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Proposal Summary

The purpose of this document is to inform stakeholders of our intention to reconfigure the 110 kV network, by introducing a system split\(^1\) at Studholme, in the event that:

- there is higher than anticipated peak load in the Lower Waitaki region, and/or
- demand response is insufficient to keep line loadings within the circuit rating.

If we need to use this grid reconfiguration, Studholme will be connected to the grid via a single circuit and an unplanned outage of the circuit will lead to loss of supply at Studholme.

Our intention is to use the grid reconfiguration only as a contingency measure for the summer months of December through mid-March from the 2016/2017 summer. However, load growth in the Waitaki Valley region may require us to consider using the 110 kV split more regularly in the future during summer months.

We will reassess this analysis within three years' dependent on the load growth and development of the grid within the region.

Figure 1 shows the single line diagram of the Lower Waitaki network and the proposed reconfiguration.

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\(^1\) The system split entails opening one of the 110 kV circuits into Studholme to break the transmission path between Waitaki and Timaru to reduce loading on the Bells Pond-Waitaki circuit.
1 What is the problem?

Since 2010 we have put the circuit between Studholme and Timaru in service (closed the operational split) for the dairy season, between October and April. This configuration provides n-1 security to the dairy factory at Studholme. However, this also provides a through transmission path between Waitaki and Timaru that increases loading on the Oamaru-Studholme-Waitaki 2 circuit.

Our load forecast for summer 2016/17 indicates that with the operational split closed in summer loading on the Bells Pond-Waitaki section of the Oamaru-Studholme-Waitaki-2 circuit (Bells Pond-Waitaki circuit) may exceed the continuous rating of the circuit with all assets in service in some circumstances. This is a result of high demand growth in the region.

The likelihood of this happening in summer 2016/17 is relatively low. It would require peak loading at regional grid exits points coinciding with low generation and insufficient demand response. However, as a prudent network operator we consider it necessary to have the required mechanisms in place to deal with this situation.

Circuit overloading following an unplanned outage is managed separately by an automatic special protection scheme (SPS) called the Bells Pond-Waitaki SPS.

2 What are we doing this summer?

Our primary plan is to use demand response to limit loading on the Bells Pond-Waitaki circuit to within its circuit rating with all circuits in service. Our demand response plan:

- prevents the Bells Pond-Waitaki SPS from operating with all circuits in service, therefore maintaining n-1 security to Studholme during summer
- ensures that if a circuit does trip, there will be enough time for the Bells Pond-Waitaki SPS to reduce nominated load at Bells Pond, avoiding a total loss of load at Bells Pond.

Using demand response allows programme participants to actively contribute to the security of the grid in the region. The programme, and previous trials, have been well received by the Waitaki region participants, and provides a mechanism to manage risks of overloading.

3 Why do we need a contingency plan?

Demand response is a relatively new innovation and we must ensure the security and safety of the grid at all times. If offered demand response is insufficient or very expensive, or the participants are unable to respond to all requests, we consider it is prudent to have a contingency plan to maintain grid security.

After considering various options, we consider that if demand response does not provide a viable option then we will introduce a system split at Studholme for the summer months of

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2 Assessment for closing the Studholme and Timaru operational split can be found here: [https://www.transpower.co.nz/sites/default/files/news-articles/attachments/net-benefit-test-stud-tim-split-feb-10.pdf](https://www.transpower.co.nz/sites/default/files/news-articles/attachments/net-benefit-test-stud-tim-split-feb-10.pdf)

3 N-1 connection security means that supply can continue following unplanned outage on one of the circuits supplying Studholme

4 This is the 110kV circuit connecting Oamaru, Glenavy, Studholme, Bells Pond and Waitaki.

5 The system split entails opening one of the 110 kV circuits into Studholme to break the transmission path between Waitaki and Timaru to reduce loading on the Bells Pond-Waitaki circuit.
December through mid-March by opening the circuit at the point shown in Figure 1 such that Studholme will be connected to the grid via a single circuit and an unplanned outage of the circuit will lead to loss of supply at Studholme.

4 What options did we consider in making this decision?

We have assessed three options:

- No action is taken:
  - The System Operator will maintain the security of the grid. One option available to them is to initiate load curtailment.

- The use of demand response to manage loading on the circuits so as to minimise the chance of lost load.

- Opening the Glenavy-Studholme section of the Oamaru-Studholme-Waitaki 2 circuit at Studholme (system split):
  - Splitting the 110 kV network stops through transmission to Timaru and reduces the Bells Pond-Waitaki circuit loading.

We have undertaken a net benefit analysis to inform our decision between these options.

5 Net Benefit Test Results

The results of our analysis show that a demand response option has the highest net benefit and it is better to implement a grid reconfiguration, to split the 110 kV network and supply Studholme at n security, than let the System Operator initiate load curtailment.

Table 1 shows a summary of the results of the net benefit test. The options are short-term solutions and assessment covers the next three years until summer 2018/19.

<table>
<thead>
<tr>
<th></th>
<th>Demand response</th>
<th>Grid reconfiguration (Dec- mid -Mar)</th>
<th>SO initiated load curtailment (base case)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected unserved energy</td>
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<td>$168,000</td>
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<tr>
<td>Fixed cost of outages</td>
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</tr>
<tr>
<td>Demand response procurement</td>
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<tr>
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<tr>
<td>Benefits</td>
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<tr>
<td>Expected reduction in cost of system losses</td>
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<td>Expected reduction in cost of unserved energy</td>
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<td>Reduction in involuntary load curtailment cost</td>
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<td>Total benefits</td>
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<td>Net benefit</td>
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</tr>
</tbody>
</table>

6 Letting the Bells Pond-Waitaki circuit exceed its circuit rating is not considered as an option as it may result in inadvertent operation of the Bells Pond-Waitaki SPS.
The results of the net benefit assessment support our intention to use demand response to manage risks as our primary solution and to implement a 110 kV grid reconfiguration, to split the 110 kV system, when demand response is insufficient to manage load in the Lower Waitaki region.
A.1 Assumptions used in assessment

- **Value of unserved energy:**
  The Electricity Industry Participation Code Schedule 12.2 4(1) gives the value of expected unserved energy (value of lost load, VoLL) = $20,000/MWh

- **Fixed cost per outage:**
  The fixed cost per outage (e.g. cost of restoring production of the major load at Studholme, the dairy factory) is estimated at $500,000 per outage

- **If System Operations (SO) forecasts that a circuit will be overloaded, and there are no other mechanisms in place to manage that overload, the SO issues a customer advice notice. If the market does not respond to correct the situation, they will initiate load curtailment to ensure circuit loading remains within circuit rating limit.**
  The estimate cost of SO initiated planned load shedding is valued at VoLL, $20,000/MWh

- **System losses are valued at the marginal cost of generation and estimated at $82/MWh in 2016 dollars. This value is derived from the wholesale electricity price indicator for 2019 in EDGS 2016 that is based on the LRMC new generation coming online.**

- **Other factors not listed above but listed in 12.117 of the Electricity Industry Participation Code are considered to be immaterial to the ranking of options detailed in our analysis.**