



# New Zealand's EnergyScape



2000

2005

2030

2050



## Steering Committee Project Overview

11 July 2007



# New Zealand's Energyscape

## FRST Energy Research Projects - Energyscape, Bioenergy Options and Hydrogen Economy

### Steering Committee Project Overview

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#### 1 Background

The primary objectives of the overall project are: to understand New Zealand's potential energy resources, related infrastructure and demand for energy; to develop a vision for New Zealand's future "Energyscape", out to 2050; and to plan the research that will best prepare us ("New Zealand Inc.") for this future. To this end, FRST have commissioned three-linked energy research projects to be undertaken by a consortium which includes: NIWA, Scion, CRL Energy, GNS Science, IRL, and their associates. The linked projects are:

- "Energyscape" (led by NIWA), which considers how indigenous energy resources can be a significant part of New Zealand's future energy system, and the energy research required for this to happen;
- "Bioenergy Options" (led by Scion), which is similar to Energyscape but focuses on the indigenous bioenergy options; and
- "Hydrogen Economy" (led by CRL Energy), which considers how hydrogen could best play a part as a significant contributor in New Zealand's energy system, and the research needs for this to happen.

The projects began in March 2007 and are due to be completed by June 2008, although the main outputs for Hydrogen Economy will be provided around December 2007. The contract values of the projects are: \$1.3M for Energyscape; \$1.1M for Bioenergy Options; and \$0.5M for Hydrogen Economy.

#### 2 Management

The energy projects will be managed at a working level by their respective lead organisation, but will share an overarching management team (Rilke de Vos and Murray Poulter, NIWA; Tony Clements and Andrew Campbell, CRL Energy; John Gifford and Peter Hall, Scion). In later stages of the programme, the research project deliverables will be integrated to provide a cohesive energy pathway picture and validation process.

#### 3 Project Plan

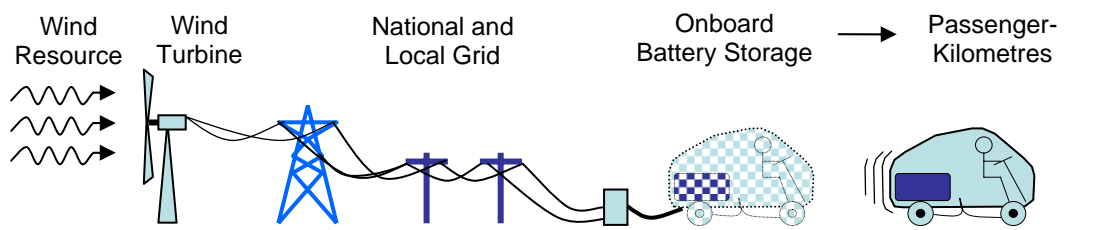
Each project has been divided into four stages:

- Stage 1 – A review of "energy pathway" options and identification of practical or preferred options for the future.
- Stage 2 – An energy, emissions and economic analysis of the preferred pathways to select a smaller number of preferred options to take forward into future scenario modelling.
- Stage 3 – Linking the three energy projects in the overarching framework of Energyscape then using this framework to model future scenarios.
- Stage 4 – An assessment of research gaps and barriers to achieving future scenarios.

### **Stage 1: Review and Identification of Energy Pathway Options.**

An energy pathway is the thread that connects an energy resource through various conversions, infrastructure and transport processes to the end user demand. Figure 1 provides an example of such an energy pathway, from wind to passenger-kilometres via the production and transport of electricity and use of an electric vehicle.

**Figure 1 – Example Energy Pathway**



Energy resources will be broadly grouped into the divisions: “climate-driven” (wind, hydro, etc); “earth resources” (coal, natural gas, geothermal, etc.) and “bioenergy” (resource options from animals, plants and biological waste streams). The end user demand will be divided into the broad categories of passenger-kilometres and freight tonne-kilometres, for transport, electricity, process heat and comfort heat for commercial and industrial users, and electricity and comfort heat for domestic end users. Forecasting of the various energy demands will be carried out during Stage 3.

During Stage 1, the Energyscape and Bioenergy Options programmes review the indigenous energy resources including mapping potential resources (i.e., what would be available if the infrastructure was available to support use of all resources found) and realisable resources (i.e., what would be available using expected available infrastructure plus taking land use issues and other known constraints into consideration), and the various conversion and transport processes that may be used to provide the energy services to the end user. The Hydrogen Economy programme will focus on the energy pathways downstream of the resources, to avoid duplication of indigenous resource studies. The reviews from the combined research will include:

- Quantification of the resource potential in a manner appropriate to the characteristics of the resource.
- Assessment of the quality and completeness of the information available.
- Assessment of the uncertainty (for example, uncertainty in the size of underground energy deposits).
- Review of the economic, energy and emissions (both GHG and local air quality) characteristics of each process for current and future technologies (for input into Stage 2).
- Identification of the barriers and constraints that may be involved.

Aside from the cost of equipment and maintenance, the costs involved in project start up can also be important – in the case of wind farms there can be several years involved in site research and approval. Further, several years can elapse during the steps from financing through to final commissioning, which can also have significant influence on the energy pathway economics and resource availability. In this regard, there is much information required to fully specify some energy pathway options but it must be noted that the energy research projects only have resources available to collect existing data and note where there are gaps, and not to carry out research to fill those gaps.

Combined research outputs of Stage 1 include GIS maps, tabulated spatial resource data, an “Issues Document”<sup>1</sup> in the case of the Hydrogen Economy Research, and a “Situation Analysis Document” in the case of the combined research:

- GIS maps will depict the potential of each energy resource spatially, using a measure deemed to be most appropriate to the resource in question. For example, a GIS map of the estimated annual average wind energy available would consider the potential generation capacity from standard wind turbine technology, as well as limitations associated with access to the grid, accessibility and scenic interruption. Those resources that also fall within the Maori kaitiakitanga (guardianship) will also be identified on these maps.
- Spatial resource data will be tabulated to enable input of the potential energy resources into the energy system modelling framework, work carried out during Stage 3.
- The “Issues” and “Situation Analysis” documents will summarise Stage 1 findings and will be circulated to stakeholders for comment. Comment will particularly be sort on the suitability of the various preferred energy pathways identified.

### ***Stage 2: Pathway Energy, Economic and Emissions Analysis***

There are thousands of energy pathway options that could be considered in scenario modelling. Stage 2 will build on the identification of preferred energy pathways begun in Stage 1 through adding energy, economic and emissions analysis. This analysis will further be used to identify the significant sensitivities, knowledge gaps, New Zealand specific barriers and opportunities for New Zealand’s future energy system.

### ***Stage 3: Future Scenario Modelling***

Stage 3 begins by integrating the research from Stages 1 and 2 into a common framework that allows the various preferred energy pathways to be “switched” off and on to build up an “energyscape” to meet the forecast demand for energy. This switching would be based on “themed” future scenarios – in this regard a “theme” is an overarching principle or requirement to be met, for example, the percentage of energy from renewable resources, the change in greenhouse emissions, or the degree of energy self-sufficiency required within a certain timeframe. These themes will be developed in consultation with stakeholders.

Stage 3 will also compare Energyscape data with that from commonly referenced datasets such as MED’s Energy Outlook 2050.

The outputs of Stage 3 include a vision for what New Zealand’s future energy system could look like and a framework to test various future scenario and energy pathway options.

### ***Stage 4: Gap Analysis***

Stage 4 will consider the gaps and barriers identified during the earlier stages of work, with particular focus given to those that risk New Zealand not realising the energyscape vision developed. Sensitivity and risk analysis will consider, among others: technical risk, research risk, magnitude of demand and supply gaps, resource and infrastructure maturity, national energy security, price volatility and the environmental impact. Combining the analysis will provide a holistic view of how to best prepare for New Zealand’s energy future, in particular identifying those areas that deserve research priority in New Zealand (as compared to research that may come from overseas) and how that research integrates across the energy sector.

The Energyscape framework will be constructed in a manner that its various inputs can be updated, and thus it can track research priority as new developments take place.

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<sup>1</sup> Noting that the earlier delivery of outputs for the Hydrogen Economy research requires the issue of a separate document.

## **4 Work Validation**

Validation of the work will come from a combination of consultation with a “Steering Committee”, a “Government Group”, a “Targeted Stakeholder Group”, as well as wider stakeholder engagement.

### ***Steering Committee***

The aim of the Steering Committee is to provide high level steering of the research work through meetings between it and various Managers of the energy research projects. The Steering Committee members are:

- David Smol, MED
- Doug Heffernan, Mighty River
- Mike Underhill, EECA
- Morgan Williamson, Consultant
- Don Elder, Solid Energy
- Tom Campbell, Rio Tinto
- Murray Bain and Ruth Berry, FRST

The various Managers that will likely attend the Steering Committee meetings are:

- Rob Murdoch and Murray Poulter, NIWA
- Rob Whitney and Tony Clemens, CRL
- Russell Burton and John Gifford, Scion
- Robin Falconer and Mike Isaac, GNS
- Angela Henderson, IRL

Three meetings are proposed:

1. 1<sup>st</sup> August 2007 (9:30am – 1pm at NIWA boardroom, Wellington) - An inception meeting (expected to be around 3 hours duration) to discuss the Energyscape framework, peer review, data sources and progress.
2. December 2007 – A progress and direction meeting (expected to be around 4 hours duration) to consider the main findings of the Situation Analysis document and discuss the development of the framework and future scenario modelling.
3. May 2008 – A wrap-up meeting (expected to be around 4 hours duration) to discuss the early findings of the future scenario modelling, how they will be translated into research priorities and reporting.

### ***Government Group***

The aim of the Government Group is to provide high level steering of policy direction and Government thinking. It is expected that there will be three or four discussion meetings between the Government Group and the Managers of the energy research projects during the course of the projects. The Government Group members are:

- Roger Fairclough, Ministry of Economic Development
- Robert Tromop, Energy Efficiency & Conservation Authority
- Kathy Perreau, Ministry of Transport

### ***Targeted Stakeholder Group***

The aims of the Targeted Stakeholder Group include:

- To provide feedback on the Situation Analysis Document and Issues Document,
- To aid in the selection of preferred pathways for follow-on analysis,
- To aid in the development of the Energyscape analysis framework,
- To aid in identifying gaps and barriers, and identifying research priorities to fill those gaps,
- To aid in the development of future themed scenarios,
- To provide opinion on the research analysis.

The Targeted Stakeholder Group is likely to include:

- Simon Hay, Meridian.
- Allan Gammon, BP.
- Steve Pearce, Solid Energy.
- Piers Scott, Consultant to BMW.
- Roger Fairclough (or representative), MED.
- Robert Tromop (or representative), EECA.
- Kathy Perreau (or representative), Ministry of Transport.
- Wolfgang Scholz, Heavy Engineering Research Association.
- Allan Melhuish, Genesis.
- FRST (to provide the name of their representative).
- Bruce Smith (or representative), Electricity Commission.
- Kieran Devine (or representative), Transpower.
- Jerome Kerrigan, The New Zealand Refining Company.
- Doug Watson, Fonterra.
- Nathan Agnew, Air New Zealand.
- Andrea Schollmann, Ministry of Tourism.
- The Manufacturers' Association.
- New Zealand Steel.
- Tony Friedlander, Road Transport Forum.
- Perry Kerr, Motor Industry Association.
- John Collins, Bus and Coach Association.

Proposed meetings with the Targeted Stakeholder Group, include:

1. 9<sup>th</sup> August 2007 (12:30pm-2:15pm at Inter-Continental Wellington) – to introduce the project to stakeholders, discuss the objectives, Energyscape framework and data sources.
2. November 2007 – to deliver and get feedback on the Situation Analysis document (which incorporates research from the Bioenergy Options and Hydrogen Economy projects)
3. March 2008 – to report and initiate feedback on the projects' future scenario analysis work.

Meeting duration is expected to be approximately 5 hrs. Roger Fairclough, MED, has agreed to chair and aid the facilitation of Meeting 2 and 3.

### ***Wider Stakeholder Engagement***

Input from a wider stakeholder audience will also be invited, primarily through invitation to the scheduled Targeted Stakeholder meetings, the difference being that feedback from the Targeted Stakeholders will be keenly sort.

## 5 Timeline

The delivery timeline and meeting schedule for the three linked projects are summarised in Table 1. Where possible, meetings will be held with the steering committee before meetings with stakeholders.

	2007												2008					
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun		
Hydrogen Economy program																		
Bioenergy Options program																		
Energyscape program																		
Stage 1 - Identification of pathways																		
Stage 2 - Energy, economic & emissions analysis																		
Stage 3 - Future scenarios analysis																		
Stage 4 - Gap analysis and plan development																		
Steering Committee meetings																		
Stakeholder meetings																		
Government Group meetings																		
Wider stakeholder meeting																		

**Table 1: Project Timeline and Meeting Schedule**