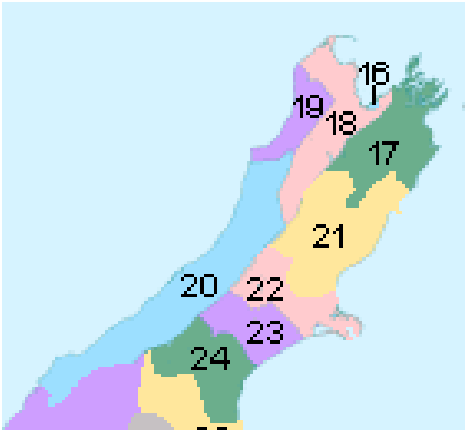
Load Management System for Upper South Island Networks

Operation of the 2009 Trial

1 Benefits of the Load Manager in reducing regional demand

New Zealand's first regional Load Manager began as a two-year trial project at the start of the 2009 winter and is estimated to have reduced load at peak times by about 30MW during the winter period.



Participating networks:

17:	Marlborough Lines
18:	Network Tasman
19:	Buller Electricity
20:	Westpower
21:	MainPower
22:	Orion
23:	Electricity Ashburton
24:	Alpine Energy

The Load Manager, installed in early 2009 in Orion's Christchurch network control centre, monitors the load on upper South Island networks in real time. During periods of high electricity demand, the Load Manager uses "ripple" signals to cooperatively control household hot water cylinders throughout the region – working within the service level targets that ensure an adequate and consistent supply of hot water to customers.

The region involved extends from Timaru in the south, through Christchurch city and rural Canterbury, to Motupipi in Golden Bay, and along the West Coast.

Population: ~700,000

Peak half hour: 1046 MW

Development team: 30 people

Distance north to south: ~500 km

Collaborating control centres: 10

Saving: $2 – 3 million/year

Voltage: 220 kV AC

The System for Upper South Island Load Management was a key factor in saving Transpower peak charges of $3m for customers in the region this year.

The software is based on an algorithm designed to give equitable load shedding amongst the distributors' customers. It does this by calculating a limit for each distributor which is automatically updated in their own load management system which then controls their load.

The algorithm at the heart of the system takes account of the different service level agreements for hot water control in each network area. Hot water service level agreements vary by network and this sometimes means that one network can control load more if another network runs out of control capacity. There can be stark differences in weather throughout the upper South Island on any given day, enabling the Load Manager to take advantage of the peak demand occurring in different places at different times.

For example, when a cold weather front moves over the South Island, the Load Manager would turn off extra hot water load in the warm areas ahead of the front to enable hot water cylinders to heat up again in the areas that have high heating loads - without creating a new peak load for the whole region.

Investigations are continuing into ways to further enhance the algorithm.

By reducing demand during peak loading times, distribution networks are able to delay costly investment needed to increase their network capacity – and thus avoid passing on these costs to retailers and in turn the public.

"It makes a great deal of sense for electricity networks to work together to reduce peak load on a regional basis," Orion CEO Roger Sutton says. "We've had encouraging early results from the trial Load Manager – our collaborative efforts over just one winter could delay transmission investment in our region by one to two years. This puts downward pressure on transmission and wholesale prices, and also electricity prices for customers," he adds.

2 Other benefits of the Load Manager

2.1 Easing pressure on national grid

The Load Manager also responds to the Security Limit (Voltage Stability limit calculated in VSAT) sent by the System Operator. When transmission is constrained due to a grid emergency, the Load Manager can remove load from the grid in a managed and coordinated manner – avoiding power outages which might otherwise have been necessary. When Islington GXP equipment tripped out on 9 December, the Load Manager responded within five minutes to the low security limit by lowering the limit to the distributors. This led to two distributors shedding load to avoid the upper South Island load exceeding the security limit.

The Load Manager has real time data on the amount of controllable load in the region and provides this to Transpower to assist their system operation. Key parameters, such as estimates of hot water cylinder load to be restored in the next one hour and two hours, are automatically collected and available to Transpower.

The Load Manager has had no impact on the interruptible load market, because hot water cylinders are not offered as interruptible load in the upper South Island. However this could be different elsewhere in New Zealand if the USI Load Manager were replicated in other regions.

2.2 Industry cooperation

Transpower's General Manager System Operations, Kieran Devine, says industry cooperation in load management enhances Transpower's ability to manage the grid when operating at full capacity.

"By managing peak demand well, electricity networks can provide some insurance against the risks of transmission build delays and high demand growth, and in some cases may allow deferral of transmission investment. We funded the upper South Island Load Manager project to see if such an innovative approach can realise such benefits, and whether such an approach could be extended to other regions. We're pleased with the progress of the initiative to date," Mr Devine says.

Nelson based Network Tasman Chief Executive Wayne Mackey says his company has recognised the benefits of ripple control for many years, as a means of managing peak loads on the network.

"We see enormous benefits coming from applying the same principles to the wider upper South Island power system, so when Orion came along offering to champion a collaborative ripple control effort, we fully supported this initiative," Mr Mackey says.

3 Successful collaboration

Commissioning the system for USI Load Manager has been more than just designing and creating the software.

3.1 People

The collaboration between 30 people in the various networks involved has been a major success factor. Within those companies there are people who have made key contributions to the success of the project. Orion staff who have had major roles during 2009 include Glenn Coates (business development and planning manager) who has lead the work, Alex Nisbet (commercial analyst) who designed the load management algorithm and Richard Moylan (network analyst) who coordinated the implementation. Mr Moylan says it is great to be part of such a visionary, forward-thinking team.

A representative from each company involved form a policy committee which oversees the operation of the centralised USI Load Manager. The primary aim of this policy committee is to appropriately manage the balance between quality of service (principally the duration of hot water control) and transmission costs (resulting from peak load based interconnection charges). The key method used to achieve this is by setting a limit for the USI load. Under normal operation this USI limit is used by the algorithm to determine limits for each distributor.

Also key to the project is the determination and commitment of the people and networks involved to make the USI Load Manager a success. The work has required leadership, project management, analysis, communication, 24/7 operation, support and commercial acumen.

3.2 Processes

Implementing processes for development and operation is also key to the ongoing success of the Load Manager.

It appears that the USI Load Manager can probably control the total load to a limit of 990MW over this summer 2009/2010 without exceeding hot water service targets. The policy committee will review the limit for winter 2010. The limit for the 2009 winter finished up at 1024 MW, having started at 1005 - this resulted in a top 12 half hour average of 1031 MW from five days throughout the year. Three of these days were before the USI Load Manager was fully commissioned. This indicates that the Load Manager could successfully limit the load on all but two days when winter weather created new peaks.

The impact of the Load Manager on the operation of other networks is mitigated by having the Load Manager give a limit to each distributor's load management system. Each distributor then uses this within their own system so the centralised Load Manager does not directly control load. In the event of an issue with the USI Load Manager, other distributors can switch back to running their load management system as they did prior to introduction of the USI Load Manager.

4 Summary

The System for USI Load Management has been very successful in managing peak demand without impacting on hot water service levels. The Islington GXP equipment failure event on 9 December has shown how quickly it can respond to a grid security event.

A workshop with USI network distributors on 3 February 2010 reviewed the operation of the trial and examined improvements for 2010 and beyond. Further enhancements are likely.

“We’re pleased to be working in collaboration with other South Island lines companies to use such tools to minimise cost and improve reliability,” Roger Sutton says.

Workshop attendees visit Orion control centre (Insert: Shift Controllers at work)