## 15 Nelson-Marlborough Regional Plan

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<th>Description</th>
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</table>

### 15.1 Regional overview and transmission system

The Nelson-Marlborough region includes a mix of significant and growing provincial cities and towns (Nelson, Blenheim and Richmond) together with smaller rural localities (Picton, the Golden Bay area).

Local generation at Cobb, embedded behind the Stoke 66 kV grid exit point, provides important voltage and load support to the region.

The existing transmission network for Nelson-Marlborough region is set out geographically in Figure 15-1 and schematically in Figure 15-2.

**Figure 15-1: Nelson-Marlborough region transmission network**
15.1.1 Transmission into the region

The Nelson-Marlborough region is connected to the National Grid via 220 kV circuits at Kikiwa.

Regional demand far exceeds generation so most of the region’s load is supplied via 220 kV circuits from the Waitaki Valley, which also supplies significant load in the South Canterbury and Canterbury regions. This shared capacity from the Waitaki Valley is important for supply security to all three regions.

15.1.2 Transmission within the region

Within the region, transmission comprises 220 kV circuits from Kikiwa to Stoke and parallel 110 kV circuits forming a ‘triangle’ between Kikiwa, Stoke, and Blenheim. Interconnection between the 220 kV and 110 kV within the region is provided by a single interconnecting transformer at Stoke. There is a second interconnecting transformer at Kikiwa\(^1\) which, together with the Stoke unit, provides n-1 security to the 110 kV transmission network.

The reactive power support in this region is provided from the 60 Mvar capacitors and 10 Mvar shunt reactors at Stoke and 20.4 Mvar capacitors at Blenheim.

15.2 Nelson-Marlborough demand

After diversity maximum demand for the Nelson Marlborough region is forecast to grow by an average 1.9 per cent per annum over the next 15 years, from 204 MW in 2017 to 270 MW by 2032. This exceeds the national average of 1.4 per cent per annum.

\(^1\) Stoke has only one 220/110 kV, 150 MVA interconnecting transformer. This transformer essentially operates in parallel with Kikiwa–T2 (150 MVA).
Table 15-1 lists the peak demand forecast (prudent growth\(^2\)) for each grid exit point for the forecast period.

**Table 15-1: Forecast annual peak demand (MW) at Nelson-Marlborough grid exit points to 2032**

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<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Blenheim (Lulworth Wind)</td>
<td>1.00</td>
<td>139</td>
<td>140</td>
<td>142</td>
<td>144</td>
<td>146</td>
<td>148</td>
<td>150</td>
<td>152</td>
<td>154</td>
<td>156</td>
<td>158</td>
<td>170</td>
</tr>
<tr>
<td>Stoke 33 kV</td>
<td>0.98</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>29</td>
<td>30</td>
<td>31</td>
<td>32</td>
<td>32</td>
<td>33</td>
<td>34</td>
<td>35</td>
<td>36</td>
</tr>
</tbody>
</table>

1. Stoke 66 kV load is a net value. It assumes a seasonal estimated generation from Cobb (embedded).

**15.3 Nelson-Marlborough generation**

The Nelson-Marlborough region’s current generation capacity is 48 MW, which is lower than local demand, requiring power to be imported through the National Grid. Table 15-2 lists the generation forecast at each grid injection point for the period to 2032. This includes all known and committed generation stations, including those embedded within the relevant local lines company’s network (Network Tasman or Marlborough Lines).\(^3\)

Further generation may be developed during the period but is not sufficiently advanced to be included in our forecasts. (Refer to section 15.5.6 for more information on potential new generation).

**Table 15-2: Forecast annual generation capacity (MW) at Nelson-Marlborough grid injection points to 2032 (existing and committed generation)**

<table>
<thead>
<tr>
<th>Grid injection point (location/name if embedded)</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>Blenheim (Lulworth Wind)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Blenheim (Waihopai)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Motupipi (Onekaka)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Stoke (Cobb)</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
</tbody>
</table>

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\(^2\) 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.

\(^3\) Only generators with capacity greater than 1 MW are listed. Generation capacity is rounded to the nearest megawatt.
15.4 Grid enhancement approach

15.4.1 Possible future Nelson-Marlborough transmission configuration

Figure 15-3 shows the possible configuration of Nelson-Marlborough 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 15-3: Possible Nelson-Marlborough transmission configuration in 2032

15.4.2 Enhancement approach

We ensure secure transmission into and within the Nelson-Marlborough 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.

As the Nelson-Marlborough region relies on generation several hundred kilometres away, there will be an ongoing need for investment in reactive support equipment (such as the STATCOM at Kikiwa and additional capacitors) to support the voltage. Any future investment on reactive support equipment in the region (such as the replacement of the Blenheim capacitor banks), would consider location and sizing in terms of the wider Upper South Island voltage issues. Our approach to maintaining voltage stability in the region is discussed in Chapter 6, Grid Backbone (South Island section).

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

<table>
<thead>
<tr>
<th>Section number</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.4.2.1</td>
<td>Nelson-Marlborough 220/110 kV interconnection security</td>
</tr>
<tr>
<td>15.4.2.2</td>
<td>Nelson supply capacity and security</td>
</tr>
<tr>
<td>15.4.2.3</td>
<td>Golden Bay area supply capacity and security</td>
</tr>
</tbody>
</table>
15.4.2.1 Nelson-Marlborough 220/110 kV interconnection security

The Stoke 220/110 kV interconnection at Stoke is effectively operating in parallel with the interconnecting transformer at Kikiwa in the West Coast region. An outage of either of these interconnecting transformers may overload assets in the Nelson-Marlborough region, depending on levels of load and generation both there and in the West Coast region.

Kikiwa–Stoke 110 kV transmission capacity

An outage of the Stoke 220/110 kV interconnecting transformer results in the Nelson-Marlborough region being supplied from the interconnection at Kikiwa via two 110 kV circuits (Kikiwa–Stoke–3 and Kikiwa–Argyle–Blenheim–Stoke–1). The Kikiwa–Stoke–3 circuit may overload as a result, causing low voltages at Blenheim when the Nelson-Marlborough region load is high coupled with low local generation.

In the short term, this issue can be managed operationally by controlling levels of load and generation in the region. The Stoke–T7 outage intertrip scheme helps to manage this issue during planned outages of the interconnecting transformer.

Enhancement approach:

- Our investigation has found that the value of unserved energy is very low for this constraint. As a result, we have been unable to identify any economic options to resolve it.
- We will continue to monitor the constraint and revisit the economic analysis when necessary.

Stoke 220/110 kV interconnection capacity

An outage of the Kikiwa transformer results in the Stoke transformer supplying the Nelson-Marlborough and West Coast regions. This may cause overloading of the Stoke transformer and low voltage issues in the West Coast region. The loading on the Stoke transformer depends on the levels of generation in the Nelson-Marlborough and West Coast regions.

In the short term, this issue can be managed operationally via generation rescheduling and load management.

Enhancement approach:

- In the medium-term, we will investigate the option of resolving the transformer branch constraints.
- Longer term, a second 220/110 kV transformer may ultimately be required at Kikiwa or Stoke.

Base E&D Capex investments

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Stoke interconnection capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project description:</td>
<td>Replace Stoke–T7 110 kV disconnectors (transformer branch limiting component)</td>
</tr>
<tr>
<td>Project’s state of completion</td>
<td>Possible</td>
</tr>
<tr>
<td>OAA level completed:</td>
<td>None</td>
</tr>
<tr>
<td>Grid need date:</td>
<td>2023</td>
</tr>
<tr>
<td>Indicative cost [$ million]:</td>
<td>0.2</td>
</tr>
<tr>
<td>Part of the GEIR?:</td>
<td>No</td>
</tr>
</tbody>
</table>
15.4.2.2 Nelson supply capacity and security

The city of Nelson and its surrounding area is supplied from the Stoke 33 kV grid exit point. Peak load is forecast to exceed the n-1 winter capacity of the two supply transformers from 2017.

In the short-term, Network Tasman can manage its load to resolve the overloading issue.

Enhancement approach:

- We will investigate the option of resolving the protection limit that constrains the capacity of the transformers. Resolving the protection limit increases the n-1 capacity by 5 MVA, deferring the overloading issue to 2020.
- In the longer-term Network Tasman is considering developing a new 220/33 kV grid exit point at Brightwater, connected to one of the 220 kV Kikiwa–Stoke circuits. Timing of the new Brightwater grid exit point will be decided by Network Tasman which has already selected land for it. Some load will be shifted from the Stoke grid exit point to Brightwater to ensure the load at Stoke remains within the n-1 capacity of the Stoke supply transformers. A new grid exit point would also provide diversity for Nelson’s electricity supply.

Base E&D Capex investments

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Stoke 33 kV supply capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project description:</td>
<td>Resolve 220/33 kV Stoke supply transformer branch constraints</td>
</tr>
<tr>
<td>Project’s state of completion</td>
<td>Possible</td>
</tr>
<tr>
<td>OAA level completed:</td>
<td>None</td>
</tr>
<tr>
<td>Grid need date:</td>
<td>2017</td>
</tr>
<tr>
<td>Indicative cost [$ million]:</td>
<td>0.2</td>
</tr>
<tr>
<td>Part of the GEIR?:</td>
<td>No</td>
</tr>
</tbody>
</table>

Customer investments

<table>
<thead>
<tr>
<th>Project Name</th>
<th>New 33 kV grid exit point for Network Tasman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project description:</td>
<td>Develop new 220/33 kV grid exit point (Brightwater GXP)</td>
</tr>
<tr>
<td>Project’s state of completion</td>
<td>Possible</td>
</tr>
<tr>
<td>OAA level completed:</td>
<td>None</td>
</tr>
<tr>
<td>Grid need date:</td>
<td>2020, customer initiated</td>
</tr>
<tr>
<td>Indicative cost [$ million]:</td>
<td>24</td>
</tr>
<tr>
<td>Part of the GEIR?:</td>
<td>No</td>
</tr>
</tbody>
</table>

15.4.2.3 Golden Bay area supply capacity and security

A single 110/66 kV transformer at Stoke serves the Golden Bay area. Winter peak load exceeds the special rating\(^4\) of the transformer.

This issue is managed operationally by constraining on Cobb generation which is embedded in the 66 kV distribution network. During transformer and bus maintenance the Golden Bay area’s distribution network is operated islanded and supplied from Cobb.

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\(^4\) The special rating refers to a rating above our normal practice, which is applied due to the particular network configuration at this location.
Network Tasman has requested that the existing transformer be upgraded and a second 110/66 kV, 40 MVA transformer be installed. The existing transformer is due for risk based condition replacement.

Enhancement approach:

- We have committed to replace the existing 110/66 kV supply transformer (funded under base capex replacement and refurbishment) and to install the second transformer at the same time (customer funded). This development, in conjunction with generation from Cobb, will provide a secure supply to the Golden Bay area for the forecast period and beyond.

### Customer investments

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Stoke—T4 Transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project description:</td>
<td>Install a second 110/66 kV supply transformer (T4) at Stoke</td>
</tr>
<tr>
<td></td>
<td>Delivery</td>
</tr>
<tr>
<td>OAA level completed:</td>
<td>OAA level 2d</td>
</tr>
<tr>
<td>Grid need date</td>
<td>2019</td>
</tr>
<tr>
<td>Indicative cost [$ million]:</td>
<td>3.4</td>
</tr>
<tr>
<td>Part of the GEIR?</td>
<td>No</td>
</tr>
</tbody>
</table>
15.5 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 15.4) 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).

15.5.1 Nelson-Marlborough 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 15-3 lists the significant upcoming work\(^5\) proposed for the Nelson-Marlborough region for the next 15 years that may significantly impact related system issues or connected parties.

Table 15-3: Proposed significant upcoming work

<table>
<thead>
<tr>
<th>Description</th>
<th>Tentative year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blenheim 33 kV capacitor banks replacement</td>
<td>2020-2025</td>
</tr>
</tbody>
</table>

15.5.2 Nelson-Marlborough asset feedback

The Asset Feedback Register does not include any E&D items specific to the Nelson-Marlborough region.

15.5.3 Changes since the 2015 Annual Planning Report

There are no changes to the listed issues since the previous Transmission Planning Report, published in 2015.

15.5.4 Nelson-Marlborough 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).

\(^5\) Condition-based replacement of the asset is included in this list.
Table 15-4 summarises issues involving the Nelson-Marlborough region for the next 15 years. For more information about a particular issue, refer to the listed section number.

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 15-4: Nelson-Marlborough region transmission issues – by region/grid exit point

<table>
<thead>
<tr>
<th>Section number</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional</td>
<td></td>
</tr>
<tr>
<td>15.5.4.1</td>
<td>Stoke 220/110 kV interconnecting transformer capacity</td>
</tr>
<tr>
<td>Site by grid exit point</td>
<td></td>
</tr>
<tr>
<td>15.5.4.2</td>
<td>Kikiwa–Stoke 110 kV transmission capacity</td>
</tr>
<tr>
<td>15.5.4.3</td>
<td>Stoke 220/33 kV supply transformer capacity</td>
</tr>
<tr>
<td>15.5.4.4</td>
<td>Stoke 110/66 kV supply transformer capacity and supply security</td>
</tr>
</tbody>
</table>

15.5.4.1 Stoke 220/110 kV interconnecting transformer capacity

Issue

A single 220/110 kV interconnecting transformer at Stoke provides a 110 kV interconnection to the Nelson-Marlborough region. This transformer has:

- nominal installed capacity of 150 MVA
- n-1 capacity of 160/160 MVA\(^6,7\) (summer/winter).

The Stoke 220/110 kV transformer is effectively operating in parallel with the 150 MVA interconnecting transformer at Kikiwa. An outage of the Kikiwa transformer results in the Stoke transformer supplying the Nelson-Marlborough and West Coast regions\(^8\). This may cause overloading of the Stoke transformer and low voltage issues within the West Coast region (see Chapter 16). The loading on the Stoke transformer depends on generation levels in the Nelson-Marlborough and West Coast regions.

What next?

We manage these issues operationally via generation rescheduling and load management. Resolving equipment constraints on the interconnecting transformer and managing the generation in both regions will resolve the issue for the forecast period. Refer to section 15.4.2.1 for our enhancement approach.

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\(^6\) Stoke has only one 220/110 kV, 150 MVA interconnecting transformer. The n-1 capacity is the result of the transformer essentially operating in parallel with Kikiwa–T2 (150 MVA).

\(^7\) The transformer’s capacity is limited by 110 kV disconnectors; with this limit resolved, the n-1 capacity will be 180/188 MVA (summer/winter).

\(^8\) The normal operating arrangement is that only Kikiwa–T2 (150 MVA) provides a 110 kV interconnection to the West Coast region, and Kikiwa–T1 (50 MVA) supplies the local 11 kV load.
15.5.4.2 Kikiwa–Stoke 110 kV transmission capacity

Issue

There are two 110 kV circuits connecting the Nelson-Marlborough and West Coast regions:

- Kikiwa–Stoke–3 circuit rated at 56/68 MVA (summer/winter)
- Kikiwa–Argyle–Blenheim–Stoke–1 circuit rated at 56/68 MVA (summer/winter).

An outage of a Stoke 220/110 kV interconnecting transformer results in the Nelson-Marlborough region being supplied from the interconnection at Kikiwa via the two 110 kV circuits. The Kikiwa–Stoke–3 circuit may overload and low voltages may occur at Blenheim when Nelson-Marlborough region load is high coupled with low local generation.

What next?

We manage these issues operationally via generation rescheduling and load management in the region. Refer to section 15.4.2.1 for our enhancement approach.

15.5.4.3 Stoke 220/33 kV supply transformer capacity

Issue

Two 220/33 kV transformers supply Stoke’s 33 kV load, providing:

- total nominal installed capacity of 240 MVA
- n-1 capacity of 138/138 MVA\(^9\) (summer/winter).

Peak load at Stoke is forecast to exceed the n-1 winter capacity of the transformers by approximately 1 MW in 2017, increasing to approximately 32 MW in 2032 (see Table 15-5).

Table 15-5: Stoke 220/33 kV supply transformer overload forecast

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<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoke 33 kV</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>32</td>
</tr>
</tbody>
</table>

What next?

These issues are currently managed operationally. Refer to section 15.4.2.2 for our enhancement approach.

15.5.4.4 Stoke 110/66 kV supply transformer capacity and supply security

Issue

The Golden Bay area is supplied by a single 110/66 kV, 23 MVA transformer at Stoke, resulting in n security. The continuous operational rating of the transformer has been increased to 28/30 MVA (summer/winter). The summer peak load at Stoke 66 kV is forecast to exceed the increased continuous rating of the transformer by

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\(^9\) The transformers’ capacity is limited by protection equipment of 138 MVA; with this limit resolved, the n-1 capacity will be 143/143 MVA (summer/winter) constrained by low voltage switchgear.
approximately 9 MW in 2017, increasing to approximately 18 MW in 2032 (see Table 15-6).

Table 15-6: Stoke 110/66 kV transformer overload forecast

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoke 66 kV</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>

What next?

This issue is currently managed by constraining on Cobb generation which is embedded in the 66 kV distribution network. A project is underway to replace the Stoke supply transformer and install an additional new one. Refer to section 15.4.2.3 for our enhancement approach.

15.5.5 Nelson-Marlborough bus security

This section summarises bus security issues that were identified for the Nelson-Marlborough region during the next 15 years, arising from the outage of a single bus section rated at 50 kV and above.

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).

15.5.5.1 Transmission bus security

Table 15-7 lists the 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.

The customers (Network Tasman and Marlborough Lines) have not requested a higher security level. Unless otherwise noted, we do not propose to increase bus security.

Table 15-7: 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>
</tr>
</thead>
<tbody>
<tr>
<td>Argyle 110 kV</td>
<td>-</td>
<td>Argyle</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Blenheim 110 kV</td>
<td>Blenheim</td>
<td>Argyle</td>
<td>-</td>
<td>15.5.5.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>note 1</td>
</tr>
<tr>
<td>Stoke 66 kV</td>
<td>Golden Bay load</td>
<td>Argyle</td>
<td>-</td>
<td>15.5.5.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>note 2</td>
</tr>
<tr>
<td>Stoke 110 kV</td>
<td>Blenheim</td>
<td>Golden Bay load</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>note 2</td>
</tr>
<tr>
<td>Stoke 220 kV</td>
<td>-</td>
<td>-</td>
<td>Possible overload of Kikiwa–Stoke–3</td>
<td>note 3</td>
</tr>
</tbody>
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1. There is no bus protection at Blenheim, so bus faults remove all connected circuits from service. This includes the Blenheim–Argyle–Kikiwa circuit, causing a loss of connection at Argyle.
2. An outage of the Stoke 110 kV or 66 kV bus will disconnect the Golden Bay area, including Cobb generation. This may or may not cause a loss of supply, depending on the balance of load and generation in the area.
3. An outage of the Stoke 220 kV bus-section A1 will disconnect the 220/110 kV interconnecting transformer, potentially causing overloading of the 110 kV Kikiwa–Stoke circuit, depending on levels of generation and load in the region (see 15.5.4.2).

### 15.5.5.2 Blenheim supply security and voltage quality

**Issue**

There is a single 110 kV bus section at Blenheim, resulting in n security. There are three 110 kV circuits (two from Stoke and one from Argyle) supplying Blenheim’s load. A fault on the:

- Blenheim 110 kV bus will result in a total loss of supply to the load
- Stoke 110 kV bus will cause a low voltage issue, which may lead to voltage collapse and loss of supply at Blenheim. If this occurs the Blenheim load will be constrained to approximately 50 MW due to the voltage instability and the capacity of the 110 kV Blenheim–Argyle–Kikiwa circuit.

**What next?**

We manage these issues operationally. The customer has not requested a higher level of security.

### 15.5.6 Nelson-Marlborough generation proposals and opportunities

This section describes regional issues that may affect generation proposals under investigation by developers and in the public domain, or other generation opportunities. We discuss the impact of committed generation projects on the grid backbone 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.

#### 15.5.6.1 Maximum regional generation

To estimate the maximum amount of new generation that can be connected in the Nelson-Marlborough region, we assume a light South Island load profile and high generation in the Nelson-Marlborough region (Cobb generating 27 MW).

For generation connected at the Stoke 220 kV bus, the maximum that can be injected under n-1 is approximately 380 MW. The constraint is caused by the 220 kV Kikiwa–Stoke circuit overloading when the other circuit is out of service.

Generation up to approximately 130 MW can be connected at the Blenheim 110 kV bus, or to the two 110 kV Blenheim–Stoke circuits. Higher levels of generation (approximately 160 MW under n-1 condition) would require a thermal upgrade of the 110 kV Kikiwa–Stoke–3 circuit and a protection upgrade on the Blenheim–Stoke–1 circuit. Further increases would require a thermal upgrade of the 110 kV Blenheim–Argyle–Kikiwa circuit.

#### 15.5.6.2 Generation on the Blenheim–Argyle–Kikiwa circuit

Blenheim–Argyle–Kikiwa is a single 110 kV circuit rated at 56/68 MVA. The maximum generation that can be connected to this circuit depends on where it is connected.
With all circuits in service, approximately 50 MW can be connected, in addition to existing generation injected at Argyle. Generation beyond this amount will need to be embedded within the Marlborough Lines network. Generation restrictions may also be needed for some outages. Alternatively, increasing the rating of the circuit is also technically feasible.

15.5.6.3 Generation connection at Stoke 66 kV

The existing Cobb hydro generation station is embedded in the Network Tasman 66 kV transmission network. The maximum new generation that can be connected at the 66 kV bus depends on the 66 kV load profile, Cobb generation and the capacity of the Stoke 110/66 kV transformer.

Approximately 30 MW of additional generation can be connected if controls are installed to automatically reduce generation under some scenarios.