Vehicle Fleets, Sustainable Development Reporting, Guide to Zero Waste, Climate Change, Successful Business School Partnerships, Sustainable Building and Fresh Water Allocation. URS is an active member of the Sustainable Business Network (SBN), the Resource Management Law Association and the NZ Society for Sustainability Engineering and Science, an IPENZ technical interest group. We have found that innovation and challenging ‘business as usual’ approaches is a cornerstone in cultivating sustainable behaviour change. Our 3i model asks that URS personnel consider the three components of sustainability; social, environmental and economic and the three ‘i’s of involvement, innovation and integration at all stages during project delivery.</p>	<p>Key Project Activities:</p>
<p>URS is a member of the New Zealand Business Council for Sustainable Development (NZBCSD). Our Chief Executive, Mark Drury, is on the Executive Committee. URS has been actively involved in a number of NZBCSD work programmes including Facilitating the Greening of Vehicle Fleets, Sustainable Development Reporting, Guide to Zero Waste, Climate Change, Successful Business School Partnerships, Sustainable Building and Fresh Water Allocation. URS is an active member of the Sustainable Business Network (SBN), the Resource Management Law Association and the NZ Society for Sustainability Engineering and Science, an IPENZ technical interest group. We have found that innovation and challenging ‘business as usual’ approaches is a cornerstone in cultivating sustainable behaviour change. Our 3i model asks that URS personnel consider the three components of sustainability; social, environmental and economic and the three ‘i’s of involvement, innovation and integration at all stages during project delivery.</p>	<p>Leading Edge:</p>
<p>URS is a member of the New Zealand Business Council for Sustainable Development (NZBCSD). Our Chief Executive, Mark Drury, is on the Executive Committee. URS has been actively involved in a number of NZBCSD work programmes including Facilitating the Greening of Vehicle Fleets, Sustainable Development Reporting, Guide to Zero Waste, Climate Change, Successful Business School Partnerships, Sustainable Building and Fresh Water Allocation. URS is an active member of the Sustainable Business Network (SBN), the Resource Management Law Association and the NZ Society for Sustainability Engineering and Science, an IPENZ technical interest group. We have found that innovation and challenging ‘business as usual’ approaches is a cornerstone in cultivating sustainable behaviour change. Our 3i model asks that URS personnel consider the three components of sustainability; social, environmental and economic and the three ‘i’s of involvement, innovation and integration at all stages during project delivery.</p>	<p>URS staff have specialist knowledge of sustainability issues surrounding biofuels and have wide industry contacts in New Zealand.</p>
<p>URS is a member of the New Zealand Business Council for Sustainable Development (NZBCSD). Our Chief Executive, Mark Drury, is on the Executive Committee. URS has been actively involved in a number of NZBCSD work programmes including Facilitating the Greening of Vehicle Fleets, Sustainable Development Reporting, Guide to Zero Waste, Climate Change, Successful Business School Partnerships, Sustainable Building and Fresh Water Allocation. URS is an active member of the Sustainable Business Network (SBN), the Resource Management Law Association and the NZ Society for Sustainability Engineering and Science, an IPENZ technical interest group. We have found that innovation and challenging ‘business as usual’ approaches is a cornerstone in cultivating sustainable behaviour change. Our 3i model asks that URS personnel consider the three components of sustainability; social, environmental and economic and the three ‘i’s of involvement, innovation and integration at all stages during project delivery.</p>	<p>Investment Base:</p>
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<p>URS is a member of the New Zealand Business Council for Sustainable Development (NZBCSD). Our Chief Executive, Mark Drury, is on the Executive Committee. URS has been actively involved in a number of NZBCSD work programmes including Facilitating the Greening of Vehicle Fleets, Sustainable Development Reporting, Guide to Zero Waste, Climate Change, Successful Business School Partnerships, Sustainable Building and Fresh Water Allocation. URS is an active member of the Sustainable Business Network (SBN), the Resource Management Law Association and the NZ Society for Sustainability Engineering and Science, an IPENZ technical interest group. We have found that innovation and challenging ‘business as usual’ approaches is a cornerstone in cultivating sustainable behaviour change. Our 3i model asks that URS personnel consider the three components of sustainability; social, environmental and economic and the three ‘i’s of involvement, innovation and integration at all stages during project delivery.</p>	<p>Production Capacity</p>
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