Southland Regional Energy Assessment

Report to

Venture Southland

By

East Harbour Management Services

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EAST HARBOUR MANAGEMENT SERVICES
P O BOX 11 595 WELLINGTON
Tel: 64 4 385 3398
Fax: 64 4 385 3397
www.eastharbour.co.nz
www.energyinfonz.com

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Executive Summary

The energy assessment has identified the following;

- Southland is energy rich, and by the region taking a measure of proactive control over how it is used, can enhance regional economic growth.

- The availability of fossil fuels and the hydrology, topography and climate for renewable energy provides a wide range of options for electricity generation and is adequate to allow for natural regional growth and development.

- Future demand for energy by existing and new industry can be met by;
  - Improving current use of energy. This will reduce current energy costs and increase regional competitiveness.
  - Investment in on-site energy plant. There are a number of investment opportunities that existing business can take which will reduce current energy costs and increase security of supply. These include;
    - Cogeneration of electricity using coal or biomass,
    - Production of heat from biomass fuelled boilers using process residues,
    - Installation of solar water heating at commercial facilities such as rest-homes, hotels, motels, and other large volume hot water users,
    - Processing of liquid waste from farms and industry in bio-digesters to produce gaseous energy.
  - Construction of new electricity generation plant. The region has large scale electricity project opportunities that can be both economic, and be built to meet environmental and community aspirations.
    - Wind (100+MW). There is a large number of potential wind farm sites, both on the coast and on inland hills that could be accessed. Development of these will require the obtaining of good wind resource information and full public consultation on location. Wind projects can also be used in conjunction with existing hydro storage lakes to provide firm electricity supply, (essentially the hydro lake acting as a battery).
    - Lignite (150+ MW). The region has vast amounts of lignite and coal available for electricity generation that can be mined and used within likely resource consent conditions. Only 150MW is identified here as that is within the current transmission constraints of the region. Electricity generation could be from stand alone power stations, or cogeneration facilities in association with other existing or new large energy users.
    - Hydro (70-120MW). There are potentially a number of small hydro generation opportunities in the region with the largest being associated with the head difference between lakes Te Anau and Manapouri.

- The Transpower transmission system provides a significant constraint on the region being able to access firm and reliable electricity. While the constraints have a low level of occurrence the lack of being able to access electricity with guaranteed supply and cost inhibits energy using industry from locating in the region. The Transpower transmission network is also a critical component of infrastructure which without adequate investment will continue to be a barrier to regional economic growth. There is significant value in encouraging early upgrade of the transmission network.

- Encouraging the Government to install its dry year reserve generation in Southland would assist overcome the transmission constraint as the generation is likely to operate when the constraint occurs. It would provide a cap on electricity prices and assist stabilise price volatility.

- The Powernet lines network provides adequate and reliable distribution of electricity to users. The network is reasonably located and has capacity for connection to most possible new generation facilities.

- An additional 190 GWh per annum of energy is achievable from improvements in energy use and new investment projects in the period up to 2010 (equivalent to about 60 MW of new generation). A further additional 1990 GWh per annum is achievable between 2010-2015 (equivalent to about 425 MW of additional electricity generation). This generation is available at around 7-15c/kWh (which is within future cost projections) depending on location and specific project.

- Gas underlying the region and offshore is potentially the most valuable resource and exploration is encouraged. Gas has the flexibility to firm intermittent renewable energy sources and can be used in a large number of applications.

- The immense coal reserves are a valuable energy resource within the region and could be exploited for regional economic growth. Developing a partnership between the region and coal resource owners may assist the identification of opportunities such as the pelletisation of coal fines.

- There are a number of other energy sources within the region that in time will become more valuable. Many of these are associated with industry processing or dairy farming. Some of these are traditional such as wind pumping of water, while others such a liquid waste digestion to produce gaseous energy have been around for years but have not been economic to develop. It is recommended that the region establish a research programme that investigates these technologies in greater detail and encourages their uptake.

- Future technologies that are worthy of research but which are likely to be more long term before uptake include;
  - Wave energy,
  - Production of ethanol from sugar beet,
  - Production of biodiesel from agricultural crops,
  - Rural wind energy utilisation

The recommended strategy for meeting future energy demand and encouraging further major industrial investment in Southland is based upon adopting;

- A balanced energy portfolio strategy.
    - Because the region is rich in both fossil fuels and renewable energy it will obtain greater value from each by an integrated utilisation. Fossil fuel energy is extremely valuable in firming less reliable and intermittent renewable energy.

- An informed community attitude to energy use and supply.
    - Many of the energy opportunities involve the general community to greater or lesser extent. Providing the community with knowledge about energy utilisation will assist adoption of wise use practices.
    - Well informed communities will be able to consider resource consents applications fully and focus their attention on potential adverse effects rather than support or opposition per se.

- Avenues for open access to information on energy technologies, equipment, specialists, and resources.
    - The lack of ready access to information of the energy resources and technologies is a major impediment to wise utilisation of the region's energy resources. This information needs to be readily available in open access.
    - The preparation of a directory of equipment suppliers, advisors etc will improve access to potential energy opportunities

- A strategic regional approach to RMA planning
    - Value will be maximised by an integration of energy activities between investors, regulators, suppliers and the community. Establishing a strategic regional approach will assist identify appropriate opportunities and assist with the obtaining of resource consents.

- Active facilitation and coordination by Venture Southland on energy matters.
    - The multitude of potential activities requires facilitation and coordination by proactive leadership as provided by Venture Southland in other areas. This may also be assisted by active facilitating investment by the Venture Southland Charitable Trust.

- A programme of community and industry activities to remove barriers and assist investors secure opportunities.
    - Many of the energy opportunities involve current technologies and knowledge. There is however a lack of knowledge about the technologies by many who could benefit from their implementation. This can be overcome by establishment of proactive mentoring and education.
    - The lack of trade skills to implement many of the energy opportunities could be addressed by Southern Institute of Technology training courses. Many of these trade shortages are nation wide which provides an opportunity for employment of trained people.
    - The establishment of an energy institute based on the provision of energy education, research and facilitation could meet the skill requirements and link to coordination and facilitation.

Southland Regional Energy Assessment

1. Introduction

Venture Southland commissioned this assessment of the availability and demand for energy in the Southland region.

The Regional Energy Assessment provides information on current and predicted future energy demands, and provides an overview of Southland's energy development opportunities.

The focus of the assessment project brief is aimed at identifying:

- *Existing information and data.*
- *Southland's energy resources and infrastructure.*
- *The constraints or barriers (if any) for regional economic development caused by a lack of 'Distributed Power,' infrastructure limitations, grid management, energy security and other factors.*
- *Southland's regional advantage in regard to renewable energy as well as fossil resources.*
- *Intermittent energy storage potential, cogeneration potential including the identification of potential commercial interests.*
- *The range of options and the possible viability of renewable energy types.*
- *Current and future energy demand and overall projected energy needs.*
- *Energy efficiency opportunities.*
- *The impacts of the Kyoto Protocols at a regional level including the impacts of a carbon tax.*
- *Resource Management Act implications and possible mitigation strategies*
- *Enabling technologies and energy management systems.*
- *Energy tariffs and pricing.*

The assessment is based around a review of publicly available information and recently updated data prepared by East Harbour Management Services (East Harbour) for and published by the Ministry of Economic Development and the Energy Efficiency and Conservation Authority (EECA). In addition East Harbour has drawn on data from its broad experience of the energy sector. Where necessary data from earlier reports has been moderated by the experience of the consultant.

The information collated has been expanded where appropriate by interview with relevant parties or experts on specific topics.

2. Background

Venture Southland has identified in the project brief that:

> *"There is a lack of available energy for current and projected demand and this is a major barrier to Regional and National Economic Growth. The ability to sustain and expand existing industry and attracting new industry is dependent on a reliable and affordable energy supply.*
>
> *In Southland Grid transmission constraints also limit the ability to deliver robust, high capacity, power supply to existing and developing industry. Current issues relating to diminishing gas reserves and low lake storage exacerbate these problems*
>
> *Venture Southland has established a working group to assess current and projected demands and proactively investigate opportunities to overcome the above limitations. This project is consistent with the Venture Southland Strategic Plan and is a major Regional focus for 2003 and 2004.*
>
> *Low energy costs are one of New Zealand's major economic advantages, however, we as a nation are inefficient users of these energy sources, largely because of our lifestyle and historic factors surrounding the very low cost of energy. This situation is, however, changing and as a region we have opportunity to address the impending energy shortages and the vagaries of climatic change, spot market pricing and increasing energy use. Preliminary research indicates that Southland has significant potential for the development of Renewable and Alternative Energy Technologies based on climatic conditions, geographic and topographical features and natural resources. This is evident by existing data and has been mandated by Industry interest.*
>
> *Southland has the potential to proactively manage its local energy needs and apply surplus energy towards facilitating the development of existing and new industry as well as potentially contributing to the national grid requirements."*

3. Project Scope

The assessment identifies the estimated energy scale, cost and potential environmental effects resulting from the deployment of a full range of technologies, along with the potential community and economic development benefits, and opportunities associated with:

- Renewable Energy.
- Fossil Fuels.
- Energy efficiency.
- Infrastructure development.
- Industry opportunities.
- Dry season management strategy.
- Public energy efficiency promotion and strategy including benefit-sharing proposals.

While the study covers all energy forms priority has been given to those energy drivers that are within the regional ability to influence, or to respond to.

The study covers the whole of the Southland region.

In reporting this assessment the information relating to Stewart Island has been addressed in a single chapter as the issues are quite distinct from the rest of the region.

4. Objective

The principal objectives of the assessment is;

- *To identify opportunities to ensure adequate availability of reliable energy at affordable prices for the region through;*
  - *utilisation of regional energy resources*
  - *addressing electricity transmission/distribution issues (if any)*
  - *improvements in the use of existing end use energy*
  - *exploitation of energy resources for commercial benefit*
- *To identify barriers to achievement of these opportunities*
- *To identify ways of facilitating opportunities*

5. Regional Demographics

There are currently 42,000 residential energy users (11,300 in rural areas and 30,700 in urban areas), and 5,000-6,000 commercial / industrial users in the region. From 1996-2001 the population declined by 6.3% similarly across all three territorial authorities[1]. However recent research undertaken by Statistics NZ indicates that Southland's population decline has bottomed out and that there has been a nominal increase in population since the 2001 census.

The total number of dwellings has increased slightly over the period while there has been a slight decline in average household size with an increase in vacancy rate (10.6% of houses are vacant cf 9.7% nationally). Since that period there has been a turn around in the Southland economy. Business and consumer confidence has risen sharply. Economic growth is probably driven by growth in returns to traditional farming, conversion to dairying, and the boost through growth in student numbers. The average unemployment rate in the year to September 2001 was 3.6% which is the lowest rate of any region in New Zealand and less than two thirds of the national average.

For base line analysis under a business as usual scenario it is assumed that growth in electricity consumption will be at 1-2%. This also reflects the increase in electricity use through greater use of electrical appliances and other equipment.

The continued economic growth throughout Southland will occur at a time when there are major technological changes within each production sector. These technology changes

[1] Butcher, G, Potential Changes in Industry and Employment in Southland Region 2001 – 2016, February 2002.

tend to not only increase energy demand but require higher levels of reliability and quality of supply.

Growth in dairying is expected, with growth to a much lesser extent in other farming to the period to 2016. This will also reflect in an increase in dairy processing with the result that the Edendale dairy factory which has recently expanded production can be expected to install further processing plant on the site.

There will probably be a decline in forestry over the forecasting period, partly because the wood harvest volume in Southland is likely to decline slightly and also because of the shift towards Douglas fir and eucalyptus, which will have low input tending regimes. Beyond 2016 there is a forecast significant growth in log production.

Further growth in wood processing is expected. However the region is short of wood and currently imports wood from North Otago where there will be rapid increases in log volumes over the next 10 years. Further growth in wood processing in Southland is possible over the medium term but it is assumed to be from additional processing to provide higher value products on existing sites.

Comalco indicate that despite being affected by high energy costs that they intend staying in the region. A more attractive electricity supply could attract industry to add value to aluminium produced by Comalco by production of end use products.

The silica resource in the region could be refined if there was adequate electricity supply at an appropriate cost.

Indigenous energy sources such as oil, gas and coal could provide additional economic growth if the region were to partner with resource owners to identify opportunities for utilisation. Building this into an energy based industry around all energy forms could provide for additional skills training particularly in the trades areas, as such skills are in short supply nationally.

A fuller description of demographic changes is summarised in Appendix 1.

6. Current Energy Use

The region has an estimated 48,900 energy customers represented by those premises with electricity accounts. A few of these will be customers with multiple accounts but the percentage of these is unknown. Many energy customers will be purchasers of energy in several different forms eg electricity and coal.

From the electricity supply information an attempt has been made to assess total energy use for each customer. Energy customers have been categorised according to how much energy they typically use. For example in the rural area dairy farms have been separated from other rural energy customers as they use a lot more energy and they also have a number of opportunities for energy substitution. Table 1 shows the assumed annual energy use for each category.

	Electricity kWh pa	Other* Energy kWh pa	Total Energy kWh pa
Residential	8,900	3,800	12,700
Commercial	20,000	17,000	37,000
Medium industrial	43,000	86,000	129,000
Large industrial	380,000	800,000	1,180,000
Average dairy farm	80,000	240,000	320,000
Large dairy farm	180,000	540,000	720,000

* Other Energy includes coal, lignite, wood, LPG but excludes transport

Table 1 Annual Energy Use by Category

The total energy use for each category of energy customer is shown in table 2.

Energy Users	Number	Total GWh of electricity used per annum	Total GWh of other energy (coal/lignite/LPG) used per annum	Total GWh of energy used per annum
Inver/Bluff Domestic	15,495	139	59	198
Rural Town Domestic	15,240	135	58	193
Rural Domestic/non Dairy Farm	11,281	99	42	141
Dairy Farm	610	48	143	191
Inver/Bluff Medium Industrial/Commercial	1,283	55	47	102
Rural Town Medium Industrial/Commercial	4,630	99	232	331
Inver/Bluff Large Industrial	172	66	155	221
Rural Industrial/Commercial	154	290	677	967
Aluminium Smelter	1	4,800		4,800
Total (including smelter)	48,865	5,732	1,295	7,145
Total (excluding smelter)		932	1,295	2,345

- *Includes Edendale and Rayonier MDF
- 1 GWh = 10^6 kWh

Table 2 Total Energy Use in Southland by Category of Customer (2002)

Southland uses 3% of the national residential electricity demand, and 25% of national industrial/commercial demand including Comalco (3% excluding Comalco). Total Southland electricity demand including Comalco is 17% of total national demand.

The average electricity demand in the region is 98MW, with peak demand of 62 MW in the Invercargill Electricity area and 114 MW peak demand in The Power Company area. If the peaks coincided this would be a total peak demand of 176MW in the region. Comalco normally takes an additional 580MW.

7. Electricity Transmission/Distribution Capacity

7.1 Transmission / Distribution System

The electricity supply system is based on the Transpower transmission system with links from Manapouri to the west and Roxburgh and Dunedin to the north. The transmission system has grid exit points at Invercargill, Tiwai, North Makarewa, Edendale, Gore and Brydone.

Electricity distribution from the transmission grid to users is via the lines owned by The Power Company and Invercargill Electricity, both of whom are managed by PowerNet.

The transmission system operates at 220kV and 110kV, while the distribution system operates from 66kV and 33kV, down to 400v and 240v.

A full description of the electricity transmission/distribution system is provided in Appendix 2.

7.2 Reliability and Security of Supply

Both the transmission and distribution systems are well managed and well maintained.

Transmission Network

Supply security from Transpower satisfies PowerNet's normal current requirements but under low lake inflow conditions (particularly in the Manapouri catchment) supply into the region is constrained to 650MW compared to the 800MW normal capacity. With the increased loads on the Southland 110 kV network, the supply to the grid exit points on the 110 kV Network is limited if one line/interconnecting transformer is out of service as result of a fault or for maintenance.

In a normal hydro inflow year 400MW will flow from the Clutha to Southland, while this reduces to 195MW in a dry hydro inflow period.

While the transmission system is already under constraint, under certain situations if a major electricity demand of around 100-150MW were to locate in Southland then this situation would occur more often. To address this constraint situation Transpower are considering increasing the supply capacity into the region by either;

- Upgrading the 220kV lines from Roxburgh to Invercargill, or
- Upgrading the 220kV network to 330kV or higher.

While either of these options will address the constraint the frequency of occurrence is fairly low and it is unlikely that upgrade would occur in the next few years. The timing for implementation will be delayed if there are difficulties in obtaining access to land and resource consents

Distribution Network

Because the Power Company system in west Southland, which is supplied through the Transpower North Makarewa point of supply, is operated as two 66kV rings this provides a high degree of security. The protection is designed to operate to disconnect any faulty section of the 66kV ring without loss of supply to other customers.

West Southland is also linked to Gore via a 33kV system. East Southland is supplied from Gore and Edendale via a 33kV system. Each part of the system has a connection to two Transpower supply points.

The 11kV distribution system has a high degree of interconnection between zone substations.

The level of faults in the distribution systems have been dropping each year since the establishment of the current organizations and management structure and they are now by several measures better than general New Zealand performance. The performance levels are shown in table 3.

	Fault Level					
	Target Faults / 100km	Current level Faults / 100km	Total Number of interruptions	SAIDI* [Minutes]	SAIFI** [Number]	CAIDI*** [Minutes]
The Power Company	5.00	5.65	570	139	2.88	48.30
Invercargill Electricity		11	35	96	2.87	33.30
New Zealand (median)		7	299	140.27	2.00	68.00
New Zealand (mean)		7	429	187.09	2.67	74.29

Table 3 Reliability of Electricity Supply

Note:
SAIDI – System Average Interruption Duration Index
SAIFI – System Average Interruption Frequency Index
CAIDI – Customer Average Interruption Duration Index

7.3 Ripple Control

The area has fully operational ripple control which as can be seen from Figures A2.6 and A2.8 in Appendix 2 has been used very effectively in managing peak electricity demand. Ripple control is one of the region’s most valuable energy management tools as the PowerNet Transpower connection costs are determined by the 12 highest half hour peak demand levels in a rolling 12 month period.

7.4 Transmission Issues

The transmission network is a critical component of infrastructure which without adequate investment will continue to be a barrier to regional economic growth. There is significant value in encouraging early upgrade of the transmission network.

The Southland transmission constraint affects the ability of current industry to obtain guaranteed electricity supply although currently on an infrequent basis. The frequency of constraint would occur more often if a new major (100 - 150MW) energy user was to locate in the region.

The uncertainty affecting electricity supply in the region is compounded by uncertainty over Transpower upgrade plans. This is an aspect where the region can assist by working with Transpower to prepare for early implementation. It would be useful to have an agreed joint action plan.

There is a need for;

- A simplified Transpower land owner approval agreement.
- Ability in legislation for a wider number of parties to distribute electricity.
- Proposed RMA amendments to cover heat plant and distribution as well as renewable technologies.

The dry year electricity supply in the South Island is compounded because of the lack of thermal generation. The transmission system power flows would be able to be managed differently if there were thermal generation, and this would have a beneficial effect on electricity prices.

This is an area where the 150 MW Government Dry Year Reserve Generation Plant may be able to provide price stability over the next two years while longer term solutions are implemented. The generation is likely to be operated when the low flows in the Waitaki lakes coincide with low Manapouri generation thus making it difficult to supplement supply from Roxburgh.

8. Current Energy Prices

8.1 Electricity

Wholesale Electricity Prices

Wholesale electricity prices are set throughout the country by reference to nodal prices. These are the prices set at the Transpower grid exit points and referenced to the South Island price at Benmore. The difference in nodal price reflects the system losses accumulating to that grid exit supply point. Retail electricity suppliers pay for electricity received at these points. The retail suppliers then add their margin and sell to customers according to either a fixed price (monthly or half hourly), or floating and usually referenced to the half hourly spot price at the nearest grid exit point.

Retail Prices

Electricity Invercargill and The Power Company are the regional lines companies and Contact Energy and Meridian Energy are the two electricity retailers most active in Southland. The retailers contract with customers and include the cost of distribution by the relevant lines company in their monthly invoice to the customer.

Electricity Network Prices

The electricity distribution cost for delivery of electricity by the two network companies are shown in figure 1 where it can be seen they compare well to other Network companies throughout the country. This comparison is based on 2002 data whereas the lines costs are now aligned.

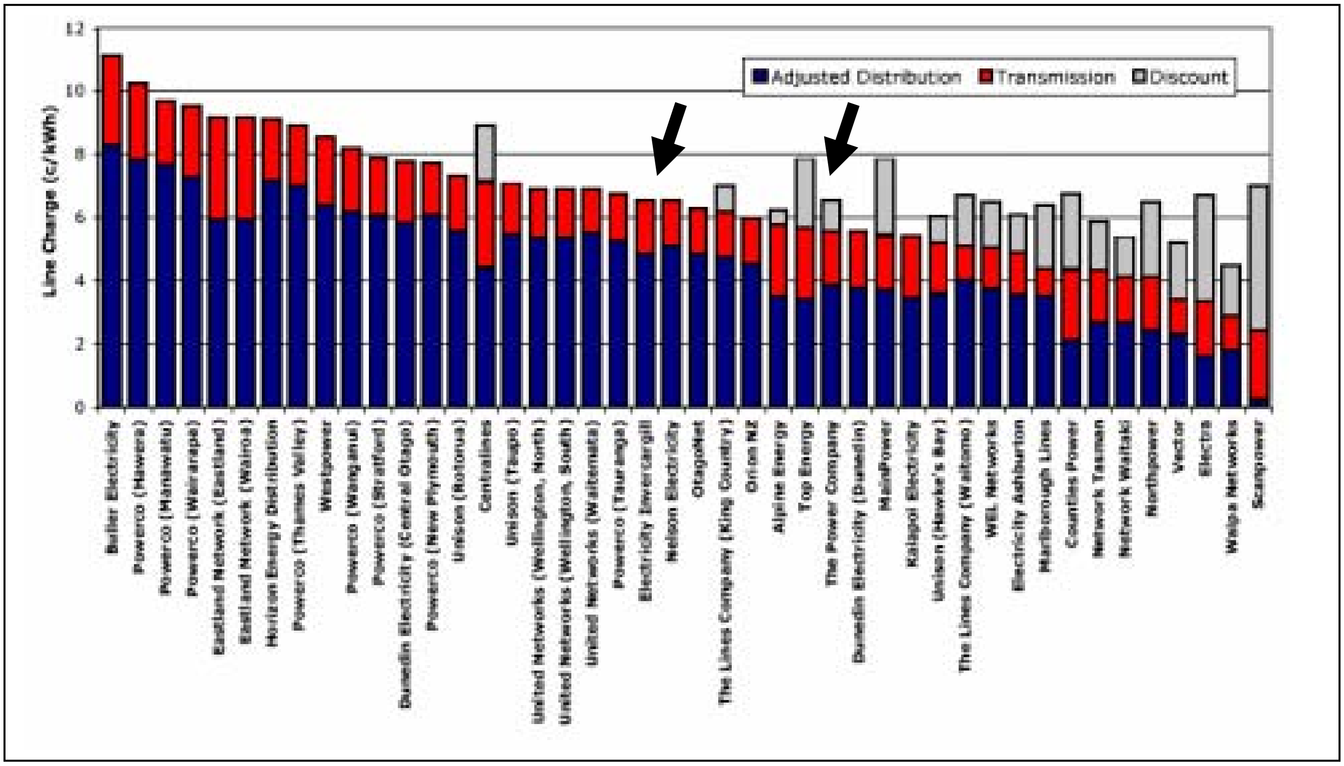

Figure 1 Comparative Electricity Network Prices

Residential Retail Electricity Prices

For residential electricity customers around 44% of their delivered cost of electricity is due to the cost of distribution. The split between fixed daily rate and variable use rate will depend on the tariff chosen but generally around 25% is fixed.

Retail electricity prices for residential customers are shown in table 4.

Residential Electricity Prices – Southland (c/kWh)													
Line Business	**Approx. No. of Residential Consumers by Line Business**	**15-Nov-99**		**15-Feb-03**		**15-May-03**		**% Change**		**% Change**		**Total Increased Cost (+) or Annual Saving (-)**	
								15-Feb-03 to 15-May-03		**15-Nov-99 to 15-May-03**		**15-Nov-99 to 15-May-03**	
Retailer		**Line**	**Retail**	**Line**	**Retail**	**Line**	**Retail**	**Line**	**Retail**	**Line**	**Retail**	**Line**	**Retail**
The Power Company	25,605	**6.26**		**6.54**		**6.54**		**0%**		**4%**		**$22**	
Contact Energy			13.76		15.57		15.57		0%		13%		$145
Meridian Energy			13.53		14.46		14.46		0%		7%		$74
Electricity Invercargill	14,282	**6.11**		**6.54**		**6.54**		**0%**		**7%**		**$34**	
Contact Energy			12.92		15.23		15.23		0%		18%		$185
Meridian Energy			12.56		12.83		13.87		8%		10%		$105

Source MED

Table 4 Residential Electricity Prices

Commercial / Industrial Electricity Customers

The electricity prices for commercial industrial users is shown in Appendix 4. This shows delivered commercial electricity prices in April 2002 (excluding Comalco) at around 11-13c/kWh with half the price being transmission and distribution charges and 25% set on a fixed daily rate.

8.2 Coal / Lignite

The cost of coal in Invercargill for a domestic customer is around $230/tonne plus delivery, and for a large industrial user this can reduce to about $85-100/tonne. Lignite costs can be around a third to a half of these costs. Lignite is about 2-3c/kWh and coal 4c/kWh.

8.3 LPG

The cost of LPG is around 10-11 c/kWh.

9. Future Energy Price Trends

Future energy prices will be driven by the availability and cost of North Island gas supply and the introduction of a carbon charge in 2007 to act to reduce CO_2 emissions. As shown by figure A3.1 in Appendix 3 the Maui gas supply is dropping and this has the following effects;

- Increased supply from other small gas fields
- Increased supply from other energy sources
- Potential for shortage of electricity supply in dry hydro years
- Increased use of coal and subsequent increase in coal price

It is estimated by some electricity retailers that with these national increases in energy cost that the flow on to electricity prices will be that by 2008 the wholesale price will be around 7.5c/kwh which is around a 50% increase above current wholesale prices.

The introduction of the carbon charge will mean that the relativities between fossil fuels and renewable energy will change. The projected costs for electricity generation post 2007 are shown in figure 2.

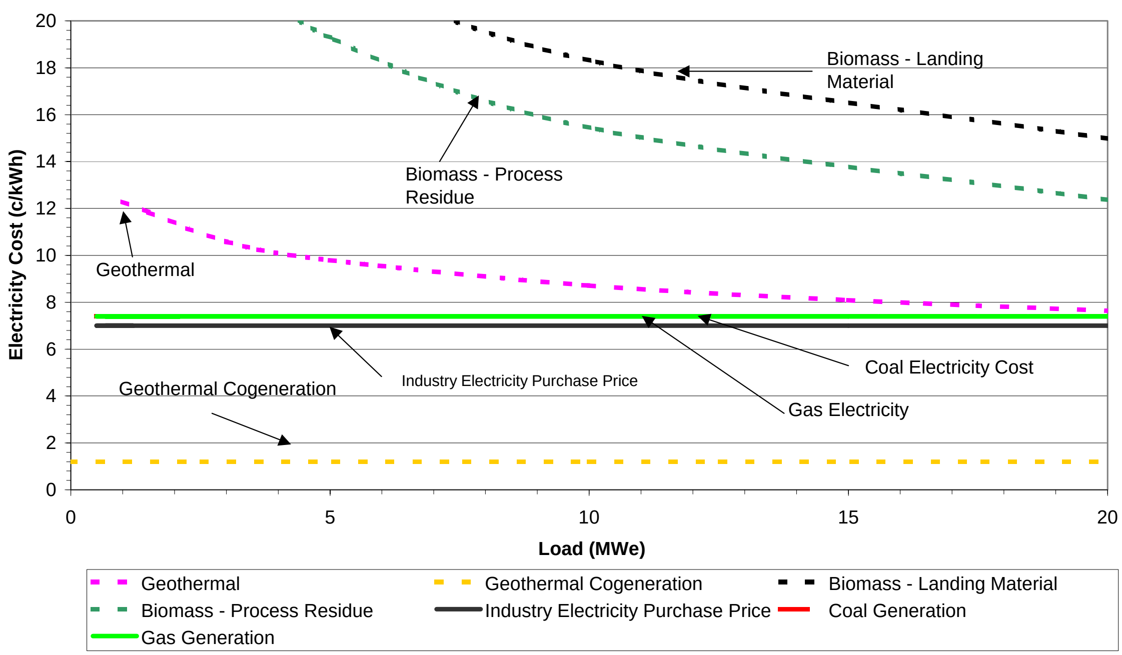

Figure 2 Electricity Generation Prices Post 2007

It has been assessed that if the carbon charge is set at the maximum of $25/tonne of CO2 and gas prices nearly double then the cost of heating using Southland coal could increase by $4.5/GJ (1.6c/kWh).

The relative cost of heat using different energy sources is shown in figure 3. As can be seen the use of bioenergy becomes very cost effective relative to coal if biomass is readily available in quantities and prices in line with these assumptions.

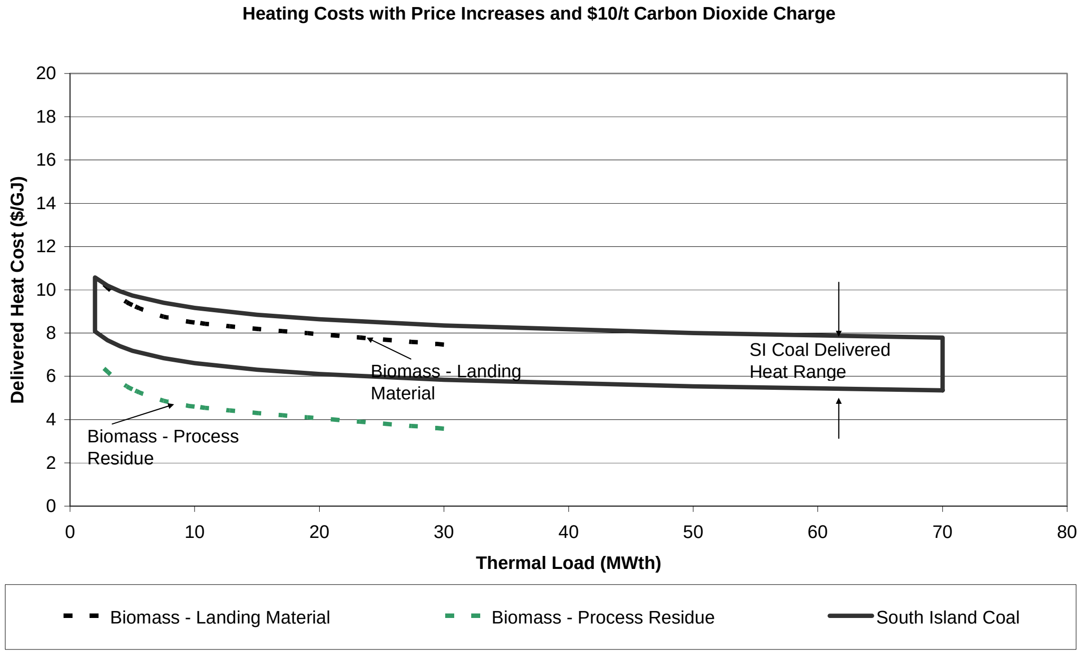

Figure 3 Cost of heat post 2007

10. Projected 2010 & 2020 Energy Use

Energy demand on a business as usual basis is expected to continue to increase at around 1-2% per year. For electricity in Southland this would be around 9-18GWh per year excluding any changes in energy use by Comalco. For other energy forms this could be an increase of around 14 -26 GWh per year. In total a business-as-usual scenario would require around 23-44 GWh of additional energy per year. This increase would be driven by normal industry growth and changes in the way energy is used. While there will be energy efficiency changes that may decrease energy use, the increase in energy efficiency will also drive an increase in energy consumption.

This annual increase in electricity demand alone is equivalent to requiring an additional 1.2 – 2.4 MW of base load electricity generation, or 3 – 6 MW of wind farm generation (wind speed 8.5 m/s) or 4.2 – 8.4 MW with a wind speed of 7 m/s.

To get a measure of an upper limit on demand an assessment has been made that an additional 100-150 MW (say 750 – 1120 GWh per year) of supply would be needed to entice a major energy user such as for silica smelting. Introduction of such industries with consequential increase in energy demand would be additional to business as usual. As a lower limit for increased electricity demand for new energy users or major expansion of existing industry it is assumed that an additional 50 MW (370 GWh per year) of electricity supply would be required. Some of the additional demand may be met by installation of cogeneration plant within the users operation thus reducing the need for additional generation.

As industry moves from a commodity base to more added value there is a resulting change in demand for energy quantity, reliability, form of fuel source, and secure quality.

Comalco already demonstrates the importance of these energy supply characteristics through the way they respond in times of electricity shortage.

With the increase in wood product processing that is expected there is also an increase in the need for heat for wood drying. It can be expected that kiln drying could increase by about 20% above that currently.

The increased dairy product processing expected at Edendale is difficult to assess because of the extent of changes occurring in their markets which are driven by international product demand and prices. In this assessment it has been assumed to be included in the additional demand referred to above.

Transport energy demand has not been addressed as it is too difficult to undertake in a limited assessment such as this.

11. Available Regional Energy Resources

11.1 Wind

Background

Southland has a long history of using wind energy for water pumping and twenty years ago there were a large number of farms using windmills for pumping. As the windmills have aged they have not been replaced and now there are few in existence.

Southland is currently being evaluated as one of the primary wind farm development areas of NZ. Several major wind farm developers are carrying out monitoring but no firm commitment to sites has been announced.

Information on the wind energy opportunities in Southland are discussed in detail in Appendix 5. Significant aspects relating to the opportunities and barriers to uptake are brought forward into this section.

Wind Resource

Study of the Southland wind energy resource is constrained by the lack of publicly available data. The wind maps available to the public were prepared from data collected in the 1980's and current wind farm developers indicate that the maps under-estimate the resource. They are also not site specific enough. The monitoring being undertaken by wind farm developers is not publicly available.

Wind resource maps in Figures A5.1-5.3 of Appendix 5 indicate that the high wind speeds are along the south coast, in some of the valleys of western Southland, and on some of the higher hill areas of inland Southland. Stewart Island is a low wind speed area around the settlement area.

It should be noted that the wind speed increases significantly as turbine hub height is increased above the ground.

Opportunities

Large Wind Farms
The high wind speed areas have mean annual wind speeds of in excess of 8.5m/s which is just attractive for installation of large (1-2 MWe) sized wind turbines.

With the generally flat topography of many of the high wind speed areas near the coast in particular, the installation of large scale turbines with 70+m height towers should not be difficult, although cranes of an adequate size would probably have to be brought in from Australia.

The economics of wind energy development are influenced by proximity to appropriately sized electricity distribution lines. Other than at Tiwai, most other sites that are likely to be developed would be close to 33, 66 or 110kV electricity lines with the capacity of individual wind farms being limited in size to about the capacity of these lines, or dependant on the cost of constructing links. With a 30MW wind farm built in an 8.5m/s wind speed area the electricity is likely to be produced at 8c/kWh. If particular areas can be identified where the wind speed is 9m/s then the generating cost would reduce to 7.4c/kwh.

The large scale wind farms are not yet commercially attractive but it is expected that by around 2007 wind energy will be able to be supplied at the wholesale cost of electricity.

The economics of large scale wind farms could be improved if the wind energy was coupled with hydro storage from Lakes Manapouri or Monowai where the hydro storage is essentially used as a storage battery for the wind energy.

Distributed Wind Turbines
Wind turbines could be installed in industrial areas such as at Kennington or Otautau for direct supply to industry. A scenario could be that one or two wind turbines could be located adjacent to the industrial electricity users. If this electricity generation was able to be embedded into the site electricity supply there may be opportunities to also reduce electricity lines connection costs. However because wind is uncontrollable the amount of cost avoidance is likely to be small unless the wind energy can be linked with other energy management initiatives on site such as cogeneration from bioenergy or lignite. Wind generation from distributed turbines would most economically be done at the time of installation of a large wind farm so that economy of scale benefits may be acquired and electricity could be generated at around 10 – 12 c/kWh. If not linked with a wind farm the cost of generation for an isolated 600 or 225kW turbine could be 15.6 – 21.1c/kWh, or 10.4-16.8c/kWh for a second hand turbine.

Agricultural Farm Scale Wind Turbines
Wind energy can be utilized on agricultural farms for both generation of electricity or direct pumping of water. Wind energy for agricultural farm scale use is disadvantaged by the generally small size of wind turbines and therefore their lower efficiency, lower wind speeds at lower hub height above the ground, and lower wind speeds because of distance from the coast. Generation of electricity at 36c/kWh from such turbines is unlikely to be economic for a number of years.

Direct pumping of water is more attractive and has previously been quite significant in Southland. Current estimates are that the cost of energy could be around 22-30c/kWh.for location of a turbine separate from the water bore eg on a nearby windy hill, or for direct pumping above the water bore. If the alternative is running a power line to a pump at the bore then the cost of the line, monthly connection cost, and energy cost may result in the wind mill being more financially attractive.

Barriers

A limit on the amount of wind generation that can occur is set by the operating requirements of Lake Manapouri and constraints on the Transpower grid. An estimate is that the limit for wind generation could be about 150MW.

The barrier to wind energy uptake in Southland is principally that the wind speeds are generally not high. Other than in areas along the coast and specific inland valleys or hills, wind speeds are too low for economic electricity generation.

There is a lack of wind data useful for evaluating sites over the region, and potential developers need to undertake their own specific monitoring of the wind. Wind monitoring requires data collection using towers which may be up to 80m high, approximately the hub height of wind turbines at present. The need for a separate notified consent for each tower means that potential developers will not be keen to install or move towers. With the preparation of District Plan Rules such applications should be able to be handled as non notified applications.

The lack of publicly available information on the wind resource means that opportunities may not be identified. In order to overcome a major barrier to the uptake of wind energy it is recommended that reliable wind data be obtained and made publicly available. This could be obtained from monitoring undertaken from the proposed Broadband Communication Transmission towers. The data would need to be at different elevations in order to identify the characteristics of the resource at different potential turbine hub heights. This would assist potential investors to identify wind energy investment opportunities.

The lack of commonly accepted information on the potential noise and other effects of wind turbine operation mean that investors have to undertake their own research and preparation of expert advice for each consent application. This is inefficient and creates a major cost barrier to the obtaining of resource consents. Much information is common to any application and it would assist wind energy developers to have this as commonly accepted reference information either as Rules in the District Plan, or in a format similar to the Air Quality Guidelines. These should be developed in conjunction with EECA and the Ministry for the Environment with encouragement to preparing a New Zealand Standard.

As the best wind resource in Southland is along the coast, on often reserve land which is not currently available for wind energy development, consideration should be given to whether wind energy development can be a shared use in these areas.

Comment

Wind energy has significant potential for Southland but because it is not the most economically attractive area throughout New Zealand for investment the region will have to establish policies and procedures that encourage potential investors. With such policies wind farms of at least 100MW could be economic and being built before 2007.

11.2 Hydro

Background

The Southland region has vast hydro potential but most of it is unavailable within the Fiordland National Park. The balance of the region has only two significant catchments, the Waiau and the Matarua, and the smaller Oreti.

A comprehensive study of the hydro potential of the region was undertaken in 1983. However this was undertaken under a different era and the type of projects being investigated today are quite different in terms of concept and relationship with adjacent communities.

The realisable hydro electricity generation potential of Southland is around 70-120MW generating around 570GWh per annum and ranging in generation costs between 8-15 c/kWh. This is a significant source of energy which may have less long term adverse environmental and societal effects than many other alternative sources of energy in the region.

The expansion of the Manapouri power station has demonstrated that hydro electricity generation facilities can be constructed in environmentally acceptable ways, while still at an acceptable economic cost. To achieve this requires developers to undertake extensive investigation and thorough consultation with affected parties. This is expensive and there is no guarantee, that despite the expenditure of large sums of money, that resource consents will be achieved. For new hydro energy projects to be even considered in the future it is necessary that a more receptive community attitude to hydro energy be developed.

The possible Southland schemes range from run-of-river which produces base load electricity, to small niche schemes that are suitable for embedded generation similar to that of the existing 0.6 MW Mataura hydro power station.

Hydro energy is a premium source of electricity because it is controllable and generators are very responsive and therefore suitable for ensuring supply security both in terms of voltage and frequency. If the hydro energy is coupled with less flexible or less reliable energy such as wind, then the value of both can be optimized.

A fuller discussion on hydro electricity generation in Southland is provided in appendix 8.

Opportunities

Lower Waiau Canal Hydro
The flow in the Waiau river is largely dependent on the generation requirements of the Manapouri power station although the Manapouri resource consent sets a minimum flow condition which would have to be maintained with any generation development.

It may be possible to develop a project aqua type hydro generation scheme in parts of the lower Waiau catchment. This would entail extraction of some flow from the main stream of the river and running this along canals to a power station where it would come back into the river. . If a 12 MW scheme were built it could produce around 55 GWh and produce electricity at around 7.5-9c/kWh. This has not been investigated but indications are that it may be possible.

Upgrade Monowai power station
The existing Monowai power station has a capacity of 6.3MW and produces 35-40GWh of electricity per annum. Resource consents have recently been obtained for continued operation of the station. Options for additional flow from the Borland river and additional generation using the existing flow have been identified but are not currently considered economic. There may also be environmental issues relating to the Borland option.

Lake Monowai storage could also be coupled with a nearby windfarm to firm the wind energy.

Upper Mararoa
Schemes have previously been considered on the upper Mararoa. Without site investigation it is unknown whether these are viable.

Mararoa Weir
The Mararoa Weir has a small head which could be utilized for generation of electricity using the residual flow. Other than a penstock and generating equipment no structural work would be required as the weir already has the capacity to handle diversion flood water. .

Te Anau Gates
There is about 20m head difference between Lakes Te Anau and Manapouri. This head can be utilized for generation of electricity by either an in river low embankment/powerhouse scheme or by construction of a tunnel to a powerhouse on the shore of Lake Manapouri. Either of these schemes could have an installed capacity of around 65 MW (350 GWh) at a cost of generation of 8-10c/kWh. The area is on the edge of the National Park so care in design to protect the Park area would be necessary.

Waikaia
The Waikaia river tributary of the Mataura offers potential for a 400m head scheme developing 15 MW (70 GWh) from a tunnel diversion. It is assessed that electricity could be generated at around 10-15c/kWh. This is currently prohibited by the Water Conservation Order.

Mataura Canal Hydro
Although previous studies emphasised the potential of dams built in gorges it may be possible to develop a project aqua type hydro generation scheme in parts of the Mataura catchment and so avoid empoundment. This would entail extraction of some flow from the main stream of the river and running this along canals to a power station where it would come back into the river. An aqua type canal project could be around 6MW and produce 30-35Gwh at between 8-12 c/kWh.

Oreti Canal Hydro
As for the Mataura it may be possible to develop a project aqua type hydro generation scheme in parts of the Oreti catchment. This would entail extraction of some flow from the main stream of the river and running this along canals to a power station where it

would come back into the river. An aqua type canal project could be around 6MW and produce 30-35GWh at between 8-12 c/kWh.

Lake Hauroko
While this project is within the National Park, the successful expansion of the Manapouri power station has shown that hydro projects can be constructed in National Parks without adversely affecting the environmental qualities. Lake Hauroko is approximately 125 m head above Lake Poteriteri and by use of a tunnel and underground power station this head could be used to generate electricity. An alternative is a scheme that uses the head of about 160 m between Lake Hauroko and Te Waewae Bay. In either case a residual flow regime for the Wairaurahiri River would need to be incorporated in any development.

Lake Wakatipu Flood Alleviation
The head difference between Lake Wakatipu and the Mataura River near Garston is about 5 m. This would be adequate so that when Lake Wakatipu floods water can be diverted into the Mataura River. This diversion would be in the old lake outlet but would have to be under conditions which would allow the diversion of water to occur while avoiding flooding in the Mataura. Such a scheme could only proceed after full community consultation including Maori because of the diversion of water from one catchment into another.

By careful design the Lake Wakatipu water may be able to be taken through a long enough canal that could result in electricity generation. Alternatively wind energy may be able to be used to pump water from Lake Whakatipu into the Oreiti for water augmentation.

Manapouri / Monowai Wind
The existing Manapouri and Monowai lake storage provides an ideal buffer for increasing the value of wind energy. Wind energy often occurs at times of low value. This value can be increased significantly if the wind generation is coupled with hydro storage. This can allow entering of firm electricity supply from such a coupled arrangement.

Further information on each of the schemes is given in appendix 8.

Barriers

The most significant barrier to any of the schemes possible in Southland is potential environmental effects. The schemes referred to are all technically possible but the mitigation measures that may have to be taken for some schemes may increase the costs so that they are uneconomic. The potential environmental effects of the schemes listed are however possibly less significant than is likely with many other alternative projects that may have to be considered within the next decade if the community wishes to increase energy use.

Comment

Hydro energy is Southland’s fourth largest source of energy and it can be accessed in a more benign way than some other sources of energy which will be the focus of the future.

Construction of hydro electricity generation schemes can be undertaken in harmony with the environment and meet community expectations. The establishment of Regional Policy

Rules that ensure a mitigation of effects will assist potential developers of schemes to feel encouraged to become involved.

Hydro energy will only proceed if the community accepts that modification of land use for such projects is acceptable (provide it is done properly).

11.3 Solar (Water Heating)

Background

Solar hot water heating systems are readily available and their performance is well established. While systems have been around for a number of years the market has not been developed because of the lack of strong industry players and public perception. The government is currently supporting the expansion of the solar water heating market and this is having a marked effect in the North Island.

The market development has been based around ensuring quality systems are available and being installed. Having achieved this the market transformation programme is about to focus on increased promotion of both mass residential and commercial (motels, rest-homes, large hot water volume user) applications.

Resource

Information in Appendix 6 shows that the solar energy resource in Southland is significant and not that different from other parts of New Zealand on an annual basis.

Opportunities

Hot Water Users
A solar hot water system can be installed in existing and new buildings. Costs of installation can be reduced if the system is incorporated in initial building design.

Use of solar energy to heat water can result in around 20-35% of electricity total cost savings in a family residential application. In other applications such as with a rest-home, motel or other large volume hot water use the reduction in energy costs can be even more significant. A solar hot water system can be installed for $2000-5000 which has a payback period of 8-10 years according to hot water use. This is equivalent to electricity supply at around 8-10c/kWh.

Solar hot water systems are well known in residential applications but their greater value can be in commercial applications where large volumes of hot water are used. With economies of scale the payback period can reduce to 7-8 years.

Installers
There is a shortage of solar water heating system installers throughout New Zealand and this can be a significant business opportunity for plumbers and other building professionals.

Regional Energy Supply Benefits
The use of ripple control with installation of solar hot water systems can provide significant regional benefits while meeting water heating requirements. This may be through reduction in peak electricity demand, or through overall reduction in demand on weak rural lines.

Barriers

The most significant barrier to the uptake of solar water heating systems is the lack of public awareness of the financial benefits to hot water users.

The cost of a solar hot water system can also be a significant barrier for many people, but, when compared to the cost of other expenditures they often make, it shouldn't be a barrier. For purchase of a solar system it is often easier to make a monthly payment to an electricity bill rather than have an upfront capital expenditure with benefits occurring in the future. This can apply to both residential and commercial applications. In some overseas locations this has been addressed by the electricity supply company, or another party such as a Trust or municipal council, installing the system and having a lease to buy arrangement with the building owner.

The value of a solar hot water heating system may not be reflected in the property value.

A further barrier is where a solar hot water system is installed on a building which may be owned by a party who is not the energy user in the building. In such situations the tenant obtains the financial benefit from reduced electricity costs, for an installation they haven't paid for.

Comment

Promotion of solar hot water systems can have significant payoff for individual hot water users and the region. To achieve the benefits there is however a need for promotion of the benefits and assistance with getting information to potential system users. Councils are in an ideal position to assist this through the provision of information with rate bills, on their website, and when building consents are being sought.

11.4 Solar (Photovoltaic)

The production of electricity from solar energy by use of photovoltaic cells is well established within a number of niche applications throughout New Zealand. These applications are generally in off-grid situations where the option of installing a power line for mains power would be uneconomic.

A discussion on the possible cost and applications of photovoltaic systems is given in Appendix 6.

Economics

Currently, PV generated electricity costs around 60c/kWh. However, the unit cost is dropping rapidly such that over the period to 2025, PV is likely to mature and enter the domestic-level grid-connected market. As such, PV will be competing against the retail cost of electricity rather than wholesale alternatives.

It is assessed that in Southland by 2012 and based on current technology the unit cost will be in the 31-48c/kWh range, and by 2025 in the 14-21 c/kWh range.

The main impediment to further uptake of PV technology has been its cost compared to grid electricity prices.

The main applications are:

- Consumer products –e.g. calculators, watches, toys. They also included individual power supplies (caravans, mobile homes, boats) and individual supplies for novelty products (home security, garden lighting, car sunroofs, fans and battery chargers).
- Industry applications – PV systems can be used in “professional systems” provided by companies active in the communication industry and the cathodic protection industry. New Zealand’s electric fence industry is a substantial and a good example.
- Standalone Power System (RAPS) applications – These are applications in the watts to kilowatt size range located at sites remote from the main distribution grid. This will be a pivotal growth area for applications like water pumping, water treatment, electric supply to rural uses and communications links.
- Grid connected distributed supply system applications –These systems are simpler than RAPS as they require only PV panels and inverter to provide AC voltage and connect to the local distribution grid. The main electricity supply acts as a storage facility, receiving electricity at times of PV surplus and supplying it at times of PV deficiency, hence there is no need for a battery system.

A photovoltaic production industry may be able to be established if the silica smelting project eventuates in Southland.

Barriers

Because the cost of production of electricity is around 60c/kWh its is generally only used for off-grid applications where PV can be a very cost competitive energy supply solution.

11.5 Coal / Lignite

Resource

The lignite resources of the Southland coal region make up 71% of New Zealand’s recoverable coal resources. Although there is a long history of mining the size of the resource is such that it can be considered untapped. All of the coalfields are multi-seam resources but a major proportion of the recoverable coal is in one to three seams which are often greater than 10m thick.

Appendix 7 show the large amount of energy that Southland holds in the form of coal and lignite.

Coal and lignite is currently principally mined by Solid Energy and New Vale Coal Company with some other small operators supplying niche contracts. There are other basically untapped reserves such as at Waituna where the thick seams are near the surface and easily mined.

The extraction of coal and lignite in large quantities would not create environmental concerns provided the mining procedures meet acceptable good practice. These procedures would be subject to resource consent conditions and would build on the experience from existing mining operations.

Pelletisation of coal fines could recover around 15% of coal that is currently unusable.

Electricity Generation

The sub bituminous quality coal available from Ohai has burning characteristics that indicate that it is most likely to be used for high value applications whereas the lower grade lignite is most suitable for mass burn operations such as electricity generation.

Coal and lignite are a valuable energy resource as they can be used to back supply of biomass for bioenergy heat plant, or be used where unmanned boiler operation is required. Coal and lignite generally has homogenous characteristics so that fuel handling can be automated and quantities can be obtained when needed to the specifications required.

Coal and lignite is able to be used to generate electricity in plant that will meet appropriate resource consents. As a result coal fired power stations are able to be located virtually anywhere such as in the middle of cities even. An example is the Huntly coal fired power station in the North Island which has operated for many years without complaint. The perception of coal being a polluter has arisen from some overseas countries where proper emission cleanup technologies have not been installed. The technologies are available and are assumed in this assessment to be included in any project developed. In addition to emission cleanup technologies there are new clean coal technologies that can be utilised for generation. Such technologies are well proven and in commercial application overseas.

For the purposes of this assessment it has been assumed that a 150MW_e lignite fuelled power station is built near to the lignite resource. An indicative cost of generating electricity from a 150 MW_e unit with a 90% load factor using lignite fuel at $1.50/GJ (including carbon charge) is 6.8c/kWh. 800,000 tonnes of lignite would be burnt each year. Transmission costs would be in additional to the cost of production – the closer to existing transmission lines the facility is built the least the additional cost will be. However distance from the lignite resource will increase transport costs. These costs assume that air emissions control are to best practice and that potential adverse environmental effects are addressed and avoided.

Cogeneration

Cogeneration is where there is a multi-use of heat for both process use and electricity generation.

The availability of coal and lignite in Southland provides an opportunity for installation of cogeneration plant of anything from 5-50MW_e at each of a number of sites. The coal or lignite could be used as a fuel by itself or co-fired with wood waste.

In the case of a 10 MW lignite/coal fired boiler feeding all the steam into a 2.6 MW second hand steam turbine generator would result in electricity being produced at a cost of 11-13c/kWh. Use of a new steam turbine generator would increase the cost of electricity very significantly. Where the plant is used in a cogeneration mode of operation the electricity cost reduces substantially because of the “additional sale” of heat for process use.

Increasing the size of the cogeneration plant at the milk factory at Edendale could be an opportunity to reduce their reliance on electricity and perhaps provide some “reserve” generation capacity in the event of a dry hydro year.

Government Climate Change Policy

The analysis in this assessment assumes that Government policies announced to date will endure and these have been taken into account in the analysis and when discussing project viability. Because Government has made Climate Change a national issue it is assumed in this assessment that no further policies or actions are required from the region. It is assumed that the changes to the Resource Management Act arising from Climate Change policies will be enacted and that Councils will take account of these when considering resource consent applications.

Barriers

The most significant barrier to construction of a lignite fired power station in Southland is the electricity transmission constraints north of Southland. An investor could not guarantee that electricity generated in Southland could be moved north under certain hydro inflow situations. This inability to be dispatched would be a significant financial risk to investors.

A properly engineered coal/lignite project should be able to get resource consents because the potential adverse effects can be avoided or remedied. The process would require a proper public consultation process to try and ensure that any concerns are addressed prior to application for resource consents. The Regional Policy Statement could be a significant barrier in that it has a bias against use of fossil energy.

Cogeneration provides a significant opportunity to hedge future industrial electricity costs but the capital expenditure is usually too great for a single site to fund by itself. Economies of scale may be realizable where several business can cluster to share capital costs. Recognising this, it is recommended that any new industry coming into the region should be encouraged to co-locate with other energy users.

The construction of cogeneration facilities are dependant on the host party needing heat. Generally there are two options available;

- Plant sizing is optimized and plant is designed for electricity generation as the primary output,
- The plant is sized and designed principally to meet process heat requirements heat with excess heat being used for generation of electricity.

This can result in plant being suboptimal within a few years when processor products change. Designing a plant configuration that minimizes this risk is necessary.

11.6 Gas

Onshore Fields

There are extensive onshore gas fields in west Southland that are reputed to be similar in size to some Taranaki fields (such as McKee) to which it was directly aligned prior to separation by strike-slip motion on the Alpine Fault.

The area has had a history of exploration for the past 100 years and the western Southland region has long been regarded as being hydrocarbon prospective. Four shallow wells were drilled in the eastern Waiau Basin from 1955 to 1958. No hydrocarbon shows were reported and both wells were plugged and abandoned. However none of these wells fully tested the potential of their respective basins over the region as a whole, but their failure to produce hydrocarbons saw further exploration largely abandoned until the late 1990s.

Onshore the Eastern Bush Prospect is one of several prospects and leads identified within the Waiau Basin. Recoverable oil reserves are estimated to be between 2.9 and 158 mmbbls, with a mid-range case of over 50 mmbbls. A similar quantity of gas is likely to be present.

GeoSphere Exploration and Thomasson International Ventures hold a permit over part of the Te Anau Basin on the eastern side of Lake Te Anau, as well as most of the Waiau Basin to near the south coast. The joint partners plan to drill the Eastern Bush prospect in the Waiau Basin but are seeking further partners before they proceed. A tentative budget for a further exploration well is $3million.

Offshore Gas Fields

South West Southland
Two offshore wells have been drilled in the Solander Basin one of which encountered oil staining. The Balleny and Waitutu basins have yet to be drilled.

Great South Basin
The presence of hydrocarbons in half the exploration wells drilled, the large thick sediments, and the large number of potential leads make the Great South Basin one of New Zealand’s most prospective for both oil and gas.

The Great South Basin is the largest of several that lie on the Campbell plateau to the east and south of Southland. Initial basin formation was similar to that of most New Zealand basins, with rifting and deposition of thick coal measures, but the Great South Basin differs in having had little deformation.

Petroleum exploration began in 1969 with Hunt International Petroleum Company. Hydrocarbons were found in four of eight wells. Reserves were estimated as 461 bcf gas but were sub-commercial in view of the water depth and remoteness.

The petroleum potential of the large offshore basin has attracted three Australian based companies while Bounty Oil and Gas hold a permit over the middle of the basin.

The Value of Gas

Gas is the most valuable energy resource that Southland has. As an energy source gas is flexible, is safe, can be stored and is an easily used fuel. If the gas under Southland can be brought to the surface at an appropriate price then it could be used to firm the renewable energy that is currently and potentially used. While gas is a premium energy source for the region, it is the oil that exploration companies normally seek because it is internationally more valuable.

The highest priority activity that the region could do would be to encourage further exploration of the Southland gas fields.

11.7 Biogas

Biogas is commonly produced by anaerobic digestion as part of the treatment of wet organic waste. This occurs in municipal wastewater and sewage treatment plants, industrial operations that have liquid wastes containing organic material, and on farms using animal waste.

In many cases because of small waste volumes and relatively high capital costs treatment of the waste to produce biogas is not economical in itself but is carried out for other reasons such as waste management, or reduction in greenhouse gas emission initiatives. Also small scale generation of biogas is rarely economic because of the high labour requirements and dilute nature of the effluent being treated. However for larger volumes such as occurs with large dairy farms of industrial processing the production of biogas can be economic, particularly if waste cleanup that would otherwise be required is avoided.

Biogas from the digestion of crop materials is typically 55% methane and from animal manures typically 65% methane.

The biogas can be used as a fuel in a number of different types of plant such as reciprocating gas engines, mini-gas turbines, Stirling engines, and fuel cells or by direct combustion in boilers or other CHP heat plant.

Anaerobic digestion is a mature technology and is used worldwide, particularly for municipal waste water treatment. Here the scale of treatment can justify the costs of installing and operating the equipment needed.

Biogas from anaerobic digestion is essentially a continuous process so it requires a reliable continuous feed of material.

There are significant environmental benefits from waste digestion. These include reduced impacts of the effluents and solid waste disposal. Sludge from the digesters can be returned to the soil as fertiliser.

Dairy Waste

The estimated cost of electricity generated by a 20kW biogas unit on a large (460+ cow) dairy farm is around 17 c/kWh. Cost savings from avoided effluent disposal would be additional to this. However there has been very little work undertaken on this technology since the 1960-80 period. It is suggested that a work programme be initiated to investigate the opportunities, both environmental and financial, available from installing digesters on new large dairy farms as they are converted to dairying.

If 5% of the manure from around 60% of all the farms was collected and processed the total amount of energy would be approximately 20 GWh.

Dairy farm ice-banks can also be used to store cooling energy.

Municipal Landfill
Analysis of the Invercargill municipal waste indicates that around 55% of it is composed of organic waste that could be converted to energy in a digester. By installing such a system at the design stage would assist ensure that the plant was able to operate optimally (Rapid pyrolysis technology destroys practically everything with minimal emissions). This could produce around 6GWh per year of energy.

Industrial Liquid Waste
There are several industrial agricultural product processing sites such as at Edendale where the liquid waste could be put in a digester to produce energy.

In a typical meat processing plant the digestion of liquid waste can produce around 0.6 MW of electricity at a cost of around 7c/kWh.

11.8 Bioenergy

Woody biomass for use as an energy feedstock can come from a number of sources;

- *Forestry residue* - slash, tops and unmerchantable stemwood from trees harvested for saw or pulp logs. Forest residue may include the cutover depending on location of harvest.
- *Wood processing residues* – bark, sawdust, shavings, offcuts, etc. from processed wood for pulp, panel board, construction timber, furniture, etc.
- *Woody crop plantations* – short rotation crops grown specifically for energy purposes, possibly in associated with land disposal of sewage and industrial effluent.

The conversion process to provide heat and electricity from woody biomass is commercially viable, there being many examples in the New Zealand wood processing industry.

Direct combustion of wood processing residues in 2-20 MW_{th} boilers or furnace systems is a common form of conversion in the forest processing industry producing steam, hot water, hot gases or hot air. Where surplus heat is available, electricity production may be feasible for use on site or for export to the grid.

Independent heat and electricity generating utility companies could produce electricity and/or process heat for sale, based on wood-fired technology. Installations ranging from 10 MW_e to 30 MW_e electric output appear to provide adequate economies of scale. The fuel source could be cutover, arisings, residues, tree crops or mixtures of all four. However such heat plant would need to be 30-90 MW thermal and such plant consume a large quantity of fuel each day. There is considered to be inadequate quantities of woody biomass available in Southland for such sized plant.

Currently only process residue is considered to be competitive with coal for industrial heating. Biomass material from forest residue or short rotation crops is too expensive mainly because of transport costs. However with greater experience of waste collection and processing it is expected that forest residue costs will decrease and the economics will thus improve. As can be seen in figure 3 the cost of bioenergy will be very competitive with coal by 2007 when the carbon charge is introduced. Bioenergy from short rotation crops will take even longer.

The economics of large scale generation of electricity from bioenergy are such that while currently uneconomic, post 2007 with the introduction of a carbon charge under the Climate Change policy, electricity generation from bioenergy will begin to become economic. The economics will commence with investment in cogeneration facilities and then embedded electricity production leading to larger scale electricity production post 2010.

For a cogeneration facility using on-site wood processing waste it appears that for a 10 MW_{th} boiler feeding all the steam into a 2.6 MW_e second hand steam turbine generator would result in electricity being produced at a cost of 9-11c/kWh.

The most likely sized bioenergy facilities for Southland wood processing sites are likely to be plant of around 2-3 MW_e embedded into a wood processor site. With the probable shortage of on-site wood waste it is likely that the biomass will have to be supplemented by coal / lignite or forest residue. If forest residue was used the cost of electricity would rise to around 14-16 c/kWh because of the increased cost of the supplementary fuel particularly through the inclusion of transport costs.

For combustion of biomass in the non wood processing sectors such as education or health the biomass can be processed into pellets for ease of transport and on-site handling. Currently this is not economic in Southland.

12. Future Technologies

12.1 Sugar Beet Ethanol

Ethanol for transport fuels is most commonly produced from sugar crops by fermentation and distillation. Ethanol is produced in the North Island from whey. The most effective agricultural crops that can be used to produce ethanol in New Zealand are maize and sugar beet.

Generally blends of up to 10 percent ethanol in petrol (E10) can be used in modern vehicles without any appreciable changes in performance. Government is currently in the process of allowing an E10 blend of petrol to be sold in New Zealand.

Early New Zealand studies have shown that sugar beet could be grown in Southland. The cost of ethanol produced is currently estimated to be 55 to 80 cents per litre tending towards the higher end of the range. However the relative price of petroleum fuels compared to biofuels would have to rise by at least 50 - 100% in order for biofuels to be competitive. Further work would be required to confirm this.

It is recommended that further more detailed work be undertaken on producing ethanol in Southland.

Further information is given in Appendix 12.

12.2 Biodiesel

The production of biodiesel from renewable energy sources is developing to the stage that production now occurs in a number of locations overseas. This could include pyrolysis of wood residues to produce bio-oil. This is an area where further work is suggested as it appears that it would be an opportunity for Southland.

12.3 Wave

Wave energy is extracted from the harnessing of energy transmitted to waves by winds moving across the ocean surface. Southland is considered one of the best sources of wave energy internationally and research into Southland's wave energy has been done periodically over the years. There are however currently no commercial wave generation facilities in operation anywhere around the world. Experimental facilities have generally all failed because of the force of storm seas.

There are a number of different wave generation technologies including:

- Tapered channel/ reservoir systems: uses traditional tidal or hydro turbine generation plant.
- Oscillating column systems: uses air pressure generated by wave movement to drive turbines.
- Reciprocating mechanised systems: uses flotation devices to drive piston, pumps etc.
- Piezoelectric systems.

Technology is currently best suited to small-to medium-scale generation, either on-shore or off-shore. Local coastal topography and the availability of natural shoreline formation limit the size of the on-shore plants

Many overseas experimental on-shore systems have made use of natural features such as coves and multiple tapered channel structures and Southland may have some suitable locations but these are not publicly known.

From an energy perspective Southland has potential for a number of plants however significantly more research needs to be undertaken before wave energy could be considered commercially viable. Current international research indicates electricity generation costs of 6-20c/kWh but as there is currently no successful operational facility these costs need to be treated with extreme caution.

Further information is given in Appendix 13.

12.4 Ocean / Tidal Energy

Ocean current generation is based upon plant, similar to wind turbines. To produce small to medium GWh outputs grouping of a number of small turbines would be required. This can be compared to a wind farm layout set at on the ocean floor. However due to the lower current speeds and denser fluid, the distance between the turbines are likely to be less than the wind turbines.

There are no known suitable sites in the seas off Southland

Further information is given in Appendix 13.

12.5 Coal Bed Methane

Interest in coal bed methane is current. Kenham Holdings, an associate company of L & M Mining, and CRL Energy have been researching new processes to tap into the methane resources for about two years. Kenham Holdings have four petroleum exploration permits for coalbed methane gas.

Technology New Zealand is also providing investment support for a project to develop new technologies that allow for the commercially viable extraction of methane gas from low-ranked coalfields. If successful, the systems could also be adapted for international use.

A decision on the commercial viability of some areas under investigation is expected before the end of the year. If successful, the methane extraction from low-ranked coal will provide a new energy source for New Zealand and deliver major environmental benefits. Previous studies indicate that there are potential gas deposits in the 8.5 billion tonnes of coal held under permit by Kenham Holdings. Mining the gas will also reduce the potential for methane to leak into the environment, thereby helping to contain global warming

While the extraction of coal bed methane has advantages for extraction of deep coal there are questions around its efficiency of energy extraction, and long term effects it may have on future extraction of coal by other means.

The economics of coal bed methane are unknown at present.

Further information is given in Appendix 13.

12.6 Hydrogen

Over the next two decades, hydrogen produced from renewable sources of energy has the potential to offer "zero CO2 emission" vehicles for road transport. Fuel cells are seen as the most efficient way to turn hydrogen into motive power. However a long transition to hydrogen from hydrocarbons is likely.

International developments and pilots in hydrogen for use as a transport fuel are underway. Direct use of hydrogen in internal combustion engines may occur in the future, but fuel cells are still 50 times more expensive per kW than petrol or diesel engines and hydrogen storage issues are yet to be fully resolved. The International Energy Agency's (IEA) view is that it will be well past 2012 before the hydrogen economy kicks in.

There are several possible sources for hydrogen:

- Electrolysis of water - Using electricity to split water molecules to create pure hydrogen and oxygen.
- Reforming fossil fuels. A reformer can split the hydrogen off the carbon in a hydrocarbon relatively easily and then use the hydrogen.
- The chemical or thermal reformation of biomass feedstocks such as SRC (short rotation coppice) wood chips or methanol manufactured from biomass.
- The biological reformation of biomass using micro-organisms.
- The direct splitting of water using light with special catalysts or extreme heat.

Hydrogen has some disadvantages that require considerable research and development including that at present producing hydrogen requires more energy than can be obtained from it.

Southland has a number of resources that could be used in the production of hydrogen so it is a technology whose development should be monitored.

Further information is given in Appendix 13.

12.7 Fuel Cells

Fuel cells have developed to the stage where they are being used for specific applications, generally for the replacement for diesel generation of electricity.

While Southland has no particular comparative advantage for fuel cell development it is a technology that could be applied in specific applications.

13. Demand Reduction / End Use Efficiency Opportunities

Investment in energy efficiency opportunities is one of the best investments that a community can make. By ensuring energy use is optimized the home or business owner is able to use the expenditure saved on other things. Business costs can be reduced, or as most often happens, the money released is used to invest in other home or business equipment.

Investment in energy efficiency does not always lead to a reduction in the total energy used, but may result in real benefits and increased productivity. Improving energy efficiency results in using less energy to achieve the same 'benefits'. If the end user can achieve greater benefits from using the same amount of energy, there is a possibility they will do just that. In industry, they may chose to increase production whilst energy use remains unchanged. In housing, they may chose to increase their comfort whilst energy use remains unchanged. The result is that personal or business objectives are maximised at a lower cost, or conversely less energy is required to achieve greater benefits.

Investment in energy efficiency is a key recommendation of this assessment as it will result in a freeing of currently inefficiently used energy to improve Southland business activity, thus leading to greater business growth, and the attraction of new business opportunities.

There is very little information on how energy is used in Southland. However extrapolation of information obtained from EECA studies of other regions and nationally may give an idea of how energy is used in Southland and of the opportunities available.

13.1 Residential Energy Use

The Household Energy End-use Project (HEEP) being undertaken by the Building Research Association of NZ (BRANZ) and financially supported by EECA has studied household energy use in Auckland, Wellington and Hamilton, and as part of the random selection of houses through NZ, HEEP is monitoring in Invercargill during 2003.

The HEEP results have already played a crucial role for energy companies to evaluate opportunities to manage their loads and deal with proposed legislative changes, for appliance suppliers to understand how consumers use their products, and improving the debate over how energy is actually used in New Zealand households. One of the recommendations of this assessment is that the region should push for greater involvement of Southland in the study

In the areas studied to date average household energy use is around 10,500 kWh/year, including electricity, natural gas and LPG. Average New Zealand residential electricity consumption is 7,800 kWh/year. This is lower than the 8,900 kWh/year of electricity used in Southland households.

Table 5 shows an international comparison of household energy use. Given the climates found in these countries, some difference is not unexpected but it is likely the low New Zealand value relates to low levels of space heating energy use.

International Comparisons

Country	Household energy use (kWh/year)
New Zealand	10,500
Australia	16,400
UK	22,200
US (average)	26,700
Canada	39,700

Table 5 International Comparison of Household Energy Use

Of total household energy, excluding that for transport, hot water accounts for about 30% (3,000kWh) of electricity and gas use, lighting about 10% (920kWh), refrigeration about 10% (920kWh), cooking about 4% (370kWh) and clothes washing and drying about 3% (300kWh).

Average expenditure on domestic fuel and electricity energy (excluding transport energy) is 3.4% of household expenditure which results in energy being a low priority item for homeowners.

In the Statistics New Zealand's Household Economic Survey the number of households with portable LPG gas heaters has increased from 2% of households in 1984 (the least popular of the eight heating types surveyed at that time) to 33% (452,800) of households in 2001 (second only to portable electric heaters). The increase in the usage of portable gas heaters is closely matched to the reduction in usage of portable electric heaters (reducing from 89% of houses in 1984 to 71% of houses in 2001); and portable kerosene heaters (reducing from 11% to 1%). It is expected that this trend has also occurred in Southland.

Around 10% of domestic electricity consumption is from standby power consumption. Standby electricity is drawn by an appliance when it is not in operation but is left with the electricity turned on. Depending on the appliance type, this can range from 0 to 20W or more. For some appliances such as TV and VCRs the future standby consumption demand may decrease, however there are a host of other rapidly increasing appliances that may increase standby consumption and a proliferation of electronic and computer controls replacing manual control. Unless measures are taken to reduce standby electricity use by these appliances, then standby and base load losses may increase dramatically, and unnecessarily despite the fact that good design can decrease the energy needed to achieve the standby function.

Houses use 5.3kWh/day of energy on heating water of which 2.6kWh/day is from standing loss. Large reductions in energy use and Greenhouse Gas emissions can be achieved by upgrading the energy efficiency of hot water systems, and by reducing hot water consumption. EECA's Residential Grants Programme has implemented a range of improvements to hot water systems, which include cylinder wraps, pipe insulation and low-flow shower heads. The projects have been run by various interested groups including community groups, local energy trusts and power/lines companies, and commercial companies.

The data reported in the HEEP Year 6 report for the first 100 houses, suggests poorly insulated cylinders have been found far more often than expected. About 30% of cylinders are more than 25 years old, with the oldest at more than 45 years. Clearly, old cylinders are widespread in New Zealand, with around 40% C (pre 1986) or D (pre-1976) grades. With an average age of 33 years for D grade electric cylinders (and the youngest 15 years), this would suggest that old cylinders are not replaced until they are over 40 years old. This would also suggest that the benefits from retrofitting cylinder wraps may be greater than previously expected.

Of the hot water systems surveyed, very few of any age or grade had cylinder wraps or pipe lagging. Pipe lagging is likely to be equally cost effective on sizes and types of hot water systems. Savings for pipe lagging are approximately 120 kWh per year, giving a saving of about $16 per year, and payback from 6-18 months, depending on the cost of lagging.

Replacing a 180 litre D grade cylinder with a new A grade cylinder gives greater energy savings and Greenhouse Gas emission reductions than wrapping the cylinder. Similarly, installing a solar water heater, or changing to gas fuel will result in energy savings. However, unless the cylinder needs to be replaced (e.g. due to age, house modifications, etc) then cylinder wrapping is by far the most cost-effective measure.

Building insulation is a key investment opportunity and while this is best addressed in the original building construction, it is still a very effective investment opportunity for existing buildings.

Table 6

Estimates of Benefits from Residential Energy Efficiency Measures

Energy Efficiency Measure	kWh saved per annum	Average Installed Cost*	Estimated cost savings per annum at 13 c/kWh**	Estimated cost savings over lifetime of measure	Simple payback time (in years)	Net benefit over lifetime of measure	Lifetime CO_2 emissions reductions (tonnes of CO_2)
Hot water cylinder wrap (R value 1.1 ; 1970's cylinder)	525	$120	$68	$546	1.8	$426	2.62
Hot water pipe lagging	120	$25	$16	$125	1.6	$100	0.60
Compact fluorescent light bulb (6 - 10,000 hour life)***	83	$8	$11	$52	0.7	$44	0.25
Low flow shower head (based on reduction in flow of 4 litres/min.)	440	$50	$57	$458	0.9	$408	2.20
Weather stripping (all windows, doors and gaps)	480	$150	$62	$306	2.4	$156	1.47
Under floor insulation	1617	$900	$210	$2,207	4.3	$1,307	10.59
Ceiling insulation (R value 2.5)	2382	$1,100	$310	$4,334	3.6	$3,234	20.80
Polythene moisture barrier (under floor)		$450					
TOTAL SAVINGS PER HOUSE	**5647**	**$2,803**	**$734**	**$8,027**	**3.8**	**$5,674**	**38.53**

Notes:

** Installed cost estimates are mid range averages for a single residence job.*
*** All savings estimates based on 110m^2 house, Invercargill climate zone and domestic energy charges of 13 cents/kWh.*

**** Lights are assumed to be installed by householder.*

It has often been estimated that up to 8% of annual residential energy use could be saved through adoption of basic, widely available, low to medium cost energy efficiency measures. Many of these savings could be achieved quickly and at very little cost. This estimate has been reinforced during 2001 and 2003 when government promoted savings were of that order. An 8% saving in Southland's residential electricity use would be about 28GWh per annum.

A summary of some of the benefits from home energy efficiency improvements is shown in table 6. For comparison with other supply opportunities it can be considered that over a ten year period that the investment in the residential energy efficiency items shown in table 6 is equivalent to electricity supply at around 9c/kWh.

13.2 Commercial Energy Use

The estimated major energy end uses in the commercial sector are space heating and space cooling (39%), lighting (14%0, water heating (13%),refrigeration (12%), and electronic equipment (6%). Motive power required in fans, pumps, and other equipment is estimated to account for 8% of the energy use in this sector.

Estimates have been made that the commercial sector could cut its current overall consumption of electricity by around 30%. Such a saving in Southland would represent around 13GWh.

Within the commercial sector the hotel sub-sector consumes around 6% of the total commercial sector energy consumption. Of the electricity used by the hotel industry, approximately 39% is for refrigeration, another 29% for space heating and cooling, 17% for water heating, 9% for cooking, 5% for lighting and the remaining 1% for electronics and other electrical uses.

It has been estimated that at least 10% could be cut from current hotel electricity consumption by adoption of energy efficient appliances and practices.

Efficiency improvements in the use of energy for heating and cooling on dairy farms are worthy of significant research.

13.3 Industrial

The major industrial energy end uses are process heating (51%), motive stationary power (12%), iron oxide reduction (11%), aluminium oxide reduction (10%), vehicles owned by the company (6%), water heating (3%), mobile motive power (3%), refrigeration (2%), lighting (1%), and others (1%).

Opportunities for improving energy efficiency in the industrial sector span a range of technologies such as motors, heat exchangers, process heating and cooling optimisation, mechanical vapour recompression, cogeneration, and infra-red heating, amongst others.

EECA reports indicate that by employing readily available technologies and behavioural changes, the following magnitude of savings could be expected in New Zealand industrial sector. It is assumed in this assessment that similar savings would occur in Southland.

- Around 20% of the current electricity used could be saved, mostly in electrical motor drive systems.
- About 55% of the coal currently used could be saved. The major source of this potential saving is from improvements in the combustion efficiency of boilers and in the efficiency of medium temperature process heating.
- About 25% of the current wood fuel use could be saved, mostly in medium temperature process heat production.
- Approximately 4% of the oil currently used could be cut, mostly in the areas of low temperature process heating, medium temperature process heating and in mobile motive power.

With monitoring of electricity use the power factor on industrial sites can be identified and if low adjusted to achieve cost savings.

The installation of electricity time-of-use meters can provide the energy use information that managers need in order to identify opportunities for cost savings.

The large energy intensity variations across companies within any given group of the industrial sector indicate sizable benchmark energy saving opportunities. For example, in the forest processing industry, if all of the companies which consume more energy per unit of physical production than their respective sub-sector averages are lifted to their sub-sector average levels, then the forest processing industry as a whole could save up to 14% of its current energy use.

EECA has established a Fleet Transport Audit Programme that should be utilised for commercial transport fleets.

14. The Portfolio of Opportunities

While Southland is rich in energy opportunities a number are not likely to be economic in the near term. Some economic opportunities may be easily achievable but will only have a small impact on the regions energy supply. Some of the potential high value opportunities may however be more difficult to achieve, or the risk of obtaining a good return on expenditure is high.

14.1 Business as Usual Opportunities

In order to obtain a picture of the opportunities that are available for improving the energy supply and cost under a business as usual scenario a list of opportunities is setout in table 7. This shows the assessed economic cost on a cents/kWh basis and assessed quantity of energy that may be affected by implementation of the opportunity. To get a measure on the significance of each opportunity investors need to look at the variable component of their electricity prices that they can effect by the investment. The fixed component of electricity supply will generally not be affected by implementation of these projects. Target opportunities should be less than 13-15c/kWh for residential applications and 8-12 c/kWh for industrial applications. (However it should be noted that some industrial applications may be able to affect both the fixed and variable component and the target would be 13-15c/kWh) The target for wholesale electricity should be 7.5c/kWh post 2007.

Opportunity	Economics	Additional* GWh pa		Comment
	c/kWh	2003 - 2010	2010 - 2015	
Large wind on coast	7.5-10.5	116	200	100MW= 316GWh
Small distributed wind (rural pumping)	30	2.5	2.5	200*10kw=4.4GWh
Small distributed wind (dairy electricity)	36		<1	0.7 from 30 farms
Distributed wind (industrial)	14-18	3	9	Second hand Turbine 9-12 c/kWh
Dairy biogas (liquid waste)	17	2	18	
Solar water heating (residential)	8-10	3	7	5% dwellings, 5 GWh
Solar water heating (large volume hot water)	6-9	1.5	1.5	50*12kw=1.5
Solar water heating (dairy)	7-9	1	2	50*9kw=1.0
Residential warm home programme	9	14	14	8% saving
Commercial business energy utilisation (audits & improvements)		7	6	
Industrial energy utilisation (audits & improvements)		10	7	
Industrial cogeneration (lignite/coal)	11-13	7	14	5*2MW=8.8
Industrial cogeneration (biomass pellets)	35		0	
Industrial cogeneration (on-site biomass waste)	9-11	11	10	
Industrial cogeneration (forest residue)	14-16		21	
Small hydro (aqua type)	8-15		570	70 - 120 MW
Ethanol (sugar beet)	11			
Large coal** (150MW_e)	6.2-8		1100	90% load factor
Municipal landfill	5-9	6		
Industrial liquid waste biogas	7	6	6	
Offshore/onshore gas				?
Wave energy	6-20			
Photovoltaic electricity	60			
Biodiesel	11			
TOTAL		**190**	**1990**	

* The additional energy being produced for each activity by the end of the period
** Could be a single power station or large cogeneration facility such as at Edendale

Table 7 List of Energy Opportunities

The additional 190 GWh per annum of energy achievable in the period up to 2010 is equivalent to about 60 MW of new generation. The further additional 1990 GWh per annum achievable between 2010-2015 is equivalent to about 425 MW of additional electricity generation.

In table 8 the opportunities are grouped and ranked in a priority order to indicate how they can be approached through a regional strategy. The priority ranking takes account of economics, strategic benefits, and ease of achievability.

Priority	Activity	Action Required
1	Community recognition of energy	Promotion of energy as a valuable Southland resource
2	Gas exploration	Encouragement of gas exploration
3	Industrial energy efficiency	Assistance through provision of information, workshops, cluster activities, benchmarking
4	Residential energy efficiency	Assistance through provision of information, public presentations, demonstration sites, media
5	Wind farms	Assistance to potential developers to obtaining access and resource consents
6	Commercial/residential solar water heating	Promotion of benefits, demonstration sites
7	Transmission upgrade	Clarification of options, secure access, resource consents
8	Coal based electricity	Assistance with establishment of a coal fired power station / cogeneration plant
9	Bioenergy cogeneration	Case studies and role models
10	Dairy Farm energy	Case studies and role models, wind maps
11	Small hydro	Multi resource use investigations – recreation, irrigation

Table 8 Prioritised Opportunities

14.2 Meeting Significant (100-150MW) Increased Demand

The opportunities for providing the approximately 100 - 150MW of additional electricity demand in the Southland region identified in section 10, which could include 50 MW of peaking generation to improve reliability of supply in the area and also avoid the need for expensive transmission upgrades, is shown in table 9. A significant amount of additional generation capacity is achievable at generation costs of 7 – 15 c/kWh and significantly from renewable and bioenergy sources as well as fossil based coal, and potentially gas. This gives a balance to the portfolio of resources, particularly in a dry or windless year through improved reliability and greater certainty of supply. Plant installed solely for peaking and generation support is more costly and the availability of Manapouri hydro storage (or hopefully gas) is more suited to this role. This is in addition to opportunities for reliable supply that could be obtained from the demand management opportunities that are listed under the business as usual scenario. .

There are a number of large generation opportunities available and while these are possible and feasible their implementation is dependent on wider national and international specific company business decisions. Note however that the costings are based on preliminary information that would need to be more fully investigated and developed with other parties.

The operation of the South Island transmission system would benefit from installation of a sizable thermal generation facility. However where to locate this is problematic because of the constraints throughout the South Island.

While there are specific large energy investment opportunities such as that based on lignite available it is unlikely that in the short term a single project would meet the additional energy requirements. This is because of the transmission constraints north of Southland that would significantly affect revenue received. It is more likely that additional supply would be met by a number of distributed energy management projects, or combined projects such as coupled hydro and wind, or a cogeneration plant at Edendale. Such an approach provides good risk management for investors and allows for staged investment. Post 2010 it is expected that a large lignite fired power station would be built.

Large scale capacity options are listed in table 9.

The demand management opportunities under business as usual are also as viable as the additional generation opportunities for meeting new demand requirements. Also with investment in a number of projects in the region investors would be able to establish a more viable support presence and there are economies of scale from the management of a number of projects.

The regional economy is based on distributed industrial complexes. This lends itself to a distributed energy solution.

Opportunities	c/kWh	Description	Comments
Base Generation			
Wind farms	8	100 MW windfarm, 1.5 MW turbines, energy firmed by linkage to Manapouri storage.	Potential is greater than 100MW.
Edendale / wood processor cogeneration	*	30 MW_e, dairy factory and wood processing site cogeneration, and peaking capability	There are adequate coal/lignite available that could fuel a number of sites
Small hydro	8 -15	70-120 MW available on a number of sites	
Lignite fuelled power station	6 - 8	100-150MWe power station located near cooling water and transmission lines	
Peaking			
Dry year reserve generation	15-20	150MWe Government owned diesel fuelled dry year reserve plant	Constrained by transmission
Sheddable load			A number of the industries in the area have capability for sheddable load.
Standby Generation	20-25		The hospitals, number of hotels and industry has standby generation installed.

* This has not been estimated as the steam load profile and boiler size is not known

Table 9 Large scale Electricity Generation Opportunities

14.3 Energy Firming and Peaking

The biggest problem with attracting new major industry to Southland is the inability for that industry to obtain a firm electricity supply at an appropriate price. Because of supply constraints when Manapouri has low water inflow and constraints on the north transmission system the need for local firming capacity would improve supply capability.

The availability of gas within the region would provide the most flexible form of firming renewable energy supply. The exploration of gas and its extraction has to be the highest priority of all regional energy opportunities.

The alternative priority opportunity would be to generate base load electricity from coal, lignite or biomass fuel. This would allow Manapouri and Monowai generation to be used for load following and peaking which it is most suited for.

Coupling wind with hydro energy firms the wind by using hydro as an energy storage reservoir.

The Government has committed to providing dry year reserve generation which currently is proposed to be by way of 150MW distillate fired gas turbine with a default location at Whirinaki in the North Island. South Island locations for some or all of this generation are possible. At a price of 15-20 c/kWh this would be a very expensive way of providing residual electricity supply in Southland long term, but its importance for Southland is for providing a price cap in the short term until additional generation is built elsewhere. The reserve generation would operate when the constraints for north –south electricity flow are most serve.

This assessment shows that for long term firm electricity supply there are a number of other more cost effective opportunities available. However many of these will take some years to implement when the national supply concerns are for the next two years. Attracting installation of reserve generation plant in Southland can ensure price stability, albeit within a still reasonably high price cap.

15. Stewart Island

Over the years there have been a number of investigations into the use of wind, hydro and wave energy on Stewart Island in order to provide cheaper energy to inhabitants. This assessment has reviewed that work and summarises it in Appendix 14. The following is concluded;

- The inhabited area of Stewart Island is a low wind speed area (average 3-4 m/s). Studies carried out over two years confirm that the wind resource is too low and wind energy is therefore not economic. While there are gusty periods there are long periods of low wind speeds. Further wind monitoring is recommended to identify if there are other adjacent areas on the island where wind speeds are higher.
- There are several hydro electricity generation opportunities which previously have not been economic because the electricity demand was too low to recover costs of construction. A hydro scheme on the Toitoi River was capital intensive and required hydrological investigations and environmental assessments. In view of modern thinking about hydro projects it would be appropriate to revisit these opportunities. It is likely however that the electricity demand on the island is still too low and hydro generation would only become economic if additional electricity demand arose from cool stores etc.
- A cable could be laid from the mainland, and while considered more economic than diesel generation, would be exposed to potential damage from oyster dredges,

ship's anchors and possible shifting sand bars unless buried which would increase installation cost. It was for this reason that it has not previously been proceeded with.

- LPG is still considered to be the least economic option mainly due to delivered fuel cost.
- It is unknown if any solar water heating systems have been installed on the island, but if not, these would be worth considering. Whatever energy source is currently used for heating water, solar energy can be used to supplement existing hot water systems and be a serious consideration for new buildings.
- Wave power has also been investigated but the resource is on the opposite coast from the load. Transmission costs across the island to get the electricity to the users make this energy source uneconomic at present.
- Diesel electricity generation at around 30c/kWh will still be the best option.
- Wave power and photovoltaic electricity generation options are likely to be come economic in the future and the cost of these should be monitored.

16. Potential Investors

There are a number of potential investors for energy opportunities and many of these are already active in the region. However as energy based projects are usually long term investments they only attract investors 'in for the long haul'.

Meridian Energy
Meridian Energy owns the Manapouri power station and control the operation of water flows associated with Lakes Te Anau and Manapouri. There is a natural interest in their investing in any generation facilities using these waters. They have also indicated that they are investigating possible wind projects near Tiwai Point and are a retailer of electricity in the region.

Meridian Energy has a subsidiary, Meridian Solutions who own the Dunedin Hospital Energy Centre, and the Blue Mountain Lumber Energy Centre. Meridian Solutions has indicated an interest in further investment in energy facilities associated with wood processing or other large energy uses in Southland. Further investments would provide economies of scale and link to the hydro and retail energy activities in the region.

Genesis Power
Genesis Power has expressed an interest in investment in the region but are not known to be active. They have some industrial customers in the region.

Mighty River Power
Mighty River Power has not invested in the South Island to date but they are known to be wishing to broaden their investment base. They have some industrial customers in the region.

TrustPower
TrustPower hold three resource consents for wind energy monitoring but recently sold the Monowai power station and vacated the region. They own a number of wind farms and

small hydro plant throughout the country and would be likely investors in further generation facilities. They have some industrial customers in the region.

Pioneer Energy
Pioneer Energy own the Monowai power station and other small hydro facilities throughout Otago. They would be likely owners /operators of wind and small hydro plant but their capital base may limit their capacity for large scale investment.

Contact Energy
Contact Energy are not known to be active or potential investors in Southland. They are a major electricity retailer in the region.

Solid Energy
Solid Energy own substantial coal/lignite reserves in Southland and have put substantial effort into investigating coal based electricity generation plant either as standalone or as cogeneration plant. They have the expertise and financial capability to build coal based electricity generation plant. In recent times they have also moved into the wood pellets business as they broaden their supply base.

Oil / Gas Exploration Companies
There are a number of New Zealand and international oil exploration companies who have been involved in oil/gas exploration in the region. Several have indicated a strong interest in continuing their involvement in the region but the economics is not currently suitable for them. With the pending increases in gas price in the North Island there will be a stage whereby their interest will increase. Effort should be put on encouraging them to return or for new companies to arrive.

Commercial / Industry Owners
The existing owners of commercial and industrial activities in the region should be the first to be encouraged to invest in cost effective on-site cogeneration / embedded small wind generation, solar, energy management, biogas. By integrating these investments into existing operations the capital costs can be reduced. They also have opportunities for working in clusters and sharing costs. Many of the industrial owners have limited cash flow and access to capital can be a major constraint on their investment in facilities that they know would be financially attractive. Joint ventures or other associations with potential investors may be options

Dairy Farmers
Dairy farmers are reasonably large users of energy but they are also the sector with the most opportunities within their own control. While access to capital will be a constraint to some, for the majority it will be the lack of role models and case studies to show by example the opportunities that they each have.

Residential
Investment in home energy efficiency improvements and the installation of solar water heating are already recognized as sound investments for homeowners. A benefit of these investments is that they can be undertaken as funding is available, can be staged, and the financial benefits accrue directly to the homeowner.

Invest South
Invest South is a 100% Southland owned equity and debt investment company with an authorised capital of $10 million. It has been established to invest in companies operating in Southland (and elsewhere in the South Island) to meet the identified shortage of available debt and equity funding for many worthwhile existing or new local businesses. Invest South would be an appropriate entity to provide financial assistance for many smaller energy projects. Southland is fortunate to have already taken this initiative as the need for such entities is now being realised elsewhere within New Zealand.

Private Investors
There has been little recognition within New Zealand of the energy investment opportunities available. Because a major barrier to many energy projects is access to capital funding the structuring of suitable investment entities is now becoming recognized. Many of the investments are low risk because of the essential nature of energy. Where energy users can convert capital expenditure into an operating cost through leasing or other financial arrangements, there are distinct commercial benefits to business.

PowerNet
With the recent widening of the ability of electricity network companies to invest in electricity generating facilities PowerNet has now been freed to become more involved in generation. There are possibly a number of distributed generation or energy management opportunities that could provide PowerNet with substantial commercial benefit. They have the capability and technical experience to take on this role and optimize the use of generation or line upgrades to provide least cost solutions. There are few other energy market players who have an ability to make trade offs in this manner. Being locally owned they also have an ability to internalize some of the intangible community benefits that are difficult for investor driven companies to secure.

Venture Southland Charitable Trust
The Trust has been established inter alia to undertake initiatives that are applicable to the recommendations of this assessment. These include;

- Facilitate initiatives for the development and/or provision of natural resources, infrastructure, assets and industry,
- To own rights to resources and intellectual property,
- To facilitate research,
- To support education and training,
- To promote approaches to sustainable development.

The Trust is a suitable vehicle to implement many of the activities arising from the recommended strategy arising from this assessment.

Community Trust of Southland
The Community Trust of Southland's purpose is to manage its investments and to apply the income from these investments for charitable, cultural, philanthropic, recreational and other purposes beneficial to the Southland community. These projects could be energy related.

17. Enabling Regional Resources / Technologies

Local Business
Encouraging local business to take a greater interest in their energy use will unleash the largest opportunity Southland has for improving utilization of energy and thus reducing current or increased demand. As energy costs are significantly higher at peak demand times obtaining a regional focus on peak demand can bring about a flattening of peak demand and a reduction in energy related costs.

Encouraging business to think about energy use /cost can encourage local entrepreneurs.

Regional Energy Champion
To maximize the opportunities for Southland in the availability and cost of energy there is a need for a recognized regional energy champion. Without a champion many opportunities will be lost and others not recognized.

It is understood that Venture Southland has picked up this role and this project is the first of its initiatives. It is important that this continue as energy supply is currently undertaken by large national companies who generally won't have a local interest in Southland. A regional energy champion can monitor their performance with regard to Southland and be an advocate on behalf of Southland interests when necessary.

The energy market is now very complex and it is only active players who can keep up with regulatory and market changes. It is also difficult to keep in touch with the principal energy market players. A regional energy champion such as Venture Southland can keep well informed about market behaviour and assist local business take appropriate actions.

Venture Southland can also facilitate the securing of government funding and assistance from renewable energy and energy efficiency programmes. Accessing such assistance is often a matter of experience in knowing how to present appropriate projects. It can also be inefficient for a number of parties to be competing locally for the often scarce funds. Regional collective programmes are likely to be most effective in securing funds for the region.

Southern Institute of Technology
The Southern Institute of Technology has a central role in assisting investment in sound energy use within the region. The shortage of trained people, particularly in the trades is a major barrier to the greater introduction of renewable energy and adoption of good energy use practices.

Community Attitudes
Encouraging Southland's energy users to think about energy and recognizing that it is an asset that can produce wealth for the region should be a key aspect of a regional energy strategy. Many of the energy resources have potential adverse connotations and it is easy to allow these to become barriers to untapping the energy wealth. The expansion of the Manapouri power station has demonstrated how energy projects can be implemented in environmentally sensitive ways that enhance societal wellbeing. There also needs to be recognition that wise use of fossil energy can allow greater value to be unleashed form renewable energy sources.

Electricity Metering

Development of a community having an efficient use of energy requires good information on where and how energy is used. This applies to all users although the larger energy users clearly need the most detailed information. This information can only be obtained from appropriate time-of-use meters.

The electricity market operates at a national level on half hourly production and use data. This level of data is also used by most major energy users as supply contracts will usually have the price based on half hourly use. This applies for both fixed price and spot market contracts.

Time-of-use electricity meter technologies have advanced to the level of accuracy that half hourly data is easily measured, and through the use of internet based communication systems, the data can be received in "real time". However less sophisticated "next day available" monitoring is available with internet access and this is more appropriate for most large energy users.

Of the large electricity users who have time-of-use meters it is unknown how many of those are receiving and using the wealth of information that is available from the meters.

It is recommended that for any user who wishes to understand their energy use and take steps to improve efficiency of use, that time-of-use meters be installed. Not only will they have the data from which to analyse how they are using energy, but they will be able to make decisions that will reduce their energy costs. They then have the option of obtaining (from some meters) internet based data in "real time" or "next day".

While it can be expected that most industrial and commercial business will have time-of-use meters before the end of the decade, it is unlikely that residential users will do the same, unless there is a strong directive from government or push from the region. This is because of the cost of meters and the significantly less opportunity that residential energy users have for altering the time they use electricity.

Energy Auditing and Benchmarking

Coupled with the metering of energy use is the undertaking of audits to ensure that it is being used efficiently. This in itself can be undertaken efficiently by having adequate local trained energy specialists and sharing the cost of audits. Many business have similar functions and if a specialist auditor has to come from elsewhere in New Zealand then it is efficient that they audit a number of business on a single visit. This can also provide good benchmarking information and identification of best practice.

Heat Technology

As the amount of heat plant increases there is a corresponding need for trained heat equipment specialists. This is an area that is often overlooked but where skilled personnel can make significant cost savings.

Government Agencies

There are a number of Government agencies who have funding programmes for achievement of specific national objectives. The Energy Efficiency and Conservation Authority (EECA) is the most prominent with regard to energy. Accessing funds from these programmes is best achieved through having experience of previous programmes and being able to align the regional and national objectives.

18. Barriers to Meeting Energy Target

Accessing Guaranteed Energy Supply
While under normal hydro year conditions Southland has adequate energy supplies the region lacks access to adequate quantities of guaranteed energy necessary to attract new energy intensive industrial opportunities. Being dependant on renewable (hydro) energy means that supply is constrained during low hydro lake situations. If Southland is able to guarantee energy supply at an appropriate price then energy intensive industries are more likely to locate in Southland.

An inability to supply guaranteed energy is a low probability event, but still higher than industry can stand.

There are three principal options for meeting additional electricity demand requirements;

- Upgrading the transmission system from Dunedin or Roxburgh,
- Install 100-150 MW of coal fired generation
- Install 100 – 150 MW of additional wind and hydro energy, coupled with Manapouri to provide a firm energy supply

Energy efficiency and electricity options such as cogeneration, solar energy, bioenergy and other opportunities are adequate only for maintenance of business as usual.

Access to Capital
While there are many energy investment opportunities available to business their access to capital funding is a significant constraint.

Resource Access
If Southland is to maximise the value from its energy resources it needs to ensure that access to resources is facilitated. At present there are some resources, particularly renewable, that are unavailable for utilization because of historical events rather than a proper need to lock them up. Access to these resources should be addressed to ensure that their unavailability is for sound and still valid reasons.

Wind
There are some areas where the best wind resource is not available because of the public ownership of the land, or its designation is thought to be reserve land. This is particularly the case along the coastal strip where the best winds occur. Wind turbines can be compatible with reserve or other land uses provided proper location and construction is a condition of resource consent.

Mataura Water Conservation Order
The Mataura Water Conservation Order was put as a blanket prohibition on the use of the water in the river during an era when there was a concern about hydro energy developments on it. The result is that because the order is so wide, covering all tributaries, it penalizes the Mataura community from using its water wisely for agriculture and energy. The issue is not that there is a Conservation Order, but that it is so blanket. The Order should apply to only those aspects of the river that fully meet the requirements of the legislation.

Community Attitudes to Energy Projects
Energy is currently portrayed in the Regional Policy Statement in a negative light as if it has a high probability of producing adverse effects which is not necessarily the case. The possible adverse effects noted are valid concerns but if Southland wishes to make positive use of its energy wealth these concerns should be noted as issues that energy users must address, rather than assuming that the adverse effect will result. Good design of energy projects can result in projects that minimize adverse effects and this should be the objective of the Policy Statement.

There is an assumption in the Policy Statement that all new investment in energy projects must be based on renewable energy, and that all non renewable energy is bad. This arises from a narrow interpretation of "sustainable". An alternative interpretation recognizes that the value of renewable energy is often maximized by support (firming) from non renewable energy. Southland is in the fortunate position that it has coal/lignite and possibly gas which it can use to maximize the value obtainable from its (non firm) renewable energy resources. This should be recognized in the Policy Statement and as such would set an alternative more positive baseline for community attitudes on energy use, while ensuring good environmental outcomes.

The Policy Statement bias against energy use needs to be balanced by recognition that positive outcomes are as valid an objective as is minimization of adverse effects.

Access to Information
As the region takes responsibility for its own energy it has the potential to facilitate a widening of the investor base for energy initiatives with the result that the region is no longer dependant on the large energy companies with their narrow interests. As potential investors, small/medium enterprises such as farmers are able to increase investment in energy opportunities they are often hindered because of the lack of information about the opportunities. This may be in the form of resource data or role models.

Environment Southland has identified in the Regional Policy Statement that access to information is a key requirement of achieving the objectives of the Policy Statement. The Venture Southland website would be an appropriate vehicle for storing the information and assisting its dissemination to potential users.

The lack of wind data in particular creates a barrier for farmers and small/medium industrial enterprises from considering the vast number of wind opportunities available. Public availability of wind maps to a realistic scale would overcome this barrier.

The preparation of case studies, reference sites and handbooks would show the opportunities available and indicate the financial benefits achievable. This is applicable to both energy efficiency and energy sourcing opportunities.

The education and transfer of knowledge needs a facilitator and Venture Southland or the Venture Southland Charitable Trust or are both ideally established to undertake this. As a facilitator they would also be a good conduit to Government for accessing specific programme funds that are available for this activity.

Resource Consents
Because the issuing of resource consents is effects based potential investors in energy projects have to provide information on potential effects. This can involve extensive research and investigation and can be very costly. In order to reduce costs and encourage good outcomes of the process it would be advantageous to all parties involved if information that is common to a number of potential opportunities are prepared as standard references. A good example and possible model is the Regional Air Quality Plan for Southland.

Over the next two decades wind turbines are likely to be distributed in a number of locations in the region. Unless the process for obtaining resource consents is made efficient, and at minimal cost, investment in wind energy opportunities will only be able to be done by large well funded developers. Excessive costs will effectively prohibit say farmers accessing this resource.

No Requirement to Supply Energy
There is currently no requirement for any energy company to supply customers or potential customers. A person seeking supply of electricity has to pay the full costs of any necessary electricity lines, transformers, or other equipment. This makes it important that a person seeking, for example a new electricity supply, should investigate the options. These may include installation of their own energy system - it may be that they can meet their energy requirements by other energy forms such as solar or bioenergy.

Most people do not have good information on their options and it may be expensive for them to fully investigate. There is a need for case studies and role models that may assist evaluation of the options, at least so that they know what specialist assistance they may need and where to get it.

Gas Exploration
While the extraction of gas from under Southland could provide the most valuable and flexible energy resource in the region it is also the most expensive and risky investment opportunity.

Fragmented Energy Market
The energy market is very fragmented with a number of players, many of whom are constrained by legislation from entering some activities. Generally, others such as the electricity retailers are also generators. Electricity network companies don't have direct contact with customers; it is through the electricity retailer.

This fragmentation means that there are significant inflexibilities in the market and its few players mean that there is little competition.

Sale of Electricity
Where a cogeneration or other similar facility is operated and there is surplus on-site electricity the owner would like to sell it. There is a difficulty in finding anyone to purchase the electricity as most retailers have their own generation. Even if a purchaser can be found it is difficult to be able to get a price that makes sale worth entering into. If the energy is controllable and able to be scheduled to high price times of the day then it is easier to find a purchaser. The transaction costs of setting up a sale and purchase

agreement, with an associated distribution agreement is generally very high and kills the project.

For photovoltaic and other small sources of generated electricity it may be possible to have a net metering arrangement. This is generally not supported by the major energy players but the benefits are such that it should be worked through with relevant parties.

RMA Legislation

The amendment to the Resource Management Act currently before Parliament makes provision for renewable energy but is limited to only covering electricity generation and does not cover heat production. There is also no provision for the access of transmission lines to any resulting development.

19. Alternative Approaches to meet 2010/2020 Energy Target

Option A - Upgrade Electricity Transmission Capacity

The upgrade of the Roxburgh – Invercargill electricity transmission network so as to be able to handle an additional 150 MW of North – South electricity flow would provide adequate capacity in Southland during periods of low water inflow into Lake Manapouri. The frequency of this constraint occurring is not high and as a result it would not be expected that upgrading would be prioritized for some years.

The priority could change if there was a firm need able to be demonstrated. To overcome this “chicken and egg” situation it is recommended that the region work closely with Transpower to sort out the preferred option, including access to land and route designation, so that the upgrade could occur quickly if a major energy user came along. It would also remove the uncertainty affecting the region with regard to energy supply options available.

If the upgrade option could be readied and “put on the shelf” then it would provide more certainty to attracting a new major energy user such as for silica smelting.

Option B - Install 100-150MW of Firm Electricity Generation

Encouragement can be given to energy companies to build large scale electricity generation facilities. These could be based on coal, hydro, wind, or distributed generation.

Each is technically viable and the cost is near current market prices. However the decision on investment is any of these will be driven by national electricity market parameters and the commercial objectives of energy companies. Other than working closely with the various potential investors to reduce barriers there is little else that the region can do. The issues that are potential barriers are generally also the issues outlined in Option D.

Installation of the Government’s Reserve Generation would be a good short term measure.

Option C - Develop Gas Supply

Because of its flexibility, gas is one of the most valuable energy sources that Southland could develop. However while it is high value, the cost of exploration and extraction are potentially high with a high risk that it would not eventuate.

From a regional perspective, effort should go into promoting the resource and the attractiveness of Southland's support infrastructure to potential international investors in order to attract a developer. If it comes off the region is a significant winner.

However because there is no gas infrastructure in place this will be a significant barrier unless it is economic for existing industry to use or new industry can locate nearby. Electricity generation is likely to be the most economic use unless a large reserve is found.

Option D - Enhanced Business as Usual

The assessment shows that Southland is energy rich and is already pursuing a number of energy initiatives. Continuing the current business as usual trends is a viable and cost effective option.

While this approach will reduce energy costs and thus enhance regional business competitiveness it may not necessarily provide for the additional long term secure electricity supply that a new large energy user such as for silica refining or other new industries require.

Portfolio of Solutions
By pursuit of a portfolio of opportunities the economic ones will proceed quickly and less economic ones only when costs are appropriate. However pursuit of a number of opportunities additional to current initiatives that are available can result in improved energy utilization, reduced energy costs, and enhanced community wellbeing. This approach can be pursued within the existing resources of the region and builds on existing capabilities. It is also incremental with costs spread over the whole community, with many benefits captured directly by investors.

A portfolio approach is a sound risk management strategy.

Promotion of Southland Energy
Southland is not generally perceived to be energy rich but it has a large amount of untapped energy much of which is easily accessible and of adequate quantities that can provide a number of opportunities. Promotion of Southland energy will encourage utilization and entrepreneurial development. This can assist reduce energy costs and encourage economic growth.

Southland is fortunate that it has a wide range of energy options and lower population density resulting in low adverse effects. This assists with assessment of resource consents.

Venture Southland Charitable Trust - Energy Champion
Southland has already taken a significant step in the establishment of Venture Southland Charitable Trust. One of the objects of the Trust is to provide leadership and facilitation of energy projects. This is a key role as with the fragmentation of the energy industry and

the concentration of power within a few larger electricity companies who are supply driven, there is a need for such a champion of Southland's energy interests.

Government wishes to assist the promotion and uptake of energy efficiency and renewable energy and for efficiency reasons likes to work through industry or regional clusters. The Trust is in a position and to become experienced in accessing government funds for specific programmes. The Trust is not only able to facilitate investment, but can itself become an investor.

Regional Implementation of the National Energy Efficiency and Conservation Strategy

The Government has established a National Energy Efficiency and Conservation strategy (NEECS) which is a very comprehensive series of programmes relating to all aspects of energy efficiency and conservation. Many of the initiatives listed and being pursued by a wide range of parties are directly applicable at a regional level. It is recommended that by active consideration and involvement with appropriate parts of the programmes that the outcomes can be easily used to assist improve energy utilization in Southland. By active participation the region will also be able to ensure that the expenditure of government funds within Southland is maximized.

City and District Council Initiatives

The Councils have the opportunity to provide the leadership and role models for establishment of an enhanced energy future for Southland. The Council policies and actions can provide encouragement and reduce implementation costs.

District Plan Policies

Councils can include encouragement for good energy utilization through District Plan Policies. These may include;

- The rules for subdivision
- Avoidance of shading effects on receipt of solar radiation by neighbours
- Good energy utilization in building design
- Recommendations on building energy efficiency standards
- Rules for energy use in specific areas

Building Design

The Councils can provide information on good building design that will improve energy use in buildings at the design stage. This is the most cost effective time to introduce change. The Councils can make available to all ratepayers information on a number of initiatives that they can take including:

- Building orientation to the sun,
- Design to capture passive solar energy and retain it in the building throughout the day
- Double glazing
- Solar water heating
- Installation of high efficiency space heaters
- Good insulation
- Internal energy distribution

This information can be provided with rates demands, through building inspectors, and at the time enquiries are made with regard to building consents. Distribution through these channels can be low cost and encourage good energy design in buildings to become a way of life.

Home Energy Rating Scheme
The introduction of a Home Energy Rating Scheme (HERS) can provide a mechanism for assisting the cost of energy efficiency improvements to be reflected in building valuations. Such a scheme has been developed by the Christchurch Regional Council and EECA and can easily be adopted by each Council.

The HERS is based on an energy efficiency rating being established for each building according to the degree of energy efficiency attributes, eg double glasing, solar water heating, insulation etc) that has been included in the building. The aim is that when a building owner sells the building that the rating is an attribute that encourages a high price.

Council Facilities
Councils can provide a good role model by including energy efficiency measures such as solar water heating in their own facilities. If ratepayers see the Council using say solar water heating, for say community swimming pools, then they are going to be more likely to consider it themselves. ECCA provides financial loans to encourage Councils to be role models.

Building Consent Processes
Many energy efficiency initiatives often require modification of building structural elements and thus require a building consent. The requirements of obtaining the consent and compliance monitoring can some times be more costly than the cost of the equipment and installation. Installation of solar water heating systems is a case in point. Councils are encouraged to adopt standard acceptable solutions for installation that mean that if complied with result in a near automatic issue of a building consent. Such processs will greatly reduce the cost of installation of many energy efficiency measures.

Regional Council Initiatives
The Regional Council has the opportunity to provide the leadership and be a role model for establishment of an enhanced energy future for Southland. The Council policies and actions can provide encouragement and reduce implementation costs.

Regional Plan Policies
Council can include encouragement for good energy utilization through Regional Plan Policies. These may include;

- The rules for water allocation
- Establishment of emission standards for heating systems
- Liquid waste discharge rules

Effects Based Policies
The Council is encouraged to review its current policies many of which are input related rather than effects based. The focus on renewable energy at the expense of utilization of fossil fuels is an example. Such a bias does not encourage the wise use of energy per se. Renewable energy is often not firm and its value reduced because of this. By use of reliable energy forms, often fossil fuel based, allows optimization of renewable energy.

Resource Consent Processes
The obtaining of resource consents for energy projects is often difficult and expensive because invariably they have the potential to adversely affect surrounding communities and often result in changed land uses. Regional policies and the use of Rules and guidelines and other standardized information can reduce costs. It is recommended that a working group involving several experienced developers and environmental guardians be established to identify efficient processes and information requirements.

Resource Consent Conditions
It is useful when there is potentially a number of similar resource consent applications likely to be lodged that standard resource consent conditions be established for the region. This can assist a developer as they can see from the outset the conditions that they can expect may be attached to a consent. It also assists potential objectors to an application to see possible conditions as they are then able to focus on the adequacy of the conditions.

Water Allocation
The establishment of water allocation rules which incorporate hydro electric generation as well as extraction, recreational uses, and preservation of native forna and flora would assist consideration of multiple use of scarce water resources.

Access to Energy Information
The establishment of a directory of information sources would assist many individuals and business in the region to identify, consider and implement energy projects. This could be accessable on the Venture Southland website. The directory could cover;

- Resource data
- Technology
- Suppliers of equipment
- Specialist advisors
- Names of trained installers of energy equipment
- Links to other information providers.

Funding of Energy Efficiency Improvements
The capital cost of many energy efficiency improvements is often a major barrier to their implementation. An example of this is solar water heating systems. In some overseas areas the local council or a special purpose entity has established a lease-to-buy programme. In these programmes the council or special purpose entity installs and owns the system and the building occupiers who gain the benefits make a monthly payment through their rates or electricity bill to pay off the eventual purchase of the system. The level of payment is set according to the level of energy saving that they receive. Such a scheme is analogous to how television sets were often purchased during the initial days of the introduction of television in New Zealand.

It is recommended that such a scheme be investigated for Southland.

Industry Benchmarking
Where there are similar businesses throughout the region eg wood processors, the establishing of benchmarking of energy utilization can assist movement of those businesses towards best practice.

Industrial / Commercial Energy Auditing
Energy auditing can produce significant savings in energy cost. The cost of auditing can be reduced if a number of businesses are audited as a group. This can reduce the cost of obtaining the most appropriate auditors through the reduction of transport and accommodation costs.

Cluster Activities
There are economies of scale from industries clustering together to negotiate energy contracts and to share expertise. Co-location around a shared energy cogeneration facility can allow optimisation of each parties energy demand to reduce costs.

Energy Contracts
With the introduction of spot electricity prices and more complex energy supply contracts many businesses may no longer be obtaining energy on the most favourable terms to their requirements. Seminars and assistance on the range of contracts available can assist reduce energy costs. This is an area that is often not addressed by business as they are often not aware of alternatives. Energy audits are usually the first identification that costs are unnecessarily high.

Promotion of Demand Reduction / End Use Efficiency / Solar
Residential and business opportunities are usually not pursued because of a lack of information and leadership. Establishment of regional programmes in association with national bodies will assist the dissemination of knowledge and thus increase the uptake of these opportunities.

Investment in Emerging Technologies
There are a number of emerging technologies that could be based on Southland energy resources or technical expertise. These include;

- Ethanol from Sugar Beet
- Biodiesel
- Wave Energy
- Hydrogen
- On-farm biodigesters
- New coal based products

20. Strategy For Meeting 2010 Energy Target

Adoption of a regional energy strategy based on the following will assist Southland competitiveness and its ability to attract new major energy use industry.

Regional Attitudes to Energy
Southland is in the fortunate position of being energy rich. Promoting Southland as being energy rich will encourage the entrepreneurs to identify opportunities. This may happen first within existing business (including farming) interests and spread to others including trades people. Setting a positive attitude frees thinking, encourages innovation, and provides opportunities for managing risk.

There are a number of ways in which energy supply and price certainty can be improved but people need encouragement to spot the opportunities. Such an attitude can subsequently spread to the large energy users considering locating in the region when they see that energy risks can be managed.

Positive attitudes to energy will recognise the inter-relationship of energy resources and the community and environmental values important to Southland.

A Portfolio Approach

There is no single activity that will improve Southlands energy supply and cost requirements and a portfolio approach is recommended. This builds on the very cost effective opportunities immediately available and leads to a strengthening of the existing commercial base of the region. From this platform improvements in energy use can be made and new opportunities pursued as they become economic.

Southland is rich in both coal based and renewable energy and utilisation of a mix of these will maximise value through firming supply capability and price. Because renewable energy is weather dependent it generally has to be used when it is available, and is not able to be controlled and used as required. This decreases its value as a contract for guaranteed supply can not be entered into. Gas and coal based energy on the other hand is controllable and there is no shortage. It is available where and when required and firm contracts for guaranteed supply can be entered into. Using high value gas or coal energy to firm low value renewable energy maximises the value of each.

Ideally industry should be encouraged to use renewable energy for base energy supply with coal, hydro, or gas being used to firm supply, manage fuel risk, and set firm energy prices. In practice this is often difficult to achieve and the cost of renewable energy is currently often too high to make such an operating regime economic.

Gas is potentially the most valuable energy source available and the potential for extracting gas from the onshore west Southland oil fields indicates that the region should be encouraging investors to explore and develop the field. If gas were available in Southland it could be used as a premium energy source by industry.

At present the Regional Policy Statement has a strong bias to renewable energy and against fossil fuel. In order that the value of renewable energy is maximised the Regional Policy Statement needs to be altered to reflect the value of both.

Leadership Programme

If opportunities for energy utilisation are to be pursued and achieved there needs to be a recognition throughout the community that many opportunities are within the reach of energy users. Within communities most opportunities are lost because they are not recognised or they are considered unachievable. A community needs to be assisted to recognise and achieve the opportunities. This can be facilitated by an energy champion such as Venture Southland.

The programme has to build on a sound and realistic experience in the energy market and knowledge of opportunities. Access to government support is dependent on knowing the system. Organising workshops and training others will broaden the community knowledge base.

Venture Southland and other regional energy players also need to work with large energy companies to ensure that Southland's interests are maximised. At present the energy market is supply dominated and energy suppliers are price setters. This is reinforced because of the lack of competition and market rigidities arising from supplier risk management approaches. A regional energy programme can facilitate the demand side to identify opportunities and thus better balance power.

Access Government Funding
Government has a national energy strategy that the region can build on. Government also makes funds available to implement the strategy. Leveraging Government funds by regional initiatives will reduce the cost of implementation of the regional strategy.

Getting the Base Right
The large number of energy efficiency and renewable energy opportunities potentially available to small / medium enterprises within the region require promotion and facilitation. It is inefficient to leave them each to identify and investigate opportunities when sharing knowledge and experience would reduce take-up costs. Working as clusters can result in shared facilities and shared expenditure.

Promotion of energy opportunities with small / medium enterprises needs to be seen as an investment opportunity. Much promotion of energy efficiency and renewable energy has been done by enthusiasts with the result that it is often perceived as alternative rather than a main stream investment opportunity.

Similarly community programmes have been promoted because "energy efficiency and renewable energy is good for you" rather than being a good investment. Coordination of community action programmes along commercial lines rather than "because it is good for you" will change attitudes and ensure a wise use of scarce funds.

Small / medium enterprises are often not seen to be the largest potential beneficiaries of energy programmes and they are left to do things themselves. In practice most business are very small and they do not have the focus, staff or experience to address energy costs most appropriately. Large regional energy benefits can be achieved if specific and focused small / medium enterprises energy programmes are established and coordinated by a regional energy champion.

Assisting business (including farming) energy use through energy auditing, contract negotiation, and benchmarking will assist regional business to be cost competitive.

Energy Research and Education Centre
Venture Southland and the Southern Institute of Technology could establish a region centre for energy research and education. This could build on the energy programmes currently run by the Institute and include seminars, workshops and general promotion of good energy use practices. As a 'centre of excellence' it could provide a high profile for the region's energy wealth and facilitate utilisation, and a focus for community education. EECA may be able to be incorporated as a partner in order to assist with nation wide research programmes. There is currently no such centre in New Zealand and it would assist establish Southland's significance in energy.

Knowledge is Power

Most energy investment opportunities are lost because they are not recognised, or if recognised, the potential investors do not have the information or role models to encourage them. Providing information on the energy resources and assisting the acquisition of knowledge and experience will empower business to look at opportunities for reducing energy costs.