

T R A N S P O W E R

**Lower South Island Renewables Investment
Proposal**

**Attachment F
Long-list and Criteria**

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1 Introduction

This document describes Transpower's:

- final long list of options,
- the short listing selection criteria; and
- the rating of the long list options against these criteria,

for the Lower South Island Renewables Investigation project. Following the receipt of submitters comments from the first stage of consultation, Transpower refined the long list of options and selected a short list. The process of refining options from the long list has been done using a number of criteria which are set out in Section 2 below.

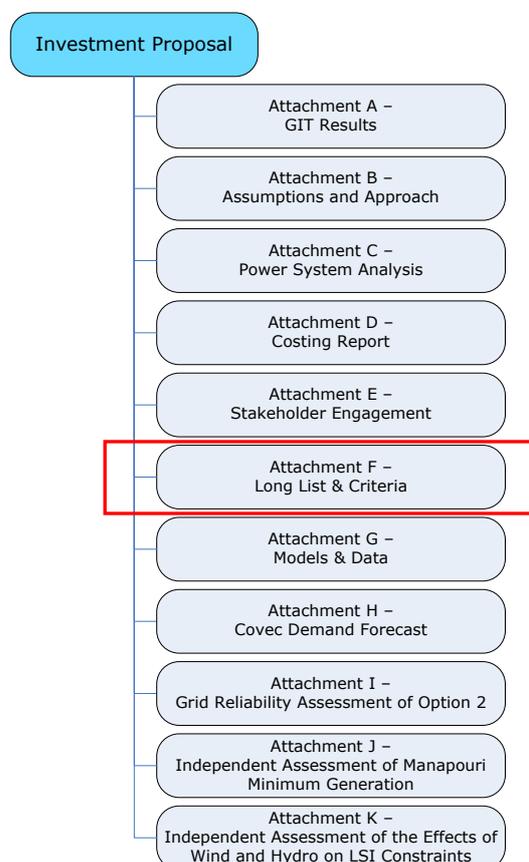
The final long list options are split into two general categories:

- Non-transmission options, comprising both supply side alternatives (including moderate and large generation) and demand side alternatives (which includes embedded generation); and
- Transmission options

1.1 Structure of the document

This document forms part of the Grid Upgrade Plan (GUP) for the Lower South Island Renewables Project.

The structure of the entire investment proposal is set out in the following figure:



2 Criteria for selecting the short listed options

A set of high level screening criteria has been developed to eliminate those options that are not appropriate for Transpower to consider in the short list. The following criteria were used for this purpose, and were been compiled by reference to, the definition of “alternative projects” under the Rules, the Government Policy Statement on Electricity Governance (GPS) and the Grid Upgrade Investigation and Review Policy (GUIRP) have been used for this purpose:

- A. Fit for purpose
 - Will meet the transmission need
- B. Technical feasibility
 - Complexity of solution
 - Reliability, availability and maintainability of the solution
 - Future flexibility - Grid Development Strategy
- C. Practicality of implementation
 - Solution implementable by required date (probability of proceeding)
 - Property and environmental risks
 - Implementation risks
- D. Good electricity industry practice (GEIP)
 - Consistent with good international practice
 - Ensure safety and environmental protection
 - Accounts for relative size, duty, age and technological status
- E. System security (additional benefit resulting from an economic investment)
 - Improved system security
 - System operator benefits (controllability)
 - Dynamic benefits (modulation features and improved system stability)
- F. Indicative cost
 - whether an option will clearly be more expensive than another option with similar or greater benefits

Each of the long list options has been assessed against these criteria.

3 Non Transmission Alternatives

This section sets out the long list of non-transmission options. It is split into two sections covering:

- Supply side alternatives; and
- Demand side alternatives

3.1 Supply Side Alternatives

Generation

Supply side alternatives involve adding more generation on the constrained side of the network, rather than investing in additional transmission capacity.

Note that this type of alternative (i.e. new generation) is analysed in the GIT analysis as an output of the generation scenarios. Therefore, generation options are not included in the short list.

Included in Short List: ✘

Reason: Generation options form part of the scenario analysis and therefore are not an alternative.

Generation runback schemes

Generation runback schemes allow a transmission system to be utilised beyond its n-1 capacity on the basis that should a transmission contingency occur, generation on the appropriate side of the constraint will be automatically reduced to alleviate circuit overloading. Implicit in such schemes is the assumption that appropriately located generation run-up will be enabled to balance the run-back, hence resulting in no lost load.

This option has not been short-listed as an alternative, although it has been investigated (but not implemented) as a short-term means of mitigating the effect of constraints. See “options considered” in the executive summary of the proposal for the reasons that a runback at Clyde and/or Roxburgh would not be useful. In addition, a runback scheme would not enhance the ability of the system to provide n-1 security under south flow conditions such as those analysed in Attachment I. For these reasons a generation runback scheme has been ruled out as not fit for purpose.

Included in Short List: ✘

3.2 Demand Side Alternatives

For the Lower South Island, demand side alternatives would entail decreasing demand in the Upper South Island or the North Island. Demand side alternatives may include:

Demand Side Management

Peak electricity demand management by lines companies, e.g. ripple control, smart metering, energy efficiency schemes, embedded generation, utilisation of stand-by generation for peak lopping etc.

Included in Short List: ✘

Reason: Not a practical alternative due to the scale of the demand side management required. Current trial of Grid Support Contracts insufficient to be a credible alternative, Criteria A, B, C and F.

Fuel switching

Demand reduction potential from fuel switching (to gas).

Included in Short List: ✘

Reason: Not a practical alternative due to the scale of fuel switching required, Criteria A, B, C and F. Is accounted for in the demand forecasts used within the analysis.

Energy Efficiency

Demand reductions may be achieved through the promotion and installation of energy efficient heating, motors and appliances.

Included in Short List: ✘

Reason: Not a practical alternative due to the scale of savings in demand required, Criteria A, B, C and F. Is accounted for in the demand forecasts used within the analysis.

Price Signals

Suggestion to use price/security of supply signals to encourage commercial and industrial customers to install peak looping diesel generation sets. This will depend on their perceived level of exposure.

Included in Short List: ✘

Reason: Not a practical alternative due to the scale of the demand side management required. A scheme similar to the 2006-8 trial of Grid Support Contracts would be insufficient to be a credible alternative. Criteria A, B, C and F.

Alternative methods

These may include such methods as:

- Using thermal storage devices to reduce peak system demand
- Using distributed generation from sources such as photovoltaic cells to reduce peak demand
- Utilising the energy stored in car batteries to reduce peak demand

While these alternative methods may be some time from practical realisation, they are nonetheless included in the long list for consideration.

Transpower is currently developing Grid Support Contracts to enable it to procure generation or demand side services to defer transmission investments.

Included in Short List: ✘

Reason: Not a practical alternative due to the scale required and lack of proponent. Current trial of Grid Support Contracts insufficient to be a credible alternative.

4 Transmission Options

Transmission options identified can be grouped into options that either:

- utilise existing assets
- build a new AC transmission line
- utilise existing, or build new HVDC transmission line.

For the AC options there is opportunity to both utilise the existing assets and build new lines. The construction may also be staged to reduce the overall cost of any upgrade.

4.1 Use of Existing Assets

The following options involve increasing the capacity of the existing 220 kV lines between Roxburgh and the Waitaki Valley.

Controlling power flow

This option may utilise a variety of methods to control power flows in the affected circuits in order to maximise the capacity of the existing system. The available methods include:

- Series reactors (to limit power flow in constrained circuits)
- Series capacitors (to increase power flow through unconstrained circuits)
- Phase shifting transformers (to enable precise control over power flow in a circuit).

Included in Short List: ✓

Reason: Series capacitors likely to assist in balancing the flows between the CYD-CML-TWZ and the ROX-LIV circuits and increasing the N-1 northward transfer capacity.

Thermal Upgrading of existing lines

This option involves thermally upgrading the existing transmission lines.

Included in Short List: ✓

Reason: Fits all the criteria including technical practicality and likely to fall within cost band of other practical alternatives with similar or greater benefits.

Reconductoring of existing lines

This option involves replacing the existing conductors on the existing transmission lines (e.g. duplexing or high capacity simplex). A number of conductor technologies, capacities, and configurations will be investigated.

Included in Short List: ✓

Reason: Fits all the criteria including technical practicality and likely to fall within cost band of other practical alternatives with similar or greater benefits.

Conversion of existing transmission lines to higher voltage

The existing lines in the LSI region can not be physically converted to 400 kV, therefore this is a new line option.

Included in Short List: ✗

Reason: Technically feasible, but the costs outweigh the benefits. Criteria B and F.

Conversion of single circuit transmission lines to double circuit lines

This option involves replacing the single circuit transmission lines with double circuit transmission lines. With this option there is the opportunity to actually remove the single circuit lines so the total number of transmission lines is the same over time.

Included in Short List: ✘

Reason: In practice this is actually a new line option and is addressed further below.

Dynamic Line Rating

This option involves utilising dynamic line rating to maximise the capacity on the existing transmission lines. Note that Transpower has initiated a review on how line ratings are determined. This may result in additional capacity being released; however, this will form part of the base case. Therefore, it is not considered as an alternative.

Included in Short List: ✘

Reason: Due to the capacity increase required this option does not fit with the purpose of the upgrade. Criteria A.

4.2 New AC Transmission Lines

New Transmission Line

This option involves constructing new single or double circuit transmission lines from the Roxburgh Substation to the Waitaki Valley. Sub-options include:

- constructing new transmission lines at 220 kV to follow the existing line routes
- constructing a new line to connect the Project Hayes wind farm to Naseby and then Livingstone.

For both options, a number of conductor technologies, capacities, and configurations have been investigated.

Included in Short List: ✔

Reason: Fits all the criteria including technical practicality and may fall within cost band of other practical alternatives.

4.3 Utilise Existing or Build New HVDC Transmission Line

Converting an existing AC transmission line to HVDC

This option involves converting an existing AC transmission line to HVDC, and constructing new HVDC (or HVDC light) converter stations at both ends of the line.

Included in Short List: ✘

Reason: High cost option relative to other AC alternatives with similar or greater benefits. Criteria F.

New HVDC transmission link

This option involves constructing a new HVDC transmission link (including converter stations). Sub-options include:

- conventional HVDC link
- HVDC light.

Included in Short List: ✘

Reason: High cost option relative to other AC alternatives with similar or greater benefits. Criteria F.

Extend the existing HVDC system

This option involves relocating one or both of the existing HVDC converter stations and extending the existing HVDC line accordingly. Alternatively, options that result in the creation of a multi-terminal HVDC system will be investigated.

Included in Short List: ✘

Reason: Extremely high cost option relative to other AC alternatives. Criteria F.

5 Summary

The following summarises the assessment of the long list options against the criteria:

Option Type	Option	Criteria					
		A Fit	B Feasible	C Practical	D GEIP	E Security	F Cost
Non Transmission, Supply Side	New generation	✗					
	Runback Scheme (SPS)	✗					
Non Transmission, Demand Side	DSM	✗	✗	✗			✗
	Fuel Switching	✗	✗	✗			✗
	Energy Efficiency	✗	✗	✗			✗
	Price Signals	✗	✗	✗			✗
	Alternatives	✗	✗	✗			✗
Transmission, Use of Existing	Controlling power flow	✓	✓	✓	✓	✓	✓
	Thermal Upgrades	✓	✓	✓	✓	✓	✓
	Reconductoring	✓	✓	✓	✓	✓	✓
	Conversion to double circuits	✗					✗
	Dynamic Line Rating	✗					
Transmission, New AC	New Lines	✓	✓	✓	✓	✓	✓
Transmission, HVDC	Conversion of AC lines						✗
	New HVDC link						✗
	Extend Existing HVDC link						✗