

Lower South Island Reliability Grid Upgrade Proposal

Stakeholder Forum

5th May 2010

TRANSPower



Introductions

PowerNet:

Roger Paterson

Chairman

Transpower Attendees:

John Clarke

General Manager Grid Development

Nick Mulgan

Team Leader Economics and Approvals

Alex Joosten

Senior Planning and Development Engineer

Caroline Horrox

Senior Environmental Advisor – Projects

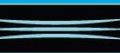
Vivien Winch

Project Manager



Content and Purpose of Today

- Brief Recap
- Technical Summary
- Economic analysis results
- Next Steps



- **Brief Recap**
- Technical Summary
- Economic analysis results
- Next Steps



Recap : Engagement

- We discussed the demand forecast and the “long list” of options with stakeholders in late 2008
- We consulted on this in early 2009
- We gave an update on progress in July 2009
- Since then
 - “LSI Renewables” “intention to approve” including \$32M of this region’s work
 - Re-examination of alternatives to building a 220 kV line

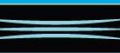
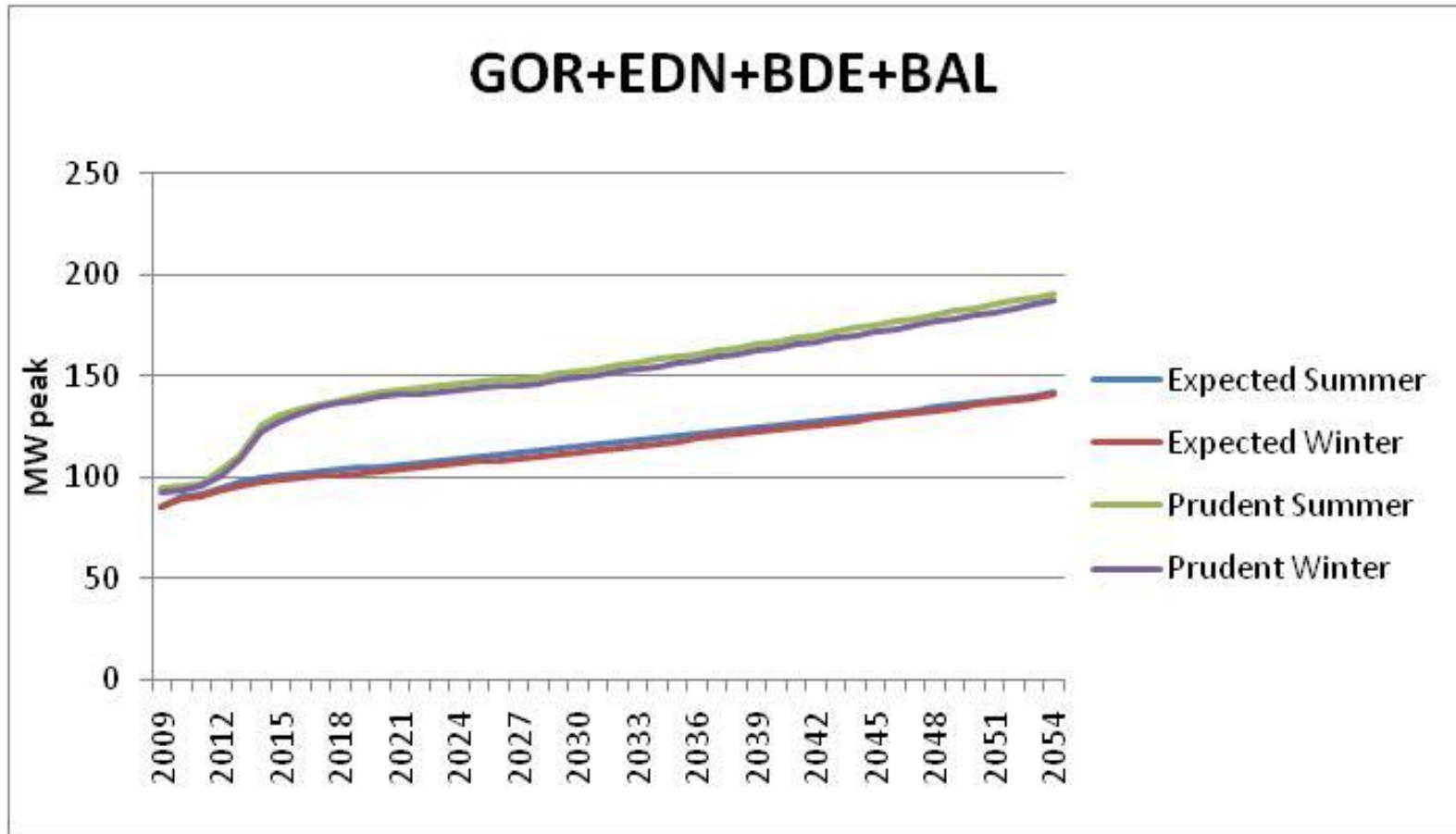


Recap : Demand Forecast

- We engaged an independent consultant, Covec Ltd., to do a demand forecast in summer 2008-9
- At the time the mood was very bullish
- They produced prudent and mean forecasts which were very different, reflecting uncertainty
- We use a prudent (high) forecast for risk-averse core grid planning and a mean forecast for economic (statistical) modelling



Demand Forecasts



More Recently : Demand Forecast

- Following discussions with PowerNet we lowered the prudent forecast by
 - Deferring growth at Gore by 2 years
 - Trigger point for different study is Brydone and Edendale adding to 48 MW
- After a discussion with Rio Tinto we have increased the prudent Tiwai demand by 5 MW per annum from 2015 to 2024 to a maximum of 690 MW
 - Prudent = Potential, not committed

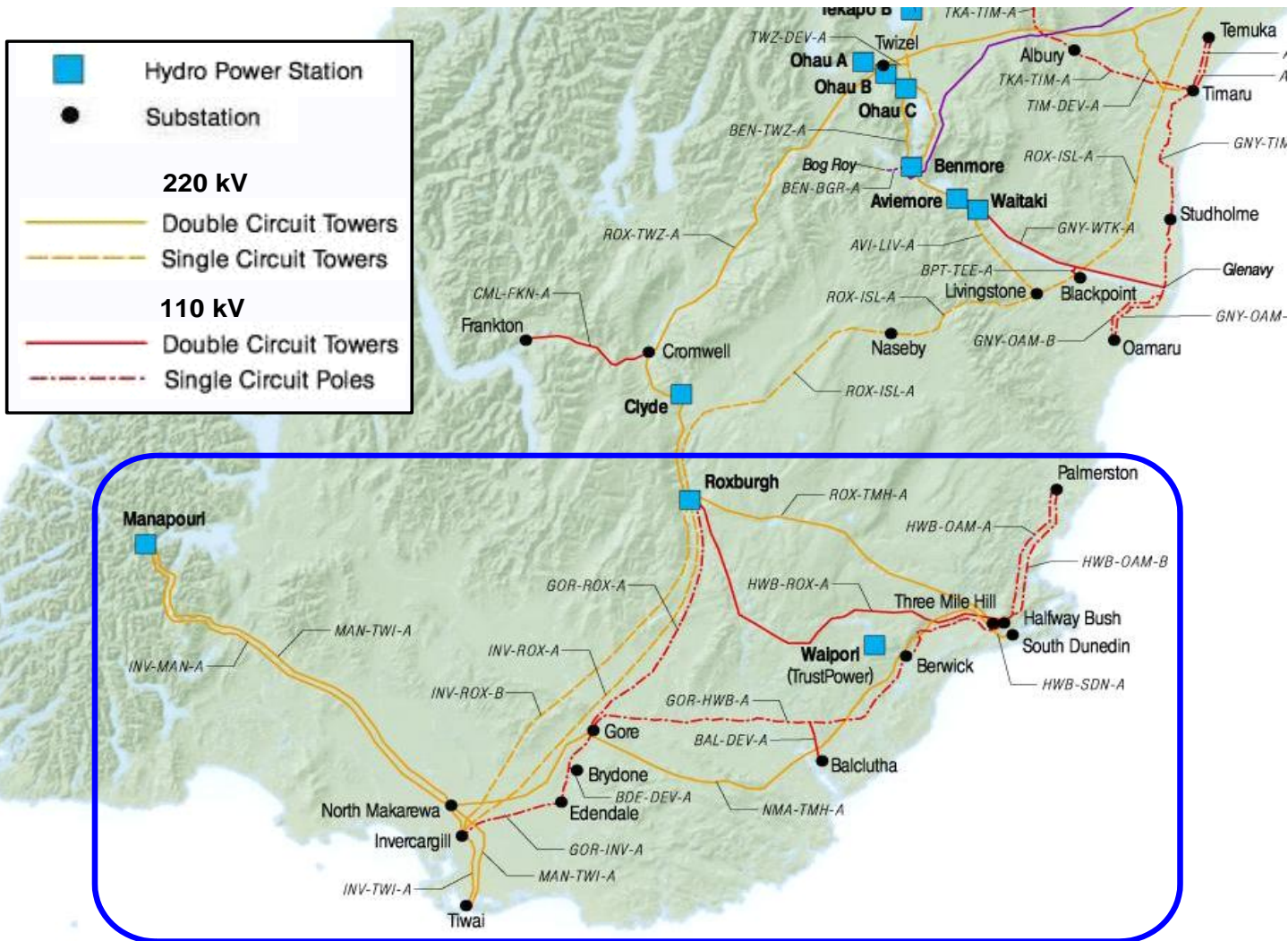


More Recently : Generation

- Following discussions with Meridian's hydrological specialists we have increased the assumption of minimum Manapouri generation during a major transmission fault to 250 MW daily average
- This change means that we no longer require an increase in 220 kV capacity as soon as possible



Recap : The Region



Scope of investigations

In

- Roxburgh and South
- 220 kV
- 110 kV

- Roxburgh interconnector
- Invercargill interconnector

Out

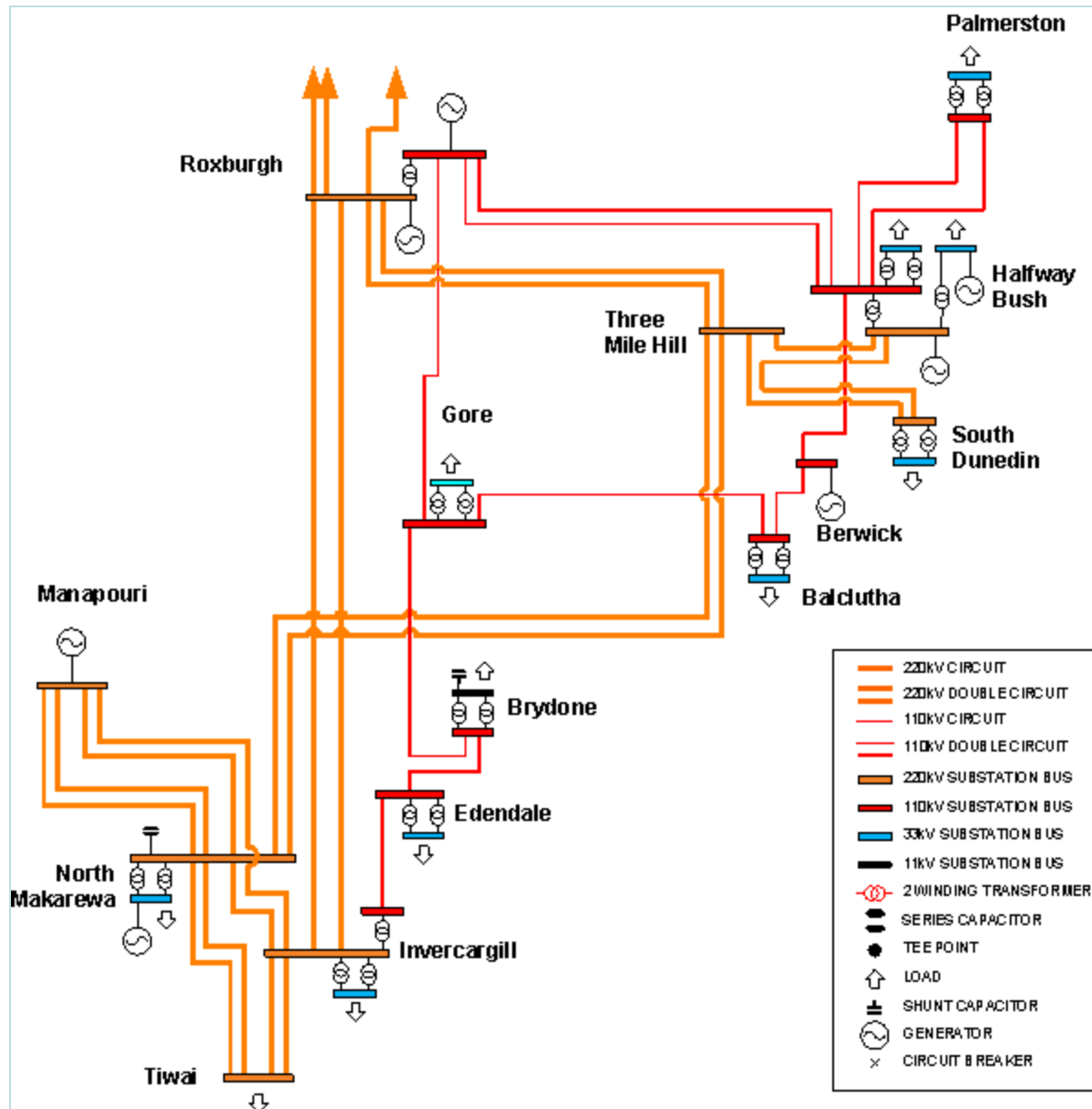
- Clyde-Roxburgh and Clutha to Waitaki lines
 - LSI Renewables project
 - Electricity Commission: Notice of intention to approve
- Halfway Bush substation incl. interconnector
 - Separate study next year



Recap : The Need

- Load growth from substations connected to the 110 kV network requires the 110 kV to be reinforced
 - but what standard can be economically justified? (Grid Investment Test or GIT)
- Load growth in the whole region, particularly south of Balclutha and Gore, requires increased core grid transmission capacity to an ‘n-1’ standard.

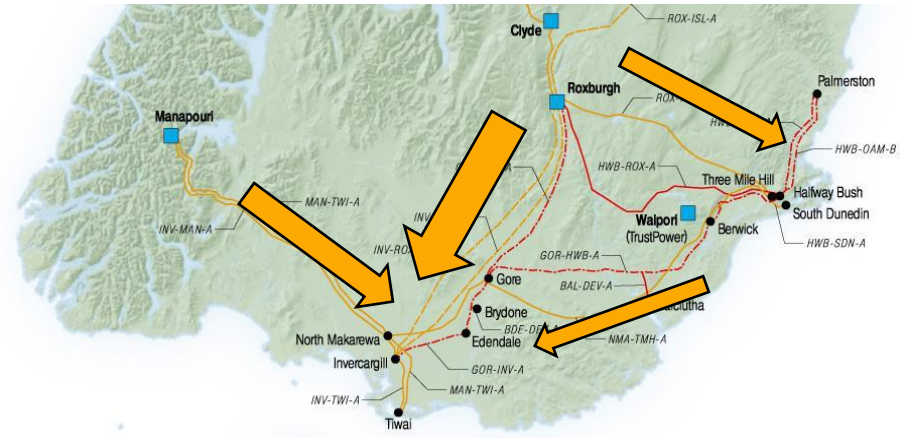




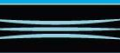
Recap:

Bulk Transfer Need (220 kV)

- Dry period security for southward flow
- INV-ROX circuits constrain the flow currently
- Overall Roxburgh-Invercargill area capacity must be greater than (Tiwai + North Makarewa + Invercargill) load, minus Manapouri generation



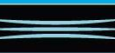
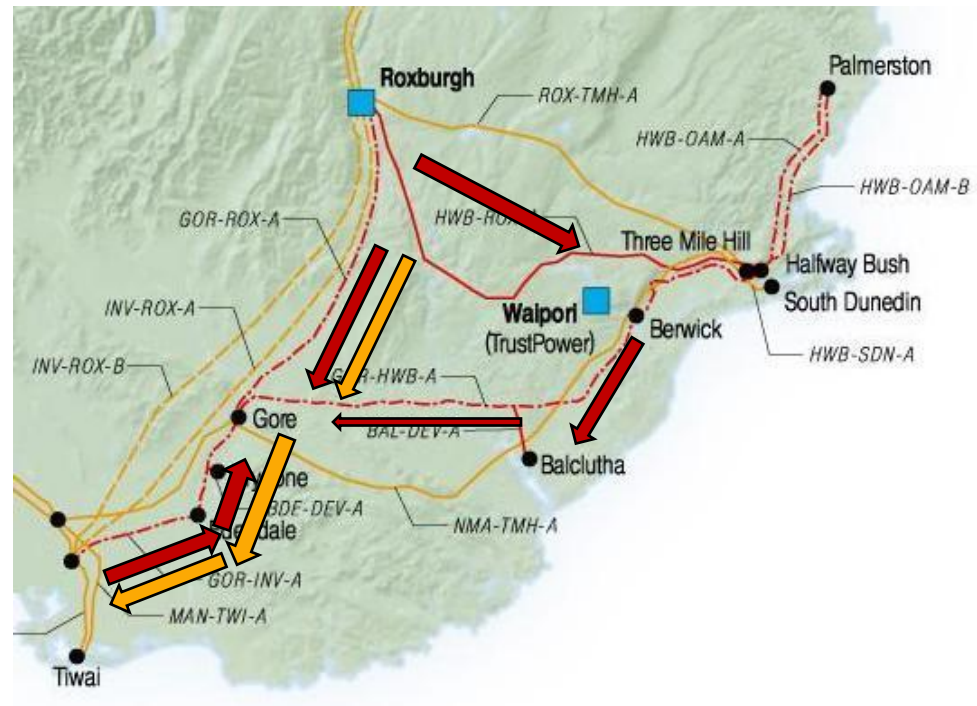
- This is “core grid” so N-1
- Meridian/Transpower/Rio Tinto agreement ends 2012



Recap:

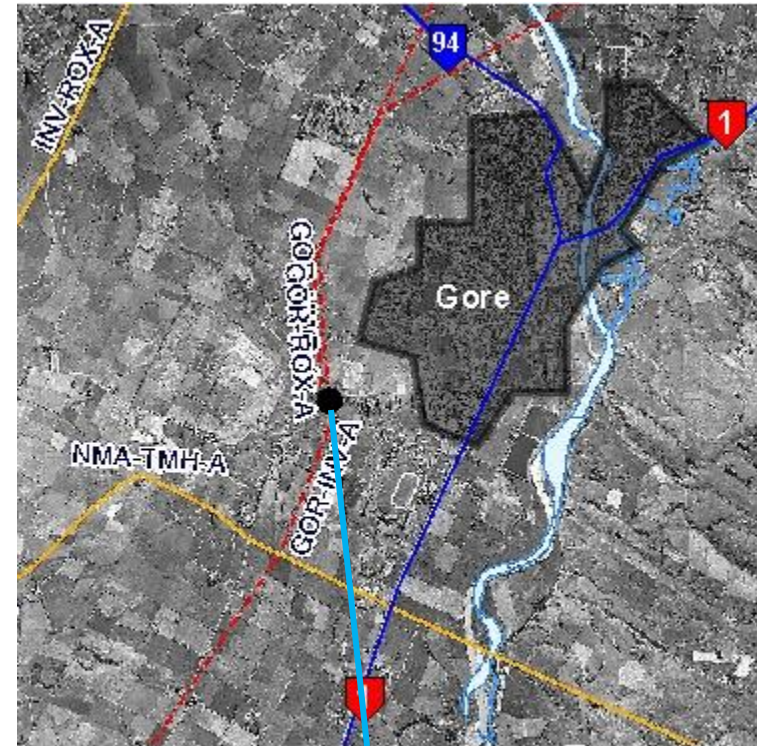
Local Southland Need (110 kV)

- Increased and potentially increasing demand
 - Dairy conversion
- 110 kV in parallel with 220 kV
 - At the moment 110 kV limits the 220 kV capacity
- Voltage issues, Gore and Balclutha
- Non-core grid so must justify economically



Recap : Gore

- Most recent and possible future load growth on the 110 kV network is near Gore
- Under-utilised North Makarewa to Three Mile Hill line passes close to the existing Gore substation
- Gore is the centre of the existing 110 kV network and so provides the most opportunities for reconfiguration



0 1 2 3 km



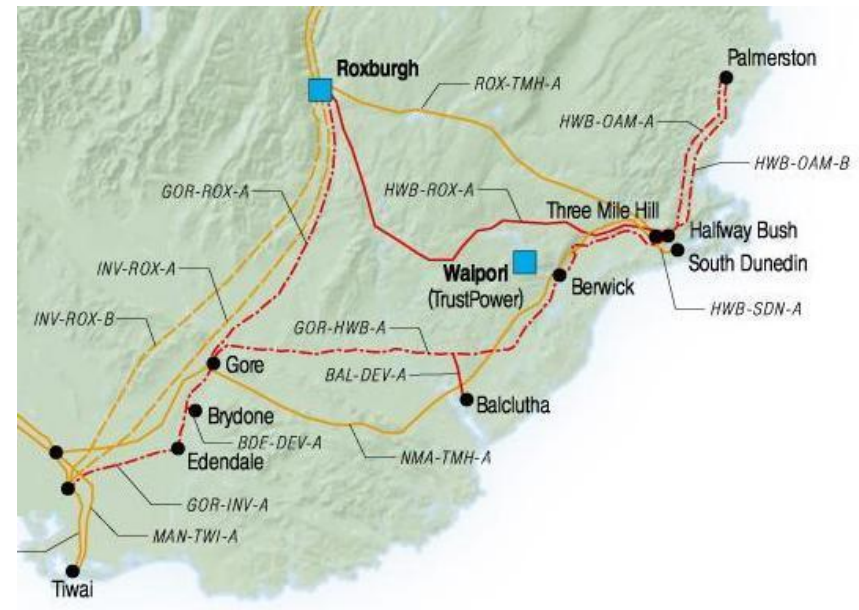
Recap: Options

- Last year we discussed many options
- At that time the most promising solution was:
 - A new 220 kV line Gore to Roxburgh, connecting to the under-utilised North Makarewa to Three Mile Hill line
 - A new 220 kV substation at Gore with 1 or 2 interconnecting transformers
 - Rearrangement of the 110 kV circuits at Gore so 110 kV is not in parallel with the 220 kV
- Parts of this are similar in the revised options, but some emphasis has changed



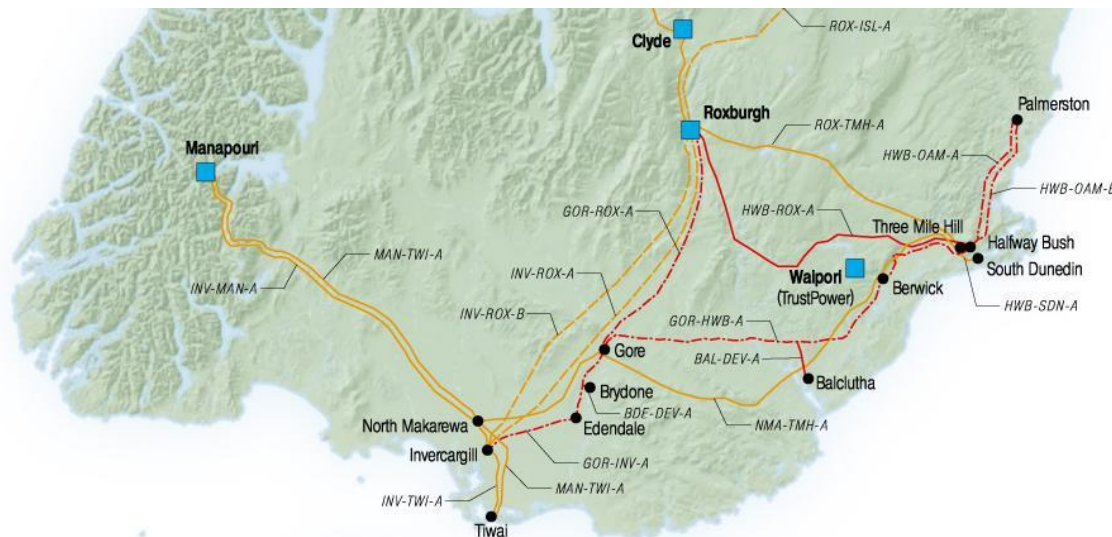
Recap: 220 kV options

- ROX-TMH and TMH-NMA circuits are under-utilised
 - Series capacitors on one or both TMH-NMA, \$30-\$60M
 - Would balance loads better
- New 220 kV ROX-GOR line = \$100M



Recap: 220 kV options(2)

- Special Protection Scheme to:
 - ramp up Manapouri generation and/or
 - drop one reduction line at Tiwai if an INV-ROX circuit fails during low Manapouri generation



Recap: 110 kV options

- Reconductor the existing 110 kV lines for much higher capacity.
- Remove the load supplied from Gore by reconnecting it to a new 220/33 kV switchyard near Gore off the 220 kV TMH-NMA line.



- Brief Recap
- **Technical Summary - Details on what potential solutions have been selected for the short list (and the top options that will be further considered)**
- Economic analysis results
- Next Steps



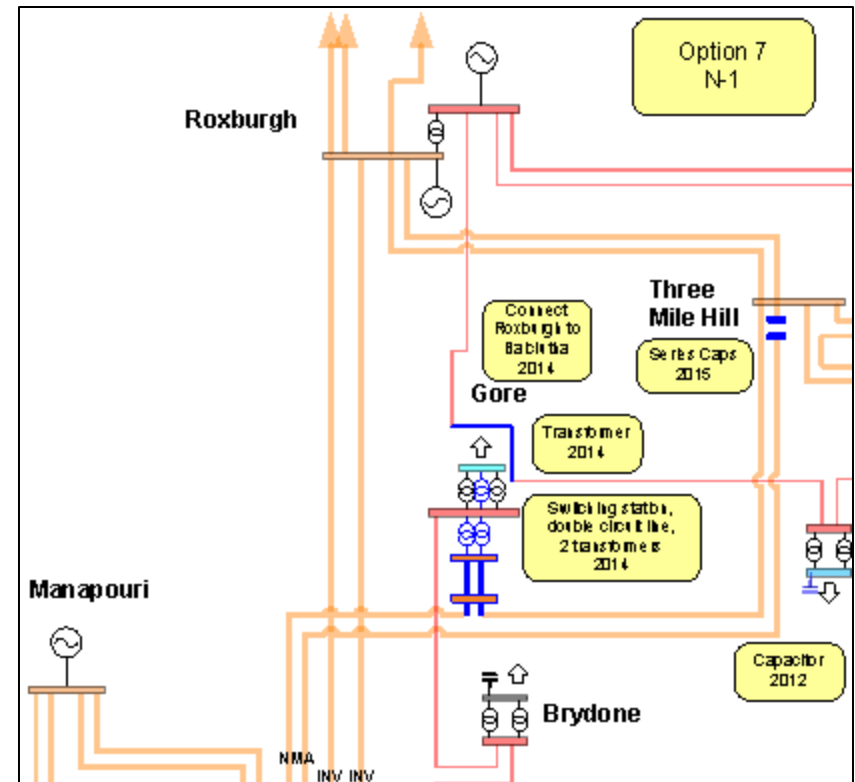
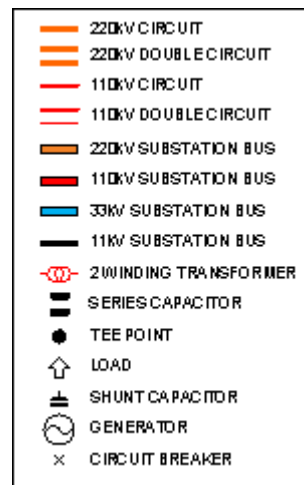
Gore Supply Transformers – common to all development options

- The Gore 110/33 kV supply transformers need to be replaced because of insufficient capacity to supply the forecast load growth.
- Some development options also require the supply transformers to be relocated within GOR substation to allow bus splitting to control line loading.
- Therefore, there are development synergies.



N-1 Development Plan: Option 7

- Build everything in 2012-2015



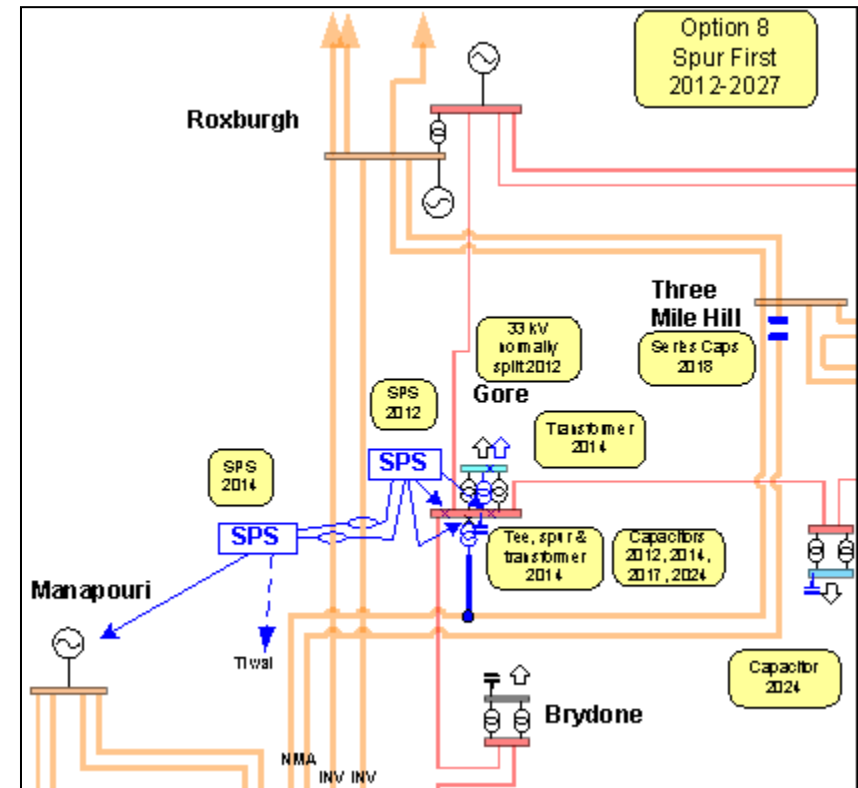
Option 7: Logic Summary

- Overloading of GOR-ROX
 - split 110 kV at GOR, supply BAL directly from ROX
- Keep N-1 at GOR
 - Two GOR interconnecting transformers (ICTs)
- Keep N-1 at EDN and BDE
 - Supply from INV and GOR
 - Cap EDN and BDE load to INV-GOR line capacity
- Bulk transfer capacity
 - 1 x 70% series capacitor on one 220 kV TMH-NMA circuit
 - no other connection possible to the circuit with series capacitors
 - need switching station on other TMH-NMA circuit for GOR ICTs
 - “other” TMH-NMA circuit also suitable for further connections (eg wind farms)



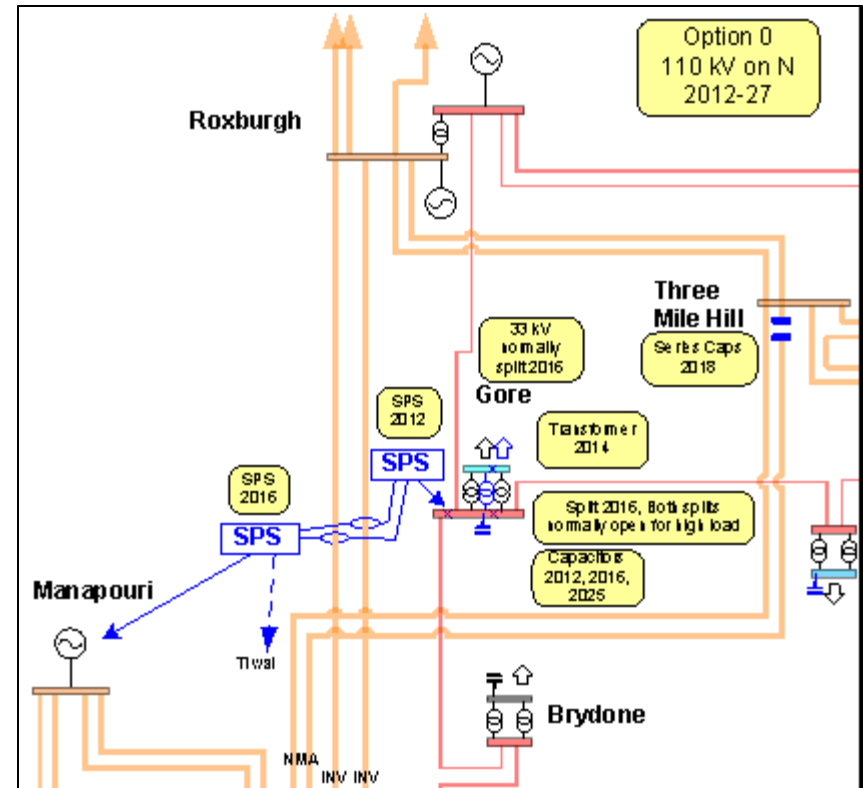
Option 8: Staged Development

- Defer Series Capacitors using SPS on Manapouri or Tiwai
- Make better use of GOR-ROX 110 kV line → keep most of Gore load off 220 kV
- Only one GOR interconnector at first to give n-1 security →
 - Hard tee, no switching station
 - Require SPS to split GOR if ROX-GOR overloads
 - Most GOR load on ROX-GOR
 - Some GOR load on BAL-GOR
 - EDN and BDE from INV
- Requires several shunt capacitors at BAL and GOR for voltage support – additional expense

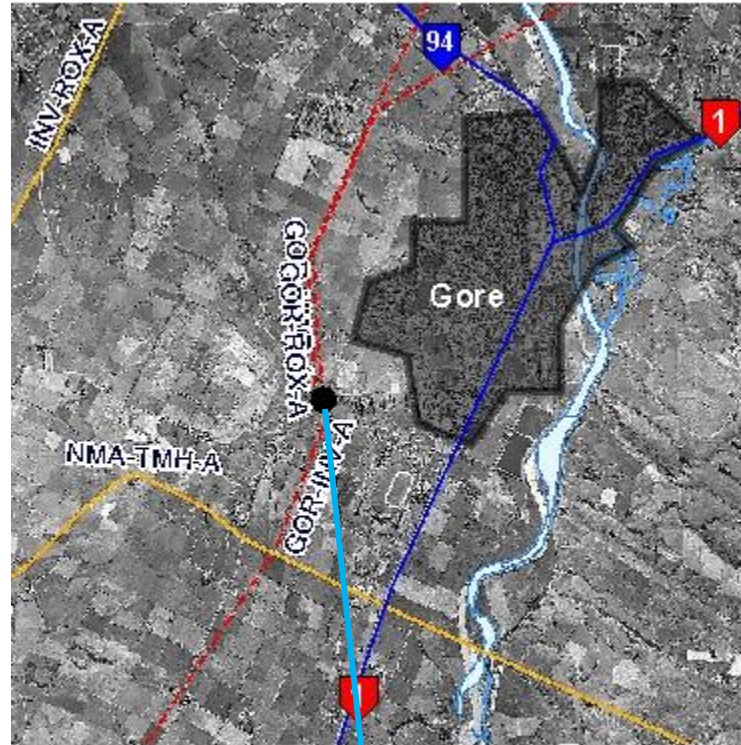


Option 0: Base case, N on 110 kV

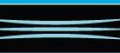
- Must be considered for economic comparison
- Base case: justify build above this
- At high loads need to split GOR bus
 - Most GOR load on ROX-GOR
 - Some GOR load on BAL-GOR
 - EDN and BDE from INV
- If a fault occurs, there is a partial Loss of Supply



Gore and Environs



0 1 2 3 km



New Line Section – The Route

- For an n-1 security level (Options 7 or 8), need a short length of new line to connect between the TMH-NMA line and existing GOR substation.
- For Option 7, need a new 220 kV station adjacent to the TMH-NMA line. The new line to GOR could be:
 - 220 kV if the ICT's are at GOR
 - 110 kV if the ICT's are at the new 220 kV station
- For Option 8, there is no new 220 kV switching station:
 - need a short new “small” 220 kV line to GOR, with ICT at GOR
- There is flexibility around the configuration and location of a new short 220 kV or 110 kV line from the TMH-NMA line (and new 220 kV station for Option 7), to GOR.
- Expand existing Gore substation for all options



New Assets – post EC approval

- For any new asset - Transpower will:
 - work with Councils and community to determine preferred option
 - follow a robust site/route selection process taking into account:
 - Community input (landowners and other stakeholders), and
 - Environmental, property, social and engineering constraints



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Grid Investment Test

- Have to justify business case
- Work in progress
- Net Present Value (NPV) calculation
 - Compare future costs/benefits with costs now
 - Each year reduce value by 7%
 - Delaying has “value”
- Trade off
 - less build ↔ more unserved energy



Unserved Energy

$$\text{\$USE} = \text{VoLL} \times \text{EUE}$$

- Cost of Unserved energy = Value of Lost Load x Expected Unserved Energy
- VoLL = \$20k/MWh except where we have clear evidence otherwise
- EUE = (Statistical) Expectation of Unserved Energy
 - Average predicted power cuts
- Doesn't take other issues into account



Indicative GIT results

	Option 0 base case	Option 7 ASAP	Option 8 staged
\$M NPV to 2010			
Capital	\$ 30	\$ 50	\$ 45
\$USE normal operation	\$ 2	\$ -	\$ -
\$USE maintenance	\$ 3	\$ -	\$ 0.3
Total	\$ 35	\$ 50	\$ 45.3

- Values are estimates only – to be revised
- Yet to include
 - Variation in transmission losses across options (small)
 - Operations and Maintenance (small)
 - Market benefits
 - Intangibles



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Next Steps

- To Transpower board May 2010
- Letter to stakeholders and potentially affected land owners May 2010
- Communication of preferred option May 2010
- Submission to Electricity Commission end May 2010
 - Dependent on extent of stakeholder consultation required
- Electricity Commission approval may take 3 months



Stakeholder engagement – opportunities for your input

- NOW - Opportunity for feedback - will feed this info the selection of the preferred solution:
 - Email vivien.winch@transpower.co.nz. or
 - Complete and mail the feedback form
- Formal Electricity Commission consultation process
- If development of new assets form part of an approved EC investment proposal, then we will work with stakeholders and potentially affected parties to determine the most appropriate location



Questions?

Thank you

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