1 Introduction

1.1 Purpose of the Transmission Planning Report

The purpose of this TPR is to provide interested parties with information about:

- the Enhancement and Development\(^1\) (E&D) transmission investments that may be required within the 15 year planning period (2017 to 2032) to address gaps in capability
- the existing and future capability of the National Grid
- our transmission planning processes.

Transparency in respect of our transmission network development processes is important to encourage efficient industry investment decision making via the timely disclosure of potential grid development needs and options.

1.1.1 Transpower context

*Transmission Tomorrow*\(^2\) provides Transpower’s perspective on the changing environment in which it operates, and how this will impact future requirements for transmission services.

To support our objective of continuing to provide quality transmission services and investing appropriately in long life assets within a changing environment, we have

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1 The E&D portfolio encompasses all investments that change the capability of the transmission grid to provided desired levels of service to our customers. Changing the capability of the grid may be either an increase or decrease in capability.

2 [https://www.transpower.co.nz/resources/transmission-tomorrow-2016-0](https://www.transpower.co.nz/resources/transmission-tomorrow-2016-0)
developed the following Grid strategic goals which are at the core of our planning strategies and processes. The TPR provides a transparent publication that sets out how we plan for grid E&D (including engaging with stakeholders), and shares progress towards the Grid strategic goals.

- **Service Performance:** The investments proposed in the TPR consider the needs of the interconnected grid and the service performance required by each of our customers, enabling effective cost-service trade-offs to be made. The flexibility in the process for investigating transmission problems or opportunities supports consideration of a broad range of options to meet transmission development needs.

- **Cost Performance:** A changing environment for transmission services requires that we match our investments to grid needs, value the future flexibility that some options may provide, and select the ‘least-regret’ investment. Our assessment of potential transmission investments gives significant weight to the whole of life cost of the asset(s) and the extent to which they enable us to achieve service levels.

- **Customers and Stakeholders:** Customers’ development plans, preferred service levels and technology choices are central to transmission investment decisions. The TPR describes how customer choices impact transmission investment choices and timing. Sharing investment planning information and processes and working closely with customers and stakeholders ensures that the best outcomes are achieved, both nationally and regionally.

- **Asset Management Capability:** A key challenge in investment planning is managing uncertainty. The need for and timing of investments is inevitably affected by external factors such as changes in the wider economy and uptake of new technologies. Continuing to improve our understanding of uncertainty and being cognisant of its potential impact is essential to building our asset management capability.

### 1.1.2 Integrated Transmission Plan

We publish a new Integrated Transmission Plan (ITP) every five years as a central part of our engagement with the Commerce Commission and stakeholders on funding levels and output targets. Our next ITP is due in 2018. Most years we publish an ITP update to provide transparency as our plans and planning evolve. The ITP also satisfies requirements under the Capital Expenditure Input Methodology (Capex IM).

The ITP describes Transpower’s business objectives, strategies, and our approach to decision-making. It also provides a high-level view of forecast expenditure and service outputs across network development, replacement, refurbishment and maintenance expenditure.

The TPR is a supporting document to the ITP, providing detailed information on current and potential future E&D investment expenditure only. This includes both base capex projects (expenditure less than $20 million) and Major Capex Projects (expenditure greater than $20 million).

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3 A ‘least regret’ approach to planning is a prudent approach for the steward of an essential service based on long-lived assets.

1.1.3 Regulatory context

Investment funding

Investments that either increase or decrease the capability of the grid are categorised as E&D projects.

The grid development plans set out in this TPR (Chapters 6 to 19) are a bottom up view of possible E&D projects for the next 15 years. Alongside this bottom-up view we consider how uncertainty in our operating environment (e.g. uptake of new technologies, changes in economic conditions and decisions by our customers) may impact our overall investment needs. This approach is described in Chapter 3.

Our view of E&D investment needs is a component of our five-yearly regulatory reset proposals, alongside our assessment of reinvestment and operating costs. The Commerce Commission evaluates our proposal as a whole and establishes funding arrangements (baselines, output targets and incentives). Once funding arrangements are established we have flexibility to reprioritise our plans, and increase or decrease overall investment, as we respond to new information.

The five-yearly process described above excludes any development investments with an expected cost in excess of $20 million. These are termed Major Capex Projects and are assessed individually by the Commission.5

Our transmission network development projects can be classified by funding arrangement as shown in Table 1-4.

Reporting requirements

Every two years, under Part 12 of the Electricity Industry Participation Code, we are required to publish:

- a Grid Reliability Report (GRR), which sets out 10-year forecasts of demand at grid exit points and generation at grid injection points, and whether the National Grid can be reasonably expected to meet (n-1) security requirements, and
- a Grid Economic Investment Report (GEIR), which identifies economic investments (those that create net market benefits) that Transpower considers could be made in respect of the interconnection assets.

The TPR fulfils the requirements of the GRR by providing:

- a forecast of demand at each grid exit point over the next 10 years (Chapters 7 - 19)
- a forecast of supply at each Grid Injection Point (GIP) over the next 10 years (Chapters 7 - 19)
- whether the power system is reasonably expected to meet the n-1 criterion at all times over the next 10 years (Asset Capability sections of Chapters 6 - 19).

The Grid Enhancement Approach sections of each regional or backbone TPR chapter fulfil the requirements of the GRR and GEIR by providing:

5 Major Capex Projects are included in the proposal for information purposes, but funding is not approved as part of this Commission assessment. Instead they are submitted to the Commission individually throughout the regulatory control period as proposals are completed.
• proposals for addressing any n-1 issues identified in the assessment of asset capability
• issues impacting the economic operation of the grid, and
• proposals to address any issues impacting economic operation of the grid.

The blue ‘investment boxes’, similar to Table 1-1, provide details of our proposals to address identified issues. Where an issue is not part of the GEIR it should be considered a GRR issue.

Table 1-1: Example of proposal to address a GRR issue

<table>
<thead>
<tr>
<th>Project name:</th>
<th>Increase interconnection capacity to Lower Waitaki Valley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project description:</td>
<td>Waihao grid exit point</td>
</tr>
<tr>
<td>Project’s state of completion:</td>
<td>Investigation started</td>
</tr>
<tr>
<td>OAA level completed:</td>
<td>OAA L3p (refer Table 1-3)</td>
</tr>
<tr>
<td>Grid need date:</td>
<td>TBA, customer initiated</td>
</tr>
<tr>
<td>Indicative cost ($ million):</td>
<td>26</td>
</tr>
<tr>
<td>Part of the GEIR?</td>
<td>No</td>
</tr>
</tbody>
</table>

The TPR contains the information required under Part 12 of the Electricity Industry Participation Code for the publication of the GRR and GEIR. These reports will not be published separately in 2017.

Under the Commerce Act Information Disclosure (ID) regulation\(^6\), Transpower is also obliged to disclose grid demand and injection information (Schedule G2). The information produced for ID is the same as the information produced for the GRR.

1.2 Investment process and classification

1.2.1 Investment process

There are two main parts to the investment planning process: identifying grid problems and opportunities for changing grid capability, and investigating options to resolve these issues through the Decision Framework.

**Identifying problems and opportunities for changing grid capability**

We use three main inputs to identify grid problems and opportunities.

- The Annual Transmission Planning process: we test the capability of the grid to meet forecast demand and generation needs over the next 15 years. This assesses the ability of the grid to remain in a secure state with any one asset out of service (n-1), from which we can identify potential future upgrades. This process provides the main input to the Decision Framework for E&D investments. The Asset Capability section of each TPR regional or backbone chapter details the results of these studies.
- Customer Developments: when customers require new connections, increase their demand or develop their own networks, changes in the transmission grid may be necessary to ensure acceptable service performance and security of supply. We obtain this information from discussion with customers and through

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the Customer Technical Request (CTR) process. Customer input is discussed in the Grid Enhancement sections of each regional or backbone chapter.

- Asset Feedback: In operating and maintaining the grid, valuable information is obtained on potential transmission problems and opportunities, and the risks associated with current asset capability. Asset Feedback is discussed in the Asset Capability section of each regional or backbone chapter.

While the Annual Transmission Planning process, in particular, has a natural focus on identifying problems, all three of the processes described above may also identify opportunities for grid investment. Opportunities generally involve investment in the interconnected grid that produce net market benefits, such as where they improve operation of the grid, reduce losses or enhance market operation.

All identified problems and opportunities are reviewed and assessed to determine whether there is an investment need.

**Applying the Decision Framework**

We investigate E&D investment needs and the options to resolve them by applying the Decision Framework. The framework requires us to consider System Needs alongside refurbishment, replacement and maintenance requirements. Where appropriate we combine individual Needs into collective Grid Needs, ensuring that investigations consider interrelated problems and opportunities.

The Grid Enhancement sections of the TPR capture our application of the Decision Framework to E&D System Needs. The outcome is a set of potential investments in each region and on the grid backbone.

As the TPR evolves we are seeking to extend our investment discussions to take account of our view of investment uncertainty as a result of changes in key investments drivers.

Our investment decision making process is described in more detail in Appendix A.

**1.2.2 Project classification**

The TPR refers to a large number of current and potential transmission and generation projects. This section explains how we present projects in the TPR in the context of their state of completion, regulatory status, identification references and costs.

**State of completion**

We classify transmission network development projects by their state of completion to provide an indication of the planning stage each one is in. Table 1-2 lists the completion states with respect to the Decision Framework and Option Assessment Approach.

**Table 1-2: State of completion classifications**

<table>
<thead>
<tr>
<th>Status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery</td>
<td>Projects that have an approved delivery business case and are in the delivery stages</td>
</tr>
</tbody>
</table>
| Committed   | Projects that have completed the options assessment stage (gone through a delivery level options assessment) and either:  
- the investment has obtained approval to proceed, or  
- Transpower has entered into an investment contract with a specific customer or customers. |
Proposed Projects that are still in the options assessment stage and have gone through a planning level options assessment

Possible These projects are in the needs identification stage and have not gone through the options assessment stage. The investments identified are possible options for future grid upgrades, subject to further analysis.

Investigation detail

We use the Options Assessment Approach (OAA) to guide the level of investigation detail undertaken when assessing System Needs. The OAA provides guidance for undertaking a commensurate approach to investigations and options analysis. The expected cost, complexity of analysis and the timing of System Need are all considered when selecting the OAA assessment level.

For issues discussed in the Grid Enhancement Approach sections of this TPR we have identified the level of analysis already undertaken. As the TPR covers grid problems and opportunities over a 10 to 15-year period many of the assessments undertaken, or underway, are ‘planning’ level options analyses. This informs the development plans in this TPR and our financial forecasting. However preferred solutions from planning level OAA assessments will be reassessed using a detailed delivery level assessment at the appropriate time.

Table 1-3 below provides a high-level description of the OAA classifications, indicating the type of System Needs that fit the criteria for each level.

Table 1-3: Options Assessment Approach Classifications

<table>
<thead>
<tr>
<th>OAA Assessment Level</th>
<th>Investigation Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>The problem or opportunity has been identified but has not yet been assessed. Costing information is based on judgement and expertise.</td>
</tr>
<tr>
<td>1</td>
<td>The asset class strategy prescribes the preferred investment solution. No options assessment is undertaken.</td>
</tr>
<tr>
<td>2 – Planning (OAA L2p)</td>
<td>For investigations with low complexity and or cost, required within 10 years. Preferred solution informs plan. Investigation revisited before any expenditure.</td>
</tr>
<tr>
<td>2 – Delivery (OAA L2d)</td>
<td>For investigations with low complexity and or cost for delivery. Preferred solution is delivered.</td>
</tr>
</tbody>
</table>
| 3 – Planning (OAA L3p) | For investigations with:  
  - Medium complexity and or cost, required within 10 years.  
  - High complexity and medium cost, required after 10 years  
  Preferred solution informs plan. Investigation revisited before any expenditure. |
| 3 – Delivery (OAA L3d) | For investigations with:  
  - Medium complexity and or cost, required for delivery.  
  - High complexity and medium cost, required for delivery.  
  Preferred solution is delivered. |
| 4 – Planning (OAA L4p) | For investigations with:  
  - High complexity and cost, required within 10 years.  
  Preferred solution informs plan. Investigation revisited before any expenditure. |
| 4 – Delivery (OAA L4d) | For investigations with:  
  - High complexity and cost (<$20 million), required for delivery.  
  Preferred solution is delivered. |
*Investment type*

Our transmission network development projects can be classified by the funding arrangement as shown in Table 1-4.

**Table 1-4: Regulatory investment type**

<table>
<thead>
<tr>
<th>Investment type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Capex</td>
<td>Replacement and Refurbishment projects of any value, or Enhancement and Development projects forecast to cost less than $20 million.(^7) We have flexibility to reprioritise across base capex, to increase or decrease overall base capex, and to shift between base capex and opex (e.g. procuring demand response to defer investments).</td>
</tr>
<tr>
<td>Major Capex Projects</td>
<td>These are individual investment proposals to enhance the Grid, which are submitted to the Commerce Commission for approval on a case by case basis. The cost threshold for individual enhancement project approval is $20 million.</td>
</tr>
<tr>
<td>Customer-specific</td>
<td>Enhancement projects on assets specific to a customer or group of customers which are agreed and paid for under an investment contract between Transpower and the customer/group of customers.</td>
</tr>
</tbody>
</table>

*Project costing*

Where investment is required to resolve an identified problem or opportunity, an indicative cost is shown. The indicative costs represent the expected cost (in 2017 dollars) to fully implement the indicated solution. Note that the accuracy of costs presented is commensurate with the current level of detail in the investigation. Cost estimates should be relatively accurate for projects in the Delivery or Committed states, but will be highly uncertain for Proposed or Possible projects.

Property and consenting costs have not generally been included because of the uncertainties involved. For some projects, property costs can significantly impact the overall cost.

Cost information generally represents a high level and provisional estimate only and should not form the basis for investment decisions. Interested parties should confirm the adequacy of these cost estimates for themselves, or contact us for more detailed information.

*Grid enhancement approach investment proposals*

The Grid Enhancement Approach in each regional and grid backbone chapter outlines our proposals to address investment needs. The proposals are summarised throughout the chapters in the blue ‘investment boxes’ similar to Table 1-1.

**1.3 Document overview**

In this TPR:

- Chapter 2 ‘Existing National Grid’ provides a description of the National Grid’s existing configuration, including recently completed projects.

\(^7\) This was increased from $5 million in RCP1 to $20 million in RCP2.
Chapter 3 ‘Investment Uncertainties’ provides a discussion of how investment drivers may vary over time, the uncertainty this drives in investment decision making and how this impacts Transpower’s view of the required funding to undertake E&D transmission investments.

Chapter 4: ‘Enhancement and Development Portfolio’ provides an overview of the E&D portfolio and how we arrive at a baseline funding level.

Chapter 5: ‘Major Grid Events’ links together the issues raised in Chapters 6 – 19 that are directly related to possible major industry and environmental changes.

Chapter 6 ‘Grid Backbone’ discusses the grid backbone’s ability to accommodate the forecast demand and any proposed investment Needs.

Chapters 7 - 19 ‘Regional Plans’ describe any proposed investment Needs and the transmission capability over the next 15 years for each region’s transmission network.

Each regional plan also provides an overview of the existing regional transmission network and any anticipated security issues.