



Otago Southland RLTP consultation
Environment Southland
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29 January 2018

RE: SUBMISSION ON THE PROPOSED VARIATIONS TO THE OTAGO SOUTHLAND REGIONAL LAND TRANSPORT PLANS DECEMBER 2017

Venture Southland wishes to thank you for the opportunity to submit on the proposed variations to the Otago Southland Regional land transport plan. This submission is predominantly focusing on the activities in the Southland Region and includes recommendations for consideration on the strategic direction of the plan and incorporation of regionally significant projects.

About Venture Southland

Venture Southland is a joint committee of councils. This unique model is known throughout New Zealand as a positive example of regional coordination and cooperation. We promote the benefits of an integrated approach with community organisations working together, and leveraging support and resources. The business, destination marketing, events and conferences, and community development teams collaborate on many projects to maximise benefits.

Venture Southland is funded through contributions from our stakeholders Invercargill City, Southland District and Gore District Councils and contributions from Community Trust of Southland and Environment Southland. As a regionally coordinated body, Venture Southland is able to access significant external project funding not normally available to local authorities.

Venture Southland has taken an active role in projects that align with the objectives in the plan, and will continue to take an active role alongside other stakeholders. Venture Southland's role includes facilitating cooperation between local government and national agencies that have interests and influences in the Southland region, as well as businesses that currently operate in the region.

Venture Southland is currently co-ordinating the following projects with relevance to the Regional Land Transport plan:

- The Regional Cycling Strategy - Ride Southland
- The Regional Energy Strategy (mandated by the local councils and endorsed by the regional council) this strategy highlights the priority for weight restricted bridges, efficient transport systems and electric vehicle infrastructure,
- Milford Sound Fibre project and alternative transport options into Milford Sound
- Roothing taxation and funding analysis
- Tourism statistics for the region and tourism development opportunities

Southland's Regional Priorities

The Southland Regional Development Strategy has identified three main challenges to enable social and economic development over the next decade: to grow the population, diversify the economy and strengthen local business.

Southland is a highly productive region, with 2.2% of the population contributing 14% of New Zealand's tradable exports. 70% of the regions GDP is derived from exports, significantly above the national target of 40%.¹ Regional prosperity and quality of life, depends heavily on good transport infrastructure. Primary industries drive much of the area's economic growth and as a result good freight services linking farms and forests, suppliers and processors and export gateways are critical. Tourism, another major economic driver in Southland, also depends on quality road links. The Southland Regional Development Strategy identified the importance of increasing the population, economic diversification and encouraging new industries. All these require investment in integrated high quality transport networks.

Coordinated Otago and Southland Activity

Venture Southland welcomes the coordinated approach being taken across the two regions to the many areas of shared priorities for the Regional Land Transport Plan. It is notable the commitment which has been made within the Otago region to the provision of a multi-nodal network and infrastructure for cyclists to travel through and enjoy the region. The formation of the Ride Southland Governance Group to provide leadership in cycling within Southland is a positive development which should mean that in the future there are further significant areas of alignment.

Growth in tourism and changing patterns of tourist travel

Southland guest nights are up 4.4% to 1.09 million to year end August/September 2017. Spend is up 9.8% to \$623 million for the year. Almost 900,000 people are estimated to have visited Milford Sound in 2017, up from 550,000 in 2014. Numbers are forecast to top one million in 2019.²

The growth of tourism has been significant across the whole Southland-Otago area, with the Queenstown hub creating pressure for 'regional dispersal' of tourists through the wider area, for example south through Lumsden and Te Anau and onto the Southern Scenic Route.

Venture Southland acknowledges the work completed in the 2015-2018 period of the plan especially the sealing of the unsealed sections of the Southern Penguin route through the Catlins, to improve road safety and enhance visitor experience.

Milford Sound and related transport routes

Venture Southland supports the Milford Road is a highway of significance as it provides the only access corridor into Milford Sound in the Fiordland National Park and the road itself provides an undoubted iconic tourist experience and attracts high volumes of tourism traffic, comprising tour buses, campervans and private vehicles, and needs to be maintained to a high standard of safety. The investment for the Milford rockfall/Avalanche protection work is crucial for the long term use of this roading network.

Venture Southland is working with NZTA, Milford Sound Tourism, Vodafone, 2Degrees, Spark, Chorus and Downer to investigate building the necessary telecommunication infrastructure from Te Anau to Milford Sound.

¹ Berl Economics, Southland Economic Profile, 2016

² Venture Southland estimates based on MDA monthly data.

This aligns with traffic safety and emergency management programmes, mobile network deployment programmes (as part of the national RBI2 implementation) and will improve general communication into and out of Milford to ensure visitor safety and support tourism development.

The state highway corridor between Frankton and Milford Sound is unique in that its predominant demand comes from tourism. Increasing tourist numbers and the increasing demand for the road to remain open are creating increased pressure on this corridor. The strong year-round tourism market is largely driving the increasing demand for the road to remain open with minimal disruption. As self-driving increases – the tourism sector has been actively promoting this experience – the increasing conflict between slower sightseeing journeys and the time-constrained through journeys to Milford Sound and back in one day needs to be managed. More safe stopping areas and slow vehicle bays are likely to be needed to accommodate this mixed purpose use, and to ensure safe, reliable journeys. The predicted growth will also place pressure on assets already at capacity, such as the Homer Tunnel, or those nearing capacity.

The nature of journeys between Queenstown and Milford Sound could be reshaped to better integrate Te Anau into them. And the airport at Te Anau could be upgraded to enable visitors to use it as an access point for travel to the southern South Island (e.g. with connections to Auckland and Christchurch). These both present opportunities for Te Anau to increase its share of the visitor market.

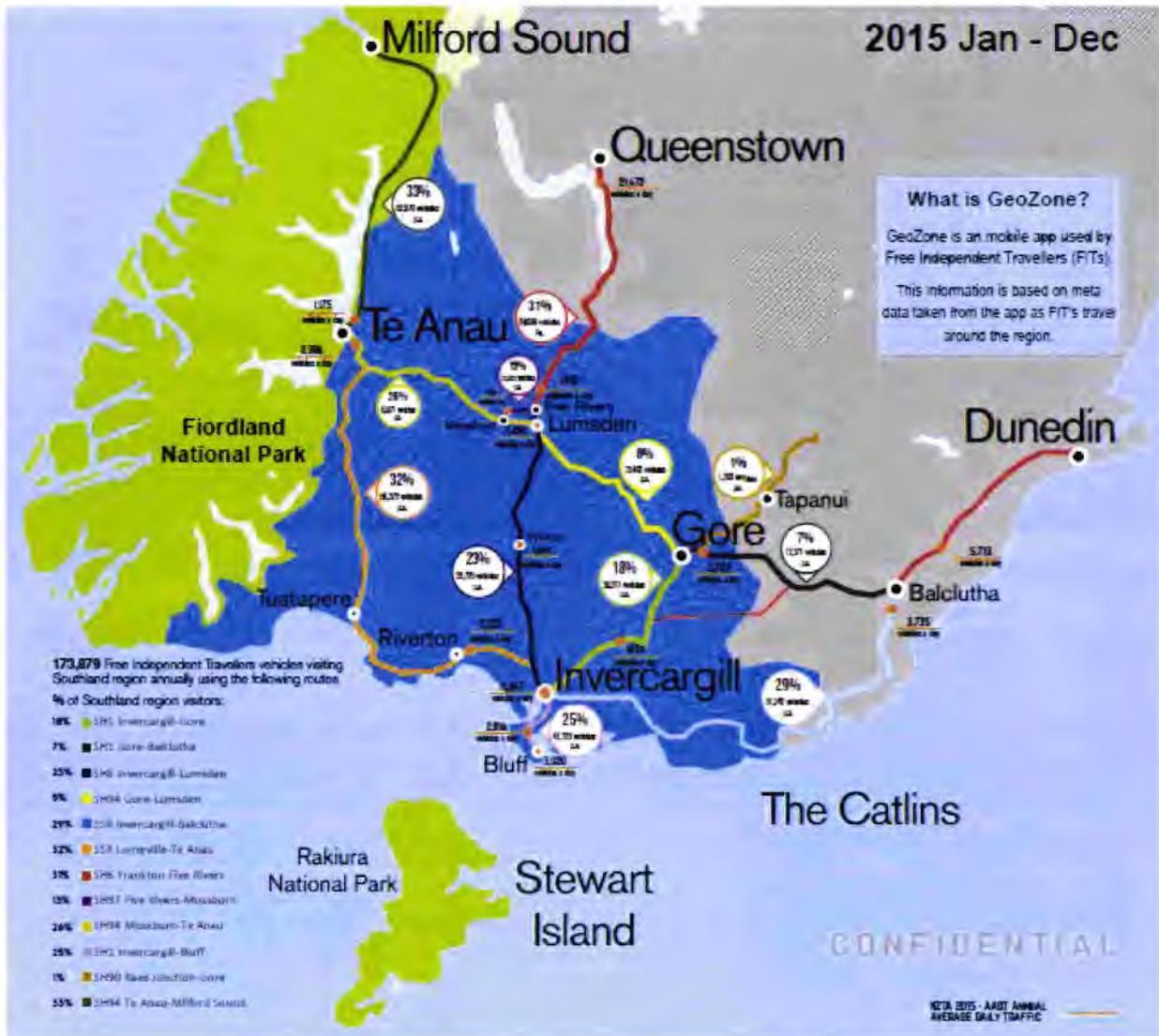
Consideration should be given to improved management of visitor dispersal in response to increased numbers of visitors into Milford Sound, including investigating options such as a Park and Ride scheme from Te Anau.

Mapping regional transport patterns

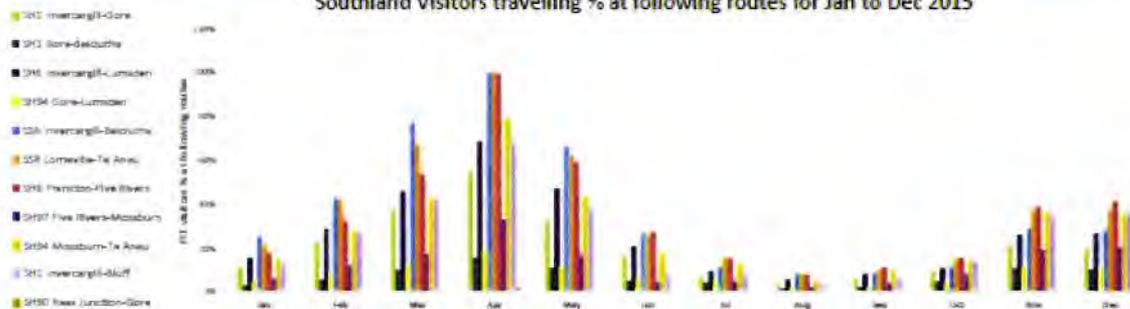
As part of its role as Regional Tourism Organisation, Venture Southland has undertaken mapping of the routes taken by Free Independent Travellers which is a large and growing market in both Southland and Otago. Venture Southland undertakes analysis of meta-data provided by the company Geozone through seven different apps aimed at the campervan and FIT market. Further information is included on this below.

Consideration should be given to the need for automatic traffic counters that would accurately record traffic numbers, the type of vehicle (truck, caravan, car) and travel direction in real time. Venture Southland would work with stakeholders to identify nodes. It is likely that 6-8 traffic counters and 2 mobile counter would be required.

Routes travelled by Free Independent Travellers Visiting Southland Region



Southland Visitors travelling % at following routes for Jan to Dec 2015

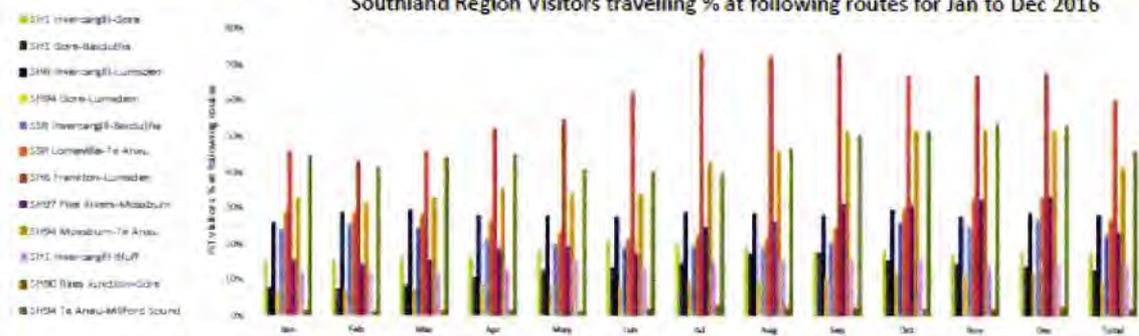


Source: GeoZone Limited - Jan-Dec 2015 (Campervan Data); NZTA 2015 - AACT Annual Average Daily Traffic analysed by Venture Southland. Estimated 13.2% market penetration. All figures have been multiplied to reflect full market. All reasonable efforts have been taken to ensure the quality and accuracy of the information. Venture Southland cannot guarantee the completeness of the information and accepts no liability for any loss suffered as a result of reliance on it. The information is not legal or professional advice and may contain information provided by other information providers. Information may be changed, deleted, added to or otherwise amended without notice.
*Note: Due to sporadic/scattered app usage of app usage at routes and rounding, percentages may not always appear to add up to 100%.

Routes travelled by Free Independent Travellers Visiting Southland Region



Southland Region Visitors travelling % at following routes for Jan to Dec 2016



Regional economic development initiatives

Integrated and optimised planning is crucial to deliver a multi - modal transport system that links air, land, sea and rail networks.

Consideration should be made of the impact on regional land transport through any change in services provided from Invercargill Airport. Recent research undertaken on behalf of the Invercargill Airport and Venture Southland, has revealed considerable suppressed demand, as well as demand for direct flight connections to Auckland. At present there is significant road traffic out of Southland, driven by use of other regional airports at Queenstown and Dunedin. Development of the cruise industry and the associated cruise strategy for the region should also be considered.

Tourism opportunities

Recent investment in tourism product in Invercargill and the Catlins, amongst other locations are part of the response to increased numbers of visitors to the region and the tourism product development strategy to support the development of more paid-for attractions for people to enjoy on their visit.

Draft maps showing the increase in availability of product can be found in appendix a.

Cycling represents a significant tourism opportunity:

- Cycling Tourist tend to visit more regions and are more likely to enjoy wine at a vineyard
- Nearly 10% of all holiday visitors participate in some form of cycling while in NZ
- Visitors participating in cycling tend to spend more (avg. \$4,900 compared to \$3,900) and stay longer (avg. 33 days compared to 16 days)
- Cycling visitors go to more areas (avg. 5 regions compared to avg. 3.5)
- Cyclists are highly satisfied with their experience and are likely to recommend NZ as a destination to others³

The Southland Cycling Strategy, being led by Ride Southland, reflects the importance of this potential market.

Consideration should be given to reviewing further investment requirements required by new tourist products in the region.

Primary sector opportunities

Venture Southland would welcome emphasis placed on ensuring that functional infrastructure is prioritised for public, private and freight transport. There would be benefits from seeking a systematic approach and investment plan to reduce inefficiencies on the road network for example, by ensuring the bridge network is capable of carrying heavy loads, through replacing key weight restricted bridges. This will reduce unnecessary journeys to enable businesses to be competitive.

Consideration should be given to undertaking a cost benefit analysis for upgrades of certain routes for freight transport, which Venture Southland would support.

Consideration should be given to developments in land transport requirements around changing land use such as proposals for a food processing hub, including increased oat production and sheep milk production and shipment of these developing product groups to market.

Assessment of the appropriate level of funding to maintain regional competitiveness

³ MBIE, International Visitor Survey, March 2017

Venture Southland has commissioned work to investigate the extent to which investment in the region's roading network is keeping pace with the amount gathered in the region from taxation.

Southland continues to contribute far more in revenue gathered from roading related taxation than is invested in roading related expenditure each year. Over the last seven years this equates to \$219 million leaving the region.

In 2013 Venture Southland undertook an analysis of taxation gathered from Southland related to roading (Road User Charges (RUC), Fuel Excise Duty (FED), Motor Vehicle Registration Fees (MVRF) in 2011, 2012, 2013. At this time, Southland was estimated to be contributing approximately \$44 million more in taxation than was being spent in region by Central Government on roading.

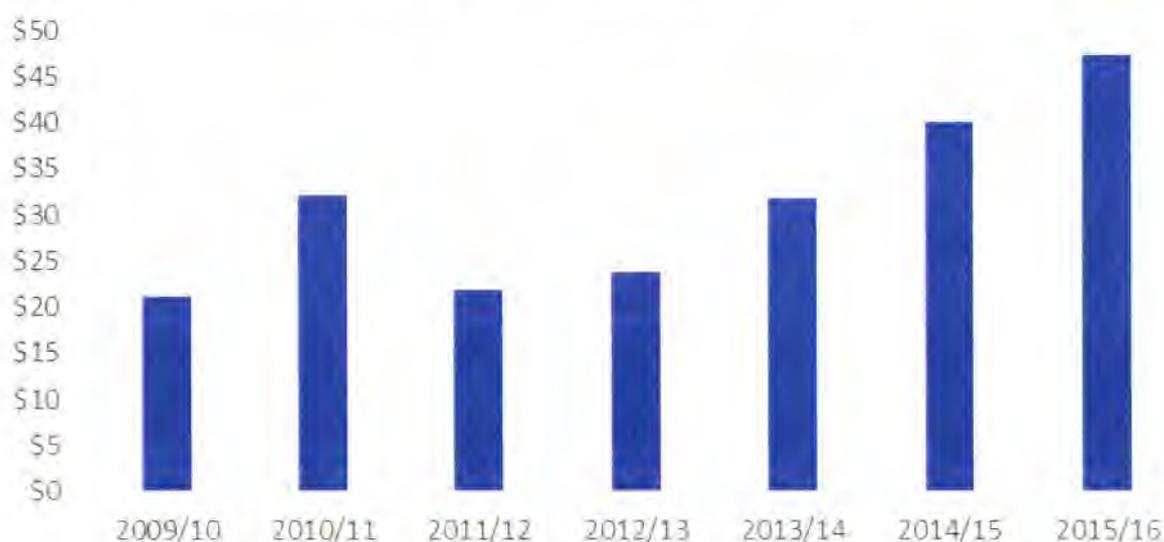
In August 2017, the economist Anthony Byett, who is a specialist in roading economics amongst other areas, was commissioned to repeat this work for 2014, 2015 and 2016.

Summary of findings

- The Southland region generated an estimated surplus of \$47 million through the National Land Transport Fund (NLTF) in the year ending June 2016. This continues the trend of recent years where revenue gained has exceeded roading expenditure by the NLTF in the region.
- The total surplus of funds generated in Southland but not spent in Southland for the past seven years is estimated at \$219 million.
- There is a marked trend of the surplus roading revenue increasing over time which can be seen in the chart and table below.

Southland - June years	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Estimated revenue gathered	73	77	79	80	85	89	94
Revenue less national overheads	76	76	68	69	78	87	87
Reported expenditure	55	44	46	45	46	47	40
Surplus revenue gathered in Southland	21	32	22	24	32	40	47

Surplus roading revenue raised through NLTF in Southland region (\$million)



The full report is available upon request.

Consideration should be given to greater alignment of revenue generated within a region with regional investment. Additional funding for roading projects would in turn lead to greater employment opportunities, one of the priorities of the Regional Development Strategy.

Changing technology

EV charging stations and infrastructure

Venture Southland would like to acknowledge the work completed by Charge Net. This focuses on SH1 and SH6.

Venture Southland has supported promotion of electric vehicles as a transport option to business for the last three years through including an electrical vehicle on its fleet and promoting the technology to business.

Consideration to include touring routes for tourism for example the Southern cluster, Southland (SH6, SH90, SH96, SH98, SH99). To enable and support tourism, the Southland regional energy strategy identifies opportunities for the use of electric vehicles and infrastructure. This project provides an asset to the region which can be built on.

LED lighting

Venture Southland supports the investment made to upgrading street lighting to LED lighting. This meets the objectives in the Southland Regional Energy strategy but is also regionally significant for tourism opportunities for promoting Southland as a Dark Skies tourism destination.

Venture Southland commissioned a report on Dark Skies opportunities for the region in November 2017. This work completed by Paul Wilson recognised the need for lighting requirements (3000K and below) for towns and cities to be eligible for any IDA Dark Skies status.

Light pollution can be easily controlled and reversed if good decisions are made about public and private lighting. At present Southland has exceptional quality night skies – with little if any light pollution – on Stewart Island, in Fiordland National Park and in much of rural Southland. However, in our towns and cities our street lighting and some key industrial sites are significant contributors to ‘sky glow’ which effects our ability to see the stars and aurora from within our towns and cities. Six key steps are needed to minimise light pollution and maximize the benefits to Southland of having naturally dark skies.

These are:

1. Commit to a lighting policy across Southland that ensures street lights and other public lighting is designed to reduce light pollution and aimed downward
2. Ensure the imminent street light upgrade programmes proposed by the Invercargill City and Gore and Southland District Council’s use LED lights that are correctly aimed downward, are warm white (for reduced sky pollution) and of appropriate output for the situation
3. Develop improved planning rules for inclusion in District Plan’s to mitigate the effect of light pollution across both public and private lighting
4. Improve education and recognition of the benefits of a dark sky and provide simple and cost effective lighting solutions for households and businesses
5. Gain international recognition for the quality of Southland’s skies by establishing the Rakiura – Stewart Island Dark Sky Sanctuary and Fiordland National Park Dark Sky Reserve
6. Support communities who wish to become internationally recognised as Dark Sky Communities Southland has a unique opportunity to be world leading as a region because of the imminent plans to replace almost all of the street lighting in Southland within the next one to two years with LED street lights. If good decisions are made with respect to these lighting upgrades, then Southland will be well placed to improve the condition of the night

sky and protect it for future generations. Failure to influence the street lighting upgrade programme will limit the opportunities for Southland to be a dark sky region and be internationally recognised for the quality of its night skies

Consideration Ensure the imminent street light upgrade programmes proposed by the Invercargill City and Gore and Southland District Council's use LED lights that are correctly aimed downward, are warm white (for reduced sky pollution) and of appropriate output for the situation

Changing awareness and expectations of risk including climate change

Venture Southland has examined a range of transport factors as part of its Zero Carbon Southland framework which is in the process of development. A summary of this framework can be found appended to this submission.

Emerging demand for active travel

Cycling

Venture Southland is coordinating and advancing a common Southland Cycling Strategy for the region on behalf of the SDC, ICC, GDC and ES. A governance group with representatives from the Councils, government agencies DOC and NZTA and community representatives has been formed to develop a priorities group and deliver the objectives from the Ride Southland strategy. This group is chaired by Councillor Alex Crackett who has drafted a submission on behalf of Ride Southland.

The vision of the Southland Cycling Strategy is to aim is to provide quality safe cycling infrastructure and increase cycling participation so that the people of Southland will gain in health, quality of life and appreciative use of their outstanding natural environment. Cycling opportunities will contribute to Southland's socio-economic and population development by increasing the attractiveness of the region as a family friendly place to live and visit.

Cycling is a popular activity in Southland engaged in by 29% of the region's population, a higher participation rate than the average of 24.8% for New Zealand as a whole. However at the same time, there are significant safety concerns. Southland has a personal risk rating of 63 and a collective risk rating of 3 (NZTA). 56% of respondents to the 2016 survey were concerned about safety on Southland's urban roads and 71% were concerned about safety on Southland's local roads.

The Southland Cycling Strategy builds on the community's interest in cycling to develop improved cycling opportunities and ensuring benefits to Southland's community through:

- improved health through participation in exercise that reduces the ill-health caused sedentary lifestyles
- improved liveability through encouraging the community to move around in, congregate and meet people in their neighbourhoods, towns and cities
- lifestyle advantages through opportunities for outdoor recreation and sport participation that contribute to making Southland a desirable place to live
- provision of a safe, usable and sustainable transport method as part of an integrated land transport system that meets peoples' needs and has less impact on the environment » contributing to economic diversification of the region through attraction of cycle tourists and provision of cycling-related services.
- supporting the development of cycling skills from learning to ride, return riders to enhancing cycling skills of elite riders

The Strategy also aligns with the New Zealand Government's actions to provide for safe, accessible cycling as a transport mode and recreational and tourism activity providing health, lifestyle and local economic benefits.

The Strategy is a guide for local government, agencies, the community, cycling organisations, the tourism industry and business to develop and invest in cycling opportunities in a consistent, collaborative and sustainable way. The

approach in the Strategy is geared to the specific needs, situations and practicalities in Southland, including the scarcity of funds and resources for cycling infrastructure development.

The Strategy covers the different ways people cycle in Southland. It applies four broad categories of cycling - commuter (or utility) cycling, recreational cycling, cycle tourism and competitive and event cycling – and the range of cycling styles – road cycling, off-road trail cycling, mountain biking (in its different forms) and BMX riding.

75% of New Zealanders living in urban areas say they would cycle if there were better networks (Statistics NZ 2016). 81% of 2016 cycling respondents believe cycling is a good investment for Councils.

Venture Southland recognises that there are opportunities for developments in cycling infrastructure that will provide regional and nationally significant cycleway linkages which will support the Government's objective to create a high-quality tourism asset which will enhance New Zealand's competitiveness as a tourism destination and provide on-going employment and economic development opportunities for regional development.

More than a million people per year use the 22 Great Rides of Nga Haerenga, the New Zealand Cycle trail. Venture Southland would suggest high priority is given to the development of the following trails, which will link current infrastructure for great rides and heartland rides to the urban cycleway network in the Southern cities, creating a healthy and enjoyable experience of cycling in Southland New Zealand for kiwis and international visitors.

Consideration should be given to including key projects from the Draft Southland Cycling Strategy.

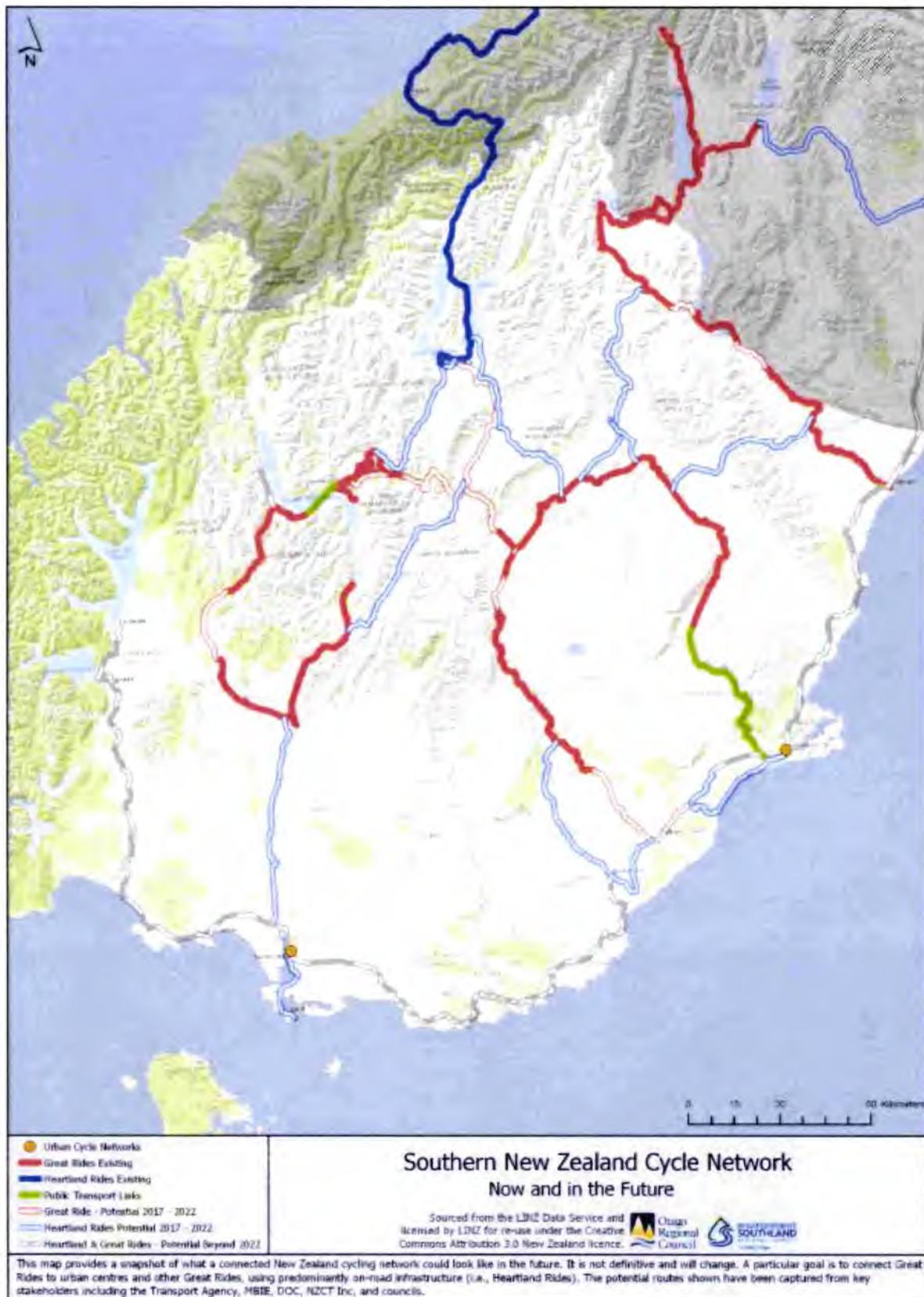
Some of the key routes identified as priorities include:

Te Araroa trail

This is a trail of national and international significance. The Invercargill to Bluff section is the penultimate stage of the Te Araroa 3000km nationwide trail. This trail takes participants somewhere between 100 - 160 days to complete the length of the country and is a nationally significant trail to ensure that users finish with a high quality experience. The initial estuary walkway from Invercargill city towards Bluff opened in 2015 and the infrastructure to complete the Invercargill - Bluff trail requires significant investment to accommodate both cycling and walking safety on this State Highway 1 section of the trail.

Consideration should be given to the incorporation of the development of additional trails to connect the Great rides, Heartland rides and urban cycleway networks within the region. Some examples of potential routes are below

Figure 5: Southern New Zealand cycle network: existing and potential.



Lumsden to Invercargill to Bluff Route (Shown above)

Distance 98 Time 1–2 days Grade 3 (Intermediate)

Having been identified as a future potential Heartland Ride, a route for consideration would be:

From Lumsden head north on the Around the Mountains Cycle Trail for 3 km before turning left down Highway 94, towards Mossburn, for 3 km. Then turn left again onto Dipton-Castlerock Road. Head south on this quiet road for 21 km. Near Dipton, turn right onto Gorge Street and then left onto South Hilend-Dipton Road. Continue south to Hundred Line Road, and turn right, then less than 1 km later, left down Riverside Road. About 8 km later, go left down Highway 96, then right down Highway 6 into Winton, where there are plenty of services. That is 59 km from Lumsden.

Continue down SH6 through Winton and just south of the town turn left onto Gap Road East. After nearly 2km, where the road veers left, turn off to the right onto O'Shannessy Road, left onto Thompsons Crossing Road East, hard right onto Cemetery Road, after 1 km fork left onto Camerone Road, left onto Forest Hill Crossing Road. Follow the track through the beautiful Forest Hill Reserve and come out at the south end onto Pettigrew Road. At the next cross roads turn right onto Wilsons Crossing Road and follow this for 10 km in a straight line all the way to Lochiel-Branchholme Road.

An alternative route south from Winton avoids the loop through Forest Hill and cuts 15 km off the journey: from the centre of Winton, head west on Gerrard Road then turn left to head south on Winton Substation Road, left onto Lochiel Bridge Road then, after 2 km, turn right onto Lochiel-Branchholme Road and rejoin the primary route at the junction with Wilsons Crossing Road.

When, after 5 km, this makes a sharp left bend, turn right onto Young Road – a short cut through to Ryal Bush-Wallacetown Road and so on to Wallacetown. In Wallacetown, turn left onto Highway 99, being careful when crossing a very narrow bridge just east of the town (stop and wait for a gap in the traffic). Turn right down Steel Road, left down West Plains Road and right down Gloucester Street and left down Durham Street. This leads to Highway 1, just next to a big supermarket (35 km from Winton). Use the pedestrian crossing 50 metres away to get across to Bainfield Road, which has cycle lanes.

A few hundred metres down Bainfield Road you can turn left and ride through Donovan Park to get to a holiday park owned by a couple of cyclists. Otherwise, ride down to the next big roundabout and turn right down Queens Drive for 4 km to Gala Street. Turn right to ride to the i-SITE and the centre of town. It is 39 km from Winton to the centre of Invercargill.

Options then exist for cycling from Invercargill to Bluff 28km which is the penultimate stage of the Te ARAROA New Zealand's Trail and significant investment is required to accommodate both cycling and walking safety on this State Highway 1 section of the trail.

The Invercargill to Riverton cycling experience is attracting more and more riders both on the State Highway 99 but also on the informal alternative Oreti Beach or Taramoa routes.

Increasing numbers of Cyclists are also taking the Southern Scenic Route from Fiordland to the Catlins.

Te Anau cycleway route including Mavara - Te Anau trail potential

37,000 people have used the the Te Anau trails Trust Te Anau to Manapouri track over the last year. There is a proposal to extend this popular track in a second stage to Te Anau Downs.

Venture Southland recognises the work undertaken by the local councils to develop the cycleway infrastructure. Venture Southland advocates for the need to develop mapping systems and promotion of current infrastructure to improve usability.

The following additional information is attached in support of this application:

- The Draft Southland Cycling Strategy
- Southland Energy Strategy
- Dark Skies proposal

Thank you for your consideration of this submission, which we would request the opportunity to speak to. Venture Southland looks forward to working further with Environment Southland and other key regional stakeholders to support the development of integrated transport solutions which promote economic and community development in the region.

If there is any further information you require we would be happy to provide this.

Yours truly,

A handwritten signature in blue ink, appearing to read 'Stephen Canny', enclosed within a blue oval shape.

STEPHEN CANNY

Group Manager: Business and Strategic Projects

ZERO CARBON SOUTHLAND

Zero Carbon Southland provides a pathway for New Zealand to meet its greenhouse gas emission targets through investing domestically rather than purchasing credits offshore. It also creates a competitive advantage for Southland businesses by reducing the cost of carbon.

TARGETS

To establish a carbon emissions baseline for Southland, Venture Southland are proposing a 3 year project delivered by Venture Southland in partnership with public and private sector organisations across all industries to measure current carbon set targets and work together to reduce the region's emission.



OBJECTIVES

- Developing a regional smart Zero Carbon Framework
- Creating an accurate local carbon measurement tool, measuring carbon avoidance of past regional projects to encourage wider adoption of technologies.
- Identifying targets and goals to achieve Zero Carbon in Southland
- Scoping a local carbon trading platform
- Building a framework and business case for a funding support scheme for local projects to continue building a cleaner and more efficient Southland
- Monitoring and reporting of goals, targets and the project

KEY OUTCOMES

- CO₂** Lower Carbon and Methane emissions
- Cleaner air and healthy communities
- Reduced waste
- Cleaner water
- Cleaner more efficient transport
- Fewer cars and safer roads
- Business competitiveness and process optimisation
- Warm, dry, affordable and healthy homes

HOW WE PLAN TO GET THERE

- Efficient waste management and reduction systems
- Biogas through methane and waste recovery
- Biomass space heating and hot water systems and District heating
- Electric and fuel cell electric vehicles
- Cycling Strategy
- Insulation programmes such as the Southern Warm Homes and clean air loans

COLLABORATION

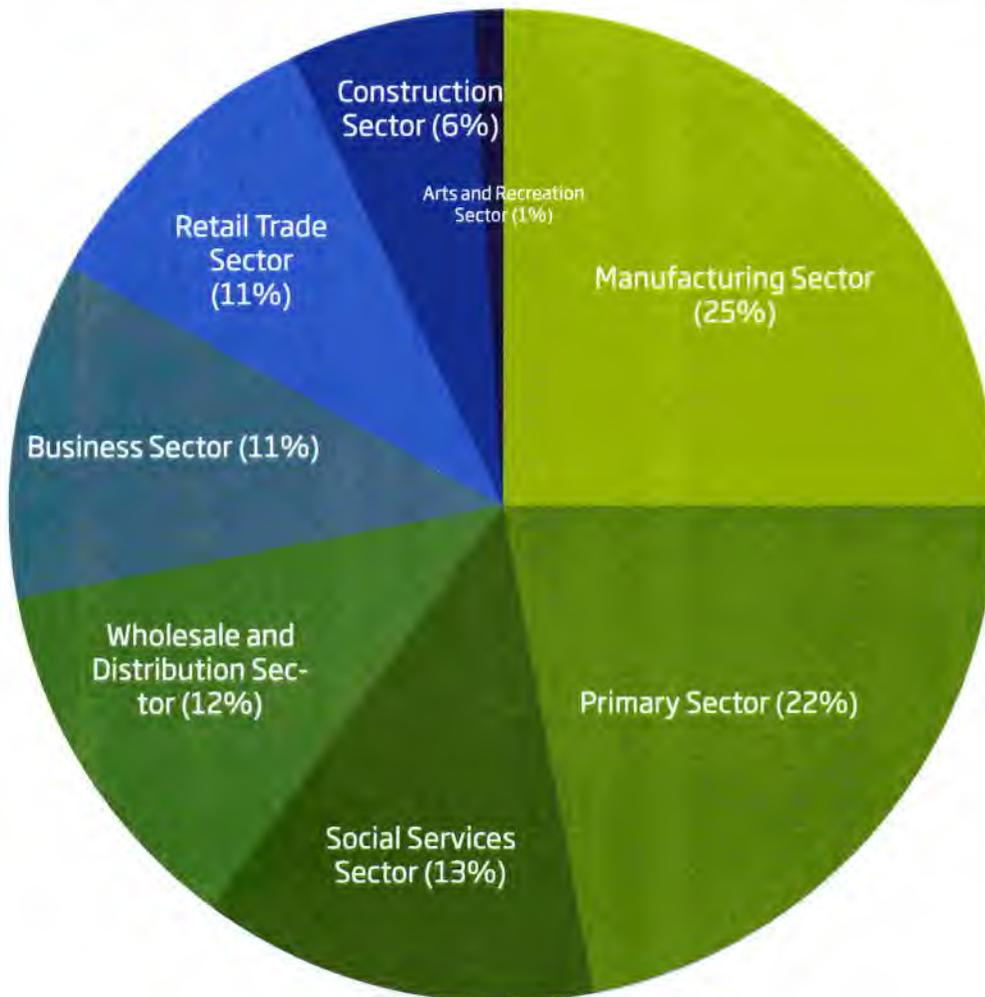
Venture Southland will be building on the successful projects already established in the Southland region and will continue to deliver these projects with those partners or will have access to the data to evaluate other Zero Carbon stakeholders projects.

CONTACT

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A REGIONAL APPROACH ZERO CARBON OPPORTUNITIES IN SOUTHLAND (BY SECTOR)

Key Sectors in Southland:
A Sector Based Approach to Reducing Carbon Outputs in Southland



AIM - IDENTIFY AND PROMOTE KEY PROJECTS FOR EACH SECTOR DELIVERED IN PARTNERSHIP WITH LOCAL INDUSTRY AND COMMUNITY

OVERALL - INTRODUCING LARGE-SCALE DISTRICT HEATING SYSTEMS, CYCLE TRACKS AND CONNECTION OF INFRASTRUCTURE

MANUFACTURING SECTOR

A total of 545 manufacturers in the region (74 are food manufacturers).

Opportunities:

- Conversion to biomass boilers
- Growing the number of electric vehicles (EVs) and fuel cell electric vehicles (FCEVs)
- Waste to biogas

SOCIAL SERVICES SECTOR

A total of 172 schools and education providers in the region.

Opportunities:

- Conversion to biomass boilers
- Growing the number of electric vehicles (EVs)

WHOLESALE AND DISTRIBUTION SECTOR

A total of 194 transport operators and 80 courier & postal businesses in the region.

Opportunity:

- Growing the number of electric vehicles (EVs) and fuel cell electric vehicles (FCEVs)

PRIMARY SECTOR

A total of 900 farms in the region. 194 forestry and logging owners.

Opportunities:

- Conversion to biomass heat processing
- Growing the number of electric vehicles (EVs) and fuel cell electric vehicles (FCEVs), including electric farm bikes
- Waste to biogas

BUSINESS SECTOR

A total of 4,100 businesses in the region.

Opportunities:

- Conversion to biomass boilers
- Growing the number of electric vehicles (EVs)

ARTS AND RECREATION AND CONSTRUCTION SECTORS

Opportunity:

- Growing the number of electric vehicles (EVs) and promoting healthy transport systems.

Southland Energy Strategy 2011





Energy Efficiency and
Conservation Authority
Te Tari Tiaki Pūngao



Southland Energy Strategy 2011

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ACKNOWLEDGEMENTS: Financial support has been received from Environment Southland (Southland regional council), and the Energy Efficiency Conservation Authority. Thank-you to Emeritus Professor AG Williamson for advice, and Venture Southland staff: Meghan Dick, Karyn Owen, Robin McNeill and Steve Canny.

LIMITATION: This report has been informed by a review of the previous Energy Strategy conducted by Aurecon New Zealand Limited (aurecongroup.com). Venture Southland and Aurecon accept no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party. A person using Aurecon documents or data accepts the risk of using the documents or data in electronic form without requesting and checking them for accuracy against the original hard copy version.

Executive Summary

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

The following strategic actions have been identified:

Energy Efficiency

Residential

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

Business

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

Energy public awareness programme

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

thinking about availability of sources of energy; promote central government resources available for initiatives. This may be through some form of event(s).

- Encourage adoption of any nationally developed green building performance rating tools (Commercial: Green Star. Residential: Homestar). Councils, businesses and residents should be encouraged to use these for new build or refurbishment projects.
- Develop demonstration projects for sustainable building design and small scale renewables.
- Advocate for central government to encourage purchase of smart appliances for replacements, including subsidies from avoided capital expenditure.

Transmission Network

Investment

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

Research

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

Infrastructure

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

Transport Solutions

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

Fuels

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

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

Rail

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

Regulatory Reviews and Empowering Policies

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

Long Term Plans

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

Legislation

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

Sustainable Buildings

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

Resource Management

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

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

Energy Sector Skills and Training Programme

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

Energy Generation Opportunities

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

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

Remote Areas

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

Gas

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

Wind Energy

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

Coal and Lignite Reserves

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

Oil Reserves

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

Solar Energy

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

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

Biomass

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

Marine Energy

- Assist in identifying suitable sites for marine energy.

Secure Industry and Attract New Industry

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

Research and Development Opportunities

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

Local Manufacturing and Servicing Opportunity

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

1. Foreword

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

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

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

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

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

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

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

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

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



Robin Campbell
Chairman of the Venture Southland Directorate

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2. Introduction

2.1 Background

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

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

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

2.2 About This Document

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

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

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

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

Accordingly, this document:

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

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

2.3 Vision for Southland's Energy Future

In the past, a vision for Southland was developed and this is publicly available in the Our Way Southland outcomes report¹. However, it does not specifically mention energy and it was identified by stakeholders that it is important to have an overarching long term vision for Southland's energy future. The following vision was circulated in the draft strategy and received much positive feedback during the submission process, with only minor changes recommended which have been incorporated below.

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

Although this strategy focuses issues and opportunities over the next ten years, it is considered appropriate that stakeholders using this document to inform decisions consider this vision in a longer term context, including the rights of the coming generations of Southlanders. Some may find the Natural Step framework and principles, known as 'system conditions', useful tools to consider how to transition towards this vision².

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

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

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

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

2.4 Key Principles

The principles used in preparing this strategy are:

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

2.5 Methodology

In order to update the Southland Energy Strategy, Venture Southland commissioned Aurecon to undertake a review that has informed this document. As part of the review, a stakeholder workshop was held on 24 June 2010 as an open forum and was attended by approximately 40 stakeholders from inside and outside the region³. The workshop was facilitated by five senior executives from Aurecon, who were specialists in different areas of energy technologies, industries, and planning. The workshop consisted of two small-group discussion sessions which reported back to the group as a whole, giving the stakeholders attending the workshop as much opportunity as possible to contribute ideas and opinions. Their interests and concerns were reflected in the review and have been incorporated into this updated strategy.

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

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

Tim Jones

³ Stakeholder Workshop Notes in Appendix I.

3. Energy Challenges

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

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

3.1 Peak Oil

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

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

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

⁴ Colin Campbell (2011). Cited in The Association for the Study of Peak Oil and Gas Cited website www.peakoil.net

⁵ International Energy Agency (2010). World Energy Outlook.

⁶ US National Intelligence Council (2008).

⁷ Parliamentary Support Research Paper (2010). The Next Oil Shock? <http://www.parliament.nz/en-NZ/ParlSupport/ResearchPapers/4/6/a/00PL.Eco10041-The-next-oil-shock.htm>

3.2 Increased Worldwide Demand for Energy

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

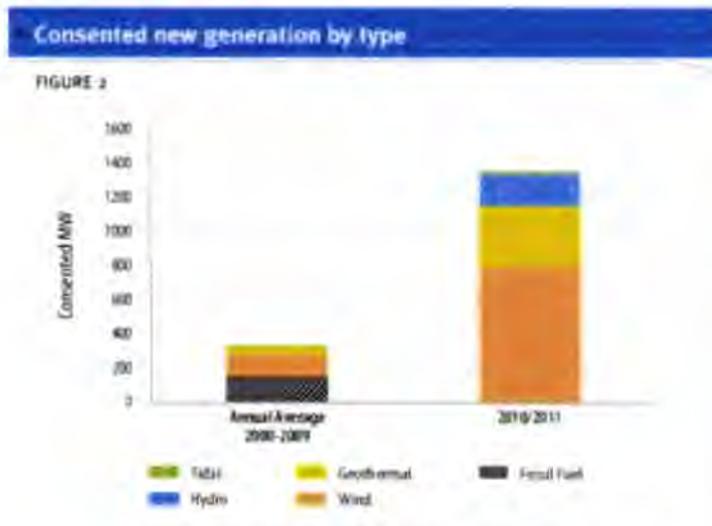
3.3 Climate Change

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

We know that to keep global warming to 2°C above historical levels requires a step-change in the way energy is produced, transported and used. But international progress has been slow. The Copenhagen Accord of 2009 lists actions that the governments of over 100 developed and developing countries propose to take to achieve this, but there is no binding legal commitment. Until now, supply concerns and relations with energy have tended to dominate national energy policies, but this is changing. Energy efficiency plays a vital role in future strategies to limit global warming. Energy efficiency will be the mantra of governments trying to ensure both national security and CO₂ equivalent reductions, and energy users are increasingly central in this vision. Energy efficiency is also vital for economic competitiveness and insulates companies from the worst of the energy price volatility.

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

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



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

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

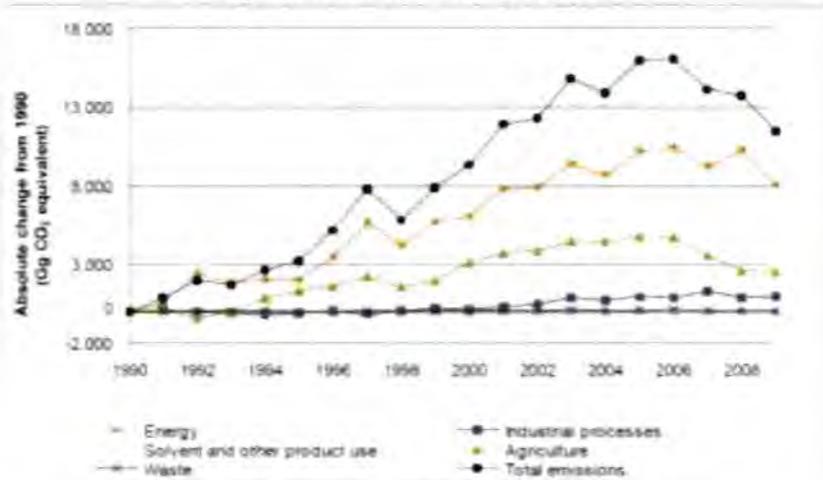
The Ministry for the Environment provide a summary of the expected effects of climate change for the country. In New Zealand we are likely to see an increase in temperature of over 1°C by 2050; fewer frost days in winter and more hot days in summer; higher rainfall in the west and less in the north and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

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

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

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

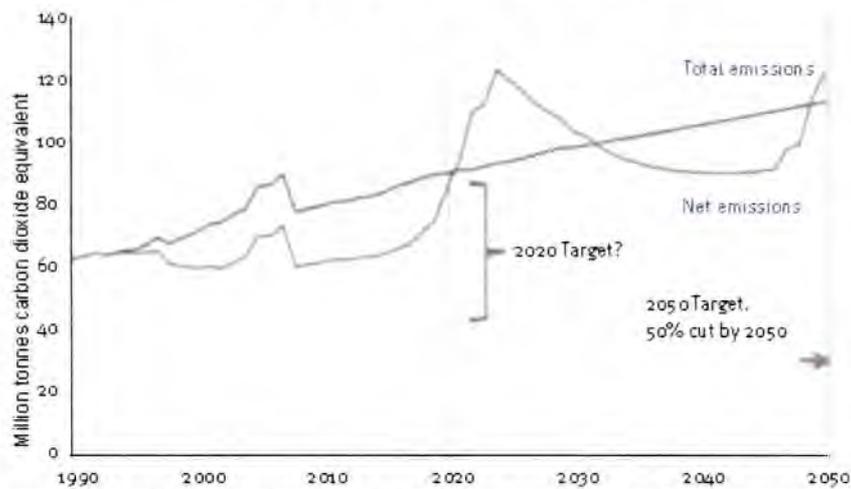
Absolute change from 1990 in New Zealand's total emissions by sector from 1990 to 2009



Source: Ministry for the Environment (2011). New Zealand's Greenhouse Gas Inventory 1990-2009.¹⁰

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

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



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

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

¹⁰ <http://www.mfe.govt.nz/publications/climate/greenhouse-gas-inventory-2011/greehouse-gas-inventory-2011.pdf>

¹¹ <http://www.mfe.govt.nz/publications/climate/nz-2020-emissions-target/html/index.html>

3.4 Constrained Mineral Resources

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

3.5 Implications of a Non-Fossil Energy Future

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

At the global level, there is little sign that energy demand will go down, with 'business as usual' forecasts suggesting a 40% increase by 2030. This will require \$26trn of investment – some 1.4% of global GDP¹³. Given the global negotiations to radically reduce emissions, and the finite nature of conventional fossil fuel sources, a rapid movement towards a highly efficient non-fossil energy future would seem to be the logical investment choice.

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

As transport costs increase, it is likely that there will be a greater emphasis on utilisation of locally produced products, particularly for food and potentially fuel. It is also likely that areas such as Southland and indeed New Zealand as a whole will have to seriously consider developing high value and value added exports rather than relying on high volume low or variable value commodity products as a source of export income. This raises an important question of if there should be a shift from food to bio-fuel production. Balancing land use for demand for food vs fuel will likely require consideration within a local, national and international context, on whether or not this is left to the market to decide, and some research on this topic has already been undertaken¹⁴. It is possible the two can be complementary. Either way, there is no doubt that the health and productivity of soils in Southland is one of the region's most valuable assets that should be protected.

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

¹² Lloyds (2010). Risk Insight Sustainable energy security: strategic risks and opportunities for business.

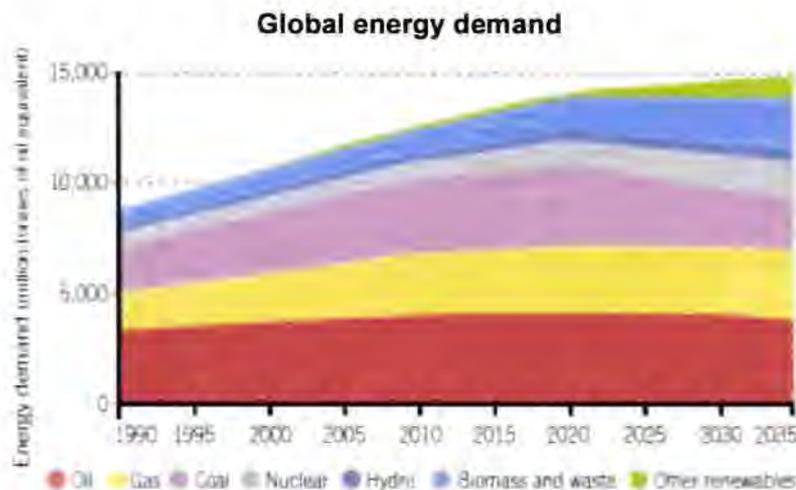
¹³ Lloyds (2010). Risk Insight Sustainable energy security: strategic risks and opportunities for business.

¹⁴ Nimmo-Bell & Co (2009). Food prices and biofuels update.

Tourism is also likely to transit from high volume low value tourism to lower volume high value tourism i.e. a greater reliance on people who can afford to travel and are able to pay accordingly for services and activities. Although current New Zealand visitor number forecasts appear to largely ignore these issues, there are an increasing number of research papers and tools¹⁵ becoming available to help operators understand the implications for their industry. Increasingly, there is also evidence of visitors seeking a low carbon or carbon neutral travel experience. This in-turn indicates the need to change what we do and how we do it. The challenge associated with both the movement of export products and visitors is how to do this in an energy efficient manner with the least embedded carbon content.

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

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



Source: International Energy Agency. World Energy Outlook 2010.

This is based on the scenario that global temperature rises will be limited to 2 degrees Celsius, and concentration of greenhouse gases is limited to 450 parts per million CO₂ equivalent – assuming national pledges and strong policies. This shows demand for coal continuing to be an important part of the energy mix through until 2020, and declining through 2035.

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

Once extracted, to retain reserves for our own local use would not be viewed favourably by international trading regulations. The extraction of fossil fuel resources is being encouraged by central government, and resources such as the Southland lignite are seen as strategically important to the New Zealand economy. For this reason it is important that decision makers are aware of both the opportunity and implications associated with the recovery and use of fossil fuels. Internationally there is a very high level of scrutiny surrounding the extraction and use of fossil fuels and the associated emissions of CO₂, and increasingly these industries are under the spotlight of international environmental movements. There is some evidence to suggest that New Zealand is starting to reflect these international trends, as recently illustrated in the almost viral debate associated with 'fracking' technologies. In this case the issues surrounding fracking have attracted extensive comment with very little appreciation of the application of the technology. There appears to be a greater awareness and public interest in the environmental and social (health and wellbeing) effects, therefore mitigation planning and implementation should be an area of significant focus and effectively communicated with the wider public.

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

Suggested action:

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

4. Setting the Scene in Southland

4.1 Population

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

The unemployment rate in 2006 was 3.8%, compared with 5.1% for all of New Zealand. This is a decrease from the previous census in 2001 of 5.5% unemployment rate².

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

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

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

¹ Statistics New Zealand (2006) Population Statistics Unit, <http://www.stats.govt.nz>

² Statistics New Zealand (2006) Population Statistics Unit, <http://www.stats.govt.nz>

Suggested action:

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

4.2 Economy

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

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

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

There is also the potential for some new industries to grow in Southland, in particular, potential for Living Cell Technologies Auckland Island Pig breeding centres, potential for space observation related activities³, and also potential for silicon refinery near a source at Pebbly Hills which could need up to 110MW⁴. These kinds of developments may place additional energy demand in particular locations. Conversely, decreases in tourism activity may decrease energy demand and need for supporting infrastructure in some locations if the destinations are no longer able to attract high volumes of visitors.

³ Venture Southland (2008) Southland Regional Economic Profile. www.southlandnz.com

⁴ Stephen Canny (2010). Cited in Southland Times. <http://www.stuff.co.nz/southland-times/news/3562481/Gore-set-for-bigger-grid-with-upgrade>

Livestock numbers in Southland at 30 June 2007

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

Source: Statistics New Zealand website

Plantation forestry is another significant land use in the Southland region providing both a potential energy source, and wood product. Southland has a young diverse estate with volume likely to increase in the short to medium term. Plantation forestry has been affected by the Emission Trading Scheme (ETS), and is likely to continue to be affected by the ETS. The ETS means that forestry owners have an increased cash flow and incentives to replant. Rising energy costs leading to increases in the costs to transport and process timber products, combined with higher sale price for carbon credits, could influence more forest owners to consider longer rotation crops⁵. Ultimately the ETS is encouraging investment in forestry. However, when forests are harvested and what for will depend on decisions of many owners. Local demand for wood products as a source of energy is increasing, with the costs of wood remaining relatively stable over the past 30 years, as compared to lignite, and electricity⁶. Opportunities for Wood Energy are discussed further in section 5.6.5 of this document.

Forestry Production and Plantings in Southland at 30 June 2007

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

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

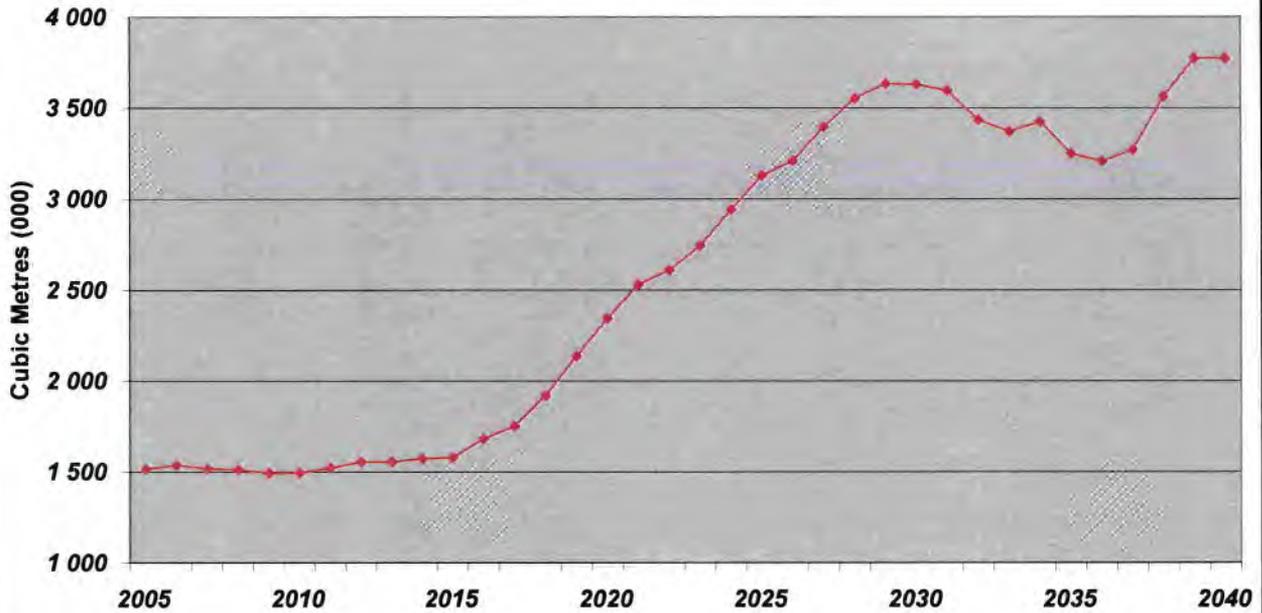
Suggested actions:

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

⁵ Parnell Trost (2010). Cited in Wood Energy Forum notes www.southlandnz.com

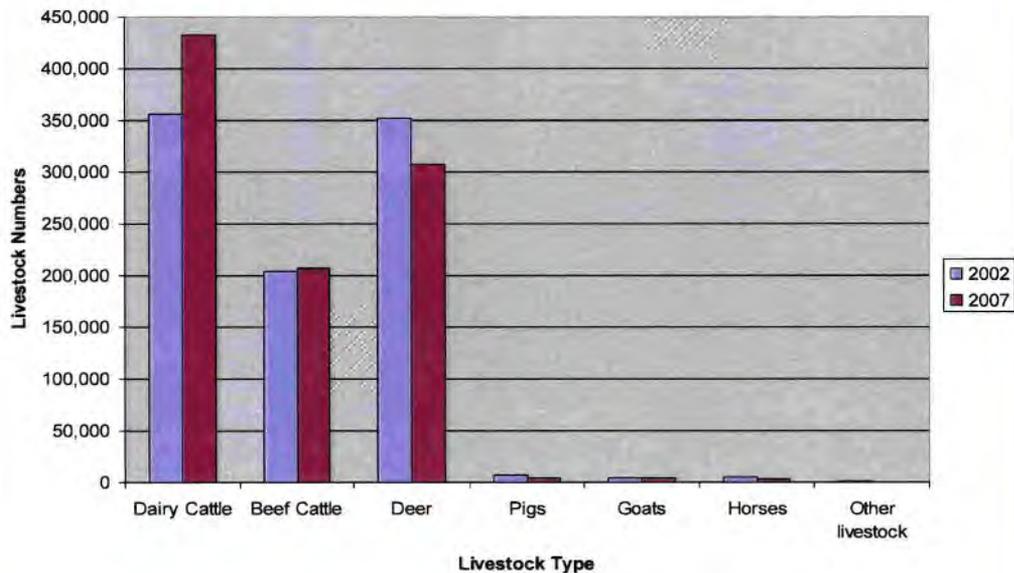
⁶ Venture Southland (2010). Wood Energy Forum. www.southlandnz.com

Projected Radiata Pine and Douglas-fir Harvest Levels (2005 - 2040) (Split Non-Declining Yield)



Source: Ministry of Agriculture and Forestry

Comparison of Livestock Numbers in Southland from 2002 to 2007



Note: During this time sheep numbers decreased by 5% to 5,662,387

Source: Statistics New Zealand website.

4.3 Regional Energy Developments

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

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

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

Suggested actions:

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

⁷ L&M Energy (2011).

4.4 Local Stakeholders' Views

In recent years there have been significant changes in the level of awareness of climate change, acknowledgement of peak oil and increased competition for natural and energy resources. In 2008 Southland businesses' awareness of broader issues was surveyed. Most (92%) were aware of climate change, and less than half (46%) were aware of peak oil. However, only 53% of local businesses had thought about the potential problems for their business as a result of wider issues⁸. General information available to businesses, such as visitor forecasts for the tourism industry do not appear to reflect any major changes as a result of these issues – however there are an increasing number of research papers exploring these issues⁹. Price increases for oil, coal/lignite, and electricity appear to be placing a higher priority on energy efficiency for some businesses, community groups and residents – with many questioning their sources of energy. Other regions have completed vulnerability assessments of peak oil impacts; such a document for Southland may help businesses understand what this issue may mean for them. Increased public awareness is key to ensuring that councils planning around these issues are well supported by ratepayers. This work could help engage the public in developing a long term vision for Southland's energy, which would assist with prioritising strategic actions.

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

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

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

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

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

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

⁸ Venture Southland (2008). Sustainable Business in Southland: Primary Research Results.

<http://www.southlandnz.com/BusinessinSouthland/RegionalProjects/SustainableBusiness.aspx>

⁹ Lincoln University (2010). <http://www.lincoln.ac.nz/Research-Centres/LEaP/Climate-Change-Peak-Oil-Society/Publications/>

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

The following are other comments of note from the workshop:

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

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

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

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

Suggested actions:

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

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

5. National Context

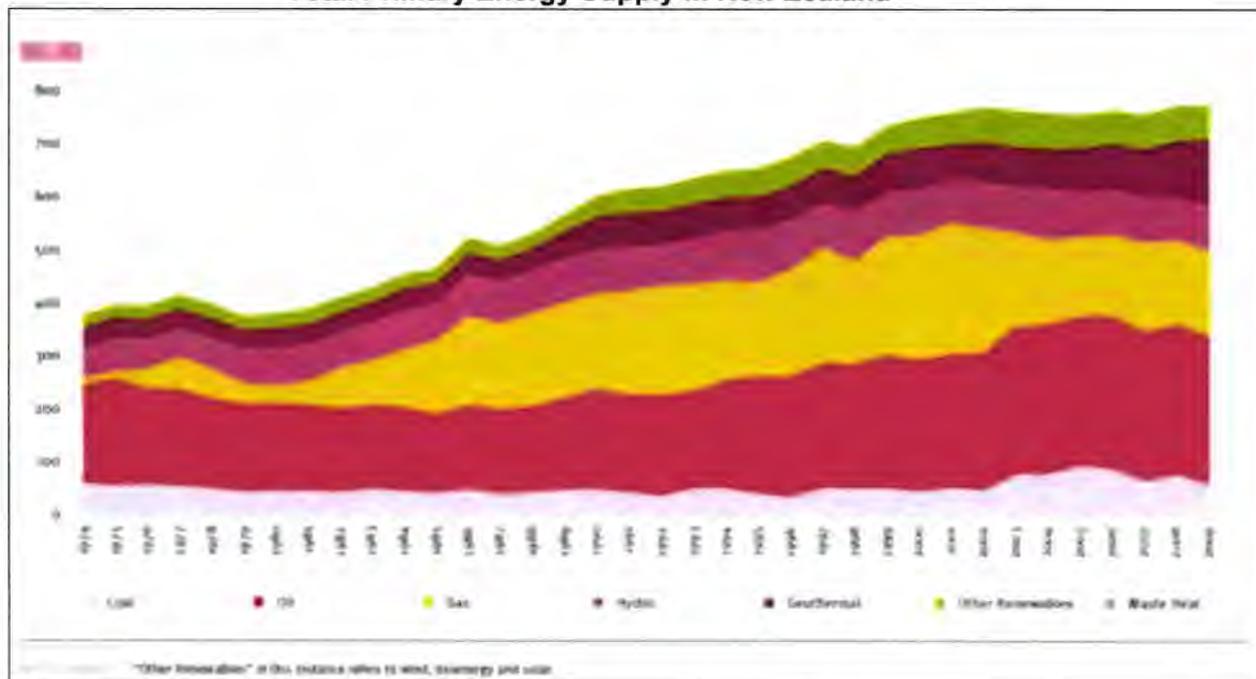
While any developments may benefit from a fit with central government policies, the size and nature of the Southland region is such that an independent approach which considers the unique factors in the Southland region but which take account of broader initiatives is often likely to be a preferred strategy.

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

5.1 Demand and Prices

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

Total Primary Energy Supply in New Zealand



Source: Energy Data File (2010). Ministry of Economic Development¹¹.

Economic activity and energy use are closely linked. Excluding the Tiwai Aluminium Smelter, which accounts for around 82% of Southland's electricity consumption, Southland accounts for 3% of national residential electricity demand and 3% of commercial demand. Including the smelter, the region accounts for 17% of total national energy demand¹². Electricity consumption dropped in 2009 the main cause was lower demand from the Tiwai Aluminium Smelter as a result of plant breakdown.

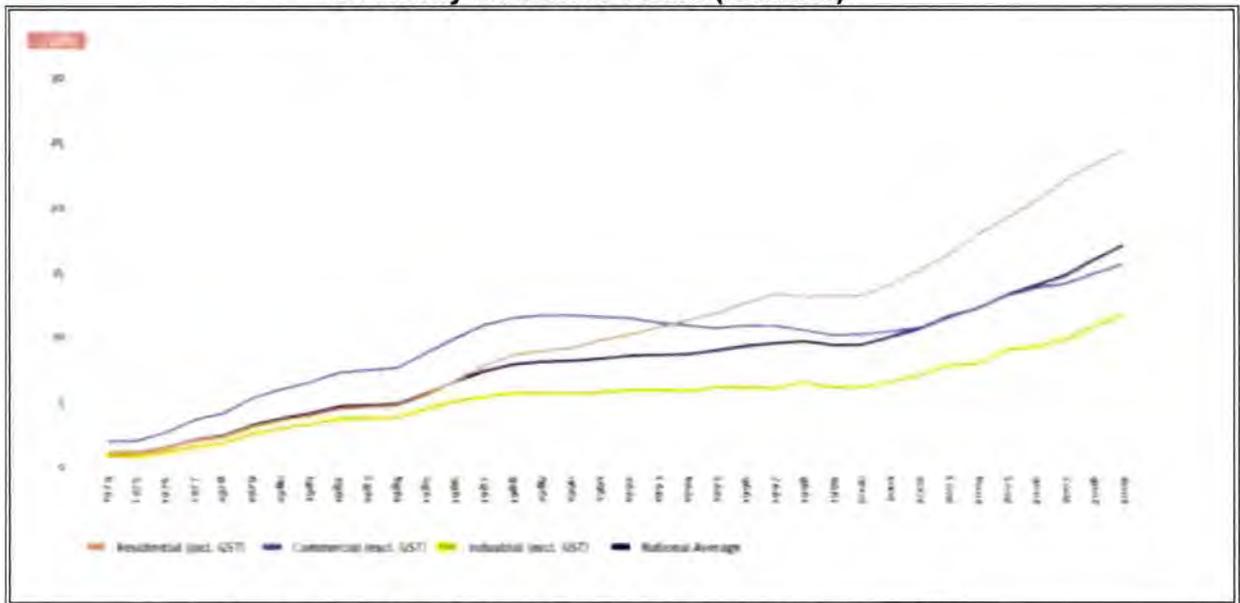
¹¹ Ministry of Economic Development (2010). Energy Data File. Figure A3

http://www.med.govt.nz/templates/StandardSummary_15169.aspx

¹² Environment Southland (2009). Para 1.06 cited in Looking After the Future. Beacon Pathway (2010).

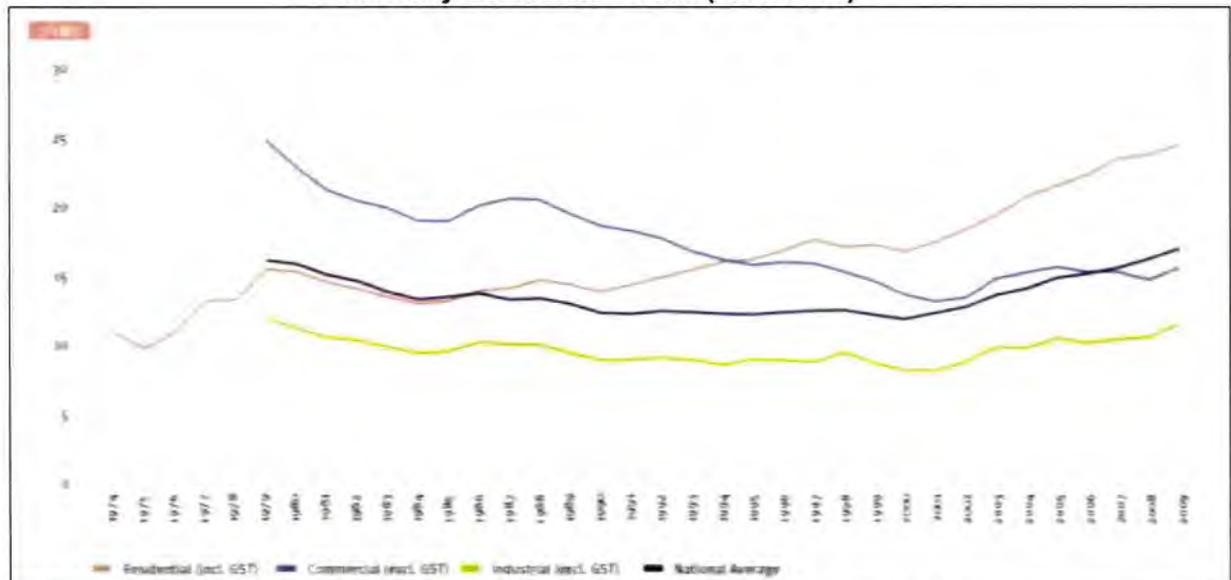
As demand for energy has increased, the price trends have also been upwards – as exhibited in the overall cost of both electricity and transport fuels shown below. We can reasonably expect that Southland demand will match that of national trends, with the exception of the impact of key industries, such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

Electricity Consumer Prices (Nominal)



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

Electricity Consumer Prices (Real 2009)

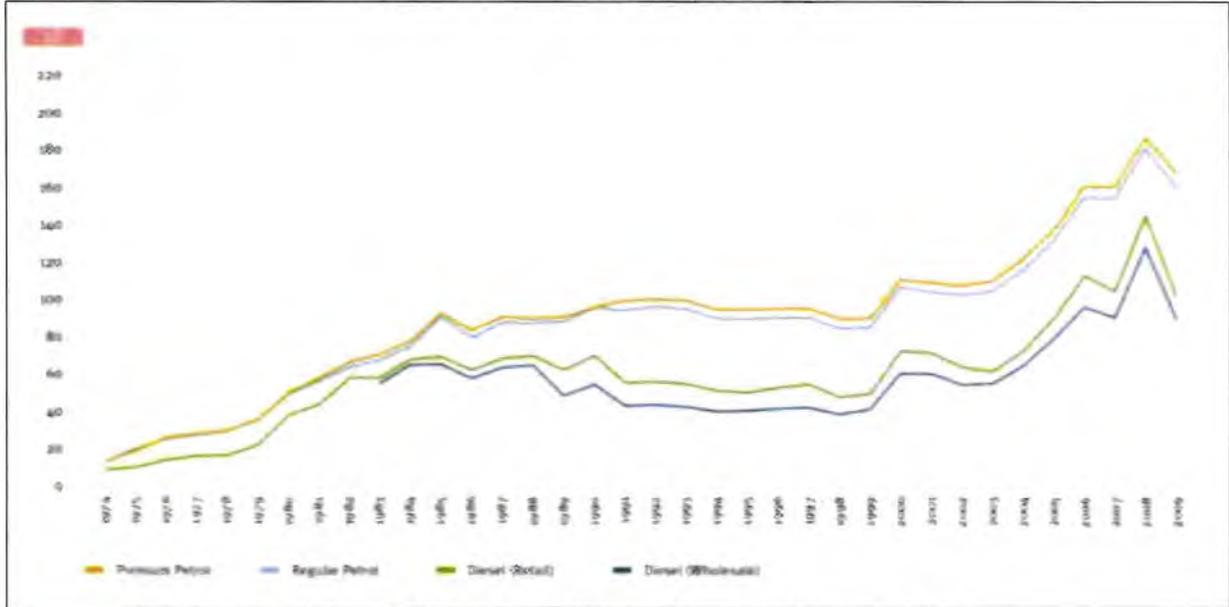


Source: Energy Data File (2010). Ministry of Economic Development.¹⁴

¹³ Ministry of Economic Development (2010).Energy Data File. Table I-1a
http://www.med.govt.nz/templates/StandardSummary_15169.aspx

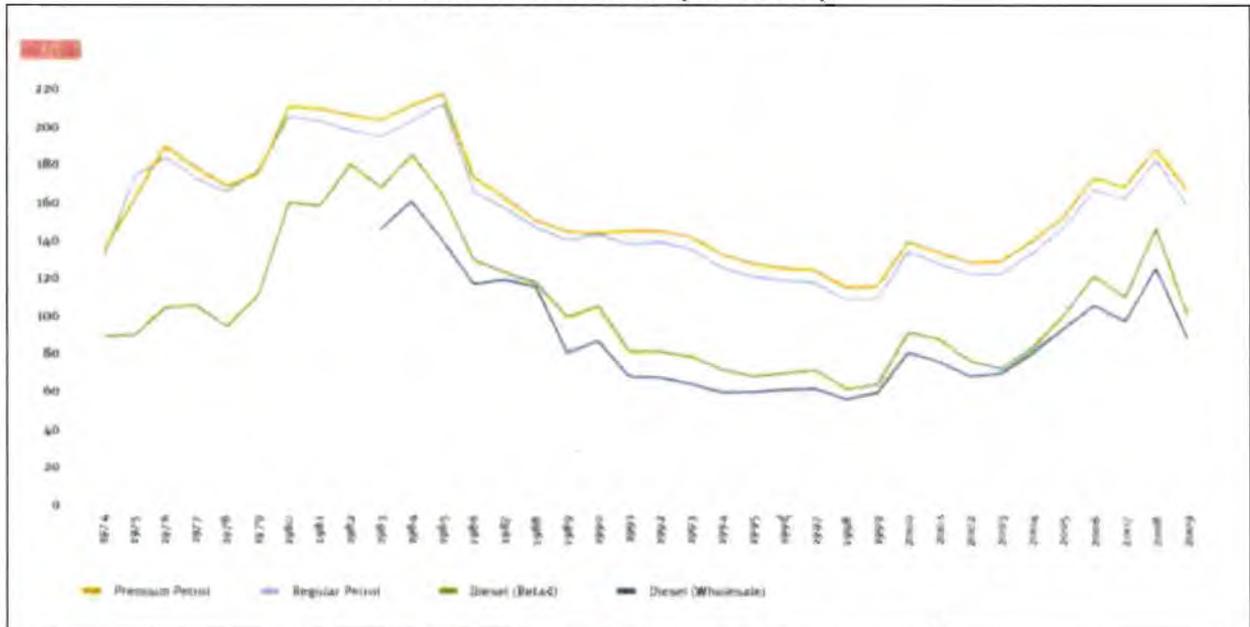
¹⁴ Ministry of Economic Development (2010).Energy Data File. Table I-1b
http://www.med.govt.nz/templates/StandardSummary_15169.aspx

Petrol and Diesel Prices (Nominal)



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

Petrol and Diesel Prices (Real 2009)

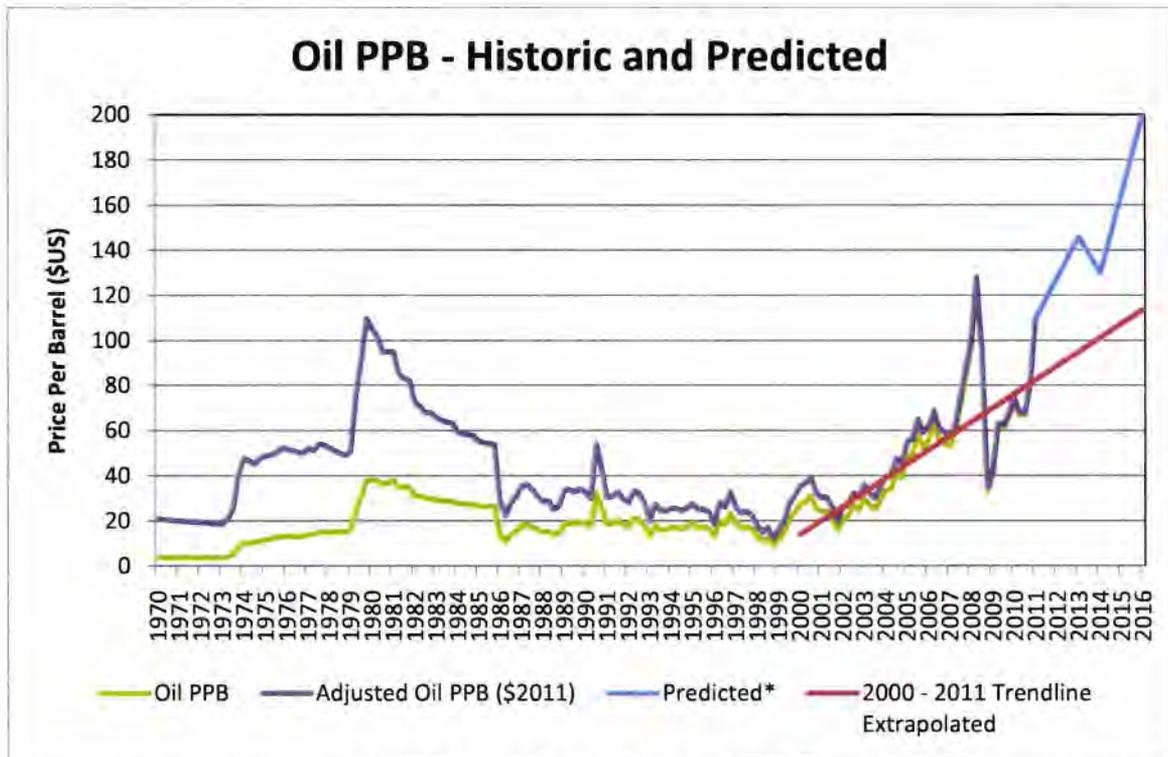


Source: Energy Data File (2010). Ministry of Economic Development.¹⁶

¹⁵ Ministry of Economic Development (2010). Energy Data File. Table I-2a
http://www.med.govt.nz/templates/StandardSummary_15169.aspx

¹⁶ Ministry of Economic Development (2010). Energy Data File. Table I-2b
http://www.med.govt.nz/templates/StandardSummary_15169.aspx

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



Source: Stevens (2010), Chatham House.¹⁷

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

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

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

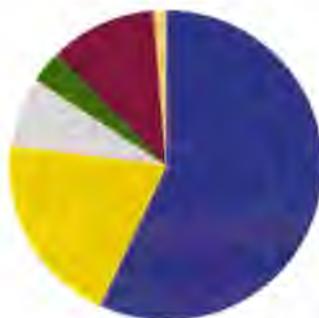
Suggested actions:

1. Undertake a vulnerability assessment of peak oil impacts for Southland, and communicate findings with the public.
2. Educate businesses, organisations and residents on the likely continued rising costs of energy to inform wise investments. This may be through some form of awareness raising event(s).
3. Identify communities within Southland at risk from a dependence on fossil fuels as a source of energy.
4. Continue to monitor viability of liquid biofuels production from crops, basing the value case on net positive energy gains, maintain awareness of associated land requirements.

5.2 Electricity Generation in New Zealand

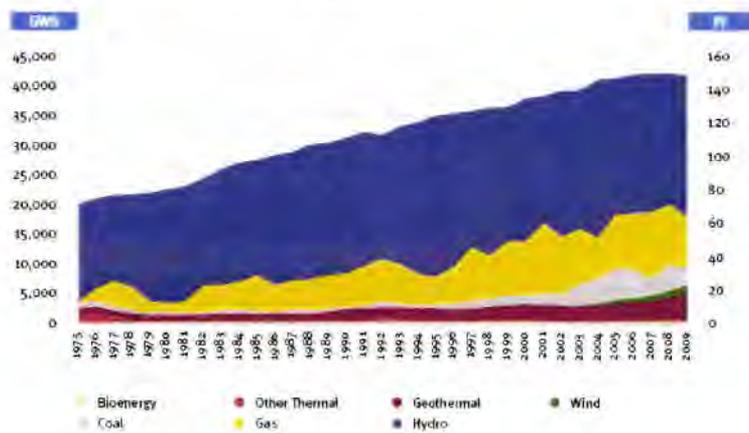
In 2009, 42,010GWh or 151PJ of electricity was generated in New Zealand. The composition of fuel type of this amount is illustrated below. This figure also illustrates the time series of generation by fuel type. In 2009, New Zealand generated 73% of electricity from renewable resources – mostly through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

Figure 6.10: Electricity Generation by Fuel Type for 2009



- Hydro 57.0%
- Gas 20.0%
- Coal 7.3%
- Wind 3.5%
- Geothermal 10.8%
- Other Thermal 0.2%
- Bioenergy 1.2%

Figure 6.11: Annual Electricity Generation by Fuel Type



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

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

5.2.1 Southland's Contribution to National Resource

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

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

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

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

Suggested actions:

1. Advocate policies that recognise and protect transmission corridors and networks.
2. Promote increased generation capacity to meet demand and achievement of the 90% renewable electricity target.

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

5.2.2 New Projects of National Significance

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

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

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

5.2.3 Dry Season Reserves

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

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

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

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

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

Suggested actions:

1. Advocate for the removal of tariffs such as the HVDC tariff as these are discouraging investment in renewable energy projects in the South Island.
2. Encourage the assessment and utilisation of opportunities relating to wind power and storage options, including pumping projects.

5.3 Legislative and Regulatory Framework

5.3.1 Southland Regional Policy Statement

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

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

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

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

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

5.3.2 Implications for Regional and District Planning

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

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

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

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

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

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

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

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

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

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

Suggested actions:

1. Planning and policy should preserve the land corridors for energy transmission that exist and recognise that there may be requirements for new corridors arising from the need to connect renewable generation to load centres. Plans should consider facilitating renewable electricity generation for remote sites, such as mini-hydro, biogas or wind turbines, where the upgrade of the transmission lines is uneconomic.
2. Promote planning for appropriate allocation of natural resources for the development of renewable generation to assist security of supply (to cope with peak load times and future overall demand).
3. Electricity generation companies, local authorities, and councils should develop a common approach to ensure that development of new generation is as streamlined as possible within the context of the RMA.
4. Advocate for changes to the electricity supply rules to encourage smaller renewable generators to connect to the grid.

The Southland Regional Policy Statement should:

1. Enable flexibility and discretion with regards to new and emerging energy technology.
2. Consider how to balance the positive effects of sustainable electricity generation against adverse environmental effects in a plan.
3. Place the onus on the developer to describe clearly how environmental effects will be mitigated – noting that large scale projects can be escalated to the EPA for review as a streamlined consent process for matters of national and regional importance.

4. Provide for technologies in this strategy, and certain levels of micro-generation activities as permitted, controlled, or discretionary (restricted) activities.
5. Allow for the establishment of alternative fuel distribution infrastructures, particularly in urban areas.
6. Develop a set of criteria to identify where wind generation would not be suitable and make specific provision for wind generation and its connection to the grid or local reticulation in remaining areas, by making it a permitted or controlled activity.
7. Acknowledge and be informed by Southland's energy strategy document.

5.4 NZ Energy Strategy

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

Priority: Diverse resource development

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

Priority: Secure and Affordable Energy

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

Priority: Efficient use of energy

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

Priority: Environmental responsibility

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

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

Suggested action:

1. Investigate required infrastructure for electric vehicles.

5.1 NZ Energy Efficiency Conservation Strategy

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

Suggested actions:

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

5.2 Emissions Trading Scheme

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

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

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

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

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

A change in the climate as a result of global warming and other influences means regions need to plan for and manage the projected impacts of climate change, and particularly imposed actions arising from national and international agreements. This includes anticipating actions to reduce greenhouse gas emissions. All six Kyoto Protocol Greenhouse gases CO₂, CH₄, N₂O, CFCs, HFCs, and SF₆ are relevant. When considering the costs and benefits of developing industries in the region, for example by way of an analysis of economic impact assessment, ETS costs and the negative economic impact of credits being purchased from outside the region require consideration. There is an opportunity to avoid this economic leakage by encouraging local credits to be purchased. This has the added benefit of encouraging local forestry, which will in turn increase supply for other regional strategic energy opportunities from biomass.

Suggested actions:

1. Encourage the harnessing the energy from waste products to avoid Emissions Trading Scheme costs.
2. Encourage local industry to purchase local carbon credits.
3. Educational programmes for energy efficiency should also stimulate forward thinking around availability and pricing of energy sources, with the goal of building resilience for changes.

5.3 National Policy Statement on Renewable Electricity

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

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

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

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

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

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

Suggested action:

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

6. Demand

It is logical to assume that any population growth and/or economic growth in Southland will increase demand for energy. By being smarter with how much and when we use electricity, we conserve energy capacity to support future economic and population growth, without necessarily having to invest in more infrastructures. If investment is needed for more efficiency, costs can be offset with reduced energy costs. Essentially, efficiency improvement and peak demand management are the lowest cost sources of energy. Furthermore, research undertaken by the International Energy agency indicates that in order to reduce CO₂ equivalent emissions to 450 parts per million, 59% of emissions reductions will need to come from efficiency of end use by 2020.³⁶

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

<5 years: Technology is proven and well developed. Pilot scale studies completed and some commercial implementation may exist. Wide-scale adoption of the technology is all that remains.

5–10 years: Technology proven and past research stage. Pilot scale studies completed but the costs of the technology prevents its large scale application. Work is being carried out to reduce such costs and make technology more widely available.

10+ years: Technology not fully proven and is under development. No pilot plant studies yet and could still be a research idea or laboratory experiment that needs more work to validate.

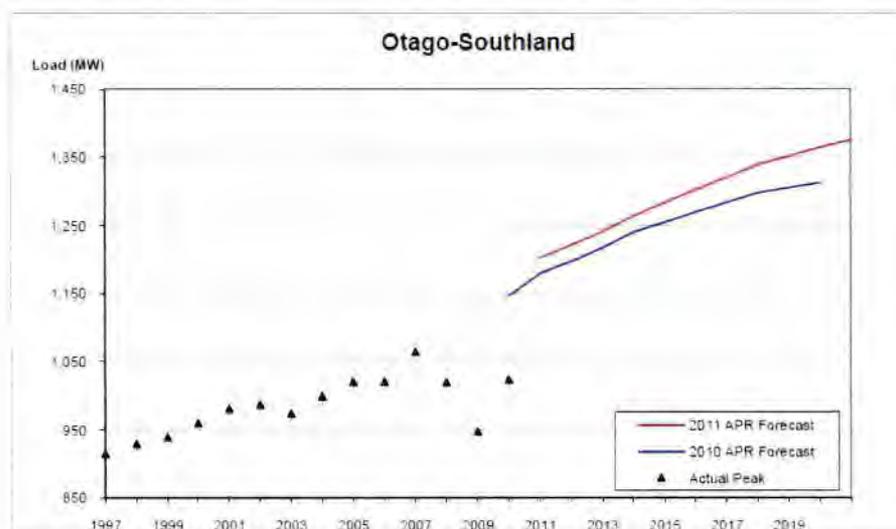
Brief descriptions of the technologies are given, and references for further information are provided. Key recommendations with regards to implementing this technology in Southland are outlined. Some of the implications in terms of planning activities are outlined in subsequent sections of the report.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

6.1 Electricity Demand Challenges

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

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

Otago-Southland Regional Electricity Demand Growth



Source: Transpower (2011). Annual Planning Report.

6.1.1 Power Quality

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

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

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

Suggested actions:

1. Test power factor as part of electrical certificate of compliance for new dairy sheds.
2. Develop a programme to implement the findings of the Dairy Shed project, including ensuring soft starts are retrofitted.
3. Encourage lines companies to ensure appropriate tariffs to encourage consumers to fit equipment to correct power factor and limit start currents.

6.1.2 Changes in Electricity Demand

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

Water Pumping

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

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

³⁷ Environment Southland (2009). Executive Summary for Regional Policy Statement Review.

³⁸ Beacon Pathway (2010). Looking after the future: Connecting short-term tools and long-term benefits to encourage sustainable buildings. www.southlandnz.com

Suggested actions:

1. Encourage effective allocation to avoid over allocation of water supplies.
2. Develop a detailed programme plan for a policy package for water demand management.
3. Identify best practice in dairy shed design, looking at opportunities for reduced energy and water use, and promote this for new conversions.
4. Consider developing a Water Resource and Water Demand Management Strategy.

Electric Vehicles

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

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

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

³⁹ Sustainable Business Oregon (2010). Electric Vehicles cited in Portland Business Journal.

<http://www.sustainablebusinessoregon.com/columns/2010/12/electric-vehicles-sustainable-for.html>

⁴⁰ Meridian Energy (2010). <http://www.meridianenergy.co.nz/AboutUs/Electric+vehicles+programme.htm>

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

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

Suggested action:

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

6.1.3 Energy Efficiency in Businesses

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

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

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

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

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

It was noted during the public consultation process that an increase in activity such as mining fossil fuels may impact on the ability of local agricultural businesses to utilise a “clean green” image. However, the dairy sector would require significant changes to the energy source of its processing plant before it could genuinely promote itself as with a “clean green” image without risking serious criticism. It is possible that many industries do clean up their act in the near future, with initiatives such as the Green Growth Advisory Group, providing policy advice to government in 2011, focussing on how exporters can make the most of a “clean, green” New Zealand brand⁴³. Actual green practice and avoiding claims of green wash will logically be one of their recommendations. Increased activity in mining fossil fuels could undermine the integrity of such strategies to capitalise on a “clean green” image. Indeed we have already seen the New Zealand tourism marketing switch from 100% Pure, implying a pure environment, to 100% Pure You. The justification for this change was “Major Tourism New Zealand research undertaken in 2010 suggested New Zealand could improve its appeal as a holiday destination by personalising its marketing message and focusing on more than stunning landscapes and awesome scenery”⁴⁴. It has been suggested during the public consultation process that large scale developments should have to consider using renewable energy, and mechanisms to achieve this should be investigated.

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

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

Suggested actions:

1. Encourage programmes which encourage energy efficiency in businesses.
2. Raise awareness of the opportunity for the agricultural sector to change its practices to better enable its promotion as a “clean and green” industry.
3. Investigate mechanisms to encourage large scale developments to consider using renewable energy.

⁴¹ <http://www.eecabusiness.govt.nz>

⁴² www.eeca.govt.nz/research-centre/eeca-research

⁴³ Ministry of Economic Development (2011). Website: http://www.med.govt.nz/templates/StandardSummary_45925.aspx

⁴⁴ Tourism New Zealand (2011). Website: <http://www.tourismnewzealand.com/about-us/what-we-do-and-how-we-do-it/campaign/>

6.1.4 Electricity Reticulation

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

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

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

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

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

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

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

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

Suggested actions:

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

6.2 Demand Management

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

6.2.1 Influencing or Anticipating Changed Demand Patterns

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

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

Suggested actions:

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

6.2.2 "Smart" Appliances (<5 years)

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

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

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

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

Considerations for smart appliances include:

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

Suggested actions:

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

⁴⁶ Automation Assist (2011). Nelson Ecofestival.

⁴⁷ Parliamentary Commissioner for the Environment (2009). Smart Electricity Meters. How households and the environment can benefit. <http://www.pce.parliament.nz/publications/all-publications/smart-electricity-meters-how-households-and-the-environment-can-benefit>

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

6.2.3 Energy Efficient Buildings

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Suggested actions:

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

Performance Rating Tools for Buildings

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

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

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

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

Suggested actions:

1. Encourage councils and businesses to use Green Star performance rating for any new build or refurbishment projects.
2. Encourage use of Homestar™ performance ratings, particularly for house sales.

6.2.4 Energy Centre of Excellence

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

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

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

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

Suggested actions:

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

6.2.5 Efficient Dairy Sheds (<5 years)

Potential for More Dairy Sheds

There are currently (end of 2010) some 809 farms in Southland, of which around 60 percent are classified as owner-operated, though equity partnerships are becoming a bigger feature of ownership structures in Southland⁵⁰. Typically, a Southland dairy farm will winter 560 cows over a land area of 192 hectares per milking platform, supplemented by a 68 hectare run-off⁵¹. Based on extrapolating Southland's existing pasture land use, up to somewhat over 1 million cows in Southland could be farmed. On this basis, 1,700 new dairy farms could be established in Southland over the coming years. Industry body Dairy NZ has indicated a desire to double the number of dairy farms in Southland over the next 10 years.

The annual energy use in a typical Southland dairy farm milking shed has been estimated to be around 100,000kWh⁵², or 160kWh for each cow⁵³. An additional 2,000kWh per hectare per year is required for land that is irrigated⁵⁴. Peak electrical load for a typical dairy shed is currently around 50kW. For dairy shed operations alone, potential electrical energy consumption, should 1,700 new dairy conversions go ahead, could thus exceed 250GWh per year, with a peak demand of over 100MW. It is not clear how much load would be created by associated irrigation pumping.

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

⁵⁰ Pastoral Monitoring (2010). MAF

⁵¹ Pastoral Monitoring (2009). MAF

⁵² Improving Dairy Shed Energy Efficiency (2007). Venture Southland. <http://www.cowshed.org.nz>. Page 17.

⁵³ Energy Use and Efficiency Measures For the NZ Dairy Farming Industry (2005). AgriLink NZ. Page 10.

⁵⁴ Energy Use and Efficiency Measures For the NZ Dairy Farming Industry (2005). AgriLink NZ. Page 10.

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

By implementing energy efficient technology and optimised milking plant design, a dairy shed could save around 36% of its energy consumption compared to a conventional dairy shed through using efficient water heating systems, milk chilling, vacuum pumps, and dairy shed lighting⁵⁵. This translates to potential annual electricity saving of over 60GWh.

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

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

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

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

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

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

⁵⁵ Energy Efficient Dairy Farming (2005). Genesis Energy. Downloaded from <http://www.dairysavings.co.nz/default.aspx?cacheb=YBSO2jko9E6LSVXUgCC6Rq&sessionid=E5pdT4i8n0GE368fmzfXVA>

⁵⁶ Morrison Low (2011), Energy from Waste Issues and Options Paper

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

Suggested actions:

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

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

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

Suggested action:

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

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

6.2.7 Superconductor Research

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

Suggested action:

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

7. Energy Storage

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

7.1 Fuel Cell Storage (5–10 years)

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

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

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

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

Suggested action:

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

7.2 Hydrogen Production (>10 years)

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

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

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

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

Suggested actions:

1. Investigate the opportunity for Southland to offer itself as a pilot location to test co-ordination and logistics for green hydrogen production.
2. Ensure flexibility in plans for land and water use with regards to hydrogen production and distribution.
3. Investigate options for addressing compliance and safety issues associated with the use and storage of hydrogen.
4. Promote the opportunities around hydrogen production to the community.

8. Energy Harvesting

8.1 Solar

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

8.1.1 Solar Hot Water Heating (<5 years)

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

- Consent process. Standard acceptable solutions for installations under the Building Code are not suitable for Southland because efficient installations of SHW in Southland require an optimal angle of panels at 46 degrees, not 45 or less, and potential snow loadings in Southland are too high for the acceptable solution to be applicable⁶⁰. Some suppliers do not have producer statements for their products which may also lead to engineers having to be involved with consents.
- Installers. It may help to develop a checklist type questionnaire for households wanting to install SHW to help them determine costs and benefits, and inform the decisions they make over suppliers (similar to the one developed for Dairy Sheds). However, if a solar saver scheme were implemented, this would take it one step further and help streamline the entire process, making it simpler for households.
- High capital cost for high efficiency systems. SHW could be encouraged if the scarcity of capital at household level could be overcome by innovative finance packages. An option is for lines companies to advance pay back through financially neutral charges to the consumer, although this is a complex option within the current electricity supply network. The more proven mechanism is voluntary targeted rates through the council, as is to be explored in the pilot solar saver scheme.
- Lack of qualified installers is an issue, and capacity building in this area is necessary for plumbers.
- Benefits of energy savings are not accrued to those who make the investment. This is noted as an issue in residential rentals, and leased premises. There is no easy answer to address this issue. Who the benefits accrue to is also an issue where the property is owned by the occupant, if they do not intend on remaining the occupant for the duration of the “payback period”. However, if building performance rating tools became commonplace, lessees could use this information when choosing premises and this would ultimately help send signals to property owners about demand for energy efficient buildings.

⁵⁹ EECA (May 2001). Alternative Technology Association, n.d., citing German performance data from International Energy Agency Photovoltaic Power System Program, PVPS Annual Report 2006, p. 63.

⁶⁰R McNeill (2008). Why isn't there a solar panel on every house in Southland.

http://www.sit.ac.nz/documents/Energy/10_Robin_D'Neill_Why%20isn't%20there%20a%20solar%20panel%20on%20every%20house%20in%20Southland%20080804.pdf

Solar Saver Scheme

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

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

Community Facilities

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

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

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

Suggested actions:

1. Establish a solar saver scheme in Southland, if after a pilot the benefits are proven and scheme is practical to be implemented.
2. Encourage plumbers to undertake training in solar water installations, to build capacity for installations.
3. Develop guidelines for schools and community facilities to assess solar hot water heating opportunities.

8.1.2 Solar Photovoltaic (<5 years)

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

There has been a saying for the last 20 years that PV will be economic for general use when the price falls below USD\$1/watt. In 2009 this price was achieved⁶¹. Therefore the technology is becoming much more robust and practically feasible. This can be seen in both simple solar powered garden lights through to integral PV cells with roofing materials now readily available. While some believe this technology will not become widespread, due to the abundance of more cost effective alternatives, the cost of PV technologies is reducing significantly and is likely to reduce further as commodity prices associated with polysilica production decrease and new PV products become available. Currently at least three major commercial scale PV arrays are being considered within Southland. We expect to see PV become more cost effective as more product development is occurring, for example where building products are replaced with PV products thus reducing the overall installation cost. Suitable returns for domestic power being fed back to the grid will accelerate the implementation of this technology and should be encouraged.

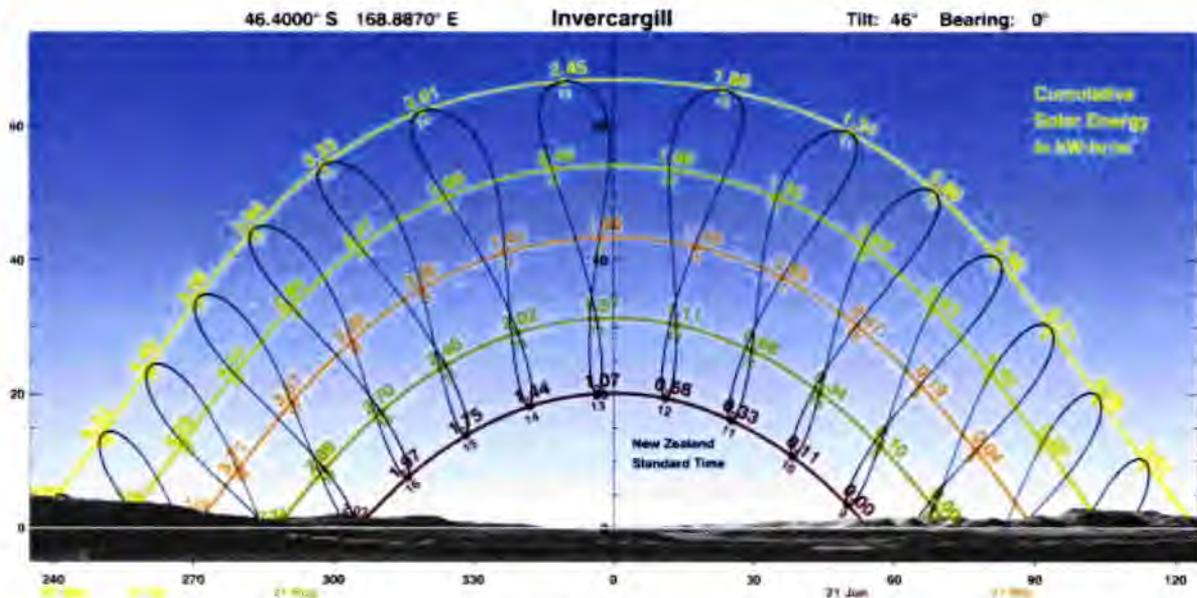
It should be noted that Southland has a silica resource in the Pebbly Hills. Silica is currently the key mineral required for solar photovoltaic energy generation. Ideally, if this silica is extracted, it would be processed within Southland to its highest and best use. Therefore it is recommended to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

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

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

⁶¹ Robin McNeill (2010). Personal Communication.

⁶² NIWA (2011) <http://www.niwa.co.nz/our-services/online-services/solarview>



Source: NIWA Solarview

Suggested actions:

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

8.2 Wood Biomass (< 5 years)

8.2.1 Wood Energy Potential

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

⁶³ Aurecon (2011). Southland Energy Review.

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

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

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

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

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

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

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

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

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

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

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

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

⁶⁶ EECA (2010). McCallums Drycleaners Case Study <http://www.eeca.govt.nz/node/9122>

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

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

Suggested actions:

1. Investigate the economics of using forestry residues and short rotation crops as an energy source.
2. Investigate the opportunity for the wood industry to develop liquid fuels, such as generating diesel using the Fischer-Tropsch or other process.

8.2.2 Wood Energy Demand

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

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

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

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

Some initial areas of focus include:

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

Some longer term areas of focus include:

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

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

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

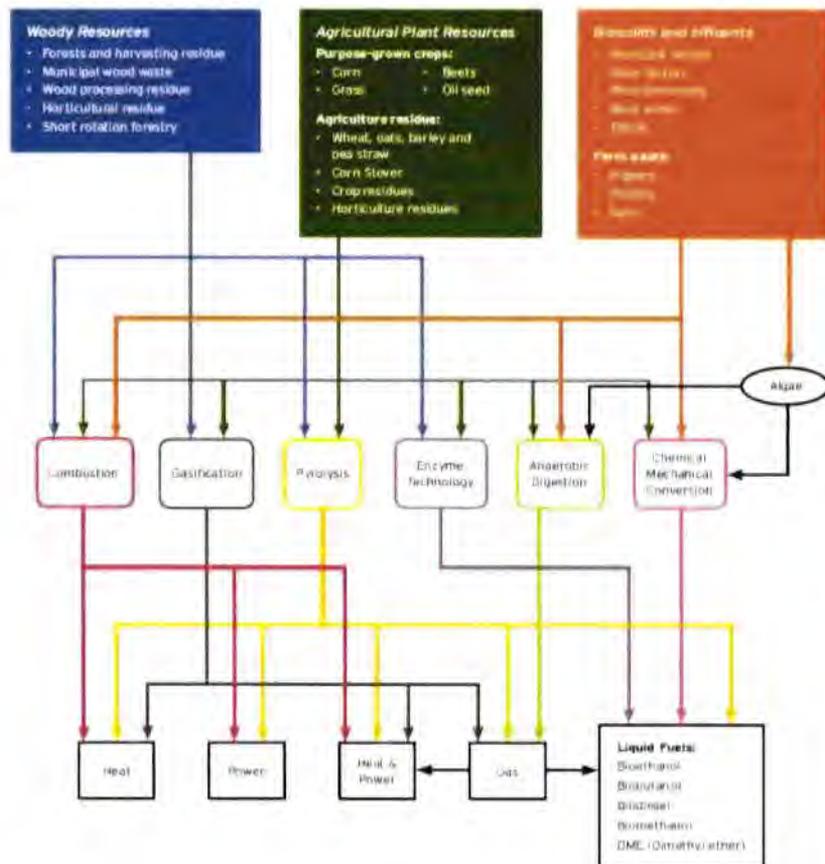
Further discussion on use of biofuels waste wood, and transport fuels is provided in subsequent sections of this document.

Suggested actions:

1. Actively promote the wood energy sector development in Southland through a range of actions outlined in the energy strategy section 8.2.2, including matching demand with supply streams.
2. Investigate the opportunity for creating incentives for promoting the use of woody biomass thus avoiding capital costs of grid upgrades and utilising avoided capital costs to fund these.
3. Encourage local manufacturers to research and develop improved technologies that contribute to the economic uptake of biomass as an energy source.

8.3 Other Biomass

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



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

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

8.3.1 Crops to Biofuels

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

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

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

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

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

⁶⁹ Nimmo-Bell & Co (2009). Food prices and biofuels update.

⁷⁰ EECA, <http://www.eeca.govt.nz/biofuels/sustainability>

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

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

Suggested actions:

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

8.3.2 Waste

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

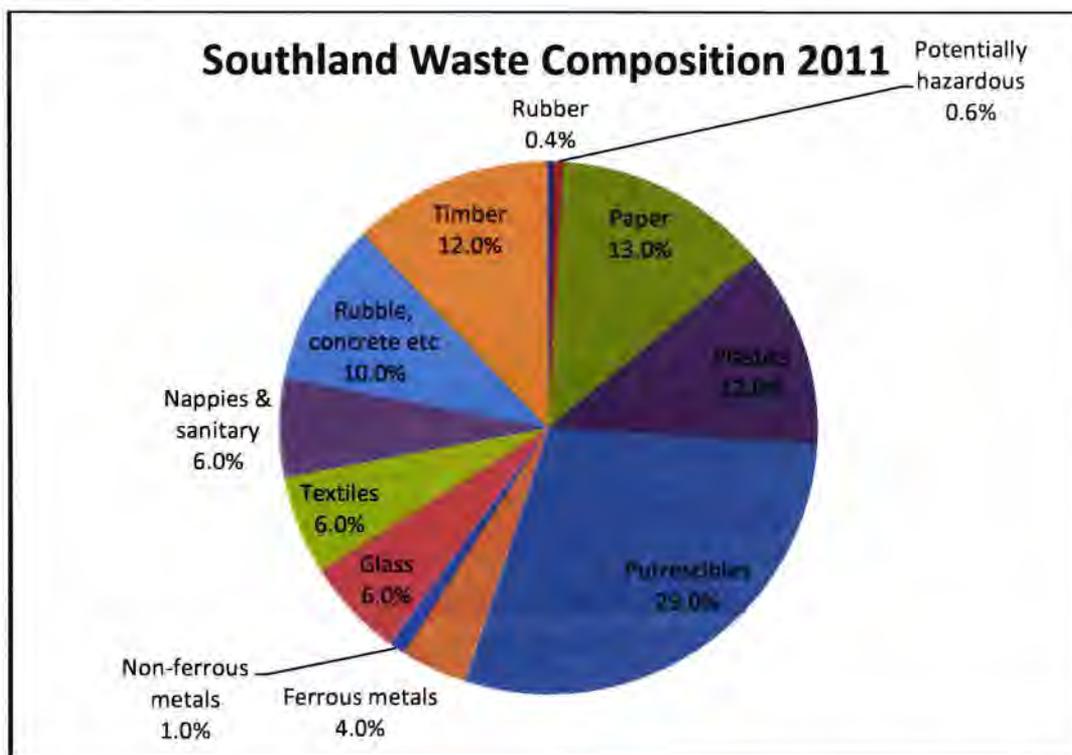
According to the Regional Solid Waste Management Plan,⁷² the only detailed regional information regarding Southland waste sources, volumes and disposal is contained in the 1987 Southland United Council's Waste Survey. This survey estimated the solid wastes generated in the region in 1987 to be 253,000 tonnes, made up of 6,900 tonnes of hazardous waste and 246,100 of non-hazardous wastes.

In 2007 a study was undertaken at the AB Lime Landfill to determine the composition of the waste disposed at the site. This data was updated following a Solid Waste Analysis Protocol (SWAP) analysis in 2011, and results are shown below.⁷³

⁷¹ Bradley, G., (2010). Fed-up public open to fuel change. NZ Herald. http://www.nzherald.co.nz/nz-government/news/article.cfm?c_id=144&objectid=10656506

⁷² Environment Southland (1996).

⁷³ Morrison Low and Associates (2011). Draft Regional Waste Assessment for Southland.



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

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

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

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

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

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

All councils in Southland provide detailed information about waste minimisation and direct their ratepayers and businesses to more sustainable practices through the WasteNet website⁷⁶. There appears to be a gap in having sufficient available data to be able to assess how well (or otherwise) each of the Councils is doing in its waste management. This gap is being filled as part of the action plans set forward in the Waste Management Plan and it will be crucial in monitoring and targeting a zero waste approach.

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

⁷⁵ Steve Smith (2010). Personal communication, General Manager AB Lime.

⁷⁶ Wastenet Southland (2010). www.wastenet.org.nz

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

Suggested actions:

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

8.3.3 Methane from Organic Waste (<5 years)

Most organic wastes can be digested in anaerobic digestion, which involves four steps. The first step, hydrolysis, breaks down organic compounds into smaller molecules and dissolves them in solution. The next two steps, acidogenesis and acetogenesis, involve further breakdown of organic compounds, while the conversion of small organic compounds to methane, CO₂ and water occur in the final step, methanogenesis. This process can be the basis for energy production from the methane produced and the residual materials from the process are often rich in soil nutrients. Anaerobic digestion of waste is a developed and mature technology. Organic fertiliser and biogas are produced from the process, and the biogas (methane) can be used as an energy source.

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

There is a small resource in the landfill worth further investigation if an appropriate economic matrix can be found. The technology to capture and utilise methane from landfills is well developed. Auckland and Christchurch landfills currently use this energy to run some of their vehicles⁷⁸. The landfill operator AB Lime has already investigated energy potential for the landfill, but unfortunately upfront capital costs are a barrier. Other council owned landfills have access to interest free crown loans, but this is not an option for the Southland landfill as it is privately owned. However, it is likely to be a question of when, rather than if, the landfill is going to be used as a source of energy.

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

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

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

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

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

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

8.3.4 Micro-Biological Processes (>10 years)

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

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

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

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

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

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

8.3.5 Ethanol from Organic Waste (5–10 years)

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

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

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

⁸⁰ Biofuels Digest (2011). <http://biofuelsdigest.com/bdigest/tag/lanzatech/>

⁸¹ Biofuels International (Jan 2011).

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

Suggested action:

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

8.3.6 Pyrolysis of Organic Waste (5–10 years)

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

8.3.7 Syngas from Organic Waste (5–10 years)

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

Suggested actions:

1. Monitor the commercialisation of the Scion Waste2gold process as a disposal route for sewage sludges that has nitrogen and phosphorous rich by-products.
2. Re-examine renewable sources of energy for farms, including biogas, and where appropriate promote them for dairy conversions.

8.3.8 Industrial Waste (< 5 years)

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

- Generating energy (biogas) from waste by digestion and use to supplement onsite energy requirements.
- Harvesting CO₂ from emission stacks of boilers (eg at Edendale), along with a source of nutrients can be used to grow algae or biomass as biofuel stock.

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

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

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

Suggested actions:

Encourage co-location of complementary industries by:

1. Identifying potential industries in Southland that could benefit from co-location (for waste streams including waste heat), and promote these opportunities.
2. Ensure plans indicating industrial zones are flexible enough to enable facilities inputs and outputs to be matched, including the development of energy generation nearby.
3. Establishing a database of commercial waste streams and heat, and attempt to match these with new or existing developments.

8.4 Transport Fuels

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

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

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

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

Transport in relation to commercial needs is potentially less flexible, where goods physically have to be moved. This highlights an issue for a region such as Southland, which focuses on primary production and tourism, both of which require transport on a larger scale. Even putting aside the fuel needed to bring visitors to New Zealand, the total amount of diesel consumed in NZ was estimated to be around 105.22PJ for 2009⁸³. Assuming diesel has a heat capacity of 44.8MJ/kg and a density of 832 kg/m³, this equates to about 2,835 million litres of diesel, which is a comparable figure to a 2001 Ministry of Economic Development estimate of an annual diesel consumption of 2,100 million litres of per annum. Scaling down this figure for Southland's population, it could be estimated that approximately 640 million litres of diesel is consumed in Southland annually.

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

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

⁸³ Ministry of Economic Development (2010). Energy Data File.

⁸⁴ Environment Southland (2007). Southland Regional Land Transport Strategy.

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

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

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

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

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

The following potential transport fuels are discussed further:

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

Suggested actions:

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

4. Investigate the feasibility of inland hubs to consolidate freight and improve freight density, energy efficiency, efficient transfer to rail and port.
5. Facilitate consortiums of larger fuel users to assist with enabling supply to meet demand for alternative fuel sources.
6. Review urban infrastructure and spend to enable and encourage transport alternatives such as walking and cycling, and ride sharing.
7. Encourage local transport operators to investigate alternative fuel sources, such as blends of sustainable biodiesel, electric vehicles and hydrogen fuel cells.
8. Advocate for central government to investigate a limit on fuel imports to help build business case for domestic liquid fuel production.
9. Investigate a formal ride sharing system to increase light vehicle occupancy.
10. Encourage initiatives such as efficient driver campaigns to encourage efficient use of fuel.
11. Progress energy objectives through influencing the development and implementation of regional land transport strategies and associated plans.
12. Encourage the upgrading of weight restricted bridges to improve road freight efficiency.

8.4.1 Bio-diesel (5–10 years)

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

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

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

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

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

Suggested action:

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

8.4.2 Coal Seam Methane (5–10+ years)

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

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

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

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

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

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

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

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

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

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

Suggested actions:

1. Investigate ways to mitigate the greenhouse gas implications of using coal seam methane as a transport fuel.
2. Promote the use of gas options as a substitute or for co-fuelling vehicles.
3. Investigate distribution and fuelling infrastructure needed for gas (including hydrogen) and liquid fuels.
4. Regional and district plans need to give consideration to the prospect of pipelines and fuel storage requirements for gas distribution.

8.4.3 Hydrogen (>10 years)

Vehicle engines can be powered using hydrogen if the car is compatible. Refer to [previous section 7.4](#) on hydrogen.

8.5 Marine Energy (>10 years)

Three sorts of marine energy are possible: wave, tide and tidal current. There are currently no commercial wave, or tidal current energy devices in operation although European governments are committing significant resources over the next three to five years. The initial cost of marine energy devices is likely to be higher than other generation technologies⁸⁸. The generators currently being evaluated are all in prototype stage and have not been scaled up to full size and developed an operational track record⁸⁹. In short, while marine energy could be applicable in 10 to 15 years time, it would be a high risk investment for Southland before then.

⁸⁸ IEA-OES Newsletter, Issue 7, September 2006.

⁸⁹ Meridian Energy Information Sheet, *Marine Energy*, March 2007.

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

8.5.1 Tidal current

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

The capacity factor of plants is estimated at 40% and costs are in the order of \$6,000 to \$9,000/kW for a small plant of 1MW or less. Projected annual operation and maintenance costs are \$150 per kW of installed capacity⁹⁰. A 200kW generator can thus be expected to cost in the order of \$1.2m to \$1.8m resulting in generation at around 10.7c/kWh for a 20-year life. A 500kW generator will thus cost in the order of \$3.6m with an annual operating cost of around \$75,000.

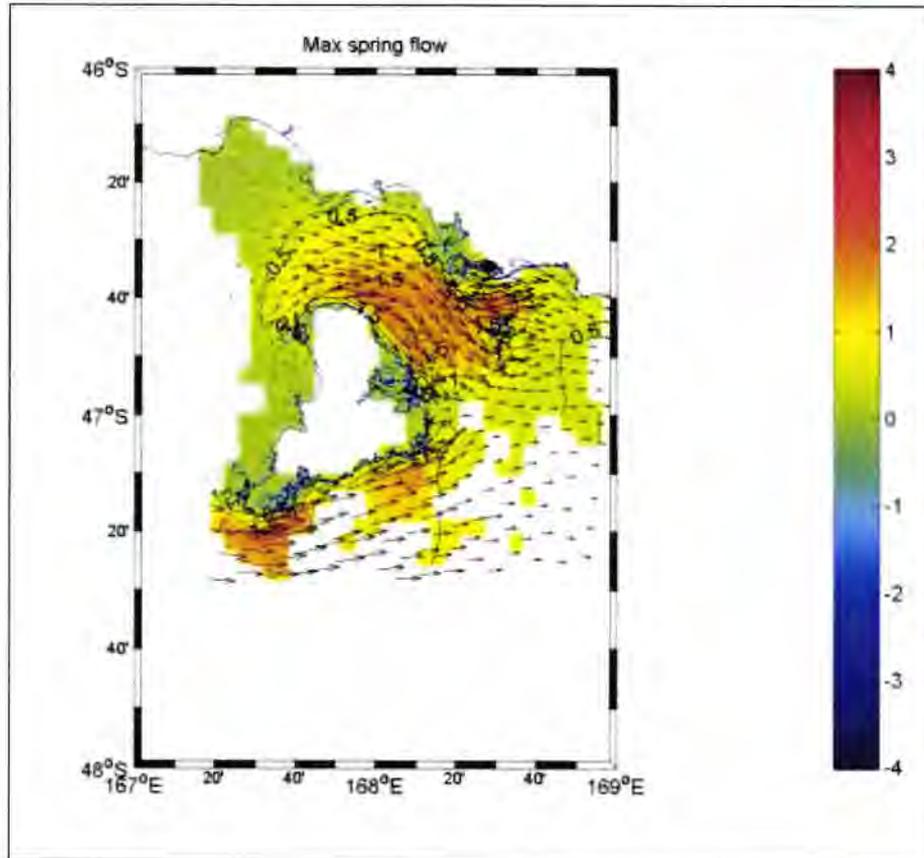
Preliminary NIWA modelling⁹¹ indicates that the maximum spring flows, for around those parts of Southland where transmission problems would not be overwhelming, to be in the order of $1\text{--}2 \text{ ms}^{-1}$ (see figure below). While localised anomalies are possible it is considered very doubtful that there could be sufficient acceleration to provide 3ms^{-1} , or more, currents. Based on analysis of marine charts, the only possibility is to harness the outgoing tide from Bluff Harbour slightly to the southwest of Stirling Point.

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

⁹⁰ Noel Hall, Chris Taylor, *Emerging Supply-side Energy Technologies*, Prepared for Min. of Economic Development, July 2006.

⁹¹ Dr Steve Chiswell, NIWA, *pers comms*, 20 March 2007.

Modelled peak spring tide velocities in knots



Source: Chiswell (2007).

8.5.2 Tide

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

8.5.3 Wave

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

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

Suggested action:

1. Assist in identifying suitable sites for marine energy.

8.6 Fossil Fuels

The use of fossil fuels has some specific considerations. While outside the scope of relevant environmental considerations for consenting process under the Resource Management Act, it is desirable that consideration be given to the global impacts of emissions of CO₂ equivalent, as well as the potential impact on the image of our export industries. A mechanism for encouraging this is the Regional Policy Statement (RPS). It is anticipated that this strategy will inform the RPS, and that regional and district plans must give effect to the RPS. The RPS should acknowledge these potential impacts.

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

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

Suggested actions:

1. Ensure the Regional Policy Statement notes the potential impact of CO₂ equivalent emissions on existing industries' and Southland's image.
2. Advocate that establishment and maintenance costs of infrastructure, monitoring and ETS costs should be fully paid by the industry, and not subsidised by tax or ratepayers.
3. Facilitate and encourage open communication between the public and developers around large scale developments.

8.6.1 Large Scale Exploitation of Lignite

An International Lignite Symposium was held in 2005. Since then opportunities for electricity, lignite briquettes, liquid fuels and fertilisers have been investigated, and processing sites for these developments have also been explored. The lignite in Southland, with a similar calorific value to wood but higher CO₂ equivalent emissions, although a poor quality coal compared to other New Zealand coals, is considered a strategic asset nationally. Modest scale mining of lignite already takes place at the New Vale mine, and some of the region's larger energy users use this resource.

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

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

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

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

⁹² Parliamentary Commissioner for the Environment (2010). Lignite and climate change: The high cost of low grade coal.

⁹³ Solid Energy (2011). Submission on Draft Southland Energy Strategy

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

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

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

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

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

During the submission process Solid Energy stated that "Each project will take care of its own ETS liability with full carbon costs being factored into the project economics along with emission mitigation being a fundamental consideration for the project design and operation." As well as finding ways to generate fewer emissions in the first place, they are looking to offset emissions by planting more trees through commercial forestry, storing more carbon through pest control programmes, purchasing carbon credits and/or storing carbon underground. They are currently trialling their own Biogold™ diesel in their Newvale Mine equipment fleet. This proactive response with regards to CO₂ is one which the public would likely be supportive of, and should be encouraged for all potential developers of fossil fuel reserves.

There is potential for national policies to change to be less supportive of such developments, particularly as public awareness of the climate change implications of such developments grows. Plans to extract this resource as a strategic asset are in conflict with New Zealand's goals and international agreements around greenhouse gas emissions. Diesel produced from coal using Fischer-Tropsch processes has a higher carbon footprint than the diesel we use now. Such developments would "increase the gap between the international climate change commitment", by 20–50%, a bill which would end up being paid for or subsidised by taxpayers⁹⁴. Clean coal is not a likely prospect within the near future, and further discussion on carbon capture and storage technology is provided in section 9 of this document.

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

If the lignite is extracted, it will likely be exported in some form. This means that Southland's existing businesses are unlikely to receive any benefit, by way of reduced input costs, because the products will be sold at world prices⁹⁶. Input energy to processes will need to be either provided, competing with existing demand, or internally generated. Options for sources of energy for such developments could include utilising waste energy from a plant in a synergistic application (eg warmed algae ponds), for which potential implications on land use around any plant would require consideration.

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

- CO₂ equivalent emissions
- air pollution through airborne particulates
- damage to the landscape
- soils displaced
- damage to waterways
- damage to aquifers
- using future generations' resources

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

⁹⁴ Parliamentary Commissioner for the Environment (2010). Lignite and climate change: The high cost of low grade coal.

⁹⁵ Transition Towns (2010). Southerners march against mining, saying "Ours - not mines!"
<http://www.transitiontowns.org.nz/taxonomy/term/923>

⁹⁶ Parliamentary Commissioner for the Environment (2010). Lignite and climate change: The high cost of low grade coal.

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

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

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

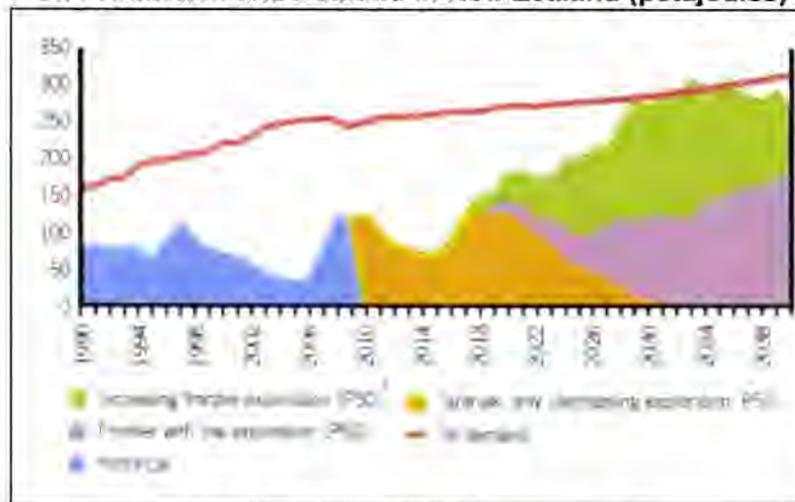
Suggested actions:

1. Ensure that if lignite reserves are extracted, local social and economic benefits are maximised, and any associated adverse environmental impacts are adequately avoided, remedied or mitigated.
2. Promote minimisation of CO₂ equivalent emissions, the development and use of environmentally sustainable sequestration opportunities and the implementation of carbon offsetting initiatives.
3. Investigate the establishment of legislation which would see locally sourced energy resources retained for local use as an import substitution.

8.6.2 Offshore Oil Exploration

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

Oil Production and Demand in New Zealand (petajoules)



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

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

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

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

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

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

Suggested actions:

1. Ensure that if oil reserves are extracted, local social and economic benefits are maximised, and any associated adverse environmental impacts are adequately avoided, remedied or mitigated.
2. Promote minimisation of CO₂ equivalent emissions, the development and use of environmentally sustainable sequestration opportunities and the implementation of carbon offsetting initiatives.
3. Request that oil spill recovery equipment be located within Southland to ensure quick recovery in the event of a spill.

8.7 Other Potential Developments

In 2003 Venture Southland commissioned a Regional Energy Assessment⁹⁷. The assessment paints a full picture of the opportunities available in Southland for renewable energy development. There have been a number of potential developments in the previous energy assessment which remain unchanged, particularly in relation to wind and hydro. The following strategic actions from the previous energy strategy are still considered relevant, hence the following have been carried over into this updated strategy:

Suggested actions:

1. Promote the development of secure and reliable energy supply for existing industry.
2. Promote the development of energy opportunities to encourage the attraction of appropriate industry to Southland.
3. Work with local Councils to encourage the inclusion of proactive policies, which facilitate the development of renewable energy generation and exploration, generation and transmission projects for consideration as part of long term plans.
4. Work with regional and local Councils as part of a review of the Regional Policy Statement and regional and district Resource Management Act plans to ensure that these reflect energy needs and this strategy.
5. Monitor legislative code and policy changes including changes to the Resource Management Act and if necessary submit as part of the public consultation
6. Encourage review of current legislation which places unnecessary restrictions on electricity distribution, generation and retailing. (The current legislation introduces elements of risk, which constrain investment in smaller regional generation projects by line companies. Southland therefore needs to advocate for the modification of the current legislation to allow lines companies to not only retail energy from power generation investment projects but also have the ability to manage the risk on the same basis as other generation investors).

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

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

9. Carbon Sequestration (5 to 10 years)

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

“Considerable energy is required for the capture, compression, transport and storage steps involved.”⁹⁹ Geo sequestration imposes a heavy energy penalty on the process using it as a means of carbon dioxide disposal. This can be as much as 8% to 12% of the energy generated by the combustion of the carbon. A geo-sequestration plant sequestering 7 tonnes/day, roughly the transport contribution of Southland, requires a 7 MW power source to run it. Current carbon capture technologies are based around the Amine cycle. For a typical thermal power station the Amine plant adds about 30% to the land footprint of the station and adds a complex chemical processing plant to the generation site. Other technologies are under development but all have technical hurdles and none so far have come up with an energy efficient way to compress the captured gas to pressures where it can be injected into suitable geological formations. “All technologies along the CCS chain have been in operation in various industries for decades, although in relatively small scale. These technologies have only been put together in industrial scale (>1Mt CO₂ captured and stored per year) in a small number of installations.”¹⁰⁰ It has been reported that there are over 80 CCS projects throughout the world. However, at the time of writing, according to Global CCS Institute there are now only 71 projects. Of those, only seven are operational.¹⁰¹ When this technology will mature enough to enable commercial application in Southland is debateable.

Significant geological investigation would be required to determine the technical feasibility of using this structure, including assessment of injectivity and the efficiency of the geological seal. The current status of this technology is best summarised “...it appears unlikely that CCS will deliver significant CO₂ reductions in a timely fashion. In addition, many uncertainties remain over the permanence of CO₂ storage, either in geological formations, or beneath the ocean. We conclude that further investment in CCS should be seriously questioned by policy makers.”¹⁰²

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

⁹⁸ International Energy Agency (2011). <http://www.iea.org/ccs/>

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

¹⁰⁰ International Energy Agency (2011). <http://www.iea.org/ccs/>

¹⁰¹ International Energy Agency (June 2011). Twitter.

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

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

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

Parties who have access to the Southern lignite reserves have undertaken considerable work investigating the potentially important innovation of Carbon Capture and Sequestration. Indeed, if this technology can advance it has potential to allay many of the public concerns around the use of our lignite reserves. The 'Clean Air Task Force' concluded in 2009 that "no credible technical body has found adequate CO₂ emissions reductions are possible without widespread use of CCS." Therefore we can expect to see continued widespread investment in developing this technology, and it is important to keep a watch on developments. The use of CO₂ in enhanced oil recovery could complement future oil and gas developments in Southland.

Suggested actions:

1. Investigate the broader benefits of bio-char to soil health, and advocate to central government for the inclusion of soil carbon into the ETS if appropriate.
2. Maintain an awareness of Carbon Capture and Sequestration technologies for potential application in Southland.

10. Remote Communities

10.1 Stewart Island

The viability of running an electricity cable from Bluff to Stewart Island has been examined. The idea was shelved due to high capital and operational costs and the inability to guarantee constant supply. It has been suggested costs would be in the order of \$9 million. Additionally, citing experience of the 1980 NZ Post Office cable that ran to the Island, which suffered from outages due to oyster dredging, anchor snags and other causes, the ability and cost to ensure constant supply would be both difficult and highly expensive.¹⁰³ An independent report undertaken by Meridian Energy subsidiary RightHouse¹⁰⁴ made similar findings. RightHouse suggested that a cable would have a capital cost in the vicinity of \$10 million and would have an ongoing maintenance cost of \$300,000 per annum. In both instances the net effect of delivering electricity across a cable like this would push the cost to consumers well past existing electricity prices.¹⁰⁵

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

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

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

Suggested actions:

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

¹⁰³ McNeill, R., et al. (2007). A proposed way forward to deal with electricity supply on Stewart Island.

¹⁰⁴ Capper, J., et al (2008). Initial Findings and Recommendations from Stewart Island energy efficiency and generation study.

¹⁰⁵ Cited in Stewart Island Electrical Supply Authority Website (2011). <http://www.siesa.co.nz/>

¹⁰⁶ Empower Consultants (2008). A study of alternative energy supply options for remote communities. <http://www.eeca.govt.nz/sites/all/files/distributed-generation-for-remote-communities-report-08.pdf>

APPENDIX I - Stakeholder Workshop Notes

Background:

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

Attendees

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

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

Lignite vs Wood

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

Opportunities from Waste

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

Planning, Policy and RMA

Local vs national needs

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

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

Long term view

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

Barriers

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

Renewables

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

Addressing Barriers

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

Efficient use

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

Wood

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

Other

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

Industrial developments

Lignite

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

Other industries

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

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

Skill gaps

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

Efficiency

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



2016 - 2026

SOUTHLAND CYCLING STRATEGY



Acknowledgements

The Southland Cycling Strategy has been prepared by TRC Tourism Ltd (www.trctourism.com) on behalf of Venture Southland, Invercargill City Council, Southland District Council and Gore District Council, Environment Southland and Sport Southland.

Acknowledgements and recognition of preceding strategies on national and regional level.

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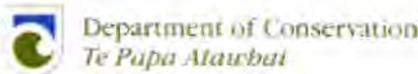


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EXECUTIVE SUMMARY

VISION STATEMENT

Our aim is to provide quality safe cycling infrastructure and increase cycling participation so that the people of Southland will gain in health, quality of life and appreciative use of their outstanding natural environment.

Cycling opportunities will contribute to Southland's socio-economic and population development by increasing the attractiveness of the region as a family friendly place to live and visit.



WHAT THE STRATEGY DOES

Cycling is a popular activity in Southland engaged in by 29% of the region's population, a higher participation rate than the average of 24.8% for New Zealand as a whole.

The Southland Cycling Strategy builds on the community's interest in cycling to develop improved cycling opportunities and ensuring benefits to Southland's community through:

- » improved health through participation in exercise that reduces the ill-health caused sedentary lifestyles
- » improved liveability through encouraging the community to move around in, congregate and meet people in their neighbourhoods, towns and cities
- » lifestyle advantages through opportunities for outdoor recreation and sport participation that contribute to making Southland a desirable place to live
- » provision of a safe, usable and sustainable transport method as part of an integrated land transport system that meets peoples' needs and has less impact on the environment
- » contributing to economic diversification of the region through attraction of cycle tourists and provision of cycling-related services.
- » supporting the development of cycling skills from learning to ride, return riders to enhancing cycling skills of elite riders

The Strategy also aligns with the New Zealand Government's actions to provide for safe, accessible cycling as a transport mode and recreational and tourism activity providing health, lifestyle and local economic benefits. The Strategy is a guide for local government, agencies, the community, cycling organisations, the tourism industry and business to develop and invest in cycling opportunities in a consistent, collaborative and sustainable way.

The approach in the Strategy is geared to the specific needs, situations and practicalities in Southland, including the scarcity of funds and resources for cycling infrastructure development. While the Strategy will assist the region to identify projects for submission to government funding programmes, these programmes are heavily committed. Southland will need to concentrate on strategic cycling developments that have most effect for the region in allocating and applying for scarce resources.

The Strategy covers the different ways people cycle in Southland. It applies four broad categories of cycling – commuter (or utility) cycling, recreational cycling, cycle tourism and competitive and event cycling – and the range of cycling styles – road cycling, off-road trail cycling, mountain biking (in its different forms) and BMX riding.

The Southland Cycling Strategy will be followed by the Priorities Plan which will be developed by governance and implementation group in conjunction with all key stakeholders.

OPPORTUNITIES FOR SOUTHLAND'S RESIDENTS ACROSS THE RANGE OF CYCLING

As demonstrated in a survey conducted in 2016, Southland residents are keen to see more investment by councils in cycling improvements in the region. Their major concerns focus on:

- » improved road safety for cyclists, including improved cycle lanes or road shoulders for commuting and recreational road riding
- » more cycling opportunities suitable for families
- » more amenities and services for cyclists on recreational and tourism road routes and trails
- » more off-road recreational and tourism trails and completion of trails under development
- » improved mountain biking opportunities near urban areas
- » a greater range of mountain biking difficulty levels and better trail maintenance.

As a priority the Strategy focuses on the consolidation and improvement of existing cycling infrastructure in the region including through improved linkages and safety in the on-road and off-road cycling network in Invercargill; completion of planned cycleways; and designation of cycling routes on highways and rural roads with associated safety improvements.

Through improved cycling safety and Learn to Ride programmes, more cycling events and social activities, and accessible cycling information and promotion, the Strategy aims to communicate with and encourage greater cycling participation in Southland's communities. Each year, more than 300 people volunteer their time and skills to the Southland various cycling groups to help to create a better environment for cycling. Southland cycling groups would not be able to deliver an amazing range of initiatives and events without volunteers. Retention and attraction of new volunteers are crucial to maintain and enhance the current state of cycling in Southland.

For mountain biking the main focus will be in improving the quality and range of opportunities at mountain biking facilities near Invercargill, Gore and Te Anau where most of Southland's mountain bikers ride. Over time the improved management and maintenance of mountain biking on backcountry management tracks and other riding opportunities on public conservation lands will be considered, subject to policies being developed by the Department of Conservation.

CYCLE TOURISM

Cycle tourism has the potential to bring socio-economic benefits to Southland through increased recreational and holiday opportunities, the economic flow-on effects of visitor expenditure and business and employment opportunities.

Southland is at an early stage in the development of cycle tourism. Except for the Around the Mountains Cycle Trail (one of the Great Rides in the New Zealand Cycle Trail) there has been little development of cycling routes with linked products and services that meet the expectations of contemporary cycle visitor markets for accessible cycling experiences of between one and several days in length.

The Strategy provides a realistic approach for Southland to develop cycle tourism. It provides for the development of a small number of high quality, distinctive Southland cycling experiences – the Around the Mountains Cycle Trail, Heartland Rides (on-road routes), and the shorter Invercargill to Bluff Cycleway and (subject to route approval) the Te Anau to Manapouri Cycleway. Assistance will be provided to the tourism industry and businesses to develop cycle-friendly products and services linked to cycling trails and routes. This approach will provide a firm foundation for extension of cycle tourism development in the longer term should opportunities be identified.

COMPETITIONS AND EVENTS

There is a strong tradition of cycling competitions and events in Southland, including the iconic Tour of Southland road race (now in its 60th year) and the SIT Zero Fees Velodrome at Invercargill which is a major resource for track cycling competitions and local cycling training and education.

The region also offers some unique, small mountain biking events. Southland's competitive cycling focus has been affected by the growth of cycling events throughout New Zealand and falling local participation. The Strategy aims to rejuvenate local and visiting interest in competitive and participative cycling events in Southland through increases in school competitions, hosting of second tier national and international events, a signature event on the Around the Mountains Cycle Trail, development of a Festival of Cycling and improved promotion of events.

THE CORE APPROACH

Improve and consolidate current cycling infrastructure and opportunities with an emphasis on safe, enjoyable family-friendly experiences.

Encourage more local cycle participation and development of a cycling culture.

Provide a small number of high quality cycling experiences with a distinctive Southland character.

Over time consider new cycling opportunities that are supported by demonstrated demand and a sound business case.

Decision-making criteria are provided to ensure that decisions on improving, consolidating, maintaining and extending Southland's cycle network are sustainable. In the region's limited funding environment preferred cycling developments will be those that provide the greatest benefits for the region and its communities.

Six main strategies will be employed to implement the Strategy are detailed as follows:

- A IMPROVE BASIC INFRASTRUCTURE TO ENCOURAGE MORE PEOPLE TO CYCLE**
- B DEVELOP AND PROMOTE A SUITE OF HIGH QUALITY CYCLING EXPERIENCES**
- C IMPLEMENT PROGRAMMES TO ENCOURAGE PEOPLE TO CYCLE AND RAISE SAFETY AWARENESS**
- D SUPPORT COMMUNITY CYCLING ACTIVITIES AND PARTICIPATION-BASED EVENTS**
- E ASSIST THE REJUVENATION OF COMPETITIVE CYCLING EVENTS**
- F SUPPORT DEVELOPMENT OF LOCAL CYCLE COMMISSIONABLE TOURISM PRODUCTS AND PARTNERSHIPS**
- G IMPLEMENT STRONG LEADERSHIP, COMMUNICATION AND COOPERATION**

A

IMPROVE BASIC INFRASTRUCTURE TO ENCOURAGE MORE PEOPLE TO CYCLE

Action	Description
A1	Conduct an audit of cycling conditions on major urban and rural road cycling routes in Southland to: <ul style="list-style-type: none">identify primary and secondary routes for cycling, including routes connecting main cycling commuting and recreational destinationsdevelop a plan for safety improvement and cycle-friendly measures consistent with the latest New Zealand standards.
A2	Re-assess the on-road cycling and off-road shared path networks in the City of Invercargill to identify route and trail construction, linkages, design and signage and safety measures required to ensure cyclists are able to travel safely and efficiently for transport and recreational purposes.
A3	Develop a master plan for implementing the reviewed on-road cycling and off-road shared path recommendations from Action A2.
A4	Investigate development of a cycle lane or cycle trail from the Invercargill airport to the city and the provision of cycle-friendly facilities (such as bike racks) at the airport.
A5	Encourage the provision of distinctive bicycle racks and other cycle friendly infrastructure (such as pumps, changing facilities) at urban and other popular cycling destinations, including the airport.
A6	Develop and communicate a timeline and plan for the development of the Invercargill to Bluff Cycleway including the route, construction costs, maintenance, interpretation and funding. Ensure construction is to a standard that encourages wide use and includes supporting infrastructure such as rest areas, shelters, toilets, local information and interpretation.
A7	Support and fund local community based initiatives to improve cycling opportunities in towns such as Waikaia, Winton, Riverton, Gore, Maitua, Edendale and Wyndham.
A8	Designate and promote cycle-friendly road cycling routes for recreational and training use originating in Invercargill, Gore and Te Anau with improved signage, enhanced usable road shoulder width and other cycle-friendly improvements.
A9	Develop 'shovel ready' proposals for cycling infrastructure (including, as relevant in cities, towns and rural areas) for funding under the New Zealand Transport Agency's cycling safety action plan and the National Land Transport Programme.
A10	Consider the development of a greater range of mountain biking opportunities at Sandy Point, Bluff, Croydon Bush, Ivon Wilson Park and the Te Anau Control Gates to address the greatest need.
A11	Implement consistent grading signage and standards across Southland mountain bike networks to assist in promoting Southland mountain biking to a range of users.
A12	Improve opportunities for BMX riding in Invercargill including co-locations with other cycling activity at Surrey Park.
A13	Support councils and relevant authorities and organisations in maintaining and making improvements in cycling infrastructure. This should include advocating the recognition of cycling as a mode of transport by regional road controlling authorities and consideration of cycling needs during road works.

B

DEVELOP AND PROMOTE A SUITE OF HIGH QUALITY CYCLING EXPERIENCES

Action	Description
B1	Investigate, designate and promote a range of quality road riding itineraries as Heartland Rides.
B2	Design and install cycling route signage.
B3	Complete and promote the Around the Mountains Cycle Trail for day and multi-day 'soft adventure' experiences and encourage development of with self-guided and guided products and supporting transport, accommodation services and interpretation.
B4	Encourage greater focus on the Southland areas of the Around the Mountain Cycle Trail through the development of trail-related products and attractions based in Southland and linkages to Fiordland.
B5	Encourage the completion of the Te Anau to Manapouri Cycleway on the route through Fiordland National Park to ensure a quality visitor experience.
B6	Support a review of the Fiordland National Park Management Plan investigating low impact cycling opportunities within the front country of the National Park.
B7	Provide comprehensive information on cycling experiences on tourism websites, visitor information centres and the Southland cycling website. Information should include maps, details of each ride (distances, elevations, difficulty); cycle-friendly services, food and accommodation; booking links; bicycle shops and transport. The information should be available in both paper and digital forms, including as downloadable apps.
B8	Promote Southland cycling experiences as a major pillar in tourism planning and part of Southland tourism marketing through a variety of media, social media (such as Trip Advisor) and marketing and public relations campaigns.
B9	Establish a monitoring system to obtain information on use of major cycling trails including the Around the Mountain Cycle Trail, the Te Anau to Manapouri Trail and the Invercargill to Bluff Trails and to demonstrate the contribution of cycling to the economy.
B10	Undertake business cases into the best options for developing future multi-day trail ride journeys in Southland.

C

IMPLEMENT PROGRAMMES TO ENCOURAGE PEOPLE TO CYCLE AND RAISE SAFETY AWARENESS

Action	Description
C1	Develop and implement a campaign to promote cycling as a desirable activity and form of exercise with health and environmental benefits, using a variety of messages to target different groups including children, young people and families. The campaign should be linked, as appropriate, to other health and exercise initiatives.
C2	Provide information on cycling opportunities to residents through a variety of media and a central information source including a core cycling website and links to other relevant sites.
C3	Consolidate and extend the 'Share the Road' campaign targeting schools, youth groups, adult cyclists, motorists and truck drivers to build awareness and promote safe cycling and road sharing practices. Extend the current 'Share the Road' roadside signage to cover all popular local road circuits and main cycle tourism routes
C4	Develop and implement a range of cyclist training programmes for different ages, skill levels and cycling types taking account of the New Zealand Transport Agency guidelines.
C5	Improve access to Learn-to-Ride parks.
C6	Investigate a new Learn-to-Ride facility that is open to the public at a prominent location in Invercargill. The facility should include road safety opportunities but also skill based facilities like a mini-pump track.
C7	Develop further open-access Learn to Ride facilities in other city parks and throughout Southland including mini-pump tracks and circuits that are fun and safe for children.
C8	Encourage the use of power assisted electric bikes (E-bikes) to improve participation in cycling for commuting and recreation.

D

SUPPORT COMMUNITY CYCLING ACTIVITIES AND PARTICIPATION-BASED EVENTS

Action	Description
D1	Work with social and community groups, youth groups, cycling clubs, Cycling Southland and Sport Southland to encourage and promote a range of social cycling activities.
D2	Work with cycling clubs, schools, Cycling Southland and Sport Southland to encourage programmes to introduce young people to the different types of cycling.
D3	Support the development and promotion of a wide range of participation programmes and events based around the Velodrome, including learn to ride, BMX, mountain biking, programs for elderly riders and community programmes run by Cycling Southland and Sport Southland.
D4	Encourage use of social media and the Southland cycling website to develop cycling networks and activities.
D5	Increase awareness of and celebrate successful cycling events, including the Southland Mountain Bike Club Winter Series, the Milford Mountain Classic and other events that are seeing strong growth and are accessible to local residents.
D6	Consider the development of a Festival of Cycling in association with other events already held in Invercargill, such as the Tour of Southland.

E ASSIST THE REJUVENATION OF COMPETITIVE CYCLING EVENTS

Action	Description
E1	Encourage school sports day and inter-school cycling competition across the disciplines of road cycling, track cycling, BMX and mountain biking.
E2	Identify hosting opportunities for second tier national and international cycling events, such as masters and youth/secondary schools events across the disciplines of road cycling, track cycling, BMX and mountain biking.
E3	Improve promotion of major cycling events such as the Tour of Southland, the Southland Mountain Bike Club Winter Series, the Great Southern Cycling Challenge and the Milford Mountain Classic, Oceania Track Championships to increase awareness and attract participants and spectators.
E4	Investigate the establishment of a signature event for the Around the Mountains Cycle Trail to raise awareness of the opportunity the trail offers as well as shorter local community based events.

F SUPPORT DEVELOPMENT OF LOCAL CYCLE COMMISSIONABLE TOURISM PRODUCTS AND PARTNERSHIPS

Action	Description
F1	Develop guidelines for provision of cycle-friendly services in Southland.
F2	As cycling experiences and routes are developed, hold experience development workshops with local businesses, accommodation operators, tour operators, transport service and local government to build awareness of the needs of cyclists and the benefits of offering cycle-friendly services and experiences linked to cycle tourism.
F3	Develop a programme for mentoring and business development advice for local enterprises establishing cycle-friendly services and products. This programme could be linked to other tourism or business support programs.
F4	Encourage availability of more bicycle hire near cycle trails and road cycling routes.

G IMPLEMENT STRONG LEADERSHIP, COMMUNICATION AND COOPERATION

Action	Description
G1	Agree to a governance model for coordination and ongoing implementation for the Cycling Strategy and establish this as an effective structure with appropriate resourcing.
G2	Establish and fund a position of Southland Cycling Coordinator for a three year period to implement the strategy, support governance and pursue additional funding.
G3	Encourage and support partnerships with local communities, cycling clubs and groups for trail management and maintenance.

1. BACKGROUND

The Southland Cycling Strategy is a guide for government, the community, cycling organisations, the tourism industry and business at the local, district and regional levels to develop and invest in cycling opportunities in a consistent, collaborative and sustainable way.

It is geared to the specific needs, situations and practicalities in Southland while guiding local stakeholders on developing effective initiatives in their local areas.

PURPOSE OF THE CYCLING STRATEGY

1.1 The Strategy applies to the area covered by the Southland District Council, the Gore District Council and the Invercargill City Council.

Underlying the Strategy is the aim to utilise improved cycling opportunities to bring multiple benefits to the Southland community through:

- ❖ improved health through participation in exercise that reduces the ill-health caused by sedentary lifestyles
- ❖ improved liveability through encouraging the community to move around in, congregate and meet people in their neighbourhoods, towns and cities
- ❖ lifestyle advantages through opportunities for outdoor recreation and sport participation that contribute to making Southland a desirable place to live
- ❖ provision of a safe, usable and sustainable transport method as part of an integrated land transport system that meets people's needs and has less impact on the environment
- ❖ contributing to economic diversification of the region through attraction of cycle tourists and provision of cycling-related services.

The Southland Cycling Strategy aligns with the 2015 Southland Regional Development Strategy, which aims to attract migration, a more varied population demographic mix and more diverse economic development to the region. The proposed improvements in cycling infrastructure and opportunities will improve the region's lifestyle choices and attractiveness for migration, tourism and investment.

HOW THE DRAFT STRATEGY WAS DEVELOPED

1.2 The Southland Cycling Strategy was developed in close consultation with the region's councils, government agencies, cycling organisations and the community.

Southland's population, social, economic and tourism situation was analysed and plans for the region's future directions and previous studies on cycling in the region were reviewed. An audit was conducted of the existing cycling infrastructure, services, experiences and organisation in Southland and competitor cycling destinations. Local and visitor cycling markets and their cycling needs and preferences were also analysed to identify the market segments and types of cycling with most potential for the region.

Community views and input on directions for cycling were provided through interviews with major stakeholders and community open house sessions. Stakeholders were also invited to comment on a paper setting out a proposed strategic approach to cycling development.

The views of Southland's cyclists were sought through an online survey that received **339 responses**.



BENEFITS OF INVESTING IN CYCLING IN NEW ZEALAND COMMUNITIES

The New Zealand Transport Agency has compiled evidence from New Zealand and other countries to show that provision of cycling infrastructure leads to increased cycling participation in communities leading to:

- ❖ improved quality of life and social connection
- ❖ reduction in travel times, improved traffic flows and reduced council road operational costs
- ❖ savings on transport for cyclists
- ❖ attraction of visitors
- ❖ reduced noise and greenhouse gas emissions
- ❖ reduction in the incidence of serious illnesses

The Southland Cycling Strategy aligns with the New Zealand Government's aims and initiatives to develop safe, accessible cycling as part of an integrated land transport system and as a transport mode and recreational/tourism activity providing health, lifestyle and local economic benefits. More detail on the planning documents related to the Southland Cycling Strategy is provided in Appendix A.

NEW ZEALAND GOVERNMENT'S CYCLING POLICY

Safer cycling throughout New Zealand - *New Zealand's Road Safety Strategy 2010-2020 and the 2015 Cycling Safety Action Plan*

Cycling as an attractive urban transport choice - a goal of additional 10 million annual urban cycling trips by 2019

Great Rides – the 23 rides in the New Zealand Cycle Trail (Nga Haerenga) developed with government and local funding from 2009

Heartland Rides – on-road cycle touring routes on existing roads identified by shoulder width, traffic speed and traffic volume

A connected cycling network – of urban cycling infrastructure, Great Rides and Heartland Rides

Combined government and local funding for cycling improvements – at the national level through the Urban Cycleways Programme and under the National Land Transport Programme.

The Southland Cycling Strategy identifies cycling development priorities that will assist the region in applying for government funding. The Urban Cycleways Programme (commenced in 2014) provides funding for cycling infrastructure in major urban areas.

The National Land Transport Programme provides funding for improved transport throughout New Zealand, including for on-road cycling and off-road cycling trails. The programme operates through Regional Land Transport Plans (developed by Regional Transport Committees) which supports projects submitted by TLAs for inclusion in for funding in the National Land Transport Programme (NLTP) for to the New Zealand Transport Agency. Southland is part of the Otago Southland Regional Land Transport Committee; which meets jointly as a more effective and efficient way of inter-regional transport planning. There may be opportunities to develop Southland cycling projects for submission in the following round of funding for 2018-21.

However at this stage in the 2015/18 investment period these Government funding programmes are heavily committed. It will be essential to have a strategic regional focus on cycling developments that have most effect for the region in applying and allocating limited resources.

Consideration of specific cycling opportunities in Southland has previously occurred under the Invercargill Walking and Cycling Strategy 2010, the March 2015 Recreational Walking and Cycling Strategy for Invercargill and the 2014 Te Anau and Environs Cycling Opportunities Study. The Otago Southland Regional Land Transport Plans 2015-2021 (developed under the National Land Transport Programme) emphasise:

- provision for safe cycling in new road construction and where this is necessary for safety
- building of separate cycleways for commuting or other economic purposes where safety of cyclists is at risk
- expanding and connecting the cycling network
- provision of bike racks in town centres and bike carriers on urban buses
- safe connections between different parts of the New Zealand Cycle Trail.

The developments and recommendations in these strategies and studies have been taken into account in developing the Southland Cycling Strategy.

Conservation lands form a large part of Southland and are important natural assets and recreational destinations for the region's residents and visitors. Mountain biking on management trails occurs on some conservation lands and there has been interest in extending and improving these opportunities.

The Department of Conservation has developed a draft *Southland Murihiki Conservation Management Strategy* (awaiting approval at the time of writing) indicating locations that may be considered for mountain biking access and facilities subject to meeting identified policies. Mountain biking in the Fiordland National Park, the region's largest national park and an iconic visitor destination, is restricted to some management trails under the Park's statutory management plan. The draft *Southland Murihiki Conservation Management Strategy* indicates that the question of mountain biking access and development of new mountain biking trails will be considered in the review of the management plan.

WHAT TYPES OF CYCLING DOES IT APPLY TO?

1.4

The Southland Cycling Strategy focusses on four broad categories of cycling activity as below and also acknowledges that there is cycling activity on sealed roads and off road trails; using different types of bicycles and seeing increased usage of e-bikes.

COMMUTER CYCLING

On-road and trail cycling as a means of transport to work, school, education institutions, shops and other places primarily in and near urban areas. Commuter cycling infrastructure can also be used for recreational cycling. Also known as 'Utility Cycling'.



RECREATIONAL CYCLING

Cycling by Southland residents during their leisure time across the different types of cycling

CYCLE TOURISM

Participation in cycling of various types by domestic and international visitors to Southland, whether as an element of a wider trip or a trip that focusses on a specific cycling experience



COMPETITIVE AND EVENT CYCLING

Cycling sporting events at the local, regional, national and international level that encourage local cycling participation and/or attract participants and spectators from elsewhere.

This category also includes non-competitive participative events in which people participate for the social experience, personal challenge or the charitable aims of the event.

Within these broad categories, cyclists undertake a range of different cycling styles which have their specific cycling markets and experience, bicycle types and infrastructure needs. The Southland Cycling Strategy aims to cater for the range of cycling styles which fall within the broad umbrellas of road cycling, trail cycling, mountain biking and BMX riding.

ROAD CYCLING

Occurs on sealed roads or other sealed surfaces

COMMUTING

Cycling as a means of transport to work, school, education institutions, shops, recreation destinations and places of social interaction and other everyday life purposes.



RECREATIONAL

The most popular form of road cycling undertaken for fitness, leisure and social purposes by a range of markets – individuals, families, social groups. Recreational road cycling also includes non-competitive organised events (often held for charity or in association with competitive events) where the emphasis is on the individual challenge, the journey and social interaction. These events can attract both local and visiting cyclists and contribute to cycle tourism in a destination.

ROAD TOURING

Travelling and exploring by road bike for leisure or holiday purposes on roads or sealed paths for a few hours, a day or a multi-day trip. Participants may use road bikes or hybrid bikes that provide more stability for carrying equipment.



ROAD RACING AND TRAINING

High speed competition and training by local and visiting amateur and professional elite cyclists at a range of competitive levels. Races are held over a range of distances and may involve road closures or traffic regulation. Informal or organised training often involves groups of riders who use pre-determined routes.

TRACK RACING AND TRAINING

Competitive racing and training on purpose-built indoor or outdoor velodromes using purpose-built bicycles.



OFF-ROAD CYCLING

OFF-ROAD TRAIL CYCLING

Off-road trail cycling on cycle paths, rail trails, and management trails in parks and forestry areas for recreational or tourism purposes. Riders may use hybrid bicycles or mountain bikes depending on the surface and terrain. Trail cycling covers a range of experiences from a few hours, to a day to multi-day trips and a range of fitness levels from trails with gentle gradients to demanding cycles in remote and steep terrain. Recreational and tourism cycle trail experiences (such as the New Zealand Cycle Trail, Nga Haerenga) have been developed in many countries and often include supporting accommodation and other services. Part of the routes covered by these trails may include unsealed and sealed vehicle roads.



MOUNTAIN BIKING

Involves riding a purpose-built mountain bike on specially-constructed mountain bike trails (often in bike parks or trail networks) or on other off-road trails such as management trails.

Mountain bike parks or trail networks often contain trails for a range of riding types and difficulty levels. The different sub-types or disciplines of mountain biking have their own competitive events.

Mountain bike touring - The 'softer' end of the mountain biking spectrum that crosses over with off-road trail touring and cross-country riding. It involves travel on cycle trails or management trails for a few hours, day trips or multi-day trips.



Photo by Ben Arthur

CROSS COUNTRY

Cross Country

A broad type of recreational or competitive mountain biking on relatively flat terrain on purpose-built single-track, management trails or 4WD trails. All-mountain riding is a more recent evolution of cross-country riding on more varied, technical and steep terrain using specialised bikes with dual, longer travel suspension.



DOWNHILL (OR GRAVITY) RIDING

Recreational and competitive riding downhill on purpose-built tracks (with a range of difficulty ratings) with an emphasis on speed and technical challenges such as jumps, berms and drops. Downhill bikes are not designed to be ridden uphill and downhill facilities usually incorporate lift access or a shuttle service to transport riders to the beginning a descent. Downhill has evolved into different racing disciplines including four cross and dual slalom which involve several riders on one track or parallel tracks.



DIRT JUMPING

Technical riding on specialised bikes (allied with BMX bikes) usually in purpose-built facilities over a series of mounds and jumps. Pump track cycling is an evolution of dirt jumping and consists of riders generating initial speed on a downhill run to carry them through the course of jumps and berms without pedaling.



BMX

Technical riding over obstacles in purpose-built facilities. An urban-based activity popular with young people.

2. VISION FOR CYCLING IN SOUTHLAND

VISION STATEMENT

Our aim is to provide quality safe cycling infrastructure and increase cycling participation so that the people of Southland will gain in health, quality of life and appreciative use of their outstanding natural environment.

2.1

Cycling opportunities will contribute to Southland's socio-economic and population development by increasing the attractiveness of the region as a family friendly place to live and visit.

GUIDING PRINCIPLES

2.2

The vision for cycling in Southland will be guided by the following principles.

- 1 Quality, consumer- driven cycling experiences**
A best-practice approach will be taken to developing and delivering cycling experiences of a high standard that are suited to the needs and preferences of Southland residents and visitor markets.
- 2 Inclusive, accessible family-friendly cycling**
The different demography, styles, skill and fitness levels of Southland's cyclists and cycle visitors will be catered for in the provision of cycling opportunities. As far as possible opportunities will be provided for commuter cycling, recreational cycling (including road, track and trail riding at different standards), cycling competitions and events, and cycle tourism.
- 3 Cycling infrastructure that provides meaningful and workable connections**
Completed cycling routes and trails will provide linked cycling connections to the places residents and visitors cycle.
- 4 Fit-for-purpose infrastructure and facilities**
Cycling routes, trails, signage and other facilities will be designed to function effectively and safely for, and meet the needs of, the type and number of users. Decisions on development of upgraded or new infrastructure and facilities will be subject to business cases.
- 5 Safe cycling**
Measures such as cycling infrastructure design, road signage and markings, road speed limits, and driver and cyclist education and awareness programmes will be used to achieve safe cycling on roads and trails.
- 6 Encouragement of participation in cycling**
A range of measures will be employed to encourage and enable growth of cycling participation. This will include education and promotion of the benefits of cycling, encouragement of cycle-friendly facilities and services and support for a range of cycling events and activities/attractions at cycling destinations.
- 7 Sustainable cycling**
Cycling infrastructure and opportunities will be developed and managed in a way that is compatible with protecting Southland's natural and cultural values and the quality of its natural environment.
- 8 Socio-economic benefits for Southland**
Cycling will be developed in a way that improves healthy recreation, lifestyle and economic opportunities for local communities, assists in attracting people to live in Southland and contributes to the economic benefits of tourism in the region.
- 9 Outcomes that are achievable**
Cycling proposals to be supported will need to be realistic in terms of such factors such as financial and other resources for development and on-going maintenance, land tenure, government policies, planning and approval requirements.
- 10 Links to national and regional cycling transport objectives**
Cycling initiatives will contribute to achievement of the Regional Land Transport Plan aims to provide safe, connected, convenient and reliable cycling journeys.

3. CYCLING CONTEXT

Cycling in Southland takes place in the wider context of cycling demand by New Zealand and local residents and by domestic and international visitors to New Zealand and the region.

CYCLING BY NEW ZEALAND RESIDENTS

3.1

Cycling is an increasingly popular sport and active recreation activity for New Zealand adults (people aged 16 years and over)¹. More people cycle in Southland proportionally than in New Zealand on average.

In 2013/14² an estimated 29% of Southland residents (about 26,000 adults) cycle at least once a year compared with 24.8% in New Zealand as a whole (about 823,000 adults).

This data covers the range of cycling types, including mountain biking.

CYCLING PARTICIPATION

NEW ZEALAND

3rd most popular sport/recreation activity after walking and swimming

24.8% of the population cycle – **823,000** New Zealanders a year

3% increase in cycling between **2007/08** and **2013/14** compared with decreases in walking and cycling

Popular in all age groups, especially for people between **35** and **74** years

About **2%** participate in cycling events

SOUTHLAND

2nd most popular physical sport/recreation activity after walking

29% of the Southland residents cycle (**26,000** adults a year) – a higher participation rate than the New Zealand average

More men (**34.2%**) than women (**24.3%**)

About **2.9%** participate in cycling events

In New Zealand overall cycling is the third most popular activity after walking and swimming (see Figure 1). Cycling participation has increased by around 3% since 2007/08 when an estimated 22% of New Zealanders cycled.

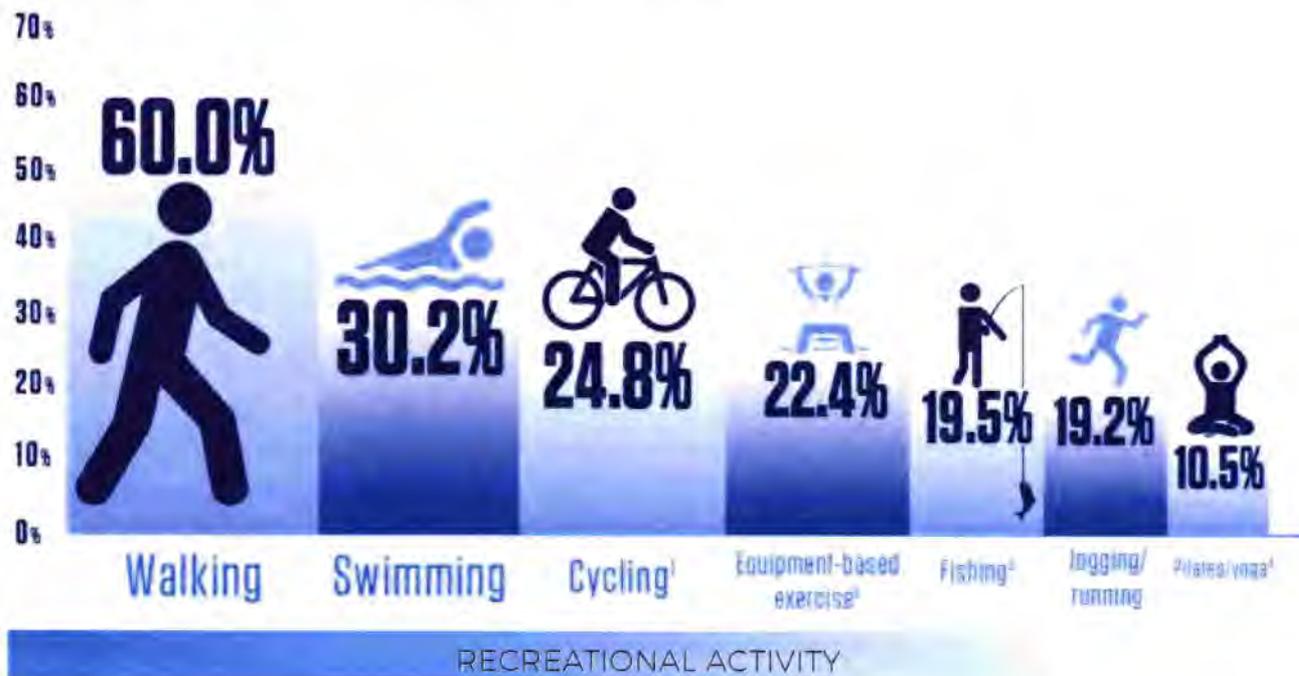
This is the highest increase rate among the most popular sport and recreation activities³. In the same period participation in walking and swimming decreased by 5.9% and 3.9% respectively. Cycling is popular among all age groups up to age 74, especially in the middle age and older age groups between 35 and 74 years.

Most active recreation by New Zealanders takes place on an informal basis on their own or with others. About 22.2% participate in regular club competitions while 8.8% and 7.9% respectively take part in short-term organised competitions or events.

¹ Sport New Zealand (2015). Sport and Active Recreation in the Lives of New Zealand Adults. 2013/14 Active New Zealand Survey Results. Wellington, Sport New Zealand.

² Sport New Zealand (2015). Sport and Active Recreation Regional Profile: Southland Region – Findings from the 2013/14 Active New Zealand Survey. Wellington: Sport New Zealand. ³ Note that there was some variation in data collection between the two survey with gardening being taken out.

Figure 1: NZ participation in sport and active recreation, 2013/14.



Cycling was the second most popular physical recreation activity in Southland after walking (48.9%) (see Figure 2).

About 19.7% of Southland adults participated in at least one sport or recreation event in 2013-14, a similar rate to all New Zealand. An estimated 2.9% of Southland residents participated in bike events, compared with 2% for all New Zealand.

By comparison, fun runs/walks and other running/walking events attracted 9.6% and 6% respectively of Southland residents. Among non-cyclists in Southland, 7% were interested in trying cycling. This was the second highest level of interest compared with other activities after golf (8.3%).

Figure 2: Southland participation in sport and active recreation, 2013/14.



¹ Sport New Zealand (2015). Sport and Active Recreation Regional Profile: Southland Region – Findings from the 2013/14 Active New Zealand Survey. Wellington: Sport New Zealand.

SOUTHLAND

In Southland the demand for cycling in general and the different cycling styles will be linked to regional population trends and demographics.

At **June 2015** Southland was estimated to have a population of **96,300** people – **2.3%** of New Zealand's population. The population is concentrated in the south east in the urban areas of Invercargill (**50,300** people or **51.7%** of Southland's population), Gore (**9,910**), Winton (**2,310**), Te Anau (**2,000**), Bluff (**1,870**) and Riverton (**1,510**)⁴.

About **30%** of Southland's population lives in rural areas - twice the national average for New Zealand's rural population. Most of Southland's population is of European origin (**78.6%**) but has been gradually diversifying. Southland's Maori population has been increasing and at **11.8%** of the Southland population is the largest Maori population on the South Island⁵.

As generally in New Zealand, Southland's population structure is showing an increase in older age groups. Around **21%** of the population (**19,929 people**) is aged **65 years** and older –slightly higher than the New Zealand average of **20%**. The distribution of other age groups in Southland is – **21%** aged **0 to 17 years** (**25,158 people**), **24%** aged **20 to 39 years** (**22,005 people**) and **28%** aged between **40 and 64** (**26,253 people**).

- » Southland's population structure and future population trends (including immigration and increases in the numbers of older residents) are important for the types of cycling opportunities and infrastructure sought by local people.
- » With the population distributed fairly evenly between age groups a range of different cycling opportunities is desirable.



Photo by Ben Arthur

⁴ Statistics New Zealand. Subnational Population Estimates 30 June 2015.

⁵ Southland Mayoral Forum (October 2015). Southland Regional Development Strategy.

Development of cycling in Southland is taking place in a growing New Zealand and Southland visitor economy.

The number and characteristics of visitors to Southland will influence demand for cycling experiences in the region.

NEW ZEALAND VISITORS

In 2012 New Zealanders undertook:

Mostly domestic travellers

- » 31.1 million day trips within New Zealand
- » 16.6 million overnight trips staying a total of 49.8 million nights.

Domestic visitors travel mainly for holidays or to visit friends and relatives.

International visitors to New Zealand are increasing

- » 3.2 million international visitors in the year ending January 2016 – an annual growth of 10%
- » They stay an average of 20 days
- » They spent a total of \$9,698 million in the year ending December 2015 – an average of \$3,440 per person per trip
- » About 50% visit for a holiday and are the biggest spenders
- » The main source markets are Australia (42% in the year ending February 2016), China (11%), the USA (8%), the UK (7%), Japan (3%) and Germany (3%).
- » International visitor numbers forecast to increase by 4% per year to 2021.

Southland is experiencing increases in expenditure and guest nights from both domestic and international visitors⁶. While the Southland Regional Tourism Organisation (RTO) area receives primarily domestic visitors (nearly half from within the Southland region), the more sparsely populated Fiordland RTO (with its iconic destinations of Fiordland National Park, Milford Sound and several 'Great Walks') has a high proportion of international visitors.

Other major visitor attractions and destinations include but are not limited to⁷:

- » Southland Museum and Art Gallery, Invercargill (227,676 visitors in 2013 and latest 12 months year end to June 2016 visitors 248,463)
- » Te Hiko Heritage Centre, Riverton (16,690 visitors in 2011 growth of 35.35% to 22,590 visitors in 2015)
- » Hokonui Moonshine Museum and Eastern Southland Art Gallery
- » Stewart Island (approximately over 35,000 visitors)
- » Wildlife tours and walking in the Catlins
- » Brown trout fishing (including in the Mataura River).
- » Bill Richardson Transport World 33,545 visitors since opening in November 2015 (updated on 01 August 2016)

A range of cultural, entertainment and sporting events draws local and other visitors. Large events include the annual Burt Munro Challenge which attracts about 25,000 attendees and the ILT Kidzone family event attracts about 11,000 attendees. Several thousand people attend the Bluff Oyster and Food Festival.

Queenstown RTO - Fast Facts:

Queenstown hosts around 2 million visitors a year – 65% international and 35% domestic
Queenstown's peak seasons are late December to March and the months of July and August

⁶ Sources of Southland visitor information – Venture Southland (2016). Southern Tourism in Numbers; Innovative Business Solutions (2010). Statistical Profile of Visitors to Southland. Cited in Venture Southland (Dec 2013). Southland Visitor Profile; Venture Southland (2016). Southern Tourism in Numbers; Information provided by Venture Southland.

⁷ Southland Visitor Profile Venture Southland (Dec 2013), H.W.Richardson Group (HWR) Info, Te Hiko Info and Queenstown - www.queenstownnz.co.nz/Media/Statistics2_md

SOUTHLAND VISITORS^{8/9}



An estimated
2.8 million
overnight and day
visitors in 2011.



Southland RTO
68.2%
Domestic Visitors



Fiordland RTO
70.8%
International Visitors
(due to iconic destinations)

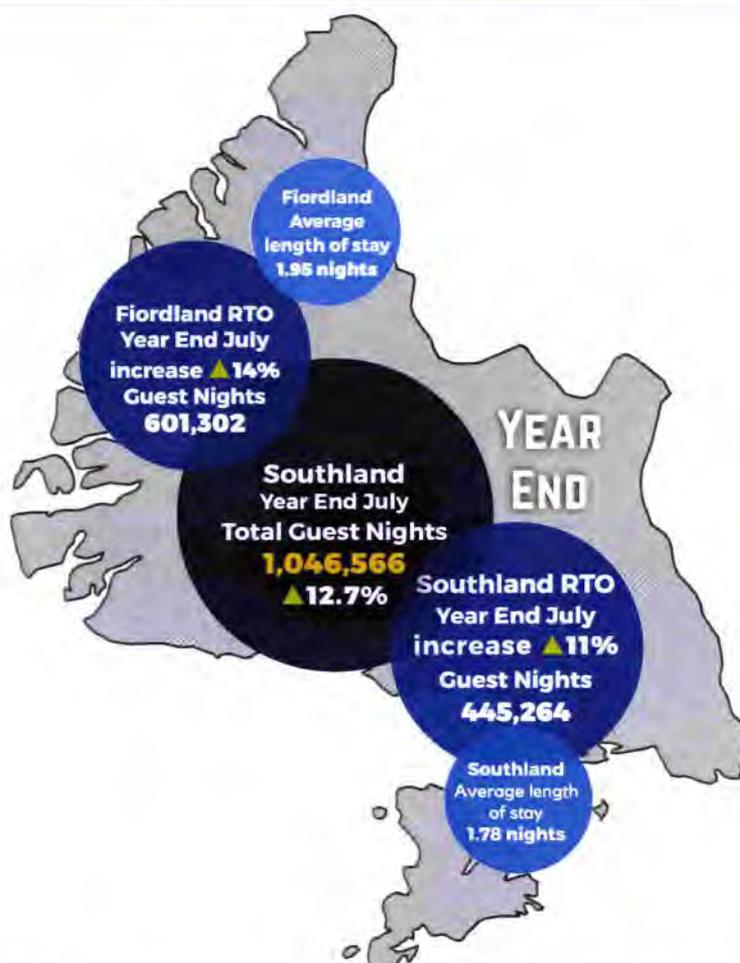


Increasing visitor
spending in the
region

EXPENDITURE

\$528

Total regional visitor spending
in the year ending July 2016



Southland and nearby areas are the main source of domestic visitors

Nearly half of all visitors to the region come from within the region, many as day visitors.

The nearby **Otago** and **Canterbury** regions are a significant domestic source market, with a smaller proportion from **Auckland** and **Wellington**.

Most visitors come for a holiday

In 2011, 41% of Southland RTO visitors came for a holiday and 33% came to visit friends and relatives. 85% of Fiordland RTO visitors came for a holiday and 9% came to visit friends and relatives

Main visitor entry points

By air and road from **Queenstown** and **Invercargill** and road routes from **Dunedin**.

⁷ Venture Southland (December 2013). Southland Visitor Profile.

⁸ Statistics New Zealand July 2016

⁹ CAM - Commercial Accommodation Monitor (MBIE, July 2016)

CYCLE TOURISM

Cycle tourism is a global phenomenon that is expanding as a way to travel while on holiday or as an activity to undertake among other holiday activities.

3.3 These trends will influence the cycling expectations of Southland's visitors.

Cycle Tourism Trends

Several factors have contributed to the growth of cycle tourism across a range of markets and demographics:

- » increasingly popularity of cycling for recreation and development of cycling cultures
- » increased provision of cycling infrastructure and routes, including specific routes and cycling trails to attract tourism. Well-promoted and packaged soft adventure cycling routes and trails with associated attractions, accommodation and services are now an established part of cycle tourism in North America, the UK, Europe and Australia and have been developed in New Zealand through the New Zealand Cycle Trail
- » a growth in specialised cycling tour products. In its 2014 global survey of cycle tour operators the Adventure Travel Trade Association¹⁰ found that 59% of tour companies surveyed saw an increase in profits over the previous year, 47% had higher reservations and that most cycle tour products were easy (24%) to moderate (50%) in difficulty
- » promotion of and investment in cycle tourism by governments and communities as the economic benefits of cycle tourism have become evident. Cycle tourists tend to stay longer in an area and hence spend more in that area than vehicle based travellers
- » development of cycle-friendly services by businesses and communities to encourage cycle tourism visitation to destinations and improve the cycling experience (see Scotland's Cyclists Welcome Scheme example)
- » the popularity of mountain biking and development of purpose-built mountain biking facilities which attract riders due to the quality of riding
- » a wide range of cycling competitions and participatory events which attract both participants and spectators
- » the trend to more experiential travel (as opposed to mass tourism) where travellers seek to immerse themselves in new places and cultures.



¹⁰ATTA (2014), Bicycle Tourism – 2014 Survey, www.adventuretravel.biz

VISIT SCOTLAND - CYCLIST WELCOME SCHEME FOR ACCOMMODATION



Accommodation establishments are accredited which provide the following services:

- » Lockable, covered bicycle storage shed
- » Clothing drying facility & clothes washing facilities or details of nearest launderette
- » Packed lunch or information on shops and eating establishments
- » Late evening meal by serviced accommodation if there are no other meal providers within one mile
- » Provision of an early breakfast
- » Local cycle route information (maps, apps)
- » Information on public transport with bicycle carriage
- » Daily weather forecast
- » Local resource and emergency contact details
- » Details of the nearest cycle repair specialist and provision of basic repair supplies (such as inner tubes, puncture repair kit, pump)
- » Free WiFi
- » Range of chargers for common mobile devices

Who are New Zealand's cycle tourists?

Cycle tourism has increased in New Zealand as a whole and is being targeted as a visitor growth area by the New Zealand Government in its marketing and infrastructure development. This is an opportunity for Southland.

For the purposes of New Zealand's visitor data collection cycle tourists are defined as domestic and international visitors who participate in cycling at least once during a trip. They include people who visit an area for a specific cycling journey or event and people who cycle on a trip when an opportunity presents itself.

There is little recent data on New Zealand's cycle tourists. The latest detailed analysis of international and domestic cycle tourism in New Zealand was conducted in 2008¹¹ and updated for international cycle tourists in the 5 years from 2008 to 2012 in 2013¹².

In 2008 New Zealand received an estimated **314,900 domestic** cycle tourists (who came mainly from New Zealand's largest population centres) and **42,100 international** cycle tourist (dominated by visitors from Australia, North America and Continental Europe).

In that year cycle tourists comprised about **1%** of all **domestic** visitors and **4 %** of all **international** holidaymakers. It was estimated in 2008 that road cycling comprised about **54%** of **international** cycle tourism and **44%** of **domestic** cycle tourism, while mountain biking comprised about **46%** of **international** cycle tourism and **56%** of **domestic** cycle tourism.

¹¹ New Zealand Government (2009). Tourist Activity – Cycle tourism. Tourism Sector Profile Series B5, September 2009

¹² Tourism New Zealand (2013), Tourist Special Interest – Cycling, April 2013; Tourism New Zealand website, Special Interest – Cycling and Mountain Biking, 15 June 2015, www.tourismnewzealand.com/markets-stats/sectors/special-interest/cycling-and-mountain-biking/.

The most popular areas for cycling by international visitors are the Auckland, Canterbury, Queenstown, West Coast, Wellington, Rotorua, Nelson, Lake Taupo and Lake Wanaka areas. Domestic visitors are primarily attracted to cycle in the Rotorua, Auckland and Canterbury, Hurunui, Queenstown, Lake Taupo areas.

Tourism New Zealand is targeting international cycle visitors from its main cycling source markets¹³:

- » recreational cyclists **aged 45 and over** from Australia, UK, USA and Germany who view nature/scenic attractions as key reasons for travel. These visitors are generally well-travelled, financially secure and are keen to experience other activities alongside their cycling experience
- » mountain biking enthusiasts **aged 25 to 40 years** from Australia who are looking for new challenges and thrills. These visitors generally travel in small groups and may seek extra adrenaline filled, competitive activities to complement their mountain biking experience.

Emerging changes towards more Free Independent Travellers in the large Chinese source market, the second largest source of international visitors to New Zealand behind Australia, suggest that cycling experiences may be appealing to more visitors from China in the future¹⁴

What cycle tourists do in New Zealand

Cycle tourism in New Zealand consists of:

- » specific **multi-day cycle** rides on roads or trails
- » **small guided** or **self-guided** cycling groups with pre-arranged accommodation and supported by a transport supplier who also transports the luggage. Such **boutique trips** may last up to **7 to 10 days**
- » individuals or small groups undertaking **self-supporting** cycling **journeys** (road, trail and mountain bike trails) carrying their equipment on their bikes
- » **day and overnight** visitors undertaking mountain biking at a mountain bike facility or trails network
- » **domestic** and **international** travellers who undertake a cycling experience as one of several experiences during their trip
- » **day visitors** who undertake a road or trail cycle experience
- » **participants** and **spectators** at cycling events. For example the the **Lake Taupo Cycle Challenge**, New Zealand's largest cycling event with both competitive and non-competitive elements, attracts over **10,000 participants** and additional spectators, with over **90% of participants** from **outside the area**.

The New Zealand Government has made a major investment in cycle trail tourism through the New Zealand Cycle Trail (Nga Haerenga) concept which was initiated in 2009. The New Zealand Cycle Trail is intended to be a world-class network of **23 multi-day cycle trails** (or 'Great Rides') throughout the country with linked accommodation, services, shuttle transport and attractions.

The trails can also be used for day cycling trips and many are also used for walking, running and events. In January 2014 almost **97,000 people** used the New Zealand Cycle Trails¹⁵ and usage increased to **125,000 people** in January 2015¹⁶.

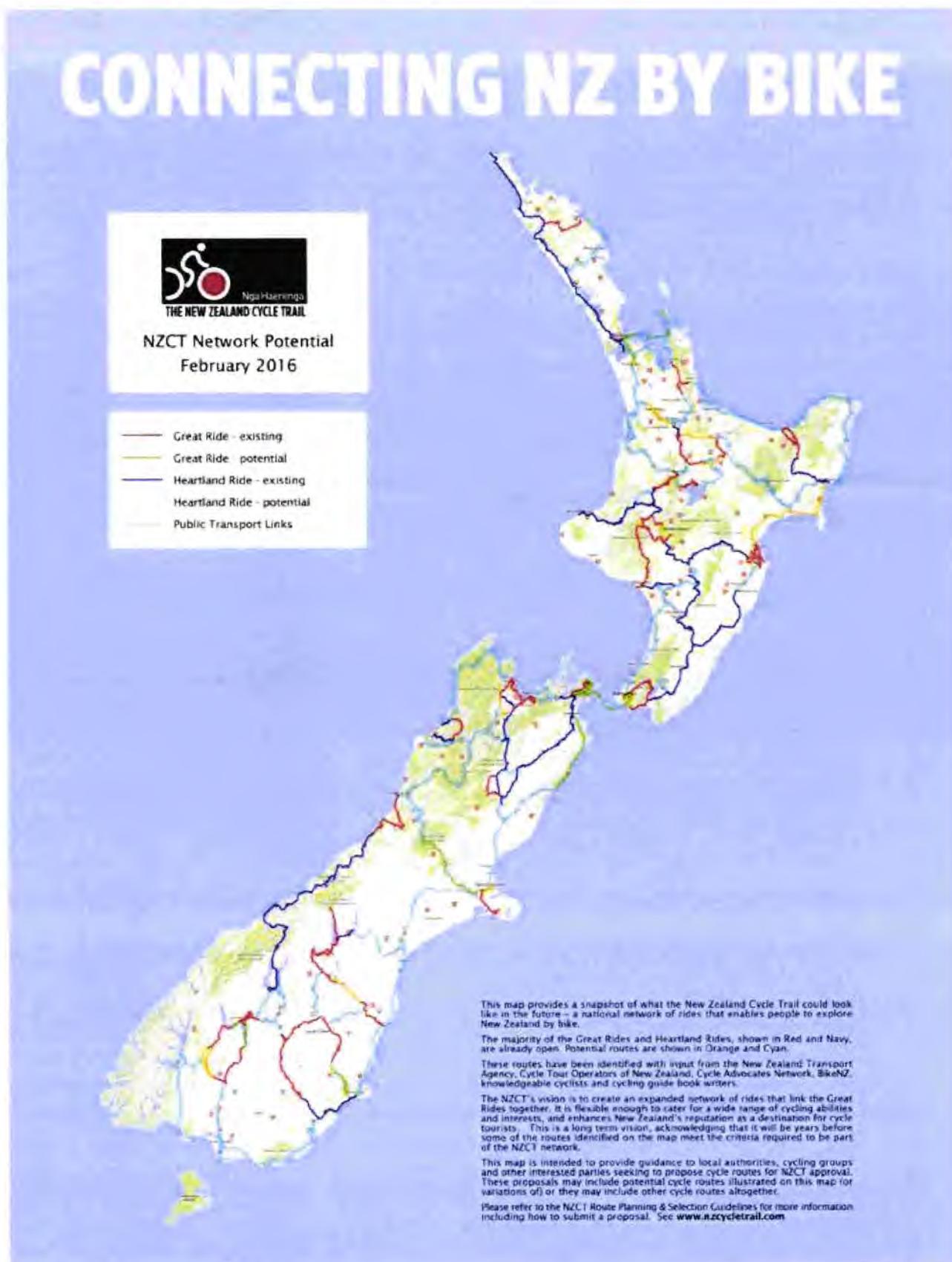
¹³ www.tourismnewzealand.com/markets-stats/sectors/special-interest/cycling-and-mountain-biking/

¹⁴ Ministry of Business, Innovation & Employment (October 2015). China FIT Visitor Market Research Report.

¹⁵ Inside Tourism, 29 May 2014

¹⁶ Speech by New Zealand Prime Minister, 13 May 2016, www.beehive.govt.nz/speech/speech-trenz

Figure 3: Nga Haerenga - The NZ Cycle Trail - existing and potential routes¹⁷



¹⁷ Source: http://nzcycletrail.com/wp-content/uploads/2015/07/NZCT_Network_Potential_20150219-final.pdf

In 2013 an evaluation and trail user survey of four newly opened trails in different locations in the New Zealand Cycle Trail network¹⁸ found differences in markets and use characteristics that were linked to the type of trail and its location. The evaluation suggests that:

- soft adventure cycle trail experiences in relatively remote areas are likely to attract mostly groups of New Zealand residents in the middle to older demographics (with a small number of international visitors) who come from neighbouring areas and nearby areas and who travel to a location specifically for the trail experience. Such trails as the Motu Trails and the Mountains to Sea Trail in the Central North Island can be major drivers of local tourism
- easy cycle trails with associated attractions near population centres are likely to attract mostly New Zealand residents for day and short overnight experiences and are appealing to older people in addition to other age groups. The Hauriki Rail Trail, a **98 km 3-day** ride in the Thames-Coromandel District near Hamilton and Auckland, has become a major reason for visiting the district. In **January 2014** the trail attracted **14,000** cyclists who spent an average of **\$103** each in the local economy
- iconic, well-promoted trails with a variety of experience offerings are likely to attract a wider range of local and users and more international visitors.

Competitor cycling destinations

Two of New Zealand's most successful cycling destinations for domestic and international visitors – Otago and Queenstown – are located in regions close to Southland (see Appendix B for descriptions of the Otago Central Rail Trail and the development of trails at Queenstown).

Both these destinations have developed through substantial collaborative infrastructure, product and service development over more than a decade and have been supported by strong governance bodies, successful promotion and fund raising and with effective partnerships with the Department of Conservation, councils, the tourism industry, local businesses and the local community. The Otago Central Rail Trail gains its appeal from its access to spectacular scenery, easy cycling suited to a range of markets and variety of linked activities and attractions that offer a highly immersive experience. The Queenstown trail network owes its success to its location in an iconic visitor destination and the wide variety of quality trail and mountain biking experiences.

Funding to construct connections between trails in Otago and Queenstown has recently been announced. This project would link the Otago Central Rail Trail, Clutha Gold Trail, the Roxburgh Gorge Trail, a proposed Cromwell Gorge Trail and trails in Queenstown – creating a linked cycle network of over **500** kilometres.

In addition to general cycling trails (some of which require a mountain bike) New Zealand has over **50** mountain biking facilities, most of which have predominantly local use. The most prominent mountain biking destinations are Rotorua, Lake Taupo, Nelson and Queenstown which attract both domestic and international visitors; provide extensive trail networks for different skill levels and riding disciplines; and are supported by facilities, services, shuttles or gondola access and events; and active mountain biking communities.

The mountain biking facilities at Rotorua, Lake Taupo and Nelson have achieved International Mountain Bicycling Association (IMBA) Ride Centre designation in recognition of the range of quality riding offered. There are only **37** IMBA Ride Centres globally¹⁹, most of them in the United States, and only one Ride Centre in Australia (at Mount Buller in Victoria), New Zealand's closest mountain biking competitor destination. A description of the Rotorua mountain biking destinations is provided in Appendix B.

¹⁸ Angus & Associates in association with TRC Tourism (November 2013). Final report, New Zealand Cycle Trail Evaluation – Four Cycle Trail Case Studies. Prepared for Ministry of Business, Innovation & Employment.

¹⁹ www.imba.com

4. CURRENT CYCLING IN SOUTHLAND

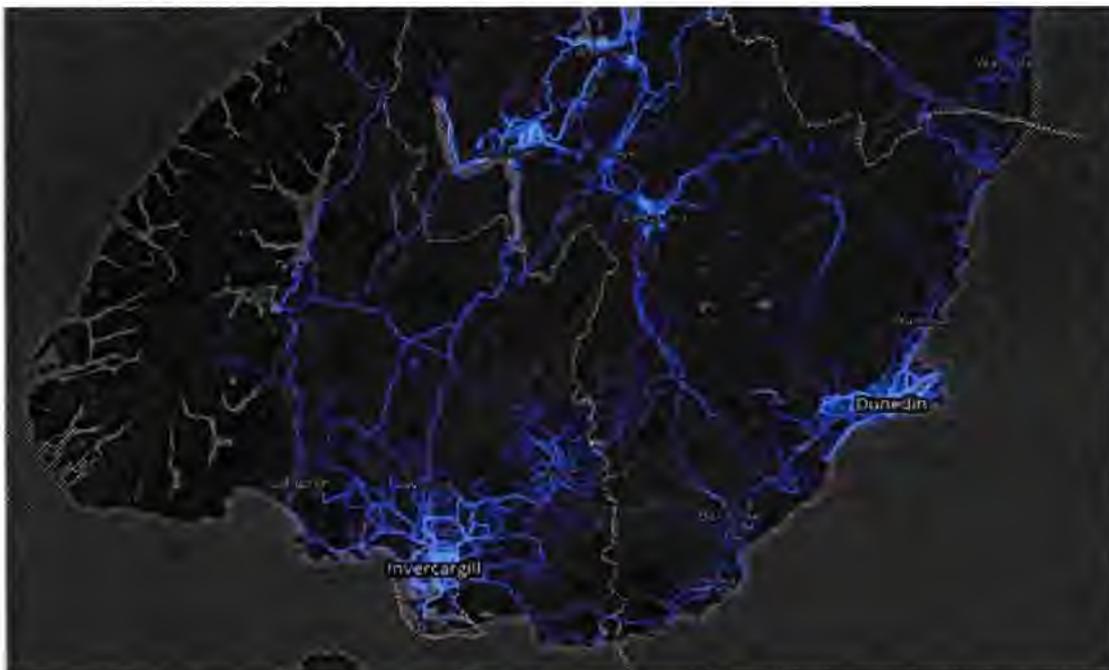
WHERE AND HOW PEOPLE CYCLE IN SOUTHLAND

This section describes the types of cycling that occurs in Southland, where it occurs and the needs and preferences of Southland's cyclists and cycling markets. The cycling survey conducted during the development of this Strategy provided insight into the places Southland residents cycle and their needs, preferences and concerns. The outcomes of the survey are summarised in Appendix C.

4.1

The main cycling routes, trails, events and services in Southland are summarised in the following sections and in Appendix D. As shown in Figure 4, cycling in Southland and neighbouring regions (as generated by the 2015 Strava Heat Map²⁰) is concentrated around population centres and major trail and road cycling routes.

Figure 4: 2015 cycling patterns in Southland and nearby districts from Strava Heat Map



WHAT SOUTHLAND'S CYCLISTS WANT

2016 Southland Cycling Survey

83% of respondents considered that investment in cycling could lead to community benefits **81%** agreed cycling was a good investment for councils

15% of respondents cycled regularly for transport, though over **60%** thought it cycling was a viable form of transport.

Most respondents agreed with council investment in cycling.

Road safety was a major concern, with strong support for improved cycle lanes or road shoulders in urban and rural areas.

Recreational and tourism road routes and trails need more amenities and services, especially toilets, drinking water, camping, accommodation and cafes.

There was support for more recreational/tourism trails, including trails suitable for families. There is a need for improved mountain biking opportunities near urban areas where most of Southland's mountain bikers ride.

A greater range of difficulty levels (including for families and young riders) and better trail maintenance is sought by mountain bikers especially at existing facilities.

²⁰ Sourced on <http://labs.strava.com/heatmap/#8/169.76074/-45.12005/blue/bike>

COMMUTER CYCLING

As elsewhere in New Zealand, commuter (also known as utility) cycling in Southland is more popular in urban areas than in rural places. Due to the general lack of traffic congestion the time benefits that accrue to cycling commuters in larger cities are limited in Southland where the benefits of commuting by bicycle centre around health, financial and environmental benefits.

4.2

Some cycling groups consulted indicated that there is a need to educate drivers on safe driving with cyclists and to promote cycling safety in schools.

In the 2013 Census, 813 (1.8%) Southland residents chose cycling as their main means of travel to work, a decrease from 1,029 (2.4%) in 2001²¹. This compares with a New Zealand average of 2.6% in main urban areas and 1.7% in rural centres. Cycling to and from work is most popular in Invercargill (2%) followed by Gore (1.6%) and Southland District (1.4%). While over 60% of respondents to the 2016 Southland cycling survey agreed that cycling for transport was viable in the region, only 15% of respondents indicated they cycled regularly (more than once a month) for transport.

All Southland territorial areas have seen a small decline in the proportion of people choosing cycling as their main means of travel to work. The rate of cycling to work is relatively static across New Zealand.

Cycling to school has declined significantly in Southland over the years. To some extent this has been replaced by the use of scooters. Observations of a sample of schools suggest that than 10% of primary school students arrive at school by bike and 10% to 20% arrive by scooter.

The Invercargill City Council has developed a network on on-road cycle lanes (in particular from east to west across the city). About 80% of this proposed on-road cycle lane network is complete. The remaining 20% of desired cycling improvements may be more difficult to achieve given relatively high costs and lower levels of use. Cycle tracks developed by Environment Southland on the flood banks make a useful contribution to commuter and recreation cycling. The cycle lane between Oreti Beach and the city has potential as a commuter and recreation/tourism route but needs significant improvement to encourage safe and popular use.

There are some facilities for bicycle storage in the inner city including bike racks at the library and other recreational facilities (such as the pool) and Esk Street. Further provision of storage facilities by Council is in the design and approval stages. The airport terminal does not include any facilities for cyclists.

In the other major towns of the region, cycling facilities are limited and roads have been generally designed with little consideration for the needs of cyclists (see illustration below). Increasing traffic volumes related to tourism and the dairy industry place cyclists at higher risk on some State Highways and arterial roads.

While some recent road improvement projects in the region have considered the safety needs of cyclists, the outcomes are not of sufficient quality or convenience to encourage cyclists to use them.

The introduction of electric power-assisted bicycles (E-bikes) is improving the accessibility of cycling, particularly for older cyclists. E-bikes also have advantages for commuter cycling by reducing effort and enabling commuters to avoid wearing sports clothing when cycling to work. The number of E-bikes is increasing but is still relatively low given their higher cost.



Cycle lane at Edendale – Impractical for cyclists

²¹ Sourced: Statistics New Zealand (2015) 2013 Census QuickStats about Transport and Communications.

COMMUTER CYCLING

Market	Market Needs & Preferences	Issues Identified in Southland ²²	Opportunities & Barriers
Local commuters	<p>Safe, accessible and connected on-road and trail routes for cycling to work, school and other daily activities.</p> <p>Bike racks and other facilities (such as storage, showers) at destinations.</p>	<p>Road safety is a major concern - Around 56% of survey respondents were concerned about the safety of cycling on urban roads.</p> <p>Southland's current and potential commuter cyclists seek:</p> <ul style="list-style-type: none"> » more or better designed cycle lanes in Invercargill and other places » addressing of cycling safety issues at certain 'hot spots' » identification of safe road routes » safe linkages along cycling routes and between cycle lanes and cycle paths » development of motorist and cyclist safety awareness » more bike racks and storage facilities at destinations, including changing and showering facilities at workplaces. 	<p>Future on-road and off-road infrastructure improvements required to address safety and encourage more commuter cycling in Invercargill and other towns need to be examined further and prioritised.</p> <p>Funding resources are limited. Proposals need to be developed to take advantage of funding programmes such as the Urban Cycleways Programme and the National Land Transport Programme.</p> <p>Cycling programmes for school children may assist in attracting more children to cycle to school and in developing road safety awareness. The Velodrome is a potential resource for such programmes.</p> <p>Continuing cycling awareness programmes/ campaigns aimed at motorists and cyclists will assist in developing safe road practices and a cycling culture.</p>



Photo courtesy of Jonathon Kennett

²² Compiled from the responses to the 2016 cycling survey and consultation with stakeholders.

RECREATIONAL CYCLING

4.3

Recreational cyclists in Southland include children learning to ride, families riding together, mountain bikers (both cross country and downhill) and road cyclists who engage in cycling for recreation as a non-competitive activity. Organisations such as the Cycling Southland, Southland Mountain Bike Club and Te Anau Cycling Inc. encourage and support both recreational and competitive riding.

There are good opportunities for recreational riding within the City of Invercargill given its low topography. As well as on-road opportunities, the city's parks (in particular Queens Park) are well suited to safe beginner and recreational riding for families and the elderly. A network of shared trails within parks offers off-road riding on grade 1 and 2 trails. The stop bank trails developed by Environment Southland are well used by walkers, runners and cyclists. The trail network in Invercargill would benefit from improved signage, removal of barriers (such as gates and bollards) and improved interconnectivity.

A trail is being constructed between Invercargill and Bluff but has not been completed. The road route between Invercargill and Bluff is heavily used by cyclists but is considered to be unsafe.

The SIT Zero Fees Velodrome provides a venue for some recreational riding including some learn-to-cycle and therapeutic cycling programmes for the young and elderly run by Cycling Southland. The Graeme Cockroft Cycle Park in Invercargill provides a safe location for learning to ride but has restricted access which does not enable casual use by residents.

There are many opportunities for road cycling throughout Southland as roads other than the main highways are generally scenic and relatively quiet, though there is truck traffic on main routes. Both casual and formal road cycling occurs throughout Southland with popular excursions being made from Invercargill to the western side of the Oreti River or east towards the Mataura River. In Te Anau road cycling is popular along the Milford Road and from Te Anau to Manapouri returning via The Key. There has been little development of cycle-friendly services and products for recreational riding, although efforts are underway.

Southland cyclists have indicated a desire to improve road riding conditions through wider roads, smoother verge surfaces and development of cycle lanes according to the 2016 cycling survey (see below).

In Invercargill specialist mountain biking opportunities are provided at Sandy Point (pump track, cross country trails to grade 2 and 3) and Bluff Hill (downhill trails grade 2 to 6). These experiences have been provided by the Southland Mountain Biking Club and have received support from the Invercargill City Council.

In Te Anau mountain bike trails are provided in Ivon Wilson Park. Some concern has been expressed that these trails are too difficult for the range of potential users²³.

A new mountain bike park featuring 10km of singletrack has recently been opened on private land at Perenuka near Te Anau. Mountain bike trails are also present at Croyden Bush (Gore) where a new trail is currently under construction. Informal and remote mountain biking activities occur at Bald Hill (Longwood Forest – permit required) and a range of management trails in Fiordland National Park, including the ride to Percy Saddle on Borland Road. Mountain biking also occurs on 4WD tracks and management and forestry trails dispersed throughout Southland, including in the Mavora area and areas north of Mossburn and Lumsden.



²³ Personal communication.

BMX facilities are provided in Invercargill and Gore and are used both by recreational and competitive riders. An off-road trail between Te Anau and Manapouri (the Te Anau-Manapouri Cycleway) has been proposed to offer recreational riding opportunities for locals as well as visitors. The Fiordland Trails Trust is raising funds for the development of the first stage of this project which will be a grade 1 and 2 shared trail from Te Anau along the Waiau River to the Rainbow Reach carpark²⁴. Part of the remainder to the proposed trail route passes through part of Fiordland National Park and requires approval from the Department of Conservation. However, under the current Fiordland National Park Management Plan, cycling is not permitted in this section of the national park.

RECREATIONAL CYCLING

Market	Market Needs & Preferences	Issues Identified in Southland ²⁵	Opportunities & Barriers
Recreational Road Cyclists	<p>Safe and accessible routes for a range of cycling levels and distances based around or starting from population centres.</p> <p>Attractive, cycle- friendly destinations with cafés and other attractions suitable for a short, half-day to day excursion or relaxing after a fitness/training ride.</p> <p>Good information on cycling routes through online and social media sources.</p> <p>Social cycling opportunities.</p>	<p>Road safety is a major concern - around 71% of survey respondents were concerned about cycling safety on Southland's roads outside of cities and towns.</p> <p>Wider and smoother road shoulders or cycle lanes on highways and rural roads to improve the cycling experience and safety.</p> <p>Cyclist warning signs on roads.</p>	<p>Road works, signage and other infrastructure requirements to address cycling safety and comfort on highways and rural roads need to be examined, prioritised and included in road and other relevant infrastructure work programmes.</p> <p>Funding resources are limited. Proposals need to be developed to take advantage of funding programmes such as the National Land Transport Programme.</p> <p>There is already a range of road cycling routes used by Southland residents. Designation of preferred road cycling routes (with signage and safety improvements) could encourage more road cycling and improve existing cycling experiences. Over time, encouragement of cycle-related service partners along routes will improve experience and generate more demand.</p> <p>Development of Heartland Rides for tourism (see next section) would be linked to this initiative and would benefit local residents.</p> <p>Accessible online information on cycling routes will assist in informing residents of road cycling routes.</p> <p>More social riding opportunities such as the 'Tweed Rides' may assist in attracting more people to cycle. Cycling programmes for school children, older people and social groups may assist in attracting more people to road cycling.</p>

²⁴ Information sourced from the Fiordland Trails Trust, www.trailstrust.co.nz

²⁵ Compiled from the responses to the 2016 cycling survey and consultation with stakeholders.

RECREATIONAL CYCLING

Market	Market Needs & Preferences	Issues Identified in Southland ²⁵	Opportunities & Barriers
Recreational Trail Cyclists	<p>Accessible, well-connected trails for a range of cycling levels and distances.</p> <p>Includes trails suitable for children, families and older people.</p> <p>Attractive cycle-friendly destinations with cafes and other attractions suitable for a short, half-day to day excursion.</p>	<p>Enhancement and improved connections on the Invercargill shared trail network including signage, removal of barriers (such as gates and bollards).</p> <p>Completion of the Invercargill to Bluff Cycleway.</p> <p>Improved cycle trail opportunities near population centres, especially Te Anau and Gore.</p> <p>Completion of the Around the Mountains Cycle Trail and development of linkages to Te Anau and other places.</p> <p>More cycle-friendly amenities along riding routes – toilets, shelter, drinking water, cafes.</p> <p>More trails in the region, especially trails suitable for families.</p> <p>Better trail maintenance, including removal of broken glass.</p> <p>Provision of toilets along trails is a major concern, together with access to car parking, shelter, drinking water, signage and trail information.</p>	<p>A review of the Invercargill shared trail network is required to identify and prioritise improvements to infrastructure and the cycling experience.</p> <p>City centre rejuvenation in Invercargill may provide opportunities for cycling excursions if cycle-friendly facilities are provided and cycling is promoted.</p> <p>Completion of the Invercargill to Bluff cycleway (including provision of amenities, information and interpretation) will require adequate arrangements for funding and future management and maintenance.</p> <p>Completion of the Around the Mountains Cycle Trail is related to the outcome of a legal challenge. Development of facilities and linked attractions along this trail will provide opportunities for both Southland residents and visitors, but will require resourcing and encouragement.</p> <p>Some residents seek a greater variety of off-road trail experiences closer to population centres. This is likely to require significant investment in trail construction.</p> <p>The level of demand, costs and benefits for such trails will need to be established.</p> <p>Partnerships are desirable to provide cycle-friendly products and services linked to trail riding. Accessible online information on cycle trails will assist in promoting use of trails.</p>



RECREATIONAL CYCLING

Market	Market Needs & Preferences	Issues Identified in Southland ²⁵	Opportunities & Barriers
Mountain Bikers	<p>Local mountain bikers are often in the young adult to middle age groups. They may include school and youth groups undertaking outdoor education activities.</p> <p>Seek diversity and challenge for each difficulty level. Single-track inter-connected trail networks with a range of trail types, difficulty levels and technical challenges, preferably providing at least a day's riding activities to maintain interest.</p> <p>Opportunities for beginners to learn and develop skills. Accessibility from population centres. Trailhead facilities. Where relevant transport (lifts, vehicle shuttles) to the top of downhill rides.</p> <p>Longer endurance riding opportunities (on management trails, single-track), including in backcountry locations.</p>	<p>Greatest demand is for more or improved facilities near population centres (Invercargill, Gore and Te Anau), including a greater variety of difficulty levels and trails suitable for families and younger riders.</p> <p>There is concern over the quality of trail networks. Some survey respondents sought professionally designed, purpose built trails or better maintenance of existing trails.</p> <p>Provision of wash down facilities and toilets at trail networks is desirable.</p> <p>More mountain biking opportunities in Fiordland National Park and other remote places are sought by a smaller numbers of riders.</p> <p>Some riders seek more downhill runs in Southland, and may go to Queenstown or other places for challenging technical riding.</p>	<p>Enhancement of the existing mountain biking hubs at Invercargill (Sandy Point and Bluff), Te Anau and Gore has most potential for offering improved riding for a large number of Southland mountain bikers. There is potential for improvement/ additions to these networks if resources are available for professional trail construction, amenities, management and maintenance.</p> <p>Riding programmes for schools, outdoor education, youth and other groups could assist in attracting more young people to participate in mountain biking.</p> <p>Support for and encouragement of volunteer trail maintenance partnerships has potential for improving the resources for trail maintenance.</p> <p>Ways to improve riding opportunities on 4WD tracks and management trails need to be investigated. On public conservation lands (except for Fiordland National Park) potential mountain biking opportunities and assessment criteria are identified by the Department of Conservation in the draft Southland Murihiki Conservation Management Strategy. Investigation of further opportunities in Fiordland National Park is likely to be considered in the review of the Park's management plan.</p> <p>More comprehensive and accessible online information on Southland's mountain biking opportunities is required.</p>



CYCLE TOURISM

4.4

Cycle tourism in Southland has not developed to the same extent as in other parts of New Zealand. Anecdotal information from industry observers suggests that cycle tourism in Southland is in a relatively static state except for mountain biking participation which is increasing. Strong competition comes from the nearby iconic cycling destinations of Central Otago and Queenstown.



Currently Southland has some small group and self-supported cyclists who cycle on routes and trails such as the following:

- » Lumsden to Invercargill road trip (Southland Traverse)
- » the Te Anau – Tuatapere – Riverton – Invercargill road trip (Southern Scenic Route)
- » a south-north road route from Balclutha through the Catlins to Invercargill (Catlins Coastal Route)
- » a backcountry road and trail trip from Queenstown /Lake Wakatipu through Mount Nicholas Station, Von Valley and Mavora Lakes to Te Anau.

There has been little development of these routes for cycle tourism through cycle-friendly services and products.

The Lake Wakatipu to Te Anau cycling trip is currently the most popular route and receives fewer than 1,000 cyclists a year. Part of this route is included in the Around the Mountains Cycle Trail (ATMCT) which is being developed by the Southland District Council and is part of the New Zealand Cycle Trail. This 180 kilometre trail is a loop which starts at Queenstown and, after a boat crossing of Lake Wakatipu, continues from Mount Nicholas Station up the Von Valley, down the Oreti Valley to Lumsden then to Kingston before returning to Queenstown (see Figure 6). Parts of the trail can also be ridden on day trips.

Construction of the ATMCT has been completed except for a section in the Upper Oreti Valley which has received construction consent but which is currently under appeal. A decision on the appeal is expected in 2016. The ATMCT is open to cyclists and shuttle bus transport is available for the uncompleted section of the trail. A number of cycle tour and accommodation products is operating along the trail.





When completed, it is estimated that the **ATMCT** will be a significant New Zealand cycle trail attracting up to **12,000 multi-day** and about **50,000 day** cyclists annually within **five years** of opening²⁶.

This trail has the potential to be a significant contributor to Southland's cycling opportunities. It offers a soft adventure riding experience through varied backcountry valleys with stunning mountain views.

The Welcome Rock Trails on the Nevis Range near Garston is a private trail network for mountain biking and hiking that has on-trail bookable private hut and glamping accommodation²⁷. Use of this trail is in the hundreds.

Figure 6: Around the Mountains Cycle Trail route



More amenities and services are sought along recreational and tourism cycling routes and trails, such as this stop on the Around the Mountains Cycle Trail.

Southland's current and potential cycle tourism markets are::

- ④ **Road Tourers** – Southland residents, domestic visitors and international visitors (likely to be mainly from Europe) for whom the road journey is an intrinsic part of the visit and a major reason from visiting the region.
- ④ **Holiday and Soft Adventure Trail Cyclists** – Southland residents, domestic and international visitors seeking an immersive trail experience. They tend to be younger couples and social groups and people in the middle to older age groups. They are likely to come from the main New Zealand population centres and Australia, the UK, the USA and Germany. Patterns of use of the New Zealand Cycle Trail and cycle trails in other countries suggest that most of this market is seeking shorter trail experiences of a day, weekend or 3 to 4 days as opposed to extended trips.
- ④ **Location-based Holiday Cyclists** – A diverse group of visitors for whom a cycling experience (short road, trail or mountain bike experiences generally up to a day) is one of several activities undertaken at a destination, adding to the diversity of the holiday and providing an experience expressing the character of the destination. They range from experienced cyclists to people who rarely cycle.
- ④ **Mountain Bikers** – Southland residents, domestic and international mountain bikers seeking a special mountain biking experience different from other places or with a reputation for challenge and/or a distinctive landscape. They are likely to come from the main New Zealand population centres, Australia and possibly Europe and North America. They are often knowledgeable about mountain biking destinations and well connected to other mountain bikers.

²⁶ TRC Tourism Pty Ltd (2014). Around the Mountains Cycle Trail – potential market demand. Prepared for Southland District Council

²⁷ www.welcomerock.co.nz

CYCLE TOURIST

Market	Market Needs & Preferences	Issues Identified in Southland ²⁸	Opportunities & Barriers
Road Tourers	<p>May be on short to extended cycling journeys. Safe roads.</p> <p>Routes with a variety of scenery, terrain, cycle-friendly facilities, food, attractions and accommodation. Good online and digital information sources. Bicycle shops.</p>	<p>Southland is not currently perceived as a major road touring destination.</p> <p>While it has attractive and varied scenery, it is disadvantaged by its relative geographical isolation, perception of weather and competition from more developed, cycle-friendly destinations in New Zealand.</p>	<p>Development of Heartland Rides, signage, safety measures, promotion, information and cycle-friendly products, accommodation options and services would be needed to attract more road touring visitors to the region.</p> <p>Improved connections between entry points (such as Invercargill airport) and cycling routes.</p> <p>Better information and promotion of Heartland road touring route opportunities and distinctive Southland experiences would be needed to attract tourists once improvements were made.</p> <p>Funding resources are limited for road safety improvements. Proposals need to be developed to take advantage of funding programmes such as the National Land Transport Programme.</p>
Holiday and Soft Adventure Trail Cyclists	<p>Soft adventure trails for day and multi-day cycling in scenic landscapes. Many seek 'must do', iconic trails that offer a distinctive experience.</p> <p>Supporting services enabling a seamless trail experience – transport to the trail, luggage storage/shuttles, overnight accommodation on or off the trail, guided and self-guided options, bicycle and equipment hire.</p> <p>Engaging interpretation and storytelling that enable immersion in landscapes and cultures.</p> <p>Good online and digital information and booking.</p>	<p>The Around the Mountains Cycle Trail (ATMCT) offers an opportunity to develop this market in northern Southland subject to the completion of the Trail and development of quality Southland-focused accommodation and products to balance the emphasis on Queenstown as the start and end point of the trail experience.</p> <p>There are some expectations that further Great Rides could be developed in Southland, including linkages from the ATMCT to Te Anau (and further south) and Gore, connections from the Clutha Gold Trail (in Otago) to Gore and a trail through the Catlins.</p>	<p>Attraction of this market faces competition from New Zealand's established iconic cycle trails including those in neighbouring regions, especially the Queenstown Trails and the Otago Central Rail Trail. Soft adventure cyclists would need the encouragement of quality experiences distinct from Queenstown and Otago to travel the additional distance to cycle in Southland.</p> <p>The proposal to link trails in Otago and Queenstown to form a 500 km cycle trail network (while creating further competition) is a potential opportunity for trail links into Southland, including to Gore in the longer term. The private trails at Welcome Rock are near the ATMCT route and could contribute to the development of this part of Southland as a trail cycling destination.</p> <p>Development of further cycle trails (including extension of the ATMCT) would be costly. Demonstration of market demand and a sound business case would be required for such proposals to be considered for funding.</p>

²⁸ Compiled from the responses to the 2016 cycling survey and consultation with stakeholders.

CYCLE TOURIST

Market	Market Needs & Preferences	Issues Identified in Southland ²⁸	Opportunities & Barriers
Location-based Holiday Cyclists	<p>A range of road and trail experiences with points of interest, cycle-friendly facilities, bike hire and associated experiences (food, nature, culture).</p> <p>These experiences will ideally be close to tourist destinations or be offered as short guided or self-guided packages. They may be parts of longer trails.</p>	<p>Opportunities exist for cycling visitors to use existing cycling infrastructure in Southland, but these are generally not well-promoted or packaged to be easily accessible to visitors.</p>	<p>Improvement of the range of road, trail and mountain biking experiences for local people and cycle tourists in Southland will provide opportunities for this market if well promoted and accessible.</p> <p>Bike hire and cycle-friendly facilities and products will be vital to encourage visitors to cycle while in the region.</p> <p>Short cycling experiences with provision of amenities and attractions that provide a different way to experience Southland are more likely to attract non-expert cyclists.</p>
Mountain Bikers	<p>Seeking quality, challenging riding often in iconic mountain biking destinations. Willing to travel for the right experience. World class trail networks that offer 2 to 3 days of riding opportunities.</p> <p>IMBA ratings²⁹ can be an incentive to visit.</p> <p>Challenging endurance riding, including IMBA Epic Rides³⁰. Good transport to riding destinations with cycle-friendly services and accommodation. Shuttle services to downhill or remote rides.</p>	<p>Southland has limited current potential to attract this market due to the small scale of mountain biking facilities and competition from mountain biking destinations such as Taupo, Rotorua, Nelson and Queenstown.</p>	<p>There is some potential to attract New Zealand mountain bikers (especially from nearby regions) to events such as the Moonshine Trail which offer riding on areas normally closed to the public.</p> <p>Improved management and promotion of backcountry mountain biking routes also has the potential to attract riders seeking a more remote experience.</p> <p>Where relevant this would entail assessment by the Department of Conservation in the draft Southland Murihiki Conservation Management Strategy and consideration of routes in Fiordland National Park in the review of the park management plan.</p> <p>More comprehensive and accessible online information on Southland's mountain biking opportunities will assist in informing mountain biking tourists of possible opportunities.</p>

²⁹IMBA has a 3-tiered Ride Centre rating system for facilities which offer quality riding for a range of riders. Ride Taupo on the North island has silver rating.

³⁰IMBA Epic Rides are demanding rides in a natural setting at least 20 miles in length and composed of more than 80% single-track.

COMPETITIVE AND EVENT CYCLING

4.5

Southland has a very strong history of competitive cycling although anecdotal evidence suggests that participation in cycling events has not increased.

Competitive cycling events are held for track cycling (in the Southland SIT Zero Fees Velodrome in Invercargill), road racing, mountain bike riding and BMX riding.

The SIT Zero Fees Velodrome (operating 7 days a week), in Southland's multi-purpose ILT Stadium Southland, was New Zealand's only indoor velodrome until 2014 and is a major centre for track cycling competitions in New Zealand. Opened in 2006, the Velodrome regarded as one of the fastest tracks at sea level in the world, has hosted numerous competitions at the local, domestic and international levels. Cycling Southland, the major club and advocate group for track and road cycling in the region, is based at the stadium. The Velodrome is being developed as a regional performance hub for young cyclists from Southland and Otago as well riders for all ages can enjoy facilities and a variety of programmes on offer from 'learn to ride' to green prescription activities.

The scheme (aimed to be operational by the end of 2016) is for young cyclists to train and participate in Southland cycling competitions with the aim of competing for slots in the New Zealand national squad.



Southland hosts the Tour of Southland³¹ which is now in its 60th year. The Tour of Southland had official sanction as an international road race from the world cycling body, Union Cycliste Internationale (UCI) until 2014. UCI ranking of the Tour is no longer being pursued due to impractical conditions, costs and limitations on participation of New Zealand riders who are not members of a registered national team³². The Tour is considered to be a significant event for local and New Zealand cyclists, with **ten riders** from Southland participating in 2015. Over time it has attracted many of New Zealand's best cyclists, up to **20 teams** of international cyclists and considerable spectator and media attention. The course taken by the Tour varies from year to year but is usually mostly contained within Southland District. The main Tour of Southland has also spawned a number of other events such the Great Southern Cycle Challenge - a junior tour and a mini tour open to all to raise funds for charity. The economic benefits of the Tour are thought to be significant for local economies due to the flow on effect from use of facilities and accommodation in towns in the region.



³¹ www.tourofsouthland.com

³² Personal communication from Cycling Southland.

The Milford Mountain Classic between Milford Sound and Te Anau is a relatively new road race organised by the Te Anau community and other stakeholders. It is becoming a popular event since it involves New Zealand's most spectacular scenic highway and the challenging climb up to, and through, the Homer Tunnel.

Regular national and local road races are held in Invercargill and elsewhere. The Tour de Lakes, event start in Queenstown (Roads of Southland, Fiordland and Central Otago), and the Yunca Junior Tour of Southland are also significant annual Southland cycling events.

The Southland Mountain Bike Club actively hosts regional mountain bike events in summer and in winter. Cross country events are held at the Sandy Point Mountain Bike Track in Invercargill and downhill events (such as the Ride Cycles Bluff Enduro) are held at Bluff. The winter race series attracts over **170 participants**. The Ivan Wilson Park at Te Anau is also the site for mountain bike races. Individual annual mountain biking events in Southland are:

- the MLT Moonshine Trail³³ mountain biking event near Gore has been running for **ten years** and attracted **204 participants** in **2016**. The event is based at Dolamore Park with courses extending from **39 km** to **45 km** and including private land which is not normally accessible to the public.
- the Meridian Whitehill Windfarm Classic is a **25 km** mountain bike event centred around the Whitehill Windfarm near Mossburn. The event attracted **120 participants** in **2016**.
- the Mount Linton Muster offers a variety of mountain bike courses from **12 km** to **40 km** on Mount Linton Station near Ohai and Nightcaps. The event has run since **2008** and attracts around **130 participants**
- the Bannockburn Gutbuster, a well-established, **75 km** race that begins at Garston in northern Southland and finishes at Bannockburn in the Central Otago District. There were **188 participants** in **2015**.

Southland BMX races are hosted by the Southland BMX Club at their BMX track at Elizabeth Park in Invercargill. Participation in cycling competitions as opposed to general commuter or recreational cycling is in the low hundreds. There is now a large variety of events available in Southland and neighbouring Otago and Queenstown. Many competition participants have become selective about which events they attend, which is seen in a decline in registrations for some events such as the iconic Motatapu off-road cycling and running event held in Queenstown. The cost of attending such events can be a major disincentive for potential participants.

Markets for competitive and event cycling in Southland are:

- **Local competitive road and track cyclists** – Local residents at various ages (including young people) interested in training for and competing in cycling races at various levels.
- **Elite, amateur and professional competitive cyclists** – Local and visiting road and track cyclists training for and competing in local, national and international level competitions.
- **Local and visiting competitive mountain bikers** – Interested in local and higher level competitions
- **Social event riders** – Local and visiting cyclists across cycling disciplines interested in riding in non-competitive, participative events.
- **Event spectators** – People who accompany event participants or who attend cycling events for the spectacle.

Cycling Southland's principal competitive road cycling programme is run from September to May each year, with up to 75 riders turning out each Saturday to ride courses around the province, in separate A, B, C and D grades. Additionally the long-standing "Wednesday World" series of road rides are offered within daylight saving dates on Wednesday evenings on a course handy to Invercargill – with up to 60 riders attending.

The longstanding non-competitive annual Surf to City event attracts over 2,000 recreational and family cyclists, across event distances of 3km, 6km and 12km.

The Glenham Trainwreck Ride in Eastern Southland attract around 120 competitors.

³³ www.moonshinetrail.co.nz

COMPETITIVE & EVENT CYCLING

Market	Market Needs & Preferences	Issues Identified in Southland ³⁴	Opportunities & Barriers
Local road and track cyclists	<p>Safe training routes and venues suitable for a range of levels.</p> <p>A range of well-organised competitions including for young cyclists and different skill and competition levels.</p>	<p>Low participation in competitions.</p> <p>Perceptions of the low safety of road cycling.</p>	<p>Increased use of the SIT Zero Fees Velodrome for training and cycling programmes.</p> <p>School cycling programmes to stimulate interest among young people.</p> <p>Improving road safety for general cycling will also improve road conditions for cycle training and competitions and remove a barrier to cycle participation. However, this will require funding (see Recreational Cycling section above).</p> <p>Rejuvenation and promotion of existing major cycling events and hosting more events may stimulate local interest in competitive cycling.</p>
Elite, amateur and professional cyclists	<p>National and international standard routes and circuits at a range of distances/terrain suitable for training and competitions at the club, national or international levels.</p> <p>Well-organised competitions on safe routes with appropriate traffic management and provision of food, water and first aid.</p> <p>The reputation of a competition, its route and challenges and level of competition can be important factors in drawing participants.</p>	<p>Southland has several established events, including the Tour of Southland, that provide opportunities for local and visiting elite and developing cyclists.</p> <p>With the proliferation of cycling events in New Zealand and other countries, cyclists are becoming more selective about which events they attend.</p>	<p>Rejuvenation and promotion of the existing major competitions may assist in developing their reputation and in attracting more participants.</p> <p>Hosting a greater range of competitive events in Southland.</p>



³⁴ Compiled from the responses to the 2016 cycling survey and consultation with stakeholders

COMPETITIVE & EVENT CYCLING

Market	Market Needs & Preferences	Issues Identified in Southland ³⁴	Opportunities & Barriers
Local and visiting mountain bikers	<p>'Best of the best' trails and courses maximising the riding experience or offering an unusual challenge or landscape.</p> <p>A range of courses suitable for different skill levels, especially if an event attracts social, club or family groups.</p> <p>Well-organised events with on-course water, food and first-aid and transport to the event location.</p>	<p>While there is potential for local level competitions Southland has limited potential for visiting competitive markets due to the small scale of its mountain biking facilities.</p> <p>Improved range of trail standards, sustainable design and maintenance to facilitate local competitions.</p> <p>Several small distance events that attract some local and visiting interest.</p>	<p>Improvement of local mountain biking facilities for general riding and a diversity of skill levels should take account of local competitive riding needs.</p> <p>There is some potential to attract New Zealand mountain bikers (especially from nearby regions) to events such as the Moonshine Trail which offer riding on areas normally closed to the public.</p> <p>There is potential to stimulate local interest in mountain biking competitions and participatory events through school and other cycling programs.</p>
Social event riders	<p>A range of well-organised non-competitive events (across the different types of cycling) that offer interest and personal challenge.</p> <p>Linked activities that add to the appeal – entertainment, food, festivals.</p>	<p>Southland has some social road cycling events.</p> <p>Lack of a signature social riding event.</p>	<p>The ATMCT may provide an opportunity to develop a signature trail event. Several of the New Zealand Cycle Trails offer one or more such events, often with cycling, running and walking options.</p>
Event spectators	<p>Well-organised competitive and non-competitive events with a reputation for challenging cycling.</p> <p>Range of linked activities – such as entertainment, food, accommodation, tours, festivals.</p>	<p>There has been limited development of activities for spectators in Southland.</p>	<p>As part of the rejuvenation of cycling events there may be opportunities to developed linked experiences and packages to attract spectators.</p> <p>This might include development of a festival of cycling in conjunction with a major event.</p>

³⁴ Compiled from the responses to the 2016 cycling survey and consultation with stakeholders

5. THE WAY FORWARD

MAIN APPROACH | The Southland Cycling Strategy focuses on providing a firm foundation of quality infrastructure, experiences and awareness building upon which cycling opportunities can be built and extended over time.

The initial priority will be to improve what we have across the range of cycling while developing local cycle participation and a cycling culture. As local and government funding resources for cycling developments are limited, any future new cycling opportunities will need to demonstrate market need, feasibility and effective benefits for Southland (see Decision Making Criteria below).

5.1

Improve and consolidate existing cycling infrastructure and opportunities with an emphasis on safe, enjoyable family friendly experiences.

Encourage more local cycle participation and development of a cycling culture.

Provide a small number of high quality cycling experiences with a distinctive Southland character.

Over time consider new cycling opportunities that are supported by demonstrated demand and a sound business case.

THE SOUTHLAND CYCLE NETWORK | Southland's cycling network will be developed over time and will consist of:

- » a core cycle network - improvements to existing cycling trails and routes that will be developed as the first priority
- » potential future developments - to be examined over time subject to demand and a sound business case

5.2 | Actions to develop the relevant infrastructure are described in the actions in chapter 6.

CORE CYCLE NETWORK	POTENTIAL FUTURE DEVELOPMENTS
<p>Invercargill on-road and off-road cycle network Linked cycling network to ensure people are able to cycle safely and efficiently for transport and recreation (Actions A2, A3 and A4)</p> <p>Learn to Ride facilities in Invercargill Improved access (Action C5)</p> <p>BMX facilities in Invercargill and Gore</p> <p>Invercargill Velodrome Venue for community cycling programs, training, competitions and events (Action D3)</p> <p>Invercargill to Bluff Cycleway (Action A6)</p> <p>Cycle-friendly road routes originating in Invercargill, Gore and Te Anau On-road cycling routes suitable for local recreational cycling and training and development of required safety infrastructure and promotion (Action A8)</p> <p>Heartland Rides Quality road riding itineraries suitable for riding by locals and visitors (Actions B1, B2)</p>	<p>Other towns Consideration of community based initiatives for cycling infrastructure in other towns subject to audit of cycling needs, funding and business cases (Actions A1, A7).</p> <p>Learn to Ride and skills based facilities for children in Invercargill and other towns.</p>

CORE CYCLE NETWORK

Around the Mountains Cycle Trail

Southland's signature trail cycling experience with supporting services, products and promotion (Actions B3, B4)

Te Anau to Manapouri Cycleway

Completed cycleway subject to consideration under the review of the Fiordland National Park Management Plan (Action B5)

Mountain Biking near population centres

Improved range of opportunities at mountain biking facilities at Sandy Point, Bluff, Croydon Bush, Ivon Wilson Park and Te Anau Control Gates with consistent grading, signage and standards (Actions A10 and A11)

POTENTIAL FUTURE DEVELOPMENTS

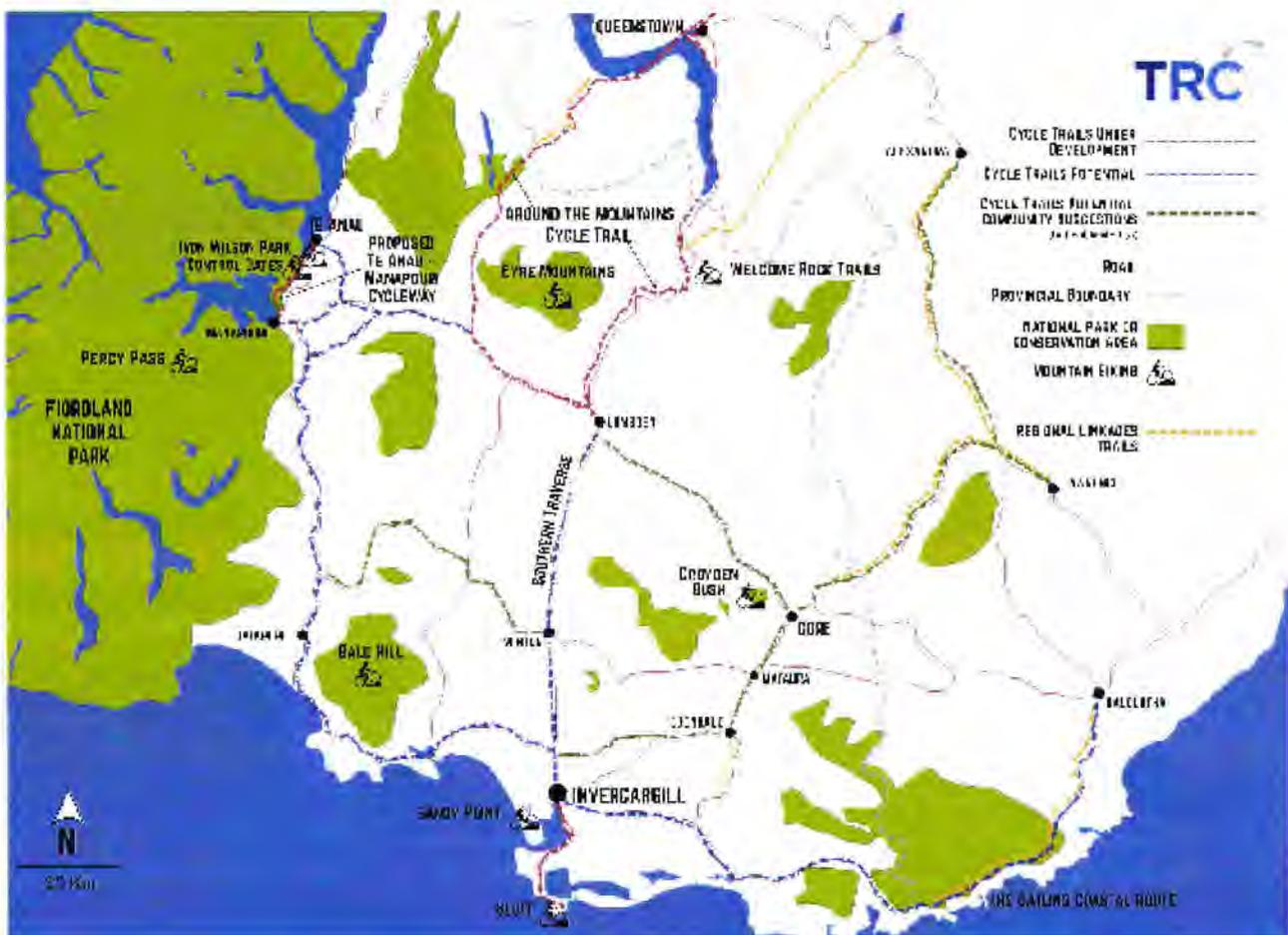
Other cycle trails

Consideration of other multi-day ride journeys subject to funding, demand and business cases (Action B10).

Backcountry Mountain Biking

Improved management and maintenance of mountain biking on management tracks and provision for ridings at other places on public conservation lands – subject to actions by the Department of Conservation under the Southland Murihiki Conservation Management Strategy and the review of the Fiordland National Park Management Plan.

Figure 5: Current major cycling opportunities in Southland



DECISION MAKING CRITERIA

The following decision-making criteria will be used to ensure that decisions on improving, consolidating, maintaining and extending Southland's cycle network are sustainable. In the region's limited funding environment preferred cycling developments will be those that provide the greatest benefits for the region and its communities.

The criteria have been designed to apply broadly across the different types of cycling developments and take account of assessment criteria for cycling projects applied under the National Land Transport Programme (<https://www.pikb.co.nz/assessment-framework/strategic-fit-3/strategic-fit-for-walking-and-cycling-2/#NZCycles>) and the New Zealand Cycle Trail (<http://nzcycletrail.com/public-resources/great-rides-fund/>).

5.3

DECISION MAKING CRITERIA FOR CYCLING INFRASTRUCTURE NEEDS AND NEW PROPOSALS

1 Demand

Demonstration using robust evidence that there is a strong level of demand for the infrastructure/development from the relevant markets (e.g. commuter, recreational, tourist).

2 Safety contribution

Where relevant, demonstration that the developments or proposed works are required to minimise road or trail accident risks.

3 Sustainable design

The development meets relevant New Zealand standards, legislative requirements and approval requirements – including for safety, purpose (e.g. trail standards), environmental protection, cultural protection.

4 Cycling network linkages

The development creates a cycling network or links to an existing cycling network – such as an urban commuter/recreation network, the New Zealand Cycle Trail, Heartland Rides, mountain biking trails and facilities.
The development is needed to create cycle linkages to population centres, transport or accommodation.

5 Importance for recreation and tourism

Contribution of the development to the quality of recreation/tourism experiences and opportunities for users and the region. Potential for business and employment opportunities.

6 Development costs

The level of funding required and options for funding. Whether the proposal meets the assessment criteria and funding requirements for relevant funding programmes.

7 Community support

A high level of support from the relevant communities, users, stakeholder groups, local government and government agencies. Agreement from affected landholders (where relevant). Lack of major barriers to development.

8 Management and maintenance

Arrangements capable of providing ongoing management and maintenance for the infrastructure/development.

9 Benefits and costs

Appraisal of the overall benefits likely from the development versus the costs of its implementation (or of not proceeding). Benefits and costs may include quantitative factors such as financial costs, projected economic impacts, estimates of accidents) or qualitative factors (community health and wellbeing impacts, impacts on lifestyle choices and amenity, potential for employment and business opportunities).

IMPLEMENTATION PARTNERS

A range of organisations will be involved in implementing the Southland Cycling Strategy in a collaborative manner through the implementation plan - government agencies, local government, trail managers, cycling organisations and clubs, the tourism industry, businesses and sponsors, community groups. The main organisations and their roles in implementing the Strategy are described below. As the Strategy is implemented it is envisaged that new partnerships will be developed. A governance body is proposed to be established to coordinate Strategy Implementation (see Strategy G).

5.4

ORGANISATION	ROLE
ADVOCACY GROUPS	Various advocacy groups but not limited to:
CCS DISABILITY ACTION	CCS Disability Action works in partnership with disabled people, their families and whanau to ensure equality of opportunity, quality of life and an environment that enhances full community integration and participation.
COMMUNITY TRUST OF SOUTHLAND	CToS as community owned grant making organisation, covers area from Stewart Island to Glenorchy, Te Anau to Tapanui and all the places in between. They provide a helping hand to hundreds of groups - both large and small - by providing funding for facilities, services, events, community projects and programmes. Since 1988 they have been supporting Southland region with grants and scholarships across a range of sectors including; sport & recreation and health and sports organisations
CYCLING SOUTHLAND	Road and track cycling training programmes, events, organisation of the Tour of Southland, community and training programmes at the SIT Velodrome, advocacy.
DEPARTMENT OF CONSERVATION	Planning and managing cycling developments and opportunities on public conservation land.
ENVIRONMENT SOUTHLAND	Construction management of sections of cycleways along stopbanks and flood protections infrastructure in Invercargill, including sections of the Invercargill to Bluff Cycleway. Consent for various land uses including works affecting water resources, coastal areas, wetlands, in-stream works (such as bridges and culverts).
FIORDLAND TRAILS TRUST	Trail development in Fiordland, including development and fund raising for the Te Anau to Manapouri Cycleway.
GORE DISTRICT COUNCIL	Development, management and maintenance of on-road and off-road cycling infrastructure. District destination promotion.
INVERCARGILL CITY COUNCIL	Development, management and maintenance of on-road and off-road cycling infrastructure in the City of Invercargill.
KIWRAIL	ONTRACK, on behalf of the government, owns and manages the rail network in New Zealand. ONTRACK can grant access rights for the use of the rail network, including allowing walking and cycling tracks, provided they don't affect rail operations. ONTRACK supports walking and cycling, and has a walking and cycling policy, which aims to keep all mode users of the rail corridor safe.
LANDOWNERS	Access to trails that pass through private land, access for mountain biking events. In some cases private landowners have developed and manage trails on their land.
MINISTRY OF BUSINESS, INNOVATION AND EMPLOYMENT	Funding for development and upgrade of the New Zealand Cycle Trail.
NEW ZEALAND AUTOMOBILE ASSOCIATION (AA)	The AA is an advocacy group representing motorists, as well as cyclists and pedestrians; advocating freedom of mobility and individual choice. They work with government, industry and the media. A key element of their advocacy and policy work is enhancing the safety of all road users.

ORGANISATION	ROLE
NEW ZEALAND CYCLE TRAIL	Brand, marketing, data collection and advocacy for the New Zealand Cycle Trail.
NEW ZEALAND POLICE	The NZ Police play a role in promoting road safety in New Zealand including through enforcement and education services.
NEW ZEALAND TRANSPORT AGENCY	Strategic priorities for cycling in New Zealand, safety guidelines, cycling network design guidelines, administration of funding under Urban Cycleways Programme and National Land Transport Programme.
OTAGO SOUTHLAND REGIONAL LAND TRANSPORT COMMITTEE	Development of the Otago Southland Regional Land Transport Plans which include recommendations for project funding under the National Land Transport Programme.
OTHER CYCLING CLUBS	Including Te Anau Cycling Inc, Hokonui Bikers, Southland BMX Club. Various offer social and event cycling opportunities, advocacy, cycling information.
ROAD SAFETY SOUTHLAND	Road Safety Southland runs road safety projects and programmes in response to local road safety issues on behalf of the local authorities in Southland. There is a strong educational focus which links closely with local police enforcement and engineering work carried out by the councils.
SOUTHERN DISTRICT HEALTH BOARD - SOUTHERN DHB	The Southern (DHB) is responsible for planning, funding and providing health and disability services to a population of over 304,268 located south of the Waitaki River. Our catchment area encompasses Invercargill City, Queenstown - Lakes District, Gore, rural Southland, Clutha, Central Otago, Maniototo, Waitaki District and Dunedin City. One of their focuses is "promoting and protecting wellness".
SOUTHLAND DISTRICT COUNCIL	Development, management and maintenance of on-road and off-road cycling infrastructure. Development and management of the Around the Mountains Cycle Trail.
SOUTHLAND MOUNTAIN BIKE CLUB	Organises events and rides, maintains trails at Sandy Point and Bluff, advocacy.
SPORT SOUTHLAND	Not-for-profit Regional Sports Trust that provides support for active lifestyle programmes, club and school sport programmes, coaching and event organising (including the MLT Moonshine Trail mountain biking event).
TOURISM AND BICYCLE INDUSTRY	Provision of products and support services related to cycle routes and trails.
VENTURE SOUTHLAND	Regional economic and community development initiatives and tourism destination promotion.

6. STRATEGIES AND ACTIONS

- A** IMPROVE BASIC INFRASTRUCTURE TO ENCOURAGE MORE PEOPLE TO CYCLE
- B** DEVELOP AND PROMOTE A SUITE OF HIGH QUALITY CYCLING EXPERIENCES
- C** IMPLEMENT PROGRAMMES TO ENCOURAGE PEOPLE TO CYCLE AND RAISE SAFETY AWARENESS



- D** SUPPORT COMMUNITY CYCLING ACTIVITIES AND PARTICIPATION-BASED EVENTS
- E** ASSIST THE REJUVENATION OF COMPETITIVE CYCLING EVENTS
- F** SUPPORT DEVELOPMENT OF LOCAL CYCLE COMMISSIONABLE TOURISM PRODUCTS AND PARTNERSHIPS
- G** IMPLEMENT STRONG LEADERSHIP, COMMUNICATION AND COOPERATION

A IMPROVE BASIC INFRASTRUCTURE TO ENCOURAGE MORE PEOPLE TO CYCLE

Southland has a range of cycling trails, on-road cycle routes and cycling facilities including a major velodrome. However, improvements are needed to the region's infrastructure to meet demand for convenient, safe and enjoyable commuter and recreational cycling and encourage more people to cycle. Local cyclists have indicated that parts of the on-road cycle lane network and the shared trail network in the City of Invercargill require upgrading and improvements of linkages to provide a safe cycling network to the places where people wish to cycle.

Cycle network linkages in Te Anau have also been identified as requiring attention. There have been some initiatives to improve cycling opportunities around towns (such as Gore, Te Anau and Winton) and planning and business cases for cycling, infrastructure in some towns, such as a possible cycling and walking path between the nearby towns of Edendale and Wyndham to address a road safety issue. However, overall there remains a need to improve the range of cycling infrastructure in and near the region's towns. To date Southland has suffered from limited cohesive forward planning and the absence of 'shovel ready' projects when funding (such as New Zealand Transport Agency cycle funding) has become available.

Cycle-friendly and safety features on major roads and other popular cycling routes could improve the attractiveness of road cycling in the region. A wider range and improved quality of trails is desirable at existing mountain biking parks in the region to meet demand for a wide range of mountain biking experiences, including for families and beginner riders. These infrastructure improvements will improve cycling opportunities for local residents and for the region's increasing number of visitors.



Action	Description	Priority
A1	<p>Conduct an audit of cycling conditions on major urban and rural road cycling routes in Southland to</p> <ul style="list-style-type: none"> » identify primary and secondary routes for cycling, including routes connecting main cycling commuting and recreational destinations. » develop a plan for safety improvement and cycle-friendly measures consistent with the latest New Zealand standards. 	High
A2	<p>Re-assess the on-road cycling and off-road shared path networks in the City of Invercargill to identify route and trail construction, linkages, design and signage and safety measures required to ensure cyclists are able to travel safely and efficiently for transport and recreational purposes.</p>	High
A3	<p>Develop a master plan for implementing the reviewed on-road cycling and off-road shared path recommendations from Action A2.</p>	High
A4	<p>Investigate development of a cycle lane or cycle trail from the Invercargill airport to the city and the provision of cycle-friendly facilities (such as bike racks) at the airport.</p>	Medium
A5	<p>Encourage the provision of distinctive bicycle racks and other cycle friendly infrastructure (such as pumps, changing facilities) at urban and other popular cycling destinations, including the airport.</p>	High
A6	<p>Develop and communicate a timeline and plan for the development of the Invercargill to Bluff Cycleway including the route, construction costs, maintenance, interpretation and funding. Ensure construction is to a standard that encourages wide use and includes supporting infrastructure such as rest areas, shelters, toilets, local information and interpretation.</p>	High
A7	<p>Support and fund local community based initiatives to improve cycling opportunities in towns such as Waikaia, Winton, Riverton, Gore, Matura, Edendale and Wyndham.</p>	Ongoing
A8	<p>Designate and promote cycle-friendly road cycling routes for recreational and training use originating in Invercargill, Gore and Te Anau with improved signage, enhanced usable road shoulder width and other cycle-friendly improvements.</p>	Medium
A9	<p>Develop 'shovel ready' proposals for cycling infrastructure (including as relevant in cities, towns and rural areas) for funding under the New Zealand Transport Agency's cycling safety action plan and the National Land Transport Programme.</p>	Ongoing
A10	<p>Consider the development of a greater range of mountain biking opportunities at Sandy Point, Bluff, Croydon Bush, Ivon Wilson Park and the Te Anau Control Gates to address the greatest need.</p>	High
A11	<p>Implement consistent grading signage and standards across Southland mountain bike networks to assist in promoting Southland mountain biking to a range of users.</p>	Medium
A12	<p>Improve opportunities for BMX riding in Invercargill including co-locations with other cycling activity at Surrey Park.</p>	Medium
A13	<p>Support councils and relevant authorities and organisations in maintaining and making improvements in cycling infrastructure. This should include advocating the recognition of cycling as a mode of transport by regional road controlling authorities and consideration of cycling needs during road works.</p>	Ongoing

B DEVELOP AND PROMOTE A SUITE OF HIGH QUALITY CYCLING EXPERIENCES

A small number of high quality road and trail cycling experiences for recreation and tourism markets will be offered in Southland. The development and promotion of these experiences will gain leverage from the presence of part of the New Zealand Cycle Trail (the Around the Mountains Cycle Trail) in the region, the region's cycling traditions such as the Tour of Southland and the proximity of the major Queenstown and Otago cycling destinations. The competition offered by Queenstown and Otago cycling destinations will be countered by distinctive Southland positioning of the cycling experiences as a strong pillar of the regional tourism strategy. Southland's cycling experiences will thus become an advantage, complementing the Queenstown cycling offer and, in some cases, also appealing to visitors and cyclists who prefer easier grade tracks.

In the longer term any proposals for new off-road cycle trails will need to demonstrate community support, demand and a sound business case. While numerous proposals have been put forward for new multi-day cycle trails in the region there is evidence to suggest that local and visiting cycle markets are more likely to seek day, weekend or 2 to 4 day experiences supported by linked products and services.

The market focus for the suite of cycling experiences will be on:

- » Road Tourers – Southland residents, domestic visitors and international visitors for whom the road journey is an intrinsic part of the visit and a major reason for visiting the region
- » Holiday and Soft Adventure Trail Cyclists – Southland residents, domestic and international visitors seeking an immersive trail experience
- » Location-based Holiday Cyclists – A diverse group of visitors for whom a cycling experience is one of several activities undertaken at a destination
- » Mountain Bikers – Southland residents, domestic and international mountain bikers seeking a special mountain biking experience different from other places or with a reputation for challenge and/or a distinctive landscape.

The improvements in infrastructure (Strategy A) will underlie the development of cycling experiences.



Action	Description	Priority
B1	Investigate, designate and promote a range of quality road riding itineraries as Heartland Rides.	High
B2	Design and install cycling route signage.	High
B3	Complete and promote the Around the Mountains Cycle Trail for day and multi-day 'soft adventure' experiences and encourage development of with self-guided and guided products and supporting transport, accommodation services and interpretation.	High
B4	Encourage greater focus on the Southland areas of the Around the Mountain Cycle Trail through the development of trail-related products and attractions based in Southland.	High
B5	Encourage the completion of the Te Anau to Manapouri Cycleway on the route through Fiordland National Park to ensure a quality visitor experience.	Medium
B6	Support a review of the Fiordland National Park Management Plan investigating low impact cycling opportunities within the front country of the National Park.	Ongoing
B7	Provide comprehensive information on cycling experiences on tourism websites, visitor information centres and the Southland cycling website. Information should include maps, details of each ride (distances, elevations, difficulty); cycle-friendly services, food and accommodation; booking links; bicycle shops and transport. The information should be available in both paper and digital forms, including as downloadable apps.	High & Ongoing
B8	Promote Southland cycling experiences as a major pillar in tourism planning and part of Southland tourism marketing through a variety of media, social media (such as Trip Advisor) and marketing and public relations campaigns.	Medium & Ongoing
B9	Establish a monitoring system to obtain information on use of major cycling trails including the Around the Mountain Cycle Trail, the Te Anau to Manapouri Trail and the Invercargill to Bluff Trails and to demonstrate the contribution of cycling to the economy.	Medium
B10	Undertake business cases into the best options for developing future multi-day trail ride journeys in Southland.	Low

C IMPLEMENT PROGRAMMES TO ENCOURAGE PEOPLE TO CYCLE AND RAISE SAFETY AWARENESS

Awareness and education programs will assist in increasing cycling participation by raising Southland residents' confidence to cycle and improving their understanding of the benefits of cycling.

These programmes include promotion of the social, health and environmental effects of cycling; provision of information on cycling opportunities; cycle safety campaigns and cycling training programmes.

Council willingness to be involved in road safety awareness improvement.

High buy-in to Share the Road and Learn to Ride programmes.

Established collaboration between Cycling Southland and road safety programmes.

Strong network of cycling clubs to assist in encouraging cycling participation and developing safety awareness.

STRENGTHS

Campaign to encourage more cycling and education on benefits.

Extend existing 'Share the Road' programme.

Range of cyclist training programmes for different ages and skill levels, including through schools.

Improved Learn to Ride facilities.

OPPORTUNITIES

Limited Learn to Ride facilities.

Lack of safety awareness by drivers and cyclists.

Use of volunteers for Share the Road and Learn to Ride programmes affects reliability of delivery.

Relatively low uptake of cycling for transport.

Southland weather.

WEAKNESSES

Limited funds and other resources – existing programmes are under-resourced.

Lack of effective governance for coordinating delivery.

Low population numbers affecting resources.

Lack of traffic congestion as a driver for commuter cycling.

THREATS

Action	Description	Priority
C1	Develop and implement a campaign to promote cycling as a desirable activity and form of exercise with health and environmental benefits, using a variety of messages to target different groups including children, young people and families. The campaign should be linked, as appropriate, to other health and exercise initiatives.	High
C2	Provide information on cycling opportunities to residents through a variety of media and a central information source including a core cycling website and links to other relevant sites.	Ongoing
C3	Consolidate and extend the 'Share the Road' campaign targeting schools, youth groups, adult cyclists, motorists and truck drivers to build awareness and promote safe cycling and road sharing practices.	High
C4	Develop and implement a range of cyclist training programmes for different ages, skill levels and cycling types taking account of the New Zealand Transport Agency guidelines.	High
C5	Improve access to Learn to Ride parks.	High
C6	Investigate a new Learn to Ride facility that is open to the public at a prominent location in Invercargill. The facility should include road safety opportunities but also skill based facilities like a mini-pump track.	Medium
C7	Develop further open-access Learn to Ride facilities in other city parks and throughout Southland including mini-pump tracks and circuits that are fun and safe for children.	Low
C8	Encourage the use of power assisted electric bikes (E-bikes) to improve participation in cycling for commuting and recreation.	Low

D SUPPORT COMMUNITY CYCLING ACTIVITIES AND PARTICIPATION-BASED EVENTS

The benefits of improved cycling infrastructure and cycling promotion will be better realised if residents have easy access to enjoyable recreational and social cycling activities. Such activities will attract Southland residents to cycle more and will assist in expanding the cycling culture in the region. While there are already various social cycling activities and participation events throughout the region better promotion to a range of cycling markets, families, young people and older people would assist in attracting more participants. There is the potential for social riding to expand as evidenced in the recent success of the 'Tweed Rides' developed by an Invercargill bike shop.



Action	Description	Priority
D1	Work with social and community groups, youth groups, cycling clubs, Cycling Southland and Sport Southland to encourage and promote a range of social cycling activities.	Medium
D2	Work with cycling clubs, schools, Cycling Southland and Sport Southland to encourage programmes to introduce young people to the different types of cycling.	High
D3	Support the development and promotion of a wide range of participation programmes and events based around the Velodrome, including learn to ride, BMX, mountain biking, programmes for elderly riders and community programmes run by Cycling Southland and Sport Southland.	Ongoing
D4	Encourage use of social media and the Southland cycling website to develop cycling networks and activities.	Ongoing
D5	Increase awareness of and celebrate successful cycling events, including the Southland Mountain Bike Club Winter Series, the Milford Mountain Classic and other events that are seeing strong growth and are accessible to local residents.	Ongoing
D6	Consider the development of a Festival of Cycling in association with other events already held in Invercargill, such as the Tour of Southland.	Medium

E ASSIST THE REJUVENATION OF COMPETITIVE CYCLING EVENTS

Southland has a strong history of competitive cycling represented in the long-running Tour of Southland (New Zealand's premier multi-day road cycling race) and track racing at the Invercargill velodrome. There is a range of competitive events at the junior, club and elite levels for road and track cycling and mountain biking events (some of which are in areas only accessible for riding during competitions such as the -Moonshine Ride). However, the region's competitive cycling focus has been affected by the growth in cycling events throughout New Zealand. Participation in competitive cycling in Southland is static except for some growth in mountain bike competing. With the opening of the Avantidrome at Cambridge on the North Island in 2014, the Invercargill SIT Velodrome is no longer the only indoor venue for national and international track competitions.



Action	Description	Priority
E1	Encourage school sports day and inter-school cycling competition across the disciplines of road cycling, track cycling, BMX and mountain biking.	Medium
E2	Identify hosting opportunities for second tier national and international cycling events, such as masters and youth/secondary schools events across the disciplines of road cycling, track cycling, BMX and mountain biking.	Medium
E3	Improve promotion of major cycling events such as the Tour of Southland, the Southland Mountain Bike Club Winter Series, the Great Southern Cycling Challenge and the Milford Mountain Classic to increase awareness and attract participants and spectators.	High
E4	Investigate the establishment of a signature event for the Around the Mountains Cycle Trail to raise awareness of the opportunity the trail offers.	Medium

F SUPPORT DEVELOPMENT OF LOCAL CYCLE COMMISSIONABLE TOURISM PRODUCTS AND PARTNERSHIPS

Products and services that cater for the needs of visiting and local cyclists are an important feature of places that have a strong local cycling culture and that attract visiting cyclists. In addition to providing retail and repair services, bike shops in many places have evolved as sources of cycling information, meeting places, activity centres and bike hire and bike tour operators. Cafes have become destinations and meeting places for weekend road and trial riders. The attraction of an area or a route for recreational cyclists will be improved if there are attractions that can be visited en route.

Globally, local businesses now offer cycle-friendly accommodation, food, transport and attractions along road and trail cycling routes and such services have come to be expected by many cycle tourists undertaking both short and long journeys. Many regions have implemented cycle-friendly services schemes where local businesses are accredited for provision of services that suit the needs of cyclists and assist to streamline their journey. Important features of these schemes for accommodation include opening hours that suit cyclists, bicycle storage, areas for washing and drying clothing and equipment, access to bicycle repair facilities, weather information, and access to food and meals.

In Southland there has been some development of accommodation and transport for cyclists in relation to the Around the Mountains Cycle Trail. There is potential to develop and/or better promote cycle-friendly services and products along the proposed cycle tourism routes in Southland through offering support and mentoring.



Action	Description	Priority
F1	Develop guidelines for provision of cycle-friendly services in Southland.	High
F2	As cycling experiences and routes are developed, hold experience development workshops with local businesses, accommodation operators, tour operators, transport services, local government to build awareness of the needs of cyclists and the benefits of offering cycle-friendly services and experiences linked to cycle tourism.	Medium
F3	Develop a programme for mentoring and business development advice for local enterprises establishing cycle-friendly services and products. This programme could be linked to other tourism or business support programs.	Medium
F4	Encourage availability of more bicycle hire near cycle trails and road cycling routes.	Medium



G IMPLEMENT STRONG LEADERSHIP, COMMUNICATION AND COOPERATION

At present, there is no one body acting as an advocate and taking a leadership role for achieving cycling improvements in Southland across all aspects of commuter, recreational, competitive and tourism cycling. The three territorial authorities are all involved in providing and maintaining cycling infrastructure and promoting road safety. Cycling Southland is primarily active in competitive cycling and has also implemented a number participation-based and safety programmes. Sport Southland is particularly involved in the delivery of participation-based events. Community and user groups such as the Southland Mountain Bike Club, Hokonui Trails Trust and Fiordland Trails Trust have been active in fundraising and trail development and maintenance. Not-for-profit volunteer groups and local councils face challenges in funding and progressing cycling projects. On the other hand, community and user groups are a valuable resource by assisting with cycle and mountain bike trail construction and maintenance. Improved coordination of cycling advocacy, development and funding is desirable to progress cycling in Southland and coordinate collaborative implementation of the Southland Cycling Strategy. Potential governance model is:

- ❖ Governance group - a representative panel of councillors from Southland District Council, Invercargill City Council and Gore District Council supported by staff member and representatives from Department of Conservation, Sport Southland, Venture Southland, Cycling Southland and key cycling stakeholders
- ❖ Supported by an independent skills-based implementation group with an independent chair assisted by representation from the councils and key stakeholders.

This model could be effective if provided with assistance and administrative support from a regional organisation. A cycling coordinator could assist the governance and implementation group with the cycling strategy implementation. The role of the cycling coordinator might include:

- ❖ acting as executive support for the governance and implementation group
- ❖ advocating, leading and collaborating to implement priority actions identified in this Strategy
- ❖ together with implementation group raising funds and establishing partnerships for the implementation of priority actions identified in this Strategy
- ❖ monitoring progress on Strategy implementation and providing a central point for cycling participation data.



Action	Description	Priority
G1	Agree to a governance model for coordination and ongoing implementation for the Cycling Strategy and establish this as an effective structure with appropriate resourcing.	High
G2	Establish and fund a position of Southland cycling coordinator for a three year period to implement the strategy, support governance and pursue funding.	Medium
G3	Encourage and support partnerships with local communities, cycling clubs and groups for trail management and maintenance.	Medium



APPENDIX

A PLANNING CONTEXT

Southland Regional Development Strategy

The Southland Regional Development Strategy³⁵ released in October 2015 aims to improve the liveability, lifestyle opportunities and socio-economic conditions in the region. As pointed out in that Strategy the region's aging population, static population numbers and the shift of population and economic activity to northern centres have the potential to deflate regional economic development and resilience and the quality of life for its residents in the future. Actions proposed under the Regional Development Strategy that could potentially affect demand for cycling, and to which the Southland Cycling Strategy can contribute, are:

- ✦ encouraging migration to the region and a more varied demographic mix, including through attracting more domestic and international tertiary students
- ✦ development of tourism as part of regional economic diversification
- ✦ building the urban culture of Invercargill to improve liveability
- ✦ improve air and road transport to the region.

Regional Cycling Strategies and Studies

Invercargill

Detailed planning for cycling infrastructure has been carried out for Invercargill and Te Anau and is being conducted for the Gore District.

The Invercargill City Council has an overarching vision to 'create an exciting, innovative, safe, caring and friendly city, offering lifestyles based on a healthy environment and diverse growing economy'. The Invercargill Walking and Cycling Strategy 2010³⁵ was developed to encourage walking and cycling among residents, guide development and funding of walking and cycling infrastructure and work towards the New Zealand Transport Strategy target of 30% of trips using walking or cycling by 2040.

The March 2015 Recreational Walking and Cycling Strategy³⁶ was developed to provide long term direction for development, maintenance and renewal of a walking and cycling trail network throughout the City and to the outlying areas of Oreti Beach, Sandy Point, Omaui and Bluff. That Strategy establishes objectives and levels of service for each trail and design; construction and maintenance standards for each category of trail; and sets out a plan for monitoring of trail use. Through the provision of trails the council seeks to encourage more people to walk and cycle resulting in health benefits, improved access to parks and the natural environment and a positive contribution to the revitalisation of the city. Priority focus areas in the Invercargill Recreational Walking and Cycling Strategy are completing trail connections between Invercargill and Oreti beach, between Invercargill and Bluff, the waterways in the east and between the city and Anderson Park.

Te Anau

In 2014 a cycling opportunities study³⁷ was conducted for Te Anau and the surrounding area to investigate improved cycling opportunities covering all types of cycling for both visitors and residents. Recommendations of the Te Anau and Environs Cycling Opportunities Study include:

³⁴ Southland Mayoral Forum (October 2015). Southland Regional Development Strategy.

³⁵ Invercargill City Council (2010). Invercargill Walking and Cycling Strategy 2010.

³⁶ Invercargill City Council (March 2015). Recreational Walking and Cycling Strategy, Prepared by Xyst.

³⁷ Envisage New Zealand (July 2014). Te Anau and Environs Cycling Opportunities Study. Prepared for Venture Southland.

- encouraging improvements to cycling access and safety around Te Anau through adjustments to existing road and path infrastructure, signage, development of additional pathways and cycle lanes and reduction of vehicle speed limits on the State Highway and major streets. Designation and promotion of cycling loops of different lengths is also recommended
- at Manapouri, formalising and signposting connecting footpaths and informal trails for cycling and improving the cycle-friendliness of roads
- improving the cycle-friendliness of roads in the Te Anau Basin for road riding and cycle touring
- extension of mountain biking opportunities through
 - improvements in shared paths in Ivon Wilson Park at Te Anau to provide for beginner and intermediate mountain biking
 - purpose-built tracks for intermediate and advanced riders in regenerating forest about the Kepler car park
 - several proposals within Fiordland National Park (including completion of the Te Anau- Manapouri Cycleway) which would be subject to approval by the Department of Conservation and changes to the park's management plan.

Department of Conservation land

The Department of Conservation has developed a draft Southland Murihiki Conservation Management Strategy³⁸ (CMS) that is being considered for approval. The draft CMS identifies some locations on public conservation lands for consideration for mountain biking access and facilities. Mountain biking in Fiordland National Park is restricted to some management trails under the Fiordland National Park Management Plan 2007-2017 which is a statutory plan under the National Parks Act 1980. The question of changes in mountain bike access and new mountain bike tracks in the national park will be considered in the review of the management plan³⁹. Policies to guide future consideration of and decisions on new mountain biking proposals are provided in the draft CMS.

New Zealand Outdoor Recreation Strategy

The New Zealand Outdoor Recreation Strategy⁴⁰ is a high level strategy that aims to encourage more people into outdoor recreation through provision of recreational access to natural areas, effective investment in outdoor recreation and improvements in the outdoor recreation sector's ability to meet changing participant needs. Aspects of the Strategy relevant to cycling are:

- provision of a graduated range of outdoor recreation opportunities across a spectrum of natural environments
- collaboration between government and the NGO sector, including in management of outdoor recreation areas and associated conflicts and over-use issues
- increasing environmental awareness among outdoor recreation participants to help protect natural resources
- consideration of outdoor recreation needs in urban design and transport planning
- encouraging schools and outdoor recreation groups to create more opportunities for young people to participate in outdoor recreation.

³⁸ Department of Conservation (2014). Conservation Management Strategy- Southland Murihiki 2015-2025, Volume 1, Revised Draft, November 2014.

³⁹ Department of Conservation (2014), South Island CMS – Common Issues Report. Discussion of issues raised by submitters that were common across the Draft Canterbury, Otago and Southland Murihiki Conservation Management Strategies 2013.

⁴⁰ Sport New Zealand (2009). Outdoor Recreation Strategy 2009-2015.

Planning for Safer Cycling

In 2010 the Ministry of Transport issued the Safer Journeys⁴¹ strategy to guide improvements in the safety of travel on New Zealand's roads. This strategy aims to develop a culture of sharing the road with pedestrians and cyclists, provide safe and convenient pedestrian and cycling routes, reduce vehicle speeds on roads frequented by cyclists and encourage road safety education in schools.

A detailed analysis of cycling safety was conducted in 2014 when the New Zealand Transport Agency convened an expert Cycling Safety Panel⁴² to examine ways for central and local government to ensure that road cycling became a safe transport option in urban and rural areas. As a result a Cycling Safety Action Plan⁴³ was released in August 2015 to deliver safer cycling through measures that include:

- » the Urban Cycleways Programme that provides funding to complete urban cycle networks
- » speed management guidelines, including reduction of motor vehicle speed limits near schools and shops and on rural roads
- » development of an updated guide for nationally-consistent cycle network design to ensure new cycling infrastructure is fit for purpose. This will consider standards for space management, surfacing, sight distances, road markings and maintenance on rural cycling routes
- » safety training including cycle training for school children and adults, cycle-awareness training for drivers of heavy vehicles, and provision of heavy vehicle awareness information to cyclists
- » extension of the 'Share the Road' campaign.

Funding under the Urban Cycleways Programme may provide opportunities for cycling developments in Southland's main urban areas while guidelines for cycling safety and network design will need to be taken into account in developing road cycling experiences.

National Land Transport Programme

The National Land Transport Programme, administered by the NZ Transport Agency (NZTA), provides funding for improving road transport throughout New Zealand. Regional Transport Committees (which represent councils and the NZTA) develop strategic directions for land transport and invite submissions from local government for transport projects, which may include projects related to cycling. Projects recommended in Regional Land Transport Plans are considered for funding under the national programme in 3-year cycles. The current national funding cycle extends from 2015 to 2018.

The Otago Southland Regional Land Transport Plans 2015-2021 set a long term goal:

To provide accessible transport connections, giving users an appropriate choice of modes, and to gain improved performance from the land transport system, by focusing on road safety, economic growth and productivity and value for money.

In relation to cycling, these plans aim to encourage and enable higher levels of cycling through improved provision of safe road space for cyclists. Construction of trails for cycle tourism is also encouraged. There are no Southland cycling projects in the 2015-2018 National Land Transport Programme. There may be opportunities to develop Southland cycling projects for submission in the following round of funding in 2018-21.

⁴¹ Ministry of Transport (2010). Safer Journeys – New Zealand's Road Safety Strategy 2010-2020.

⁴² Cycling Safety Panel (December 2014). Safer Journeys for People Who Cycle: Cycling Safety Panel Final Report and Recommendations.

⁴³ New Zealand Transport Agency (August 2015). Making Cycling Safer and More Attractive: The NZ Transport Agency's cycling safety action plan.

**OTAGO
SOUTHLAND
REGIONAL LAND
TRANSPORT
PLANS
2015-2021**

The Otago Southland Regional Land Transport Plans 2015-2021 '... seek to encourage and enable higher levels of cycling. Reallocating existing roading space to cycling, and providing for cycling in new roading projects, will help increase recognition of the rights of cyclists to safe road space. Provision of good quality cycle facilities, within the roading corridor, including separate facilities, will play an important role in increasing the levels of cycling within the two regions. Improved land-use planning practices will also assist in greater levels of cycling activity because local services as well as transport services will be more accessible by bicycle.

Continued expansion of cycle tourism, through the provision of quality experiences on trails, the construction of further trails will help build this sector of the tourist market, aimed at both overseas and domestic visitors. Providing better connections between trails (although is not a major focus of this plan) will encourage visitors to remain longer in the south.'

Primary policies

New road construction and major improvements include provision for safe walking and cycling in high pedestrian and cycle use areas.

Transfer some existing road space over to walking and cycling where this is needed to ensure safe travel.

Build cycleways/walkways separated from motorised traffic where the safety of those using active transport to commute is at significant risk from the traffic.

Expand and improve the cycling network, and connect existing cycling routes to keep cyclists safe, and to encourage new cyclists. Give priority, where there is latent or emerging demand, to initiatives that assist with access to and from schools, workplaces, and local commuting trails.

Ensure all urban buses are able to carry bikes, and urban town centres have bike racks.

Ensure there are sufficient, attractive and safe choices for travel between parts of Nga Haerenga the NZ Cycle Trail, supporting the growth of cycle tourism.

When needed, prompt a change in travel behaviour towards increased walking and cycling in urban areas by managing traffic to maintain certain levels of congestion, and/or adapting the supply and pricing of car parking over time; and promoting multi-modal journeys with public transport or ride sharing.

B CASE STUDIES OF NZ CYCLING DESTINATIONS

Otago Central Rail Trail

The highly successful Otago Central Rail Trail has become a model for many of the trail experiences in the New Zealand Cycle Trail. The rail trail (a 150 km 3 to 4 day cycle that can also be used for shorter journeys and for walking and horse riding) was opened in 2000 on the disused Central Otago railway line between Clyde and Dunedin as an initiative aimed at rejuvenating the stagnating local economy. The rail trail passes through spectacular mountain and valley scenery, old gold mining towns and agricultural areas. A wide range of accommodation, attractions (such as heritage sites, arts, wineries, farm visits), tours, food and cafes, sporting activities, bike hire, transport and luggage services are offered by local businesses.

An estimated 12,000 to 15,000 multi-day cyclists and up to 50,000 day cyclists use the Central Otago Rail Trail each year. The trail has an international and domestic reputation as an iconic experience. International visitors comprise over one third of trail visitors and have increased as a proportion of trail users since the trail was opened. Most international trail users come from Australia with significant numbers from Europe, South Africa, the UK and North America. The trail attracts visitors from around New Zealand, predominantly from the upper North Island (nearly two-thirds of domestic visitors in a 2014/15 survey), with lesser numbers of visitors from the nearby Canterbury and Otago regions and the lower North Island⁴⁴. A high proportion of domestic and international rail trail visitors arrived via aircraft to the Queenstown or Dunedin airports.

In 2014/15 it was estimated that the rail trail had resulted in an addition of total economic output of over \$10 million to the Otago and Central Otago economies and 102.4 full time employment equivalents.

The success of the Otago Central Rail Trail in attracting visitors and improving the local economy has owed much to the achievements of the Otago Central Rail Trail Charitable Trust in developing, coordinating and promoting trail experiences (with local tourism organisations), the contribution of the Department of Conservation to infrastructure and recreational experiences, and the collaboration of over 70 local businesses and organisations in offering trail-related products and services.

Queenstown Trails

Queenstown is a premier cycling destination with a global reputation noted for its extensive network of over 190 kilometres of quality cycling and walking trails and facilities for mountain biking. It includes the 120 km Queenstown Trail, part of the New Zealand Cycle Network. Development of the trail network at Queenstown commenced in 2004 under the guidance of the Queenstown Trails Trust, with assistance from the Department of Conservation, the Queenstown Lakes District Council, the tourism industry and local cycling and walking groups. The network offers mainly easy to intermediate level riding on shared cycling, walking and hiking trails ranging from short to full day excursions. There is also a local commuter/recreational trail network within and between local communities which is planned for extension over the next ten years. There are five mountain bike parks that offer riding from beginner to advanced levels and challenging downhill and technical trails at Ben Lomond (accessed by the Skyline Gondola) and Wynyard Terrain Park.

Use of the cycling network varies from a few hundred users on some trails to very large numbers on the most popular sections of the Queenstown Trail between Frankton and Queenstown. In 2015 a total of 214,100 journeys by cyclists, walkers and event competitors was recorded on the Queenstown Trail⁴⁵. About 46% of users of the Queenstown Trail are estimated to be international visitors and a relatively high

⁴⁴ Central Otago District Council (May 2015). Otago Central Rail Trail: User Survey 2014-15.

⁴⁵ Kennedy, M (27 January 2016). Queenstown Trail Visitation, Executive summary for Period - October 01 2012 to December 31 2015.

use of the trail network by local residents⁴⁶. The Skyline/Ben Lomond downhill mountain biking trails (serviced by a gondola) attract about 50,000 to 70,000 riders a year⁴⁷.

Demand for cycling in Queenstown is increasing due to:

- » the quality and promotion of a range of cycling infrastructure and experiences
- » the availability of a wide range of linked, well-promoted and bookable attractions, accommodation, guided and self-guided packages and services such as bike hire and shuttle transport. Some of these are pre-existing business offering products for Queenstown visitors generally, while others are businesses that offer trail-specific products
- » its status as an iconic visitor destination attracting a range of visitors seeking soft adventure and adventure activities
- » ease of access through the Queenstown airport
- » the growth of the local Queenstown population which is forecast to grow from about 30,700 in 2015 to about 57,000 in 2025⁴⁸

Effective planning and management of the trail network by the Queenstown Trails Trust has been critical to its success including through:

- » building an extensive trail network collaboratively across different land tenures
- » fund raising and income generation through grant funding, investments and events
- » partnerships with the Department of Conservation, local community and recreation groups, landholders and businesses for trail development, experience development and trail maintenance.

Rotorua Mountain Biking

The mountain bike network at Whakarewarewa Forest near Rotorua has an international reputation for its mountain biking. The mountain biking network was gradually developed in a forest park designated for a range of recreational activities through the efforts of the local mountain biking club, the Rotorua District Council, funding from the Rotorua MTB Charitable Trust, the use of Department of Corrections labour and development of support services and products by local businesses.

The development of the area for mountain biking has been assisted by Rotorua's status as an established visitor destination with broad appeal to a large market and its accessibility from North Island population centres and Auckland airport. The reputation of the Whakarewarewa Forest trails and visitation levels also grew when it hosted the 2006 UCI World Mountain Bike Championships. Around 102,000 mountain bikers visited the trails in 2009 (an 85% growth from 2005 visitation) contributing an estimated \$8.7 million to the local economy in 2009⁴⁹. This economic contribution grew to \$10.2 million in 2012.

Rotorua offers 150 km of mountain bike trails across a range of disciplines and skill levels, year-round gondola access to downhill trails, on-site bike hire and food services, a technical riding school, guided tours and customised multi-adventure activities. There are also numerous bike shops, bike hire services, guiding, cyclist transport services and cycle-friendly accommodation properties in Rotorua.

Rotorua has hosted international level mountain biking competitions and hosts several major events including the Crankworx Rotorua (part of the Crankworx World Tour) and the 10-day Rotorua Bike Festival. In 2015 Crankworx added about \$3.7 million to the local economy and attracted over 8,000 visitors. The Rotorua facility has been designated a Gold Level Ride Centre by the International Mountain Bicycling Association - the highest IMBA Ride Centre ranking.

⁴⁶ Angus & Associates in association with TRC Tourism (November 2013).

⁴⁷ TRC Tourism (2015). Queenstown Trails for the future 2015-2025. Prepared for the Queenstown Trails Trust.

⁴⁸ Queenstown Lakes District Council (2015). Long Term Plan 2015.

⁴⁹ APR Consultants Ltd (2009). Recreational Use and Economic Impact of Whakarewarewa Forest: 2009 Update.

C SURVEY OF SOUTHLAND CYCLISTS

As part of the development of the Southland Cycling Strategy a survey was conducted of Southland cyclists to ascertain cycling activities undertaken and their thoughts on the quality of cycling experiences in the region and how they could be improved. The online survey was distributed to contacts through the Venture Southland databases and attracted 339 responses. The survey respondents covered a range of ages – 1.75% were aged under 18 years, 6.3% between 18 and 29, 30.8% between 30 and 44, 41.4% between 45 and 59 and 19.6% over 60 years. The people surveyed participated in a range of cycling activities.

Cycling activity	Daily % (No.)	Weekly % (No.)	Monthly % (No.)	In last year % (No)	Total (No.)
Road riding - training	15.38% (10)	44.62% (29)	15.38% (10)	24.62% (16)	65
Road riding - recreation	6.13% (10)	43.56% (71)	25.15% (41)	25.15% (41)	163
Road riding –transport/ commuting	36.11% (39)	29.63% (32)	11.11% (12)	23.15% (25)	108
Recreational riding on local cycle trails	10.71% (21)	31.63% (62)	31.12% (61)	26.53% (52)	196
Mountain bike riding on local trails	8.02% (13)	46.30% (75)	24.07% (39)	21.69% (35)	162
Track cycling - velodrome	1.96% (1)	15.69% (8)	13.73% (7)	68.63% (35)	51
Around the Mountains Cycle Trails	4.48% (3)	2.99% (2)	13.43% (9)	79.10% (53)	67
Otago Central Rail Trail	1.82% (2)	0.91% (1)	9.09% (10)	88.18% (97)	110
Queenstown Trail	2.13% (2)	4.26% (4)	12.77% (12)	80.85% (76)	94

Issue

Views of survey respondents

Investment in cycling

- » 83% considered that investment in cycling could lead to community benefits
- » 81% agreed cycling was a good investment for councils – though opposition was expressed by a small number
- » Caution was expressed by some respondents – such as investment in new mountain bike trails which may receive limited use in winter and impacts on other recreational users (such as permitting cycling on walking trails).

Cycling for transport

About 62% agreed it was viable in Southland, but only 29% cycled regularly for transport (once a month or more).

Urban cycling facility needs

Most emphasis was on bike racks or storage at destinations. Some indicated need for changing and showering facilities at workplaces.

Road safety

Safety was a major concern with around 56% concerned about the safety of cycling on urban roads and 71% concerned about cycling safety on roads outside of cities and towns.

Road cycling infrastructure

- » Desirability of more (or better designed) cycle lanes in Invercargill
- » Safe linkages along cycling routes and between cycle lanes and cycle paths
- » Wider and smoother road shoulders or cycle lanes on highways and rural roads
- » Cyclist warning signs.

Quality of recreational cycle trails

- Varied views were expressed.
- » 46% considered trails were of good quality, but 40% were neutral
 - » 59% saw a need for more recreational cycle trails, with 63% wanting more trails suitable for families
 - » Suggestions included completing the Invercargill to Bluff Trail; trails in the Catlins; between Gore and Lumsden; in the Te Anau areas and connections from the ATMCT to Te Anau and further south.

Facilities for recreational and tourism cycling

- » Provision of toilets along routes and trails a major concern.
- » Provision of car parking, shelter, drinking water, signage and information.
- » Better maintenance of roads and trails, including removal of broken glass.
- » More camping and accommodation, cafes and bike hire near or along routes.

Preferred mountain biking destinations

- » Availability of mountain biking facilities close to population centres is important – 70% of respondents preferred to ride in the Invercargill area at Sandy Point or Bluff.
- » A smaller number had preferred rides dispersed throughout the region including Gore, Te Anau and a variety of 4WD and management trails in Fiordland National Park, Longwood, Mavora and areas north of Mossburn and Lumsden.
- » Some preferred to ride in the Queenstown and Wanaka areas.

Mountain biking facility needs

- » More trails at existing or new locations including a greater variety of difficulty levels and trails suitable for families and younger riders.
- » Some sought professionally designed, purpose built trails or better maintenance of existing trails
- » Wash down facilities, toilets.

D SOUTHLAND CYCLING AUDIT

The following table summarises Southland's range of cycling and associated infrastructure and services.

Name/ Location	Use	Access	Infrastructure, Routes & Connections	Associated Experiences, Services & Partnerships	Planning, Tenure & Management	Issues, Opportunities & Gaps
COMMUTER CYCLING						
Invercargill cycle network	Relatively light use. 1- 2% of all road users	Various access points. East – west connections most well developed.	On-road cycle lanes 80% - 90% complete. Last 10 – 20% more difficult to complete and justify given low use and lack of traffic congestion.	No additional services	Public Roads (ICC)	Focus on quality improvements including making the Oreti Beach to City route more safe and attractive to cyclists.
ROAD RIDING ROUTES						
Myross Bush Loop 26 km – can be extended 16km by adding loop from the Mill Road North- Bainfield Road intersection	No data on the level of use.	From the Velodrome at Surrey Park.	Rides are on public roads. No supporting infrastructure	No additional services	Public roads	Improved signage and recognition as a cycling route. Safety audit of road would benefit cyclists.
The Catlins 80km – 170 km of options for all grades	No data on the level of use.	From Invercargill many options to Fortrose and beyond.	Rides are on public roads. No supporting infrastructure	No additional services	Public roads	Improved signage and recognition as a cycling route. Safety audit of road would benefit cyclists.
Riverton to Tuatapere 50 km point to point ride from Riverton	No data on the level of use.	Can ride from Invercargill	Rides are on public roads. No supporting infrastructure	No additional services	Public roads	Improved signage and recognition as a cycling route. Safety audit of road would benefit cyclists.
Hedgehope Loop 75km traditional Invercargill training ride.	No data on the level of use.	From Invercargill	Rides are on public roads. No supporting infrastructure	No additional services	Public roads	Improved signage and recognition as a cycling route. Safety audit of road would benefit cyclists.
Gore District	No identified popular routes	From Gore	Rides are on public roads. No supporting infrastructure	No additional services	Public roads	Improved signage and recognition as a cycling route. Safety audit of road would benefit cyclists.

Name/ Location	Use	Access	Infrastructure, Routes & Connections	Associated Experiences, Services & Partnerships	Planning, Tenure & Management	Issues, Opportunities & Gaps
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ROAD RIDING - TOURISM ROUTES

Southern Scenic Route
610 km scenic drive route between Queenstown and Dunedin that is also promoting as a road cycling route. In Southland cycling mostly occurs between Invercargill, Riverton, Tuatapere and Te Anau.

Less than 1,000 cycle tourists a year.

Route is between Queenstown and Dunedin.

The Southern Scenic route is signposted with brown tourism signposting.

Range of accommodation.

Rides are on public roads.

Improved promotion. Safety audit of road/cycle issues. Route through Invercargill not ideal. Economic development opportunities in Manapouri, Tuatapere, Riverton, Curio Bay.

Catlins Coastal Route
From Balclutha through the Catlins to Invercargill

Southern Traverse
From Invercargill to Lumsden

ROAD RIDING EVENTS

Tour of Southland
Multi stage road race attracting international- standard riders

20 teams but much larger range of other associated events and users

Route varies but includes stages in Queenstown Lakes District in addition to Southland

Sponsored by SBS Bank

Cycling Southland

Well established professional road race. Previously category 2.2 UCI International Tour event, but lost this rating in 2014 due to costs⁵⁰.

ICC Surf to City
Participation based walking/running/ cycling event.

2,000+ participants, with numbers increasing.

Oreti Beach to City

Invercargill City and Sport Southland

Would benefit from improvements to the route. General opportunity to promote cycling in Invercargill.

Milford Mountain Classic
January road race with 120 km, 100 km (Richoh Homer Hundred) and 65 km (Eglington Challenge) events between Milford and Te Anau

Courses suitable for good recreational riders, club riders and elite riders.

Milford to Te Anau

State Hwy 94

Several sponsors, including Meridian Energy.

Invercargill City and Sport Southland

Tour de Lakes
Annual road race with stages held in Southland, Central Otago and the Queenstown area. Provides events for different grades.

⁵⁰ Personal communication from Cycling Southland.

Name/ Location	Use	Access	Infrastructure, Routes & Connections	Associated Experiences, Services & Partnerships	Planning, Tenure & Management	Issues, Opportunities & Gaps
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ROAD RIDING - TOURISM ROUTES

Yunca Junior Tour of Southland

Two day six stage event for 13 to under 19 grades

170 – 200 riders.

Teretonga, Hedgehope and other locations

Teretonga Racetrack Local roads

Sponsored by Yunca

Cycling Southland

Southland Road Champs

Time trials held annually in April. Under 15s to Masters

No Info available

Invercargill Velodrome

Within the city area

Cycling Southland

A highly competitive "elitist"

Wednesday World" series of road rides are offered within daylight saving dates on Wednesday evenings

up to 60 riders attending

Invercargill Velodrome

Within the city area

Cycling Southland

Westpac Rescue Helicopter Charity Ride Frankton to Invercargill

Fundraiser limited to 60 riders.

TRACK CYCLING FACILITIES

SIT Zero Fees Velodrome, Invercargill

World Class cycling facility, that was once New Zealand's only indoor velodrome and was instrumental in establishing the sport in the country.

Invercargill

250 metre timber indoor track

Hosts elite cyclists and some major cycling events, such as the UCI Junior Track World Championships in 2012 and biannually national championships

Cycling Southland

Opportunities to develop learn to cycle and disabled and elderly Education/Community side every strong. Event opportunities such as Masters Cycling.

TRACK CYCLING EVENTS

National Age Group Championships

Invercargill SIT Velodrome

Elite riders – age group riders from under 15s to masters

Cycling Southland

Crowe Horwarth Corporate Pursuit Annual cycling challenge run as Italian pursuit. Held in August

ILT Junior Track Carnival held in October Two day event for elite junior cyclists from New Zealand and Australia

Invercargill SIT Velodrome

Elite riders – Junior

Cycling Southland

Name/ Location	Use	Access	Infrastructure, Routes & Connections	Associated Experiences, Services & Partnerships	Planning, Tenure & Management	Issues, Opportunities & Gaps
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OFF-ROAD TRAILS

<p>Around the Mountains Cycle Trail (ATMCT) Proposed as a circuit – Queenstown/Lake Wakatipu, Mount Nicholas Station, Oreti Valley, Lumsden, Kingston, Queenstown. Part of the New Zealand Cycle Trail. Oreti Valley section is not completed as it is subject to an appeal.</p>	<p>Easy track grade 1-3. 185 km total trail when completed. Can be done as a complete ride or broken into sections. Athol Bridge Counter showed 7,240 users Nov 15 – Feb 16 15,000 uses per annum Up to 12,000 multi-day users per annum and 50,000 day users projected within 5 years of the trail and enabling services.</p>	<p>45 minutes from Queenstown 1 hour from Te Anau 1 hour from Wanaka. Trail begins and finishes near Queenstown which has direct international flights to and from Australia, a major cycling market.</p>	<p>Begins with the TSS Earnslaw cruise from Queenstown across Lake Wakatipu, then extends south into rural Southland and returns to Lake Wakatipu. 156 km of the trail is open Multi-day ride or short ride combinations available.</p>	<p>Begins with lake cruise on steamship TSS Earnslaw. Earnslaw – Real Journeys. Shuttle transport, cycle hire and guided and independent day and multi-day cycling packages with accommodation are offered (http://www.aroundthemountains.co.nz/our-rides/)</p>	<p>SDC Lead other agencies as land administrators QLDC/NZTA/LINZ/DOC/Landcorp</p>	<p>Resource consent granted but has been appealed. Decision to be announced in 2016. Over \$10 million spent of potentially \$14 million project. Strong political interest. Potential to release economic and social opportunities for small communities. If not completed will become a series of shorter day rides.</p>
<p>Eyre Mountains/Taka Ra Haka Conservation Park Tracks</p>	<p>Very low</p>	<p>Upper Oreti, Mount Bee, Shepherd Creek Mataura River</p>	<p>Many tracks for mountain biking with a variety of scenery and cycling terrain. 25 km + of tracks from the campsite to Boundary Hut and Forks Hut in the Mavora Lakes Conservation Park.</p>	<p>Remote and front country trails primarily on 4WD tracks</p>	<p>Conservation Park</p>	<p>Improved promotion of opportunity</p>
<p>Mavora – Greenstone Walkway</p>	<p>Low</p>	<p>From State Highway 94 between Mossburn and Te Anau.</p>	<p>Hut in the Mavora Lakes Conservation Park.</p>			

COMMERCIAL TRAIL TOURS

<p>Around the Mountains Small group guided cycling tours on the ATMCT</p>		<p>Sherpa Shuttle bus service available from November to mid April operating 7 days a week.</p>		<p>Tour offered as a partnership between Real Journeys and the Around the Mountains Cycle Trail.</p>	<p>Cycle tour company has been operating since 2010.</p>	
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Location	Grade	Access	Facilities	Management	Notes
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MOUNTAIN BIKE PARKS AND TRAILS

Elizabeth Park BMX track	Moderate but static	Off John Street and Lime Street, Invercargill	Jump park with no buildings		Lease from ICC Potential for relocation to Surrey Park to improve connection with cycling
Sandy Point Mountain Bike Trails 17km of mostly grade 3 single track at Invercargill	Easy and Intermediate grade track. High Use Limited by sandy and flat terrain.	From Sandy Point Road	Toilets, car park, signage.		Managed by Southland Mountain Bike Club Forestry activity necessitates the need for trail redevelopment from time to time.
Bluff Hill Cross Country Tracks	High Use				Invercargill City Council
Gore Mountain Bike Track		From Pope Road			Gore District Council/ Department of Conservation
Ivon Wilson Park, Te Anau					
Perenuka Mountain Bike Park, Te Anau 10km of trails on private land	New facility in 2015		Single track	Constructed by landholder with community assistance	Private land
Longwoods Forest, Orepuki Riding on management tracks	One of the most popular backcountry endurance rides in Southland.		Most well known route is the 47km trail to Bald Hill, from which there are extensive views.		Department of Conservation/ Private Land
Eyre Mountains Riding on management trails.					Department of Conservation.

MOUNTAIN BIKE PARKS AND TRAILS

<p>Welcome Rock Trails Privately-operated track on a high country sheep station in northern Southland on the border with the Otago District.</p>	<p>Intermediate grade 3 track recommended for experienced single track riders Shared use trail also used for hiking.</p>	<p>1 hour and 5 minutes from Queenstown. A shuttle service is available from Queenstown and Te Anau to Garston.</p>	<p>27km single loop grade 3 track that can also be hiked. Starts at the Southland Ski Hut and loops back to same point. It costs \$40 per adult to ride the trails. Two huts and a campsite on the trail are operated by Welcome Rock Trails and can be booked online.</p>	<p>High country scenery. Accommodation on the hut in several forms: the historic Mud Hut, the modern Slate Hut, the converted wool shed known as the Iron Hut, and the Roaring Lion Camp. Baggage can be delivered to huts. Glamping accommodation available.</p>	<p>Private trail on private land, track was constructed by landowner.</p>
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Management trails in Fiordland National Park
Endurance rides permissible on management trails, including the Borland Road, Percy Saddle and links to West Arm and Lake Manapouri.

Department of Conservation

COMMERCIAL MOUNTAIN BIKE TOURS

None identified

MOUNTAIN BIKE EVENTS

<p>The Farm Jam Held in March, combines natural-terrain freestyle motocross, BMX dirt and mountain-bike dirt-jumping</p>		<p>Winton, Central Southland</p>
<p>Bannockburn Gutbuster Between northern Southland and Central Otago District</p>	<p>188 participants</p>	<p>Winton, Central Southland</p>
<p>250 participants in winter series</p>		<p>Winter cross country series monthly event May- October.</p>
<p>The Glenham Trainwreck Ride</p>	<p>around 120 competitors</p>	<p>Winton January Eastern Southland</p>
<p>Southland Mountain Bike Clubs</p>	<p>Info not available</p>	<p>Mid-winter 4 & 8 hour Enduro (Sandy Point Mountain Bike Track)</p>

Name/ Location	Use	Access	Infrastructure, Routes & Connections	Associated Experiences, Services & Partnerships	Planning, Tenure & Management	Issues, Opportunities & Gaps
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MOUNTAIN BIKE EVENTS

Moonshine Trail Gore District mountain bike and running event for 15 years and over, various distances.	204 participants in 2016	Dolamore Park	Some of the event is on private farmland only opened once a year for the event	Sponsored by Mataura Licensing Trust	Coordinated by Sport Southland	
Mount Linton Muster Mount Linton Station near Ohai and Nightcaps	About 130 participants		Courses range from 12 km to 40 km.			
Meridian Whitehill Windfarm Classic Held near Mossburn	120 participants in 2016		25 km course.			

BICYCLE SHOPS AND SERVICES (ROAD AND MTB)

Ride Cycles Invercargill	Stocks road bikes, mountain bikes and bikes for leisurely recreational riding.			Organisers Tweed Rides — social rides at a leisurely pace on safe routes visiting places of interest in and near Invercargill ⁵¹ .		
Cycle Surgery Invercargill	Stocks road and mountain bikes, parts and equipment. Bike repairs and service. Bike hire.					
Wensley Cycles Invercargill	Stocks road and mountain bikes, parts and equipment. Bike repairs and service					
Outdoor @ H & J Smith Invercargill	Stocks road and mountain bikes, parts and equipment. Bike repairs and service					
Cross Road Cycles Gore	Stocks road and mountain bikes, parts and equipment. Bike repairs and service					
Outside Sports Te Anau		Stocks road and mountain bikes, parts and equipment. Bike repairs and service. Bike hire				

⁵¹ Kennedy, D. (20 October 2015). Why Invercargill Should be a City of Cyclists. <http://localbodies-bsprout.blogspot.com.au/2015/10/why-invercargill-should-be-city-of.html>; Ride Cycles Facebook Page. <https://www.facebook.com/Ride-Cycles-375007025903133/>

Name/ Location	Use	Access	Infrastructure, Routes & Connections	Associated Experiences, Services & Partnerships	Planning, Tenure & Management	Issues, Opportunities & Gaps
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BICYCLE SHOPS AND SERVICES (ROAD AND MTB)

Te Anau Mini Golf, Quadricycle and Bike Hire
Te Anau

Bike hire

Oban Visitor Centre
Stewart Island

Visitor information and bike hire

Six mountain bikes available for hire

CYCLING CLUBS AND ASSOCIATIONS

Cycling Southland Club runs approximately 8 major events each year

300 members Membership and participation static

From Invercargill Velodrome generally.

Sponsored by major supporting sponsors - ILT Foundation, SBS Bank, Yunca, SIT Zerofees, The Lion Foundation, Community Trust of Southland, Vital Signs

Cycling Southland

Southland Mountain Bike Club
Based at Invercargill

Has various local sponsors. Club maintains Bluff Hill Trails and Sandy Point Tracks

Hokonui Bikers

Social groups of MTB riders associated with the Southland Mountain Bike Club. Run regular rides.

Te Anau Cycling Inc
Focusses on the range of cycling in the area

40 members

Fiordland Trails Trust

Southland BMX Club

Moderate

Elizabeth Park, Invercargill

Sponsored by Wensley's Cycles, ILT, Community Trust of Southland

Lease from ICC

Potential for relocation to Surrey Park to improve connection with cycling

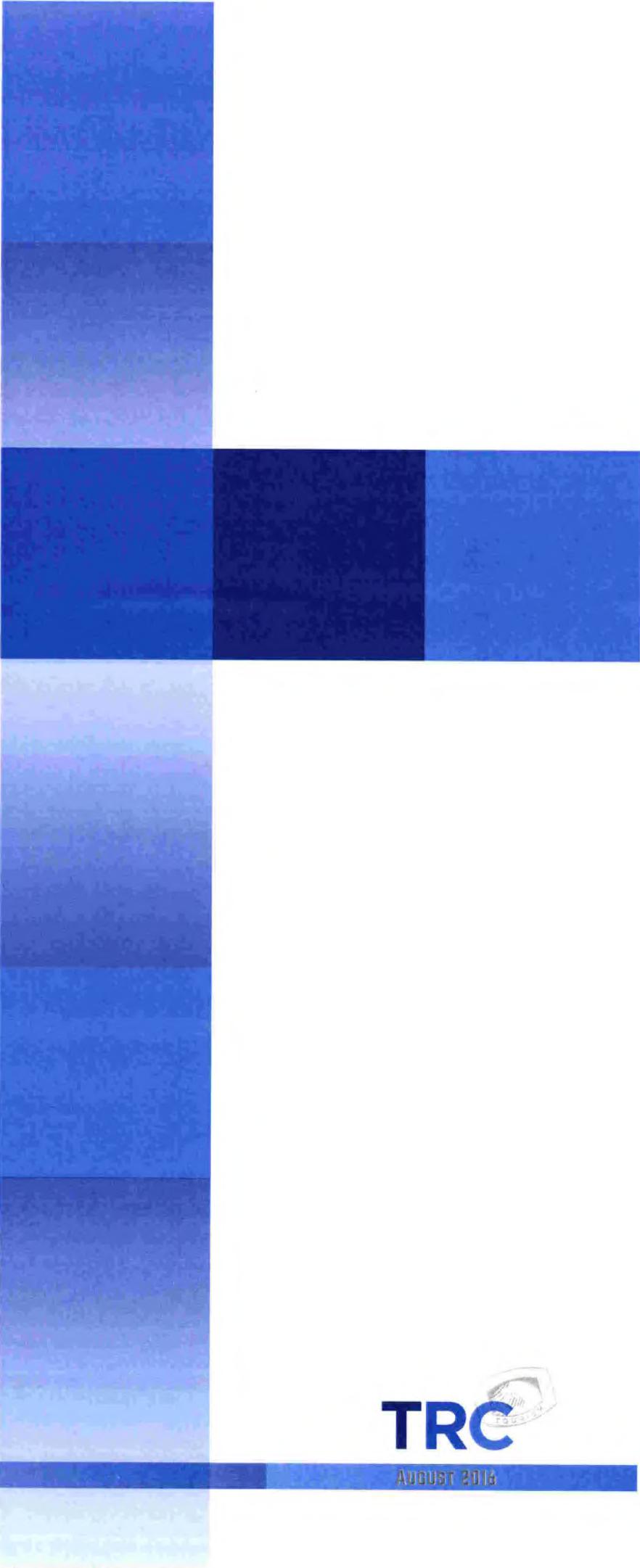
Gore BMX Club and track

Low

Hamilton Park, Gore

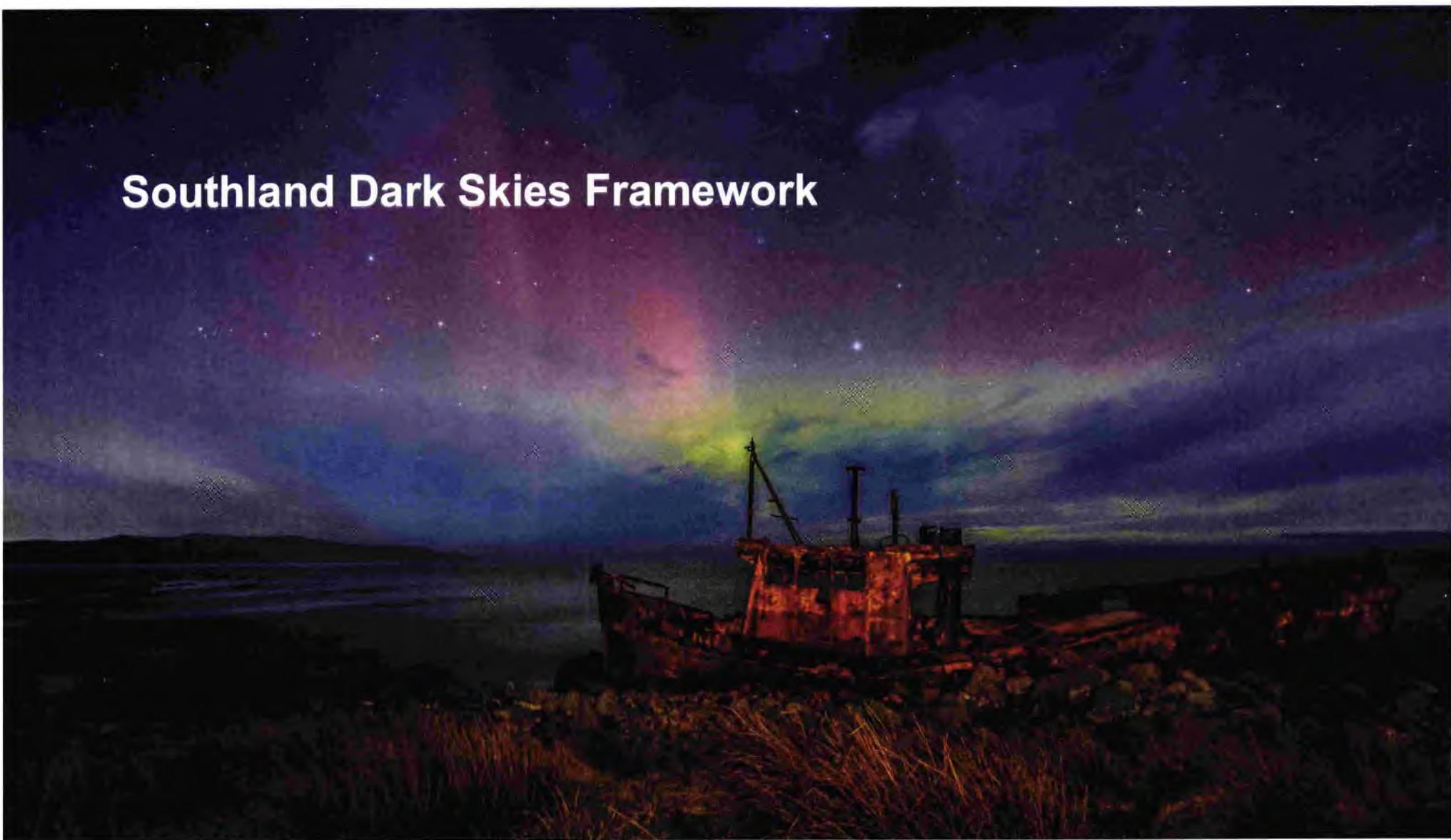
Lease from GDC

Low profile/ viability of club



AUGUST 2016

Southland Dark Skies Framework



Draft November 2017
Venture Southland



F₂

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1 Introduction

The night sky is one of the natural treasures of Southland. We are fortunate that the effects of light pollution in Southland is largely limited to Invercargill City and most rural residents can experience a relatively dark sky where the milky way is clearly visible on clear nights.

As Southland grows with further residential and industrial development there is a risk that the ability to see the night sky will diminish because of light pollution. The glow from street lighting in Invercargill can already be seen across Southland.

The increased and widespread use of artificial light at night is not only impairing our view of the universe, it is adversely affecting our environment, our safety, our energy consumption and our health.

The inappropriate or excessive use of artificial light – known as light pollution – can have serious environmental consequences for humans, wildlife, and our climate. Components of light pollution include:

- **Glare** – excessive brightness that causes visual discomfort
- **Light trespass** – light falling where it is not intended or needed
- **Clutter** – bright, confusing and excessive groupings of light sources
- **Sky glow** – brightening of the night sky over inhabited areas¹

There is a growing awareness of the effects of light pollution worldwide. About two thirds of human population today live under light polluted skies, not dark enough to see the Milky Way

Urban sky glow is the result of stray light being scattered in the atmosphere brightening the natural sky background level. This effect is extremely detrimental to astronomers as well as annoying to many people in the general public.

This Southland Dark Skies Framework seeks to establish a framework for maximizing opportunities associated with Southland night sky.

If we are to light our streets, parks, workplaces and homes some amount of sky glow is unavoidable as light is reflected off the ground back into the sky. The way many places are currently lit however results in unnecessary and avoidable light pollution and energy wastage.

Normally such pollution and wastage is a result of a lack of awareness of the effect of stray light and insufficient attention to the proper design and control of the light needed for a specific application.

Recent public interest in aurora activity and Southland's ideal geographical position to observe the southern lights, Southern Cross and the Milky Way highlight the importance of the night sky to Southland. Rakiura itself takes its name from the glowing skies of this region, the aurora lights.

Putting in place a framework to help protect and promote the quality of Southland's night sky will produce better outcomes for Southlanders including improving the environment we live in and create opportunities for tourism associated with star-gazing.

¹ <http://www.darksky.org/light-pollution/>

2 Executive summary

Light pollution can be easily controlled and reversed if we make good decisions about public and private lighting.

At present Southland has exceptional quality night skies – with little if any light pollution – on Stewart Island, in Fiordland National Park and in much of rural Southland. However, in our towns and cities our street lighting and some key industrial sites are significant contributors to 'sky glow' which effects our ability to see the stars and aurora from within out towns and cities.

Six key steps are needed to minimise light pollution and maximize the benefits to Southland of having naturally dark skies. These are:

1. Commit to a lighting policy across Southland that ensures street lights and other public lighting is designed to reduce light pollution and aimed downward
2. Ensure the imminent street light upgrade programmes proposed by the Invercargill City and Gore and Southland District Council's use LED lights that are correctly aimed downward, are warm white (for reduced sky pollution) and of appropriate output for the situation
3. Develop improved planning rules for inclusion in District Plan's to mitigate the effect of light pollution across both public and private lighting
4. Improve education and recognition of the benefits of a dark sky and provide simple and cost effective lighting solutions for households and businesses

5. Gain international recognition for the quality of Southland's skies by establishing the Rakiura – Stewart Island Dark Sky Sanctuary and Fiordland National Park Dark Sky Reserve
6. Support communities who wish to become internationally recognised as Dark Sky Communities

Southland has a unique opportunity to be world leading as a region because of the imminent plans to replace almost all of the street lighting in Southland within the next one to two years with LED street lights.

If good decisions are made with respect to these lighting upgrades, then Southland will be well placed to improve the condition of the night sky and protect it for future generations. Failure to influence the street lighting upgrade programme will limit the opportunities for Southland to be a dark sky region and be internationally recognised for the quality of its night skies.



Figure 1 Waipapa Point - Kea Photography

3 Situation analysis

3.1 The Southland Night Sky

The quality of the night sky in Southland is still very good. The growth in the dairy sector has seen the development of significant dairy sheds and processing factories with associated industrial lighting and these have increased the amount of sky glow but such installations are relatively isolated.

The majority of Southland experiences natural darkness or close or natural darkness. One way to measure the quality of the night sky is by measuring *surface brightness* in magnitudes per square arcsecond. Surface brightness is useful way to express natural and artificial sky glow.

Figure 2 shows the 'hot spots' of light pollution in New Zealand. Figures 8-13 show more detailed light pollution estimates from Jurij Stare's Light Pollution Map which displays light radiance from NOAA and SQM data from the Unihedron reading database.

The following table gives a crude estimate of sky glow in magnitudes per square arcsecond for various different environments on a moonless night with good transparency²:

- 17.0 poor urban skies
- 18.0 good urban skies, poor suburban skies
- 19.0 fairly good suburban skies
- 20.0 very good suburban skies
- 21.0 typical rural skies
- 22.0 ideal dark-sky site

² <https://tonyflanders.wordpress.com/surface-brightness/>

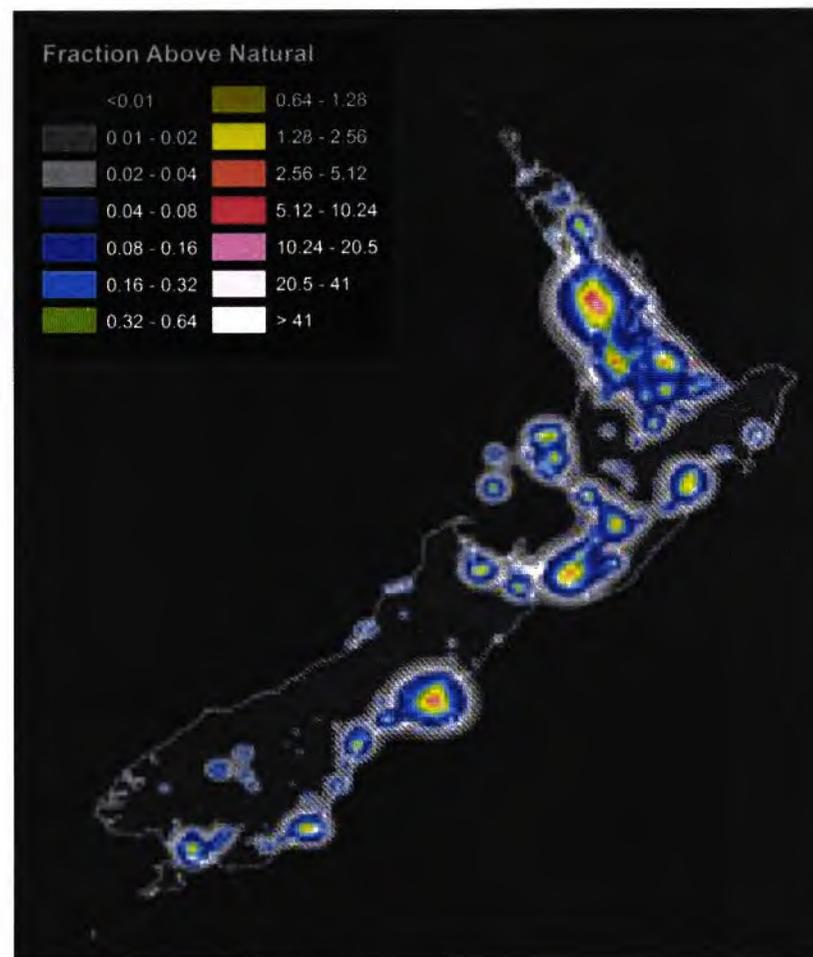


Figure 2 World Light Atlas image of New Zealand

In general skies in Southland are recorded at levels above 20.0 magnitudes per square arcsecond showing that relative to other areas, Southland skies are very good quality.

3.1.1 INVERCARGILL CITY

As Southland’s urban centre, Invercargill City (figure 2) produces the most significant amount of sky glow with the main contributor being the street lighting network. Outside of the residential areas of the city sky glow is significant out to Wallacetown and Longbush.

In particular the tear-drop lanterns on Dee street produce significant light spill. Industrial sites at Awarua, Kennington and Lorneville are also noticeable. Sky quality readings undertaken by Xyst surrounding Invercargill City showed sky quality compared to very good suburban skies.

Table 1 Sky Quality Readings Invercargill

Location	Average SQM
Queens Park Cricket Oval	19.75
Stead Street Wharf	20.31
Oreti Beach	21.39
Estuary Walkway Lookout	20.31

Improvements to street lighting would have a significant effect on levels of light pollution

3.1.2 BLUFF

Bluff (figure 3 - 4) is dominated by light pollution from the Port and Tiwai Aluminium Smelter. While there are a lot of light sources at the Port, many of these could be re-aimed or time controlled to reduce light pollution and energy consumption.



Figure 3 Lights of Bluff Port and Invercargill beyond



Figure 4 Tiwai Smelter lighting

There are also opportunities to reduce light pollution at the smelter which is producing high amounts of light pollution, in particular at the wharf terminal (figure 4).

Sky quality readings undertaken by Xyst at Bluff showed sky quality compared to typical rural skies.

Table 2 Sky Quality Readings Bluff

Location	Average SQM
Bluff Hill	21.30
Stirling Point	21.24

Improvements to lighting at South Port and the Tiwai Smelter would like have a significant effect of levels of light pollution.



Figure 5 Oban street lighting

³ The New Zealand King Salmon Company Limited: Assessment of Environmental Effects - Submerged Artificial Lighting – Crawthorn Report No. 1982 August 2011

3.1.3 RAKIURA - STEWART ISLAND

There are 41 street lights on Stewart Island most of which are well controlled (figure 5) and private owned lighting is minimal. Recently installed LED floodlights on the wharf buildings however are significant contributors to light pollution and demonstrate how one or two poorly selected light fittings can have a disproportionate effect on light pollution (figure 6 and 7).

Sky quality readings undertaken by Xyst at Rakiura showed sky quality compared to an ideal dark sky site.

Table 3 Sky Quality Readings Rakiura-Stewart Island

Location	Average SQM
Lee Bay	21.66
Horseshoe Bay	21.52
Butterfield Beach	21.85
Mill Creek	21.80
Trail Park	21.81
Observation Rock	21.79
Evening Cove	21.83
Deep Bay	21.79

Improvements to public and private lighting would further enhance the quality of the night sky.

Outside of Halfmoon Bay, light sources are limited to aquaculture activity in Big Glory Bay. Light spill from aquaculture appears minimal as underwater lighting is directed downward and has little effect on the night sky³.



Figure 7 Oban - Note LED Floodlights on Wharf Building



Figure 6 Symmetrical LED floodlight at wharf

3.1.4 EASTERN SOUTHLAND

Lighting in Eastern Southland including Balfour, Riversdale, Gore and Maitua is largely limited to townships and a few industrial and mining sites.

Sky quality readings undertaken by Xyst in Eastern Southland showed sky quality compared to fairly good suburban skies to typical rural skies.

Table 4 Sky Quality Readings Eastern Southland

Location	Average SQM
Balfour	20.83
Riversdale	19.37
Mandeville	21.47
Croydon Bush Road	21.44
Gore Domain	19.98
Hamilton Park	21.55

Improvements to public and private lighting would further enhance the quality of the night sky.

Given the quality of the night skies in the surrounding rural areas, lighting within the townships is having a disproportionate effect on light pollution. Improvements in the public street lighting network will have a significant impact in reducing light pollution and demonstrate leadership that may encourage industrial and mining sites to improve their lighting also.

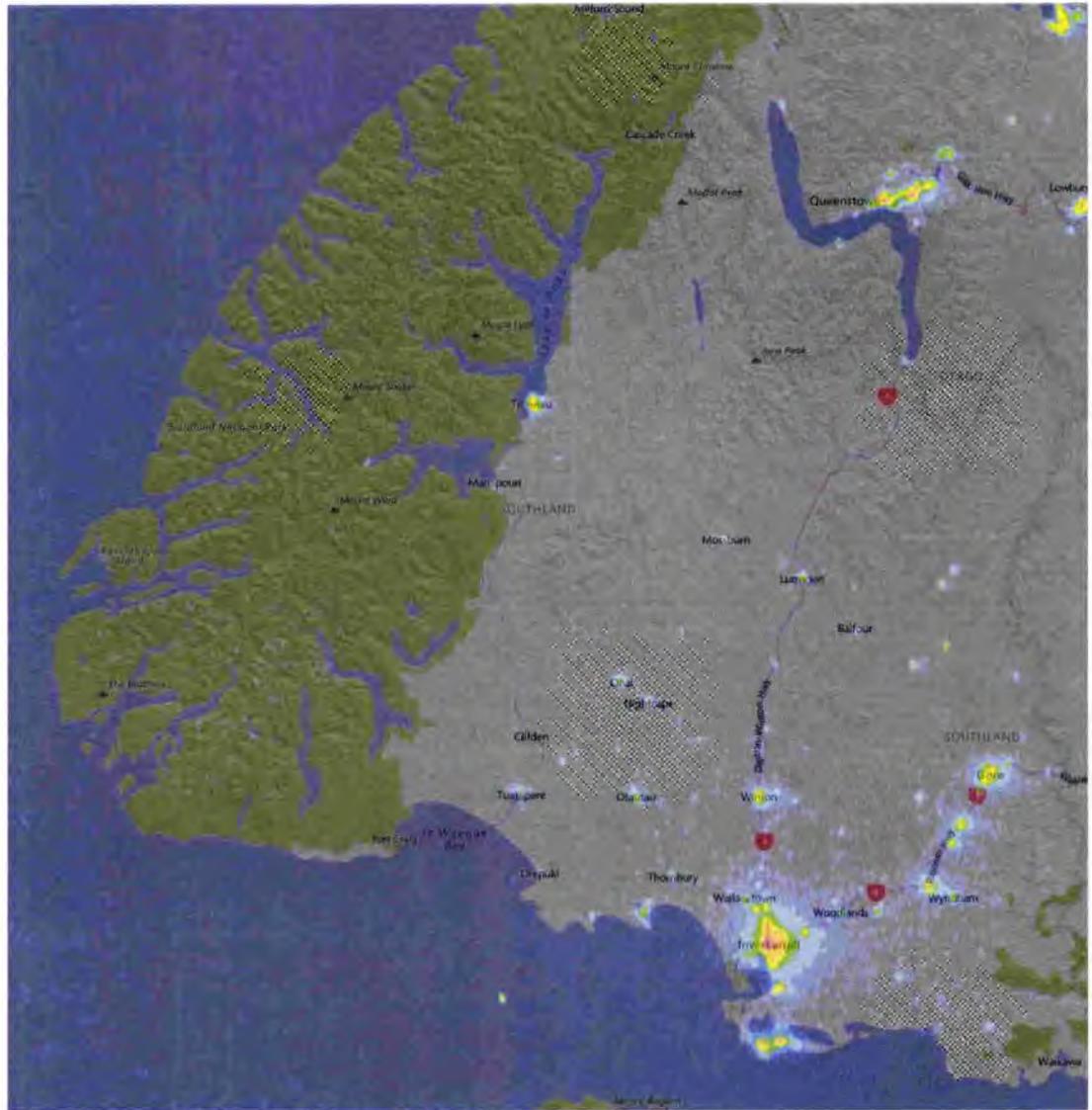
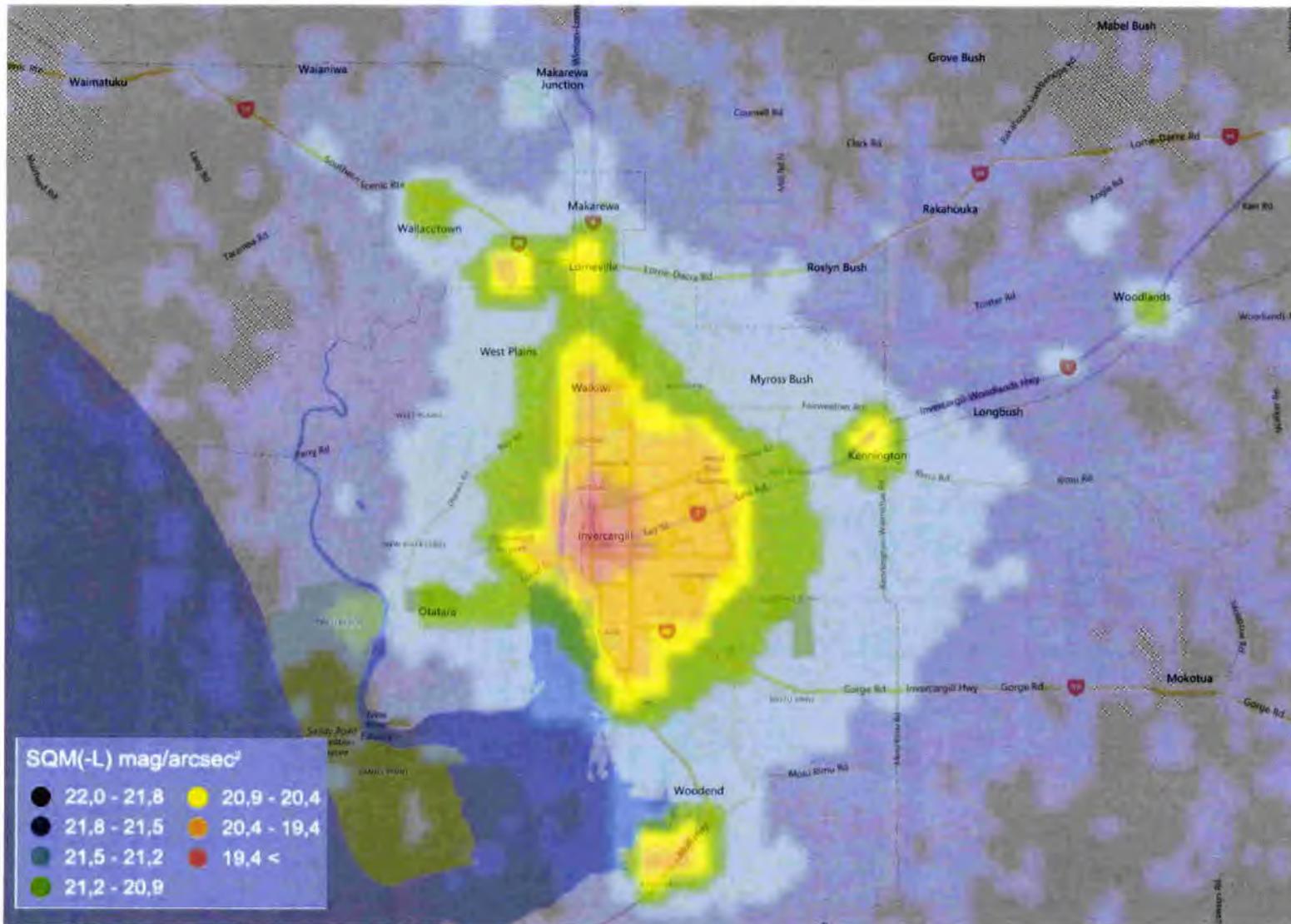


Figure 8 Southland Region Light Pollution <http://www.lightpollutionmap.info/>



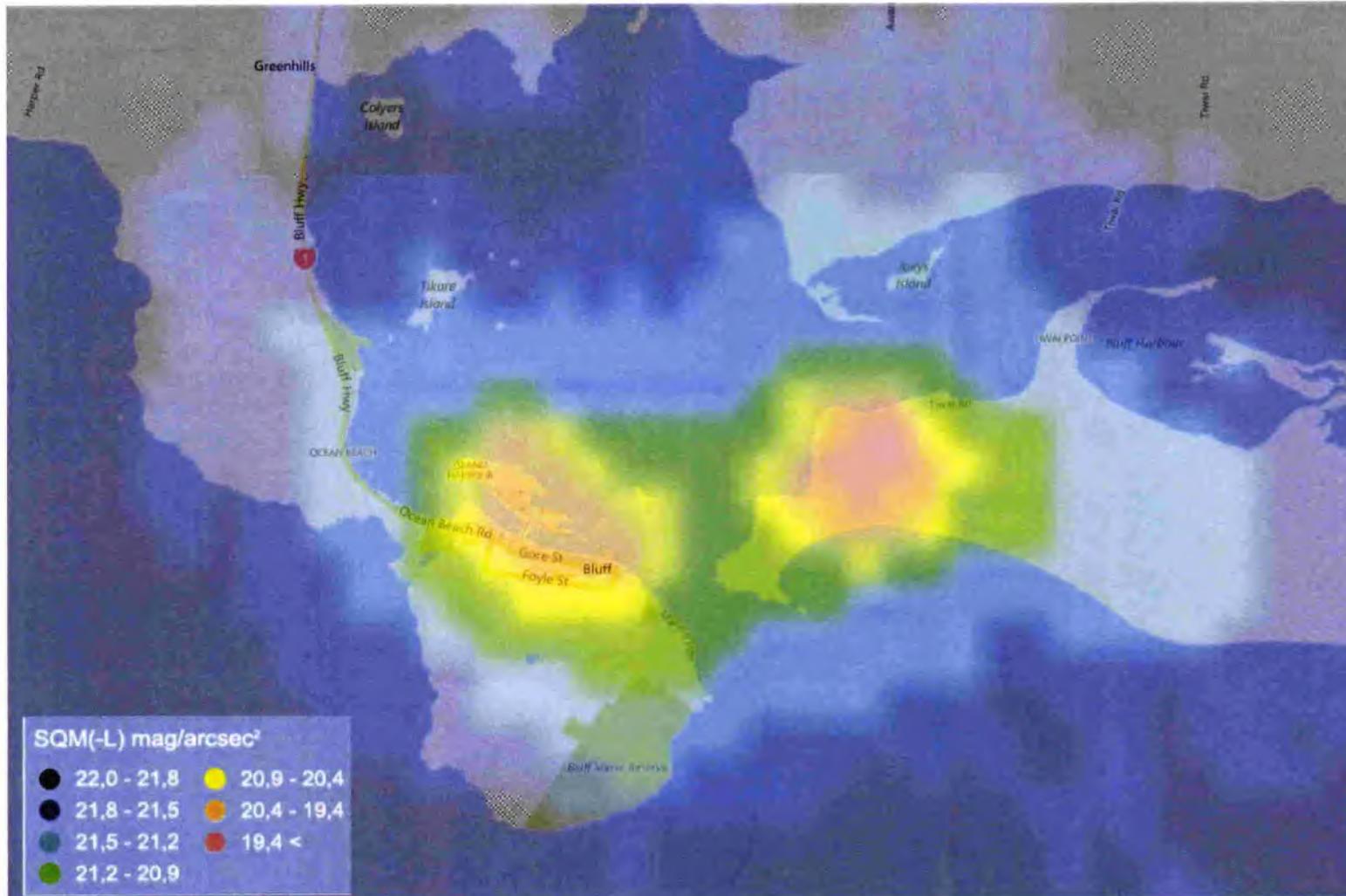


Figure 10 Bluff and Tiwai Light Pollution <http://www.lightpollutionmap>

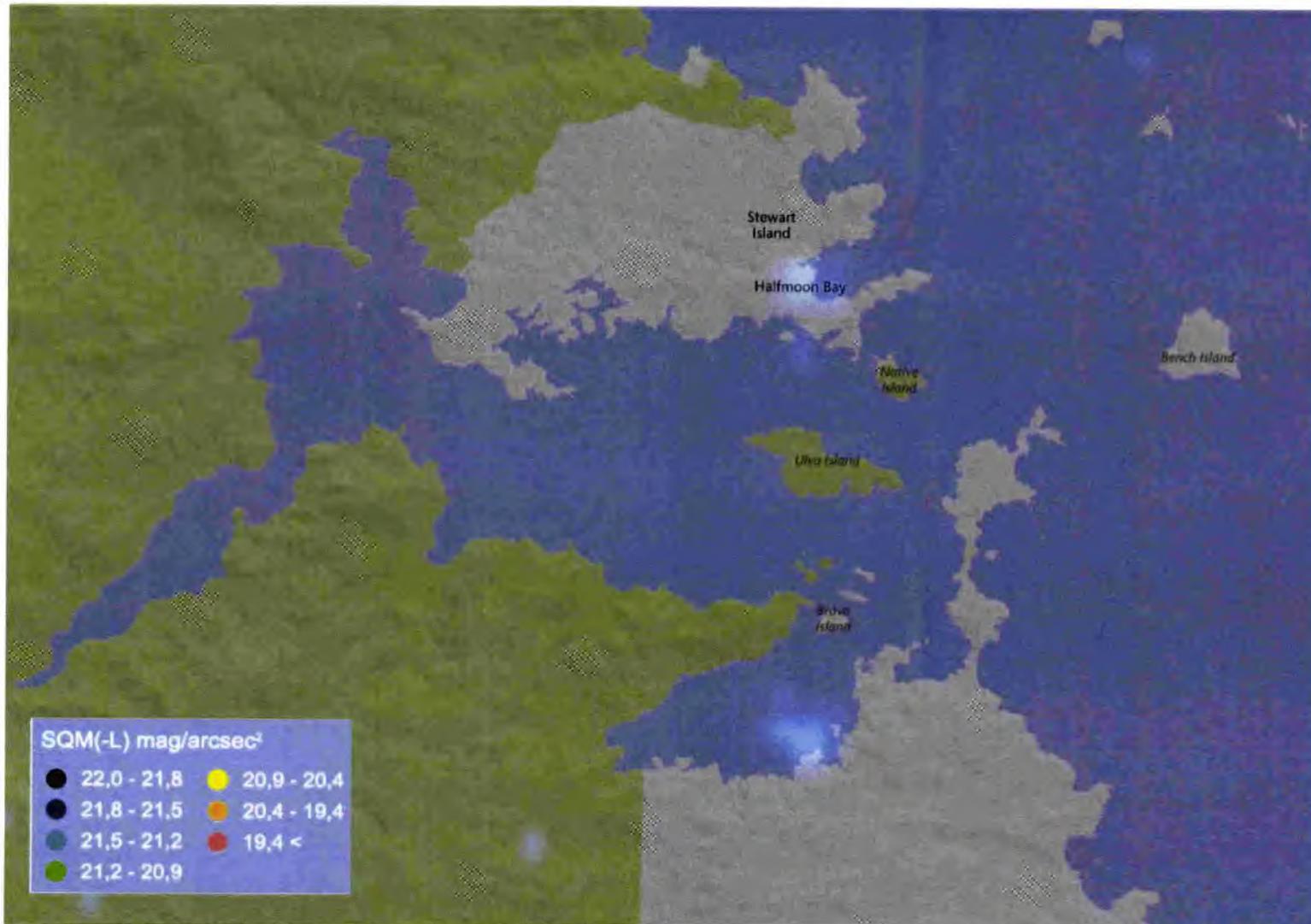


Figure 8 Stewart Island Light Pollution <http://www.lightpollutionmap>

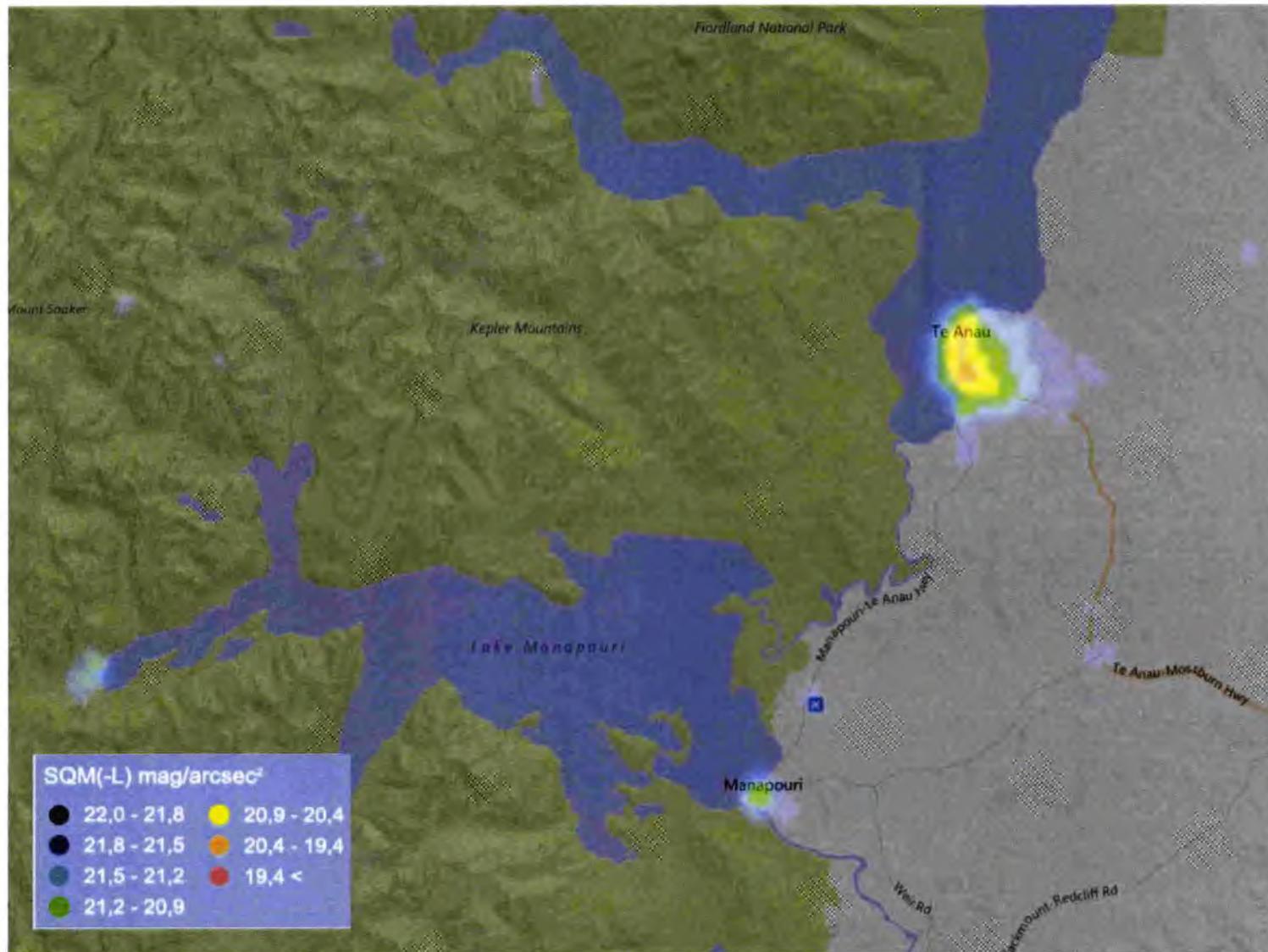


Figure 9 Te Anau Light Pollution <http://www.lightpollutionmap>

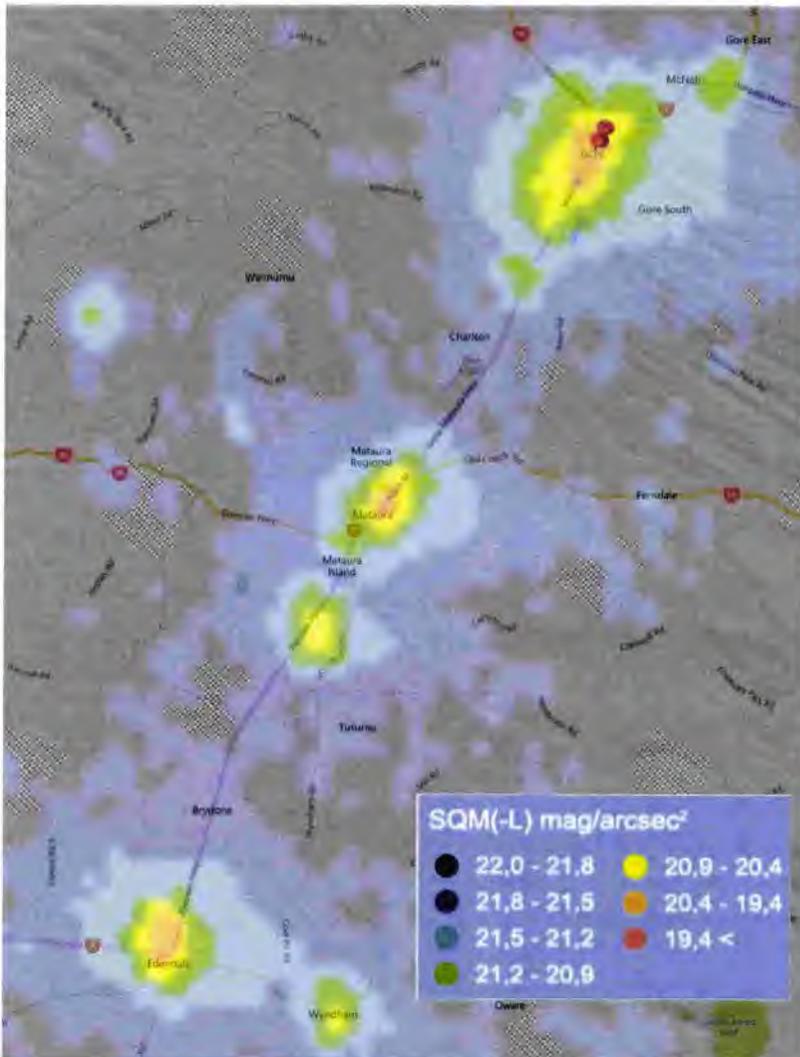


Figure 11 Eastern Southland Light Pollution



Figure 10 Riversdale

3.1.5 NORTHERN SOUTHLAND

Lighting in Northern Southland including Mossburn and Lumsden, Athol and Garston is mainly limited to townships.

Sky quality readings undertaken by Xyst in Eastern Southland showed sky quality compared to typical rural skies and ideal dark sky sites.

Table 5 Sky Quality Readings Northern Southland

Location	Average SQM
Wilderness Rest Area	21.50
Centre Hill Road	21.42
Mossburn Domain	21.21
Lumsden Domain	21.10

Lumsden Railway Station	20.43
Jollies Pass Rest Area	21.61

Given the quality of the night skies in the surrounding rural areas, lighting within the townships of Lumsden and Mossburn is having a disproportionate effect on light pollution. Improvements in the public street lighting network will have a significant impact in reducing light pollution.

3.1.6 TE ANAU AND MANAPOURI

Lighting in Te Anau and Manapouri is mainly limited to townships.

Sky quality readings undertaken by Xyst in Te Anau showed sky quality compared to typical rural skies.

Table 6 Sky Quality Readings Te Anau

Location	Average SQM
Boat Harbour	21.14
Te Anau Gardens	20.49
DOC Office	20.88
Control Gates	21.36

Improvements in the public street lighting network and private lighting will have a significant impact in reducing light pollution.

It was noticeable that changes in private lighting can have a significant effect on overall levels of light pollution (figure 14 & 15). An example is the Fresh Choice supermarket in Te Anau where lighting has been upgraded to LED floodlights which are mounted at 45° above the horizon and are highly visible beyond the town boundary. A design using asymmetrical floodlights (figure 17 & 18) would have achieved a better result at the same cost with minimal light spill and with improved comfort and safety for customers.



Figure 12 High angle symmetrical flood lights at Fresh Choice, Te Anau

In Manapouri, public street lighting is relatively limited, however private lighting is having a relatively significant effect.



Figure 14 Floodlighting in staff car park with upward light component visible



Figure 13 Te Anau lighting - note supermarket lights in centre

The images opposite demonstrate how through good lighting design and fitting selection, light spill can be avoided. Generally higher poles are required with Asymmetrical flood lights but the result is significantly less light pollution, less impacts of neighbours and a more comfortable lights scheme for users.



Figure 15 Symmetrical beam floodlight with high amount of upward light spill

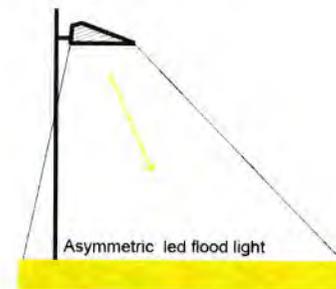


Figure 16 Asymmetrical beam floodlight with no direct upward light spill

3.2 District Plan policies

The four territorial authorities have varying policy approaches to controlling the effects of artificial lighting. Extracts of the specific rules are contained in Appendix 1.

Except for the Southland District Plan, there are no rules within other District Plans to place controls on upward light spill or colour temperature effecting light pollution.

3.2.1 GORE DISTRICT PLAN

The District Plan does not provide any rules limiting pollution of the night sky. Rules are aimed at limiting the obtrusive effects of artificial lighting on neighbours only. Between 5 and 15 lux is permitted at the boundary with no controls on upward light spill or colour temperature.

3.2.2 INVERCARGILL CITY DISTRICT PLAN

The District Plan does not provide any rules limiting pollution of the night sky. Rules anticipate high levels of glare and light spill in the industrial zones and have no limits for the amount of light spill that can be generated at sites such as the smelter, port and airport.

Rules in other zones are aimed at limiting the obtrusive effects of artificial lighting on neighbours only. Between 5 and 10 lux is permitted at the boundary with no controls on upward light spill or colour temperature.

3.2.3 SOUTHLAND DISTRICT PLAN

The District Plan limits pollution of the night sky in the rural zones of the District. The following rule is included:

General Rural Standards

All on site lighting shall be designed and maintained so there is no spill of light above the horizontal plane and it is directed away from adjacent properties and roads.

There are no rules limiting pollution of the night sky in the other zones and no controls at all on light spill within the Rakiura/Fiordland Zone. Between 3 and 12 lux is permitted at the boundary with no controls on upward light spill or colour temperature in other zones.

3.3 Regional plans and policies

3.3.1 REGIONAL COASTAL PLAN FOR SOUTHLAND

The Regional Coastal Plan for Southland recognises that “*The amenity values of the coastal marine area can be adversely affected by activities that threaten public safety or create nuisance effects such as dust, noise, light spill, glare, vibration, smoke, odour or electrical interference*”⁴

3.3.2 THE CRY OF THE PEOPLE - TE TANGI A TAUIRA

The Iwi Management Plan recognises the visual intrusion of light pollution as an issue for Ngāi Tahu ki Murihiku as light pollution can distort celestial darkness. The plan includes the following policy:

Encourage techniques to eliminate the effects of light pollution. Techniques should be introduced during planning phases for new suburban and coastal subdivisions.

Encourage techniques to eliminate the effects of light pollution from coastal structures on migratory marine birds.

⁴ Regional Coastal Plan for Southland Issue 5.3.3

3.4 Conservation Management Strategies

The Department of Conservation (DOC) prepares Conservation Management Strategies and management plans for Rakiura National Park and Fiordland National Park.

3.4.1 STEWART ISLAND/RAKIURA CONSERVATION MANAGEMENT STRATEGY AND RAKIURA NATIONAL PARK MANAGEMENT PLAN 2011-2021

The strategy and plan does not include any specific policy to control the effects of artificial light, however objectives and policies regarding facility development seek to minimise impacts on national park values and include criteria to ensure buildings and structures to not impact on the visual landscape.

3.4.2 SOUTHLAND MURIHIKU CONSERVATION MANAGEMENT STRATEGY 2016

The strategy recognises the impacts of artificial lighting on the night sky and anticipates an outcome where there is minimal artificial light effecting the night sky. There are no specific policies limiting artificial light however.

3.5 Implications

With the exception of part of the Southland District Plan there is a lack of rules to control light pollution. Current measures are generally aimed at limiting the effects of lighting on neighbours.

The process of District Plan review is costly and time consuming and Council's will have many competing priorities for other required changes to the District Plan.

It would be desirable to introduce model planning rules that each regulatory authority could introduce over time as District Plan changes take place.

An alternative would be to introduce a voluntary best practice guide or lighting policy. Such a policy could be introduced more quickly. Queenstown Lakes District Council took taken this approach with the introducing of a lighting policy in 2006. This policy is referenced in many resource consent applications and subsequent decisions and has had a positive effect on influencing lighting selections on new developments.

A lighting policy could also serve as a useful template for a subsequent plan change or inclusion within reviews of council's District Plans.

3.6 Street lighting upgrade programmes

Most street lighting in Southland consists of high pressure sodium (HPS) light sources in unshielded luminaires and moderate (5-15°) tilt angles.

HPS lamps produce an orange light which until recent times has been the most efficient light source available for street lighting. The colour of HPS lamps is generally around 2000K with poor colour rendering properties.

Road Controlling Authorities are now beginning to replace HPS and other older lighting technologies with Light Emitting Diodes (LED) lighting with the aim of reducing energy and maintenance costs.

The New Zealand Transport Agency (NZTA) has announced that the funding assistance rate for LED will be advanced to 85% if completed by June 2018. The rate which Council's would have otherwise been eligible for was approximately 55%. This is an opportunity to complete

the works earlier than planned and will mean a significant saving for ratepayers which many communities have taken advantage off.

NZTA have produced a specification (M30) for LED luminaires that have gone through a rigorous selection process and are acceptable for installation on the State Highway network. Most Councils have adopted the M30 Specification with respect to their own replacement programmes and for new lighting projects.

Generally, upgrading is being undertaken on a like for like basis without recognition of the differences between LED and HPS light sources such as:

- Full cut off design with no upward light spill when mounted horizontally (0° tilt)
- Strong horizontal cut off resulting in increased contrast between lit and unlit areas
- Increased colour temperature from 2000K to 4000K with blue rich light.

There is concern that LED replacement programmes are increasing sky glow by increasing the amount of blue rich light emitted by street lighting. The shorter wavelength content of LED lighting can increase sky glow as shorter wavelengths tend to scatter more readily in the atmosphere than longer wavelengths, so the spectral content of a light source directly influences sky glow.

Table 7 Selected blue light characteristics of various lighting sources at 1000 lumen output⁵

Light Source	Colour Temperature (K)	Appearance	% Blue
HPS	2041	Orange	10%
Metal Halide	3145	Warm White	24%
LED	3000	Warm White	18-25%
LED	3500	Warm- Neutral White	22-27%
LED	4000	Neutral White	27-32%

There is also concern that blue-rich light can have effects on human health and other biological and ecological impacts. The American Medical Association (AMA) has released guidance on the use of LED lighting. This includes the following advice:

“In addition to its impact on drivers, blue-rich LED streetlights operate at a wavelength that most adversely suppresses melatonin during night. It is estimated that white LED lamps have five times greater impact on circadian sleep rhythms than conventional street lamps. Recent large surveys found that brighter residential nighttime lighting is associated with reduced sleep times, dissatisfaction with sleep quality, excessive sleepiness, impaired daytime functioning and obesity.

The detrimental effects of high-intensity LED lighting are not limited to humans. Excessive outdoor lighting disrupts many species that need a dark environment. For instance, poorly designed LED lighting disorients some bird, insect, turtle and fish species, and U.S. national parks have adopted optimal lighting designs and practices that minimize the effects of light pollution on the environment.

⁵ Extracted from Table 6. An Investigation of LED Street Lighting’s Impact on Sky Glow, Pacific Northwest National Laboratory for U.S. Department of Energy April 2017

Recognizing the detrimental effects of poorly-designed, high-intensity LED lighting, the AMA encourages communities to minimize and control blue-rich environmental lighting by using the lowest emission of blue light possible to reduce glare. The AMA recommends an intensity threshold for optimal LED lighting that minimizes blue-rich light. The AMA also recommends all LED lighting should be properly shielded to minimize glare and detrimental human health and environmental effects, and consideration should be given to utilize the ability of LED lighting to be dimmed for off-peak time periods.”⁶

While research into the effects of LED replacement lighting continues, the following conclusion from the U.S. Department of Energy notes that there are three main influencers of sky glow from street lights being:

1. The amount of blue-rich light in the light source
2. The lumen output of the light source
3. The amount of light emitted upwards being a combination of the luminaire design and tilt angle

They concluded;

“While increasing the short wavelength content of exterior lighting sources increases the potential for sky glow, other characteristics of LED street lighting luminaires can reduce or completely offset these effects. The three main characteristics of luminaires that influence sky glow are spectral power distribution (SPD), total lumen output, and luminaire light distribution (and, most importantly, the amount of that distribution emitted as uplight). Each of these characteristics can be specified through the selection of luminaires and should therefore be carefully evaluated as part of the system design.”⁷

⁶ <https://www.ama-assn.org/ama-adopts-guidance-reduce-harm-high-intensity-street-lights>

⁷ An Investigation of LED Street Lighting’s Impact on Sky Glow, Pacific Northwest National Laboratory for U.S. Department of Energy April 2017

It is common in New Zealand for street lights to be mounted on utility (power) poles which generally have much greater spacing than would otherwise be ideal with stand-alone poles. To compensate for the increased spacing, lights are often tilted above the horizontal.

In some situations, extreme angles are used. These higher angles in particular cause significant light pollution.

LED lighting is designed to be mounted horizontally (0° tilt). When mounted in this way there is generally no direct upward light spill which is a significant advantage for protection of the night sky.

It is recommended that street lighting upgrades in Southland therefore:

1. Use LED sources with a maximum CCT of 3000K
2. Review light output requirements to ensure the lumen output is appropriate for the location
3. Luminaires selected are fully shielded and are mounted with a 0° tilt (which will require modification of some pole outreaches)

There is a relatively small window of opportunity to influence Council street lighting upgrade programmes as many are advancing upgrade programmes in 2017/18 to take advantage of the NZTA subsidies.

3.6.1 INVERCARGILL CITY COUNCIL

The Invercargill City Council manages over 7000 street lights⁸ with the vast majority of these being HPS light sources. The City is embarking on a HPS to LED replacement programme with some XX lights programmed to be replaced this year.

⁸ 2014 – Invercargill City Roading Asset Management Plan – V3.0

The anticipated expenditure on LED lighting will be around \$2,850,000 with a subsidy of \$2,400,000.

ICC has adopted a policy to use 3000K colour lighting is used in the P Class residential areas (Road Class - Access) and the 4000K is used for V Class roads (Arterials and Collectors).

3.6.2 GORE DISTRICT COUNCIL

The Gore District Council manages over 1500 street lights⁹ with the vast majority of these being HPS light sources. The Council staff are currently preparing a business case for a HPS to LED replacement programme for submission to Council and NZTA.

3.6.3 SOUTHLAND DISTRICT COUNCIL

The Southland District Council manages over 2850 street lights¹⁰ with the vast majority of these being HPS light sources. The City has committed to a HPS programme has purchased approximately 700 LED street lighting units. An LED upgrade has been completed in Wallacetown with the entire Southland District street lighting network to be retrofitted by 30 June 2018.

3.6.4 IMPLICATIONS FOR DARK SKY INITIATIVES

If the Council's wish to pursue Dark Sky initiatives, then there will need to be some urgent consideration of the proposed LED upgrade programmes to ensure that the three critical elements of colour temperature, lumen output and tilt angle are all considered. If this opportunity is missed it may be many years before incremental improvements can be made.

⁹ 2014 – Gore District Roading Asset Management Plan 2015



Figure 17 Street lights in Monowai with 45° tilt angle creating significant upward light spill. Changing these HPS luminaires to LED without adjusting the tilt angle to 0° will impact on the night sky and potentially create a traffic hazard and glare issues for neighbours

¹⁰

http://southland.infocouncil.biz/Open/2017/08/SER_20170809_AGN_826_AT.htm#PDF3_Attachment_21582_1

4 Aquaculture lighting

The Southland Regional Development Strategy has identified the development of aquaculture as a key economic initiative. Some nine sites have been identified for consideration on Stewart Island and in Southland¹¹

Aquaculture uses lighting for navigation aids, work platform safety and stimulation of growth by underwater lighting.

Dark Sky status will not be an impediment to the development of the aquaculture industry as underwater lights are directed downwards, and work platform lighting can be easily controlled by light colour selection, timing and shielding. Similar systems have been developed in other countries show lighting can be managed in a way that allows activity to flourish and doesn't allow light spill.

Aquaculture in Norway is an example of very functional lighting in terms of the environment. This approach is a good example of how it could be managed on Stewart Island and in coastal Southland.

The Ministry of Primary Industries Marine advice to marine farmers is to "minimise the use of non-navigational lights on site, and, where possible, lights should be shielded from all but essential directions. If spotlights must be used, they should be positioned as high above the water as possible so that penetration is maximised and reflection is minimised".¹²

Security lighting or other utility lighting and can likely be addressed through design and light fitting selection. Minimising the effects of night lighting through consideration of light temperature, timing or motion controls and shading will reduce light pollution and other impacts such as impact risks with seabirds.

¹¹ <http://www.stuff.co.nz/southland-times/news/73188717/Nine-new-aquaculture-sites-forecast-for-Southland>

The Regional Coastal Plan for Southland also contains rules which would support the shielding of lights and use of timers and appropriate wattages for lighting in the coastal marine areas.

5 Opportunities

5.1 Lighting Policy

Developing a lighting policy that all councils could adopt would be a significant first step in improving and protecting the night sky in Southland. A policy would apply to all Council led projects but could also be used by developers to demonstrate best practice in their resource consent applications.

A lighting policy would be a useful precursor to including rules within a District plan.

Lighting Policy would generally include:

- Standards for night sky protection including colour temperature and tilt angles
- Standards for lighting of roads, parks, monuments, buildings, car parks and sports fields
- Recommendations and best practice examples

If Councils adopt a lighting policy it shows leadership that can encourage other private business to follow suit.

¹² Overview Of Ecological Effects of Aquaculture, Ministry of Primary Industries 2013

5.2 Regulation

Establishing a model set of lighting rules appropriate for Southland would enable Councils to incorporate the lighting rules into their respective district plans and the Department of Conservation to include similar rules within their conservation management strategies and park management plans.

5.3 Education

Developing information resources such as a best practice guide to lighting would be beneficial. This could be provided on Council and Venture Southland websites would provide useful information for households and businesses on the objectives of retaining a quality night sky in Southland and demonstrate simple and cost effective ways to reduce light pollution.

Few, if any lighting installations set out to create night pollution. Most poor installations are made through a lack of awareness of the effects. Effective lighting that has minimal impact on the night sky can be delivered without additional cost to consumers. In many cases, lighting improvements will have significant financial paybacks through reduced maintenance and energy costs.

Producing a brochure for distribution at electrical retailers would also be beneficial. Lighting suppliers may well be able to assist with funding such an initiative.

Introduction of best practice lighting awards or local accreditation of "Southland Sky friendly" projects could also be considered to promote best practice.

5.4 Recognition

The International Dark Sky Association (IDA) has developed the Dark Sky Places Programme. The programme was started by the IDA in 2001 to encourage communities around the world to preserve and protect dark sites through responsible lighting policies and public education.

The Dark Sky Places program offers five types of designations:

1. **International Dark Sky Communities**
Communities are legally organized cities and towns that adopt quality outdoor lighting ordinances and undertake efforts to educate residents about the importance of dark skies.
2. **International Dark Sky Parks**
Parks are publicly- or privately-owned spaces protected for natural conservation that implement good outdoor lighting and provide dark sky programs for visitors.
3. **International Dark Sky Reserves**
Reserves consist of a dark "core" zone surrounded by a populated periphery where policy controls are enacted to protect the darkness of the core.

4. **International Dark Sky Sanctuaries**

Sanctuaries are the most remote (and often darkest) places in the world whose conservation state is most fragile.

5. **Dark Sky Developments of Distinction**

Developments of Distinction recognize subdivisions, master planned communities, and unincorporated neighborhoods and townships whose planning actively promotes a more natural night sky but does not qualify them for the International Dark Sky Community designation.

5.4.1 NEW ZEALAND DARK SKY PLACES

Aoraki Mackenzie International Dark Sky Reserve

The first Dark Sky Place in New Zealand was the Aoraki Mackenzie International Dark Sky Reserve (AMIDSR) which is comprised of Aoraki/Mt. Cook National Park and the Mackenzie Basin.

Outdoor lighting controls were first put into place in the area during the early 1980s. They have not only helped minimise light pollution for the nearby Mt. John Observatory, but also conserve energy, protect wildlife and make the area a popular stargazing destination for tourists.

As with many regions in New Zealand, the Mackenzie has received significant growth in tourism however it is considered that the Dark Sky Reserve has prompted many visitors to stay overnight at Lake Tekapo.



5.4.2 AOTEA/ GREAT BARRIER ISLAND DARK SKY

Figure 18 Tekapo Dark Sky Reserve. Photo Fraser Gunn

New Zealand's first Dark Sky Sanctuary (and the third in the world) was approved by the IDA in 2017¹³. The sanctuary shares many similarities to Stewart Island in that it is a relatively remote island with limited lighting. Most the land is in the protection of DOC.

As the Sanctuary was only confirmed in June this year, its success in encouraging tourism is yet to be determined. The experience of the Great Barrier Community will be invaluable in assisting communities such as Stewart Island to progress applications if they chose to do so.

¹³ <https://www.stuff.co.nz/travel/destinations/nz/94001815/great-barriers-exceptional-starry-nights-recognised-with-dark-sky-sanctuary-status>

5.4.3 OTHER PROPOSALS IN PREPARATION

There may be other proposals in preparation. We are aware of the following within New Zealand.

Naseby

Naseby in Central Otago is reportedly preparing an application as a Dark Sky Community¹⁴. If successful, this would be the first Dark Sky Community accredited in New Zealand.

Christchurch Red Zone

Work is being undertaken in Christchurch to consider establishment of a Dark Sky Park within the Christchurch Red Zone.

5.4.4 ELIGIBILITY AND CRITERIA

The IDA has set out the eligibility and criteria for each of the five dark sky designations. These are summarized in Appendix 3. Having considered the natural attributes of Southland and the existing policy and lighting condition in Southland we consider that the following opportunities exist for accreditation:

1. Rakiura- Stewart Island – Dark Sky Sanctuary

The quality of the night sky on Stewart Island is such that it could potentially achieve Sanctuary status. This is discussed in more detail in the Rakiura - Stewart Island Pilot Dark Sky Report.

2. Fiordland National Park – Dark Sky Reserve

Te Anau and Manapouri could, with the inclusion of Fiordland National Park, create a Dark Sky Reserve which would exceed 12,500km and be the largest dark sky reserve in the world. Alternatively, Fiordland National Park could be designated as a

Dark Sky Park which would create the first Dark Sky Park in New Zealand.

3. Dark Sky Communities

Communities such as Garston, Mossburn, Lumsden, Gore and Tuatapere, could become dark sky communities once District Plan rules were in place. Until such time the planning rules are in place it would be difficult to achieve a dark sky designation.

¹⁴ <https://www.odt.co.nz/regions/central-otago/towns-bid-become-dark-sky-community>

5.5 Astro-tourism

New Zealand's skies consistently rate as one of the world's top star-gazing locations and is developing an excellent reputation as a star gazing destination. Many industrialised cities such as those in mainland China have little if any view of the stars. Many visitors are fascinated with the clarity and beauty of the night sky in New Zealand.

The established astro-tourism operators at Lake Tekapo have experienced strong growth especially from international tour groups. This growth has seen increasing demands for accommodation and services. Recent announcements for new hotels, apartments and residential developments are signs of growing confidence that the Reserve is a popular destination for visitors. Specialised accommodation businesses offering personal tours of the night sky are becoming established.¹⁵

Tekapo's astro-tourism joint venture between Earth & Sky and Ngāi Tahu Tourism has attracted a total of \$3.5m of government investment in the latest round of funding from the Tourism Growth Partnership (TGP) which will contribute to the development of a new International Astronomy Centre¹⁶.

The \$3.5m Ministry of Business, Innovation and Employment (MBIE) co-investment would cover about a third of the central South Island project's overall \$10m cost. It will be matched by \$7m of industry funding to be raised by the partners.

Astro-tourism is now one of New Zealand's top tourist attractions. The Mackenzie has about 1.5 million tourists a year, and Earth & Sky are expecting up to 200,000 customers annually. Many accommodation places in the region mention AMIDSR on their websites, a testimony of the drawing power of the Reserve for their businesses².

¹⁵ Aoraki Mackenzie International Dark Sky Reserve 2015-2016 Report

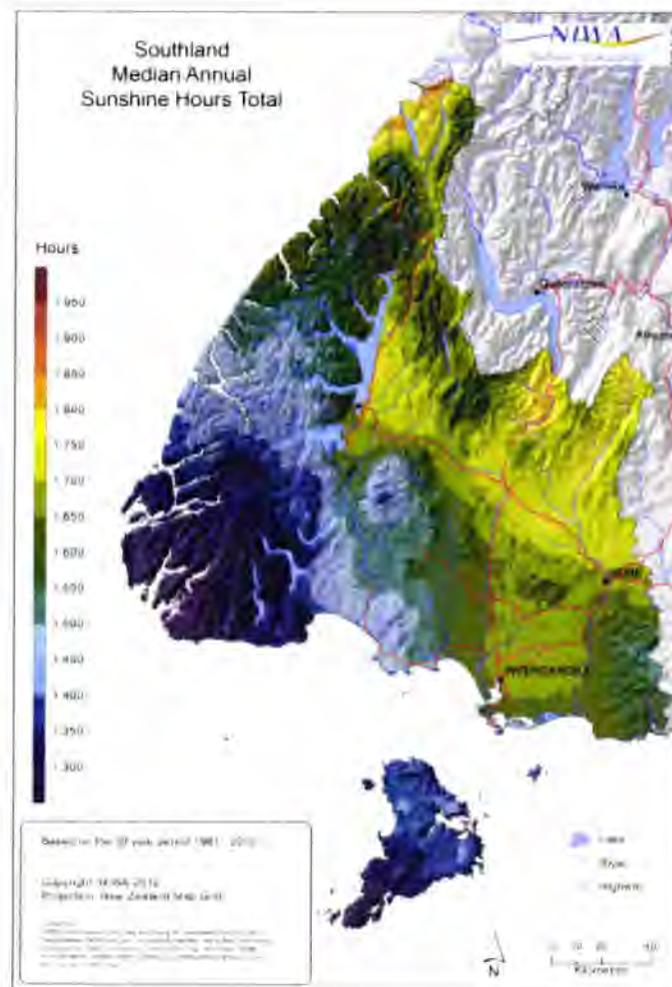


Figure 19 <https://www.niwa.co.nz/climate/research-projects/national-and-regional-climate-maps>

¹⁶ <http://tourismticker.com/2016/11/09/star-gazers-win-tgp-funding/>

Astro tourism has been growing strongly and many general tourism businesses (e.g. Skyline Queenstown) and specialist star gazing companies have been established including [Earth & Sky](#) (Tekapo) [Stargazing Tours](#) (Tekapo), Camel Tours (operating for 20 years in Queenstown), [Astronomy Fiordland](#) (Te Anau) – Private/educational bookings only.

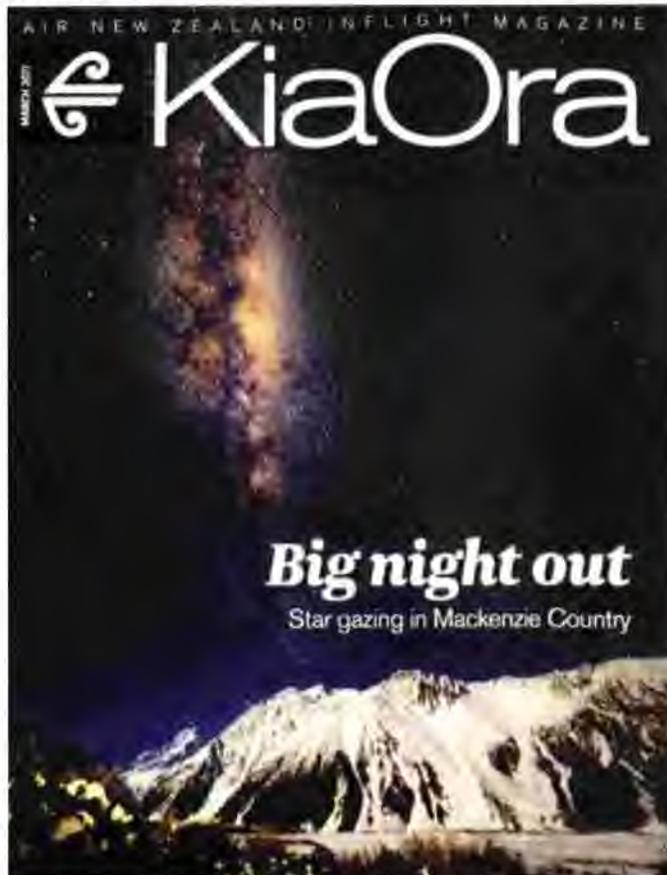


Figure 20 Star gazing promoted in Air New Zealand's in-flight magazine

There is good potential for establishing small boutique businesses based around astro-tourism. Establishment costs are generally low for such businesses.

5.5.1 CONSTRAINTS

Cloud cover

The main constraint to establishing such businesses in Southland would be the reliability of clear weather. For this reason, opportunities in inland Southland (roughly north of SH94) may be more sustainable than in Invercargill City for example. While Southland is subject to cloud cover on occasion, particularly on the coastal margins, on many of these occasions there are still vantage points for night sky viewing, particularly at inland locations. To address this, we need to ensure there are mechanisms in place to indicate the best vantage points to operators and tourists. For passionate night sky viewers, periods of cloud cover may even mean visitors staying for a longer period of time.

The following graphs are computer generated models of seasonal average cloud cover. The graphs show the monthly number of sunny, partly cloudy, overcast and precipitation days. Days with less than 20% cloud cover are considered as sunny, with 20-80% cloud cover as partly cloudy and with more than 80% as overcast. The models would suggest that even inland Southland is "partly cloudy" for some 18 days were local knowledge would suggest that the skies, and in particular the night sky, is clear to a far greater degree than these models suggest. The data is derived from a global weather model at approximately 30km resolution and cannot reproduce detailed local weather effects.

Both Great Barrier Island and Lake Tekapo experience skies with less cloudy days. The January average for overcast days is Great Barrier Island 5.4 days, Lake Tekapo 6.8 days, Garston 9.6 days and 15.7 days on Stewart Island.

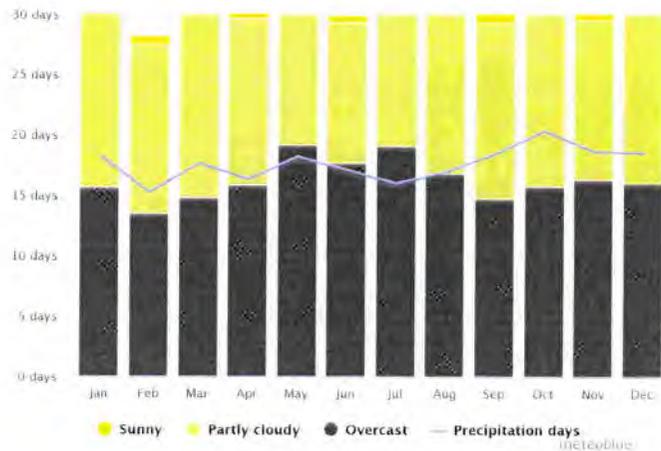


Figure 21 Average cloud cover Stewart Island - <https://www.meteoblue.com/en/weather/forecast/modelclimate>

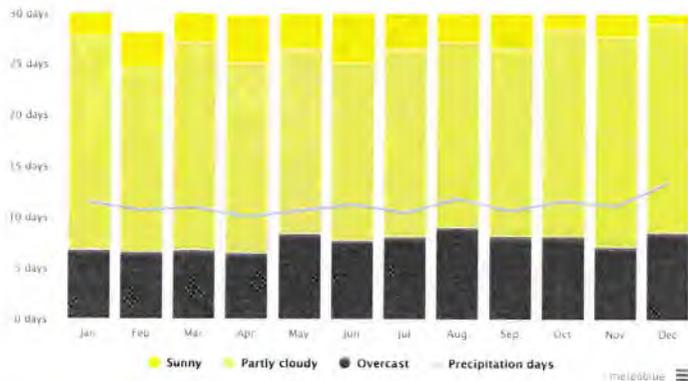


Figure 22 Average Cloud Cover Lake Tekapo

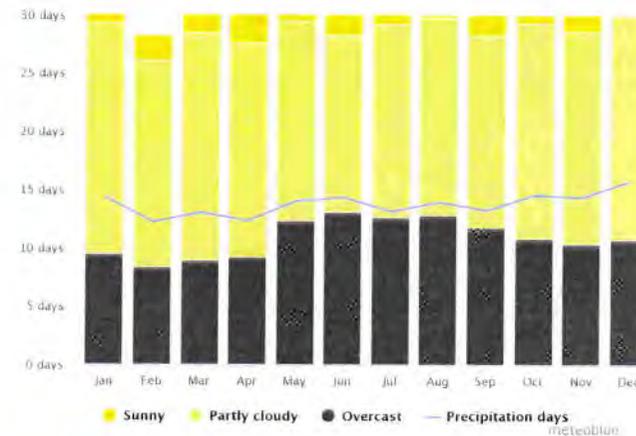


Figure 23 Average cloud cover Garston - <https://www.meteoblue.com/en/weather/forecast/modelclimate>

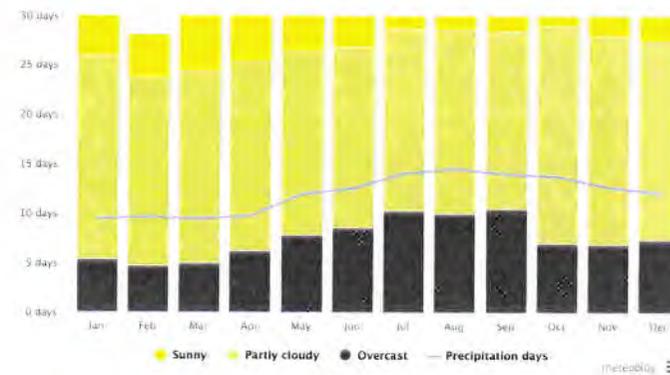


Figure 24 Average Cloud Cover Great Barrier Island

Establishment costs

Establishment costs for astro-tourism are modest and similar to similar small scale guiding businesses. Owner operator models are the most common initially with businesses trading on specialist knowledge. The key costs include marketing and promotion, transportation and specialist astronomy equipment. Generally, this includes telescopes and specialist astro-photography equipment such as full-image digital cameras and equatorial tracking equipment.

Knowledge

Operators looking to establish astro-tourism businesses will need to develop knowledge of the night sky and be able to identify and interpret astronomical features. The Southland Astronomical Society and Observatory may be able to have role in developing the necessary knowledge for prospective astro-tourism businesses.

Competition

Of the two established businesses in Queenstown, one is a specialist operator focused on the Japanese market only and the other is Skyline Queenstown which offers nightly tours of one-hour duration for \$93 including gondola ride. While Tekapo is well established as a star gazing destination with the dark sky reserve, Mt John observatory and established businesses, there is opportunity to engage visitors to Southland who may not have considered or had the time or opportunity (given weather conditions) to view the night sky in Tekapo.



Figure 22 Matarkiri promotions in Auckland (above) and Kapiti (below)

5.6 A framework for Southland

Considering the above factors, we consider the following framework could be established.

5.6.1 PROTECTING THE RESOURCE

The most critical aspect facing southland at present is to ensure that the roll out of replacement LED fittings is done in a manner that does not compromise Southland's existing sky quality nor its ability to gain dark skies designation by the IDA.

The development of a lighting policy that the Councils can adopt will be critical to this along with establishing model district plan rules for inclusion into District Plans as opportunity arises.

5.6.2 RECONGITION

Establishing the Rakiura Dark Sky Sanctuary and Fiordland Dark Sky Reserve will raise the international profile of Southland as an outstanding dark sky resource and visitor destination.

5.6.3 TOURISM AND GROWTH

In conjunction with Dark Sky accreditation has been achieved, work can be progressed to promote Southland as a dark sky tourism resource an assist local operators to establish tourism ventures associated with dark sky tourism.

Protecting and enhancing the skies of Southland will also add to the quality of life of Southland residents and reinforce Southland as a unique place to live and raise families.

Events related to star gazing such as Matariki can both attract visitors and provide local community opportunities.

Southland Dark Skies Framework

Protecting the resource

Recognition

Tourism and Growth

Lighting Policy

Rakiura Dark Sky Sanctuary

Establishing operators

Upgraded
Street Lighting

Fiordland Dark Sky Reserve

Quality of life

Best practice guide

Dark Sky Communities -
Gore, Lumsden, Tuatapere etc

Events

District Plan rules

Appendix 1: Extracts of current policy and rules

Gore District Plan

4.6 Lightspill

4.6.1 Rule

(1) All activities shall comply with the following standards:

(a) Rural and residential zones

The emission of lightspill and/or glare measured at the boundary of the site of the emission, does not exceed:
7.00 p.m. - 7.00 a.m. 5 Lux

(b) Commercial, Industrial and Mixed Use zones

The emission of lightspill and/or glare measured at the boundary of the site of the emission does not exceed:
7.00p.m. to 7.00a.m.15 Lux

Provided that at the boundary of Commercial, Industrial or Mixed Use Zones with either Rural or Residential Zones, the emissions of lightspill or glare do not exceed the maximum allowable emission with Rural or Residential Zones.

(2) Measurement required by (1) above

(a) shall be taken at the boundary of site of the activity generating lightspill;

(b) shall be taken in the horizontal and vertical plane approximately 1.5 metres above ground level;

(c) shall be assessed in accordance with Australian Standard AS4282 1997: Control of the obtrusive effects of outdoor lighting.

(3) Any land use activity that does not comply with (1) above is a restricted discretionary activity.

The matters over which Council shall exercise its discretion are the adverse environmental effects of the matters with which there is non-compliance.

Transportation Routes

4.14.1 Rule

(1) All land use activities shall comply with the following standards:

- (a) Lighting shall not be constructed or maintained so that direct or indirect luminance or glare causes adverse effects on traffic safety.

Gore Townscape Precinct

4.15.1 Rule

(1) Within that part of the commercial zone at Gore shown on the District Plan Maps as “Central Area”:

- (a) Other than to provide recesses associated with the entrance of persons, buildings shall provide continuous frontage to the street.
- (b) Buildings shall provide a veranda to the edge of the footpath, together with under veranda lighting.

Invercargill City District Plan

4.33.12 Industrial Sub-Areas

The purpose of the Industrial Sub-Areas is to allow for industries to locate together where their associated adverse effects will have the least impact, while providing for the economic well-being of the people of Invercargill. The amenity in industrial areas is not suitable for non-sensitive activities because of “reverse sensitivity” issues. The characteristics of the Industrial Sub-Area are:

1. (A) Moderate levels of noise day and night
2. (B) The opportunity to generate odour emissions
3. (C) High levels of glare and lightspill
4. (D) Storage and use of hazardous substances
5. (E) Tall structures
6. (F) Car parks, yards, storage areas
7. (G) Heavy vehicles and hazardous substances transporters

4.36 LIGHTSPILL

4.36.1 All activities shall be designed, constructed and operated to comply with the following maximum levels of lightspill:

(A) Lightspill shall be measured and assessed in accordance with the Interim Australian Standard AS 4282 (Int) 1995: Control of the Obtrusive Effects of Outdoor Lighting

4.36.2 The generation of lightspill, measured at the boundary of the site, shall not exceed the following:

	Sunset through midnight to sunrise
URBAN AREA	
Domicile Sub-Areas	5 lux
Enterprise Sub-Areas	10 lux
Suburban Service, Business, and Business A Sub-Areas	10 lux
City Centre Sub-Area	10 lux
Hospital Sub-Area	5 lux
Seaport Sub-Area	No limit
COUNTRY AREA	
Rural Sub-Area	5 lux
Industrial and Industrial A Sub-Areas	10 lux
Otatara Sub-Area	5 lux
Airport Operations Sub-Area	No limit
Airport Protection Sub-Area	5 lux
Smelter Sub-Area	No limit
Rural Service Sub-Area	5 lux

4.36.3 At the boundaries of Sub-Areas, the lightspill standard shall be the lower of the two levels.

4.36.4 Where an activity cannot meet the standards above, the activity shall be a discretionary activity.

The matter over which Council shall exercise its discretion is:

- (A) The adverse environmental effects of the matter(s) with which there is non-compliance

Southland District Plan

Rule RURAL.7 - General Rural Standards

All activities shall comply with the following General Rural Standards:

Lighting and Glare

- (a) **All on site lighting shall be designed and maintained so there is no spill of light above the horizontal plane and it is directed away from adjacent properties and roads.**
- (b) The spill of light from artificial lighting (excluding street lights and traffic signals) on to any other site shall not exceed 8 lux (horizontal and vertical) when measured at the boundary of any other site.
- (c) Artificial lighting shall not dazzle or distract road users or interfere with any traffic aids or signals.

Urban Zone

Lighting and Glare

- (a) The spill of light from artificial lighting (excluding street lights and traffic signals) on to any other site (except as provided for by (b) below) shall not exceed 8 lux (horizontal and vertical) when measured at or within the boundary of any other site.
- (b) The spill of light from artificial lighting (excluding street lights and traffic signals) on to any other site within the commercial precinct shall not exceed 12 lux (horizontal and vertical) when measured at or within the boundary of that site.
- (c) All outdoor lighting shall be directed away from adjoining properties.

Te Anau Residential Zone

Lighting

- (a) All fixed lighting shall be directed away from adjacent roads and properties.

(b) Any building or fence constructed or clad in metal, or material with reflective surfaces shall be painted or otherwise coated with non-reflective finish.

(c) No activity shall result in a greater than 3 lux spill, horizontal and vertical, of light onto any adjacent property, measured at any point inside the boundary of the adjoining property.

Industrial Zone

Lighting and Glare

All exterior lighting shall be designed, located and at all times directed, screened, adjusted and maintained to ensure that:

(a) The spill of light from artificial lighting (excluding street lights and traffic signals) on to any other site shall not exceed 10 lux (horizontal and vertical) when measured at or within the boundary of any other site.

(b) All outdoor lighting is directed away from adjoining properties.

Section 3.5 FIORDLAND/RAKIURA ZONE - 7

No specific lighting rules

Eweburn Zone

Lighting

(a) No access road lighting will be permitted other than at intersection points.

Regional Coastal Plan for Southland

Policy 5.3.4 - Lighting

Ensure that all lighting associated with any structure and any area of occupation associated with the structure will be shielded or directed away from:

- a. adjacent activities;
- b. streets; and
- c. navigation channels;

to avoid the spill of light or glare that is:

- i. detrimental to the amenity of residential or other users;
- ii. a hazard to traffic on streets outside of the coastal marine area; and
- iii. a hazard to navigation within the coastal marine area;

unless the purpose of the light is to illuminate or mark a street or navigation channel.

Explanation - To prevent the reduction of amenity values and to avoid the creation of hazards, the impact of lighting beyond its target area needs to be considered. The timing and frequency of the adverse effects of lighting will vary depending on the number of hours of poor light or darkness and the time of year. Light spill can be avoided by several means including shielding, directing and using luminaries of appropriate wattage and focal characteristics.

See also Sections 11 and 20

Rule 11.2.14 - Erection of lights other than navigation aids - Permitted

The erection of lights other than navigation aids on new and existing structures, is a permitted activity where:

- (a) all lights on the structure and any area of occupation associated with the structure will be positioned and aimed within the occupied site away from residential properties and public roadways; and
- (b) the amount of light spill (horizontal and vertical) measured at a height of 1.0 metre above ground at a horizontal distance of 2.0 metres or more inside the boundary

Conservation Management Strategy

Rakiura

Objective

1. To allow appropriate facilities and access for management purposes, provided they avoid or otherwise minimise impacts on the national park values.

Policies

1. Should manage any buildings or structures essential to support management activities according to the following criteria:
 - a) that the form, design and placement of the building, structure, or facility should be such that its impact on the vegetation, topography, cultural values, ecological values and wildlife of the site is avoided, or otherwise minimised; and
 - b) consideration should be given to alternative sites in order to determine the site with the least impact; and
 - c) building material should be sensitive to the natural surroundings and any nearby or associated buildings, structures or facilities; and
 - d) facilities should not visually affect the landscape except where high structural visibility is required for safety reasons; and
 - e) facilities of a temporary and/or relocatable design should be preferred over permanent facilities; and
 - f) all facilities will meet legal requirements.

2. Should avoid or otherwise minimise disturbance to other users and the environment, and consider other relevant planning documents when using aircraft, vehicles or boats to access Rakiura National Park for management purposes.

Outcome, policies and milestones for the Takitimu Place

Commercial recreational activity supports cultural initiatives or is otherwise indistinguishable from traditional recreational use. Limited structural development, with minimal artificial noise and light, is of such a scale that the natural and cultural landscapes retain their dominance, and adverse effects on the Takitimu Mountains ecosystems are avoided.

Outcome, policies and milestones for the Fiordland Te Rua-o-te-moko Place

The natural and wild character of the Fiordland Te Rua-o-te-moko Place prevails, including the ability to view a clear night sky that is unaffected by artificial light.

The Fiordland coastal marine area

Structural development within the Fiordland coastal marine area does not detract from the outstanding natural character and natural quiet of this Place, particularly in the southern fiords, where the only modifications are those necessary to support visitor access, scientific research and monitoring, or the fishing industry, and artificial light does not prevent viewing of the night sky.

Outcome, policies and milestones for the Eastern High Country Mata-puke Taratara Place

Structural development or commercial activity is minimal and undertaken in a manner that enhances conservation values and recreational uses of this Place. The effects of artificial light are minimised.

Outcome, policies and milestones for the Longwood O Hekeia Place

The protected landscape is highly valued by visitors and locals as a backdrop to their journey along the Southern Scenic Route. The dark night sky is unaffected by artificial light.

Outcome, policies and milestones for the Awarua Place

Viewing of the night sky and the natural behaviour of indigenous birds are unaffected by artificial light.

Outcome, policies and milestones for the Foveaux Te Ara a Kiwa Place

Mineral exploration and structural development within this Place and the adjoining Places does not detract from the outstanding natural coastal or locally distinctive landscapes, and impacts on threatened and at risk marine species and important marine ecosystems are avoided. The effects of artificial light on marine mammals and wildlife are minimised.

Outcome, policies and milestones for the Subantarctic Ngā Moutere O Murihiku Ki Tonga Place

The naturalness and wildness of the Subantarctic Ngā Moutere O Murihiku Ki Tonga Place, including the unpolluted night sky, are all pervasive. Redundant structures have been removed and any new development is minimal, blending in with the surrounding environment, and avoiding displacement of endemic flora and fauna or damage to historic sites. Artificial light does not impact on seabirds flying at night

Appendix 2 – Sky Quality Measurements

Site	Date	Time	Altitude	Lat	Long	Moon Alt	Moon Illumination	Sky Condition	Reading 1	Reading 2	Reading 3	Average SQM
Invercargill												
Queens Park Cricket Oval	3/08/17	4:32	5	46.4050°S	168.3577°E	-4.0	77.71	Clear	19.83	19.72	19.71	19.75
Stead Street Wharf	3/08/17	4:37	0	46.4197°S	168.3383°E	-4.7	77.71	Clear	20.36	20.23	20.33	20.31
Oreti Beach	3/08/17	4:44	0	46.4399°S	168.2314°E	-5.6	77.71	Clear	21.38	21.40	21.39	21.39
Estuary Walkway Lookout	3/08/17	4:56	10	46.4271°S	168.3410°E	-7.3	77.71	Clear	20.36	20.33	20.23	20.31
Bluff Hill	3/08/17	5:07	261	46.6151°S	168.3387°E	-8.7	77.71	Clear	21.30	21.28	21.31	21.30
Stirling Point	3/08/17	5:33	4	46.6134°S	168.3573°E	-12.1	77.71	Clear	21.25	21.20	21.27	21.24
											Median	20.77
											Average	20.72
Rakiura												
Lee Bay	4/08/17	5:11	10	46.8635°S	168.1233°E	-0.7	85.20	Clear	21.71	21.62	21.64	21.66
Horseshoe Bay	4/08/17	5:18	3	46.8820°S	168.1317°E	-2.4	85.20	Clear	21.17	21.72	21.68	21.52
Butterfield Beach	4/08/17	5:22	5	46.8906°S	168.1320°E	-2.9	85.20	Clear	21.82	21.84	21.88	21.85
Mill Creek	4/08/17	5:27	11	46.8936°S	168.1255°E	-3.6	85.20	Clear	21.83	21.79	21.79	21.80
Traill Park	4/08/17	5:32	37	46.9008°S	168.1244°E	-4.3	85.20	Clear	21.86	21.78	21.80	21.81
Observation Rock	4/08/17	5:40	64	46.9025°S	168.1246°E	-5.4	85.20	Clear	21.79	21.80	21.78	21.79
Evening Cove	4/08/17	5:49	4	46.8985°S	168.1457°E	-6.7	85.20	Clear	21.87	21.81	21.82	21.83
Deep Bay	4/08/17	6:02	8	46.9059°S	168.1382°E	-8.3	85.20	Clear	21.78	21.81	21.79	21.79
Thule Bay	4/08/17	6:10	4	46.9030°S	168.1186°E	-9.5	85.20	Clear	21.73	21.72	21.75	21.73
											Median	21.79
											Average	21.75
Te Anau												
Boat Harbour	22/08/17	20:40	206	45.4076°S	167.7054°E	-21.5	0.44	2/8 High Cirrus	21.17	21.12	21.13	21.14
Te Anau Gardens	22/08/17	20:59	210	45.4171°S	167.7145°E	-24.7	0.46	2/8 High Cirrus	20.13	20.66	20.69	20.49

DOC Office	22/08/17	21:07	215	45.4233°S	167.7182°E	-26	0.47	2/8 High Cirus	20.87	20.86	20.92	20.88
Control Gates	22/08/17	21:09	216	45.4425°S	167.6901°E	-28.8	0.47	2/8 High Cirus	21.43	21.35	21.31	21.36
											Median	21.01
Northern Southland											Average	20.97
Wilderness Rest Area	22/08/17	21:25	270	45.5245°S	167.8103°E	-28.9	0.49	Clear	21.47	21.46	21.50	21.48
Centre Hill Road	22/08/17	21:44	373	45.5840°S	168.1215°E	-32.1	0.51	Clear	21.46	21.42	21.42	21.43
Mossburn Domain	22/08/17	21:55	293	45.6692°S	168.2331°E	-33.8	0.52	Clear	21.26	21.10	21.21	21.19
Lumsden Domain	22/08/17	22:12	188	45.7350°S	168.4363°E	-36.5	0.54	Clear	21.37	21.38	21.10	21.28
Lumsen Railway Station	22/08/17	22:18	188	45.7397°S	168.4424°E	-37.4	0.55	Clear	20.91	20.01	20.43	20.45
Jollies Pass Rest Area	23/08/17	0:37	401	45.5727°S	168.5028°E	-52.7	0.72	Clear	21.51	21.54	21.61	21.55
											Median	21.36
Eastern Southland											Average	21.23
Balfour	22/08/17	22:35	171	45.8390°S	168.5875°E	-39.8	0.57	Clear	20.93	20.56	20.99	20.83
Riversdale	22/08/17	22:50	122	45.9016°S	168.7420°E	-41.9	0.58	Clear	19.59	19.99	18.52	19.37
Mandeville	22/08/17	22:59	103	45.9840°S	168.7998°E	-43.1	0.60	Clear	21.48	21.47	21.47	21.47
Croydon Bush Road	22/08/17	23:16	174	46.0714°S	168.8899°E	-45.2	0.62	Clear	21.4	21.38	21.54	21.44
Gore Domain	22/08/17	23:30	70	46.0960°S	168.9412°E	-46.8	0.64	Clear	20.01	20.01	19.91	19.98
Hamilton Park	22/08/17	23:38	79	46.0946°S	168.9592°E	-47.6	0.65	Clear	21.12	21.32	21.19	21.55
											Median	21.13
											Average	20.77

Appendix 3 – Dark Sky Designation Criteria

	Dark Sky Community	Dark Sky Park	Dark Sky Reserve	Dark Sky Sanctuary
Definition	An IDA Dark Sky Community (DSC) is a town, city, or municipality that has shown exceptional dedication to the preservation of the night sky through the implementation and enforcement of quality lighting codes, dark sky education, and citizen support of dark skies.	An IDA Dark Sky Park (DSP) is a land possessing an exceptional or distinguished quality of starry nights and a nocturnal environment that is specifically protected for its scientific, natural, educational, cultural heritage, and/or public enjoyment. The land may be publicly owned, or privately owned provided that the landowner(s) consent to the right of permanent, ongoing public access to specific areas included in the IDA designation.	An IDA Dark Sky Reserve (DSR) is a public or private land of substantial size (of 700 km ²) possessing an exceptional or distinguished quality of starry nights and a nocturnal environment and that is specifically protected for its scientific, natural, educational, cultural heritage, and/or public enjoyment. The DSR consists of two regions: (1) a “core” area meeting the minimum criteria for sky quality and natural darkness, and (2) a “peripheral” or “buffer” area that supports dark sky values in the core and while receiving similar benefits. The DSR is formed through a partnership of landowners and/or administrators that recognize the value of natural nightscapes through regulations, formal agreements, and long term planning. The core and the peripheral zone together are referred to as the “Reserve” and “DSR” in this document.	An IDA Dark Sky Sanctuary (DSS) is a public or private land possessing an exceptional or distinguished quality of starry nights and a nocturnal environment that is specifically protected for its scientific, natural, or educational value, its cultural heritage, and/or public enjoyment. A DSS differs from a Dark Sky Park or Reserve in that it is typically situated in a very remote location with few (if any) nearby threats to the quality of its dark night skies and does not otherwise meet the requirements for designation as a Park or Reserve. The typical geographic isolation of Sanctuaries significantly limits opportunities for public outreach, so a DSS designation is specifically designed to increase awareness of these fragile sites and promote their long-term conservation.
Eligibility	Dark Sky Community	Dark Sky Park	Dark Sky Reserve	Dark Sky Sanctuary
Governance	Legally formed entity such as Council or Community Association	n/a	n/a	n/a
Land status	n/a	Protected public lands or protected private lands	Core of the proposed DSR must be a public or a private land protected for scientific, natural, educational, cultural, heritage and/or public enjoyment;	Public or a private land legally protected for scientific, natural, educational, cultural, heritage and/or public enjoyment purposes;

Access	n/a	Regular night time public access	Regular night time public access	Regular night time public access
Sky Quality	n/a	Exceptional dark sky resource	Exceptional dark sky resource. Core night sky quality must fit in one of the three tier qualifications (Gold, Silver, Bronze)	Exceptional dark sky resource routinely equal or darker than 21.5 magnitudes per square arcsecond.
Minimum area	n/a	n/a	The peripheral area should encompass a minimum of 700 km ² around the core (roughly equivalent to a 15km radius) OR an area sufficient to mitigate 80% of current and expected future light pollution threats.	n/a
Minimum Requirement	Dark Sky Community	Dark Sky Park	Dark Sky Reserve	Dark Sky Sanctuary

Lighting Code or Lightscape Management Plan	Lighting Code/District Plan Rules which include:	Lightscape Management Plan (LMP) with the following minimum standards:	A quality comprehensive Lightscape Management Plan (LMP) should be adopted by a sufficient number of communities within the entire DSR (core and periphery) corresponding to at least 80% of population AND 80% of designated area of protection. The regulations contained in the LMP should address all private AND public owners of communities within the area of protection.	A quality comprehensive Lightscape Management Plan (LMP) should be adopted by the agency administering the proposed DSS. The LMP regulations must be binding upon all private and public landowners within the area of protection. Minimum standards include: <ul style="list-style-type: none"> i) New, current, and required retrofit lighting must conform to the Sanctuary's LMP (which in turn must meet the "Lightscape Management Plan Guidelines" included in this document). The Guidelines for Outdoor Lighting in RASC/IDA Dark Sky Places should be used while creating the park's LMP; AND ii) A light warranting policy (prescribing whether an area should or should not be lighted), lighting curfews, and appropriate illumination levels
Full Cut Off lighting	Fully shielded or full cutoff light fittings for all fixtures over 1500 lumens	Fully shielded or full cutoff light fittings for all fixtures over 500 lumens with no light above the horizontal.	Fully shielded or full cutoff light fittings for all fixtures over 500 lumens with no light above the horizontal.	Fully shielded or full cutoff light fittings for all fixtures over 500 lumens with no light above the horizontal.

Maximum colour temperature (kelvin)	<3000K	<3000K, 2000K or less recommended	<3000K, 2000K or less recommended	<3000K, 2000K or less recommended
Restrictions on numbers of unshielded fittings	Limit on lumens per hectare or total site lumens	When unshielded fixtures are used, impacts to the lightscape must be minimized with the use of timers and/or curfews	When unshielded fixtures are used, impacts to the lightscape must be minimized with the use of timers and/or curfews	When unshielded fixtures of ≤500 initial lumens total are used, impacts to the lightscape must be minimized with the use of timers and/or curfews
Lighting Policy	A policy to address over-lighting, such as energy density caps, lumens/acre caps, or maximum illuminance specifications,	Lightscape Management Plan (LMP) exceeds requirements of surrounding or other jurisdiction policy requirements	Lightscape Management Plan (LMP) exceeds requirements of surrounding or other jurisdiction policy requirements	Lightscape Management Plan (LMP) exceeds requirements of surrounding or other jurisdiction policy requirements
	A provision that clearly: (1) indicates where, when, and under what circumstances new public outdoor lighting (street lighting and lighting on other public property and rights-of-way) is warranted and will be permitted, and (2) requires that adaptive controls and curfews be employed in all future installations of public outdoor lighting.	Inclusion of recognition of importance of dark sky resource in park management plans		
Fixture conformance	n/a	At least two-thirds (67%) of existing outdoor lighting fixtures within the park conforming to the LMP	At least two-thirds (67%) of existing outdoor lighting fixtures within the core conforming to the LMP	At least two-thirds (67%) of existing outdoor lighting fixtures within the sanctuary conforming to the LMP
Community Commitment	Dark Sky Community	Dark Sky Park	Dark Sky Reserve	Dark Sky Sanctuary

Lighting Inventory	n/a	Lighting Inventory and a plan to bring 90% of outdoor lighting into compliance with the Park's LMP within five (5) years of receiving an IDA designation, as well as a written commitment to bring the Park into 100% compliance within ten (10) years of designation;	Lighting Inventory and a plan to bring 90% of outdoor lighting into compliance with the Reserve's LMP within five (5) years of receiving an IDA designation, as well as a written commitment to bring the Reserve into 100% compliance within ten (10) years of designation;	
Measurement Programme	A sky brightness measurement program must be maintained either by the Community or by another public or private organization (university, research center, IDA chapter, astronomy club, etc.) to follow the evolution of light pollution in the DSC.	A measurement program must be maintained either by the Park, private landowner(s), or by another public or private organization (university, research center, IDA chapter, astronomy club, etc.) to follow the evolution of light pollution in the DSP and assert that the night sky quality does not degrade;	A measurement program must be maintained either by the Park, private landowner(s), or by another public or private organization (university, research center, IDA chapter, astronomy club, etc.) to follow the evolution of light pollution in the DSP and assert that the night sky quality does not degrade;	
	City owned lighting conforming with, or committed to conforming with, the lighting code (if the latter, a published plan with a timeline for completion in no more than 5 years),			
	Municipal support of dark skies and good lighting as indicated through city publications, flyers, public service announcements, funding of lighting upgrades, etc.			

Leadership		<p>The Park has set a leadership example in the restoration of dark skies by implementing at least one of the following: (1) Producing at least one “night sky friendly” lighting project that is publicly visible and interpreted, OR (2) Involving at least two external partners in dark sky restoration efforts (e.g. chamber of commerce, power utility, university research, tribal nations, environmental groups, conservation groups, natural history association), OR (3) Cooperation with at least two nearby municipalities that results in adoption of lighting codes that improve sky conditions in the Park, OR (4) Inventorying and monitoring night sky quality and using results to educate the public, OR (5) A combination of the above or an alternative restoration project may be suggested.</p>	<p>Communities must have a number of examples of conforming lighting installations proportional to the size of the population they serve, both on roadways AND on different private sites (industries, stores, public services, etc.): i) Each participating municipality (excluding businesses, residences, and partners without installed lighting) should have completed at least one highly visible demonstration project with night sky friendly lighting consisting of at least 10 lighting fixtures for each 5000 residents; AND/OR Dark Sky Reserve Designation Guidelines, IDA 5 ii) Approximately 10% of fixtures within the Reserve (outside of the core) must be retrofitted or brought into compliance with the appropriate regulation or guideline. This percentage does not include fixtures that were compliant upon the initial lighting survey, but rather must show active motivation of the community to make changes through the form of retrofits and/or appropriate physical changes to the current fixtures’ form. Such changes may include, but are not limited to, installation</p>	
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			of adaptive controls such as timers and dimmers.	
Signs			Must erect and maintain a sign indicating the IDA Dark Sky Reserve designation along a roadway entrance, along a footpath entrance if no roadway exists, or a visitor contact center. Sign must include DSR text and logo. With IDA approval, an alternative wording may be used, such as Dark Sky Wilderness, Night Sky Refuge, or similar.	
Reporting	Annual Report	Annual Report	Annual Report	Annual Report