

New Zealand Bioenergy Mission to Canada Post Mission Review

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**VANCOUVER, BRITISH COLUMBIA
TEMISCAMING, QUEBEC
OTTAWA, ONTARIO
MONTREAL, QUEBEC**

1. Summary

The New Zealand Trade and Enterprise led Bioenergy Mission to Canada undertaken during May 2011 visited people and sites across Canada who were either producing liquid biofuels from wood or were in an advanced stage of commercialising specific technology. The Mission included representatives of the New Zealand forestry, wood processing and bioenergy sectors who were actively considering the opportunities for investment in the production of advanced biofuels (biodiesel, bioethanol) from New Zealand's vast quantities of wood, much of which as harvest or process residues may currently be either wasted or have low value uses.

Trade and Enterprise had very successfully obtained access to a wide representation of liquid biofuels people and sites for the Mission to visit which provided a very thorough briefing on the status of wood-to-liquid biofuels commercialisation in Canada. Most of the operating sites visited were at the pre-commercialisation phase (operating only demonstration plant) however the Tembec pulp mill was producing ethanol commercially and most technology developers visited were involved with commercial scale plant at new sites at other locations within North America.

The parties involved with wood-to-liquid biofuels projects in Canada are leveraging off the current market for production of bioethanol from high sugar/starch feedstocks so there is an emphasis on the production of bioethanol. Pyrolysis oil is being produced by some parties visited but mainly for direct use in electricity generation. Production of drop-in biodiesel is a target but generally not at the commercial phase of development yet.

The visit confirmed that full commercial investment of wood-to-biofuel projects is still 5-10 years away except where there are niche drivers of high value co-products, or as a means of avoiding the cost of disposing of waste. There is no specific technology that at this stage appears to be an obvious technology of choice but most are on the cusp of commercialisation.

With the high level of technology development being undertaken in Canada and elsewhere New Zealand should focus on being a fast follower by adapting the technology to New Zealand feedstocks and market conditions. However as both New Zealand and Canada grow softwood forests there is value in ensuring active collaboration on the production of biofuels from softwoods.

The area of specific focus for New Zealand should be on the availability and specific characteristics of our forest derived feedstocks. Canadian feedstocks are generally derived from government owned forests whereas in New Zealand most forests are privately owned and there is a separation between grower, harvester and user. This fragmentation of the market creates a barrier where co-ordination and collective action between the parties is necessary if biofuels production is to evolve. Biofuels

production requires quality feedstock at the lowest price which is in conflict with the objective of increasing the value to forest and land owners of their forest crops. A fragmented feedstock market also requires greater levels of information to be derived and made available to all market participants.

The visit to the Enerkem liquid biofuels facility also showed that municipal refuse can be a good feedstock for the production of liquid biofuels.

A focus on feedstock for heat plant will provide a transition into the emerging liquid biofuels market when it arrives. Investors in liquid biofuels production facilities require secure supply of large volumes of biomass.

2. Background

Canada is considered a leader in bioenergy and already has a long-term strategy to extract additional value from traditional forest products industries. The Mission was undertaken to provide the delegation an opportunity to learn more about Canada's approach to growing its bio-economy and how their Future Bio-pathways Project¹ has provided a model for how the forest products industry can build on its world-class forest management practices. The Bio-pathways study, produced by the Forest Products Association of Canada (FPAC), focuses on the triple bottom line: clean energy, high employment and economic recovery. The study results point to the economies of scale achievable by integrating the production of bio-products and bioenergy into the existing forest processing industry, and placing traditional products, especially lumber and pulp, at the heart of a new green business model. (This is reinforced by the Mission visit to the Tembec pulp mill where biofuels production is integrated into other site businesses and is able to operate commercially.)

The Mission was organised to²:

- Hear first hand from the specialists who have conducted extensive economic studies of bioenergy and bio-products options.
- Visit demonstration plants and hear about new business initiatives.
- Leave with a knowledge of the state of play for a range of new technology options.
- Understand the support that has been gathered to galvanise progress – including state, industry and investment activities.
- Have the opportunity to conduct one-on-one business meetings.

3. Mission itinerary

The delegation was timed to coincide with several conferences that were being held in Canada:

1. The [Global Forest Products Leadership Summit 2011](#) held in Vancouver from 8 to 11 May. A multi-day series of conferences and events that included the PwC 24th Annual Global Forest & Paper Industry Conference, PPPC's International Pulp Week, and the International Wood Markets Group conference.
2. The 2011 BIO World Congress on Industrial Biotechnology and Bioprocessing held in Toronto from 8 to 11 May.

¹ [Presentation to the NZ conference – Future bioPathways](#), R Gilsean, Canadian forest service, Oct 2010

² NZTE external brief (May 2011) that gives the background and objectives of the mission.

3. BC Bioenergy Network Conference & Exhibition 12 May. This one-day conference addressed Torrefaction, next generation wood pellets, new developments in Bioenergy and the Bio-pathways II report.

The Mission followed the first two of these conferences and included attendance at the BCBN conference. The Mission was based around presentations by university researchers, private sector bioenergy companies and government agencies. However most significant was the site visits to demonstration and pilot scale plants, a biorefinery visit, and meetings with practitioners actually with operating plant rather than with those talking about liquid biofuels.

a. Why Canada?:

- Forestry strategy – Canada has established a long term strategy to extract additional value from wood by transforming its traditional forest products industries.
- FPAC 'Future Bio-pathways' study³ – in-depth analysis/assessment of prospects for forest products industry. By the time of the visit stage II of this study was ready for presentation – Obtaining first hand information on the study results was considered important as one of NZ's 'gaps' is the lack of engagement of the forestry and the wood sector in initiatives to obtain additional value from forestry via opportunities in bioenergy. Study results are proving valuable as research is going into new areas of gasification, pyrolysis, etc and into many products – bio-fuels, bio-products, and bio-materials. This is important for NZ as we are currently faced with difficulty of challenging economics for bioenergy alone. The Canadian study also shows financial potential of integrated bio-refinery scenario.
- Canadians are thought leaders in forestry and biotech sectors, but also most closely aligned to NZ in terms of focus on woody biomass.
- Legacy of NZ activity in the forestry industry in Canada.
- Policy vacuum exists in NZ – can learn from Federal and BC policies and influence NZ policy makers.
- Timing with forestry and wood conferences to attract NZ leaders in wood (both growing and processing).

b. Objectives of the mission:

The objectives were to:

- Inform NZ decision-makers, investors and stakeholders about bioenergy and bio-product opportunities.
- Establish collaborations and relationships between Canada and NZ.
- Increase collaboration between NZ companies in the sector and cross-sector.
- Explore opportunities to partner with Canadian companies in third markets.

4. Primary learnings from the Mission

a. Primary drivers

The primary driver in Canada is simply the use of vast amounts of biomass which can be used in economic energy demand applications. This biomass can come from forest harvesting or the processing of waste organic matter such as from municipal

³ [Forest Products Association of Canada www.fpac.ca](http://www.fpac.ca)

refuse. This increased production of energy from biomass mirrors the New Zealand opportunity.

The demand drivers are however different in that in Canada the use of biomass for electricity generation is more important than in New Zealand. In some regions reducing carbon was also an important driver.

Encouragement of the use of biomass for energy and for the extraction of biochemicals for the production of bioproducts however is very strong from the Canadian provincial and federal governments where the economic benefits from bioenergy are recognised and actively supported. This appears to occur because the provincial and federal governments are the owner of the forests and are seeking additional revenue from the resource.

b. *Bioeconomy*

The most powerful impression from the Mission was that Canada is already on the first rung of the bioeconomy ladder. It has significant R&D underway, it has attracted investors and it has the provincial and federal governments providing significant encouragement for R&D and commercialisation.

The Canadian bioenergy growth has been helped immensely by the pine beetle which has encouraged the forest owners to harvest and process dead trees before they deteriorate. However they also have a forestry sector that is in decline and there is a recognition by forest owners and forest processors in particular that for the sector to survive it will need to focus on producing the most valuable forest products and this includes emerging products such as biofuels.

The biotechnology sector around the Toronto area is embracing bioproducts particularly as replacement for plastic used in the automotive industry. This will become more widespread as the cost of petroleum based products increases.

The extraction of biochemicals from biomass is an area where New Zealand could establish a stronger presence as the value from the biochemicals is likely to be significantly higher than the value of a biofuel coproduct.

c. *Phase of technology development*

There are some technologies that are now well proven and operating commercially however the bulk of technologies were still at the pilot or demonstration stage of development. Those where an outcome was heat were the most developed including those associated with gasification technology such as by Nexterra.

The information gained on the state of technology developments for transport fuels confirmed that the assumptions in the NZ Bioenergy Strategy of transport biofuels not being economic for another 5-10 years is appropriate.

With the range of technologies being developed for transport fuels there are currently no clear leaders. However with such a large number of technologies under development New Zealand can afford to wait for a few years to see which technologies are the winners. However there are three areas where New Zealand may have a comparative advantage or should focus attention:

1. Forest harvest residues are extremely important in providing feedstock for heat or transport biofuel products. New Zealand can use internationally developed harvest residue collection and processing equipment but its

application will be unique in NZ because of the different forest ownership structure and the nature of the residue.

2. Ongoing research is necessary with regard to the preprocessing of softwood feedstock into the form most efficient for subsequent processing into a transport biofuel. Scion's work on the extraction of sugars should be strongly supported as the sugars can provide a platform for many of the technologies for the production of transport biofuels.
3. Evaluation of the use of municipal refuse as a feedstock for the production of liquid biofuels using technologies such as from Nexterra should be encouraged.

d. *Markets*

The lack of emphasis on markets was a great disappointment as technology developers appeared to be focusing on their technology without a similar focus on the range of products that they can produce. For example Ensyn are producing pyrolysis oil for use as a fuel for electricity generation to replace petroleum based fuels in off-grid applications. Despite recognising the wider values from pyrolysis oil there was little discussion of the other uses of pyrolysis oil as a feedstock for transport fuel or the extraction of biochemicals. It would appear that this lack of focus on transport fuel or the extraction of biochemicals is because the technologies are still at the early stage of commercial development.

Throughout it appeared that there was more of a technology push rather than a market demand pull.

e. *Coproducts*

Throughout the Mission it was reinforced that growth is not solely about biofuels but it is biofuels plus coproducts such as biochemicals, environmental outcomes pulp and paper, logs and food. It was generally difficult to see the separate value of the biofuel as the value of the coproducts supplemented the biofuel value or vice versa.

The Tembec mill was a very good example of the symbiotic relationship between the product streams. The Tembec mill is run as three profit centres and each is treated as a proper business with revenue maximization.

f. *R&D*

In each of the regions visited by the Mission there was a strong academic interest in the emerging biofuels technologies and their applications. There was a very strong university presence throughout. Primary research appears to be undertaken by the universities and government researchers such as CANMET Energy Technology Centre, while commercialization is undertaken by private sector companies supported by FP Innovations and BC Bioenergy Network. Natural Resources Canada are working very closely with the Forest Products Association of Canada to get the forestry sector to broaden its product range and thus increase the revenue gained from biomass.

The encouragement for research and innovation that was encountered was extraordinary compared to New Zealand where little research is undertaken and commercialization of opportunities is left to individuals to fend for themselves. The encouragement comes from the top with both Federal and provincial governments being active promoters of the extraction of greater value from forestry and land use.

There appeared to be close collaboration between universities and communities with communities establishing commercial clusters for development of bioproducts. In the Toronto area there are a number of communities where the local council economic development entities are working with the local university to attract new investors and manufacturers of bioproducts to cluster in their locality. These clusters are creating a euphoria of growth and innovation based on the premise that “success breeds success”.

g. *Adding Value to fibre*

Throughout Canada there is a strong push to identify how greater value can be obtained from wood fibre arising as residue from traditional forestry and wood processing activities.

Appendix: Details on mission attendees and specific visits

1. Organisation

The Mission was led by NZTE and put together by a team of NZTE, BANZ and Scion New Zealand and Vancouver staff. NZTE Vancouver Office established contact with Canadian parties and arranged visits or presentation, and logistics.

Assistance to the Mission was provided from NZTE Strategic Initiatives programme.

2. Attendees

Company	Delegate	Responsibility
Carter Holt Harvey Pulp & Paper Ltd	Lyndon Haugh	Energy Manager
Red Stag Timber/EROS Capital Ltd	Jason Cordes	Managing Director
Norske Skog Tasman	Clinton Boyes	Line Manager
Energy for Industry	Matthew Spooner	Development Project Manager
Materials Processing Ltd	Peter Fredricsen	Managing Director
	Jan Grover	Strategic Manager
Living Energy	Rob Mallinson*	Managing Director
SCION	Trevor Stuthridge	Group Manager, Sustainable Design
Industrial Research Ltd	Tom Rogers	Maori Business Development Manager
University of Canterbury	Christopher Williamson*	Senior Lecturer, Chemical and Process Engineering
New Zealand Trade and Enterprise	Barbara Webster	Programme Manager, Strategic Initiatives Team
	Rod McDonald	Business Development Manager
	Joe Holtz	Mission Coordinator
Bioenergy Association of NZ	Brian Cox	Executive Officer
New Zealand Forest Owners Association	David Rhodes*	Executive Officer
Ministry for Science and Innovation	Lesley McConnell*	Counsellor Science & Technology, USA and Canada, Washington DC
Rayonier / Matariki Forests	James Treadwell	Business Development Manager

* Part attendance

3. Programme

a. *Vancouver, British Columbia*

BC Bioenergy Network Conference & Exhibition

- Attendance at BCNB conference
- www.bcbioenergy.ca
- Established in April 2008 with a \$25 million grant from the British Columbia government, the BC Bioenergy Network is an industry-led initiative that is the catalyst for deploying near-term bioenergy technologies and supporting mission-driven research to build a world class bioenergy capability in BC. BCBN invests in capital and technology development as well as targeted capacity building.
- The BC Bioenergy Network supports the demonstration and deployment of products and systems that:
 - Produce heat, power or combined heat & power;
 - Process biomass into solid fuel;
 - Refine biomass into liquid fuel; or
 - Collect or concentrate biogas to be used as fuel

Messages from the conference

- Leverage of BCNC funding is a key objective through establishments of partnerships and collaboration
- Focus on building on the strengths of existing business e.g. wood energy in the case of NZ
- Bioenergy has twice as many pages in IPCC report than any other technology
- It is not the availability of the resource but public policies that will bring growth in bioenergy about
- Europe does not have enough biomass at competitive prices to meet its climate change targets and is looking to import biomass. Canada is able to meet this demand because of large volumes of zero resource cost pine beetle ravaged forests.
- Biofuels is the lead into establishment of a bioeconomy to progressively replace petroleum based products as oil becomes more expensive
- Importance of homogeneity of feedstock for smooth running of conversion technologies
- Biomass is a feedstock, torrefied biomass is a fuel
- There needs to be a greater focus on the return to fibre owners
- Emphasis is on assisting the forest products sector to develop new wood products
- For investment to occur we need to take the risk out of feedstock supply
- Networking reception sponsored by NZTE

Signing of memorandum of Understanding between BANZ and CanBio

- BANZ and CanBio sign MOU
- www.canbio.ca
- Meet Doug Bradley, President and Executive Director of the Canadian Bioenergy Association (CanBio) and Board Member of the World Bioenergy Association

BioPathways Presentation and Discussion

- Andrew Goodison from FP Innovations www.fpinnovations.ca gave presentation on the Bio-pathways study.
<http://canadaforests.nrcan.gc.ca/rpt/biopathwaysproject>

Messages

- Project only looked at the technologies – not the markets. (This would appear to be an area where a lot of work is needed so that the markets develop)
- Covered engineered wood and biofuels products

Visit to FP Innovations

- Visit the new Evalutree facility for wood and fibre analysis

Messages

- Structure of FPInnovations on commercialization
- Objective – maximizing fibre value
- Priorities and work programmes driven by private sector members
- Members have access to models and can run their own scenarios
- Need to focus on the platforms

University of British Columbia biofuels programmes:

- Hosted by Jack Saddler, Former Dean of UBC Forestry Department and on IEA Task 39, involved in commercialisation of next gen biofuels
- www.bioenergy.ubc.ca

Messages

- Emphasis on biomaterials and clean technology
- Focus is on higher value products from biomass
- International RE targets driving demand not markets
- Logistics drives the size of plant
- Biomass feedstock prices will continue to go up as demand for fibre increases. A negative for promotion bioenergy as an attractive green technology when compared to other green technologies.

Nexterra:

- Presentation from Nexterra <http://www.nexterra.ca>
- The Kruger paper tissue mill uses a Nexterra direct-fired biomass gasification plant to provide process steam for multiple uses at the mill (half the mills supply). The fuel source is wood residue from local mills and/or clean construction debris.
- 5 plant built

Lignol:

- Presentation from Lignol Innovations Ltd. <http://www.lignol.ca/index.html>
- Lignol established a Cellulosic Ethanol Development Centre in Vancouver which consists of a pilot plant (producing cellulosic ethanol and HP-L lignin), a state of the art enzyme development laboratory and an engineering group. Lignol's de-lignification pre-treatment process is being integrated with recently acquired saccharification and fermentation process capabilities. Lignol is optimizing this integration and plans to design a commercial demonstration plant to be constructed in concert with one or more industry partners.

Messages

- The total biorefinery concept is the focus not just ethanol. Not yet a commercial reality.

Flotech biogas upgrading plant

- Visit Catalyst Power biogas facility at Abbotsford to see Flotech Limited's www.flotech.com biogas upgrading system (NZ technology)
- Biogas plant feedstock is from cowshed dry and wet waste supplemented by supply of organic matter from neighbouring farms etc. Biogas is cleaned and fed into the gas distribution system.

*b. Temiscaming, Toronto***Tembec Biorefinery**

- Visit to Tembec Biorefinery in Temiscaming www.tembec.com to see the commercial production of ethanol from pulp residues.
- Briefing with Tembec and the University of Toronto on the onsite biogas production facility.
- Tembec is purported to be the best example of a biorefinery that Canada has to offer. It is an old sulphite mill, transformed by Frank Dottori, and involves ethanol production, anaerobic treatment, and use of methane for fuel. Tembec has a biofilter to treat the H₂S from the anaerobic gas, and it has an aerobic treatment system. The mill produces a wide range of products (wood, pulp, ethanol, lignocellulosics, resins, board).

Messages

- Full integration of biochemicals and pulp production
- Biochemicals successfully runs as a profit centre

*c. Ottawa, Ontario***Forest Products Association of Canada**

- Briefing by FPAC www.fpac.ca on the structure for undertaking the Bio-pathways project, how FPAC is member based and its leadership in the sector.
- FPAC is working in partnership with government agencies such as is widening its network

Messages

- Make sure asking the right questions
- Pathway provides an analysis of options
- Developers now going to FP Innovations to get further analysis
- Forced some parties to get fibre supply sorted.
- Based only on current harvest practices
- Now moving on to markets for products
- Partnership network meetings to facilitate transition

Natural Resources Canada

- Presentation with Rory Gilson (NRCan) www.nrcan.gc.ca

Messages

- Importance of the role of government in facilitating change

CANMET Energy Technology Centre

- 300 scientists 33% transportation
- Taking technology from lab to pilot
- Working with Wood Pellets Assoc to improve quality of wood pellets

Ensyn

- Site visit to Ensyn Corporation in Renfrew.
- www.ensyn.com
- Ensyn has a commercial scale RTP (Rapid Thermal Processing™) Facility in Renfrew, processing 100 dry tonnes of residual wood per day to bio-oil.
- Backed by Honeywell and UOP
- Have made pyrolysis oil for 20+ years. First commercial plant 1989

Messages

- RTP doesn't destroy form of lignin
- Ensyn can also be part investor

Meeting with the New Zealand High Commission

- Meeting with the high Commissioner and staff

*d. Montreal, Quebec***Enerkem**

- Visit Enerkem pilot / commercial plant in Westbury.
- www.enerkem.com
- Enerkem is a waste to biofuels and green chemicals technology company. They have a thermochemical platform transforming municipal waste, forest biomass, and agricultural residues to biofuel, green chemicals and electricity.

Messages

- Very flexible in feedstocks and products
- 2 commercial plant
- Interested in BOO projects – not a technology supplier