Southland Energy Strategy 2011

Venture Southland
Enterprise, Tourism & Community Development

Southland
New Zealand

Southland Energy Strategy 2011

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Executive Summary

Southland has many challenges ahead with regards to energy, largely due to the global challenges of peak oil and climate change within a world which has increasing demand for energy. This strategy outlines the opportunities for Southland with regards to energy generation, storage and use, based on a review of the region's 2003 Energy Strategy. The strategy also provides a high level overview of areas of risk which will need to be addressed while considering the opportunities, in order to maintain economic, cultural and social wellbeing, as well as protect the environmental values which support us.

The following strategic actions have been identified:

Energy Efficiency

Residential

- Encourage and support uptake of Warm Up NZ Insulation Scheme, and the possibility of a voluntary targeted rates scheme to promote the uptake of insulation and clean heat.
- Encourage use of Homestar™ performance ratings, particularly for house sales.

Business

- Encourage energy efficiency in the commercial, industrial and small-medium enterprise sectors.
- Identify good practices in dairy shed design, looking at reducing energy and water use, and have these included in new conversions and retrofits where practically possible.
- Promote and support the use of renewable energy sources for dairy farms (wind, small hydro or biogas) to enable farms to have greater self sufficiency in energy and to encourage the better management of waste.
- Investigate, promote and support technologies that convert dairy effluent into biogas and less environmentally harmful fertiliser.
- Investigate the potential of co-ordinating farm energy production (electricity, biogas), on a provincial basis, to create and support the commercial viability of any surplus energy.
- Undertake social research to better understand how decisions on farms are made, under various ownership/management structures. Use this research to inform projects which will increase capital investment in energy efficiency and infrastructure, such as using biodigestors.
- Develop a programme to undertake energy audits or assessments on dairy farms, based on the findings of the Dairy Shed project, and encourage retrofitting for efficient energy use. This should include ensuring that soft starts are retrofitted. Encourage lines companies to ensure appropriate tariffs to encourage consumers to fit equipment to correct power factor and limit start currents.
- Encourage electricity retailers to enhance peak demand pricing structure, and to include practical industry specific advice on adjusting systems to take advantage of low peak periods.
- Raise awareness of the opportunity for the agricultural sector to change its practices to better enable its promotion as a "clean and green" industry.
- Investigate mechanisms to encourage large scale developments to consider using renewable energy.

Energy public awareness programme

- Undertake a vulnerability assessment of peak oil impacts for Southland, and communicate findings with the public.
- Encourage programmes for businesses, community facilities and residents, which raise awareness of likely rising energy costs; promote energy efficiency; encourage forward

thinking about availability of sources of energy; promote central government resources available for initiatives. This may be through some form of event(s).
- Encourage adoption of any nationally developed green building performance rating tools (Commercial: Green Star. Residential: Homestar). Councils, businesses and residents should be encouraged to use these for new build or refurbishment projects.
- Develop demonstration projects for sustainable building design and small scale renewables.
- Advocate for central government to encourage purchase of smart appliances for replacements, including subsidies from avoided capital expenditure.

Transmission Network

Investment
- Facilitate investment in transmission grid and distribution upgrades as required.
- Work with PowerNet to ensure that Transpower is encouraged to produce adequate transmission capability, and that this is maintained. Ensure a reinvestment programme is developed to service generation and industry establishment within the region as appropriate.

Research
- Facilitate stakeholder discussion around potential goals and initiatives for anticipating and influencing changing energy demand patterns.
- Promote research into the application of energy management systems, smart metering, power generation and cogeneration technologies, and industry co-location opportunities.

Infrastructure
- Develop high speed broadband to enable smart grid applications in the future.
- Maintain awareness of fuel cell and other storage developments to inform infrastructure planning.
- Facilitate co-operation between lines and generation for the development of distributed energy generation, including identifying and addressing any planning constraints.
- Advocate policies that recognise and protect transmission corridors and networks.

Transport Solutions

- Investigate the required infrastructure and implications of potential demand for electric vehicle charging in the Southland context, and facilitate solutions to issues. This could include participating in trials.
- Review urban infrastructure and spend to enable and encourage transport alternatives such as walking and cycling, and ride sharing.
- Investigate a formal ride sharing system to increase light vehicle occupancy.
- Investigate the feasibility of inland hubs to consolidate freight and improve freight density, energy efficiency, efficient transfer to rail and port.
- Encourage initiatives such as efficient driver campaigns to encourage efficient use of fuel.
- Encourage the replacement of weight restricted bridges to improve road freight efficiency.

Fuels
- Facilitate consortiums of larger fuel users to assist with enabling supply to meet demand for alternative fuel sources, such as blends of sustainable biodiesel.
- Encourage local transport operators to investigate alternative fuel sources, such as blends of sustainable biodiesel, electric vehicles and hydrogen fuel cells.
- Advocate for central government to investigate a limit on fuel imports to help build business case for domestic liquid fuel production.

- Promote the use of gas options as a substitute or for co-fuelling vehicles.
- Investigate distribution and fuelling infrastructure needed for gas (including hydrogen) and liquid fuels.
- Encourage organisations to have policies and constitutional documents which enable teleworking, internet based communication and electronic communication.

Rail

- Encourage continued maintenance of rail networks, and electrification of the network.
- Investigate logistics required to enable effective use of road/rail transport.

Regulatory Reviews and Empowering Policies

- Advocate for changes to the electricity supply rules to encourage smaller renewable generators to connect to the grid.
- Electricity generation companies, local authorities, and councils should develop a common approach to ensure that development of new generation is as streamlined and efficient as possible within the context of the Resource Management Act.
- Progress energy objectives through influencing the development and implementation of regional land transport strategies and associated plans.

Long Term Plans

- Work with local Councils to encourage the inclusion of proactive policies which facilitate the development of renewable energy resources and exploration, generation and transmission projects for consideration as part of long term plans.
- Consider developing a Water Resource Plan and Water Demand Management Strategy.

Legislation

- Monitor legislative code and policy changes, including changes to the Resource Management Act, and if necessary submit as part of the public consultation.
- Encourage review of current legislation which places unnecessary restrictions on electricity distribution, generation and retailing.
- Encourage effective allocation to avoid over allocation of water supplies.
- Investigate the establishment of legislation which would see locally sourced energy resources retained for local use as an import substitution.
- Advocate for central and local government to ensure the establishment and maintenance costs of any infrastructure, monitoring costs and Emissions Trading Scheme costs for lignite mining are not subsidised by ratepayers or taxpayers. Encourage these to be met by industry.

Sustainable Buildings

- Develop a detailed programme plan for the following policy packages to encourage sustainable buildings including council leadership and demonstration: energy efficiency, renewable supply and thermal comfort; water demand management.
- Encourage energy efficiency and renewable energy projects as part of the council's building infrastructure and operations.
- Investigate opportunities to require energy plans for new builds.
- Advocate for greater regulation nationally on minimum requirements for energy efficient features in all new buildings, particularly in cooler climates.
- Test power factor as part of electrical certificate of compliance for new dairy sheds.
- Promote best practice dairy shed construction for new conversions.

Resource Management

- Incorporate the National Policy Statement on Renewable Electricity Generation and give effect to it in regional policy statements, regional and district plans.

- Work with regional and local Councils as part of a review of the Regional Policy Statement, and regional and district Resource Management Act plans to ensure that these reflect energy needs in this strategy.
- Ensure the Regional Policy Statement notes the potential impact of CO2 equivalent emissions on Southland's image.
- Advocate that establishment and maintenance costs of infrastructure, monitoring and Emissions Trading Scheme costs should be fully paid by the industry, and not subsidised by tax or ratepayers.
- Facilitate and encourage open communication between the public and developers around large scale developments.
- Ensure flexibility in plans for land and water use with regards to hydrogen production and distribution.
- Enable flexibility and discretionary authority with regards to new and emerging technology.
- Consider how to balance the positive effects of sustainable electricity generation against adverse environmental effects in a plan.
- Place the onus on developers to describe clearly how environmental effects will be mitigated.
- Planning and policy should preserve the land corridors for energy transmission that exist and recognise that there may be requirements for new corridors arising from the need to connect renewable generation to load centres. Plans should consider facilitating renewable electricity generation for remote sites, such as mini-hydro, biogas or wind turbines, where the upgrade of the transmission lines is uneconomic.
- Promote planning for appropriate allocation of natural resources for the development of renewable generation to assist security of supply (to cope with peak load times and future overall demand).
- Provide for technologies in this strategy, and certain levels of micro-generation activities as permitted, controlled, or discretionary (restricted) activities.
- Allow for the establishment of alternative fuel distribution infrastructures, particularly in urban areas.
- Develop a set of criteria to identify where wind generation would not be suitable and make specific provision for wind generation and its connection to the grid or local reticulation in remaining areas by making it a permitted or controlled activity.
- Regional and district plans need to give consideration to the prospect of pipelines and fuel storage requirements for gas distribution.

Energy Sector Skills and Training Programme

- Identify local skill gaps and address these with appropriate training.
- Encourage local up-skilling to meet demand for services such as energy assessments/audits.
- Encourage plumbers to undertake training in solar water installations, to build capacity for installations.
- Create a stakeholder group who can assist with clarifying a vision and strategic direction to assist with the Southern Institute of Technology energy centre of excellence.

Energy Generation Opportunities

- Promote increased generation capacity to meet demand and achievement of the 90% renewable electricity target.
- Promote the establishment of cost effective reserve generation capability in Southland.
- Advocate for the removal of tariffs such as the High Voltage Direct Current tariff for the Cook Straight as these are discouraging investment in renewable energy projects in the South Island.

- Encourage co-location of complementary industries by:
  - Identifying potential industries in Southland that could benefit from co-location (for waste streams, including waste heat) and promote these opportunities.
  - Ensure plans indicating industrial zones are flexible enough to enable facilities inputs and outputs to be matched, including the development of energy generation nearby.
  - Establishing a database of commercial waste stream and heat, and attempt to match these with new or existing developments.
- Facilitate and encourage open communication between the public and developers around large scale developments.

Remote Areas

- Investigate energy storage options for energy generated on Stewart Island.
- Identify key locations within Southland where communities are at most risk from a dependence on fossil fuels, or are subject to significant energy price barriers. Ensure that any peak oil vulnerability assessment includes these communities. Work with national partners to develop local solutions for these at risk communities and seek funding solutions, which may include renewable energy investments.
- Promote small-scale renewable energy development in remote areas.

Gas

- Investigate ways to mitigate the greenhouse gas implications of using coal seam methane as a transport fuel.

Wind Energy

- Encourage wind farm developments in Southland in appropriate locations.
- Facilitate the establishment of wind monitoring and enhanced wind mapping to identify suitable zones for wind generation and ensure that appropriate RMA planning provisions are made, including making it a permitted or controlled activity.
- Secure funding for study to monitor large scale wind generation opportunities on Stewart Island.
- Encourage the assessment and utilisation of opportunities relating to wind power and storage options, including pumping projects.

Coal and Lignite Reserves

- Ensure that if lignite reserves are extracted, local social and economic benefits are maximised, and any associated adverse environmental impacts are adequately avoided, remedied or mitigated.
- Ensure local community needs are addressed with any resource development.

Oil Reserves

- Ensure that if oil reserves are extracted, local social and economic benefits are maximised, and any associated adverse environmental impacts are adequately avoided, remedied or mitigated.
- Request that oil spill recovery equipment be located within Southland to ensure quick recovery in the event of a spill.

Solar Energy

- Promote the establishment and ongoing monitoring of solar energy opportunities for Southland.
- Undertake ground truthing to test accuracy of NIWA solar mapping tool, and encourage appropriate use of the tool.
- Encourage widespread uptake of small scale photovoltaic where appropriate.
- Encourage widespread uptake of small scale solar water heating:
- Establish a solar saver scheme in Southland, if after a pilot the benefits are proven and scheme is practical to be implemented.

- Develop guidelines for schools and community facilities to assess solar hot water heating opportunities.

Biomass

- Facilitate algae to biodiesel initiatives in the region.
- Continue to monitor viability of liquid biofuels production from crops, basing the value case on net positive energy gains; maintain awareness of associated land requirements.
- Investigate the opportunity for the wood industry to develop liquid fuels, such as generating diesel using the Fischer-Tropsch or other process.
- Investigate opportunities for generating energy from waste, including heat, electricity and transport fuels. Ensure avoidance of ETS costs are included in any cost benefit analysis.
- Investigate the opportunity to target forestry waste.
- Monitor the commercialisation of the Scion Waste2gold process as a disposal route for sewage sludges that have nitrogen and phosphorous rich by-products.
- Re-examine renewable sources of energy (including biogas), and where appropriate promote them for use in the dairy industry.
- Actively promote the wood energy sector development in Southland through a range of actions, including matching demand with supply streams.
- Investigate the economics of using forestry residues and short rotation crops as an energy source.
- Investigate the opportunity for creating incentives for promoting the use of woody biomass thus avoiding capital costs of grid upgrades and utilising avoided capital costs to fund these.
- Encourage local manufacturers to research and develop improved technologies that contribute to the economic uptake of biomass as an energy source.

Marine Energy

- Assist in identifying suitable sites for marine energy.

Secure Industry and Attract New Industry

- Promote the development of secure and reliable energy supply for existing industry.
- Promote the development of energy opportunities to encourage the attraction of appropriate industry to Southland.
- Encourage the development of GreenStarTM rated commercial buildings.
- Investigate the opportunity for Southland to offer itself as a pilot location to test co-ordination and logistics for green hydrogen production.
- Investigate options for addressing compliance and safety issues associated with the use and storage of hydrogen.
- Investigate technologies and practices that would reduce on-farm water use.
- Maintain an awareness of Carbon Capture and Sequestration technologies for potential application in Southland.

Research and Development Opportunities

- Maintain awareness of options for photovoltaic silica based production opportunities.
- Assist project developers with investigating and undertaking feasibility studies on projects which utilise renewable energy sources (small scale wind energy, solar, bio-energy etc).
- Facilitate a co-ordinated industry response to the roll out of smart appliances, smart metering and electricity pricing that encourages the uptake of these appliances.
- Investigate the broader benefits of bio-char to soil health, and advocate to central government for the inclusion of soil carbon into the Emissions Trading Scheme if appropriate.

Local Manufacturing and Servicing Opportunity

- Promote awareness of potential manufacturing and servicing opportunities:
  - Solar energy componentry
  - Heat management and recovery systems
  - Hydrogen cell technology and systems
  - Marine energy technology
  - Photovoltaics
  - Energy metering and control systems for grid interface
- Encourage local industry to purchase local carbon credits.
- Promote minimisation of CO2 equivalent emissions, the development and use of environmentally sustainable sequestration opportunities and the implementation of carbon offsetting initiatives.
- Monitor developments in superconductor research and investigate local opportunities as technology matures.

1. Foreword

Awareness of climate change, acknowledgement of peak oil and increased competition for natural and energy resources in New Zealand is becoming increasingly evident. However, many local businesses have not thought about the implications of these global issues for our local economy, or their business. Price increases of electricity and fossil fuels, and forecast increasing costs of oil will place a higher priority on energy efficiency and the use of renewable energy resources. There are major challenges, the need to address the adoption of more efficient technologies and practices. Education is needed to help us consider the new energy future when making any investment decision, be it as simple as what kind of light fittings go in your home, or as complex as how to best design a dairy shed, or where to locate new industrial premises. Proactive action in the short term will be a wise investment, because in an energy scarce future it will be much more costly to retrofit our way out of energy-inefficient decisions – particularly in relation to large capital investments such as buildings. Investment in energy efficient buildings, renewable energy generation and resource efficiency dramatically enhances business and community resilience. This is increasingly a key factor in retaining existing business and in attracting new businesses and residents to a city or region.

In the past Southland has taken a lead in the energy sector by having a regionally co-ordinated approach to energy, with the first Energy Assessment for the region undertaken in 2003, and the Regional Energy Strategy published in 2005. Some of the actions in the strategy have progressed, some still require further work, and some have not progressed. There have also been a number of changes which indicate a need to add more strategic actions to prepare the region for what is to come, and highlight a need to create a combined long term vision for the future of Southland's energy. These changes include the mix of industries in the region, and population. These recent changes, as well as the forecasted changes, have implications for regional energy demand. If Southland is to address challenges and benefit from opportunities in the energy sector in the future, we also need to consider the global and national changes occurring, notably efforts to mitigate climate change and the peaking of fossil fuel extraction. These changes suggest a need to shift focus from developing resources that will maximise economic growth, to preparing for how to maintain stable energy services necessary for supporting a thriving healthy community. This updated energy strategy is a call to action which will require co-ordination, new thinking, investment and skills to implement changes.

Some businesses, community groups and residents are questioning their sources of energy as a result of heightened awareness of coming challenges. Availability of alternative sources is an issue; for example Southland doesn't have access to natural gas options at present. There are barriers to small scale distributed generation which need to be addressed. Changes in sources of energy are intrinsically linked to environmental impacts which need to carefully managed, both at the source and the point of use, as illustrated by some residents noting a change in air quality with lower quality coal now being used.

Within the foreseeable future it is possible that there will be significant developments based on either on shore, or off shore energy resources. If this occurs, it will be important for the region to be prepared in order to ensure maximum local benefit is captured.

At a public workshop held as part of this strategy development, community well-being as a key outcome was stressed, with this theme encapsulated in the statement: "it's not all about development; it's about the right kind of development", by having regard to the nature of the resource used and local community needs. Despite our region's richness in resources, we must acknowledge the fact that we are part of a global trading nation, and subsequently demand and supply worldwide will influence our local energy resource availability and its price locally. In order to be a resilient region, we will need to have a diverse range of energy sources, and this will require us to be well informed, skilled and adaptable.

This strategy examines a number of possible future options. It becomes clear that there are some long lead times involved with regards to new technology. This time should be used to ensure that the regulatory and compliance environment enables the development of alternative technologies to be carried out within a user friendly, socially and environmentally acceptable framework. There is an opportunity to become a test market and advocate for such technologies, which may in itself have economic benefits for the region and future export opportunities for local businesses who could be engaged in this work. Following public feedback on the draft version of this strategy, we can now paint a combined long term vision for the energy future of Southland, and can use this to prioritise the strategic actions in this document.

Two new strategic opportunities emerged from the review. One is the potential use of gas as a local transport fuel. The other is the possibility that the waste from industry, such as dairy farms, could be used to provide energy from waste, which may have the potential to significantly reduce electricity demand as well as avoid environmental harm. It was also clear from the investigations that there was an immediately available opportunity to avoid capital expenditure on distribution assets if more attention was paid to the quality of demand, with corrections for power factor and avoidance of micro peaking by installing soft starting on dairy shed loads.

This updated energy strategy for Southland outlines the strategic actions needed to ensure Southland has a secure and cost effective energy supply, to enable and foster community and economic development, while acknowledging that maintaining our environment's health underpins the ability for this development to occur.

Energy, its availability and its cost, will be hugely important factors in determining the standard of living Southland people will enjoy in future. So this is an important document and I wish to acknowledge the significant effort from Venture Southland staff, and funding received from the Energy Efficiency Conservation Authority and Environment Southland.

Robin Campbell
Chairman of the Venture Southland Directorate

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2. Introduction

2.1 Background

As a region Southland has a strong economic base with much of the region's gross domestic product generated from the harvesting or creation of value from natural resources rather than from value adding activities on products or services produced elsewhere. The fundamental driving forces are therefore the resources available and the efficiency with which the producers use imports to the region.

In 2003, a comprehensive report on energy demand in Southland, and the energy resources available in the region, was undertaken and published by Venture Southland. In 2005 this was developed into an energy strategy for the region.

Venture Southland has taken an active role in implementing the previous energy strategy, and will continue to take an active role alongside other stakeholders in the implementation of this strategy. Venture Southland's role in the strategy includes facilitating cooperation between local government and national agencies that have interests and influences in the Southland region, as well as organisations that currently operate in the region and those which plan to in the future.

2.2 About This Document

Venture Southland commissioned a review to consider the current (2010) energy situation and build on the previous energy reports. Because much of the content of the original reports is still relevant and many of the resources are essentially unchanged, this updated strategy concentrates on looking forward and considers the impact that changing social, economic, and technological factors may have on the energy producers and users based in the Southland region.

Producing a regional energy strategy is not required by law; consequently there is no statutory process for the preparation of this document, and no requirement for it to be implemented. The strategy is aimed at identifying the opportunities and the associated risks associated with energy, for all stakeholders. The implementation of these initiatives is reliant on the collective actions of a wide range of stakeholder groups, as well as sourcing funding. Some actions will be led by industry rather than Council or Venture Southland.

During the term of this strategy, it is expected that there will be unprecedented changes both in technologies and public perceptions, which may change the priority and detailed implementation of each of these actions. This strategy has a timeframe focussing on the next 10 years. The strategy will be reviewed if appropriate in five years time.

This updated energy strategy for Southland looks at the incentives and barriers around projects, processes, and developments impacting on the supply and demand for energy in the Southland region. In particular it identifies the issues that need to be considered in advance to ensure that the region can maintain an appropriate level of control over development and the effects of development, while ensuring that it also remains industry and technology friendly. Economic, social and environmental effects are included. The quantity of content of each section in the document is not reflective of the level of importance that should be placed in each area; rather it is reflective of the amount of information which is available and was not covered in the previous strategy.

Accordingly, this document:

- Does not update all statistics outlined in the 2003 report
- Reviews major data that has moved or changed since the 2003 report
- Looks at the current and future relationship between supply and demand
- Considers the opportunities and barriers related to energy for Southland
- Reviews the technologies that exist and those that are on the horizon
- Views technologies and opportunities through the perspectives outlined by stakeholders
- Outlines updated strategic actions, with a focus on ensuring future options are not restricted
- Should be considered as an update and extension of the original work carried out in 2003 and 2005.

This strategy will be used to inform an implementation plan, which will detail the actions, timeframe, who will be involved, the resource required to implement. This plan will be developed in consultation with other stakeholders.

2.3 Vision for Southland's Energy Future

In the past, a vision for Southland was developed and this is publicly available in the Our Way Southland outcomes report[1]. However, it does not specifically mention energy and it was identified by stakeholders that it is important to have an overarching long term vision for Southland's energy future. The following vision was circulated in the draft strategy and received much positive feedback during the submission process, with only minor changes recommended which have been incorporated below.

> Southland communities harness energy resources available to them, in a way that protects and enhances their environmental, social and economic wellbeing. Southland has a resilient renewable energy supply which minimises the impact on our neighbours. With a high level of awareness of limited energy resources, efficient use of energy is common practice.

Although this strategy focuses issues and opportunities over the next ten years, it is considered appropriate that stakeholders using this document to inform decisions consider this vision in a longer term context, including the rights of the coming generations of Southlanders. Some may find the Natural Step framework and principles, known as 'system conditions', useful tools to consider how to transition towards this vision[2].

This document contains a wide ranging exposition of almost all possible energy opportunities for Southland, along with highlighting various economic, technology and environmental considerations. With the above principles in mind, and based on the feedback during the submission process, the following are the priorities for Southland's energy strategy implementation to help steer towards the vision for Southland's energy future:

1. Energy Efficiency
2. Development of renewable sources of energy
3. Responsible use of fossil fuels

[1] Our Way Southland (2005). http://www.ourwaysouthland.org.nz/documents/2005-our-way-southland-community-outcomes-report.pdf

[2] An example of the Natural Step applied at a nation-wide level can be found in "Sustainability Analysis for New Zealand" here: http://www.pce.parliament.nz/assets/Uploads/Reports/pdf/natural.pdf

2.4 Key Principles

The principles used in preparing this strategy are:

- Southland has diverse energy resources, including significant renewable energy resources, which can be utilised to improve community and economic development in the region.
- Community and economic development is reliant on maintaining a healthy environment.
- Secure and cost effective renewable energy supply is achievable by implementing an integrated regional energy strategy.
- Future demand can be met by: Promoting energy efficiency;
  - Encouraging the effective use of energy resources;
  - Encouraging the use and development of renewable energy resources;
  - Investing in local exploration and generation opportunities.
- Energy conservation practices and renewable energy technologies offer significant benefits to users.
- Southland's energy challenges and opportunities should be considered within the context of global issues. These include:
  - Increasing energy costs, including oil price
  - Supply chain risks associated with accessing fuel, particularly transport fuel such as diesel.

2.5 Methodology

In order to update the Southland Energy Strategy, Venture Southland commissioned Aurecon to undertake a review that has informed this document. As part of the review, a stakeholder workshop was held on 24 June 2010 as an open forum and was attended by approximately 40 stakeholders from inside and outside the region[3]. The workshop was facilitated by five senior executives from Aurecon, who were specialists in different areas of energy technologies, industries, and planning. The workshop consisted of two small-group discussion sessions which reported back to the group as a whole, giving the stakeholders attending the workshop as much opportunity as possible to contribute ideas and opinions. Their interests and concerns were reflected in the review and have been incorporated into this updated strategy.

This draft version of this document was made available for public comment in May 2011 on www.southlandnz.com, and 21 submissions were received, along with a few phone calls and one late submission. Overall the quality of submissions was noted by the Venture Southland board as being of exceptional quality. The views of the submitters have subsequently been incorporated into this document. Submitters were asked to indicate which areas they felt were higher priority for progressing, these have guided the priorities for implementation.

"I just want to say that I'm impressed by both the approach taken in, and the wide scope of, this draft Strategy - it's excellent that you are covering issues such as fuel poverty. "
Tim Jones

[3] Stakeholder Workshop Notes in Appendix I.

3. Energy Challenges

New Zealand's energy demand has been growing steadily and is forecast to continue to grow. New Zealand must confront two major energy challenges as it meets growing energy demand. The first is to respond to the risk of climate change by reducing greenhouse gas emissions caused by the production and use of energy. The second is to deliver clean, secure, affordable energy while treating the environment responsibly.

Global trends appear to be propelling us towards a carbon-constrained world. These trends include: the dynamics affecting availability and demand for hydrocarbons, and the international climate change mitigation agenda. Responses from government and industry in terms of renewable energy and carbon legislation may vary. The new opportunities and risks emanating from technological change and climate instability have significant implications for businesses and society in general, and for the energy sector specifically, in the coming decade. Energy efficiency and renewable energy, regardless of scale, will play a critical role towards addressing national and global energy challenges, and play a vital role in the wellbeing of the region.

3.1 Peak Oil

Undoubtedly the greatest single influence on energy use and availability other than climate change will be the diminishing reserves of oil and gas – both globally and locally. Peak oil is "the maximum rate of the production of oil in any area under consideration, recognising that it is a finite natural resource, subject to depletion."[4] The International Energy Agency states that the all time peak output of oil was reached in 2006 at 70 million barrels per day.[5]

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> "*In some cases, the surprise element is only a matter of timing: an energy transition, for example is inevitable; the only questions are when and how abruptly or smoothly such a transition occurs. An energy transition from one type of fuel (fossil fuels) to another (alternative) is an event that historically has only happened once a century at most with momentous consequences."*[6]

In 2010 a Parliamentary Research paper looking at the situation over the next five years, summarised that another supply crunch is likely to occur soon after 2012 due to rising demand and insufficient production capacity. It noted that economic consequences of high oil prices can induce global recessions, and that this "may be at the start of a cycle of supply crunches leading to price spikes and recessions, followed by recoveries leading to supply crunches." Export-generating industries such as tourism and food exports are very vulnerable to oil shocks because of their reliance on affordable international transport, but domestic oil production cannot insulate the country from global oil price shocks.[7] In some situations civil unrest can be a result of such shocks.

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[4] Colin Campbell (2011). Cited in The Association for the Study of Peak Oil and Gas Cited website www.peakoil.net
[5] International Energy Agency (2010). World Energy Outlook.
[6] US National Intelligence Council (2008).
[7] Parliamentary Support Research Paper (2010). The Next Oil Shock? http://www.parliament.nz/en-NZ/ParlSupport/ResearchPapers/4/6/a/00PLEco10041-The-next-oil-shock.htm

3.2 Increased Worldwide Demand for Energy

Population growth and increasing wealth of developing nations leads to an increase in demand for energy. Historically, energy security has been understood as defence against supply disruption and price instability. Within this mindset, protecting the status quo is paramount. Yet dynamic trends, including the sharp rise in demand from newly industrialising economies, green house gas induced global warming and the increased availability of alternative energy technologies, mean that protecting traditional energy practices will make us far less secure, and less competitive, in the future. This is in addition to the threat that climate change poses to energy infrastructure. These are not issues for the energy sector alone, and therefore require urgent attention. The return to high and volatile oil prices after 2005 reinforced the link between energy prices, profits and economic stability for most businesses and society as a whole.

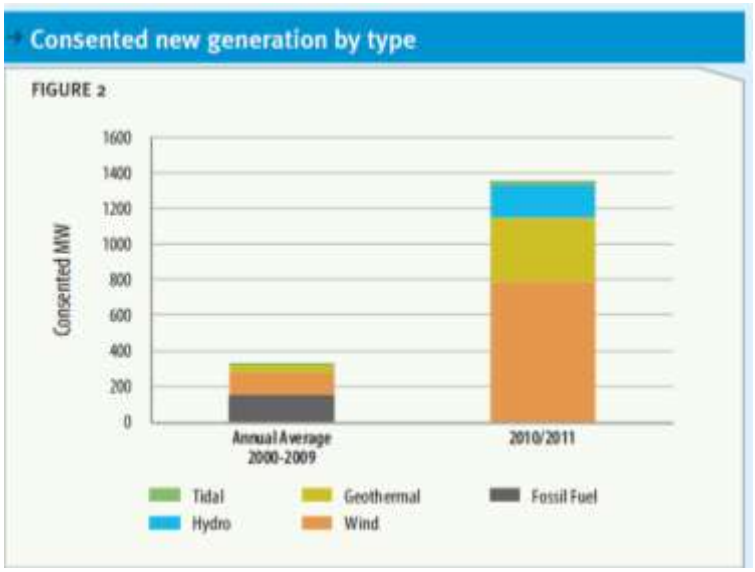
3.3 Climate Change

Climate change creates many risks and uncertainties for society and industry. Anticipated disruption around energy, water and other critical natural resources pose new political, economic and human security challenges.

We know that to keep global warming to 2°C above historical levels requires a step-change in the way energy is produced, transported and used. But international progress has been slow. The Copenhagen Accord of 2009 lists actions that the governments of over 100 developed and developing countries propose to take to achieve this, but there is no binding legal commitment. Until now, supply concerns and relations with energy have tended to dominate national energy policies, but this is changing. Energy efficiency plays a vital role in future strategies to limit global warming. Energy efficiency will be the mantra of governments trying to ensure both national security and CO_2 equivalent reductions, and energy users are increasingly central in this vision. Energy efficiency is also vital for economic competitiveness and insulates companies from the worst of the energy price volatility.

The International Energy Agency say demand for all sources of energy will increase. “Oil remains the dominant fuel in the primary energy mix to 2035”, with demand for coal rising to around 2020 and declining towards the end of 2035. “The use of modern renewable energy — including hydro, wind, solar, geothermal, modern biomass and marine energy — triples between 2008 and 2035, its share in total energy demand increasing from 7% to 14%.”[8] Renewable energy has moved into the mainstream and is now supplying the majority of new electricity generation. This trend is also shown in New Zealand, “1340 MW of new renewable-generating capacity was consented in the past year (2011) with no new fossil-fuelled plants. This is a fivefold increase in renewables consented as compared to the past decade, with most growth pre-ETS being fossil-fuelled.”

[8] International Energy Agency (2010). World Energy Outlook 2010.



Source: Ministry for the Environment (2011).
Report on the New Zealand Emissions Trading Scheme

To increase efficiency substantially and allow the uptake of more renewable energy, radically different infrastructures are being planned around the world. These may include local and transitional 'smart grids' that communicate with household and industrial appliances and electric vehicles, enabling intermittent distributed energy from wind, solar and other renewables that generate power back to the grid and help regulate demand.

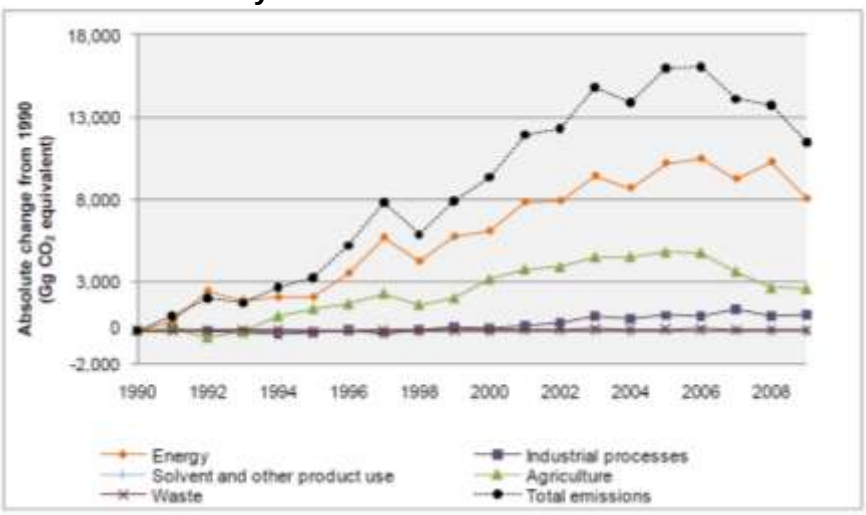
The Ministry for the Environment provide a summary of the expected effects of climate change for the country. In New Zealand we are likely to see an increase in temperature of over 1ºC by 2050; fewer frost days in winter and more hot days in summer; higher rainfall in the west and less in the north and east; more frequent extreme weather events such as droughts and floods; reduced snow; increase in westerly winds in the south, increase in average sea levels. These changes have implications for energy generation, storage and demand. Southland, along with the rest of New Zealand, is likely to become warmer and wetter, with fewer frosts, and Southland's temperature could be, on average, up to 2.5°C warmer over the next 70-100 years. While a rise in temperature may present positive and negative implications for agriculture, it is unlikely to reduce the demand for domestic heating significantly in the next 10-15 years. Even if a rise in temperature were to reduce demand for heating, improving the thermal efficiency of buildings will still be relevant, because insulation and glazing are just as important for keeping buildings cool in warmer weather.

Changing rainfall patterns have some serious implications for management of the water resource in Southland in the years ahead.[9] The implications of and opportunities for water harvesting and water storage are likely to become increasingly important for the support of future developments. Scarcity of water also has energy demand implications due to the energy required to access, treat and transport water, as well as energy being required to transport, treat and dispose of waste water.

[9] Beacon Pathway (2010). Looking after the future: Connecting short-term tools and long-term benefits to encourage sustainable buildings. www.southlandnz.com

New Zealand's own greenhouse gas emission profile in terms of total emissions by sector is shown below (1990-2009).

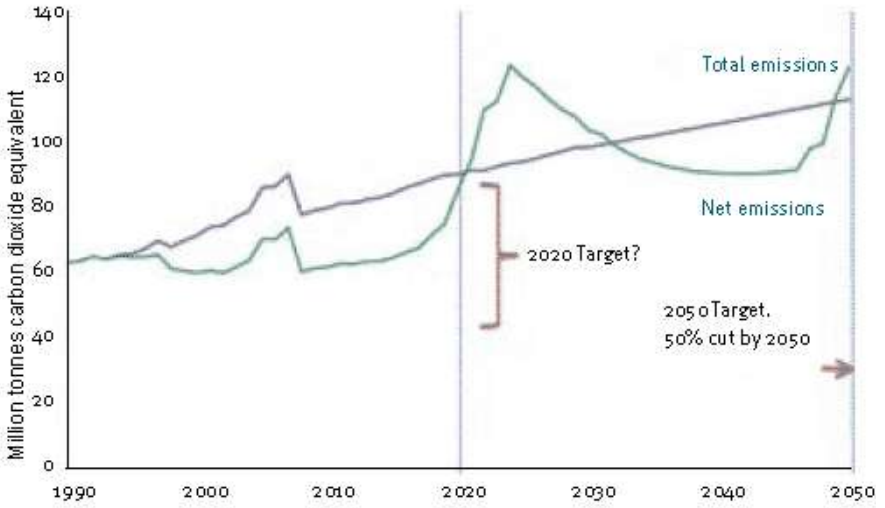
Absolute change from 1990 in New Zealand's total emissions by sector from 1990 to 2009



Source: Ministry for the Environment (2011).
New Zealand's Greenhouse Gas Inventory 1990–2009.[10]

When total emissions are balanced out with forestry plantings, which remove emissions from the atmosphere essentially offsetting emissions, New Zealand's net greenhouse gas emissions present a different picture.

New Zealand's total and net greenhouse gas emissions and removals (historical and projected), 1990–2050



Source: Ministry for the Environment (2009). New Zealand's 2020 Emissions Target.[11]

In particular, New Zealand's net emissions spike beyond 2020 and show significant reductions are needed to reach the country's target of a 50% cut in net emissions by 2050.

[10] http://www.mfe.govt.nz/publications/climate/greenhouse-gas-inventory-2011/greehouse-gas-inventory-2011.pdf
[11] http://www.mfe.govt.nz/publications/climate/nz-2020-emissions-target/html/index.html

3.4 Constrained Mineral Resources

Limited availability around the world of rare earth elements and key ores required for manufacturing of energy efficient technologies will place constraints on technological solutions. In particular this limits energy storage options by way of batteries. Mineral resources are a constraint on all development, including conventional and new renewable and energy efficient technologies.

3.5 Implications of a Non-Fossil Energy Future

Meeting the dual challenge of maintaining stable energy services in the short term, without jeopardising them in the long term, means reformulating 'energy security' as 'securing the transition to a low or no carbon economy'. This cannot be based purely on access to affordable units of energy, be it litres of fuel or kilowatt hours (kWh), but rather one which prepares for a long-term vision of efficient, clean, safe delivery of energy services to meet societal needs.[12]

At the global level, there is little sign that energy demand will go down, with 'business as usual' forecasts suggesting a 40% increase by 2030. This will require $26trn of investment – some 1.4% of global GDP[13]. Given the global negotiations to radically reduce emissions, and the finite nature of conventional fossil fuel sources, a rapid movement towards a highly efficient non-fossil energy future would seem to be the logical investment choice.

For energy businesses, the higher upfront investment costs, technological uncertainties and lack of confidence in the short-term economics (compared with conventional fuels) raise problems and risks. These include the dangers of changes in policy or higher costs associated with being a first mover. Businesses in the wider economy also need to be aware of the changing energy context their operations and supply chains will rely on. Businesses that can adapt their activities to benefit from emerging energy trends and manage the risks will gain an advantage over their competitors.

As transport costs increase, it is likely that there will be a greater emphasis on utilisation of locally produced products, particularly for food and potentially fuel. It is also likely that areas such as Southland and indeed New Zealand as a whole will have to seriously consider developing high value and value added exports rather than relying on high volume low or variable value commodity products as a source of export income. This raises an important question of if there should be a shift from food to bio-fuel production. Balancing land use for demand for food vs fuel will likely require consideration within a local, national and international context, on whether or not this is left to the market to decide, and some research on this topic has already been undertaken[14]. It is possible the two can be complementary. Either way, there is no doubt that the health and productivity of soils in Southland is one of the region's most valuable assets that should be protected.

In order to reduce transport costs, greater emphasis will need to be given to production automation, high speed communications and non traditional work practices, with possibly a trend towards work teams collaborating in geographically diverse locations, relying less on commuting to and from offices or international travel but increasingly relying on online collaborations.

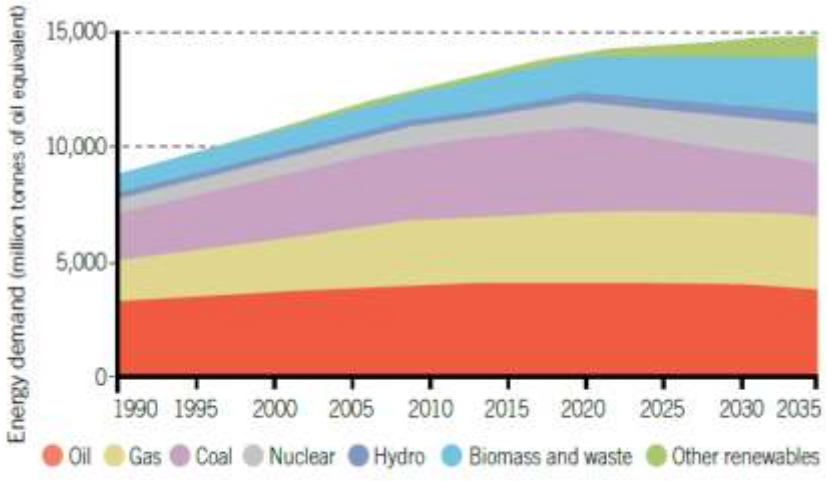
[12] Lloyds (2010). Risk Insight Sustainable energy security: strategic risks and opportunities for business.
[13] Lloyds (2010). Risk Insight Sustainable energy security: strategic risks and opportunities for business.
[14] Nimmo-Bell & Co (2009). Food prices and biofuels update.

Tourism is also likely to transit from high volume low value tourism to lower volume high value tourism i.e. a greater reliance on people who can afford to travel and are able to pay accordingly for services and activities. Although current New Zealand visitor number forecasts appear to largely ignore these issues, there are an increasing number of research papers and tools[15] becoming available to help operators understand the implications for their industry. Increasingly, there is also evidence of visitors seeking a low carbon or carbon neutral travel experience. This in-turn indicates the need to change what we do and how we do it. The challenge associated with both the movement of export products and visitors is how to do this in an energy efficient manner with the least embedded carbon content.

These global challenges will have an impact on the entire world, and Southland is no exception. There is no such thing as a silver bullet solution. Relying on single solutions also adds risk, should an issue occur to prevent successful harvesting or delivery, or use of that resource.

Southland has many minerals which could play a part in our energy future, such as high purity silica which could be used for solar photovoltaics, known platinum reserves for electrical components, and lignite. Many see the large lignite resources the region has, and believe it to be a solution to local challenges. Putting aside the carbon implications, the reality is, at such time as the region's oil, gas and lignite resources are extracted, the owners of that resource will be looking to maximise revenue opportunities by processing it into a higher value product. If there is demand from Southlanders for the product, they will still be paying international prices, which will be driven by supply and demand globally. The following graph shows the International Energy Agency's forecasted global energy demand through to 2035.

Global energy demand



Source: International Energy Agency. World Energy Outlook 2010.

This is based on the scenario that global temperature rises will be limited to 2 degrees Celsius, and concentration of greenhouse gases is limited to 450 parts per million CO_2 equivalent – assuming national pledges and strong policies. This shows demand for coal continuing to be an important part of the energy mix through until 2020, and declining through 2035.

[15] Covec (2010). Tourism Oil Price Tool. http://www.covec.co.nz/tourism-oil-price-tool

Once extracted, to retain reserves for our own local use would not be viewed favourably by international trading regulations. The extraction of fossil fuel resources is being encouraged by central government, and resources such as the Southland lignite are seen as strategically important to the New Zealand economy. For this reason it is important that decision makers are aware of both the opportunity and implications associated with the recovery and use of fossil fuels. Internationally there is a very high level of scrutiny surrounding the extraction and use of fossil fuels and the associated emissions of CO_2, and increasingly these industries are under the spotlight of international environmental movements. There is some evidence to suggest that New Zealand is starting to reflect these international trends, as recently illustrated in the almost viral debate associated with 'fracking' technologies. In this case the issues surrounding fracking have attracted extensive comment with very little appreciation of the application of the technology. There appears to be a greater awareness and public interest in the environmental and social (health and wellbeing) effects, therefore mitigation planning and implementation should be an area of significant focus and effectively communicated with the wider public.

Southland has its own unique challenge in that its communities are geographically dispersed, with a large amount of GDP reliant on rural activity, in addition to our economic activity being dependent on exports. A resilient region will be one which has multiple options for sources of energy, and some level of community control over these resources. Logically, these factors lead one to envisage many small scale privately owned renewable energy sources. Storage of energy remains a key challenge for any source of electricity generation. Such distributed generation projects require the back up support of a grid network to enable peak loads to be shed, and enable continued supply when systems are not functioning. What kinds of demand management will be needed for such a system to work? Who has control over the supporting network and what are their drivers? Should Southlanders take back some ownership of the infrastructure required for such a network? These questions are fundamental to enabling a resilient energy supply for the Southland region into the future.

Suggested action:

1. Prioritising of energy generation opportunities should be considered not only within a national needs context, but within the global context.

4. Setting the Scene in Southland

4.1 Population

The Southland region contains 2.3% of New Zealand's population and is estimated to produce 2.7% of the country's GDP. This population proportion has decreased by 1% since the 2001 census to a total population of 90,876 as at the 2006 census. The region's population is distributed with 30% in the Southland District, 55% in Invercargill City and the remainder in Gore District. Of the three territorial areas, only Invercargill has increased in population since the 2001 Census. An estimate of population change in June 2009 puts Southland's population at 93,500. Taking the medium projection scenario, it is projected that Southland's population between 2006 and 2031 could be reduced by 5.6% over this period. The high growth scenario of the same projection suggests the population could grow by 10%[1]. If one of the major potential developments occurs in this period, Southland's future population is likely to lie between these two numbers.

The unemployment rate in 2006 was 3.8%, compared with 5.1% for all of New Zealand. This is a decrease from the previous census in 2001 of 5.5% unemployment rate[2].

The 2006 Census found that the total number of dwellings had increased by 1103 since 2001. While the total number of dwellings is increasing, the number of unoccupied dwellings in Southland is also increasing. This indicates a number of new builds are continuing, even despite a population decline. The average household size in Southland is 2.5 people, compared with an average of 2.7 people for all of New Zealand. There has been an increase in the number of multiple-family households (two or more families) since the 2001 Census, which had previously been decreasing.

These statistics indicate the importance of actions which can encourage the investment being made in new builds to be energy efficient. Research has been undertaken to identify barriers to improving the energy efficiency and thermal comfort of buildings in Southland. This work and key recommendations are included in section 5.6.3 of this document.

The location of our region's populations is also worthy of note. Southland is home to many communities which are located in remote places, from the small mining towns of Ohai to those which gain their income from mainly tourism, such as Milford Sound. The most remote of our communities is Stewart Island with 639 rated properties, but far fewer permanent residents. In the case of Stewart Island, residents face high costs of living, and having energy reliant on coal and diesel shipped to the island, they face increasing costs as competition for fossil fuels increases. In remote communities, the risk is that without the ability to afford these currently imported fuel sources in the future, residents may be forced to relocate. Without the local workforce the options for maintaining economic activity in these places become nonviable. This in turn potentially impacts on the ability to service our primary production sector in these locations.

[1] Statistics New Zealand (2006). Population Statistics Unit. http://www.stats.govt.nz
[2] Statistics New Zealand (2006). Population Statistics Unit. http://www.stats.govt.nz

Suggested action:

1. Identify key locations within Southland where communities are at most risk from a dependence on fossil fuels or are subject to significant energy price barriers. Work with national partners to develop local solutions for these at risk communities and seek funding solutions in the form of renewable energy investments.

4.2 Economy

Southland has a strong, real wealth generating economy based on primary production and process industries including dairying, meat processing and the Tiwai Aluminium Smelter, an extraordinarily large consumer of electricity in Southland.

In terms of economic performance it is one of the top performing regions. The availability of affordable and highly productive land has seen a significant increase in the number of dairy farms in the region. Dairy cattle numbers rose almost 19 per cent for the year to June 2009. It is estimated that there were some 430,000 dairy cows, and 800 dairy farms in Southland in the 2008-2009 season.

In 2010 there were 458,306 dairy cows in Southland on 169,749 hectares of farmland – an average of 2.7 cows per hectare. The maximum likely stocking rate may be as high as 3 cows per hectare. Therefore the maximum that this land could support is 170,000 x 3 = 510,000 cows – growth of about 11%. As a rough measure there is an additional 50% area used as support and run-off land, so say 170,000 x 1.5 = 255,000 hectares of land is committed to dairy farming at present. So the other growth is the land left to convert. Statistics New Zealand records 715,731 hectares of grassland in Southland. Deduct that already committed to dairy and you get 490,000 hectares. Divided by 1.5 for support land and multiplied by 3 cows per hectare give a potential additional cow population of 980,000 for an upper limit of say 1,500,000 milking cows. At the current stocking rate of 2.7 cows per hectare this reduces to 1,350,000 milking cows. This figure is only a limit and whether it is achieved will depend on many factors such as finance, labour, farmers who wish to farm dairy, and competing land use. Both sheep and deer farming have decreased in Southland as a result of reduced returns but this can always change. If dairy conversions continue, this will likely see continued decrease in sheep and deer farming, and potentially a decline in other crop production.

There is also the potential for some new industries to grow in Southland, in particular, potential for Living Cell Technologies Auckland Island Pig breeding centres, potential for space observation related activities[3], and also potential for silicon refinery near a source at Pebbly Hills which could need up to 110MW[4]. These kinds of developments may place additional energy demand in particular locations. Conversely, decreases in tourism activity may decrease energy demand and need for supporting infrastructure in some locations if the destinations are no longer able to attract high volumes of visitors.

[3] Venture Southland (2008) Southland Regional Economic Profile. www.southlandnz.com
[4] Stephen Canny (2010). Cited in Southland Times. http://www.stuff.co.nz/southland-times/news/3662481/Gore-set-for-bigger-grid-with-upgrade

Livestock numbers in Southland at 30 June 2007

Total sheep	5,662,387	**Goats**	4,519	**Alpacas and llamas**	240
Total dairy cattle	432,642	**Total pigs**	4,303	**All other livestock**	97
Total deer	307,524	**Horses**	3,366		
Total beef cattle	207,588	**Ostriches and emus**	Confidential		

Source: Statistics New Zealand website

Plantation forestry is another significant land use in the Southland region providing both a potential energy source, and wood product. Southland has a young diverse estate with volume likely to increase in the short to medium term. Plantation forestry has been affected by the Emission Trading Scheme (ETS), and is likely to continue to be affected by the ETS. The ETS means that forestry owners have an increased cash flow and incentives to replant. Rising energy costs leading to increases in the costs to transport and process timber products, combined with higher sale price for carbon credits, could influence more forest owners to consider longer rotation crops[5]. Ultimately the ETS is encouraging investment in forestry. However, when forests are harvested and what for will depend on decisions of many owners. Local demand for wood products as a source of energy is increasing, with the costs of wood remaining relatively stable over the past 30 years, as compared to lignite, and electricity[6]. Opportunities for Wood Energy are discussed further in section 5.6.5 of this document.

Forestry Production and Plantings in Southland at 30 June 2007

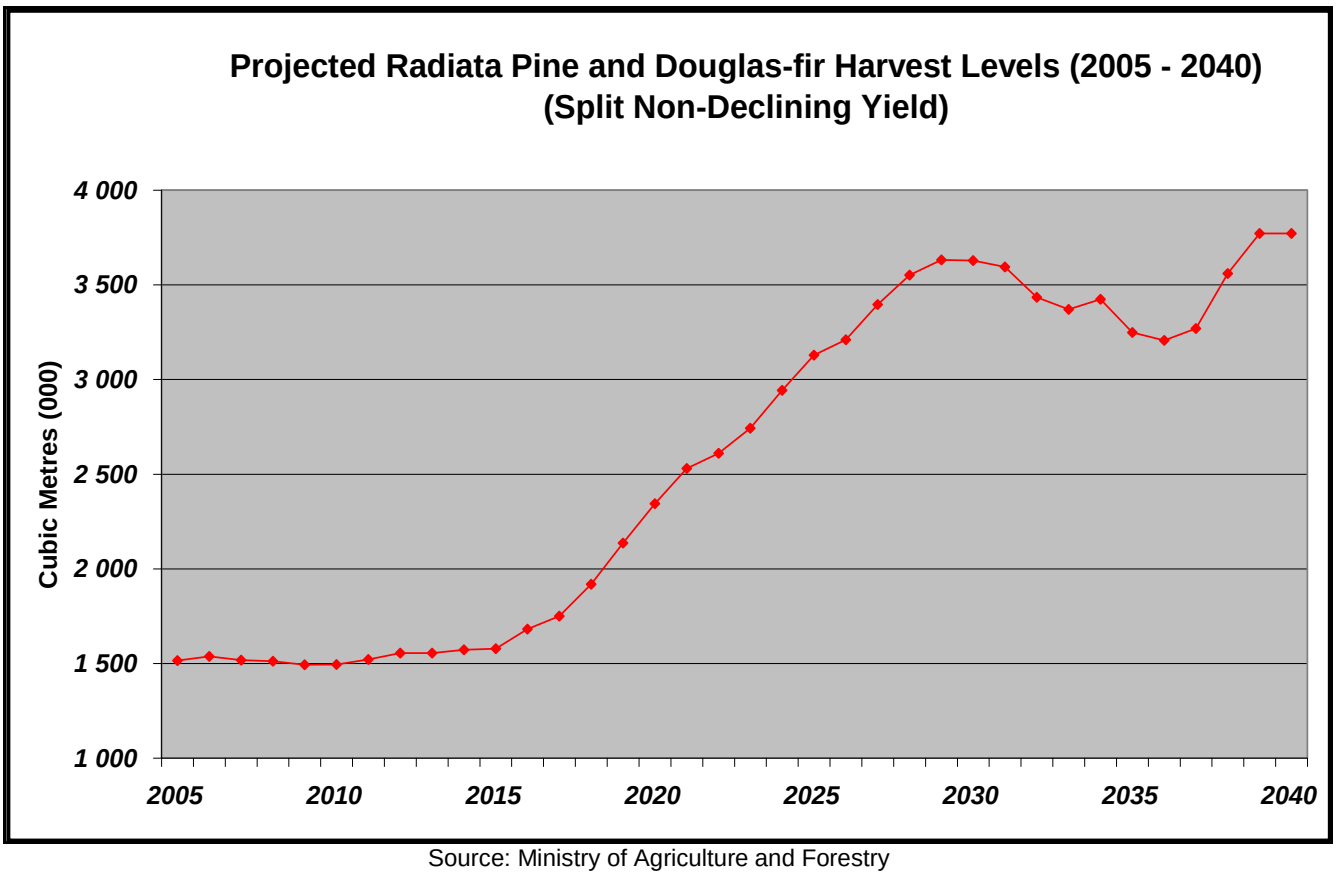
Exotic planting		**Exotic timber harvesting**	
New area 207ha	Replanted 1267ha	1306ha	479,503 m^3

Source: Ministry of Agriculture and Forestry website. NB Includes South Otago

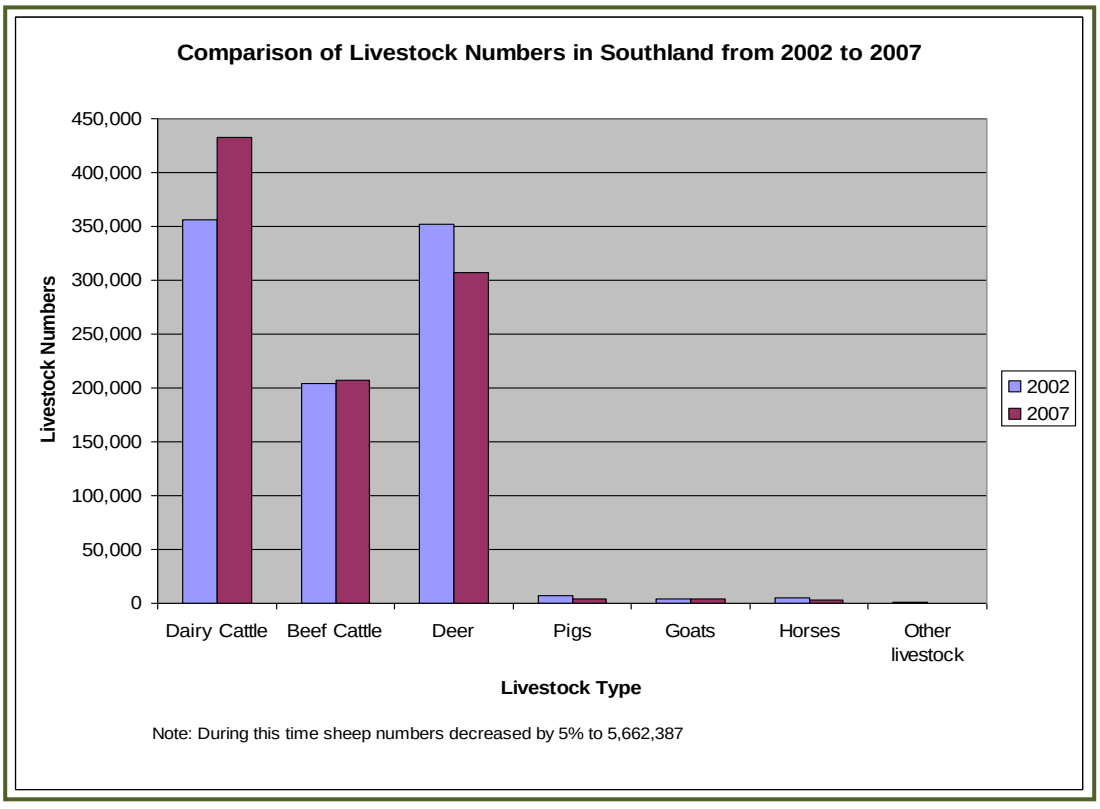
Suggested actions:

1. Identify best practice in dairy shed design and promote this for new conversions.
2. Develop a programme to undertake energy audits or assessments on dairy farms, and encourage retrofitting for efficient energy use.
3. Promote best practice dairy shed construction for new conversions.
4. Assist the wood energy sector development in Southland.

[5] Parnell Trost (2010). Cited in Wood Energy Forum notes www.southlandnz.com
[6] Venture Southland (2010). Wood Energy Forum. www.southlandnz.com



Source: Ministry of Agriculture and Forestry



Source: Statistics New Zealand website.

4.3 Regional Energy Developments

Since the 2005 strategy the following developments have been started or completed:

- Electricity grid upgrades to lower South Island approved ($170 million).
- Electricity grid stability project approved ($62 million).
- Wind farming establishments:
  - White Hills (58MW) established.
  - Kaiwera Downs (planned up to 240MW) consent granted, waiting on favourable economic conditions.
  - Slopedown (planned up to 150MW) application for consent to be lodged.
- Wide coverage data transmission network in place giving broadband access to at least 96% of the regional population.
- Increase in use of solar technologies with a number of solar water heating projects and photovoltaic installations.
- Coal seam methane exploration undertaken.[7]

There have also been developments in relation to lignite and oil which are discussed further below.

Suggested actions:

1. Encourage wind farm developments in Southland in appropriate locations.
2. Develop high speed broadband to enable smart grid applications in the future.
3. Encourage widespread uptake of small scale solar technologies such as photovoltaics and solar water heating where appropriate.
4. Facilitate investment in transmission grid and distribution upgrades as required.
5. Work with PowerNet to ensure that Transpower is encouraged to produce adequate transmission capability, and that this is maintained. Ensure a reinvestment programme is developed to service generation and industry establishment within the region as appropriate.

[7] L&M Energy (2011).

4.4 Local Stakeholders' Views

In recent years there have been significant changes in the level of awareness of climate change, acknowledgement of peak oil and increased competition for natural and energy resources. In 2008 Southland businesses' awareness of broader issues was surveyed. Most (92%) were aware of climate change, and less than half (46%) were aware of peak oil. However, only 53% of local businesses had thought about the potential problems for their business as a result of wider issues[8]. General information available to businesses, such as visitor forecasts for the tourism industry do not appear to reflect any major changes as a result of these issues – however there are an increasing number of research papers exploring these issues[9]. Price increases for oil, coal/lignite, and electricity appear to be placing a higher priority on energy efficiency for some businesses, community groups and residents – with many questioning their sources of energy. Other regions have completed vulnerability assessments of peak oil impacts; such a document for Southland may help businesses understand what this issue may mean for them. Increased public awareness is key to ensuring that councils planning around these issues are well supported by ratepayers. This work could help engage the public in developing a long term vision for Southland's energy, which would assist with prioritising strategic actions.

In general, while not objecting to development based on resources, stakeholders consider it important to ensure that development benefits the region in as many ways as possible. Stakeholders' views are that development should:

- Incorporate a balanced approach between economic development and community interests.
- Provide certainty as well as flexibility with regards to sources of energy.
- Utilise Southland's regional advantages within the context of national and global economic influences.
- Recognise that often the Southland economy differs from the rest of the nation, and that national and international policy and market systems may not represent the optimal strategies for the region.

Community well-being as a key outcome was stressed during the workshop, with this theme encapsulated in the statement: "it's not all about development; it's about the right kind of development", by having regard to the nature of the resource used and local community needs.

Several of the submissions on this strategy noted that Central Government has a history of ignoring the local impacts of national initiatives, the Clutha Dam and Manapouri power schemes are two past examples of this. They noted that the mining of lignite has not been promoted by the Government to primarily improve the local environment or help local communities.

There was a strong view that there is energy potential in waste streams. Stakeholders expressed:

- Willingness to cooperate to realise synergies.
- Belief that a combined policy will deliver the best outcome.

[8] Venture Southland (2008). Sustainable Business in Southland: Primary Research Results. http://www.southlandnz.com/BusinessinSouthland/RegionalProjects/SustainableBusiness.aspx
[9] Lincoln University (2010). http://www.lincoln.ac.nz/Research-Centres/LEaP/Climate-Change-Peak-Oil--Society/Publications/

- View that there are problems of waste disposal that could be resolved by technological solutions such as pyrolysis, thermal oxidation, or incineration.

The following are other comments of note from the workshop:

- There was strong interest in the use of renewable energy resources including forests, forestry wastes, crops such as Miscanthus and others.
- There were barriers to development of local solutions imposed by national imperatives. Such as High Voltage Direct Current tariffs incurred when wheeling power across the grid between local grid entry/exit points..
- Dairy developments are considered energy intensive and likely to continue.
- There are a number of barriers to new industry development including:
  - Limited trade skills to support industry
  - Infrastructure limits. For example Solid Energy noted that their proposed briquette and urea production developments face limits with roads, rail and electricity.
  - Time required in obtaining consents.
- Recognition that energy efficiency is important but some uncertainty as to how this can be implemented on a wide scale.

In addition to these relatively general points raised by stakeholders a number of specific suggestions are incorporated in later sections of this document.

"Beacon Pathway Inc congratulates Venture Southland in the preparation of the draft Energy Strategy for Southland. Venture Southland has done a thorough job in developing a comprehensive and robust strategy document, which includes future contribution from solar, other renewables and strategies to mitigate use of fossil fuels upon which the province currently has a high dependence."

It is noted that Dunedin City Council had a Peak Oil Assessment undertaken in 2010 and could be a useful tool for planning and awareness-raising in Southland.[10]

Suggested actions:

1. Investigate opportunities for generating energy from waste.
2. Identify local skill gaps and address these with appropriate training.
3. Ensure local community needs are addressed with any resource development.
4. Undertake vulnerability assessments of peak oil impacts for Southland, and communicate findings with the public.

[10] Dunedin City Council (2010). http://www.dunedin.govt.nz/your-council/factline/issue-333/dunedins-vulnerability-to-peak-oil-assessed

5. National Context

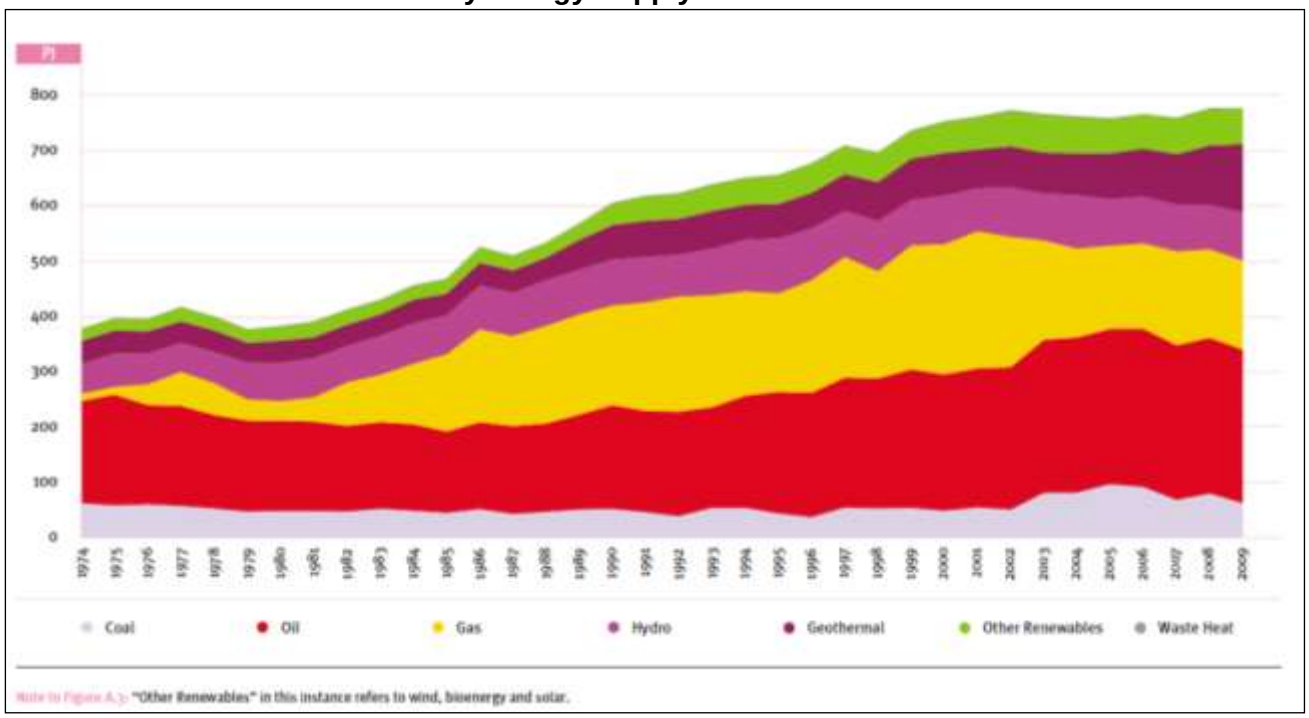
While any developments may benefit from a fit with central government policies, the size and nature of the Southland region is such that an independent approach which considers the unique factors in the Southland region but which take account of broader initiatives is often likely to be a preferred strategy.

The national changes and central government documents of relevance to Southland's Energy Strategy are summarised below.

5.1 Demand and Prices

"Between 1990 and 2002, New Zealand's per capita energy consumption increased by around 13% to around 135GJ (equivalent to approximately 3,800 litres of petrol) per person. Since then it has reduced to 121GJ, which is just 2% above 1990 levels".

Total Primary Energy Supply in New Zealand



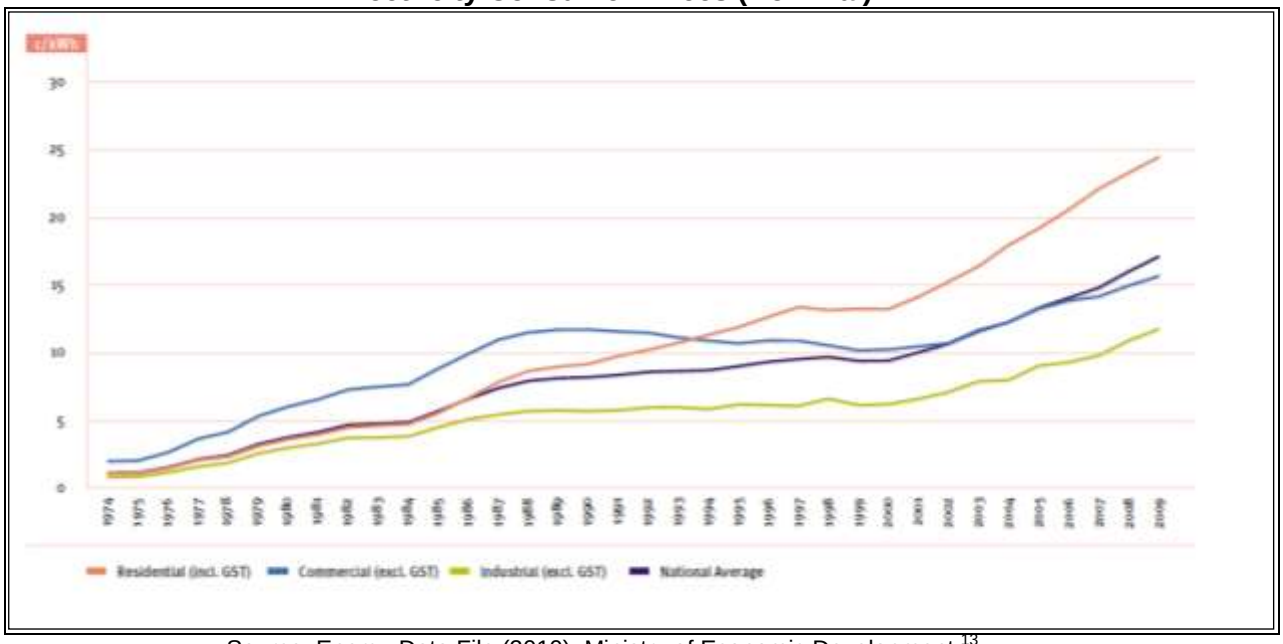
Source: Energy Data File (2010). Ministry of Economic Development[11].

Economic activity and energy use are closely linked. Excluding the Tiwai Aluminium Smelter, which accounts for around 82% of Southland's electricity consumption, Southland accounts for 3% of national residential electricity demand and 3% of commercial demand. Including the smelter, the region accounts for 17% of total national energy demand[12]. Electricity consumption dropped in 2009 the main cause was lower demand from the Tiwai Aluminium Smelter as a result of plant breakdown.

[11] Ministry of Economic Development (2010).Energy Data File. Figure A3
http://www.med.govt.nz/templates/StandardSummary____15169.aspx
[12] Environment Southland (2009). Para 1.06 cited in Looking After the Future. Beacon Pathway (2010).

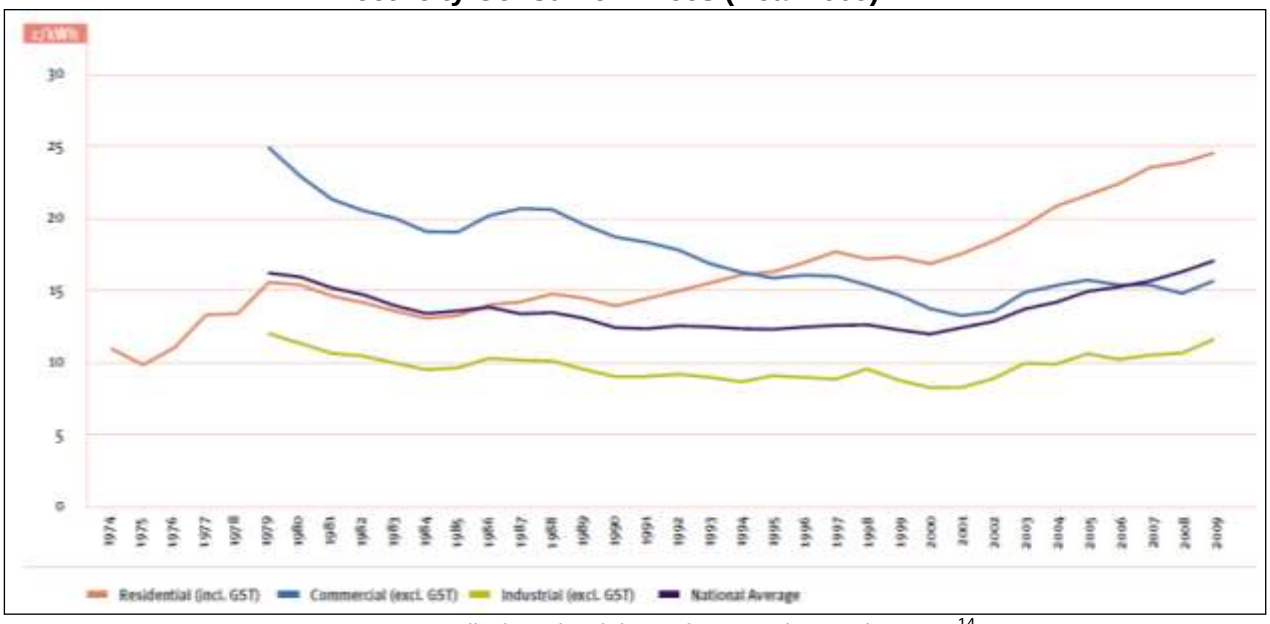
As demand for energy has increased, the price trends have also been upwards – as exhibited in the overall cost of both electricity and transport fuels shown below. We can reasonably expect that Southland demand will match that of national trends, with the exception of the impact of key industries, such as dairy, as discussed in previous sections of this strategy.

Electricity Consumer Prices (Nominal)



Source: Energy Data File (2010). Ministry of Economic Development.[13].

Electricity Consumer Prices (Real 2009)



Source: Energy Data File (2010). Ministry of Economic Development.[14].

[13] Ministry of Economic Development (2010).Energy Data File. Table I-1a
http://www.med.govt.nz/templates/StandardSummary____15169.aspx
[14] Ministry of Economic Development (2010).Energy Data File. Table I-1b
http://www.med.govt.nz/templates/StandardSummary____15169.aspx

Petrol and Diesel Prices (Nominal)

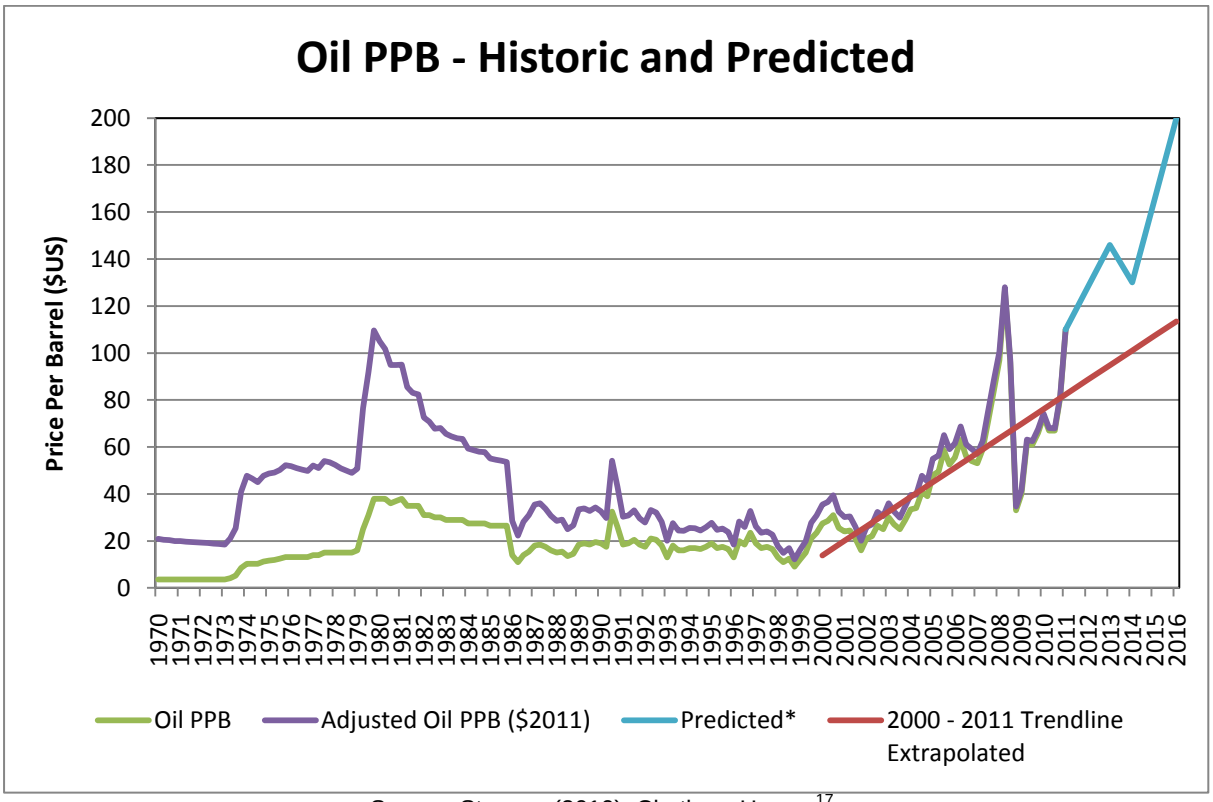
Source: Energy Data File (2010). Ministry of Economic Development.[15].

Petrol and Diesel Prices (Real 2009)

Source: Energy Data File (2010). Ministry of Economic Development.[16].

[15] Ministry of Economic Development (2010).Energy Data File. Table I-2a
http://www.med.govt.nz/templates/StandardSummary____15169.aspx
[16] Ministry of Economic Development (2010).Energy Data File. Table I-2b
http://www.med.govt.nz/templates/StandardSummary____15169.aspx

Energy analysts predict that energy prices will continue to rise – both oil and electricity. This is likely to be driven both by international demand for oil continuing to increase against an ever increasing shortage of easily recoverable reserves, as well as emissions trading regime which imposes emissions cost on producers of carbon dioxide-emitting energy sources.



Source: Stevens (2010), Chatham House.[17]

There are two fundamental and interlinked drivers for the Southland micro-economy – the price received for exported food and the availability of economically priced fuel. A market shock in either of these (in any combination of up or down) may require consideration of the balance between land for food production and land for fuel production. Such a shock could reasonably be expected in 2012/13 when the price of a barrel of oil is expected to rise sharply, coupled with the full cost of carbon credits for the energy sector in 2013, and this will have ripple impacts throughout the economy, and impact on all other energy prices.

In order to prepare for this market shock, a vulnerability assessment of peak oil impacts could be undertaken. This assessment could identify key areas where changes should be considered, such as locations of essential services, town planning, transport networks, alternative transport options.

[17] Cited in Lloyd's 360° Risk Insight, Sustainable Energy Security: Strategic Risks and Opportunities for Business.

Suggested actions:

1. Undertake a vulnerability assessment of peak oil impacts for Southland, and communicate findings with the public.

2. Educate businesses, organisations and residents on the likely continued rising costs of energy to inform wise investments. This may be through some form of awareness raising event(s).

3. Identify communities within Southland at risk from a dependence on fossil fuels as a source of energy.

4. Continue to monitor viability of liquid biofuels production from crops, basing the value case on net positive energy gains, maintain awareness of associated land requirements.

5.2 Electricity Generation in New Zealand

In 2009, 42,010GWh or 151PJ of electricity was generated in New Zealand. The composition of fuel type of this amount is illustrated below. This figure also illustrates the time series of generation by fuel type. In 2009, New Zealand generated 73% of electricity from renewable resources – mostly through the use of hydro generation.[18]

Figure G.1b: Electricity Generation by Fuel Type for 2009

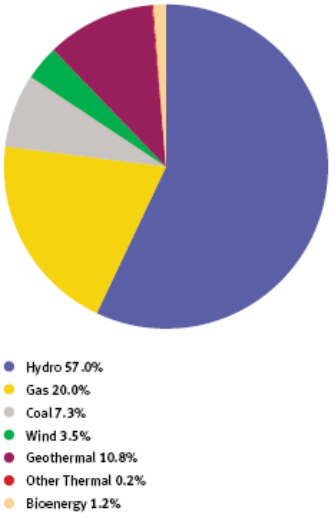
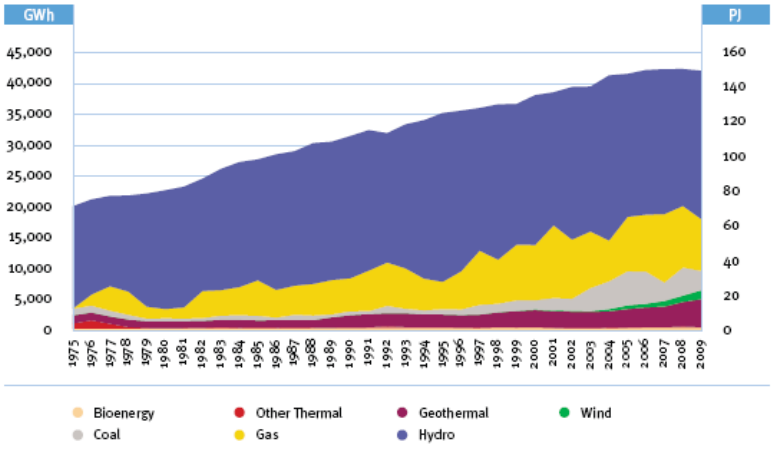


Figure G.1c: Annual Electricity Generation by Fuel Type



Liquid biofuels is an emerging industry in New Zealand, contributing less than 1% of total production in 2009. The increase in generation from renewables over the past decade has not kept pace with the increased demand for energy. The proposed National Policy Statement for renewable energy seeks to address this issue with a target of generating 90 percent of New Zealand's electricity from renewable energy sources by 2025.

[18] Energy Data File (2010). Ministry of Economic Development

5.2.1 Southland's Contribution to National Resource

Electricity generation as reported in the Ministry of Economic Development's New Zealand Energy Data File (page 103, 2009) indicates 45% of generation is from the South Island with contributions from Southland-based renewable resources, namely Manapouri hydro (710MW), and White Hill wind farm (58MW)[19]. There is also potential for Southland to contribute further to New Zealand's supply of renewable electricity.

Resilience of electricity supply is important to stakeholders in Southland. National Policy Statements (NPS) on Electricity Transmission and Renewable Electricity Generation are now in force. The latter is discussed further under section 5.7. The NPS on Electricity Transmission seeks to ensure the efficient and secure supply of electricity by recognising electricity as a matter of national importance. This needs to be matched with local level strategic planning, including any infrastructure upgrades.

- Provision in District Plans for efficient approval processes for upgrades of both existing facilities and infrastructure is desirable.
- A range of generation types is preferable to ensure continuity of supply.
- Economic electricity supply will encourage economic development.
- Policies need to support the building of sufficient generation capacity to meet demand.
- In general, increased reliance on renewable energy does not reduce the need for reliable transmission and distribution assets, depending on how and where it is generated. Maintaining transmission corridors and networks is essential if New Zealand is going to meet its target of 90% renewable electricity.
- Increased reliance on renewable energy has implications for security of supply and how this is managed, as well as requiring energy storage.
- An interconnected grid allows pooling of resources. At times, local or remote generation will not be available, usually due to maintenance, break-down, or lack of fuel source (eg hydro, wind or solar). The grid is many times more reliable than the individual generating units connected to it, and replacement generation can come from a common pool, rather than each generator providing its own backup.

It is also worthy of note that with supply of energy being a matter of national importance, and recent changes to the Resource Management Act process, with the establishment of the Environmental Management Agency, many resource consents for large scale developments may not be processed locally. This may have implications for local concerns, because the cost, time and travel involved in being part of any submission or hearing process is increased. Therefore, councils may play an increasingly important role in gathering local community views on impacts, and ensuring these are communicated on behalf of the community through district and regional plans, and in submission processes.

Suggested actions:

1. Advocate policies that recognise and protect transmission corridors and networks.

2. Promote increased generation capacity to meet demand and achievement of the 90% renewable electricity target.

[19] Transpower's 2008 and 2010 Annual Planning Report (Table 6.2.1), this is the operating capacity.

5.2.2 New Projects of National Significance

It is important not only to consider potential location of new generation opportunities, but where the potential users of that energy are located. For example, wave energy in coastal areas needs to be close to demand points to be viable. Other large scale sources becoming available within the immediate area and in the foreseeable future include:

- Clutha hydro development. Development of Clutha hydro would create surplus energy in lower part of South Island;
- Possible shale gas. Overseas developments have technically released large quantities of shale gas. The Orepuki oil shales may be amenable to this technology;
- Methane hydrates. The development of large scale methane recovery from the plentiful methane hydrates offshore in the North Island, taking an optimistic view, may reduce electricity demand and produce a surplus in the South Island;
- Waste processing. Technology to utilise waste to generate electricity and by-products that will enhance soil health in the region may become essential as other means of waste disposal become proscribed by compliance issues or simply uneconomic.

Local stakeholders have also asked the questions: would locally controlled distribution infrastructures be more appropriate, and can many competitors achieve competitive economies or does the inefficiency of multiple small operations impose both energy and economic penalties.

5.2.3 Dry Season Reserves

During a dry season, the inability for New Zealand's hydro and South Island power generation to cope with industry power demand has become an acute issue which needs to be addressed. Although this is a national issue, it has an impact on South Island industry. The last dry season crisis occurred in 2008; it was the driest season on record for the hydro lakes. In Southland, it was fortunate that at the time, the Tiwai Aluminium Smelter, Southland's largest energy user, was not operating at full capacity due to a switchyard transformer failure. The smelter, being the only user of the Manapouri hydropower, regularly voluntarily reduce their energy consumption in order to reduce demand to prevent power cuts and save on peak energy costs. Other than the smelter, the rest of Southland's electricity comes from the grid, so even though climate change means Southland is predicted to get slightly wetter, less rain elsewhere is a risk to our local supply of electricity. In summary, dry seasons affect production, hence affect our export industry. Industry investment can also be limited because of perceived risks associated with business interruption.

Climate change predictions indicate warmer and wetter weather in general, although there are higher instances of drought also predicted. Water performs a role storing energy, often in the form of dams. Therefore it is expected that a higher priority will be placed on searching for and developing solutions to the problem of a lack of seasonal reserve generation.

Solutions to this problem are likely to be located near demand points. It is also important to note that there is one identified issue which is preventing investment in generation in the South Island. The High Voltage Direct Current (HVDC) tariff which applies across the Cook Straight is seen as a disincentive for investment in South Island power generation. This tariff should be abolished.

Fundamentally, dry season reserves come down to a storage issue. With large-scale hydro, your storage capacity is where the dam infrastructure is. However, with more widespread localised generation, it may be that excess produced in one location can be shared with other locations experiencing reduced generation. In this context, decisions over where things like wind farms are placed should perhaps not be based solely on which sites generate the most energy, but which sites will generate substitute energy when others are not at optimum capacity. This kind of strategic focus could influence which projects are considered to be of national significance. This point highlights a need for detailed micro level wind mapping of the country, including consideration of complementary seasonal variations.

Geothermal energy from 1–3km deep currently supplies around 10% of the country's electricity. "If even a small percentage of the natural deep geothermal energy can be converted to electricity, New Zealand's energy security from renewable sources will be assured".[20] It is an area where further research is being undertaken to better quantify the potential of these resources. This is a potential source of reserve which could provide a solution to this nation-wide challenge of needing dry season reserves.

Suggested actions:

1. Advocate for the removal of tariffs such as the HVDC tariff as these are discouraging investment in renewable energy projects in the South Island.

2. Encourage the assessment and utilisation of opportunities relating to wind power and storage options, including pumping projects.

5.3 Legislative and Regulatory Framework

5.3.1 Southland Regional Policy Statement

The regional council, Environment Southland, is reviewing the Regional Policy Statement (RPS) in conjunction with the Southland District Council's review of the Southland District Plan. Both councils have decided to work together in the initial consultation stages of the review to avoid inconsistencies between planning documents. When Gore and Invercargill District Plans are reviewed, the updated RPS will be available and District Plans must be consistent with this policy.

Security of supply, price rises and the environmental consequences of fossil fuels as energy sources are all highlighted as issues in the current RPS. It is important that the RPS provides a regional framework for sustainable energy management and that this is reflected in the provisions of the Southland District Plan, Invercargill City Plan, and Gore District Plan.

During the public submission process on the draft version of this document, a number of submitters expressed concern that the Resource Management Act is not able to address the potential risks around climate change and cannot deal with the wider environmental and social impacts related to an individual business proposal. This document is able to provide a broader view and should be used to inform the RPS, and subsequently regional and district plans must give effect to this, and subsequently influence resource consent process.

[20] Bignall, G (2010). Hotter and Deeper: New Zealand's Research Programme to Harness its Deep Geothermal Resources. *Proceedings World Geothermal Congress.*

It is also worthy of note that the RPS will guide Environment Southland's updating of the Regional Air Quality Plan. This plan will place limits on emissions of particulates, potentially more stringent that current limits. During the submission process, even industries such as Solid Energy supported such reviews, noting they "found the regional air quality plan to be in need of updating, whereas both Canterbury and Otago have very strong plans with real limits". This will have a flow-on impact on sources of energy used by industrial and residential users. This has potential to drive demand for cleaner burning fuel sources, particularly for those currently using coal/lignite for heat. However, this could also impact on electricity demand, for example with increased heat pump use. Current pricing of fuel sources would indicate that electricity would be the most expensive energy source option, with wood chips being the cheapest per unit of energy, even when compared with coal/lignite. However, larger users may have negotiated different rates than those publicly available.

5.3.2 Implications for Regional and District Planning

The current regional and district plan provisions will require revision to adapt to new technologies and issues that have arisen since these plans were implemented. There are a range of emerging issues, including national energy needs, security of supply issues, renewable energy generation, maintenance of existing infrastructure, energy efficiency, climate change and the emissions trading scheme, the impacts of bio-fuel production and Resource Management Act consenting issues. Consideration should be given to the following issues:

- District Plan timeframes are 10 years (with the opportunity for earlier reviews) – therefore it is reasonable for the Energy Strategy to look 10 years ahead to anticipate likely energy technology developments and allow for them. However, a 20 year horizon would be more useful to enable new and emerging technologies.
- Provision for emerging technologies in the Regional Policy Statement and Regional and District Plans (eg no current reference to wave and tidal action generation in Regional Coastal Plan).
- Provision for short term solutions which may be needed in response to volatility in energy price and supply.
- Provide for certain types and levels of energy generation development (wind monitoring masts, new prototype generation and micro-generation activities as a permitted/controlled activity).
- Facilitation of the establishment of alternative fuel distribution infrastructures, particularly in urban areas. For example power points for electric vehicle charging, CNG or LNG fuel from coal seam methane, possible hydrogen distribution.
- How voluntary targeted rates can be utilised to encouraged desired changes to our energy inefficient buildings.

The Regional Land Plan and District Plans of Gore and Southland protect landscape areas of the hills which can represent a significant barrier to the development of wind farms. It is recommended that plans acknowledge the importance of existing and potential wind generation locations and infrastructure and include policies and methods that enable wind energy to contribute to the regional and national energy needs. Some submitters on the draft version of this strategy identified a desire for applications for wind turbines to be processed on a case by case basis through the RMA in the context of the National Policy Statement on Renewable Energy. While it is agreed the selection of suitable sites for the development of wind turbines should be considered on the merit of the application, under the terms of the RMA.

Local councils will be encouraged to recognise the need and role of wind electricity generation to meet future energy demand and the national targets for renewables, and give consideration on methods of accommodating these within their respective plans and energy statements. There would appear to be significant merit in adopting a permitted activity approach towards the development of wind turbines in some modified landscape areas. A set of criteria should be developed to identify where wind generation would not be suitable and make specific provision for wind generation and its connection to the grid or local reticulation in remaining areas.

- Recognise the need to achieve balance between environmental considerations and energy needs, especially in light of New Zealand's commitment to Kyoto Protocol and possible land use implications arising from the Emissions Trading Scheme.
- The 'blanket' overlays of important landscapes need to be reassessed and specific areas identified which are not suitable for wind farm development, biofuel production or carbon farming.
- Effects on landscape are not forever (eg wind farms and forests have a lifespan).
- A set of criteria should be developed to identify where wind generation would not be suitable and make provision for wind generation in remaining areas.
- Sufficient flexibility should be incorporated in planning to allow for biofuel and carbon farming as a land use in appropriate areas.

Planning frameworks should provide an efficient path for the upgrade and expansion of existing facilities, recognising that in some circumstances there can be advantages to upgrading existing energy facilities where feasible rather than constructing new ones. While the increased demand from population growth is likely to occur relatively slowly, electricity demand patterns in regions can change dramatically as land use and demand-side technology changes. This is evident with the large scale dairy conversions in Southland, which not only increased demand, but changed annual and diurnal demand patterns. It is important that existing infrastructure can be upgraded without constraint. Councils must manage land use activities within transmission corridors and on identified strategic routes.

One of the key barriers to distributed small scale generation projects, which often have a low level of environmental effects, is the consenting requirements of the RMA and Building Act. District Plans do not make the distinction between small and large scale projects and effects. Plans should consider facilitating renewable electricity generation for remote sites, such as mini-hydro, biogas or wind turbines, where the upgrade of the transmission lines is uneconomic. The proposed NPS for renewable energy generation will provide guidance on consenting issues to remove the barriers for micro generation such as photovoltaic, micro wind and micro hydro systems. Such systems have several needs as well as advantages:

- System development to allow grid backup, however this is not required.
- Economic benefit should be available to owners from surplus generation fed into the grid
- These systems help achieve national and international targets
- These systems help protect the area against rising fossil fuel and electricity costs, including those associated with the Emissions Trading Scheme (ETS).
- Increases security and diversity of supply and assists with existing and future transmission/distribution constraints as well as assisting with avoidance of transmission losses.
- Low level of environmental effects.

An acceptable district plan definition of small scale and micro generation should be developed to distinguish between activities that would be permitted and the larger scale activities which would require consent. The plan could even go so far as to identify the key large scale wind generation areas through targeted discussion with stakeholders, and making proactive policies in these sites to enable streamlined processing of consents should they develop further. There will be issues relating to grid and distribution control that will need to be resolved if the contribution of this type of generation is significant in terms of the local grid. These issues are linked to the increased use of smart grids and smart appliances and their ability to contribute to local power supply stability. Demand side management and distributed energy storage are related issues.

There is significant potential to achieve energy objectives through influencing the development and implementation of regional land transport strategies and associated plans. These documents guide the development of transport systems including public transport, roads, walking, cycling and freight for a ten year period. They provide the overall context for investment in a region's transport network and form the basis for identification, selection, and prioritisation of projects and activities, setting targets against which the region's transport networks can be monitored. The section of this document which relates to transport fuels is relevant, section 8.4.

Suggested actions:

1. Planning and policy should preserve the land corridors for energy transmission that exist and recognise that there may be requirements for new corridors arising from the need to connect renewable generation to load centres. Plans should consider facilitating renewable electricity generation for remote sites, such as mini-hydro, biogas or wind turbines, where the upgrade of the transmission lines is uneconomic.

2. Promote planning for appropriate allocation of natural resources for the development of renewable generation to assist security of supply (to cope with peak load times and future overall demand).

3. Electricity generation companies, local authorities, and councils should develop a common approach to ensure that development of new generation is as streamlined as possible within the context of the RMA.

4. Advocate for changes to the electricity supply rules to encourage smaller renewable generators to connect to the grid.

The Southland Regional Policy Statement should:

1. Enable flexibility and discretion with regards to new and emerging energy technology.

2. Consider how to balance the positive effects of sustainable electricity generation against adverse environmental effects in a plan.

3. Place the onus on the developer to describe clearly how environmental effects will be mitigated – noting that large scale projects can be escalated to the EPA for review as a streamlined consent process for matters of national and regional importance.

4. Provide for technologies in this strategy, and certain levels of micro-generation activities as permitted, controlled, or discretionary (restricted) activities.

5. Allow for the establishment of alternative fuel distribution infrastructures, particularly in urban areas.

6. Develop a set of criteria to identify where wind generation would not be suitable and make specific provision for wind generation and its connection to the grid or local reticulation in remaining areas, by making it a permitted or controlled activity.

7. Acknowledge and be informed by Southland's energy strategy document.

5.4 NZ Energy Strategy

The New Zealand Energy Strategy was released in August 2011 setting out the government's direction for energy including developing New Zealand's energy potential. The Strategy identifies four priorities with areas of focus:

Priority: **Diverse resource development**

- Develop petroleum and mineral fuel resources
- Develop renewable energy resources (from 74% in 2010 to 90% for electricity generation by 2025)
- Embrace new energy technologies

Priority: **Secure and Affordable Energy**

- Competitive energy markets
- Oil security and transport
- Reliable electricity supply

Priority: **Efficient use of energy**

- Better consumer information to inform energy choices
- Enhance business competitiveness through energy efficiency
- An energy efficient transport system
- Warm, dry, energy efficient homes

Priority: **Environmental responsibility**

- Best practice in environmental management for energy projects
- Reduce energy-related greenhouse gas emissions

The Strategy recognises that New Zealand is reliant on overseas oil supply and is therefore vulnerable to increases in oil prices and external disruptions to oil supply. The diversification of transport energy sources is vital for New Zealand's energy security and resilience. The Government has stated it will ultimately leave it up to the market (consumer response to oil prices) but will keep an eye on market developments of alternative energy sources and act to stimulate new markets or remove barriers. For example, the Government has exempted light electric vehicles from road user charges until 2013. Therefore, it will be up to regions to take the lead in developing solutions to assist the market. There are further actions throughout this document which respond to the National Energy Strategy priorities.

Suggested action:

1. Investigate required infrastructure for electric vehicles.

5.1 NZ Energy Efficiency Conservation Strategy

The New Zealand Energy Efficiency and Conservation Strategy 2011-2016 (NZEECS), focuses on the promotion of energy efficiency, conservation and renewable energy. Government measures are information, incentives, codes and standards and research and development. The Government's proposed energy efficiency target is for the NZEECS to deliver 55PJ of saving across the economy by 2015. The Strategy suggests that the transport and industry sector has the greatest potential for improvement in energy efficiency.

Suggested actions:

1. Encourage businesses to make energy efficiency improvements.
2. Encourage local up-skilling to meet demand for services such as energy assessments.
3. Promote central government resources available for energy efficiency initiatives.
4. Address barriers to investing in sustainable buildings by workshopping council policy packages and continuing support for programmes such as the Southland Warm Homes scheme.
5. Encourage adoption of any nationally developed green building rating tools.

5.2 Emissions Trading Scheme

The Emissions Trading Scheme (ETS) has been identified by the government as the primary tool to reduce emissions in the energy sector, and all other sectors across the economy.

The cost of carbon arising from the ETS will affect businesses as the costs flow down and through the economy, for example, increases in transport and energy costs, and in the costs of products arising from industrial processes. The costs for a business with ETS obligations will depend on the extent to which it is able to reduce or offset its emissions and reduce the cost of having to hold units. Entities which try to pass on the entire cost of units, which they are originally required to hold, may face resistance from their customers.

There is a weak linkage between energy price and rates of consumption that may encourage some conservation, as well as providing a lever to influence consumer participation in conservation programmes and incentive programmes. This linkage is strengthened if there are convenient and economic alternatives (for example efficient and low cost public transport). It should be noted that in some situations, particularly with a geographically dispersed population, public transport may not always be an efficient option.

The ETS will also provide an incentive to move to renewable sources of energy which will become cheaper relative to oil based products and fossil-fuelled electricity generation. In order to meet the Government's target of 90% renewable electricity generation by 2025, it is likely that significant wind and geothermal and approximately 25% growth in hydro development will be required. Emerging technologies such as wave and tidal renewable energy may play a small role as well.

The ETS is planned to include greenhouses gases from pastoral agriculture, horticulture and arable production – methane from livestock and nitrous oxide from animal effluent and synthetic fertiliser. Agriculture is required to report its emissions from 2012 through to 2014, but it is not required to pay for its emissions until 2015. The growing awareness of the waste of active nitrogen and the damage this is doing to the environment, coupled with the imposition of ETS charges may lead to a disruptive change to the chemical production of nitrogen based fertilisers, particularly if farmers go back to natural methods, such as fixing nitrogen with clover.

A change in the climate as a result of global warming and other influences means regions need to plan for and manage the projected impacts of climate change, and particularly imposed actions arising from national and international agreements. This includes anticipating actions to reduce greenhouse gas emissions. All six Kyoto Protocol Greenhouse gases CO_2, CH_4, N_2O, CFCs, HFCs, and SF_6 are relevant. When considering the costs and benefits of developing industries in the region, for example by way of an analysis of economic impact assessment, ETS costs and the negative economic impact of credits being purchased from outside the region require consideration. There is an opportunity to avoid this economic leakage by encouraging local credits to be purchased. This has the added benefit of encouraging local forestry, which will in turn increase supply for other regional strategic energy opportunities from biomass.

Suggested actions:

1. Encourage the harnessing the energy from waste products to avoid Emissions Trading Scheme costs.

2. Encourage local industry to purchase local carbon credits.

3. Educational programmes for energy efficiency should also stimulate forward thinking around availability and pricing of energy sources, with the goal of building resilience for changes.

5.3 National Policy Statement on Renewable Electricity

The National Policy Statement (NPS) on Renewable Energy came into effect in May 2011. The purpose of the Policy Statement is to assist decision makers by setting out clear objectives on renewable energy and the control of greenhouse gas emissions. The intention is to clarify the government's position on the benefits of renewable energy and promote a nationally consistent approach to balancing the competing values associated with the development of renewable energy resources. Decision makers are required to weigh up the national benefits of renewables. The environmental effects of smaller scale energy developments, including distributed generation, are also clarified so that local authorities and industry bodies can enable acceptable smaller scale projects to go ahead without undue delay and administrative cost.

Councils have to incorporate the NPS into their regional policy statements, regional and district plans, and must give effect to it, including considering it when deciding whether to grant consent applications.

Renewable electricity infrastructure plays an essential role in the functioning of the region and results in positive effects and national, regional and local benefits which should be promoted within the regulatory regime. The benefits to be derived from renewable energy include: security of supply; reduction in greenhouse gas emission; reducing dependence on the national grid; reduction in transmission losses; reliability; reduced dependency on imported energy source; reduced exposure to fossil fuel price volatility; industry and wider development benefits; and contribution to the renewable electricity target. The potential for further development of renewable energy resources should also be provided for. The following notes important related considerations for RMA plans which will assist in giving effect to the NPS:

- Planning provisions should recognise and provide for the existing use of the renewable resource for electricity generation in the region and recognise that there is significant potential in the region for additional renewable electricity generation at any scale.
- Planning provisions should be enabling and proactively facilitate existing and new renewable energy generation activities.
- Wind energy is expected to take a greater share in electricity generation in the future and is crucial to the electricity system.
- Emerging renewable energy technologies, including marine energy, are also expected to play a role in providing energy in the future.
- Provisions should recognise that electricity generation facilities are required to locate where renewable energy resources exist and that there are functional and technical constraints associated.
- Wind energy is expected to take a greater share in electricity generation in the future and is crucial to the electricity system.
- Activities in the vicinity of infrastructure and utilities may lead to adverse effects which compromise electricity generation from renewable energy resources. This includes activities such as subdivisions and may include activities in neighbouring districts creating cross-boundary issues.
- There is an opportunity to provide for flexibility and innovation in the area of small-scale renewable energy technologies and planning provisions should reflect the nature and scale of the effects associated with small-scale generation which are likely to be minor.

- District Plans should clarify the activity status of energy facilities.
- There is significant potential for improvements in the efficiency of the end use in the built environment and transport systems. Buildings are long lived elements of urban infrastructure which can constrain society's future energy choices, impacting on future energy sustainability and greenhouse gas emissions.
- Appropriate site and building orientation should support the principles of optimum energy efficiency and solar energy gain (in relation to the size, shape, layout and orientation of lots as well as the building).
- Subdivision and development should be designed to facilitate small-scale renewable energy generation (solar photovoltaics; domestic wind turbines; solar water heating; heat pumps; passive solar design).
- Settlement patterns should minimise transport requirements and provide, where possible, for alternatives to single occupancy vehicles.
- Urban development should occur in a coordinated and efficient manner that results in more efficient use of infrastructure services.
- Non-regulatory methods such as Design Guides can assist in facilitating energy efficiency in the built environment.

In summary, planning provisions should be enabling and proactively facilitate existing and new renewable energy generation activities to assist in security of supply and achievement of the nations 90% renewable electricity target.

Suggested action:

1. Incorporate the National Policy Statement on Renewable Electricity Generation and give effect to it in regional policy statements, regional and district plans.

6. Demand

It is logical to assume that any population growth and/or economic growth in Southland will increase demand for energy. By being smarter with how much and when we use electricity, we conserve energy capacity to support future economic and population growth, without necessarily having to invest in more infrastructures. If investment is needed for more efficiency, costs can be offset with reduced energy costs. Essentially, efficiency improvement and peak demand management are the lowest cost sources of energy. Furthermore, research undertaken by the International Energy agency indicates that in order to reduce CO_2 equivalent emissions to 450 parts per million, 59% of emissions reductions will need to come from efficiency of end use by 2020.[36]

In considering the energy future for Southland consideration needs to be given to potential technologies which may be introduced in the future. In this section of the report we have classified the technologies into three time frames:

> <5 years: Technology is proven and well developed. Pilot scale studies completed and some commercial implementation may exist. Wide-scale adoption of the technology is all that remains.
>
> 5–10 years: Technology proven and past research stage. Pilot scale studies completed but the costs of the technology prevents its large scale application. Work is being carried out to reduce such costs and make technology more widely available.
>
> 10+ years: Technology not fully proven and is under development. No pilot plant studies yet and could still be a research idea or laboratory experiment that needs more work to validate.

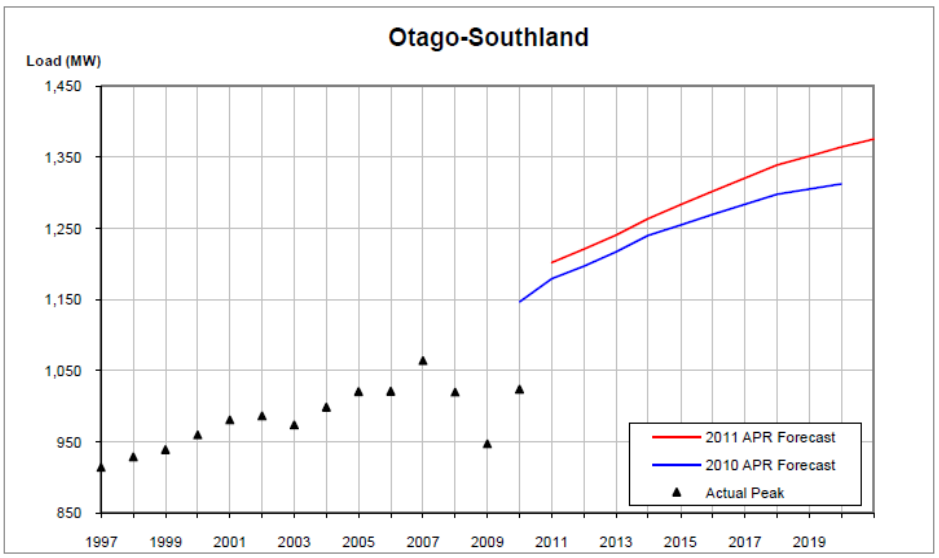
Brief descriptions of the technologies are given, and references for further information are provided. Key recommendations with regards to implementing this technology in Southland are outlined. Some of the implications in terms of planning activities are outlined in subsequent sections of the report. It is noted that the cycle of development from idea to commercial application has been accelerating and these time frames may be overestimated. It is also noted that technologies in the 10+ year category may fail to develop as expected.

6.1 Electricity Demand Challenges

Demand for electricity in the Otago-Southland region is forecast to grow on average by 1.5% annually over the next 10 years, from 1,202MW in 2011 to 1,376MW by 2021. While this is lower than the national average demand growth of 1.8% annually, it does not acknowledge major potential projects which could develop over this time.

[36] Available at http://www.worldenergyoutlook.org/2009_excerpt.asp

Otago-Southland Regional Electricity Demand Growth



Source: Transpower (2011). Annual Planning Report.

6.1.1 Power Quality

Quality of demand was an issue identified in the Dairy Shed project, and dairy farm conversions are predicted to continue into the near to medium future. Clusters of conversions are currently identified as driving electricity supply and distribution.

Poor power factor and suspected issues with harmonics can place unnecessary load on sections of the rural distribution network. High starting currents can also provoke local voltage dips when many loads start in short periods, such as the start of milking. Testing of power factor as part of obtaining an electrical certificate of compliance could reduce risk of new dairy sheds adding to this pressure.

Penalties in the tariff exist but do not seem to be used effectively by lines companies to encourage consumers to fit equipment to correct power factor and limit start currents, both of which are done most effectively at the equipment or the consumer's point of supply. Collection of real time data from smart meters and appropriate tariffs which encourage the conditioning of the consumer's load would improve distribution system resilience and reduce the need for capital plant. Collateral issues such as harmonics generated by power electronics need to be considered in parallel with these initiatives to avoid power quality degradation. Consistent imposition of tariff penalties representing recovery of the capital wastage coupled with an incentive representing the benefit of avoided capital investment should be assessed as a mechanism to encourage retrofits. These initiatives could all be implemented in a programme aimed at implementing the findings of the Dairy Shed project.

Suggested actions:

1. Test power factor as part of electrical certificate of compliance for new dairy sheds.

2. Develop a programme to implement the findings of the Dairy Shed project, including ensuring soft starts are retrofitted.

3. Encourage lines companies to ensure appropriate tariffs to encourage consumers to fit equipment to correct power factor and limit start currents.

6.1.2 Changes in Electricity Demand

Growth of existing industries, such as the dairy industry, has potential to substantially increase the quantity of energy demand in Southland. These have been discussed under 'industry changes'. Demand will also be influenced by population and economic activity in general, which has also already been discussed. This section of the document seeks to highlight the other major influences on energy demand over the coming 10 years which require consideration.

Water Pumping

There is a link between energy demand and water use in the region. Water use often requires pumping to access water, which increases in intensity when the resource is depleting. Environment Southland has identified that "efficient use of water will become ever more relevant as demand for water in the region grows and competition between uses (both in stream and abstractive) increases."[37] Any over-allocation of water in aquifers will also increase pressure on energy resources. This may need to include looking at allocations of water for farms, particularly because their use of the water also contributes to increased energy consumption through irrigation systems. An option could be to limit expansion of irrigation to where there is a proven supply of water and efficient electricity demand.

Improved management and allocation of water supplies will contribute to minimising power consumption. Invercargill LTCCP (now referred to as 'long term plan') notes that water losses are not quantified across the city. In the Bluff reticulation area (currently being upgraded), losses are estimated to account for 50% of the total water consumed. Southland does have a water supply issue, despite it's rainfall levels, and there are costs to the community in treating and supplying water – significant amounts of which is not even making it to consumers. Of the water that does reach consumers, only around 3% of reticulated water is used for drinking or cooking (potable purposes). The remainder is used for lower-grade uses such as washing, flushing toilets, and garden watering. This suggests that there is substantial potential for improving regional water efficiencies through simple measures, such as reduced use in households, measures which also adequately manage potential health risks.[38] A Water Demand Management Strategy could be developed for the region, building from the experience of other councils, (eg Tauranga, Nelson) to conserve valuable water and reduce energy use in treating and pumping water and wastewater. In Southland, this could be an extension of the work being done on a Water Demand Assessment.

[37] Environment Southland (2009). Executive Summary for Regional Policy Statement Review.
[38] Beacon Pathway (2010). Looking after the future: Connecting short-term tools and long-term benefits to encourage sustainable buildings. www.southlandnz.com

Suggested actions:

1. Encourage effective allocation to avoid over allocation of water supplies.

2. Develop a detailed programme plan for a policy package for water demand management.

3. Identify best practice in dairy shed design, looking at opportunities for reduced energy and water use, and promote this for new conversions.

4. Consider developing a Water Resource and Water Demand Management Strategy.

Electric Vehicles

Although the uptake of electric vehicle use is likely to be low in the next 5 years, vehicle technologies are developing rapidly and early planning to ensure barriers to the new technologies are not imposed is important. “900 all-electric Nissan vehicles have started to arrive in Oregon as part of the EV Project, which is a national demonstration project to gather data on electrical vehicle driving needs.” 39 This project is focussed on making the electric car accessible and user friendly, as well as establishing required infrastructure, such as charging stations. “Electric vehicles will require charging stations to be located in the areas they are most likely to be parked at for extended periods of time. This includes homes, work places, parking structures and downtown streets, as well as retail facilities.” Unless New Zealand attempts to get back into manufacturing vehicles, the technology options available to us are largely going to be dependent on the success and manufacturing of overseas electric vehicles. Increased use of electric vehicles has the potential to place significant demand on the local electrical energy supply and distribution system. Meridian Energy and Mitsubishi New Zealand embarked on a nation wide trial of the iMiEV electric vehicle from January to April 2009, “Electric vehicles are ideally suited to New Zealand due to our abundance of renewable electricity, relatively short commuting distances and short recharging times – enabled by our ubiquitous 230V electricity network.” We are currently looking at innovative ways to accelerate the deployment of electric vehicles and continue to research this exciting industry.40 Southland could take the opportunity to be part of any trials in New Zealand.

Southland, with its intense dairy demand, does not have the long low overnight demand that other urban areas have. Interaction between the demand for overnight vehicle charging, the ability of vehicle batteries to supplement domestic supply, and the unusual demand pattern of the Southland grid needs to be reviewed in particular the following questions need to be addressed:

- Will there be a need to encourage recharging during the low period in the middle of the day?
- Does this mean that there is a central business district issue arising from the need to charge vehicles during the day as well as a domestic issue arising from the desire to charge vehicles overnight?

[39] Sustainable Business Oregon (2010). Electric Vehicles cited in Portland Business Journal. http://www.sustainablebusinessoregon.com/columns/2010/12/electric-vehicles-sustainable-for.html.
[40] Meridian Energy (2010). http://www.meridianenergy.co.nz/AboutUs/Electric+vehicles+programme.htm

- Can vehicles be supplied complete with solar photovoltaic (PV) kits for houses to enhance solar generation and reduce grid stress, such as currently being proposed by some vehicle manufacturers?
- Should there be a programme to subsidise PV charging for electric vehicles funded from avoided network strengthening capital charges?

It is possible Southland may need to participate in some trials in order to fully understand the practicalities of using electric vehicles in the region.

Suggested action:

1. Investigate implications of potential demand for electric vehicle charging in the Southland context, and facilitate solutions to issues. This could include participating in trials.

6.1.3 Energy Efficiency in Businesses

In July 2008 Venture Southland commenced a two year project promoting sustainable business practices in Southland, with a grant from the Ministry for the Environment's now defunct Sustainable Management Fund. This project followed on from the Sustainable Tourism South project, which has been running since 2004. The main outcome for year one was the completion of the regional strategy, "Sustainable Businesses Southland; Resources and Opportunities", a gap analysis between business needs and available assistance. The strategy was formally endorsed by Southland District Council, Invercargill City Council and Gore District Council. The strategy implementation was guided by a group called the Southland Sustainability Liaison Group, which consists of people who work at a technical level assisting businesses. The website www.sustainablesouthland.co.nz was developed to provide Southland businesses with easy access to resources and programmes related to business sustainability in an effective and co-ordinated manner. Case studies were completed of local businesses and promoted on the website also. The businesses that are implementing sustainable practices are benefiting from energy efficiency and waste-stream reductions, with the website saving them research time and money.

During the project implementation, Venture Southland identified a number of barriers to building sustainable buildings, namely:

- A lack of independent advice available to small and medium sized businesses, mainly on the topic of energy.
- A lack of sustainable buildings to develop case studies of, particularly those with small scale renewables.
- A disconnect between owners and tenants regarding investment in sustainable buildings and who reduced operating costs accrue to.
- An inability to apply nationally accepted solutions in the Southland region for solar water heating installations.

Subsequently a report was commissioned to identify and address barriers to sustainable buildings, the findings and recommendations from this report are detailed under the section on 'sustainable buildings' below.

Energy efficiency in the commercial, industrial and small-medium enterprise sectors presents significant potential for energy efficiency improvements. The majority of businesses can save at least 20% off their energy costs. The Energy Efficiency and Conservation Authority (EECA), has a range of information and programmes which could assist, including the local Energising Business audits being delivered by EIS Energy.[41]It is noted that research plays an important role in delivering practical information that should support best practice in energy efficiency informing investment decisions deliver the best returns. EECA undertakes a range of research which may assist in the implementation of the strategy. For example, EECA maintains and develops the national energy end use database.[42]

It was noted during the public consultation process that an increase in activity such as mining fossil fuels may impact on the ability of local agricultural businesses to utilise a "clean green" image. However, the dairy sector would require significant changes to the energy source of its processing plant before it could genuinely promote itself as with a "clean green" image without risking serious criticism. It is possible that many industries do clean up their act in the near future, with initiatives such as the Green Growth Advisory Group, providing policy advice to government in 2011, focussing on how exporters can make the most of a "clean, green" New Zealand brand[43]. Actual green practice and avoiding claims of green wash will logically be one of their recommendations. Increased activity in mining fossil fuels could undermine the integrity of such strategies to capitalise on a "clean green" image. Indeed we have already seen the New Zealand tourism marketing switch from 100% Pure, implying a pure environment, to 100% Pure You. The justification for this change was "Major Tourism New Zealand research undertaken in 2010 suggested New Zealand could improve its appeal as a holiday destination by personalising its marketing message and focusing on more than stunning landscapes and awesome scenery"[44]. It has been suggested during the public consultation process that large scale developments should have to consider using renewable energy, and mechanisms to achieve this should be investigated.

Other topics relating to sustainable business practices are covered in the following sections of this document:

- Opportunities for industrial operations to benefit from utilising other operations' waste streams, particularly waste heat. Further discussion on co-location as a method of encouraging energy efficiency in businesses is provided in section 8.3.8.
- Woody biomass as a source of industrial heat could be further encouraged, this is discussed further in section 8.2.2.

Suggested actions:

1. Encourage programmes which encourage energy efficiency in businesses.

2. Raise awareness of the opportunity for the agricultural sector to change its practices to better enable its promotion as a "clean and green" industry.

3. Investigate mechanisms to encourage large scale developments to consider using renewable energy.

[41] http://www.eecabusiness.govt.nz
[42] www.eeca.govt.nz/research-centre/eeca-research
[43] Ministry of Economic Development (2011). Website: http://www.med.govt.nz/templates/StandardSummary____45925.aspx
[44] Tourism New Zealand (2011). Website: http://www.tourismnewzealand.com/about-us/what-we-do-and-how-we-do-it/campaign/

6.1.4 Electricity Reticulation

Concentrations of demand exist in urban areas, and in rural areas where activities such as dairy farms are present. These can often only be served by long spur lines. Problems can occur with reliability on these spur lines arising from lack of redundancy. These circumstances represent opportunities to introduce additional resilience to the supply through small scale distributed electricity generation, from renewable sources. However, this still requires the ability to feed back to the grid, or store electricity – which has issues which are discussed further under energy storage in section 7.

There is an opportunity to encourage new dairy conversions to utilise technologies which would allow the provision of distributed energy to reduce reliance on the network and increase electricity generation from renewable sources. This opportunity could be explored in the proposed Well Designed Dairy Shed research project. Distributed generation also has some advantages if there is an increase in extreme weather events from climate change as it reduces reliance on grid supplied energy.

There are some identified issues with distributed electricity generation, namely the powerlines company's current lack of obligation to maintain powerlines beyond 2013, which is an issue which is attempting to be addressed at a legislative level. There is also an issue with regards to councils, and a lack of confidence in off grid generation to meet the electricity service required for new subdivisions.

The benefits from greater uptake of distributed renewable energy generation are multiple. These include:

- Helps to achieve our national (90% renewable target for electricity generation by 2025) and international targets as well as safeguard the environment locally and globally;
- Helps protect against rising fossil fuel and electricity costs including those associated with the recently introduced Emissions Trading Scheme;
- Increases security and diversity of supply and assists with existing and future transmission/distribution constraints as well as assisting with avoidance of transmission losses;
- Provides the possibility of local ownership, wealth creation, employment and wider economic benefits through demonstration projects;
- Enhances Southland's reputation, builds the capacity for investment and increases reliability and resilience;
- Provides potential win/win scenarios (eg biogas from agricultural waste and forestry residues, cogeneration opportunities using gas from landfill); and
- Provides a potential new income stream for forestry/agricultural sector.

There is a need to get lines and generation companies on board for development of distributed electricity and ensure planning is under way for services infrastructure and grid capability constraints based on predicted demand and base load requirements. There may also be fiscal, educational and cultural barriers, such as the impact on neighbours, which need to be addressed. The built environment and district plan zoning may also place restrictions which will need to be considered. However, a lack of resource is not considered to be an issue, just a case of selecting the right source (solar, wind, wood, other biomass) for the right location (climate, seasonal variations, geography)[45]. The technologies for these are discussed further in this report, where there has been a change since the 2003 assessment.

[45] Beacon Pathway (2010). Looking after the future: Connecting short-term tools and long-term benefits to encourage sustainable buildings. www.southlandnz.com

Now that the EECA Fund for Distributed Generation is defunct, consideration needs to be given to how to assist project developers to investigate and undertake feasibility studies on projects which utilise renewable energy sources (small scale wind energy, solar, bio-energy etc).

Suggested actions:

1. Facilitate co-operation between lines and generation companies for the development of distributed energy, including identifying and addressing any planning constraints. This should include looking at tariffs.
2. Assist project developers with investigating and undertaking feasibility studies on projects which utilise renewable energy sources (small scale wind energy, solar, bio-energy etc).
3. Identify best practice in dairy sheds, including options for renewable sources of energy.

6.2 Demand Management

Using the energy we already have as efficiently as possible is seen as a high priority for the region. There are strategic actions noted to help achieve this, largely these follow on from what was in the previous strategy. However, there have been changes to technologies which may assist in the efficiency of how we use energy and manage multiple demands, these are noted below.

6.2.1 Influencing or Anticipating Changed Demand Patterns

There may be benefits in terms of capital expenditure and efficiency of industrial electricity if demand patterns could be influenced by the use of incentives. Before these incentives can be considered the stakeholders would need to define the goals. This would be particularly beneficial if undertaking planning for a distributed generation network.

There is already research undertaken in energy management systems, and it is suggested local effort could be focussed on the application of energy management systems, metering and generation. Otago University are also undertaking social research into successful means to encourage individuals to reduce their energy consumption, most appropriate information to provide to individuals to inform them about their consumption patterns, and best means to enable actions which result in energy savings and subsequently energy saving behaviour.

Suggested actions:

1. Facilitate stakeholder discussion around potential goals and initiatives for anticipating and influencing changing energy demand patterns.

2. Promote research into the application of energy management systems, smart metering, power generation and cogeneration technologies, and industry co-location opportunities.

6.2.2 “Smart” Appliances (<5 years)

There is worldwide interest in fitting domestic electrical appliances with telecommunications interfaces for remote control and monitoring. These so-called smart appliances could be

individually turned on and off to manage network demand to optimise both generation and transmission operations in a way similar to present ripple control. This could bring about cheaper tariffs for consumers who operate these smart appliances, and/or allow electricity retailers to sell renewable electricity to individual appliances. There are many potential benefits to consumers beyond energy optimisation.

Current thinking is split between those who believe that smart appliances will need to work in conjunction with smart meters to obtain energy efficiencies and those who consider that access through home data networks linked to the Internet is sufficient by taking advantage of the availability of practically unlimited IPv6 Internet addresses. There are already energy management systems being promoted to households, so they can activate electronics remotely.[46]

For smart meters to contribute meaningfully to energy efficiency in the household, they need to be coupled with smart appliances, and electricity companies could be encouraged to offer smart pricing. Some retailers are already installing "smart meters", but they do not have a display for the occupant. The inclusion of Home Area Network (HAN) circuitry in devices deployed will ensure that displays can be added later.[47]

Considerations for smart appliances include:

- Telecommunications topologies, protocols and standards for smart appliances and smart meters are still being debated around the world with consensus still to be achieved.
- Although at least one official view is that smart appliances are ten years away, Fisher and Paykel are planning to demonstrate a suite of smart appliances in the middle of 2011.
- Full advantages of using smart appliances for network operators will not be realised until there is significant consumer take-up. Whiteware typically has a design lifetime of 8 to 10 years, so widespread penetration of smart appliances will not take place until 5 years, or so after introduction. However, useful lessons and some utility could be obtained much earlier.
- To use smart appliances, households must have a broadband Internet connection to allow continuous data connectivity. (The data transferred by smart appliances will, however, be small and at low speed).
- It is most likely that smart appliances will use IPv6 Internet addresses and so for best operation home Internet gateways will need static IPv6 addresses. This may be a problem for some existing broadband connections and telecommunications providers.
- A coordinated industry response, including whiteware manufacturers, lines companies, and electricity retailers, is needed to obtain real benefits from deploying smart appliances.
- Consumers will need to be prepared to pay the additional $10, or so for the additional electronics in each smart appliance, or for this amount to be subsidised.

Suggested actions:

1. Advocate for central government to encourage purchase of smart appliances for replacements, including subsidies from avoided capital expenditure.

[46] Automation Assist (2011). Nelson Ecofestival.
[47] Parliamentary Commissioner for the Environment (2009).Smart Electricity Meters: How households and the environment can benefit. http://www.pce.parliament.nz/publications/all-publications/smart-electricity-meters-how-households-and-the-environment-can-benefit

2. Facilitate a co-ordinated industry response to the roll out of smart appliances, smart metering and electricity pricing that encourages the uptake of these appliances.

6.2.3 Energy Efficient Buildings

In 2010 Venture Southland commissioned Beacon Pathway to prepare a report detailing recommendations as to how Southland can overcome the dislocation between short-term tools and long-term benefits to encourage sustainable buildings, using best practice examples from around New Zealand.

The report "Looking after the Future" is available on www.southlandnz.com. In summary, the report noted there are many long-term benefits to be reaped from making more sustainable building choices, whether they are new buildings, or retrofits. The benefits include new skill development, job creation, lower health costs, improved productivity and improved quality of life. Sustainable buildings also have potential to minimise energy demand in the region, directly and indirectly, reducing the load on infrastructure. This report identifies five key performance areas where buildings can be made more sustainable: energy, water, indoor environment quality (essentially, health and comfort), materials, and waste. With regards to simple interventions that can be made with energy the report notes:

- Insulation
- Passive solar design
- Application of renewable technologies
- Efficient space and water heating (eg solar, heat pump, wetback)
- Efficient lighting, heating, and appliances

Barriers include upfront capital costs, difficulty matching costs and benefits, lack of reliable advice, lack of skilled tradespeople, council processes, added time and hassle, and limited cultural expectations.

The report provides a high-level assessment of Southland region's housing stock, business sustainability priorities, climate, and infrastructure. It notes that Southland has a solar resource currently underutilised. At the same time the south's cooler climate means higher energy demand, which makes the risks of rising energy costs higher. Homes and businesses energy use are interlinked with many businesses operating from their homes. It concludes that there is a good case for promoting more sustainable buildings – in new buildings and renovation of existing buildings.

Exciting new policies and programmes are emerging to support smarter, more sustainable buildings around New Zealand. This report recommends that councils in the Southland region could take a lead from these programmes, benefitting from the lessons learned in these programmes, and maximising the return on regional investment.

Three policy packages are proposed in the report for further consideration, and all have an impact on energy demand:

- **Council leadership and demonstration**: ensuring councils' investment in buildings and property is cost-effective, resource-efficient and sustainable.
- **Energy efficiency, renewable supply and thermal comfort**: A cross-council programme to identify and overcome barriers to energy efficiency, renewable supply,

and thermal comfort measures. As with the Nelson Solar Saver Scheme, the programme could develop a 'one-stop-shop' to support prospective developers and renovators to make more sustainable and energy efficient building choices.

- **Water demand management:** Evaluating the savings potential for Southland region from commercial and residential water demand management, building community awareness of water issues, including the potential conflict between agricultural and community use, and developing implementation programmes to support improved efficiency.

The report provides a broad overview of the range of initiatives that could be pursued within each of the three recommended policy packages. Further detailed analysis would be necessary to develop an implementation plan for the region. Some specific actions are recommended as next steps in the process:

1. Work jointly across all four councils in the region to develop a detailed programme plan for each policy package.
2. Evaluate the potential of each policy package, including consideration of cost of implementation, likely effect on the building stock, costs and benefits to the community.
3. Consider developing innovative approaches that utilise the region's strengths and opportunities to implement the packages. For example, retrofitting sporting or community facilities as a means of demonstrating what is possible to the community.
4. Identify and partner with relevant stakeholders to engage in the development and implementation of the policy packages. This should include central government, in ensuring national guidelines and standards are able to incorporate Southland's specific regional situation.
5. Deepen the assessment of the condition and performance of the region's non-residential building stock, and identify sustainability priorities for that building stock.
6. Give particular consideration to the following actions:
    - appointment of an Eco Design Advisor, shared across the councils to address the need for independent advice
    - develop methods to apply the Home Star residential performance rating tool with ratepayers to utilise this as a communication tool between stakeholders
    - partner with community groups to upgrade insulation and heating under the EECA Warm Up New Zealand Campaign
    - establish a Building Cluster to build industry capability through knowledge sharing, case studies and collaborative demonstration projects.

It is important that any policies or incentives for energy savings are considered holistically by both local council and regional councils as a package, in order to pre-empt unintended consequences. For example, actions such as encouraging use of energy efficient appliances may drive up demand for heat pumps. This may reduce energy demand if replacing fan heaters, but when used as a replacement for fuel burners it ultimately increases electricity demand. On the other hand this would also result in positive health benefits by reducing particulate emissions. It would be beneficial for other stakeholders to be invited to work with council staff in workshopping these policy options, to provide advice on unintended consequences, but also enabling the opportunity to build on the success of existing schemes such as the Southland Warm Homes Scheme. The policy package around water demand also has indirect impacts on energy.

A mechanism which should be explored as part of these policy packages is the use of voluntary targeted rates. EECA have suggested this proven mechanism could assist with insulation and clean heat, and Environment Southland have committed to considering this as part of their long term plan.

EECA has a range of information which could assist in the implementation of this action, including new studies associated with the Building Energy End-use Survey being undertaken by BRANZ and the Primary Sector End-use Survey being undertaken by Statistics New Zealand.

It was noted during the public submission process that local government may create disincentives to the strategies for renewable energy and sustainability within the region. Disincentives such as high consent fees, complicated and complex consent applications and procedures, and staff discouraging new ideas or being negative about the use of sustainable and renewable energy features. It is noted that local government does not actively create disincentives, but seeks to recover costs to be fair to ratepayers. It is acknowledged that local government could streamline some of its consent processes to encourage desirable activities such as that being explored with the solar pilot. This could be discussed during the proposed council process for workshopping policy packages for sustainable buildings.

In many situations, we see buildings with an expected life span of 50 years or longer being designed without consideration of the energy costs of that building over that time. Independent advice during the time of design can help, and councils who have employed an Ecodesign Advisor within their building compliance teams have found this to be the case. Some, who are building, intend to lease the space or on-sell, and hence lack the motivation to design for low operating energy costs into the future as they will not be the ones paying this cost.

This problem even exists in council's own infrastructure, where a higher initial investment is sometimes needed to give long term cost savings in energy, as there is a perceived lack of public support. Requiring new builds to have energy plans as part of their resource consent or building consent could ensure new builds are energy efficient, to ensure that the legacy of cold, unhealthy and energy intensive living conditions are not passed on to future generations. Southland could lead the way in developing the standards and regulatory framework for our situation. If regulation for new builds was combined with finance schemes for retrofits, and good independent advice, this could be an effective approach. For example, council could find a way to build and certify local remodelling businesses who specialise in energy conversions, develop schemes to finance the conversions with pay-back from future realised capital gains, and require that home insulation and clean heat conversion standards be met on all buildings whether new or existing.

The implementation of this strategy needs to involve setting specific targets. It is logical that these targets should align with EECA's Statement of Intent, as this will ensure that any central government assistance is captured at the time it is available. The draft NZEECS target is by 2015, 4PJ of savings and historical trends of increasing energy use by households levelling off. The outcomes include:

- Warm, dry and energy efficient homes with improved air quality to reduce ill health and lost productivity.
- Better consumer information to inform energy choices – awareness leads to action, greater understanding and better choices by consumers.

With regards to business, the draft NZEECS targets by 2015 include: 21PJ savings and 14% improvement from commercial and industrial sector energy intensity levels, 10% reduction in energy use per full-time equivalent in the public sector, 4% improvement in kilometres travelled by land by 2015, 90% electricity being generated from renewable sources by 2025. The outcomes include:

- Enhanced business growth and competitiveness
- Greater value for money from the public sector
- More efficient transport system with greater diversity of fuels and renewable
- Efficient renewable electricity system supporting NZ's global competitiveness.

Any targets set need to be monitored, which can be difficult. One way to monitor is to use the number of people who participate in government assistance programmes. The following targets are based on the EECA outputs for 2011-2014, with the Southland target for residential programmes being 2.18% of the national target, which is representative of the regions population.

Indicator	**Target 2011–2014**	
	NZ	**Southland**
Number of Clean Heat subsidies accessed in Southland (CSC holders)	510	11
Number of pre-2000 houses insulated through the Warm up NZ: Heat Smart programme	107,500	2,344
Number of efficient heaters through the Warm up NZ: Heat Smart programme	20,000	436
Number of Homestar™ assessments for both new homes, resale of existing and rental housing	n/a	30
Number of Greenstar buildings	n/a	3

Since the Looking After the Future report was published there have been structural changes to the Home Energy Advice Centre (HEAC). The HEAC was established by the Community Energy Network and the service was available via free phone, email and home visit in Auckland, Wellington and Christchurch. Services were available outside these areas online and for the cost of a toll call; the service was not widely promoted in Southland due to funding constraints. The pilot scheme won the Community Award at the 2010 EECA Awards.

From winter 2011 it is expected the service will be operated through a network delivery model. This will include a Community Energy Network managed website and 0800 number linked to regionally-delivered services. Community Energy Network will administer training, technical manuals, delivery protocols and quality assurance to members who wish to participate in the programme. Awarua Synergy is a member of the Community Energy Network with an interest in delivering local advice services under this model. In future, other not-for-profit organisations, such as Environment Centres, may also be part of the network. Local provision of this service should be considered as an option when workshopping the policy package for energy efficiency.

Also since the report was published, there was the collapse of Stadium Southland. This very well used facility has potential to be a leading example, as discussed in the report. Stadium Southland could demonstrate what is possible to the community with regards to efficient building design, as well as building resilience against rising energy costs.

It is considered that having a stock of energy efficient buildings may help attract businesses to the region, particularly as energy costs become an increasingly important consideration in business location. Having a star rating to reflect the efficiency of buildings can be a useful way of communicating this.

Suggested actions:

1. Develop a detailed programme plan for the following policy packages: council leadership and demonstration; energy efficiency, renewable supply and thermal comfort; water demand management, including considering using voluntary targeted rates.
2. Encourage the development of GreenStar^{TM} rated commercial buildings.
3. Investigate opportunities to require energy plans for new builds.
4. Advocate for greater regulation nationally for energy efficiency features in all new buildings, particularly in cooler climates.
5. Encourage energy efficiency and renewable energy projects as part of the council's building infrastructure and operations.

Performance Rating Tools for Buildings

Performance rating tools have been identified as a useful system for evaluating and communicating the performance and benefits of sustainable buildings.[48] There is a commercial performance rating tool called *Green Star*. It is a national voluntary environmental performance rating scheme, which has gained wide acceptance in the commercial sector. With an increase in new builds and retrofits using the rating, developers and their customers are interested and engaged in the process, recognising the benefits of procuring a building with a 'badge' that states that it is healthy, smart, efficient, has lower operating costs etc., and sometimes is used in PR to reflect corporate social responsibility.

However, there are no commercial Green Star rated buildings in Southland at the time of writing. There is an opportunity to attract new businesses to the region if Southland is known to be able to provide building stock that has low operating energy costs. This will be an increasing opportunity into the future as geographical locations become less of a consideration with a rise in telecommuting, and energy costs increase. Both councils and businesses within Southland would be well advised to investigate the potential for pursuing Green Star performance ratings in any new build or refurbishment projects being considered.

[48] Beacon Pathway (2010). Looking after the future: Connecting short-term tools and long-term benefits to encourage sustainable buildings. www.southlandnz.com

In 2010 a residential rating tool for New Zealand was launched by Beacon Pathway, the New Zealand Green Building Council and BRANZ, known as Homestar™. It provides the first independent means to measure the performance of New Zealand's new and existing homes. *"Based on a 10-star scale the scheme has two major components: a web based self-assessment – provided freely and accessible for all to use, and an independent third party assessment which can provide a certificate of performance for the homeowner."* The certification aspect is hoped to transform the way we talk about homes, enabling a common language through from potential owners, to developers to investors. The free online assessment can help educate and inspire homeowners to take action. There is broad potential for local authorities to use Homestar™ as a point of interaction with the community regarding the state of their houses. Some councils are exploring the possibility to use Homestar™ to underpin 'retrofit the city' campaigns, as well as using it as an educational and awareness raising tool.[49]

Suggested actions:

1. Encourage councils and businesses to use Green Star performance rating for any new build or refurbishment projects.

2. Encourage use of Homestar™ performance ratings, particularly for house sales.

6.2.4 Energy Centre of Excellence

The SIT undertook steps to establish an 'Energy Centre of Excellence'. The intention was to provide a classroom and a public space to learn about efficient design, renewable energy and associated technologies. A building was constructed but not progressed. Furthermore the Renewable Energy programme struggled to take hold, and has not been run in the past two years. It was also intended to develop an energy efficiency technology library and web based information database. However due to a lack of a full time staff member to work on this, the database has not been started. It has been suggested that this centre has potential to provide a showcase demonstration space for locals and visitors. This centre also has potential to provide support to encourage uptake of government incentives and assistance, such as those offered by EECA. This work could also extend to showcasing projects in the wider region, such as Stewart Island trials and, if a skill base exists, potentially develop demonstration projects. The courses currently on offer include training for plumbers for solar water heating installations, and training being developed for electricians. It is also suggested that this course content be reviewed, with a goal of aligning training to skill gaps.

In order to seek funding to create a demonstration area, first a clear vision and objectives for the space needs to be created. If this centre is to be developed to provide a resource for students, and a public demonstration area, the first logical step in creating this centre is to obtain the input of a wider group of stakeholders. In order to share resources, collaboration with other groups needing such a public space should be considered. Likely partners for collaboration include those working on environmental or energy efficiency projects. For example, Invercargill Environment Centre, Awarua Synergy, Southland Warm Homes Trust. In particular, entities which have the support of national networks would be of benefit to ensuring content remains relevant. It is suggested that a stakeholder group be formed to help create a vision for the space and seek collaboration with other groups where possible to reduce resources required. A potential downfall of a space which covers a wider range of topics has the downside of staff being expected to have expertise across all areas.

[49] Beacon Pathway (2010). Looking after the future: Connecting short-term tools and long-term benefits to encourage sustainable buildings. www.southlandnz.com

However, this could be overcome by advertising times when the experts in each topic are available to answer questions.

Suggested actions:

1. Develop demonstration projects for sustainable building design and small scale renewables.
2. Identify local skill gaps and address these with appropriate training.
3. Create a stakeholder group who can assist with clarifying a vision and strategic direction to assist with the Southern Institute of Technology energy centre of excellence.

6.2.5 Efficient Dairy Sheds (<5 years)

Potential for More Dairy Sheds

There are currently (end of 2010) some 809 farms in Southland, of which around 60 percent are classified as owner-operated, though equity partnerships are becoming a bigger feature of ownership structures in Southland[50]. Typically, a Southland dairy farm will winter 560 cows over a land area of 192 hectares per milking platform, supplemented by a 68 hectare run-off[51]. Based on extrapolating Southland's existing pasture land use, up to somewhat over 1 million cows in Southland could be farmed. On this basis, 1,700 new dairy farms could be established in Southland over the coming years. Industry body Dairy NZ has indicated a desire to double the number of dairy farms in Southland over the next 10 years.

The annual energy use in a typical Southland dairy farm milking shed has been estimated to be around 100,000kWh[52], or 160kWh for each cow[53]. An additional 2,000kWh per hectare per year is required for land that is irrigated[54]. Peak electrical load for a typical dairy shed is currently around 50kW. For dairy shed operations alone, potential electrical energy consumption, should 1,700 new dairy conversions go ahead, could thus exceed 250GWh per year, with a peak demand of over 100MW. It is not clear how much load would be created by associated irrigation pumping.

Between 2005 and 2008 Venture Southland managed a project to evaluate the different technologies available to dairy farmers to improve energy efficiency in the dairy shed. The project was funded by the Sustainable Farming Fund and Dairy InSight (now Dairy NZ), and the research was undertaken by the Centre for Advanced Engineering at the University of Canterbury. The project examined the actual performance and effects of various equipment, including heat pumps, heat recovery units, solar water heaters, vacuum pump variable speed drives, milk pump variable speed drives, milk vat insulating wrap and chilled water milk coolers. To this end, five dairy farms were fitted with real-time energy monitoring using the Woosh Wireless network and monitored through a milking season.

[50] Pastoral Monitoring (2010). MAF
[51] Pastoral Monitoring (2009). MAF.
[52] Improving Dairy Shed Energy Efficiency (2007). Venture Southland. http://www.cowshed.org.nz. Page 17.
[53] Energy Use and Efficiency Measures For the NZ Dairy Farming Industry (2005). AgriLink NZ. Page 10.
[54] Energy Use and Efficiency Measures For the NZ Dairy Farming Industry (2005). AgriLink NZ. Page 10.

The project has provided much-needed information for farmers who have often been wary of making energy management decisions based on incomplete information and claims made within sales literature. In addition, this study has highlighted a number of critical points for the dairy sector to consider. The key areas for energy savings included looking at vacuum pump and variable speed control; hot water heat pumps, and heat exchangers. This project identified a number of challenges with regards to power factor corrections required, and suspected issues with harmonics of power supply in dairy sheds.

By implementing energy efficient technology and optimised milking plant design, a dairy shed could save around 36% of its energy consumption compared to a conventional dairy shed through using efficient water heating systems, milk chilling, vacuum pumps, and dairy shed lighting[55]. This translates to potential annual electricity saving of over 60GWh.

If one allows for an arbitrary 5 year payback for capital equipment on farms and assume that electricity will retail at 15c/kWh, up to $45M could realistically be invested in new dairy sheds for energy efficient equipment.

There is potential for manure produced by cows to generate usable energy. Indicative figures highlight that if all the manure produced by a herd of 650 cows could be collected and digested, the plant would have an equivalent energy output of approximately 70kW. While this is an upper limit that would be impossible to achieve with most current Southland grazing regimes, it does indicate that it may be feasible for dairy sheds to become self sufficient in energy and at the same time reduce their environmental footprint. In addition, some of the nutrients from the biogas production are retained in the sludge by-product that could be used as fertiliser. Anaerobic digestion from covered ponds is likely to be the most practical, as the slurry has high water content from wash down processes. This would also mean no additional tanks or space is required for the set up.[56]

The benefits of utilising biogas on farms are assumed to be well known. However, there appears to be a need to better understand why there has not been greater uptake of this technology. If social research was undertaken to better understand how decisions on farms are made, under various ownership/management structures, this could provide great insight, and inform a project to address any barriers to uptake.

It is noted that dairy sheds need two wash downs per day with approximately 2,000 litres of water at a temperature of at least 65°C. Solar water heating has limitations because there is no sun after the evening wash down to reheat the tanks nor any guarantee that it will be there to heat the water after the first wash down of the day. Woody biomass (chips, pellets or firewood) may be a more appropriate renewable source of energy for water heating in dairy sheds.

Another aspect worthy of further investigation is using the waste heat to perform a stage in the reduction process, dewatering the product, reducing the energy required to transport the product. Waste heat from biomass co-generation could be used to fuel this process.

Water for dairy farming is essentially free at present, but it is not unlimited and extracting it is relatively expensive. There is speculation that even current water use for dairy farming may not be sustainable. Achieving efficiencies in water usage for dairy shed operations and irrigation would almost certainly translate into reduced energy requirements.

[55] Energy Efficient Dairy Farming (2005). Genesis Energy. Downloaded from http://www.dairysavings.co.nz/default.aspx?cacheb=YBSO2jkp9E6LSVXUgCC6Rg&sessionid=E5pdT4i8n0GE368fmzfXVA
[56] Morrison Low (2011), Energy from Waste Issues and Options Paper.

For this reason, developing ways to reduce water consumption are closely allied with advances in energy efficiency. To this end, education may be an appropriate initial step, but consideration needs to be given to reconsidering the entire farm design process from the outset.

Suggested actions:

1. Identify good practices in dairy shed design, looking at reducing energy and water use, and have these included in new conversions and retrofits where practically possible.
2. Re-examine renewable sources of energy (including biogas and woody biomass), and where appropriate promote them for dairy conversions.
3. Investigate technologies and practices that would reduce on-farm water use.
4. Promote and support the use of renewable energy sources for dairy farms (wind, small hydro or biogas) to enable farms to have greater self sufficiency in energy and to encourage the better management of waste.
5. Investigate, promote and support technologies that convert dairy effluent into biogas and less environmentally harmful fertiliser.
6. Investigate the potential of co-ordinating farm energy production (electricity, biogas), on a provincial basis, to create and support the commercial viability of any surplus energy.
7. Undertake social research to better understand how decisions on farms are made, under various ownership/management structures. Use this research to inform projects which will increase capital investment in energy efficiency and infrastructure such as utilising biodigestors.

6.2.6 Market Trading Around Electricity Peak Loads (<5 years)

There is a possibility that benefits can be gained from energy trading. Energy trading could minimise the costs and improve dairy farm productivity by taking advantage of the presumed low spot price during the local demand that occurs in national non peak periods. There are two consumption peaks for dairy farms: 4am-6am and 2pm-4pm. The normal domestic peaks are 7am-10am and 4pm-9pm. [57] This would require active market participation by consumers or a consumer based organisation. A successful study by the Centre for Advanced Engineering NZ (CAENZ) for Venture Southland generated a proposed strategy and check list for farmers around energy usage, this could be used to educate users such as dairy farms on practical actions to minimise their energy use to avoid the financial impact of peak prices.

Suggested action:

1. Encourage electricity retailers to enhance peak demand pricing structure, and to include practical industry specific advice on adjusting systems to take advantage of low peak periods.

[57] Energy Market Services website (2011). http://www.em6live.co.nz/PlanningRegion.aspx?planningregion=uni

6.2.7 Superconductor Research

Research was undertaken into the potential manufacturing of superconductors in Southland. While there were benefits to be found in manufacturers' process improvements, there were few energy savings that could be made. This opportunity was not progressed further.

Suggested action:

1. Monitor developments in superconductor research and investigate local opportunities as technology matures.

7. Energy Storage

Storing energy is a key challenge of particular importance for intermittent renewable energy sources. Converting this energy to electricity and storing in batteries has challenges around battery life, and efficiency due to energy losses in conversion, but also has limitations because the world is limited in the metals required to produce these batteries. They also tend to have a low energy density, which means they are not user friendly with the space and weight requirements of consumers. There are also opportunities for compressed air to be used as a form of energy storage in some applications, and there is some work being done on engines run on compressed air. Although some options for energy storage may have a low energy return on energy invested, for example hydrogen is around 1, the nature of when we demand energy and the source of that energy, is likely to mean that in some cases a lower energy return on energy invested is likely to have to be accepted, for the convenience factor of being able to use that energy at times when generation is lower, eg batteries to enable solar energy to be used at night/winter, and hydrogen to enable static generation to be used by mobile machinery such as vehicles. Although developments in energy storage would facilitate widespread uptake of renewable energy, it is not essential to their uptake.

7.1 Fuel Cell Storage (5–10 years)

Prototype fuel cells have been used in vehicles and other applications over the past few years. Although the technology is still in development stage, wide-scale commercial application of fuel cell technology can optimistically be expected within 5–10 years. Current observations are:

- Current developments in fuel cell technology include higher powered methanol based fuel cells. Methanol as a fuel is available although it is generally based on fossil fuels. This technology could change the consumer attitude to electric vehicles and remove the need for charging stations.
- Battery Electric Vehicles (BEV) that can also be used to supply houses through the BEV battery while on standby is a technology being developed (5–10 years away). It may be that in the future cars could be sold with PV kit for charging as part of the deal. Potentially these could be subsidised by local lines companies from capital avoidance funds.
- New cells based around titanium dioxide and biological actives are under development. These are currently competitive with conventional PV and are expected to develop quickly. Note there may be an opportunity in titanium dioxide production in Southland as well.

Although it is unlikely electric vehicles will supply houses, controlled charging will be likely to smooth out intermittent renewable generation. A technical breakthrough in this technology could advance the utilisation of this technology rapidly. Maintained awareness of these developments is required in order to understand the infrastructure requirements of successful technologies. Literature suggests that there are possible breakthroughs at laboratory demonstration stages.[58]

[58] Green beat (2010). Oorja unveils methanol fuel cell that could triple EV driving ranges.http://green.venturebeat.com/2010/02/17/oorja-unveils-methanol-fuel-cell-that-could-triple-ev-driving-ranges/

Suggested action:

1. Maintain awareness of fuel cell and other storage developments to inform infrastructure planning.

7.2 Hydrogen Production (>10 years)

Hydrogen production offers a form of energy storage which can be large scale or smaller fuel cells. There is potential for hydrogen to offer an energy storage mechanism to suit most locations, or even a transportable fuel cell, being charged by whatever the most suitable source of energy generation is for the site. Hence hydrogen offers the opportunity to enhance widespread uptake of small and large scale renewable energy generation (photovoltaics, wind turbines, marine energy etc.) through water electrolysis.

Large scale usage of 'green' hydrogen as energy will depend on the two developing technologies maturing and becoming commercially viable: fuel cell technology and the generation of cheap renewable sources of energy.

Widespread uptake will have a number of challenges which are not insurmountable. These include fuel cell technology developments, and compliance and safety issues. The latter are significant issues for the distribution and sale of hydrogen as a fuel. Transport providers in the region are already investigating solutions. There is also a commercialisation challenge with hydrogen due to the energy return on energy invested; only a fraction of the energy input can be recovered for end use.

It is not likely that hydrogen production will be in full commercial use for at least another 10 years. However, with regards to co-ordination and logistics, there is an opportunity for Southland to offer itself as a pilot location if there is provision for prototype and test bed activities to be undertaken without excessive regulation. Land and water use implications should be considered to ensure there are no barriers created by other competing activities, so that there is enough room for the activity and that the water is going to be pure enough to use for hydrogen. This kind of pilot project could be initiated through wider education on the opportunity.

Suggested actions:

1. Investigate the opportunity for Southland to offer itself as a pilot location to test co-ordination and logistics for green hydrogen production.

2. Ensure flexibility in plans for land and water use with regards to hydrogen production and distribution.

3. Investigate options for addressing compliance and safety issues associated with the use and storage of hydrogen.

4. Promote the opportunities around hydrogen production to the community.

8. Energy Harvesting

8.1 Solar

Contrary to popular perception, there is good potential for solar energy throughout Southland – with a particular emphasis on solar water heating opportunities. Notably, Southland compares favourably in terms of its solar resource on an international basis with more solar gain than Germany, which is home to the "solar city capital", Freiburg59.

8.1.1 Solar Hot Water Heating (<5 years)

Solar hot water heating (SHW) technologies are currently available and viable in many cases. SHW has been identified as an opportunity to reduce energy costs in homes, some workplaces and in some community facilities and some installations have already taken place in Southland. However, there remain a number of barriers to widespread uptake of SHW, including:

- Consent process. Standard acceptable solutions for installations under the Building Code are not suitable for Southland because efficient installations of SHW in Southland require an optimal angle of panels at 46 degrees, not 45 or less, and potential snow loadings in Southland are too high for the acceptable solution to be applicable[60]. Some suppliers do not have producer statements for their products which may also lead to engineers having to be involved with consents.
- Installers. It may help to develop a checklist type questionnaire for households wanting to install SHW to help them determine costs and benefits, and inform the decisions they make over suppliers (similar to the one developed for Dairy Sheds). However, if a solar saver scheme were implemented, this would take it one step further and help streamline the entire process, making it simpler for households.
- High capital cost for high efficiency systems. SHW could be encouraged if the scarcity of capital at household level could be overcome by innovative finance packages. An option is for lines companies to advance pay back through financially neutral charges to the consumer, although this is a complex option within the current electricity supply network. The more proven mechanism is voluntary targeted rates through the council, as is to be explored in the pilot solar saver scheme.
- Lack of qualified installers is an issue, and capacity building in this area is necessary for plumbers.
- Benefits of energy savings are not accrued to those who make the investment. This is noted as an issue in residential rentals, and leased premises. There is no easy answer to address this issue. Who the benefits accrue to is also an issue where the property is owned by the occupant, if they do not intend on remaining the occupant for the duration of the "payback period". However, if building performance rating tools became commonplace, lessees could use this information when choosing premises and this would ultimately help send signals to property owners about demand for energy efficient buildings.

[59] EECA (May 2001). Alternative Technology Association, n.d., citing German performance data from International Energy Agency Photovoltaic Power System Program, PVPS Annual Report 2006, p. 63.
[60] R McNeill (2008). Why isn't there a solar panel on every house in Southland. http://www.sit.ac.nz/documents/Energy/10_Robin_O'Neill_Why%20isn't%20there%20a%20solar%20panel%20on%20every%20house%20in%20Southland%20080604.pdf

Solar Saver Scheme
In Nelson, a number of these barriers have been addressed with a solar saver scheme. Venture Southland has received a proposal to run a pilot for a Southland Solar Saver initiative, which councils approved to take part in during 2011.

The pilot will enable councils to better understand the benefits and practicality of a solar saver scheme in Southland. The pilot includes looking at using voluntary targeted rates to provide homeowners with loans to fund solar water heating, sourcing the most appropriate panels for local conditions, ensuring installations are undertaken by appropriately skilled people, and streamlining the consent process. The pilot also proposes to consider opportunities for community facilities to benefit from the scheme, and further work could be done in this area.

Community Facilities
Community facilities, such as schools and community swimming pools are showing an increasing interest in solar water heating. However, in some cases the viability does not stack up, particularly when a broader look at associated factors is considered. For example, seasonality or other associated costs affect the payback periods. Given Southland has a number of schools and close to 50 swimming pools, rather than dealing with each facility on a case by case basis from scratch, it is suggested some guidelines could be developed based on research into current local installations. This research may reveal some of the weaknesses that can be fixed and further monitored pilot plants to lend to optimised installations. These guidelines should include:

- on-site considerations
- technical design
- system choice
- calculating payback
- funding options
- stakeholder views
- issues and obstacles
- operation and maintenance
- impact on human and financial resources

It should be noted that, due to the cost and energy savings of solar water heating systems being dependent on the demand for hot water, site specific information, and the specific system chosen, this research would not negate the need for individual assessments, but would provide guidance to ensure the assessments include all relevant considerations.

Suggested actions:

1. Establish a solar saver scheme in Southland, if after a pilot the benefits are proven and scheme is practical to be implemented.

2. Encourage plumbers to undertake training in solar water installations, to build capacity for installations.

3. Develop guidelines for schools and community facilities to assess solar hot water heating opportunities.

8.1.2 Solar Photovoltaic (<5 years)

Solar Photovoltaic (PV) technology is used to generate electricity which can then be used (by feeding back to the grid) after inverting, or stored by way of a battery. In domestic situations, if the building is connected to the grid, it would be likely that both batteries and an inverter are used in the set up. The energy can then be drawn from the batteries for a range of uses, such as household appliances, or electric vehicles. The batteries and inverters form a large part of the set up cost for a PV system. Batteries are discussed further in this document under energy storage.

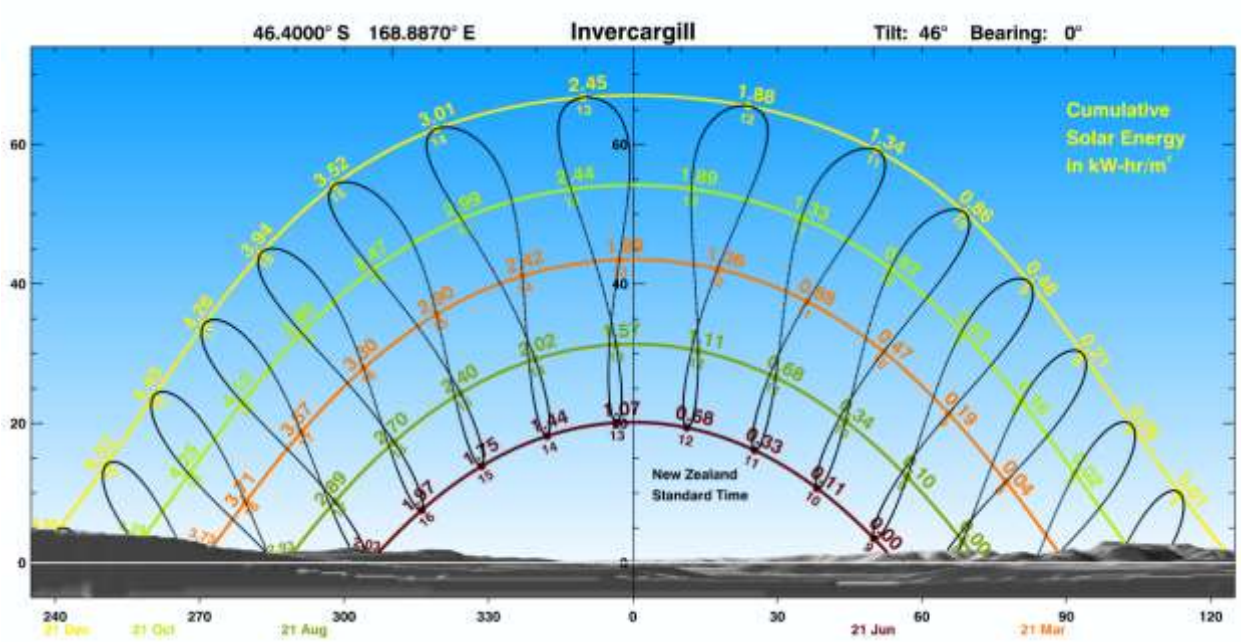
There has been a saying for the last 20 years that PV will be economic for general use when the price falls below USD$1/watt. In 2009 this price was achieved[61]. Therefore the technology is becoming much more robust and practically feasible. This can be seen in both simple solar powered garden lights through to integral PV cells with roofing materials now readily available. While some believe this technology will not become widespread, due to the abundance of more cost effective alternatives, the cost of PV technologies is reducing significantly and is likely to reduce further as commodity prices associated with polysilica production decrease and new PV products become available. Currently at least three major commercial scale PV arrays are being considered within Southland. We expect to see PV become more cost effective as more product development is occurring, for example where building products are replaced with PV products thus reducing the overall installation cost. Suitable returns for domestic power being fed back to the grid will accelerate the implementation of this technology and should be encouraged.

It should be noted that Southland has a silica resource in the Pebbly Hills. Silica is currently the key mineral required for solar photovoltaic energy generation. Ideally, if this silica is extracted, it would be processed within Southland to its highest and best use. Therefore it is recommended to take an active interest in technology developments and barriers, and address these locally where appropriate. It should be noted that silica is not a rare resource, but the Southland resource has been tested and is of high quality for this use. There are other methods for PV production which do not use silica, such as new energy technologies which mimic energy production from processes similar to photosynthesis.

There are potential safety concerns around use of widespread uptake of solar PV on homes with regards to fire. Although fire risk caused by the panels may be low, there is potential risk to fire fighters, with risk of electrocution. This is something that should be addressed if widespread uptake of PV on roofs becomes likely.

It has been identified that obtaining a more detailed understanding of the solar resource in Southland could assist with feasibility studies in the future. NIWA has produced a tool which will assist called SolarView.[62] However, NIWA have identified it would be beneficial to undertake some ground truthing of this tool to test its accuracy.

[61] Robin McNeill (2010). Personal Communication.
[62] NIWA (2011) http://www.niwa.co.nz/our-services/online-services/solarview



Source: NIWA Solarview

Suggested actions:

1. Maintain awareness of options for photovoltaic silica based production opportunities.
2. Promote the establishment and ongoing monitoring of solar energy opportunities for Southland.
3. Undertake ground truthing to test accuracy of NIWA solar mapping tool, and encourage appropriate use of the tool.

8.2 Wood Biomass (< 5 years)

8.2.1 Wood Energy Potential

Southland has a wood resource which is large enough to be considered in any strategic planning. The Ministry of Agriculture and Forestry (MAF) has conducted a detailed study of wood availability in Otago and Southland for the next few decades, and there is also significant forecasting which has been completed by Scion. In the following table, the MAF harvest forecasts are provided, along with the heating energy and power potential of this resource. The theoretical power plant that could be run from each component of the waste stream is shown in the table as power, based on the assumption that 100% of residues could be recovered and economically converted to energy.[63]

[63] Aurecon (2011). Southland Energy Review.

Years	2005/10	2011/15	2016/20	2021/25
Annual log harvest volumes ('000m³ per annum)	1688	2102	1890	4813
Landing residue supply ('000m³ per annum)	83	105	95	241
Heating energy (TJ)	247	312	283	717
Power (MW)	8	10	9	23
Cutover residue supply ('000m³ per annum)	113	139	102	277
Heating energy (TJ)	336	414	303	824
Power (MW)	11	13	10	26
Hauler cutover supply ('000m³ per annum)	157	193	142	385
Heating energy (TJ)	467	574	422	1145
Power (MW)	15	18	13	36
Total residue ('000m³ per annum)	353	437	339	903
Heating energy (TJ)	1050	1300	1009	2686
Power (MW)	33	41	32	85
Predicted processing residue produced ('000m³ per annum)	369		418	
Heating energy (TJ)	1803		2043	
Power (MW)	57		65	
Predicted non-processing residue available ('000m³ per annum)	32		37	
Heating energy (TJ)	156		181	
Power (MW)	5		6	

These figures are produced only as an indication as to where the waste streams may fit in any strategic planning. The scenarios generally predicted a steady increase of recoverable volumes of wood over the coming years, reaching over 1,000,000 cubic meters per year in one scenario by the early 2020s. Some scenarios predict a drop in recoverable volume available after 2034. This is because the modelled scenario assumes a declining yield harvest after the forests planted in the 1990s have been harvested.

Analysis for Douglas-fir availability shows a steady increase in the volume available starting from the early 2020s, reaching a maximum of around 900,000 cubic metres with large growers dominating the production. Small growers are unlikely to produce any meaningful volumes of harvest until after 2035. The modelled scenario assumes a declining yield of Douglas-fir volumes after 2050 due to harvesting the forests planted in the late 1990s.

The effects of the ETS and the creation of carbon forestry may change harvest behaviours. Observations during the Wood Energy Forum held in Invercargill in November 2010, were that as costs of transportation and harvesting rise, due to rising energy costs, that there may be a move towards longer rotation species, such as Douglas-fir.

Although it is relatively simple to identify potential wood supply, based on current plantations, there are a number of factors which influence the potential supply. Supply in the future may be threatened if the highest and best use of the land currently in forest changes to either dairy or other fuel farming.

Previous studies showed wood processing residues to be the most feasible material to use. There is currently wood chip being exported, and potential supplier's state there is an abundance of supply which could be made available locally if demand existed. As the efficiency of conversion of timber at sawmills increases, the amount of waste available reduces. However, as energy prices increase for competing sources of fuel, the comparative returns for wood harvested for products vs energy will change, and it may be that harvest solely for energy may become a viable option. Economics of using forestry residues and short rotation crops needs to be investigated, including considering embedded energy with transport costs.

While the energy value of the waste wood is significant there are substantial barriers to its economic utilisation, particularly around the anticipated energy cost of collection of the fuel and delivery of the energy. As a rule of thumb approximately a 30km radius is the maximum distance from materials supply to demand, beyond that the cost of transport exceeds the value of the fuel.[64]

Wood fuel as a source of energy has benefits that align well with New Zealand's commitments to reducing emissions, particularly if using waste wood. If the wood is from a forest which is replanted, it is essentially carbon neutral, because the emissions released when burned, are the same as the emissions sequestered during the life of the tree. In addition to being able to burn wood as a source of heat, wood can also be gasified to generate electricity. There is also an opportunity for the wood industry to develop liquid fuels, such as generating diesel using a method known as the Fischer-Tropsch process, which is a process well known for producing diesel from coal since 1920s. The Parliamentary Commissioner for the Environment noted in a report that wood biomass presented the best opportunity for biofuels for New Zealand, "a significant reduction in our carbon dioxide emissions could be made if we were able to produce a substantial amount of transport fuel from biomass".[65] The report also noted that wood fuels have similar energy content to lignite, which has less energy, carbon and more water content than other New Zealand coals.

With regards to technology changes that will assist in strategic use of the region's wood resource, the following points are worthy of noting:

- Initiatives using biomass as a fuel source for combustion have been implemented in schools and a commercial laundry and dry cleaning business in Invercargill replacing their LPG boiler with a woodchip one, cutting their carbon emission and reducing their energy costs.[66]

[64] Source: Aurecon (2011). Southland Energy Review. Note that this is linked to the transport fuel used and if it was coal seam gas based then this figure could change.

[65] Parliamentary Commissioner for the Environment (2010). Some biofuels are better than others: Thinking strategically about biofuels. http://www.pce.parliament.nz/publications/all-publications/some-biofuels-are-better-than-others-thinking-strategically-about-biofuels

[66] EECA (2010). McCallums Drycleaners Case Study. http://www.eeca.go5vt.nz/node/9122

- Wood pellet fires and boilers are commercially available for domestic and industrial use, and wood pellets are being supplied commercially from small local producers to large suppliers such as Natures Flame (Solid Energy).
- Technology has matured over the years. Biomass combustion plants have been built worldwide; large scale pilot gasification plants have been built and their development is on-going; small scale gasification units are commercially available; Fischer-Tropsch pilot plants for wood to diesel conversion exist in Europe.
- With the introduction of the Emissions Trading Scheme (ETS), biomass combustion is likely to play a larger role as an energy production technology in NZ, including the mixed fuel firing of thermal energy plants.
- Road improvements and modifications to accommodate biomass transport need to be addressed in planning and maintenance activities, road/rail combinations should be investigated.

Currently the best use for this resource appears to be onsite use by those generating waste wood. Further investigations into forestry residues, short rotation crops and investigation into liquid fuel production is suggested. There is also an opportunity for larger energy users currently reliant on lignite to be targeted to switch to wood energy.

Suggested actions:

1. Investigate the economics of using forestry residues and short rotation crops as an energy source.

2. Investigate the opportunity for the wood industry to develop liquid fuels, such as generating diesel using the Fischer-Tropsch or other process.

8.2.2 Wood Energy Demand

In November 2010 a forum was held in Invercargill to identify if there was a need to establish a Wood Energy Cluster to work towards some strategic and marketing objectives to advance the wood energy industry. The notes and presentations from the forum can be downloaded from www.southlandnz.com/energy. In summary, attendees felt there was an opportunity to better utilise Southland's wood resource for energy. It was noted that the region (including South Otago) has a young estate and an increased interest from potential users of wood energy, particularly as an alternative to firing boilers with fossil fuels. It was identified that in order to establish a strong supply chain in the region, suppliers of chips and pellets would want to be confident 4MW of demand was present. Therefore a key suggestion from attendees at the forum was that a demand assessment be undertaken as a first step.

A comprehensive demand assessment was completed June 2011, and can be downloaded from www.southlandnz.com/energy. In addition to identifying that there was at least 4MW of potential demand for industrial heat, it noted that waste wood currently at landing/skid sites could supply a significant portion (19%) of the heat demand for commercial/industrial users for wood energy in Southland.[67]

[67] EIS Energy (2011). Wood Energy Demand Assessment.

The assessment contains a number of specific recommendations including the formation of a regional bio-energy cluster to strategically coordinate some of these activities. This is a proven concept for other parts of New Zealand and if enacted for Southland could speed up the establishment of a well co-ordinated supply chain, and facilitate addressing any supply related and logistical challenges into the future. A cluster could begin by establishing a Memorandum of Understanding, and consider progressing to a formal legal structure if desirable in the future. This group would have potential to evolve to become a regional ESCo (Energy Supply Company). Its initial focus would be wood, but it should not limit itself in this regard as this cluster could act as a building block for future large scale biomass to liquid fuel, biomass to wood gas, and biomass to electricity opportunities. A group working collaboratively in this way could also advocate for grants to subsidise the development of the renewable non electric energy sector to reduce the need or alter timing for grid upgrades. While this concept is unlikely to be an option with the current set up, it could be investigated further.

Some initial areas of focus include:

- Identifying energy efficient methods of drying chips, including looking for suitable microclimates to for air drying.
- Enacting strategic actions to stimulate demand and address barriers: determining and promoting a single information portal, promoting wood energy (particularly for commercial and industrial applications) with agreed consistent key messages, promotion of co-firing (where appropriate), encouraging sustainable procurement policies to ensure whole of life costs are considered.
- Collecting data on wood energy costs.
- Adopting best practice in supply: long term agreements, adopt and develop standards for supply and installations.
- Promoting clean burning appliances running on woody biomass for residential, commercial and industrial applications, and advocating for stricter air quality standards, and phasing out polluting burners to help meet the National Environmental Standard for Air Quality.
- Identify and invest in any required infrastructure to support a good supply chain for biomass.

Some longer term areas of focus include:

- Suitable types and locations for short rotation crops
- Transportation options as fuel costs rise
- Possible trials into torrefaction to create a higher density fuel, if transporting to distant markets becomes attractive

The SIT already promote understanding of biomass energy and other renewable energy systems in the Bachelor of Environment Management course content. The renewables course content could offer increased focus on wood energy, and provide a useful mechanism for industry upskilling where required.

Local manufacturers should be encouraged to research and develop products that contribute to the economic uptake of biomass as an energy source.

Further discussion on use of biofuels waste wood, and transport fuels is provided in subsequent sections of this document.

Suggested actions:

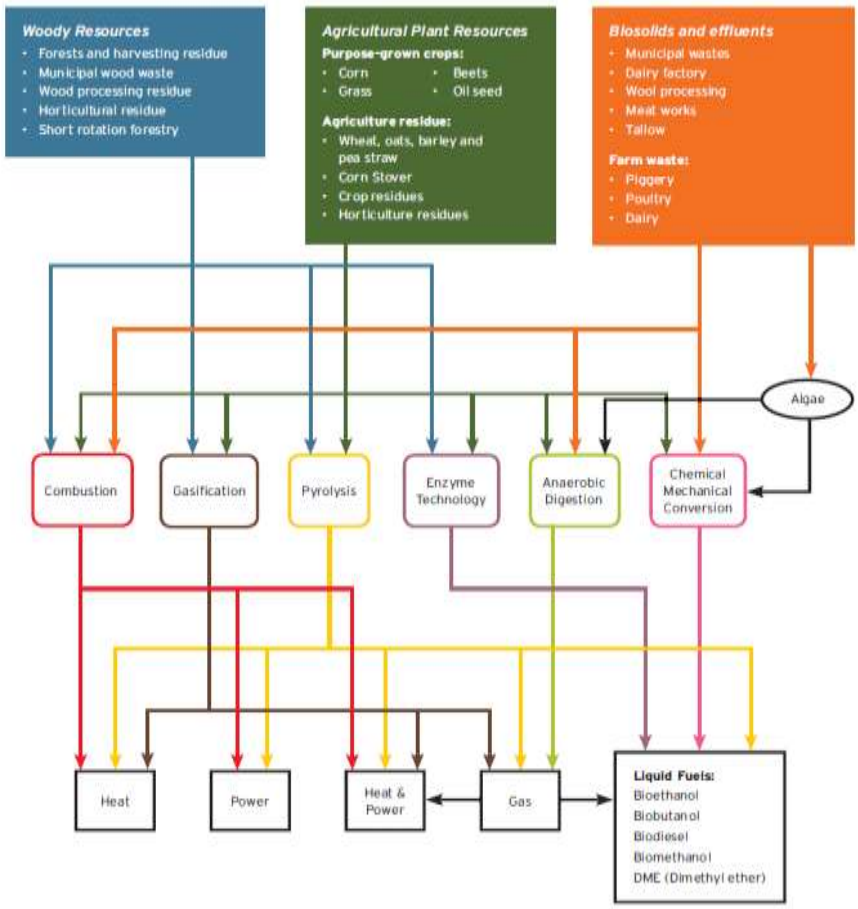
1. Actively promote the wood energy sector development in Southland through a range of actions outlined in the energy strategy section 8.2.2, including matching demand with supply streams.

2. Investigate the opportunity for creating incentives for promoting the use of woody biomass thus avoiding capital costs of grid upgrades and utilising avoided capital costs to fund these.

3. Encourage local manufacturers to research and develop improved technologies that contribute to the economic uptake of biomass as an energy source.

8.3 Other Biomass

The following chart (Scion 2007)[68] gives a good overview of the range of potential biomass resources (including wood), the conversion processes able to harness this energy source, and the end use for that energy.



[68]Scion (2007). Bioenergy Options for New Zealand, Situation Analysis, Pg 12

An important consideration for biological processes, such as growing algae, is the climate requirements for success, as well as availability and locations of feedstocks. The relationship between the energy required and getting conditions right for the process and transport of feedstock to a processing point and then back to a user is referred to as embedded energy. In many cases, small scale or even portable processing plants are going to be more likely to offer a viable solution due to the transport distances involved in Southland.

8.3.1 Crops to Biofuels

In 2006 a summary report on bio-fuels research and the potential for these technologies in Southland was produced by Crops for Southland. In summary, it identifies key strategic actions to assist the introduction of biofuel use in the South, namely:

- Work with interested parties including farmers and rural supply merchants to import and trial the latest canola varieties to assess the agronomic issues surrounding oil production from seed.
- Work with interested parties to import and get running a transportable biodiesel production plant in Southland
- Keep a watching brief on developments in Bioethanol and pyrolysis oils. Specifically the project developments regarding using Radiata Pine to produce bio-oils and algae to biodiesel.
- Any work in Fischer-Tropsch processes is long term because of the capital cost required to build a plant.

Following this report, trials involving growing of a number of varieties of canola were undertaken. Oils were extracted and a biodiesel production plant was also established in Awarua. However, the costs involved in the growing and production process did not stack up at the time. Even if the economic viability were to be more positive in a present day analysis, a key question needs to be asked: is the energy output from the oil greater than the energy input into the process, taking into consideration the entire process from tilling the soils through to distribution? If the processing plant can be transportable, or low cost enough to do at a small scale, some biofuel crop processes may be viable.

Another issue to take into consideration is what impact diverting land use from food production to fuel production has on the environment, and the price of food locally. As mentioned previously, some research has been done in this area. However, the findings were that "The primary drivers of food prices are oil prices, macroeconomic changes influencing exchange rates, and underlying supply and demand for food. Biofuels adds another dimension to the equation, but biofuels are not a primary driver of food prices."[69]EECA have also developed a voluntary biofuel sustainability framework which allows biodiesel producers and retailers to report on the environmental credentials of their products.[70]

There is an argument that food and fuel production from crops can be complementary, particularly as a break crop. During the submission process Solid Energy noted that they have a viable business model in today's market, with scale. "Canola derived biofuel can supply the Southland market with 20% blend as a break crop, with all the associated benefits especially given the excellent climate for oil seed rape and complementary dairy industry for cake". Of all the biofuel options, this is one for which the technology is well developed at a commercial scale. EECA is supportive of liquid biofuel production from crops, and state that biodiesel is more likely to be produced in Southland than ethanol. Some biofuel production from rapeseed grown as a break crop is already occurring in Otago and Southland.

[69] Nimmo-Bell & Co (2009). Food prices and biofuels update.
[70] EECA. http://www.eeca.govt.nz/biofuels/sustainability

It is suspected that an even stronger case can be made for prioritising biomass to energy options which are focussed on waste items. These waste streams could be co-products or by-products of crops rather than dedicated crops, forestry waste and farm waste. These are discussed further under the section on waste 8.3.2.

There is an algae-to-biofuel plant which a local engineering company has become involved with, and as part of their work they have included considering how this technology could be rolled out to assist meeting local industry needs. “Solray Energy and its public sector partners have spent about $4 million on a processing plant that converts almost any plant matter, including algae, to fuel”. At present their work is being done targeting high quality fuel users, signalled by their agreement with the US Defence Force.[71] Climate may be a factor in the success of algae related projects in Southland. Processes that require large land areas, such as algae ponds, may struggle to compete with other profitable land uses. There are other benefits to some biological harvesting which should also be kept in mind, for example species such as Duckweed, which could have water quality remedial benefits.

Suggested actions:

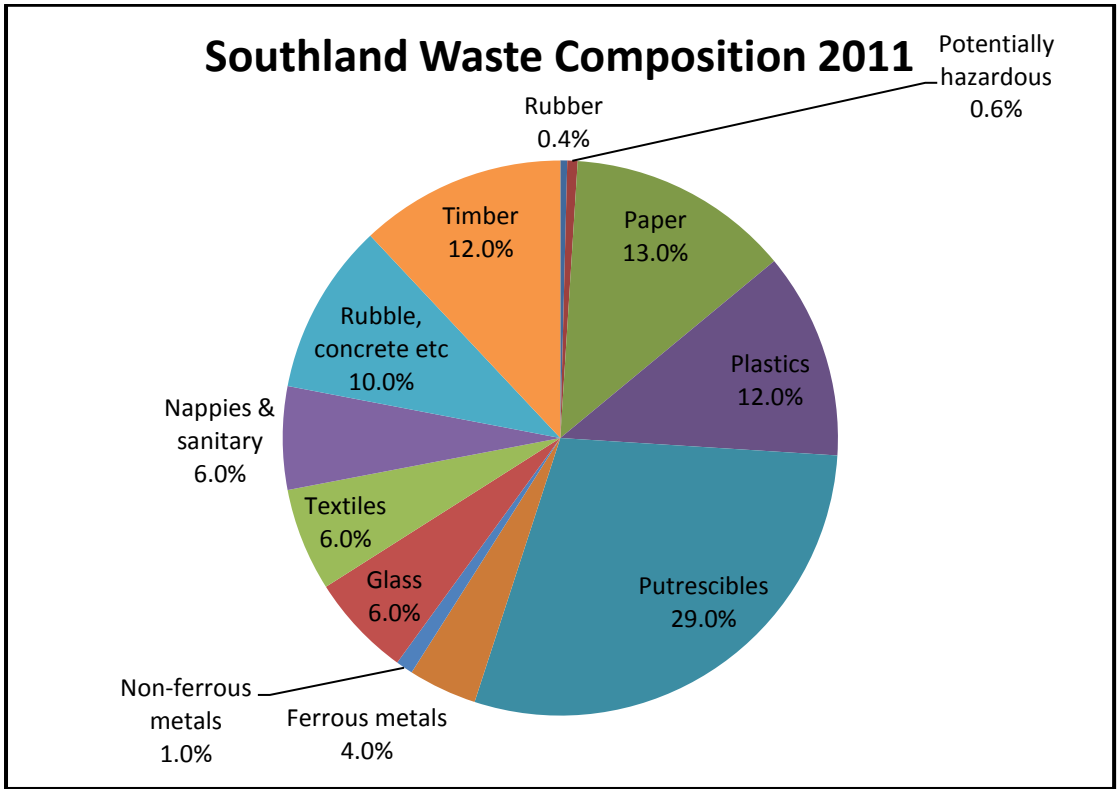
1. Continue to monitor viability of liquid biofuels production from crops, basing the value case on net positive energy gains.
2. Investigate the opportunity to use Fischer-Tropsch, or other process to generate biodiesel from wood biomass.
3. Investigate the opportunity to target forestry waste.
4. Facilitate algae to biodiesel initiatives in the region.

8.3.2 Waste

Waste presents an option for energy generation in the region. Southland’s three territorial authorities manage refuse disposal on behalf of their ratepayers. In 2004 the Councils procured the services of a regional sanitary landfill for the disposal of their waste, the AB Lime owned and operated site at Kings Bend, Winton, and closed over 60 sites throughout the region. There are other smaller privately owned landfill and/or clean fill facilities operating. Councils operate a network of waste Transfer Stations and recycle drop off centres for the disposal of solid waste, and collection of hazardous and green waste. All the Transfer Stations in Southland District have re-use shops at the entrance; Gore does not operate theirs at present.

According to the Regional Solid Waste Management Plan,[72] the only detailed regional information regarding Southland waste sources, volumes and disposal is contained in the 1987 Southland United Council’s Waste Survey. This survey estimated the solid wastes generated in the region in 1987 to be 253,000 tonnes, made up of 6,900 tonnes of hazardous waste and 246,100 of non-hazardous wastes.
In 2007 a study was undertaken at the AB Lime Landfill to determine the composition of the waste disposed at the site. This data was updated following a Solid Waste Analysis Protocol (SWAP) analysis in 2011, and results are shown below.[73]

[71] Bradley, G., (2010). Fed-up public open to fuel change. NZ Herald. http://www.nzherald.co.nz/nz-government/news/article.cfm?c_id=144&objectid=10656508
[72] Environment Southland (1996).
[73] Morrison Low and Associates (2011). Draft Regional Waste Assessment for Southland.



In 2004 the Southland territorial authorities under the banner of "WasteNet Southland" and in collaboration with Environment Southland jointly developed a Waste Management Plan (WMP) as required by the Local Government Act. The 'WasteNet' Councils have all adopted the following statement of intent: "Council adopts the philosophy of working towards Zero Waste through effective education, waste prevention, minimisation and recycling. This will be done in co-operation with other WasteNet Councils in Southland and other Zero Waste Councils throughout New Zealand, with recognition of the life cycle environmental, social, economic and cultural effects of waste. It will focus on protecting Southland's natural resources from the adverse effects of all forms of waste.

In 2008 the Government restructured waste legislation with the ratification of the Waste Minimisation Act 2008 which:

- Encourages the reduction in the amount of waste we generate and aims to lessen the environmental harm of waste.
- Benefits our economy by encouraging better use of materials throughout the product life cycle, promoting domestic reprocessing of recovered materials and providing more employment.74

The Waste Minimisation Act also requires territorial authorities to review and update their Waste Management (and Minimisation) Plan by June 2012. Currently the WasteNet Councils are working together on updating their plan, and this energy strategy, a waste assessment, and an issues and options paper on energy from waste will help inform this work. A key question to be posed with the waste plan and energy strategy is: if waste is treated as a resource for energy generation, how does this fit with the waste minimisation philosophy and zero waste objectives in the waste plan? The argument cannot be solely on energy generation without considering the environmental and social benefits, hence the following points are worthy of noting:

[74] Ministry for the Environment (2010). http://www.mfe.govt.nz/issues/waste/waste-minimisation.html

- Recycling can, in theory, reduce Greenhouse Gas (GHG) emissions created during manufacturing. This is particularly the case with items such as glass and aluminium, where most of the emissions (and energy intensity) from the product are generated during the initial creation of the product. Therefore collecting, crushing, melting and reusing the material generally generates fewer emissions than starting from raw product. The emissions reduction from recycling other products, such as paper and plastics, will be less so, because their manufacturing process is not as emissions intensive. The energy, and associated emissions, involved with transporting recyclables to their next point of processing and their end user would have to be factored into any emissions reduction argument. At present the nearest glass recycling is in Auckland, and the local aluminium smelter will only recycle what they know was originally generated by them (to maintain their unique selling point of purity of metal).
- The minimised resource use from recycling any products has the environmental benefits of reducing the need for more raw resources to be extracted, which in itself can be energy intensive, particularly in the case of metals.
- Reducing, reusing and recycling lowers pressure on landfill space if the items were otherwise disposed of. The Resource Management Act has made obtaining permits for new landfills more difficult, and this can affect the economic feasibility of landfill disposal as an option. However, in Southland, there is unlikely to be an issue with a lack of landfill space for the next 200 years, with waste being used to fill land space from extracted lime in a 'class A' landfill.[75] Other regions will likely see waste processing become a priority not as an energy production technology but as an alternative to landfill.
- Diverting of organic waste from landfill prevents methane emissions from being generated in this anaerobic environment. The emissions generated in the landfill at present are being flared to prevent odour issues, but this represents an energy loss. If further organic matter were directed to the landfill, the landfill operators would likely view it as being viable to invest in technology to capture and store the methane for use in their lime works. However, methane could be generated more effectively in a purpose built plant for organic matter, which could logistically be located closer to the source, and save on transport costs, which will undoubtedly rise in the future.
- The viability of recycling sorting schemes is often focussed on economic viability; hence automated technologies are often a focus. However, in Southland the recycling is done by hand at Southland Disability Enterprises, where the goal is to create more employment through manual systems rather than opting for cost effective automated systems. Recycling therefore has wider community benefits through employment opportunities.

All councils in Southland provide detailed information about waste minimisation and direct their ratepayers and businesses to more sustainable practices through the WasteNet website[76]. There appears to be a gap in having sufficient available data to be able to assess how well (or otherwise) each of the Councils is doing in its waste management. This gap is being filled as part of the action plans set forward in the Waste Management Plan and it will be crucial in monitoring and targeting a zero waste approach.

When completed, the waste assessment and issues and options paper on waste to energy will identify the potential to utilise Southland's waste as a source of energy generation – including heat, electricity generation and transport fuels. There is a need to identify the appropriate vehicle to co-ordinate Southland's various waste volumes to minimise unnecessary infrastructure development.

[75] Steve Smith (2010). Personal communication, General Manager AB Lime.
[76] Wastenet Southland (2010). www.wastenet.org.nz

The implications of rising energy costs on current systems of collection and disposal and existing contractual arrangements needs to be taken into consideration. It is suggested that evaluation criteria could be used to assess the opportunities, looking at energy returned on energy invested, and other issues such as: environmental harm from toxins; rising energy costs (transport fuels, combustion fuels and electricity); environmental harm from emissions; potential to recover other elements which could improve soil health; political, regulatory and educational barriers.

Suggested actions:

1. Investigate the potential to utilise Southland's waste as a source of energy generation, including heat, electricity and transport fuels.

8.3.3 Methane from Organic Waste (<5 years)

Most organic wastes can be digested in anaerobic digestion, which involves four steps. The first step, hydrolysis, breaks down organic compounds into smaller molecules and dissolves them in solution. The next two steps, acidogenesis and acetogenesis, involve further breakdown of organic compounds, while the conversion of small organic compounds to methane, CO_2 and water occur in the final step, methanogenesis. This process can be the basis for energy production from the methane produced and the residual materials from the process are often rich in soil nutrients. Anaerobic digestion of waste is a developed and mature technology. Organic fertiliser and biogas are produced from the process, and the biogas (methane) can be used as an energy source.

Recovery of nutrients could become an additional driver for processing waste streams, particularly in the case of farms, where recovering nitrogen and phosphorous is likely to become increasingly important. Sewage treatment sludges are a rich source of phosphorous and recovery technologies exist. The Scion Thermal Oxidation Process shows promise in this area, and should be monitored.[77] Production of biogas from dairy waste needs to be investigated in terms of what can be a feasible size in the dairy farming space. This needs to be linked to any efficient dairy shed initiative. Clustering waste producers (such as dairy farmers) near a single biogas plant may be appropriate. It is also possible for diesel and petrol engines to run on biogas, which could be helpful for farmers to internalise some of their costs by becoming more self reliant. Biogas could also have larger scale applications, such as using domestic sewage, industrial wastes, and organic waste to produce a commercial transport fuel.

There is a small resource in the landfill worth further investigation if an appropriate economic matrix can be found. The technology to capture and utilise methane from landfills is well developed. Auckland and Christchurch landfills currently use this energy to run some of their vehicles[78]. The landfill operator AB Lime has already investigated energy potential for the landfill, but unfortunately upfront capital costs are a barrier. Other council owned landfills have access to interest free crown loans, but this is not an option for the Southland landfill as it is privately owned. However, it is likely to be a question of when, rather than if, the landfill is going to be used as a source of energy.

[77] Scion Research (2010). Cited in http://www.scoop.co.nz/stories/SC1008/S00070/rotorua-to-gain-from-innovative-research.htm

[78] Stuff (2010). http://www.stuff.co.nz/national/4389012/First-biogas-truck-trialled

Timber going to landfill also presents an opportunity to establish a stewardship scheme to recover this product and use it as an energy input. In 2007 an estimated 11% of landfill waste was timber, which would have equated to 27,830 tonnes of timber in 1987. This timber is likely to be mostly treated timber as a result of demolition works, but treated and untreated timber could be processed to recover energy. The key would be to invest in the technology to use treated timber. In Finland a product stewardship scheme exists where a fee is charged at the time of purchase of treated timber, and at disposal. The wood is stored, chipped and dried. A planned incineration plant has been designed to undertake the controlled combustion of 50,000 tonnes per annum, providing 80GWh of heat and 40GWh of electricity.[79]

Not only is there potential for energy from the landfill, but there is also green waste collected at Invercargill Transfer station (6,000 tonne per year), and potentially more would be received if the entrance fee for public drop off is removed. Public awareness and participation would be crucial in expansion of any voluntary recovery as part of a drop off service.

This green waste has potential to be transported to the landfill and contribute to methane production via the landfill. At the landfill, there is not only the landfill operation as a potential user of this methane, but the associated lime works. However, it may be more viable to consider local biodigestors to reduce the embedded energy involved in transport and enable more efficient specialised processes. Location of the facility (or facilities) needs to be analysed for optimum use of the methane produced, as well as finding an appropriate use for the heat generated during the methane production. Waste to energy plant needs to be sized based on amount of organic waste available. This may make smaller plants a non-feasible solution economically, but technologies are advancing in the area of smaller production units. It should be noted that in Christchurch, the methane is being used to power the landfill vehicles, and this may be a sensible option to ensure that volumes of waste collected matches with the energy needed to transport the waste to points of processing.

Future policies need to highlight the need for organic waste collection and treatment. Separation of wastes into organics, inorganic, and recyclables is an important aspect for effective utilisation. There are mechanical and biological methods of separating the wastes in the waste treatment facility. Developments in machine vision (i.e. robotics) may make this an automated process for mixed wastes in the future.

8.3.4 Micro-Biological Processes (>10 years)

There is active research world-wide on the possibilities associated with micro-biological processes to generate fuels, process wastes, deal with toxic substances and contaminated land, water and waste. Microbial processes either require significant industrial plants or large shallow ponds to support the necessary growth. The following observations can be made about the progress of this technology:

- Microbial production of industrial products and fuels from waste is becoming an established technology.
- Microbial Fuel Cells have already shown capabilities of cleaning waste waters while generating energy and caustic soda as a by-product.
- Research is being undertaken into phytoremediation – growing specialised plants on contaminated areas to uptake the toxic materials in their roots/leaves. Note that the subsequent disposal of the grown material can re-create the problem.

[79] Love, C. (2007). Extended Producer Responsibility Of Treated Timber Waste http://www.cmsl.co.nz/assets/sm/2252/61/030-LOVESimon.pdf

Technological breakthroughs in the above should be monitored. An understanding of the requirements for these niche technologies to be commercialised should be obtained, to better understand whether large scale application is feasible within Southland. The following are likely to impact the feasibility:

- Climate
- Timing of when technological breakthroughs may occur, and how this fits with infrastructure investments
- Regulatory environment (Hazardous Substances and New Organisms Act)
- Planning issues around potentially large artificial ponds being created for 'growing' organisms
- Ability to match waste items from industry with suitable processes, and users of the energy created

When these requirements are better understood, a business case could be made for considering whether Southland should create an opportunity by being an advocate, promoter and test market for these technologies for global markets.

8.3.5 Ethanol from Organic Waste (5–10 years)

Bio-fuels are still seen as politically important despite the New Zealand government not imposing the requirement for fuel companies to include 3.4% of bio-fuels in their overall fuel sales. The political will to impose a bio-fuel requirement needs to be closely monitored as a political move can change the economics of fuels such as these overnight.

The appeal of timing on this aspect of energy supply may vary considerably, and the following comments can me made about this technology:

- Technology has matured but it is estimated there is another 5–10 years before ethanol based fuel systems are commercially and socially viable.
- Should a satisfactory chemical or microbial process that allows economic use of lignin or cellulose based material develop from laboratory to full scale production this would remove one of the major barriers to use of these waste or harvest resources.
- New Zealand company Lanzatech, designed a process to produce ethanol from industrial gas streams and carbon waste products (organic or inorganic). It is currently working with the US Department of Energy to develop drop-in jet fuels using this technology.[80]
- Given its high annual growth and possibility of annual harvesting, the feasibility of using Miscanthus as an ethanol feedstock should be investigated. A NZ group in the North Island is conducting studies on its propagation. Beet is another fuel stock worth investigating.
- Technologies to produce ethanol from lignin and crop wastes are developing but appear to be possibly 5 to 10 years away.
- Investment is being made by BP-Dupont's Butamax to develop conversion technologies using seaweed as a feedstock for methanol, ethanol and biobutanol.[81]

[80] Biofuels Digest (2011). http://biofuelsdigest.com/bdigest/tag/lanzatech/
[81] Biofuels International (Jan 2011).

There may be industrial opportunities linked to ethanol from cellulose and lignin based wastes if those technologies develop quickly. Some options may be more immediately implementable and the work done in the past by the Liquid Fuels Trust Board in the 1980's may be worth reviewing.

Suggested action:

1. Continue to monitor viability of liquid biofuel production from crops, basing the value case on net positive energy gains; maintain awareness of associated land requirements.

8.3.6 Pyrolysis of Organic Waste (5–10 years)

Pyrolysis of organic waste produces liquid and gaseous streams that can be used as fuel, and solid chars that can be used to make activated carbon or used as bio-char for soil conditioning. There is a Japanese process known as "Blest" which uses pyrolysis to turn plastics to diesel. No known commercial application of organic waste processing by pyrolysis has been identified although some companies offer pyrolysis waste treatment solutions. Technology is probably 5 years away from being implemented by Councils. [82]

8.3.7 Syngas from Organic Waste (5–10 years)

Plasma arc gasification of waste to produce syngas is a developing technology. A number of plants have been proposed but no commercial scale plant built yet. It will probably take 5–10 years before full development of technology for municipal wastes. The production of a solid slag might be an issue for Southland. The technology is attractive due to its associated destruction of toxins and hazardous material like PCB's.

Suggested actions:

1. Monitor the commercialisation of the Scion Waste2gold process as a disposal route for sewage sludges that has nitrogen and phosphorous rich by-products.

2. Re-examine renewable sources of energy for farms, including biogas, and where appropriate promote them for dairy conversions.

8.3.8 Industrial Waste (< 5 years)

Industrial zones can generate opportunities to match an existing industrial facility's output to an input for another facility. There are technologies that will facilitate the use of waste from one manufacturing facility as feedstock for another. Some of the potential matches are outlined below:

- Generating energy (biogas) from waste by digestion and use to supplement onsite energy requirements.
- Harvesting CO_2 from emission stacks of boilers (eg at Edendale), along with a source of nutrients can be used to grow algae or biomass as biofuel stock.

[82] Splainex (2011). http://www.splainex.com/waste_recycling.htm

- Producing bio-diesel from sewage ponds by harvesting the algae in the ponds. Aquaflow has done pilot tests in their Marlborough site, and Solray has done tests at their Christchurch site.
- Lanzatech technology can be used to produce ethanol as biofuel sourced from industrial emission gases (off NZAS aluminium smelter or Edendale dairy factory)
- Export of spent cell liner from the NZAS aluminium smelter can be used in cement manufacture (Holcim).
- Potential lignite based developments could present an opportunity for an industrial cluster of users.
- Can use animal by-products with other traditional biomass as a source of fuel for heat.

Mechanisms for these opportunities to be identified and marketed should be developed. The establishment of industrial zones with multiple large energy users grouped together may be beneficial for biomass energy plant, or other sources of energy. This is not only important for looking at opportunities to utilise waste streams, but could be applied to waste heat. This location of complimentary operations is referred to as co-location. Heat recovery is a clever option which is well understood, but is likely to require some form of greater co-ordination to connect heat producers with users early on in the location selection period. Such co-ordination could be enhanced through appropriate infrastructure within industrial areas. A good basic level of understanding of heat users has already been collated in EECA's heat plant database.

Suggested actions:

Encourage co-location of complementary industries by:

1. Identifying potential industries in Southland that could benefit from co-location (for waste streams including waste heat), and promote these opportunities.

2. Ensure plans indicating industrial zones are flexible enough to enable facilities inputs and outputs to be matched, including the development of energy generation nearby.

3. Establishing a database of commercial waste streams and heat, and attempt to match these with new or existing developments.

8.4 Transport Fuels

Transport fuels are a critical component of the energy that supports economic activity in Southland. The motivations for investigating alternative fuels include fuel shortages, price spikes, and those seeking a lower carbon footprint. If seeking a lower carbon footprint is the motivating factor, it is important to keep in mind the net carbon footprint, i.e. not just the fuel itself. Available substitutes depends upon the type of engine currently used (petrol or diesel), as this impacts on the way the energy is carried and brought to the vehicle.

As with any energy related subject, the least cost investment is using what you have more efficiently. Campaigns to improve driver behaviour can have multiple benefits: reducing fuel used, saving people money, making driving behaviour safer, making roads safer for other users. Such campaigns can also increase occupancy rates, for example by encouraging ride sharing.

Transport fuels such as petrol used for personal trips has some flexibility. For example, people can choose to reduce use, find alternatives like walking and cycling, and sharing rides. There is a walking and cycling strategy for Invercargill and further engagement with the public on the barriers to walking and cycling could see this strategy evolve to become a useful tool for improving support infrastructure to make cycling safer. There is also opportunity to grow some of the grass roots movements encouraging cycling, such as the Bike Doctor, and other cycling initiatives being led by Invercargill Environment Centre. Action to facilitate this by reviewing urban infrastructure could be pursued through the regional land transport strategy and associated plans. Urban infrastructure needs to enable this and encourage this. Electric vehicles may play a role as an alternative to small petrol vehicles. Increased public transport in the form of buses run on biofuels are unlikely to be a large solution, due to the low and geographically dispersed population making a regular service unviable. Some shuttle type services are working well in smaller towns where people are all travelling to Invercargill for services such as health services. A formal ride sharing system, through a website or other mechanisms, could be investigated to facilitate ride sharing.

Some businesses and community organisations can adapt the way in which they operate to reduce the need for transport, such as increasing use of teleworking, using internet-based communications and electronic communication. However, they need to have internal policies, and the technology to support this, which is currently easily accessible.

Transport in relation to commercial needs is potentially less flexible, where goods physically have to be moved. This highlights an issue for a region such as Southland, which focuses on primary production and tourism, both of which require transport on a larger scale. Even putting aside the fuel needed to bring visitors to New Zealand, the total amount of diesel consumed in NZ was estimated to be around 105.22PJ for 2009[83]. Assuming diesel has a heat capacity of 44.8MJ/kg and a density of 832 kg/m^3, this equates to about 2,835 million litres of diesel, which is a comparable figure to a 2001 Ministry of Economic Development estimate of an annual diesel consumption of 2,100 million litres of per annum. Scaling down this figure for Southland's population, it could be estimated that approximately 640 million litres of diesel is consumed in Southland annually.

Southland has a Regional Land Transport Strategy which was adopted in 2007, and is due to be reviewed in 2011. An integrated transport study is going to underpin the review. The current strategy identifies that in addition to a number of road network upgrades, promoting alternatives to private transport, and upgrading rail lines is important. However, with regards to fuel use, while it acknowledges "Continued dependence on non-renewable sources of energy such as oil, is unsustainable", it only identified energy conservation and efficiency as options to address this, and directs attention to the national EECA strategy for goals.[84]

Rail is likely to play an increasing role in transport in Southland, particularly for freight, so there is a need to look at road/rail logistics. Rather than seeing road and rail as competing forms of transport, opportunities for partnership approaches should be encouraged. This may include research and consideration of the feasibility of inland ports to consolidate freight and improve energy efficiency, including transfer to rail. EECA and the Waikato Regional Council are currently identifying how integrated land use planning can result in energy savings to the transport sector. They are focusing on a case study that looks at transport logistics and freight hub planning. This could result in learnings relevant to Southland.

[83] Ministry of Economic Development (2010). Energy Data File.
[84] Environment Southland (2007). Southland Regional Land Transport Strategy.

There are some key issues to investigate in relation to alternative fuel sources, including:

- Which sources are viable, and is the technology to utilise these available in the next 5–10 years.
- What infrastructure is required to support the distribution and use of these alternatives.
- How can alternative fuel supply points be facilitated
- What other implications are there when the nature of vehicle fuelling changes, potentially from relatively few fuel stations with rapid refuelling to widely distributed trickle charging points for electric or gas supply points, or if electric vehicles will have exchangeable batteries.

The transition to electric vehicles is occurring relatively slowly, and still has many limitations for a geographically dispersed population such as in Southland. Because of the fleet conversion required, the transition is likely to continue to be slow. Furthermore, electric vehicles are unlikely to provide a solution for long distance freight. A more orderly transition would be likely if alternative fuel supplies were developed.

Security of supply could be pursued through development of local fuel supply, and depending on the source of this supply it could offer emissions reductions. However, because many of these vehicles will need this same source of fuel outside the region, co-fuelling needs to be considered as a logical solution to enable flexibility with fuel sources. The best economics of the current co-fuel product offerings are with the heavy duty, over-the-road vehicle segment using large amounts of diesel fuel. Market potential of co-fuel technologies increases significantly if fuelling stations are established; such has been shown in the successful biodiesel consortium established in Queenstown. It may be that consortiums of larger fuel users would assist with enabling supply to meet demand. Local transport operators should also be encouraged to investigate alternative fuel sources.

In order to stimulate investment into liquid fuel production, in particular transport fuel production, the government could consider the prospect of putting in place fuel import reduction targets.

The following potential transport fuels are discussed further:

- Biodiesel: discussed below (8.4.1), and under wood biomass.
- Gas: Coal Seam Methane discussed below (8.4.2), and biogas discussed under waste (8.3.2).
- Hydrogen fuels with intermittent sources, discussed under energy storage (7.2).
- Electric vehicles are discussed under electricity demand (section 6.1.2)

Suggested actions:

1. Encourage organisations to have policies and constitutional documents which enable teleworking, internet based communication and electronic communication.
2. Encourage continued maintenance of rail networks, and electrification of the network.
3. Investigate logistics required to enable effective use of road/rail transport.

4. Investigate the feasibility of inland hubs to consolidate freight and improve freight density, energy efficiency, efficient transfer to rail and port.

5. Facilitate consortiums of larger fuel users to assist with enabling supply to meet demand for alternative fuel sources.

6. Review urban infrastructure and spend to enable and encourage transport alternatives such as walking and cycling, and ride sharing.

7. Encourage local transport operators to investigate alternative fuel sources, such as blends of sustainable biodiesel, electric vehicles and hydrogen fuel cells.

8. Advocate for central government to investigate a limit on fuel imports to help build business case for domestic liquid fuel production.

9. Investigate a formal ride sharing system to increase light vehicle occupancy.

10. Encourage initiatives such as efficient driver campaigns to encourage efficient use of fuel.

11. Progress energy objectives through influencing the development and implementation of regional land transport strategies and associated plans.

12. Encourage the upgrading of weight restricted bridges to improve road freight efficiency.

8.4.1 Bio-diesel (5–10 years)

There has been a large market growth in biofuels globally over the past few years as bio-diesel blend has become a mandatory requirement in some American and European states. The cost of production of bio-diesel has decreased but is still an obstacle. Without government subsidies bio-diesel will cost more than petro-diesel in the short term.

The yield of biodiesel produced from a hectare of land varies drastically based on the harvest, ranging from 3000 litres/hectare for algae to about 770 litres/hectare for sunflowers. Southland will probably require a different crop to suit its climate and conditions. However, if it is assumed that on average 1500 litres of diesel can be produced on a hectare of land, this yield figure along with the estimate of annual diesel consumption in Southland indicates that about 430,000 hectares of land would be required for biodiesel production to satisfy all the requirements of diesel consumption in Southland. This is 60% of the land area currently intensively farmed in the province. This calculation assumes that the intensive farming of bio-diesel crops does not in itself increase diesel use, which is likely.

The Parliamentary Commissioner for the Environment has suggested that wood is a logical biomass to produce a biofuel that can provide a drop in fuel solution for the country, with other biofuel options not being of adequate supply to provide large scale solutions, as well as having potential to displace other land uses.[85] Further discussion on crops to biofuels is provided under section 8.3.1.

[85] Parliamentary Commissioner for the Environment (2010). Some biofuels are better than others: Thinking strategically about biofuels. http://www.pce.parliament.nz/publications/all-publications/some-biofuels-are-better-than-others-thinking-strategically-about-biofuels

Biodiesel from wood using the Fischer-Tropsch process or other processes is worthy of further investigation.[86] The capital required for the Fischer-Tropsch process may not be viable at a small scale. Options exist to integrate woody biomass with lignite to liquid options, but the disadvantage of this is it loses its appeal as a renewable source of energy. There are a number of pilot scale production plants, and laboratory scale work is also being undertaken, looking at other methods of producing liquid fuels from wood. In order to take some of these technologies from a pilot scale to commercial scale, models worth considering include using open fuel standards and a co-operative approach, possibly combined with an Energy Supply Company (ESCo) model.

Suggested action:

1. Investigate the opportunity for the wood industry to develop liquid fuels, such as generating diesel using the Fischer-Tropsch, or other process.

8.4.2 Coal Seam Methane (5–10+ years)

Vehicle engines can be modified to allow gas fuel induction, and storage. This gas could come from a range of renewable sources, such as organic wastes, woody material or, as discussed further below, coal seam methane.

Coal seam methane (CSM, CSG) is a resource that should be reviewed in terms of its highest and best use. The L&M group is carrying out economic and environmental studies on various permit areas in Western Southland and has announced good gas flows. The potential gas flows from lignite mines are likely to be less.[87] Indications are that the maximum rate of utilisation would be achieved by a 10MW peak supply turbine, but the potential to use it as a substitute transport fuel seems to the authors to be of greater overall economic and environmental benefit.

Gas or liquid fuels could be piped down existing transport network reserves to give a simple distribution system. The implications of establishing distribution and fuelling infrastructure need to be considered:

- Are there regulations allowing gas installations?
- Are there qualified local personnel for gas system installation and handling?
- Are there plans to provide training in these fields?

All these need regional solutions to be developed. Best and most valuable use may be to use the gas as a substitute transport fuel because the technologies for direct utilisation in dual fuel engines exist and will allow vehicles to travel beyond the gas distribution network when required. The prospect of major pipelines to be developed on or adjacent to transport corridors and potentially within railway reserves needs consideration. Associated with this is the potential need for bulk fuel storage, including potentially on or adjacent to the port of Bluff. Regional and district plans need to give consideration to these matters.

[86] Williamson, A.G. & Mason, I.G (2010). Transitions in transit: future options for transport energy in New Zealand.

[87] Parliamentary Commissioner for the Environment (2010). Some biofuels are better than others: Thinking strategically about biofuels. http://www.pce.parliament.nz/publications/all-publications/some-biofuels-are-better-than-others-thinking-strategically-about-biofuels

With more coal bed methane wells drilled worldwide, the technology has matured over the years. As the cost of energy increases, this assists the economic viability of utilising this resource. Working this within the ETS may add to the economic benefits.

Water treatment and disposal has proved to be a problem in areas producing coal seam gas as it is generally water-borne. A process know as fracking involves the pumping of mainly water and sand through a well into deeply buried gas-bearing rock to open up fissures in the rock and increase the flow of gas. Sometimes chemical additives are used to make the process work. Some of the fluids return to the surface and then have to be disposed of. If the water can be cleaned up there may be a synergistic opportunity with irrigation based industries. New technologies for the sustainable production of natural gas from depleted wells are on the horizon. The process involves pumping water and nutrients, along with specialised microbes that consume carbon and produce methane, into depleted oil and gas wells,. The methane is then harvested for use as natural gas, utilising the depleted wells for energy production. The researchers also determined that some forms of microbes also exist that actively produce methane in coal fields.

It is worth noting that both petrol and diesel engines can also be run on biogas, which is discussed in more detail under the section on waste. Any form of renewable energy options should include consideration of the energy returned on energy invested – the balance of which can change depending on the technology available.

Suggested actions:

1. Investigate ways to mitigate the greenhouse gas implications of using coal seam methane as a transport fuel.

2. Promote the use of gas options as a substitute or for co-fuelling vehicles.

3. Investigate distribution and fuelling infrastructure needed for gas (including hydrogen) and liquid fuels.

4. Regional and district plans need to give consideration to the prospect of pipelines and fuel storage requirements for gas distribution.

8.4.3 Hydrogen (>10 years)

Vehicle engines can be powered using hydrogen if the car is compatible. Refer to previous section 7.4 on hydrogen.

8.5 Marine Energy (>10 years)

Three sorts of marine energy are possible: wave, tide and tidal current. There are currently no commercial wave, or tidal current energy devices in operation although European governments are committing significant resources over the next three to five years. The initial cost of marine energy devices is likely to be higher than other generation technologies[88]. The generators currently being evaluated are all in prototype stage and have not been scaled up to full size and developed an operational track record[89]. In short, while marine energy could be applicable in 10 to 15 years time, it would be a high risk investment for Southland before then.

[88] IEA-OES Newsletter, Issue 7, September 2006.
[89] Meridian Energy Information Sheet, *Marine Energy*, March 2007.

That said, a number of venture capital marine energy generators are currently being considered for New Zealand and the South Coast and Bluff are areas being considered as potential marine energy test sites. These evaluation opportunities may accelerate marine technological development which could favour possible deployment to Stewart Island.

8.5.1 Tidal current

Tidal current generation technologies would appear to be the most mature marine energy generation possibility for Southland. The best prospects for economic utilisation of the resource is generally considered to be in water depths greater than 30 metres and mean spring peak velocities of greater than 2.5 ms^{-1}. Smaller scale units appear to require greater currents: Blue Energy have provided advice that a current of some 6 to 8 knots (3 to 4 ms^{-1}) is required for their 250kW generator.

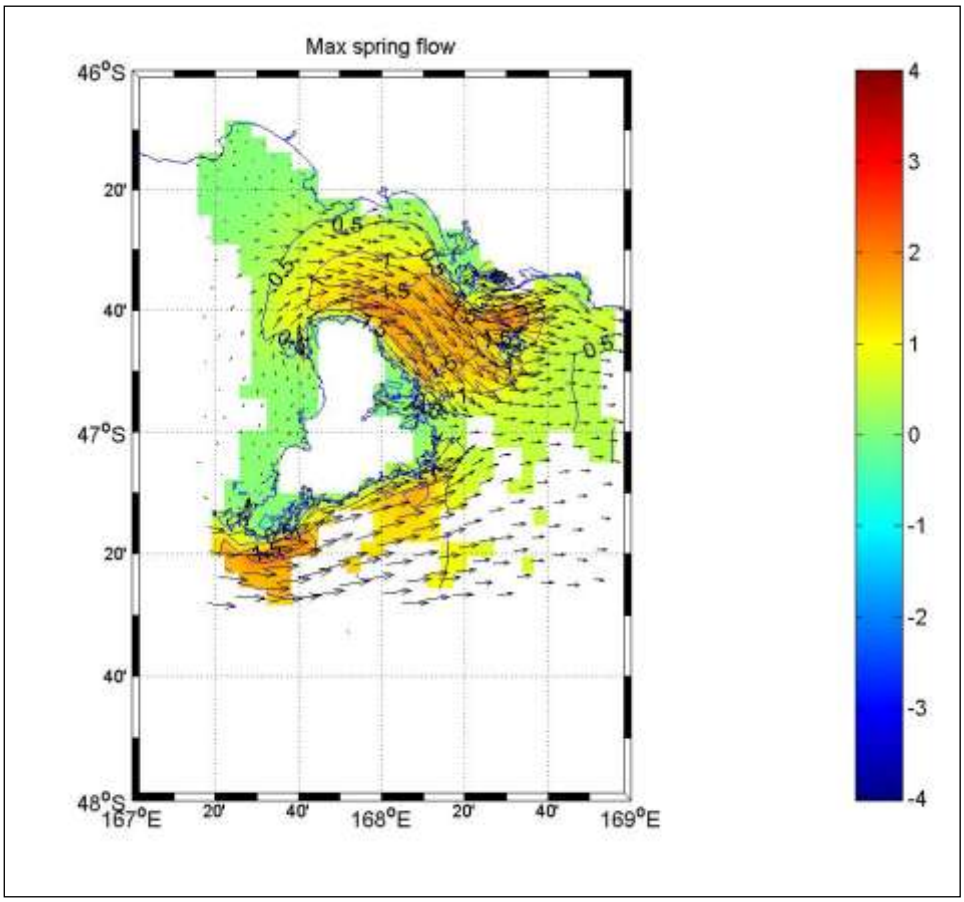
The capacity factor of plants is estimated at 40% and costs are in the order of $6,000 to $9,000/kW for a small plant of 1MW or less. Projected annual operation and maintenance costs are $150 per kW of installed capacity[90]. A 200kW generator can thus be expected to cost in the order of $1.2m to $1.8m resulting in generation at around 10.7c/kWh for a 20-year life. A 500kW generator will thus cost in the order of $3.6m with an annual operating cost of around $75,000.

Preliminary NIWA modelling[91] indicates that the maximum spring flows, for around those parts of Southland where transmission problems would not be overwhelming, to be in the order of 1–2 ms^{-1} (see figure below). While localised anomalies are possible it is considered very doubtful that there could be sufficient acceleration to provide 3ms^{-1}, or more, currents. Based on analysis of marine charts, the only possibility is to harness the outgoing tide from Bluff Harbour slightly to the southwest of Stirling Point.

There has been some conjecture that a tidal current generator could be installed in the Bluff Harbour, to harness the flow out of the Awarua Estuary. In reality, such a generator would behave rather more as a tidal generator and the low head to be derived from the relatively small tides experienced (See below) would make it rather ineffective, notwithstanding the adverse environmental impacts that would likely be created.

[90] Noel Hall, Chris Taylor, *Emerging Supply-side Energy Technologies*, Prepared for Min. of Economic Development, July 2006.
[91] Dr Steve Chiswell, NIWA, *pers comms*, 20 March 2007.

Modelled peak spring tide velocities in knots



Source: Chiswell (2007).

8.5.2 Tide

Tides around Southland are not large and on average are 2.5 metres. The average tidal power head available is thus limited to between 0.5 and 1 metre. To store enough water to allow for 100 kW average power production will require at least an area 1 kilometre square and an average penstock flow of over 10 m^3s^{-1}. Other than damming the Awarua Estuary, or Jacobs River Estuary, this is not very practicable and at any rate any tidal generation would result in such massive disturbance to the foreshore and seabed that it would not be permitted under the Coastal Plan and would unlikely receive much public support.

8.5.3 Wave

Research carried out by NIWA shows that the wave heights in and around Southland are often insufficient to be useful for wave power generation. Even in Foveaux Straight, mean wave heights are only of the order of a few metres. A number of prototype wave energy systems have been deployed around the world, but have generally been found to be vulnerable to damage from extreme wave incidents. The technology is expensive, high risk and slow to develop. Wave power is not a viable option given the currently available technology.

Wave Energy Technology NZ has positioned directional and wave buoys in various locations in New Zealand, including Foveaux Strait, in order to record and compile data on wave flow and feasibility of utilising it for energy generation. No results are yet available.

Suggested action:

1. Assist in identifying suitable sites for marine energy.

8.6 Fossil Fuels

The use of fossil fuels has some specific considerations. While outside the scope of relevant environmental considerations for consenting process under the Resource Management Act, it is desirable that consideration be given to the global impacts of emissions of CO_2 equivalent, as well as the potential impact on the image of our export industries. A mechanism for encouraging this is the Regional Policy Statement (RPS). It is anticipated that this strategy will inform the RPS, and that regional and district plans must give effect to the RPS. The RPS should acknowledge these potential impacts.

Local and central government should ensure that establishment and maintenance costs of any fossil fuel industry's infrastructure/monitoring should be paid by the industry itself. This includes ETS costs, which should be paid for wholly by the industry, hence factored into each business case, not tax payer subsidised via allocations of NZ carbon credit units. Existing industry allocations of NZ carbon credit units for fossil fuel energy suppliers should be phased out as soon as possible, to enable market mechanisms to take effect and enable investment in new renewables to be more competitive.

In general, the public submissions on the draft version of this document reflected the fact that there are some very strong public opinions about extracting and developing the region's fossil fuels. While the submissions were of a high quality, there was some misinformation, and a genuine desire for the public communication process to be improved. Any entity involved in the development of such resources would be well advised to have a strong communication strategy, which is based on open, transparent information, and can respond quickly to public requests for information. This is particularly important for large scale developments which may be processed through the Environmental Protection Agency. In some instances, a regional entity may be needed to collectively inform and share the views of the local people at a national level.

Suggested actions:

1. Ensure the Regional Policy Statement notes the potential impact of CO2 equivalent emissions on existing industries' and Southland's image.

2. Advocate that establishment and maintenance costs of infrastructure, monitoring and ETS costs should be fully paid by the industry, and not subsidised by tax or ratepayers.

3. Facilitate and encourage open communication between the public and developers around large scale developments.

8.6.1 Large Scale Exploitation of Lignite

An International Lignite Symposium was held in 2005. Since then opportunities for electricity, lignite briquettes, liquid fuels and fertilisers have been investigated, and processing sites for these developments have also been explored. The lignite in Southland, with a similar calorific value to wood but higher CO_2 equivalent emissions, although a poor quality coal compared to other New Zealand coals, is considered a strategic asset nationally. Modest scale mining of lignite already takes place at the New Vale mine, and some of the region's larger energy users use this resource.

Solid Energy and L&M Group are proposing to mine Southland and Otago lignite, with reserves totalling areas of 3,000ha and 20,000ha respectively.[92] Solid Energy state their aim is to produce reliable energy sources and high-value products, using the 1.5 billion tonnes of local resource. As part of this, they have searched globally for technologies in lignite conversion and gas production from coal, as part of a drive to achieve energy security for New Zealand. "Southland lignite reserves, along with other gas development projects from coal, could be New Zealand's insurance policy, giving the breathing space to move in the long-term from fossil fuels to economically reliable and sustainable renewable fuels. It would also help New Zealand survive oil, energy and commodity price shocks in the short-term."[93]

Options for using this poor quality coal include converting it to liquid transport fuel using either:

- Indirect Gasification — this is the same front-end technology as in coal to fertiliser but with conversion producing high-quality transport fuels rather than fertiliser
- Direct Liquefaction — reacting lignite in a solvent with a source of hydrogen at high temperature, also producing high-quality transport fuels
- Pyrolysis — heating the lignite at medium temperature in the absence of air, producing coal tar.

Fischer-Tropsch process was previously investigated, but involves large scale investment. The intention would be to embed this liquid fuel into the domestic market to substitute fuel imports, and potentially create an export commodity. Concept studies are continuing with plans for a commercial plant in 2019–2020.

[92] Parliamentary Commissioner for the Environment (2010). Lignite and climate change: The high cost of low grade coal.
[93] Solid Energy (2011). Submission on Draft Southland Energy Strategy

Solid Energy is also considering two other products, nitrogen fertiliser urea and briquettes. New Zealand is currently a net importer of fertiliser, and the urea produced would substitute fertiliser imports, and potentially create an export product as well. Solid Energy anticipate final decisions about the plant location in late 2011, various plant size options are under consideration.

Solid Energy has applied for consent for the briquette plant on industrial zoned land at the Mataura mine site on Craig Road. If consent is granted, technology of Solid Energy's joint venture partner GTL Energy will be used to produce up to 90,000 tonnes per year of briquettes from 150,000 tonnes of lignite mined from New Vale mine. However, the economic viability of this option is not well known and the plant will essentially be producing the briquettes in order to begin testing the market for potential returns. Solid Energy plans to trial these technology paths in New Zealand conditions through demonstration pilot projects to build capability and knowledge. If successful, these projects will lead to larger-scale commercial operations.
For reasons of local resilience it is desirable for the region's energy reserves to be used to substitute energy imports where possible and legislation which enshrines this approach is encouraged.

With the investigation and development process already under way, local consideration needs to be given to when is the best time to;

- Begin to build the physical support infrastructure (roads, bridges, water, power).
- Begin to train the required trades to support the technologies that will be used.
- Mitigate some of the social pressures such as housing limitations for the supporting work-force.
- Begin to provide or plan for environmental support and protection.

However, there is a risk in moving too early with such associated infrastructure investments, particularly if ratepayers or taxpayers are going to be taking some of this burden. In some instances, some infrastructure upgrades may be consistent with a broader strategy aimed at improving resilience and movement of goods. From the locals' perspectives reflected in submissions on this strategy, a strong steer was given that external costs of the industry should not be borne by local rate and tax payers. Local government should ensure that establishment and maintenance costs of any infrastructure/monitoring should be paid by the industry, and central government should ensure the full ETS costs are paid without free allocations of units.

During the submission process Solid Energy stated that "Each project will take care of its own ETS liability with full carbon costs being factored into the project economics along with emission mitigation being a fundamental consideration for the project design and operation." As well as finding ways to generate fewer emissions in the first place, they are looking to offset emissions by planting more trees through commercial forestry, storing more carbon through pest control programmes, purchasing carbon credits and/or storing carbon underground. They are currently trialling their own Biogold^{TM} diesel in their Newvale Mine equipment fleet. This proactive response with regards to CO_2 is one which the public would likely be supportive of, and should be encouraged for all potential developers of fossil fuel reserves.

There is potential for national policies to change to be less supportive of such developments, particularly as public awareness of the climate change implications of such developments grows. Plans to extract this resource as a strategic asset are in conflict with New Zealand's goals and international agreements around greenhouse gas emissions. Diesel produced from coal using Fischer-Tropsch processes has a higher carbon footprint than the diesel we use now. Such developments would "increase the gap between the international climate change commitment", by 20–50%, a bill which would end up being paid for or subsidised by taxpayers[94]. Clean coal is not a likely prospect within the near future, and further discussion on carbon capture and storage technology is provided in section 9 of this document.

There is a strong local stakeholder desire for the potential social and environmental effects of such developments to be adequately addressed. There are already local and national groups who are strongly opposed to increasing mining activity in the region, as reflected in a strong public presence with an anti-mining march in the streets of Invercargill attended by approximately 400 people.[95] Although the main message was against mining public land, many also had strong views on the lignite reserves in Southland.

If the lignite is extracted, it will likely be exported in some form. This means that Southland's existing businesses are unlikely to receive any benefit, by way of reduced input costs, because the products will be sold at world prices[96]. Input energy to processes will need to be either provided, competing with existing demand, or internally generated. Options for sources of energy for such developments could include utilising waste energy from a plant in a synergistic application (eg warmed algae ponds), for which potential implications on land use around any plant would require consideration.

Several of the submissions on this strategy noted that Central Government has a history of ignoring the local impacts of national initiatives, the Clutha Dam and Manapouri power schemes are two past examples of this. Furthermore Ohai and Nightcaps were given examples of the lasting negative effects of mining coal on people, communities and social wellbeing. They noted that the mining of lignite has not been promoted by the Government to primarily improve the local environment or help local communities. Local concerns with regards to environmental impacts include:

- CO_2 equivalent emissions
- air pollution through airborne particulates
- damage to the landscape
- soils displaced
- damage to waterways
- damage to aquifers
- using future generations' resources

There were also concerns around the track record of the mining industry and how adverse impacts in any of the above areas may impact on the ability to use a "clean green" image to promote farming in the region. This is noted as a risk. However, in particular, the dairy sector would require significant changes to the energy source of its processing plant before it could genuinely promote itself as with a "clean green" image without risking serious criticism.

[94] Parliamentary Commissioner for the Environment (2010). Lignite and climate change: The high cost of low grade coal.
[95] Transition Towns (2010). Southerners march against mining, saying "Ours - not mines!" http://www.transitiontowns.org.nz/taxonomy/term/923
[96] Parliamentary Commissioner for the Environment (2010). Lignite and climate change: The high cost of low grade coal.

Public submissions on this strategy reflected concern that in relation to large scale lignite mining, the number of real jobs and the potential economic benefits for local communities hasn't been properly quantified. These have not been considered yet in many situations because the projects have not been formalised. It is expected that aspects such as job creation, economic and social benefits would be investigated by the developer at the feasibility stage. Solid Energy state the annual increase in GDP from a urea plan would be up to $377 million, based on today's urea price of US$265 per tonne. Jobs will also be created with total capital expenditure potentially exceeding NZ$10 billion in construction projects, upgraded infrastructure and on-going work for associated industries. The following gives some indicative figures of likely employment levels:

- Briquette Plant Phase 1 – September 2011 – Commissioning May 2012, operational workforce: 12 at plant, 3 at mine. Construction workforce 50–70 (Eastern Southland)
- Briquetting Phase 2 – 2014 operational workforce: 30 at plant, 150 at mine. Construction workforce 500 (Eastern Southland)
- Lignite to Fertiliser – 2017 operational 160 at plant, 200 at mine workers (Eastern Southland) Construction workforce of 2500 for 2 years
- Lignite to Diesel 2019/2020 operational workforce of 670 workers (Waituna Ashers or Mataura Basin) Construction Workforce 3500 (3.5 years)

Many submitters requested that a 10 year moratorium be placed on the extraction of lignite to allow time to ensure the best use of this resource is undertaken for the direct benefit of New Zealand, while avoiding environmental impacts. Although the Resource Management Act process will require that environmental impacts are adequately avoided remedied or mitigated, it does not cover the carbon emissions. Submitters put together a strong argument for a strategic decision to leave the lignite reserves in the ground until such time as carbon capture and sequestration is proven to be effective, noting that the value of the resource is only likely to increase in the interim. It is not considered the purpose of this strategy to make such specific demands, but to identify the issues and opportunities for the region, noting relevant considerations for progress in each of these areas.

Suggested actions:

1. Ensure that if lignite reserves are extracted, local social and economic benefits are maximised, and any associated adverse environmental impacts are adequately avoided, remedied or mitigated.

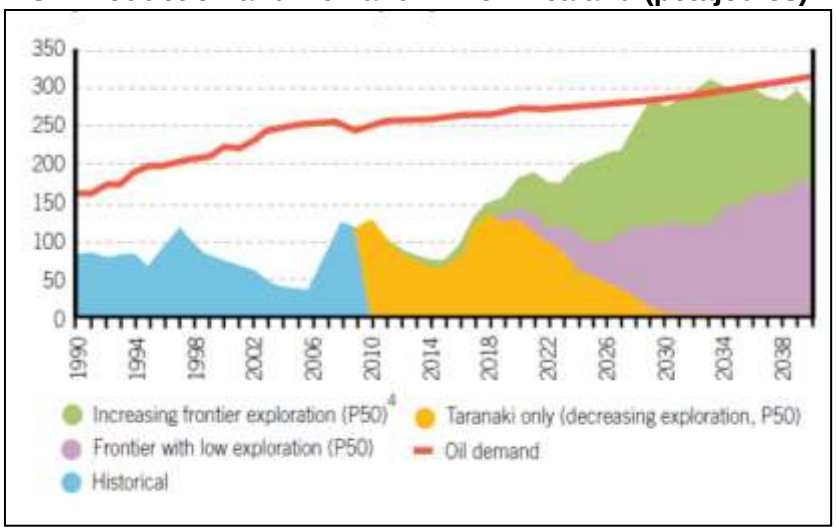
2. Promote minimisation of CO_2 equivalent emissions, the development and use of environmentally sustainable sequestration opportunities and the implementation of carbon offsetting initiatives.

3. Investigate the establishment of legislation which would see locally sourced energy resources retained for local use as an import substitution.

8.6.2 Offshore Oil Exploration

It is possible that at some point in the future the oil resource in the Great South Basin will be extracted. Supply shortage predictions are soft but there are increasing indications that there will be significant excess demand for oil within 30 to 50 years and for that to be met activities will need to begin in the foreseeable future.

Oil Production and Demand in New Zealand (petajoules)



Source: Ministry of Economic Development.
New Zealand Energy Strategy 2011-2021

Southland is already considering the effects and requirements of becoming a service centre for a deepwater remote offshore oil industry. The benefits of Southland becoming a service centre would include an increase in job availability and economic activity for related servicing industries – if the potential employees and servicing industries have the skills required.

Currently there is competition to become the base for future activities in the Great South Basin, particularly around the port facility, although a long term view is certainly required. There are infrastructures that will need to be upgraded, and preparation should be being made for timely investment. Examples of associated investment areas include: airport, storage onshore at Bluff, water supply to the port, environmental support or protection, search and rescue. Oil/gas is realistically unlikely to come ashore but if exploration is successful the area will become a major transport, maintenance, communication and logistics hub. A resource of trained rig labour would add to the attractiveness of the port. Providing an offshore industry may require additional infrastructure.

- Consideration could be given to facilitating the establishment of onshore operations initially for supporting exploration activities, making sure that any compliance issues can be dealt with rapidly using fast track but comprehensive planning processes.
- Having an appropriate infrastructure skeleton in place that would allow for expedited establishment in terms of support facilities by foreign companies coming into the area would allow some control and capture of economic effects and benefits.

The expected timeframe would involve a positive decision in 2011 to be followed by seismic exploration in 2011/2012 with 15 workers, exploration drilling in 2013/2015 with 250 workers and, if prospects are proven, production drilling in 2015– with potentially 300–350 workers.

The biggest risk for Southland is that some of our greatest assets, coastal landscape, aquaculture and biodiversity wise, could be impacted in an oil spill situation. Advocating for best practice is paramount to avoid this. However, in the case of a spill, the equipment required to clean up is often not on hand, and there is a time delay in accessing it. Therefore, it's suggested that it is a requirement that the spill equipment be housed in Southland to ensure quick access in the event of a spill.

Suggested actions:

1. Ensure that if oil reserves are extracted, local social and economic benefits are maximised, and any associated adverse environmental impacts are adequately avoided, remedied or mitigated.

2. Promote minimisation of CO_2 equivalent emissions, the development and use of environmentally sustainable sequestration opportunities and the implementation of carbon offsetting initiatives.

3. Request that oil spill recovery equipment be located within Southland to ensure quick recovery in the event of a spill.

8.7 Other Potential Developments

In 2003 Venture Southland commissioned a Regional Energy Assessment[97]. The assessment paints a full picture of the opportunities available in Southland for renewable energy development. There have been a number of potential developments in the previous energy assessment which remain unchanged, particularly in relation to wind and hydro. The following strategic actions from the previous energy strategy are still considered relevant, hence the following have been carried over into this updated strategy:

Suggested actions:

1. Promote the development of secure and reliable energy supply for existing industry.

2. Promote the development of energy opportunities to encourage the attraction of appropriate industry to Southland.

3. Work with local Councils to encourage the inclusion of proactive policies, which facilitate the development of renewable energy generation and exploration, generation and transmission projects for consideration as part of long term plans.

4. Work with regional and local Councils as part of a review of the Regional Policy Statement and regional and district Resource Management Act plans to ensure that these reflect energy needs and this strategy.

5. Monitor legislative code and policy changes including changes to the Resource Management Act and if necessary submit as part of the public consultation

6. Encourage review of current legislation which places unnecessary restrictions on electricity distribution, generation and retailing. (The current legislation introduces elements of risk, which constrain investment in smaller regional generation projects by line companies. Southland therefore needs to advocate for the modification of the current legislation to allow lines companies to not only retail energy from power generation investment projects but also have the ability to manage the risk on the same basis as other generation investors).

[97] East Harbour Management Services (2003). Regional Energy Assessment for Southland.

7. Promote the establishment of cost effective reserve generation capability in Southland.

8. Wind Monitoring: Facilitate the establishment of wind monitoring and enhanced wind mapping to identify suitable zones for wind generation and ensure that appropriate RMA planning provisions are made.
9. Promote awareness of potential manufacturing and servicing opportunities for: solar energy componentry, heat management and recovery systems, hydrogen cell technology and systems, marine energy technology, photovoltaics, energy metering and control systems for grid interface.

9. Carbon Sequestration (5 to 10 years)

Carbon capture and storage will be an important issue in regards to climate change and the ETS balance, particularly as "projections for global energy demand still point to fossil fuels being combusted in quantities incompatible with levels required to stabilise greenhouse gas concentrations at safe levels in the atmosphere."[98] Carbon sequestration is a technique for long-term storage of carbon dioxide or other forms of carbon to mitigate global warming. Southland has a range of opportunities in this area that could impact the energy situation. Other than planting more trees, these options include the incorporation of carbon sequestration in the agricultural sector by creating bio-char and adding this to soils, and the potential use of the Western Southland geological cap structure as a geo-sequestration site. Capturing and transporting technology is well understood but expensive. Storage is less well understood.

"Considerable energy is required for the capture, compression, transport and storage steps involved."[99] Geo sequestration imposes a heavy energy penalty on the process using it as a means of carbon dioxide disposal. This can be as much as 8% to 12% of the energy generated by the combustion of the carbon. A geo-sequestration plant sequestering 7 tonnes/day, roughly the transport contribution of Southland, requires a 7 MW power source to run it. Current carbon capture technologies are based around the Amine cycle. For a typical thermal power station the Amine plant adds about 30% to the land footprint of the station and adds a complex chemical processing plant to the generation site. Other technologies are under development but all have technical hurdles and none so far have come up with an energy efficient way to compress the captured gas to pressures where it can be injected into suitable geological formations. "All technologies along the CCS chain have been in operation in various industries for decades, although in relatively small scale. These technologies have only been put together in industrial scale (>1Mt CO_2 captured and stored per year) in a small number of installations."[100] It has been reported that there are over 80 CCS projects throughout the world. However, at the time of writing, according to Global CCS Institute there are now only 71 projects. Of those, only seven are operational.[101] When this technology will mature enough to enable commercial application in Southland is debateable.

Significant geological investigation would be required to determine the technical feasibility of using this structure, including assessment of injectivity and the efficiency of the geological seal. The current status of this technology is best summarised "...it appears unlikely that CCS will deliver significant CO_2 reductions in a timely fashion. In addition, many uncertainties remain over the permanence of CO_2 storage, either in geological formations, or beneath the ocean. We conclude that further investment in CCS should be seriously questioned by policy makers. "[102]

There are concerns around potential contamination of aquifers, and lack of national or local rules governing legal or financial liability in the event of storage failure. The consequences of release of carbon dioxide from below-ground reservoirs have previously caused widespread loss of life, as was seen in the 1986 disaster in Africa. Although this particular example was a natural reserve under a lake, the consequences of the release of man made reserves could be similar if not properly managed, and in a country with high geological activity, such as New Zealand, potentially more likely.

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[98] International Energy Agency (2011). http://www.iea.org/ccs/

[99] S.C. Page, A.G.Williamson, I.G.Mason (2009). Carbon capture and storage: Fundamental thermodynamics and current technology. Cited in Energy Policy. www.elsevier.com/locate/enpol

[100] International Energy Agency (2011). http://www.iea.org/ccs/

[101] International Energy Agency (June 2011). Twitter.

[102] S.C. Page, A.G.Williamson, I.G.Mason (2009). Carbon capture and storage: Fundamental thermodynamics and current technology. Cited in Energy Policy. www.elsevier.com/locate/enpol.

The other significant barrier for sequestration is the carbon dioxide collection/delivery pipeline. Consideration of opportunities to route pipelines for CSG in a way that allows for them to be used in off peak times for the transport of carbon dioxide to sequestration sites should be considered in any regional reticulation plans. The economics of pipeline transport depends a lot on the operating pressure. Typical geo-sequestration injection pressures are over 74 bar (1070 psi), and rating pipelines for this pressure will not be economical as the core use will be at significantly lower pressures requiring careful analysis of overall economics and transport of the energy necessary to compress the gas in order to transport it to the injection site.

Carbon sequestration through the use of bio-char involves the pyrolysis of biomass to produce bio-char, which is then returned to the soil and acts as a carbon sink by capturing carbon into the ground for a long time. The bio-char charcoal also contributes to soil health. There needs to be a better understanding of the desirability of recycling material back to the soil. National policies also need to include soil carbon if this method of sequestration is going to be recognised under the ETS.

Parties who have access to the Southern lignite reserves have undertaken considerable work investigating the potentially important innovation of Carbon Capture and Sequestration. Indeed, if this technology can advance it has potential to allay many of the public concerns around the use of our lignite reserves. The 'Clean Air Task Force' concluded in 2009 that "no credible technical body has found adequate CO_2 emissions reductions are possible without widespread use of CCS." Therefore we can expect to see continued widespread investment in developing this technology, and it is important to keep a watch on developments. The use of CO_2 in enhanced oil recovery could complement future oil and gas developments in Southland.

Suggested actions:

1. Investigate the broader benefits of bio-char to soil health, and advocate to central government for the inclusion of soil carbon into the ETS if appropriate.

2. Maintain an awareness of Carbon Capture and Sequestration technologies for potential application in Southland.

10. Remote Communities

10.1 Stewart Island

The viability of running an electricity cable from Bluff to Stewart Island has been examined. The idea was shelved due to high capital and operational costs and the inability to guarantee constant supply. It has been suggested costs would be in the order of $9 million. Additionally, citing experience of the 1980 NZ Post Office cable that ran to the Island, which suffered from outages due to oyster dredging, anchor snags and other causes, the ability and cost to ensure constant supply would be both difficult and highly expensive.[103] An independent report undertaken by Meridian Energy subsidiary RightHouse[104] made similar findings. RightHouse suggested that a cable would have a capital cost in the vicinity of $10 million and would have an ongoing maintenance cost of $300,000 per annum. In both instances the net effect of delivering electricity across a cable like this would push the cost to consumers well past existing electricity prices.[105]

Stewart Island Electrical Supply Authority (SIESA) has been investigating alternative means of power generation for Stewart Island for both the environmental and economic benefits of renewable generation. At this time, a trial of solar and wind is running on the Island incorporating the following renewable energy assets:

- A 2kW array of Amorphous PV panels mounted on the Stewart Island Department of Conservation office, and;
- A 2kW array of Monocrystalline PV panels mounted on the Stewart Island Flights office, and;
- A 2.4kW (nominal) Skystream wind turbine at Schofields on Ringaringa Road.

Real-time and historical information about how the two different solar arrays are performing can be viewed on www.siesa.co.nz. Monitoring using this system first started on the 23rd of June 2010. However, the panels have been operating since October 2008. The data obtained from the PV trials is scalable, but the wind monitoring is not. Therefore SIESA has sought a scoping study for monitoring wind generation opportunities, which is currently being considered. If larger scale wind generation is found to be viable, the next key step would be identifying an appropriate way to store this energy. EECA has also been undertaking research into remote communities which may be worth reviewing.[106]

Suggested actions:

1. Secure funding for study to monitor large scale wind generation opportunities on Stewart Island.
2. Investigate energy storage options for energy generated on Stewart Island.
3. Promote small-scale renewable energy development in remote areas given the significant potential and resulting benefits.

[103] McNeill, R., et al. (2007). A proposed way forward to deal with electricity supply on Stewart Island.
[104] Capper, J., et al (2008). Initial Findings and Recommendations from Stewart Island energy efficiency and generation study.
[105] Cited in Stewart Island Electrical Supply Authority Website (2011). http://www.siesa.co.nz/
[106] Empower Consultants (2008). A study of alternative energy supply options for remote communities. http://www.eeca.govt.nz/sites/all/files/distributed-generation-for-remote-communities-report-08.pdf

APPENDIX I - Stakeholder Workshop Notes

Background:

In order to update the Southland Energy Strategy, Venture Southland commissioned Aurecon to undertake a review of the previous strategy. As part of the review, a stakeholder workshop was held on 24 June 2010 as an open forum and was attended by approximately 40 stakeholders from inside and outside the region. The workshop was facilitated by five senior executives from Aurecon, who were specialists in different areas of energy technologies, industries, and planning. The workshop consisted of two small-group discussion sessions which reported back to the group as a whole, giving the stakeholders attending the workshop as much opportunity as possible to contribute ideas and opinions. This document notes the interests and concerns raised during the workshop, with bolded headings showing the topics covered in the discussion, and subheadings indicating themes. These are reflected in the updated energy strategy.

Attendees

- Jackie Kruger – Invercargill City Councillor
- Chris McKeown – L&M Petroleum
- Paul Withers – Gore DC
- Graeme Sycamore – Invercargill City Councillor
- Dave Rohan – Southland Chamber of Commerce
- Nathan Donelly – Alliance Group
- Ross Fraser – Living Cell Technologies
- Tim Shadbolt – Mayor Invercargill City Council
- Rachel Poole – Tuatapere transport and Lindsay Dixon Sawmill
- Tanea Hawkins – Recycling Southland Ltd
- Nigel Gear – South Port
- Jeff Troon – Venture Southland
- Steve Canny – Venture Southland
- Meghan Dick – Venture Southland
- Simon Cockroft – Venture Southland
- Robin McNeill – Venture Southland
- Kendyl Kennedy – Venture Southland
- Blair Jackson – RPC Consultants
- Walt Denley – Environment Southland
- Ken Swinney – Environment Southland
- Dean Addie - EIS
- Roger Paterson – Powernet
- Marcus Roy – Southland District Council
- Dave Adamson – Southland District Council
- Unknown representative – Aurecon
- Steve Jenkins – Aurecon
- Bruce Ford – Stewart Island Community Board
- Richard Hay - Southland Chamber of Commerce
- Ben Dunbar-Smith – EECA
- Len Damiano – Solid Energy
- Greg Visser – Solid Energy

Thermal / Coal / Generation / Chemical Process & Biological Processes / Metro Waste

Lignite vs Wood

- Industry – Lignite extraction industry in Southland – would be hard to export because of high moisture content and it falls apart
- LNG – L&M investigation 100,000 litres LNG per year can replace diesel
- L&M – workshop next month, CNG, LNG
- "Elephant grass" being grown all over New Zealand, gets mixed in with coal
- Southland residents have been forced out of using good quality coal, i.e. Ohai coal. Briquettes have lower sulphur and less moisture, sold to commercial companies, schools etc. Demo plant being built with trials in the export market – going to China/Chile etc. Time frame = 2011. 65 degree heat required to dry the coal, us the coal to dry the coal
- Pellet plant: will lignite pellets take over wood pellets? Lignite briquette 50-60% [the cost?] of wood pellets
- Is there a market in the Southland area to service wood pellets? Wood pellets are the cleanest burning resource available. Wood pellets are primarily being exported to Europe, Italy, Japan. Sawdust from local mills sold to farmers for dry pads on farms.
- Barriers for Solid Energy plans regionally:
    - Infrastructure: roads, rail, electricity
    - Resources: people, trades etc
    - Consents: time taken to get stuff approved

Opportunities from Waste

- Collaboration in Invercargill, it is 38km to landfill although using lime quarry so can use methane gas effectively. Sludge, compost, bio-gas, fat sludge, municipal waste, meat works, Napier = 13MW combuster urban lumber
- Landfill gas – flair at 800 degrees
- Bio-mass – Add to landfill (central) economies of scale, Washdyke single boiler
- Rotorua – Waste to gold process, the feedstock is own waste
- Landfill vs offsite plant
- Gas – heat: pool, hospital, town hall (like Christchurch)
- Need for strategy: re sludges/biomass waste, characterise all amounts – 100% to capture all value. Characterise waste destinations, characterise potential uses, economic benefits and environmental impacts
- Use above to define strategy for disposal of waste mentioned
- Energy is going to get progressively more expensive every year now
- Can we use forestry to generate energy resources
- ETS: plant forestry, get carbon credits, harvest, could it work? What would you do with the waste?
- Waste in Bluff Hill pines, etc

Planning, Policy and RMA

Local vs national needs

- Efficiency of resource use for communities is important, a focus on best use.
- What about Southland's energy contribution to the whole country, not just Southland?
- Recognition of region's energy resource and the role this plays in economic development (both regionally and nationally)
- Impacts to consider through the strategy: air, water, infrastructure, etc the use of the energy strategy as a platform then policy can enable
- Certainty as well as flexibility
- Objectivity and a balanced perspective is vital.
- It's not all about development, it is about the RIGHT kind of development
- Community well-being needs to be considered

- A look at energy from waste streams and other new sources eg algae. The conflict between crops for fuel vs food security

Long term view

- Future direction needs to be considered
- Timing for Environment Southland: ES are at the initial stages of the regional policy statement (RPS) and district plan, which the energy strategy will feed into. From ES point of view: the strategy must be balanced – that is the best use of resources, match to community need, etc, and the strategy must incorporate local issues
- A focus is required on the energy future as much as the current issues/situation. Keeping an open mind for our energy future and consider future scenarios of a global scale
- Include a section on constraints. Responsibilities needs to be included in the strategy also
- Formal review period identified for the strategy including review of the social, economic and environmental impacts. 5 year cycle for this is realistic with identification of some elements that may require attention earlier than 5 years
- Include what is known and what is conventional vs what is possible. What are the uncertainties?
- Forward thinking, what happens when non-renewables are gone? What investments have been made towards future infrastructure?
- Can the strategy help to paint a picture of the future look of the region and begin educating/informing public expectations?
- The importance of continuing and improving energy conservation

Barriers

- Can councils and processes enable innovation: eg improved education, identify and remove barriers
- Are policies and plans enabling or barriers? What about incentives?
- Wind developments close to demand points – work towards these becoming permitted activities. Allowance through RPS for projects of national significance to go through the EPA. Identification of areas of good resource is a possibility but you don't want the identification of these areas to drive up land prices unnecessarily
- Look at the restrictions eg small wind generation (distributed generation) and how difficult it is to incorporate these into current energy systems. Look at the regulatory environment and possible changes. Eg government mandate for double/triple glazing? What about a 'star rating' for energy efficient homes to guide renters/buyers – perhaps local authorities could have a role to play in this.
- The energy strategy can encourage work outside the strategy – eg the benefits of developing a concept energy efficient herringbone and rotary dairy shed design available for farmers to consider.
- Holistic look at infrastructure (cross-council boundaries). Improved information sharing and standards between councils – mechanics of applications
- More coordination (industry as well as council) how can councils and policies encourage this? Existing organisations ability to facilitate eg Wastenet
- Identification of missed opportunities eg council and industry collaboration. Eg energy conservation and cogeneration

Renewables

- Untapped opportunities for further use
- Demand for renewables – a unique competitive advantage for the region?
- Local resilience – the need for diversity and not reliant on one source
- Need to have higher level policies

Addressing Barriers

- Issues around infrastructure (grid, peak loads etc)
- Managing impacts
- Proactive planning in preparation for large scale generation eg landscape values
- Small scale generation – ability to feed back into the grid
- Opportunities off grid systems. Barriers? District plan?
- Using a rating system to incentivise small scale renewables, eg solar. A barrier because rates would become unaffordable?
- Feedback into the grid – credit and pay. Canberra = 3.8% price to feed back. Requires Government incentive though
- Collective strength – network companies and economies of scale
- Electricity companies producing incentive – off grid to take load off line, current disproportion of line charges

Efficient use

- Seasonality of industries
- Power Factor – needs regulation/mandated
- Dairy shed regulation – incentives for more efficient sheds, regulate water use, review electricity charges
- Business use – opportunity to become more efficient

Wood

- Opportunities for wood – biomass – increasing demand due to the ETS

Other

- Marine technology is still a while away
- Hydro – sustainable? Rainfall. Project aqua – locals pro [?]
- Deep geothermal – earth loop – regenerated steam
- Solar – photovoltaics, solar thermal – in Australia this is combined with steam. Technology range causing issues
- Wind turbines – marine grade required for Southland conditions. Noise standards?

Industrial developments

Lignite

- Is the social impact worth the costs for new industry vs a resource that is becoming more and more valuable?
- Are Southland's best interests aligned with New Zealand's? (Referring to lignite)
- Meeting the needs of existing industry and looking after it
- Water use and energy use are both interlinked so both must be considered together
- What about clusters and synergies?
- Coal seam gas – water content could be useful for other industries eg cooperative projects heat vs cooling

Other industries

- Extractor industries, export industries
- Lignite, water, wind, wood – regionally
- Gas in western Southland – finding an economical way to extract it, is the demand for gas there in Southland? How effectively can it be used? Export opportunities?
- Our big industry is growing food so energy efficiency within this industry is important as growth worldwide in the demand for food grows.
- Primary products – meat: skins sent to China after being salted
- Aluminium – rims on tyres sent away – cheaper labour in China, etc compared to Southland
- Shelf life of products – new technologies to keep products fresh for longer, better packaging etc
- Strategic choice for new industry if new developments come on board (Southland may get to be selective about what industries move into the region)

- Entice industry through the energy strategy. Which industries? Eg new dairy processor
- Transport fuel crisis
- Quality of life in Southland is great, cheaper to live, cost of fuels etc
- A contradiction: if energy is too cheap, people will waste it, if it is too expensive people won't pay
- Infrastructure

Skill gaps

- New technologies developing all the time. Encourage people to gain skills needed for projects that will be developed in the next 10–15 years. Tertiary education facilities need to work with major industry players
- Need ongoing level of skills in employees – a lot leave the region after they have graduated, need to retain students after they graduate, provide education locally so they don't have to leave
- Regionally – make an investment in knowledge and skills that will be required in the next 10–15 years
- Up-skill local people vs bringing in trained people from outside the region
- Education needs

Efficiency

- Look at the use of waste stream material
- Community investment into efficient systems (not looking at the narrow economic view of x% return)
- A way of encouraging energy self-sufficiency as much as possible for large industry
- Major industrial developments should have an energy plan
- Use of natural/local grown fibres for insulation
- Tourism as an industry: negative for a coal-fired power station – a huge effect on this industry