## 10 Bay of Plenty Regional Plan

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### 10.1 Regional overview and transmission system

The Bay of Plenty region has a mix of growing provincial cities (Mount Maunganui, Tauranga, and Rotorua) together with smaller, less active rural localities (Waiotahi and Te Kaha) and heavy industry (Kawerau).

The existing transmission network for the Bay of Plenty region is shown geographically in Figure 10-1 and schematically in Figure 10-2.

**Figure 10-1: Bay of Plenty region transmission**

![Bay of Plenty region transmission](image-url)
10.1.1 Transmission into the region

As generation capacity in the Bay of Plenty region is lower than its maximum demand, the deficit is imported through the National Grid during peak load conditions, and any surplus is exported during light load conditions.

The 220 kV Atiamuri–Whakamaru and Ohakuri–Wairakei circuits connect the region to the rest of the National Grid. The Bay of Plenty load is predominantly supplied through these circuits, and the region will be on security whenever one of these circuits is out of service. These two circuits form part of the grid backbone (refer to Chapter 6 for further discussion).

There is also a low capacity 110 kV Tarukenga–Kinleith–Arapuni connection that connects the Bay of Plenty to the Waikato 110 kV regional network. At present, in normal operation this connection is split at Arapuni to prevent overloading.¹

10.1.2 Transmission within the region

The transmission network in the Bay of Plenty region comprises high capacity 220 kV and low capacity 110 kV circuits, with interconnecting transformers located at Tarukenga, Kailimako, Edgecumbe, and Kawerau. There is also a single 50 kV circuit between Waiotahi and Te Kaha that forms the single supply to the Te Kaha township.

¹ See Chapter 9, for more information about the Arapuni bus split.
Reactive support is provided by 25 Mvar capacitors at Tauranga and Mount Maunganui as these two areas have a relatively high load with very little local generation.

The Kawerau 110 kV bus is unique in that it has a significant amount of generation and interruptible load connected to it. These respond to North Island under-frequency events, which may cause overloads on the already constrained 220/110 kV interconnecting transformers.

Most of the Bay of Plenty generation is at the eastern end of the region (around Kawerau) but the bulk of the load is near the western end (near Rotorua and Tauranga) so power-flow within the region is generally from east to west.

10.2 Bay of Plenty demand

After diversity maximum demand for the Bay of Plenty region is forecast to grow by an average of 2.0 per cent per annum over the next 15 years, from 401 MW in 2017 to 544 MW in 2032. This exceeds the national average growth rate of 1.4 per cent per annum. Table 10-1 sets out forecasts peak demand (prudent growth\(^2\)) at each grid exit point over the forecast period.

Table 10-1: Forecast annual peak demand (MW) at Bay of Plenty grid exit points to 2032

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<tr>
<td>Edgecumbe</td>
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<td>Kaitimako 1, 2</td>
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<td>Kawerau – Horizon</td>
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<td>20</td>
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<td>20</td>
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<td>20</td>
<td>20</td>
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<td>Kawerau T6–T9</td>
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<td>32</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Kawerau – T11 and T14</td>
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<td>85</td>
<td>85</td>
<td>85</td>
<td>85</td>
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<tr>
<td>Mt Maunganui 33 kV 3, 4</td>
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<td>71</td>
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<td>62</td>
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<td>Owhata</td>
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<td>33</td>
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<td>10</td>
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<td>Tauranga 11 kV 1</td>
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</tr>
<tr>
<td>Tauranga 33 kV</td>
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<td>64</td>
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<td></td>
</tr>
<tr>
<td>Te Kaha</td>
<td>0.98</td>
<td>2</td>
<td>2</td>
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<td>2</td>
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<td></td>
</tr>
<tr>
<td>Te Matai 3, 4</td>
<td>0.96</td>
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<td>41</td>
<td>42</td>
<td>55</td>
<td>56</td>
<td>56</td>
<td>57</td>
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<td>60</td>
<td>60</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waiohanga</td>
<td>0.99</td>
<td>11</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
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<td>14</td>
<td>15</td>
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</tbody>
</table>

This demand forecast assumes the following planned load transfers:
1. 5 MW moves from Tauranga-11 kV to Kaitimako in 2019
2. 8 MW moves from Tauranga-11 kV to Kaitimako in 2028
3. 4 MW moves from Mount Maunganui to Te Matai in 2018
4. 11 MW moves from Mount Maunganui to Te Matai in 2020

\(^2\) Our prudent peak forecast has a 10 per cent probability of exceedance forecast for the first seven years of the forecast period. For the rest of the forecast period we assume an expected (or mean) rate of growth. Refer to Chapter 3 for further information on demand forecasting.
10.3 Bay of Plenty generation

The Bay of Plenty region’s generation capacity is currently approximately 392 MW. This is less than regional peak demand so any deficit imported is through the National Grid. At low load the region may import or export power depending on the level of generation dispatched.

Kaimai is a run-of-river hydro scheme that injects into the Tauranga 33 kV bus. Output from the scheme varies between 14 MW and 42 MW – typically, 14 MW is the minimum generation available from the scheme, though this relies on sufficient water being available.

Table 10-2 lists the generation forecast for each grid injection point for the forecast period. This includes all known and committed generation stations including those embedded within the relevant local lines company’s network (Horizon Energy, Unison, or Powerco).³

Further generation may be developed during the period but is not sufficiently advanced to be included in our forecasts. (Refer to section 10.5.7 for more information on potential new generation).

Table 10-2: Forecast annual generation capacity (MW) at Bay of Plenty grid injection points to 2032 (existing and committed generation)

<table>
<thead>
<tr>
<th>Grid injection point (location/name if embedded)</th>
<th>Generation capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid injection point (location/name if embedded)</td>
<td>2017</td>
</tr>
<tr>
<td>Edgecumbe (Bay Milk)</td>
<td>10</td>
</tr>
<tr>
<td>Kawerau (BOPE)</td>
<td>6</td>
</tr>
<tr>
<td>Kawerau (Oji)</td>
<td>27</td>
</tr>
<tr>
<td>Kawerau (KAG)</td>
<td>105</td>
</tr>
<tr>
<td>Kawerau (KA24)</td>
<td>9</td>
</tr>
<tr>
<td>Kawerau (TPP)</td>
<td>37</td>
</tr>
<tr>
<td>Matahina</td>
<td>72</td>
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<tr>
<td>Mount Maunganui (Balance Agri)</td>
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<tr>
<td>Rotorua (Fletcher Forests)</td>
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<td>Rotorua (Wheao Flaxy Scheme)</td>
<td>24</td>
</tr>
<tr>
<td>Tauranga (Kaimai)</td>
<td>42</td>
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</tbody>
</table>

1. The electricity market designation for the Ngāti Tūwharetoa generator is Onepu.

³ Only generating stations with a capacity greater than 1 MW are listed. Generation capacity is rounded to the nearest megawatt.
10.4 Grid enhancement approach

10.4.1 Possible future Bay of Plenty transmission configuration

Figure 10-3 shows the possible configuration of Bay of Plenty transmission in 2032. New assets, upgraded assets, and assets scheduled for replacement within the forecast period (based on potential enhancement approaches set out in the following sections) are shown.

Figure 10-3: Possible Bay of Plenty region transmission configuration in 2032

10.4.2 Enhancement approach

We ensure secure transmission into and within the Bay of Plenty region into the future. Through the E&D process we assess transmission capacity and reactive support requirements in the region over the next 15 years (while remaining cognisant of longer-term development opportunities). In developing Grid Enhancement Approaches to address identified issues and opportunities we take into account uncertainty in future demand, generation and technological developments.

Transmission issues likely requiring E&D or Customer-funded investments in the Bay of Plenty over the next 10-15 years are:

<table>
<thead>
<tr>
<th>Section number</th>
<th>Issue</th>
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</thead>
<tbody>
<tr>
<td>10.4.2.1</td>
<td>Kawerau area generation constraints</td>
</tr>
<tr>
<td>10.4.2.2</td>
<td>Horizon Energy’s Kawerau 11 kV supply capacity and fault levels</td>
</tr>
<tr>
<td>10.4.2.3</td>
<td>Edgécume supply transformer capacity</td>
</tr>
</tbody>
</table>
10.4.2.1 Kawerau area generation constraints

There is potential for significant additional geothermal generation in the eastern Bay of Plenty area, around Kawerau. If this does eventuate, a staged transmission capacity upgrade will be required (see section 10.5.7.1 for more information on generation opportunities in the region).

There are constraints on the existing generation on the Kawerau 110 kV bus due to the low capacity 110 kV Edgecumbe–Kawerau and Edgecumbe–Owhata circuits and the ageing and low capacity Kawerau–T13 interconnecting transformer which is due for risk based condition replacement. The circuit capacity constraints are managed by special protection schemes while the interconnecting transformer capacity issue is not managed as connected parties are satisfied that the probability of overloading and tripping of the transformer is sufficiently low (with existing levels of load and generation).

Any transmission investments required in the future depend on the scale of additional generation. Connecting more than approximately 20-30 MW of additional generation directly or indirectly to the Kawerau 110 kV bus will cause constraints on the 110 kV network and the 220/110 kV interconnecting transformers.

Connecting more than approximately 35 MW of generation at Kawerau (to the 110 kV or 220 kV buses), will also cause constraints on the 220 kV Edgecumbe–Kawerau and Kawerau–Ohakuri circuits. The Atiamuri–Ohakuri circuit in the core grid may also cause generation export constraints from the Kawerau area and Wairakei (see Chapter 6).

Enhancement approach:

- The Kawerau–T13 transformer is due for risk based condition replacement in 2019. An investigation is presently underway and we will discuss options with stakeholders before implementing a solution. The interconnecting transformers are not part of the core grid so investments will need to be economically justified based on generation dispatch benefits.

- We will investigate investment options to address generation export constraints in response to new generation proposals in the Kawerau area. Depending on the scale of additional generation, options for a staged upgrade of generation export capacity include:
  - 220/110 kV transformer capacity
    - replace Kawerau–T13 with a transformer with a 250 MVA transformer identical to Kawerau–T12 (if not already done due to risk based replacement of Kawerau–T13)
  - 110 kV transmission capacity
    - split the 110 kV system between Edgecumbe and Kawerau

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4 Over and above the committed 25 MW Te Ahi O Maui generation expected to come online in 2018.

5 If we replace Kawerau–T13 with an existing surplus transformer there will be a slight decrease in generation export capacity.
10.4.2.2 Horizon Energy’s Kawerau 11 kV supply capacity and fault levels

Two 110/11 kV transformers supply Horizon Energy’s load at Kawerau. Both supply transformers are due for risk based condition replacement in 2018-2019.

A 25 MW geothermal generator (Te Ahi O Maui) connected within Horizon Energy’s 11 kV system will be commissioned by the end of 2017. It will increase the 11 kV fault levels above the rating of equipment within the distribution system. Therefore, to limit the 11 kV fault level, only one supply transformer can be on load when the generator is connected (with the other transformer on standby), putting the load on a security.

Both supply transformers for Horizon Energy are connected to the same 110 kV bus section, which results in a loss of supply for outages of that bus section.

Enhancement approach:

- We plan to replace both 110/11 kV supply transformers that supply Horizon Energy at Kawerau with refurbished higher impedance units (base capex
replacement and refurbishment). The higher impedance transformers limit the fault contribution from the transmission grid, to a level that will allow both supply transformers to be on load when Te Ahi O Maui is connected, restoring n-1 security. The fault level will be within the rating of the equipment within Horizon Energy’s 11 kV sub transmission system.

- The replacement supply transformers will be connected to two different 110 kV bus sections, so a bus section outage will not cause a loss of supply to Horizon Energy. The supply transformer replacements will be co-ordinated with the risk based replacement of the 110 kV switchgear which is due in the next three years.

### 10.4.2.3 Edgecumbe supply transformer capacity

The Edgecumbe supply transformers are forecast to exceed their n-1 rating from 2017. One of the 220/33 kV supply transformers, T8, is due for risk based condition replacement in 2019. The T8 supply transformer has a slightly lower rating than the parallel T7 transformer, and replacing T8 with a larger unit will only provide a slight increase in n-1 capacity at Edgecumbe (around 3-4 MW), which does not provide sufficient capacity for the forecast period.

Enhancement approach:

- We will work with Horizon Energy to determine the capacity requirements of the Edgecumbe–T8 replacement unit (base capex replacement and refurbishment) and whether there is a need to replace T7 with a larger unit at the same time (customer funded).

#### Customer investments

<table>
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<tr>
<th>Project name</th>
<th>Edgecumbe supply capacity</th>
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<td>Project description:</td>
<td>Replace Edgecumbe–T7 220/33 kV supply transformer with a larger unit</td>
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<td>Project’s state of completion:</td>
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<td>OAA level completed:</td>
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<td>Grid need date:</td>
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<td>Indicative cost ($ million):</td>
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<tr>
<td>Part of the GEIR?:</td>
<td>No</td>
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### 10.4.2.4 Mount Maunganui and Te Matai supply capacity and security

We forecast significant growth in demand for the Tauranga area which is underpinned by both infill and greenfield residential and commercial developments. Due to this growth in demand, constraints are expected at three of Powerco’s four grid exit points within the 5–10 year horizon.

The Mount Maunganui load is forecasted to exceed the 110 kV transmission limit within the forecast period. To address this issue, Powerco plans to transfer load to the Te Matai grid exit point from 2020.

However, the increased load at Te Matai causes:

- the Te Matai supply transformers’ n-1 capacity to be exceeded initially, with the continuous capacity of Te Matai–T1, the smaller of the two supply transformers, exceeded at a later time
- low post contingency voltages at Te Matai with large voltage steps during Kaitimako–Te Matai circuit outages.
Enhancement approach:

- **Te Matai–T1** limits the n-1 capacity. This transformer is due for risk based condition replacement in 2019. We are working with Powerco to investigate supply transformer options at Te Matai. A possible solution is to replace Te Matai–T1 with a higher rated unit in 2019 and upgrade the other transformer when the need arises.

- In parallel, we are investigating options to improve voltage quality at the Te Matai supply bus. A possible option is to install a capacitor at Te Matai to provide voltage support.

- We will work with Powerco to identify a long-term development strategy to supply the load at Te Matai when it grows beyond the n-1 capacity of the existing 110 kV circuits after the end of forecast period.

### Customer investments

<table>
<thead>
<tr>
<th>Project name:</th>
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<td>Project description:</td>
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### Base E&D Capex investments

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**10.4.2.5 Tauranga and Kaitimako supply capacity and security**

We expect n-1 110 kV transmission constraints at Tauranga within the forecast period. Powerco plans to transfer load from the Tauranga 11 kV grid exit point to the Kaitimako 33 kV grid exit point from 2019, which will relieve the issue for the forecast period.

The Kaitimako grid exit point is supplied by a single supply transformer, providing n security.

The severity of the 110 kV transmission issues in the forecast period is very sensitive to the level of generation embedded within the Tauranga 33 kV grid exit point, especially at peak times. Tauranga will become more dependent on this generation to maintain n-1 security in the forecast period if no investments are made on the transmission system.

Enhancement approach:

- We will work with Powerco to identify a long-term development strategy to supply the Tauranga and Kaitimako loads.
10.4.2.6 Rotorua area supply capacity

Unison takes supply for its Rotorua network from four grid exit points: Tarukenga, Rotorua (33 kV and 11 kV), and Owhata. The Rotorua 33 kV and 11 kV grid exit points are supplied by the two 110 kV Rotorua–Tarukenga circuits that have a lower n-1 capacity than the supply transformers. The peak loading on the circuits is expected to slightly exceed their n-1 capacity so an outage on one circuit during a peak load period will cause the parallel circuit to overload.

Unison’s distribution network has a high level of interconnectivity between the grid exit points at 11 kV. This interconnectivity, together with its increasing investments in automation, allows Unison to transfer loads between the grid exit points.

Enhancement approach:

- Unison has indicated that it will permanently transfer loads from the Rotorua grid exit points to the Owhata grid exit point to relieve the transmission constraints on the two 110 kV Rotorua–Tarukenga circuits.
- Peak demand at the Owhata grid exit point already exceeds the n-1 capacity of its supply transformers. The Owhata supply transformers are due for risk based condition replacement in 2018 (base capex replacement and refurbishment). The replacement 110/11 kV transformers will be sized to provide n-1 capacity at the Owhata grid exit point, including the planned load shift from Rotorua and future load growth.

10.4.2.7 Waiotahi supply capacity

The Waiotahi grid exit point supplies the Opotiki and Te Kaha towns and their surrounding areas.

Peak demand at the Waiotahi grid exit point is expected to exceed the n-1 capacity of its supply transformers from 2017. Both Waiotahi 110/11 kV supply transformers are due for risk based condition replacements in 2021-2023.

Horizon Energy has indicated that its 11 kV distribution network into Opotiki (from Waiotahi) is voltage constrained and it is investigating transmission upgrade options to reinforce supply to Opotiki.

Enhancement approach:

We are discussing investment options with Horizon Energy, including:

- Replacing the existing 110/11 kV supply transformers at Waiotahi with 110/33 kV or 110/33/11 kV transformers and operating the Waiotahi–Te Kaha line at 33 kV. The Te Kaha supply transformer can be converted to 33/11 kV, so the transformer does not need to be replaced.
- We may be able co-ordinate the replacement of the existing Waiotahi supply transformers (base capex replacement and refurbishment) with Horizon Energy’s preferred solution to increase capacity into Opotiki. We will collaborate with Horizon Energy on possible options.
10.5 Asset capability and management

We assess the transmission capacity and reactive support requirements in the region for the next 15 years. When an issue or opportunity exists, we have examined initial options and actions that may be taken to address it. Grid Enhancement Approaches (refer to section 10.4) have been developed to address issues or opportunities that require action within the forecast period and where investment is justified.

This section discusses the main inputs to the E&D process. These are:

- transmission capability (taking into account forecast demand and generation and possible technological changes)
- customer requests
- generation proposals and opportunities
- risk-based asset replacements
- significant upcoming work planned over the period
- asset feedback (information on assets or issues submitted through the asset feedback process).

10.5.1 Bay of Plenty significant upcoming work

We integrate our capital project and maintenance works to enable system issues to be resolved, if possible, when assets are replaced or refurbished. Table 10-3 lists the significant upcoming work proposed within the Bay of Plenty region for the next 15 years that may significantly impact related system issues or connected parties.

<table>
<thead>
<tr>
<th>Description</th>
<th>Tentative year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edgecumbe supply transformers risk based condition replacement</td>
<td>2019-2021</td>
</tr>
<tr>
<td>Kawerau 11 kV switchgear replacement</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Kawerau 110/11 kV supply transformers risk based condition replacement</td>
<td>2019</td>
</tr>
<tr>
<td>Kawerau 220/110 kV interconnecting transformer risk based condition replacement</td>
<td>2019-2021</td>
</tr>
<tr>
<td>Kawerau 110 kV switchgear replacements</td>
<td>2018-2019</td>
</tr>
<tr>
<td>Owhata 110/11 kV supply transformers risk based condition replacement, and</td>
<td>2018</td>
</tr>
<tr>
<td>Owhata 11 kV switchgear replacement</td>
<td>2020-2022</td>
</tr>
<tr>
<td>Te Matai 33 kV outdoor to indoor conversion</td>
<td>2017</td>
</tr>
<tr>
<td>Te Matai 110/33 kV T1 supply transformer risk based condition replacement</td>
<td>2017-2019</td>
</tr>
<tr>
<td>Waiotahi 110/11 kV supply transformer risk based condition replacement</td>
<td>2021-2023</td>
</tr>
</tbody>
</table>

10.5.2 Bay of Plenty asset feedback

The Asset Feedback Register includes the following entries related to E&D that are specific to the Bay of Plenty region:

- Edgecumbe–T4/T5 decommissioning investigation
- Kawerau 110 kV bus rationalisation

---

6 This may include replacement of the asset due to its condition assessment.
10.5.2.1 Edgcumbe–T4/T5 decommissioning investigation

Issue

Edgcumbe–T4 and T5 220/110 kV transformers are normally on hot standby (open at the 110 kV end). We need to review this arrangement to determine whether these units are still required and the economic benefit of keeping or decommissioning them.

What next?

This issue is addressed in Other Items of Interest section 10.5.6.1.

10.5.2.2 Kawerau 110 kV bus rationalisation

Issue

There is little physical space in and around the Kawerau 110 kV bus, so access for works can be constrained. It can also be difficult to obtain outages for maintenance because multiple parties are connected to the same bus section and their maintenance cycles often differ.

What next?

These issues will be investigated as part of other investigations at Kawerau. This includes the investigation presently underway for the 110 kV switchgear replacement and the 110/11 kV transformer replacement. Based upon investigations to date it is expected that the maintenance access issue can be partially addressed. However, it is unlikely to be economic to address the issue of multiple parties connected to the same bus section as this would require a major reconfiguration of the bus.

10.5.3 Changes since the 2015 Transmission Planning Report

Table 10-4 lists the specific new issues and those that are no longer relevant within the forecast period (relative to our previous Transmission Planning report).

Table 10-4: Changes since the 2015 TPR

<table>
<thead>
<tr>
<th>Issues</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiohine (Te Kaha) transformer T5 capacity</td>
<td>Removed. Reduced load forecast.</td>
</tr>
<tr>
<td>Rotorua supply transformer capacity</td>
<td>New issue. Higher expected load forecast.</td>
</tr>
<tr>
<td>Tauranga 11 kV supply capacity</td>
<td>Removed. Increased transformer branch limit.</td>
</tr>
</tbody>
</table>

10.5.4 Bay of Plenty transmission capability

This transmission capability section reports whether the Grid can be reasonably expected to meet (n-1) security requirements over the next 15 years. This section, together with the demand and generation sections, forms part of the Grid Reliability Report (GRR).

Table 10-5 summarises transmission capability issues that were identified for the Bay of Plenty region during the next 15 years. In each case, we have detected a condition that would constrain the network capacity if action were not taken. Each issue is discussed in more detail below.

This transmission capability section reports whether the Grid can be reasonably expected to meet (n-1) security requirements over the next 15 years. This section,
together with the demand and generation sections, forms part of the Grid Reliability Report (GRR).

### Table 10-5: Bay of Plenty region transmission issues – regional / site by grid exit point

<table>
<thead>
<tr>
<th>Section number</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regional</strong></td>
<td><strong>Issue</strong></td>
</tr>
<tr>
<td>10.5.4.1</td>
<td>Kawerau 110 kV bus constraint</td>
</tr>
<tr>
<td>10.5.4.2</td>
<td>Tauranga and Mount Maunganui transmission security</td>
</tr>
<tr>
<td><strong>Site by grid exit point</strong></td>
<td><strong>Issue</strong></td>
</tr>
<tr>
<td>10.5.4.3</td>
<td>Edgecumbe supply transformer capacity</td>
</tr>
<tr>
<td>10.5.4.4</td>
<td>Kaitimako supply security</td>
</tr>
<tr>
<td>10.5.4.5</td>
<td>Kawerau–Matahina 110 kV transmission security and capacity</td>
</tr>
<tr>
<td>10.5.4.6</td>
<td>Mount Maunganui supply transformer and transmission capacity</td>
</tr>
<tr>
<td>10.5.4.7</td>
<td>Owhata supply transformer capacity</td>
</tr>
<tr>
<td>10.5.4.8</td>
<td>Rotorua–Tarukenga 110 kV transmission capacity and security</td>
</tr>
<tr>
<td>10.5.4.9</td>
<td>Rotorua 11 kV and 33 kV supply transformer capacity</td>
</tr>
<tr>
<td>10.5.4.10</td>
<td>Tarukenga supply security</td>
</tr>
<tr>
<td>10.5.4.11</td>
<td>Te Matai supply transformer capacity and low voltage</td>
</tr>
<tr>
<td>10.5.4.12</td>
<td>Waiotahi supply transformer capacity</td>
</tr>
<tr>
<td>10.5.4.13</td>
<td>Waiotahi and Te Kaha supply security</td>
</tr>
</tbody>
</table>

### 10.5.4.1 Kawerau 110 kV bus constraints

#### Issue

Generation at Aniwhenua, Matahina, Kawerau Geothermal (KAG), embedded generation within Horizon’s distribution network, and embedded generation within the Norske Skog mill all connect to the Kawerau 110 kV bus. The Kawerau 110 kV bus is connected to the rest of the system via the:

- Kawerau–T12, 220/110 kV transformer (250 MVA, 10 per cent impedance)
- Kawerau–T13, 220/110 kV transformer (100 MVA, 10 per cent impedance)
- low capacity 110 kV circuits (Kawerau–Edgecumbe–1 and 2, each rated at 48/59 MVA summer/winter, in series with Edgecumbe–Owhata rated at 57/69 MVA summer/winter).

To avoid pre-contingency generation constraints for circuit outages, two special protection schemes open the circuit if it overloads:

- Edgecumbe–Owhata–2 overload protection scheme
- Edgecumbe–Kawerau–1 and 2 overload protection scheme.

There are constraints on generation export from the Kawerau 110 kV bus when there is high generation and low demand at Kawerau:

- An outage of the Kawerau–T12 transformer may cause the Edgecumbe–Owhata–2 overload protection scheme to operate. This will overload the Kawerau–T13 transformer and may cause it to trip, resulting in a loss of supply to load (at Kawerau, Waiotahi, and Te Kaha) and a loss of connection for the generation.
What next?

We discussed the risks of a Kawerau–T12 contingency causing a loss of supply to the Kawerau 110 kV bus with interested stakeholders. Their feedback supports taking no action at present to mitigate the risk. This approach is supported by our economic analysis, even after commissioning the 25 MW Te Ahi O Maui geothermal generator. This is because the probability of a Kawerau–T12 outage is low and with the usual levels of generation and load the Edgecumbe–Owhata–2 special protection scheme will not operate. Therefore Kawerau–T13 will not usually overload and trip.7

Refer to section 10.4.2.1 for our longer-term enhancement approach.

10.5.4.2 Tauranga and Mount Maunganui transmission security

Issue

Tauranga and Mount Maunganui are supplied from Kaitimako through the following 110 kV circuits (see Figure 10-4):

- Kaitimako–Tauranga–1, rated at 96/105 MVA (summer/winter)
- Kaitimako–Mount Maunganui–1, rated at 63/77 MVA (summer/winter)
- a shared Kaitimako–Tauranga–Mount Maunganui–2 circuit with the following ratings:
  - Kaitimako–Poike section 96/105 MVA (summer/winter)
  - Poike–Tauranga section 96/105 MVA (summer/winter)
  - Poike–Mount Maunganui 63/77 MVA (summer/winter).

![Figure 10-4: Kaitimako grid configuration](image)

An outage of the Kaitimako–Tauranga–1 circuit or the Kaitimako–Mount Maunganui–1 circuit may activate a special protection scheme to reconfigure the grid and put Tauranga and Mount Maunganui on security to prevent overloading8 the Kaitimako–Poike circuit section from 2018.

An outage of either circuit to Tauranga will overload the other circuit from 2021, affecting 33 kV and 11 kV grid exit points at Tauranga.

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7 See section 10.5.5.4 for information about the effect of a Kawerau–T12 outage due to a bus tripping.

8 This assumes Kaimai (embedded at Tauranga) is generating 14 MW.
What next?

In the short to medium term, Powerco plans to shift load away from Tauranga and Mount Maunganui to resolve capacity issues on the 110 kV transmission network.

Refer to section 10.4.2.4 and 10.4.2.5 for our proposed approach.

10.5.4.3 Edgecumbe supply transformer capacity

Issue

Two 220/33 kV transformers supply Edgecumbe's load, providing:

- total nominal installed capacity of 100 MVA
- n-1 capacity of 62/67 MVA (summer/winter).

Peak load at Edgecumbe is forecast to exceed the n-1 winter capacity of the transformers by approximately 6 MW in 2017, increasing to approximately 14 MW in 2032 (see Table 10-6).

Table 10-6: Edgecumbe supply transformer overload forecast

<table>
<thead>
<tr>
<th>Grid exit point</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2032</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edgecumbe</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

What next?

One of the 220/33 kV supply transformers (T8) is due for risk based condition replacement in 2019. Refer to section 10.4.2.3 for our proposed approach.

10.5.4.4 Kaitimako supply security

Issue

A single 110/33 kV, 75 MVA transformer supplies load at Kaitimako resulting in n security. Some of the 11 kV Tauranga load is to be shifted to Kaitimako, with peak demand forecast to grow to 44 MW by 2032.

What next?

The lack of n-1 security is currently managed operationally using load back-feeding capability from Tauranga at 33 kV. Refer to section 10.4.2.5 for our proposed longer-term approach.

10.5.4.5 Kawerau–Matahina 110 kV transmission security and capacity

Issue

The 110 kV Kawerau–Matahina line comprises two circuits each rated at 88/98 MVA (summer/winter).

The loss of one Kawerau–Matahina circuit may overload the remaining circuit if there is high generation output at Matahina and Aniwihenua.

What next?

The overload can be managed operationally by constraining generation at Matahina and Aniwihenua. Alternatively, the Aniwihenua generation can be reconfigured to
inject into Horizon’s 33 kV network instead, reducing the transmission requirements on the 110 kV Kawerau–Matahina circuits.

The existing situation is considered satisfactory by the connected customers and no investments are planned to increase the transmission capacity.

10.5.4.6 Mount Maunganui supply transformer and transmission capacity

**Issue**

Two 110/33 kV transformers supply Mount Maunganui’s load, providing:

- total nominal installed capacity of 150 MVA
- n-1 capacity of 87/87\(^9\) MVA (summer/winter).

The n-1 transmission capacity into Mount Maunganui is limited to approximately 75 MW by the rating of the Kaitimako–Mount Maunganui circuit (see section 10.5.4.2), which limits the maximum load before the transformer limit applies.

**What next?**

Powerco plans to develop its distribution network to transfer load from Mount Maunganui to Te Matai from 2020. The planned load transfer will ensure n-1 capacity at Mount Maunganui is maintained for the forecast period, otherwise load constraints are expected from about 2022.

We will continue to monitor developments in the region and develop a long-term plan with Powerco. See section 10.4.2.4 for our enhancement approach for the Tauranga area. No investments are planned to increase transmission capacity into Mount Maunganui.

10.5.4.7 Owhata supply transformer capacity

**Issue**

Two 110/11 kV transformers supply Owhata’s load, providing:

- total nominal installed capacity of 20 MVA
- n-1 capacity of 11/12 MVA (summer/winter).

Peak load at Owhata is forecast to exceed the n-1 winter capacity of the existing transformers by approximately 3 MW from 2017, increasing to approximately 6 MW in 2032 (see Table 10-7).

<table>
<thead>
<tr>
<th>Grid exit point</th>
<th>Transformer overload (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owhata</td>
<td>3</td>
</tr>
</tbody>
</table>

\(^9\) The transformers’ capacity is limited by the protection limit; with this limit removed, the n-1 capacity will be 94/98 MVA summer/winter.
What next?

In the short term, operational measures will be used to manage the issue, including temporarily transferring load to Rotorua. Refer to section 10.4.2.6 for our longer-term approach.

10.5.4.8 Rotorua–Tarukenga 110 kV transmission capacity and security

Issue

The 110 kV Rotorua–Tarukenga line comprises two circuits, each rated at 63/77 MVA (summer/winter). The Rotorua 110 kV bus is split so that:

- the local generation at Wheao, one 110/33 kV transformer, and one 110/11 kV transformer are all connected to the Rotorua–Tarukenga–2 circuit
- one 110/33 kV transformer and one 110/11 kV transformer are both supplied from the 110 kV Rotorua–Tarukenga–1 circuit.

An outage of the 110 kV Rotorua–Tarukenga–2 circuit:

- results in the loss of Wheao generation
- overloads the remaining 110 kV Rotorua–Tarukenga–1 circuit (as it supplies all Rotorua’s load).

Peak load at Rotorua is forecast to exceed the n-1 capacity of the circuits by approximately 9 MW in 2017, increasing to approximately 26 MW in 2032 (see Table 10-8).

Table 10-8: Rotorua–Tarukenga circuit overload forecast

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Circuit overload (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotorua–Tarukenga</td>
<td>9</td>
</tr>
</tbody>
</table>

What next?

We are discussing future supply options with Unison (the local lines company) and Trustpower (owner of the embedded generation connected at Rotorua), including both operational and investment options. See section 10.4.2.6 for our proposed approach for the Rotorua area’s supply capacity.

Currently, no investments are planned to increase the capacity of the Rotorua–Tarukenga transmission circuits.

10.5.4.9 Rotorua 11 kV and 33 kV supply transformer capacity

Issue

Rotorua’s load is supplied by two 110/11 kV transformers and two 110/33 kV transformers.

At 11 kV this provides:

- total nominal installed capacity of 70 MVA
• n-1 capacity of 36/36 MVA\(^{10}\) (summer/winter).

At 33 kV this provides:

• total nominal installed capacity of 120 MVA
• n-1 capacity of 66/66 MVA\(^{11}\) (summer/winter).

The peak load at Rotorua is forecast to exceed the n-1 winter capacity of both the 110/11 kV and 110/33 kV Rotorua supply transformers by approximately 1 MW in 2032 and 2026 respectively. The 110/33 kV n-1 capacity is expected to be exceeded by 6 MW by 2032.

<table>
<thead>
<tr>
<th>Grid exit point</th>
<th>Transformer overload (MW)</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2032</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotorua 11 kV</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Rotorua 33 kV</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What next?

In the medium term, the issue can be handled operationally, including via temporary load transfer to the Owhata grid exit point. We will discuss options for managing the capacity issues with Unison closer to the need date.

Currently, no investments are planned to increase the Rotorua supply transformer capacities.

10.5.4.10 Tarukenga supply security

Issue

A single 110/11 kV, 20 MVA supply transformer supplies the Tarukenga grid exit point resulting in n security. The peak load at Tarukenga is forecast to grow to 8 MW by 2032 which is well below the capacity of the supply transformer.

What next?

The customer (Unison) is able to manage the lack of n-1 security issue operationally by transferring load to alternative grid exit points. See section 10.4.2.6 for our proposed approach to the Rotorua area’s supply capacity.

Currently, no investments are planned to increase security of supply at the Tarukenga grid exit point.

10.5.4.11 Te Matai supply transformer capacity and low voltage

Issue

Two 110/33 kV transformers (rated at 30 MVA and 40 MVA) supply Te Matai’s load, providing:

\(^{10}\) The transformers’ capacity is limited by low voltage current transformer, circuit breaker and metering limits; with these limits resolved, the n-1 capacity will be 47.7/49.9 MVA (summer/winter).

\(^{11}\) The transformers’ capacity is limited by protection limits; with these limits resolved, the n-1 capacity will be 68.2/71.1 MVA (summer/winter).
total nominal installed capacity of 70 MVA

n-1 capacity of 36/39 MVA (summer/winter).

The peak load at Te Matai is forecast to exceed the n-1 winter capacity of the transformers’ by approximately 1 MW in 2017, increasing to approximately 27 MW in 2032 (see Table 10-10).

Following the load transfer from Mount Maunganui the peak load is forecast to exceed the transformers’ winter installed capacity (with both transformers in service) by approximately 3 MW in 2020, increasing to approximately 12 MW in 2032.

**Table 10-10: Te Matai supply transformer overload forecast**

<table>
<thead>
<tr>
<th>Grid exit point</th>
<th>Transformer overload (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Te Matai – pre-contingency</td>
<td>0</td>
</tr>
<tr>
<td>Te Matai – post-contingency</td>
<td>1</td>
</tr>
</tbody>
</table>

The Te Matai 110 kV voltage will fall below 0.95 pu for a Kaitimako–Te Matai circuit outage from 2020 (with the 33 kV supply voltage falling to 0.91 pu). A voltage step greater than five per cent also occurs from about this time for the same contingency, or for a contingency of either Te Matai–T1 or T2.

Only one of the existing supply transformers has an on-load tap changer. Using the on-load tap changer to manage the 33 kV bus voltage will cause circulating reactive power flows, further increasing the loading on the transformers.

**What next?**

One of the Te Matai supply transformers is due for risk based condition replacement and we are working with Powerco to identify investment options to increase the supply capacity and address voltage issues at Te Matai. Refer to section 10.4.2.4 for our proposed approach.

**10.5.4.12 Waiotahi supply transformer capacity**

**Issue**

Two 110/11 kV transformers supply Waiotahi’s load, providing:

- total nominal installed capacity of 20 MVA
- n-1 capacity of 11/12 MVA (summer/winter).

The transformers also supply Te Kaha’s load via an 11/50 kV step-up transformer at Waiotahi. The combined peak load at Waiotahi and Te Kaha is forecast to exceed the n-1 winter capacity of the Waiotahi transformers by approximately 2 MW in 2017, increasing to 5 MW in 2032 (see Table 10-11).

**Table 10-11: Waiotahi supply transformer overload forecast**

<table>
<thead>
<tr>
<th>Grid exit point</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2032</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiotahi (and Te Kaha)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
**What next?**

The Waiotahi supply transformers are due for risk based condition replacement in 2021 and Horizon Energy is also forecasting voltage constraints on its 11 kV distribution network to Opotiki where the bulk of its load is. We are working with Horizon Energy to identify investment options to increase supply capacity at Waiotahi and into Opotiki. See section 10.4.2.7 for our proposed approach.

**10.5.4.13 Waiotahi and Te Kaha supply security**

**Issue**

Waiotahi and Te Kaha are supplied by one transmission circuit (a 110 kV circuit to Waiotahi and a 50 kV circuit to Te Kaha) resulting in n security.

Both loads are supplied by a single Edgecumbe–Waiotahi circuit with the:

- Waiotahi 11 kV load supplied through two 10 MVA transformers
- Te Kaha 11 kV load supplied through:
  - a 11/50 kV, 3 MVA step up transformer at Waiotahi
  - a 50 kV Te Kaha–Waiotahi circuit rated at 48/59 MVA (summer/winter)
  - a 50/11 kV, 7.5 MVA transformer at Te Kaha.

**What next?**

The lack of n-1 security can be managed operationally by Horizon Energy. No investments planned to increase security to either Waiotahi or Te Kaha.

**10.5.5 Bay of Plenty bus security**

Table 10-12 presents issues arising from the outage of a single bus section rated at 50 kV and above for the next 15 years. These are discussed in more detail in the subsequent sections.

Bus outages disconnect more than one power system component (for example, other circuits, transformers, reactive support or generators). Therefore, bus outages may cause greater issues than a single circuit or transformer outage (although the risk of a bus fault is low, being less common than a circuit or transformer outage).

**Table 10-12: Bay of Plenty region transmission issues – bus security**

<table>
<thead>
<tr>
<th>Section number</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.5.5.1</td>
<td>Transmission bus security</td>
</tr>
<tr>
<td>10.5.5.2</td>
<td>Atiamuri–Taruenga 220 kV transmission capacity</td>
</tr>
<tr>
<td>10.5.5.3</td>
<td>Kaitimako 110 kV bus security</td>
</tr>
<tr>
<td>10.5.5.4</td>
<td>Kawerau 110 kV bus security</td>
</tr>
<tr>
<td>10.5.5.5</td>
<td>Kawerau 220 kV bus security</td>
</tr>
<tr>
<td>10.5.5.6</td>
<td>Okere–Te Matai 110 kV transmission capacity</td>
</tr>
</tbody>
</table>

**10.5.5.1 Transmission bus security**

Table 10-13 lists bus outages that cause voltage issues or a total loss of supply. Generators are included only if a bus outage disconnects the whole generation station.
or causes a widespread system impact. Supply bus outages, typically 11 kV and 33 kV, are not listed.

### Table 10-13: Transmission bus outages

<table>
<thead>
<tr>
<th>Transmission bus outage</th>
<th>Loss of supply</th>
<th>Generation disconnection</th>
<th>Transmission issue</th>
<th>Further information</th>
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1. There is no bus section circuit breaker at Edgecumbe, Mount Maunganui, Owhata, Tauranga and Te Matai, so a bus fault causes loss of supply.

The customers (Horizon Energy, Norske Skog, Powerco, Todd Energy, Trust Power, and Unison) have not requested a higher security level. Unless otherwise noted, we do not propose to increase bus security and future investment is likely to be customer driven.

If increased bus security is required, the options typically include bus reconfiguration and/or additional bus circuit breakers.

#### 10.5.5.2 Atiamuri–Tarukenga 220 kV transmission capacity

**Issue**

The outage of a Tarukenga 220 kV bus section disconnects:

- a 220/110 kV Tarukenga interconnecting transformer
- a 220 kV Atiamuri–Tarukenga circuit
- a 220 kV Kaitimako–Tarukenga circuit
- both 220 kV Edgecumbe–Tarukenga circuits.

This may in turn overload the Edgecumbe–Owhata circuit, which has a special protection scheme to automatically open the circuit to remove the overload. This may
result in, or exacerbate, overloading of the remaining 220 kV Atiamuri–Tarukenga circuit from about 2023 during periods of:

- high western Bay of Plenty and Rotorua area net load, or
- high eastern Bay of Plenty net generation.

**What next?**

In the medium term this issue can be managed operationally. An option to resolve this issue is to connect one of the Edgecumbe–Tarukenga circuits to the other 220 kV bus section at Tarukenga. However, our analysis shows it is currently uneconomic to implement this option. We will continue to monitor the risk associated with the loss of this Tarukenga bus section and review the economic analysis when the need arises.

There is currently no investment planned to address this bus security issue.

### 10.5.5.3 Kaitimako 110 kV bus security

**Issue**

There are three 110 kV bus sections at Kaitimako. An outage of one of the 110 kV bus sections disconnects the:

- 220/110 kV Kaitimako–T4 interconnecting transformer
- 110 kV Kaitimako–Mount Maunganui circuit
- 110 kV Kaitimako–Te Matai circuit.

This bus outage can also cause low voltages at Te Matai.

An outage of another 110 kV bus disconnects the:

- 220/110 kV Kaitimako–T2 interconnecting transformer
- 110 kV Kaitimako–Tauranga–1 circuit
- 110/33 kV Kaitimako–T1 supply transformer.

This bus outage results in a loss of supply at Kaitimako (see section 10.5.4.4). This load can usually be backfed from Tauranga, but the simultaneous loss of the Kaitimako–Tauranga–1 circuit will result in Tauranga only being supplied from the Kaitimako–Mount Maunganui–Tauranga–2 circuit, which may restrict the amount of load that can be transferred to Tauranga.

Any 110 kV bus section outage beyond 2021 will cause constraints at peak load on the remaining circuit to Tauranga.

**What next?**

The Kaitimako bus section security issue will be deferred by shifting load from Mount Maunganui to Te Matai in 2020 (see section 10.5.4.6).

Capacity constraints into Tauranga can be managed operationally. Our proposed longer term approach for Tauranga’s supply capacity is discussed in section 10.4.2.5.

No investments are planned for increasing security on the Kaitimako 110 kV bus.
10.5.5.4 Kawerau 110 kV bus security

**Issue**

The outage of a Kawerau 110 kV bus section disconnects:

- the Kawerau–T12, 250 MVA, 220/110 kV transformer
- the 110 kV Edgecumbe–Kawerau–1 circuit
- the 110 kV Kawerau–Matahina–1 circuit
- Kawerau geothermal generation, Horizon Energy load
- two of the four 110/11 kV transformers supplying Norske Skog.

This bus outage reduces the generation on the Kawerau 110 kV bus due to the Kawerau geothermal generator disconnecting, coupled with a reduction in load and export capacity. This may overload the Edgecumbe–Kawerau–2 circuit, which has a special protection scheme to automatically open the circuit to remove the overload. This in turn may result in the Kawerau–T13, 220/110 kV transformer overloading and tripping, causing a loss of supply to the Kawerau load and a loss of connection to the generation (see section 10.5.4.1).

**What next?**

Both Horizon Energy supply transformers (T1 and T2), and the T13 interconnecting transformer are due for risk based condition replacements within the next three years. Refer to sections 10.4.2.1 and 10.4.2.2 for our approach to the T13 transformer issue, T1 and T2 issue, and the 110 kV switchgear issue, respectively.

10.5.5.5 Kawerau 220 kV bus security

**Issue**

The outage of a Kawerau 220 kV bus section disconnects:

- the Kawerau–T12, 250 MVA, 220/110 kV transformer
- the 220 kV Edgecumbe–Kawerau–3 circuit
- one of the two 220/11 kV transformers supplying Norske Skog.

This may overload the Edgecumbe–Owhata circuit, which has a special protection scheme to automatically open the circuit to remove the overload. This in turn may overload and trip the Kawerau–T13, 220/110 kV transformer, causing a loss of supply to the Kawerau, Te Kaha and Waiotahi grid exit points and a loss of connection to generation (see section 10.5.4.1).

**What next?**

The Kawerau–T13 interconnecting transformer is due for risk based condition replacement in 2019. Refer to section 10.4.2.1 for our proposed approach.

We have not planned any investments to increase the Kawerau 220 kV bus security.

10.5.5.6 Okere–Te Matai 110 kV transmission capacity

**Issue**

The outage of a Kaitimako 220 kV bus section disconnects a:

- 220/110 kV Kaitimako interconnecting transformer
• 220 kV Kaitimako–Tarukenga circuit.

This bus outage causes an increase in the power flow from Okere to Te Matai and on to Kaitimako. The Okere–Te Matai circuit may overload from around 2022 during periods of:

• high western Bay of Plenty load
• low western Bay of Plenty generation, or
• high eastern Bay of Plenty net generation.

In addition, the bus outage can cause low voltages at Te Matai.

What next?

This issue can be resolved operationally by splitting the Kaitimako–Te Matai circuit if the Kaitimako bus outage occurs. We will continue to monitor this risk and investigate investment options as the need arises.

No investments are currently planned for increasing security on the Kaitimako 220 kV bus.

10.5.6 Other regional items of interest

10.5.6.1 Edgecumbe 220/110 kV interconnecting transformers

Issue

The two 220/110 kV interconnecting transformers at Edgecumbe (T4 and T5) are normally operated on hot standby (opened on the 110 kV side). Both transformers were manufactured in the early 1950’s.

What next?

The transformers meet most criteria for risk-based replacement, except they are not normally on load. The transformers are switched in for maintenance outages that require the 110 kV Edgecumbe–Kawerau–1 and 2 circuits to be out of service (e.g. Kawerau–T12 outages). When switched in, the transformers maintain the existing level of security to Owhata, Waiotahi and Te Kaha, manage voltage issues at Te Matai, and manage loading on the 110 kV Okere–Tarukenga circuit section.

We will retain the transformers in their existing configuration until their condition deteriorates to a point where they create an unacceptable risk or major investments are required to retain them. We will then decommission the transformers.

We will assess replacement options for the transformers before decommissioning. For the existing levels of generation at Kawerau, we expect it will be uneconomic to replace the transformers and outages will need to be carefully managed. However, the transformers will be replaced if significant additional generation is connected to the Kawerau 110 kV bus (see section 10.4.2.1).

10.5.7 Bay of Plenty proposals and opportunities

This section details relevant regional issues for selected generation proposals under investigation by developers and in the public domain, or other generation opportunities. The impact of committed generation projects on the grid backbone is dealt with separately in Chapter 6.
The maximum generation that can be connected depends on several factors and is usually expressed as a range. Generation developers should consult with us at an early stage of their investigations to discuss connection issues.

10.5.7.1 Generation connection at Kawerau

There are a number of other future generation connection proposals in the Kawerau area as the area has significant geothermal resources. If more than approximately 20-30 MW of additional generation (in addition to the 25 MW scheme connecting in 2018) connects directly or indirectly to the Kawerau 110 kV bus, we will likely need to invest in the transmission grid to facilitate the additional generation. Connecting more than approximately 35 MW of generation at Kawerau (to the 110 kV or 220 kV buses), will also overload the 220 kV Edgecumbe–Kawerau, Atiamuri–Ohakuri or Kawerau–Ohakuri circuits if the other circuit is out of service.

Grid investment options to facilitate generation connection at Kawerau are discussed in section 10.4.2.1.

The increased generation at Kawerau may increase the 11 kV supply bus and distribution system fault levels sufficiently to exceed their fault-level capacities. This particularly applies if new generation is connected directly to the supply bus, and may also be an issue if the generation is embedded within the distribution system. This may require the replacement of the existing supply transformers with higher-impedance transformers and/or replacement of the existing 11 kV switchboard.

We already have investments planned to resolve the fault level issue on the distribution 11 kV system. See section 10.4.2.2 for our approach.

10.5.7.2 Generation connection to the 220 kV Edgecumbe–Tarukenga circuits

The area around the Edgecumbe–Tarukenga–1 and 2 circuits has a number of potential geothermal developments. Up to approximately 250 MW of generation could connect to these circuits before system upgrades are required, depending on developments at Kawerau. This capability decreases for outages of some 220 kV circuits in the Bay of Plenty region.

10.5.7.3 Generation connection to the Okere–Te Matai circuit

Some generation prospects exist close to the 110 kV circuits bounded by Tarukenga, Te Matai and Kawerau. These circuits can become highly loaded for some circuit outages when there is high demand. Under these conditions, the generation may need to be reduced or switched off.