

## What are the priority Forestry Sector R&D Strategy areas for funding?

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### Introduction

Over the next three decades there is expected to be a significant growth in the use of wood as a feedstock for the production of advanced biofuels and the extraction of biochemicals. The NZ Bioenergy Strategy<sup>1</sup> identifies that 30% of transport fuel could economically come from bioenergy by 2040, the bulk of this would come from wood.

Internationally there is a range of technologies which are already at the stage of pilot commercial development. With the demand and the technology for conversion of wood to energy well established the focus for NZ forestry bioenergy R&D should be in the production and supply of feedstock to energy plant. The feedstock may come from harvest and process residues derived from the production of primary wood products such as logs, lumber and pulp wood, or from new energy crops. The production of wood feedstock for bioenergy is complementary to traditional forestry operations as, in the main and while significant as a revenue stream, bioenergy will principally be a co-product of normal forestry or farm operation.

The wood feedstock may be used in chip or processed pellet form in heat plant or for the production of transport fuel using advanced biofuel technologies. Regardless of end use the wood feedstock produced and supplied from forestry operations is identical. An R&D programme focused on feedstock production and supply would therefore focus on a revenue stream for forest owners driven by both demands.

As the heat sector expands as more heat plant convert to using wood fuel pressure will come on the availability of feedstock to be converted into chip or pellets for domestic combustion or export. Development of the wood energy feedstock supply market is critical in the short term if the price of feedstock to these current uses is not increased to the detriment of the existing wood pellet market in particular.

Wood energy feedstock can be produced from conventional long rotation (25 to 35 year) forests (LRF), short rotation forests (SRF 3-15 year rotation) and short rotation coppice crops (SRC 1-3 year rotation). The length of the rotation has a significant bearing on the timing of the availability of revenue streams but is generally determined by the land topography and species. Long rotation forests are only suitable on hill country, while short rotation forests and SRC require flattish land. However there are large areas of many forests and farms where there can be a mix and match of types. For example a farm can have a farm forestry block on some steep land, while having a short rotation crop on some areas of flat land (stream margins), all in combination with normal forest or farm operations. The advantage being that the SRC provides an annual revenue stream within 1-3 years while LRF is a long term investment.

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<sup>1</sup> <http://www.bioenergy.org.nz/NZBioenergyStrategy2010.pdf>

Forestry and farming can and should have a goal of producing food and fuel, not food versus fuel. Farms can use woodlots and shelterbelts to produce wood fuel and forests can provide food via grazing etc and sites for specialty crops requiring shade. Research on these topics should be expanded and / or revisited.

The choice of species for production of wood products that includes wood energy feedstock may be quite different from species grown primarily for logs and lumber. Research has been undertaken previously on the range of species (including grasses) which would be suitable for growing. What is now required is the commercialization of that knowledge, supported by further R&D on management regimes and optimizing species / site choices.

The R&D for the production of feedstock for bioenergy products is equally applicable to the extraction of biochemicals from wood.

Past R&D work has identified some key issues going forward;

- Wood is a significant current and future biomass resource providing a revenue stream to forest owners, landowners and wood processors via bioenergy
- Revenue to forest and land owners from the production and supply of wood as an energy feedstock can be increased by improving quality and consistency of the product
- Processing, transport and handling of wood energy feedstock is the main area of supply concern
- The revenue stream to forest owners can be optimised by recognition of the value of wood energy feedstock to complement traditional forestry operations.
- The form of contract for harvesting and transport of wood energy feedstock can improve the financial return to forest and land owners significantly.
- The extraction of biochemicals from wood may in many cases be a stronger value driver than bioenergy in which case bioenergy may be a co-product of a high value biochemicals sector.

**Objective** - To increase revenue to forest and land owners by speeding up the commercialisation of wood-to-energy projects (heat, liquid biofuel), thus establishing the supply-chain infrastructure to supply other 'near-commercial' bio-product opportunities, (bio-chemicals) with a reliable and consistent quality feedstock.

### Topics for R&D

The following topics have been identified:

- Resource
- Production and supply of wood energy feedstock
- Transfer of international knowledge and experience to potential NZ commercialisation parties.
- Knowledge and technology development
- Conversion of wood to energy
- Commercialisation, and

- Cornerstone projects,

### **1. Resource**

- We need a much better understanding of species, siting and regimes that have a biomass rather than solely a solid wood focus (including SRC – willow, miscanthus etc)
- We need to provide much more detail in regional forest supply forecasts of existing and potential forestry and provide reliable market information to potential bioenergy plant investors evaluating siting and investment options. (Foresters have adequate knowledge of planting locations but this needs to be turned into useful information for bioenergy plant investors).
- Growers need information on the potential value of different species and growing regimes so as to assist with planting decisions.

### **2. Production and supply of wood energy feedstock**

- A key barrier to the commercialization of all the wood-based energy technologies that could increase the demand and value of wood fibre is a good, reliable supply of consistent quality wood fibre. To put feedstock into any value-adding process it needs to have consistent properties (size, proportion of fines and contaminants, and ideally at least part-dried to a certain moisture content range). A work programme would assist
  - a. Feedstock supply:
    - Improving the feedstock availability and quality
    - reducing the harvesting and production cost of feedstock
    - ensuring good financial returns to players throughout the value chain
  - b. Establishment of biomass depots in key regions, thereby providing an avenue for feedstock supply
  - c. Provide data on the cost of feedstock transport to bioenergy facilities which is critical for investment identification and evaluation
- Wood energy feedstock needs to be produced to recognised and accepted classification standards so that buyers and sellers can have confidence in the product they are contracting for. Work needs to be undertaken with forest harvesters on methods and equipment that assists in the production of quality classified product.
- As a start up industry bioenergy facility owners currently have difficulty in obtaining long term forward contracts for the supply of wood fibre that will support the term of their investment. Pilot projects around collective action of regional growers would break the impasse. Eg Broking of supply from small biomass growers, or the establishment of regional clusters to firm supply.
- Currently high quality wood residues in the form of log offcuts etc are available at the harvest site but are then turned into low quality chip by poor processing and handling methods and equipment. Research needs to be done to establish methods and equipment for improving the value of the chip produced.
- Wood is a low density energy form and often difficult to handle and in particular transport. Research needs to be done on appropriate handling and transport equipment to meet NZ conditions.

- There are opportunities to boost the return by better/cheaper segregation and/or boosting the recovery of material at harvest time (and this latter is most likely achievable by research that brings down harvest costs). We know that possibly 10~15% of the above ground biomass is left on the site at harvest (current harvest methods make it impossible to cost effectively recover this material) and that by-and-large the 10-15% of the tree mass that is left in the ground (stump & root mass). Potentially there is 30% (or more) extra volume of fibre grown which can be used as a product for sale. Undertaking research to work out a cost effect way to collect and process this currently wasted material would provide additional revenue to forest owners.

### **3. *Transfer of international knowledge and experience to potential NZ commercialisation parties.***

- Currently international learnings and experience on wood feedstock production is transferred in an ad hoc manner if at all. A programme of collection and dissemination of international knowledge and experience would be established using existing sector association dissemination mechanisms.
- Valuable information is available from participation in the IEA Bioenergy Task Groups (e.g -Task 43 Biomass feedstocks for energy markets). We need to coordinate, fund and expand participation in these programmes and where appropriate other international fora.
- Coordinate programmes for workshops, seminars and networking assisting transfer of knowledge from researchers to industry.
- Establish a stronger means of transferring information obtained by overseas visits and participation with other organisations to NZ . Encourage those involved in such activities to report through their industry association newsletters on what they have learnt.
- Establish a contestable fund for commercialisation practitioners to obtain funding to visit overseas commercial establishments.
- Collaboration with the farming sector on land and water systems remediation opportunities using selected purpose grown energy crop species (e.g. CSIRO Future Farms CRC) to provide both harvestable fuels and remediation of, for example;
  - o Run-off capture from farms into waterways
  - o Soil retention and erosion prevention
  - o Water retention and wind protection
  - o Fauna/flora diversity and corridors

### **4. *Knowledge and technology development***

- A number of small/medium applied research projects e.g. clinker creation in central North Island boilers, cannot obtain research funding. Establish a contestable programme modelled on the previous EECA contestable Wood Energy Programme with applications sought for funding.
- Establish a cross sector steering group involving all relevant industry associations to develop and coordinate wood-to-energy research programmes.
- The knowledge and experience of developments undertaken within NZ can be very valuable to a wide range of other people. Establish through the energy associations a programme of

seminars/workshops and the preparation and publication of case studies. Use newsletters to report on specific activities.

- With BANZ develop a database of reference projects and publish these on the internet.

### **5. Conversion of wood to energy**

- Establish a centre of knowledge and expertise for advising investors on the range of wood to energy conversion technologies with a critical area being the fundamental science and understanding of the most efficient and commercially attractive routes, as well as taking advantage of niche opportunities (geothermal / link to existing wood resources and processing facilities).
- Expand biochemical conversion (enzymes to ethanol, butanol, diesel) knowledge. Establish mechanisms for collecting information from overseas research and adapting it to NZ conditions.
- Expand thermochemical technology knowledge programme with a focus on relevant to NZ, gasification to diesel (especially via micro-channel FT) etc, pyrolysis to diesel (Ignite)etc
- With BANZ establish a web based reference source for wood to energy information.
- Build on the University of Canterbury Chemical & Process Eng dept Wood Gasification to Synthetic Diesel (microchannel FT) project – while acknowledging that the challenges of small scale FT development are really big the opportunities for gasification are large.
- Gasification of wood into gas is an appropriate technology for bolting onto the front of gas boilers. Establish a programme of work on this application.

### **6. Commercialisation**

- The forestry and wood processing sector already provides 8.5% of NZ energy supply from wood fuel. The sector already has extensive experience in collecting and processing wood into a usable feedstock for combustion. The R&D programme should be an extension of that extensive existing body of knowledge and experience. The focus should therefore be on doing it better and extending it.
- Commercialisation has to come from the establishment a platform of knowledge, experience and drive. Work needs to be undertaken to build up a body of information showing the relative economics of producing biofuels from wood. The commercialisation paths also need to be identified and information made available to investors so that they can make informed and confident decisions. The platform of information will also encourage Government to get behind the commercialisation initiatives. Getting Government supporting the opportunities for additional value and economic growth from wood via bioenergy will be critical for encouraging investors.
- The industry developed NZ Bioenergy Strategy sets a pathway and provides a vision of what is economically possible. This now needs to be developed further into a programme of action.
- The research programme needs to be focused on facilitating market development and should therefore be aimed at providing the science and technology necessary for investors to make good investment decisions. The R&D programme needs to become a mix of blue sky and applied investor focused projects so that there is a push and a pull.

- Establish an R&D program looking at what value a biofuels product will bring to the forestry sector but in particular compared to wood combustion be it in chipped or pellet form. The R&D would look at not just value but when that value can be expected (wood combustion now or oil from wood in a number of years). We know we can get oil from wood now but in how many years will that be commercially viable and what return will it generate for the forestry sector? This compared to the value generated now if the barriers to implementation were removed for wood combustion. The results of the R&D could then be disseminated through the industry associations.
- Establishment of a mechanism through Future Forest Research and other industry organisations on identifying appropriate wood to energy research and commercialisation projects, and using this as a basis for applications for funding.
- Undertake market research to assist potential investors identify, assess and pursue investment opportunities.
- With NZTE develop a Business Incubator service providing mentoring / professional services leading to commercialisation.
- MAF's report Future Drivers for NZ Forestry has identified that the future is constrained by past investment decisions. We need to review opportunities for new multi-product crop (with way higher yields and/or values) or address ways of managing the existing crops so as to dramatically increase their value and thus address the constraints of history.
- Science needs to partner with industry; fuel users, distributors, producers and forestry. There is a role for central government / policy / funding to facilitate this but the primary action has to come from industry..
- New Crops or research investments that dramatically increase the value of the existing crop are in all probability 'high risk' research programmes. They're not likely to be obvious logical incremental steps to an already well mapped/understood route to the future - one is looking for a 'paradigm shifter' or a game changer. So if the research is 'high(er)' risk that probably means a greater risk of 'failure' - i.e., money spent for no discernable salvable output. So if we need to have a successful output that possibly means that we shouldn't end up putting all the research funding into one project/programme. We need a portfolio approach.
- Undertake work to identify facts on the role of forests in providing environmental benefits/services from production of feedstock for energy as well as a range of valuable commodities.
- Research needs to be undertaken into how wood feedstock is measured and sold. Currently wood chip for heat plant is sold on volume without regard to classification and quality. Changing the form of measurement and establishing strong classification within contracts will improve the value and thus the revenue stream throughout the chain of custody.
- Harvest contracts generally do not include an incentive for the collection of quality and classified wood residue after primary products (logs) are produced. Research into alternative forms of contract which will provide incentives for wood feedstock production should be undertaken.
- Most progressive business have an R&D activity which is focused on new product development. Treating forestry collectively as a business would indicate that the forestry sector should have an R&D programme focusing on new products. Bioenergy could be one of those new products.

- NZ has a comparative advantage through the ready access to geothermal energy. Research should be undertaken on how geothermal energy can be used as a foundation for reducing the costs of bioenergy production.
- Coordinate wood-to-energy R&D across all research agencies and the private sector so that there is leverage between programmes and efficiency of funding.

#### **7. Cornerstone projects**

- In order to get projects through to the commercial stage of development there needs to be assistance for start up investigations and initial capital development. The projects supported would need to meet certain criteria as being leaders and have the potential to be cornerstone projects for greater roll out. For example the scale to establish a 'biomass depot' collective local coordination between suppliers may be needed. A contestable fund similar to the previous EECA Wood Energy Programme should be established.
- A contestable fund could also fund 'NZ-firsts' with perceived commercial risk, for instance blending fruit pomace or grape marc with wood fuel for combustion.