Arapuni Bus Split Net Benefit Test Update

The purpose of this document is to provide an update to the Net Benefit Test for the Arapuni bus split. This update is based on feedback received during consultation with the industry.

What has changed from the previous document?

In response to the consultation that occurred in November 2014 a third option has been included in our Net Benefit Test. That option is to defer the closing of the Arapuni bus split until 2017 by performing maintenance this summer.

Why are we revisiting the Net Benefit Test?

We published results of the Net Benefit Test in November 2014. That document indicated the most economic course of action was to close the Arapuni bus split at the end of the 2014/15 summer. An industry consultation meeting was held to discuss the outcome of this Net Benefit Test. The response to that consultation was that a third option be considered. That option was to maintain the existing configuration at Arapuni until 2017.

The documentation of previous tests can be found at the following link:

https://www.transpower.co.nz/news/grid-configuration

Options considered

1. Close Arapuni bus split permanently, this option has a capital cost of $26,000
2. Invest to install Arapuni bus split permanently, this option has a capital cost of $570,000.
3. Keep the existing configuration at Arapuni until 2017, this option has an immediate maintenance cost of $26,000 and a capital cost of $26,000 in 2017.

Assumptions

Some assumptions are different from past tests to reflect changes to the system or ensure the change in conclusion is robust.

Losses and generation constraints have been valued based on marginal costs used in our evaluation of the Bunnythorpe-Haywards A and B conductor replacement Major Capex Proposal1.

Value of lost load is $20,000/MWh.

Previous tests have assumed a five minute off load time is required on the Arapuni-Hamilton circuits for the outage of a parallel circuit or 220 kV Hamilton-Whakamaru circuit. With the new RAS software this constraint has been relaxed. The analysis assumes that the Arapuni-Hamilton circuits may be loaded to 95% of their seasonal rating pre-contingency.


March 2015
In the past, we have conservatively valued losses and generation constraints at $20/MWh and found the split was still justified. As these costs were considered lower-bounds on the benefit of the split, there was no need to refine these assumptions further.

We have valued generation constraints and losses based on the month and time of day we would expect them to occur. The costs are based on modelling undertaken for our Bunnythorpe-Haywards A and B Conductor Replacement Project.

For our analysis of this project we used data from the 2013 year on the grid to determine the constraints that would occur at Arapuni with the current grid configuration.

We then estimated the degree to which the constraints would reduce Arapuni generation using historical dispatch information from 2000-2009.

**Future Developments**

There are two future developments that have an impact on the constraints on the Arapuni-Hamilton circuits. That is the Hangatiki-Te Awamutu circuit and the Putaruru Grid Exit Point.

With these two developments commissioned operating with the Arapuni bus split open will be increasingly difficult. The split will also have a diminishing fuel cost benefit as constraints on Arapuni generation will be rare after the projects are commissioned.

For these reasons the Net Benefit Test is only performed over the three years until 2017 when these developments are expected to be commissioned.

The reduced unserved energy cost of having the Arapuni bus split closed is in two places:

- **Hangatiki** - which will no longer be exposed to a common bus fault at Arapuni North (around $26,000 per year)
- **Kinleith** - which will no longer be exposed to the loss of one Kinleith-Tarukenga circuit immediately followed by the other circuit (around $40,000 per year).

**High Level Results**

Table 1 - Table 2 shows the results of the Net Benefit Test for each of the options.

**Table 1: Option 1 – Close Arapuni bus split permanently ($000)**

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>Total (NPV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Cost</td>
<td>-26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced Unserved Energy</td>
<td>66</td>
<td>66</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Reduction in Fuel Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction in Losses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (PV)</td>
<td>37</td>
<td>58</td>
<td>54</td>
<td>149</td>
</tr>
</tbody>
</table>

**Table 2: Option 2 – Make Arapuni bus split permanent ($000)**

<table>
<thead>
<tr>
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<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>Total (NPV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Cost</td>
<td>-570</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
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March 2015
The results show that option 3 is clearly the most economic of the three options.

Option 3 unquantified costs

There is a cost associated with option 3 that has not been quantified here. If an item of equipment connected to the North Bus fails, that bus will need to be removed from service to perform repairs. Provided this cost is less than $314,000 option 3 remains the most economic.

A high level calculation of the cost of such an event follows.

An unplanned maintenance outage of approximately 12 hours is required for the repair work. In that time assuming a conservative maximum of one generating unit can be dispatched on the north bus. Therefore an unplanned outage will cost $65,000-90,000 per outage.

Quantifying how frequently these urgent repairs will be required over the next three years is complex. However, the above calculation indicates unscheduled maintenance would be required 1-2 times a year, which is well in excess of outage probabilities, to make option 1 more economic.

We have scheduled maintenance work on the north bus equipment this summer. That work will help to reduce the likelihood of unscheduled maintenance on the north bus in the next three years.

What are we proposing to do?

We are proposing to permanently close the Arapuni bus split at the end of the summer ratings period in early 2017.

In order to defer the closure of this split we need to perform maintenance on our equipment this summer. We are working with affected parties to ensure this maintenance proceeds as required.

Waikato Region Schematic

March 2015