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EXECUTIVE SUMMARY

The role of Planning

Over the last few years, there has been a strong focus on the provision of new grid infrastructure to keep up with the demand for transmission services. Much of this new build is now complete. Our future focus is on undertaking lifecycle-based asset replacement and refurbishment and operating our assets to deliver a level of service that meets our customers’ expectations at lowest whole-of-life cost.

The decisions that we make in the planning stage of our assets’ lifecycles will largely dictate the total cost of service delivery and the level of service that our assets deliver to our customers.

Planning activities

Our planning approach consists of a number of interrelated activities that include defining required service levels; understanding asset management drivers; identifying, prioritising and integrating options; estimating project costs; and engaging with stakeholders.

The key drivers for building new assets or replacing existing assets are safety, network performance, future demand, risk of asset failure and cost performance.

The extent to which these drivers are considered varies, with no single driver providing definitive direction on when a new asset is required or an existing asset should be replaced or refurbished. The current approach sees the drivers being considered as a suite of information that directs further analysis and informs the final decision.

Consideration of these drivers determine the need for any investment decision and we investigate and analyse options to meet that need. The output of this stage of the planning process is a preferred solution that meets the investment need. Collectively, these preferred options form an unconstrained 10-year capital plan.

Various constraints are then applied to the plan to ensure it is well integrated and close to optimal. The constraints considered in the integration process are resource availability, outage plans, and the site and regional plans.

Our governance processes underpin the capital planning process and ensures the capital plan has been derived in a systematic and rigorous manner. The development of our capital plan is further supported by robust stakeholder engagement and consultation where required.
Objectives and Strategies

We have developed asset management objectives across five areas, being safety, service performance, cost performance, New Zealand communities and asset management capability.

We have developed the objectives to reflect where we want to be by 2020. The strategies describe how we will achieve the objectives and we will use a number of improvement indicators to track our progress. A summary of the planning objectives is shown in Table 1 below.

<table>
<thead>
<tr>
<th>Area</th>
<th>Improvement Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>Our designs for new assets will contribute to minimising the risk of injury to our workforce and the public through application of Safety by Design, by ensuring that safety is prioritised in our options analysis and approvals processes. Our risk assessment of safety drivers for new assets will be consistent across fleet strategies and aligned to our asset management risk framework.</td>
</tr>
<tr>
<td>Service Performance</td>
<td>We can explicitly demonstrate the link between our expenditure and asset performance. We can demonstrate our Grid expenditure is at the 'right' level to achieve our performance targets.</td>
</tr>
<tr>
<td>Cost Performance</td>
<td>We minimise the whole-of-life cost of our assets by applying a systematic approach to our planning including options analysis, whole-of-life costing and consistent consideration of risk. Our longer-term cost estimates are of sufficient accuracy to provide customer certainty that we can achieve the target performance within our planned expenditure. We can demonstrate that we are getting increased use from our assets through the application of technology and innovation.</td>
</tr>
<tr>
<td>New Zealand Communities</td>
<td>Location of our future corridors and sites will be derived through collaboration with other infrastructure providers. Our existing transmission corridors will be adopted into the plans of the six largest territorial authorities. Reduce sulphur hexafluoride (SF₆) emissions to as low a level as practicable.</td>
</tr>
<tr>
<td>Asset Management Capability</td>
<td>Competence framework that supports the core competences required to support the Planning Lifecycle in place.</td>
</tr>
</tbody>
</table>

Table 1: Planning Objectives
1 INTRODUCTION

This Planning Lifecycle Strategy describes our current approach to transmission system and asset planning, our improvement objectives for RCP2 and the strategies being adopted to deliver these improvements. It has been developed based on good practice guidance from internationally recognised sources, including the relevant clauses of BSI PAS 55:2008.

1.1 Scope

This document details the planning activities and strategies for the New Zealand transmission system (Grid). It describes the drivers for capital expenditure (Capex) and our approach to address these. This approach includes needs identification, options analysis, approval, and then handover to our delivery teams for implementation. The overall planning approach includes the capital planning and approval (CPA) process.

Capex Categories

We categorise Capex into three main classes.

- **Replacement and Refurbishment (R & R):** capital investments that maintain the asset fleet to meet our performance criteria. These investments consist of either like-for-like replacements, or refurbishments that extend the life of existing assets.

- **Enhancement and Development (E & D):** capital investments that lead to new grid build to provide additional capacity and capability.
  - Major Capex Projects include those E & D projects in excess of $20 million
  - Base E & D projects include those projects costing less than $20 million

- **Customer investments:** investments made to meet requirements specified by a customer, where we would not undertake that investment as part of our normal programme of work. The costs of customer projects are met by the customer making the request.

1.2 Strategic Alignment

This Planning Lifecycle Strategy sits within our suite of core asset management documents shown in Figure 1. It supports the ‘line of sight’ from the asset management policy through to the asset management plans and subsequent asset interventions.
1.3 **Document Structure**

The rest of this document is structured as follows.

- **Chapter 2** discusses the context for planning the New Zealand transmission system.
- **Chapter 3** describes our current planning approach.
- **Chapter 4** sets out our asset management objectives and the strategies that support them.
2 CONTEXT

Our Asset Management Strategy provides an overview of the context in which we manage the Grid. This chapter expands that context and focuses on issues directly relevant to planning activities.

2.1 Safety Management

Safety is one of our key values. We have developed safety by design\(^1\) principles (Safety by Design) to enable the right trade-offs to eliminate, isolate or minimise potential safety hazards during the design phase.

Our Safety by Design approach is supported by a strategy document\(^2\) and a committee made up of senior design engineers from Transpower and our service providers. Their role is to provide leadership in the practical application of Safety by Design principles throughout the asset lifecycle.

Our approach focuses on ensuring that we plan and design a transmission system that is safe to operate and maintain and minimizes any risk to public safety. We have developed standard designs for substation equipment that incorporate Safety by Design. We continually update these standard designs with lessons learned from incident investigations to minimise the risk of that type of event recurring.

2.2 Planning Considerations

The Grid is isolated from any other transmission systems and the areas of demand (load) are usually some distance from areas of significant generation. The transmission system also has relatively little interconnection or ‘meshing’. This is of particular relevance to our planning as:

- some parts of the transmission system do not have a high resilience to faults and outages due to a relatively low level of redundancy
- some parts of the transmission system are susceptible to voltage stability issues
- variations in inflows into the hydro power station lakes (wet/dry years) can cause substantial variation in power flow on the Grid
- outages for maintenance and project work can be difficult to arrange due to network security considerations
- outage durations often must be very limited, and can be cancelled at short notice for reasons of system security.

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\(^1\) Transpower standard TP.DG 47.01 – ‘Safety by Design – Strategy and Application’.

\(^2\) Transpower standard TP.DG 47.01 – ‘Safety by Design – Strategy and Application’.
2.3 Interaction with other Lifecycle Stages

The area bound by the red dashed line in Figure 2 shows the scope of this document as it relates to our asset lifecycle. It shows the main drivers and objectives that inform planning decisions. The other lifecycle activities are described in the respective lifecycle strategies. The high-level interactions between planning and the other lifecycle stages are briefly described below.

Figure 2: Scope of the Planning Lifecycle Strategy

Delivery

The delivery stage includes the implementation of the capital projects that have been approved in the planning lifecycle stage. Planning ensures that the scope of capital projects is adequately defined and that they can be implemented within the required timeframe.

Delivery processes are used to construct and commission the assets. These processes include the provision of feedback to the planning process. This feedback includes, among other things, actual out-turn costs, lessons learned, constructability issues, actual lead times and stakeholder feedback.

Operations

Planning considers operational requirements as part of the whole-of-life approach to planning the transmission network. This involves consideration of how we operate our assets (such as loading and frequency of operation) and the impact this has on each asset’s life. Planning new or replacement assets also involves consideration of how we can safely take these assets out of service for maintenance without compromising performance.

Operational processes provide information to the planning process on network and asset performance or risks, and any lessons learned to improve the planning process.

Maintenance

How we maintain our assets has a significant effect on their expected life. Adopting a whole-of-life approach requires us to make tradeoffs between Operating expenditure (Opex) and
Capex. This requires that our capital planning decisions take into account the ongoing operational and maintenance costs of potential solutions.

Maintenance provides feedback on any lessons learned to improve the planning process. It also provides condition assessment information as a crucial input into the R & R planning process.

**Disposal**

In general, the decision to dispose or divest of an asset is made as part of a wider project or programme during the planning phase for those larger works. Planning takes into account the required disposal and divestment activities (immediate and future).

Disposal processes provide feedback on any lessons learned to ensure we accurately account for disposal costs. The disposal stage can also include detailed investigation of the asset to provide information regarding failures.
3 CURRENT PLANNING APPROACH

This chapter sets out our current approach to capital investment planning.

3.1 Introduction

Our asset management objective is to safely provide a grid that can deliver a level of service that aligns with our customer expectations at lowest lifecycle cost. Planning sits at the heart of achieving this and plays a key role by ensuring that appropriate interventions are undertaken at an optimum time.

3.1.1 Overview

The purpose of our planning process is to identify required Capex projects and integrate these into an efficient and deliverable work plan across a rolling 10-year time horizon.

Our approach, as illustrated in Figure 3 above consists of three main stages: project planning, integration and approval. This approach is applied to the three main categories of Grid Capex (R & R, E & D, and customer investments). Each of the three main stages has internal processes and supporting activities and is subject to our overall governance processes. The main stages are noted below.

Figure 3: Planning Process and Main Functions

While this process primarily addresses Capex, it also includes the planning of some maintenance projects.
Needs Identification: our Grid Capex investments are undertaken in response to a number of drivers that are identified through various activities including asset condition monitoring, network studies, technology assessments and safety reviews.

Options Analysis: for any given need(s) there can be several potential solutions. We identify and evaluate these to confirm the best option based on whole-of-life costs including benefits.

Project Integration: the range of potential projects are prioritised within fleet portfolios. This is based on factors such as relative asset criticality and impacts on asset health.

Portfolio Integration: Capex portfolios are further prioritised using the integrated works planning (IWP) process. This is done to maximise delivery efficiency across portfolios and programmes, including Opex and Major E & D.

Final Approval: a robust final approval process is undertaken prior to handover to delivery.

Governance: throughout the planning process we use a series of challenge and review processes to ensure that proposed projects are consistent with relevant objectives. This process includes stakeholder consultation.

Cost Estimation: an important supporting activity for our planning processes. It provides consistent and accurate cost estimates to support decision making.

The rest of this chapter provides further detail on these processes.

3.2 Needs Identification

The capital investment needs result from a number of drivers or ‘needs’. The extent to which individual drivers are directly relevant to specific Capex investments will vary. Also, certain needs are more likely to drive specific Capex types; for example, the risk of asset failure is generally linked to R & R.

These needs are identified through a number of activities across the business, including asset condition monitoring, network studies, technology assessments and safety reviews. The extent to which these drivers are considered varies, with no one driver in isolation providing a definitive indication on when an asset intervention may be required. During RCP2 our Grid Capex investments will be primarily driven by safety, service performance, demand, and risk of asset failure. These drivers are discussed in the following subsections.

3.2.1 Safety

Safety is a fundamental organisational value and is a key driver for Grid Capex. Investments are sometimes required to ensure that Grid assets do not pose safety risks to staff, service providers, or the general public, or at least that such risks are isolated or minimised to the extent possible.

The need to ensure safety for staff and the general public will lead to the need for new, replacement or refurbished assets. One example is the plan to replace existing 33 kilovolt (kV) outdoor switchyards with indoor switchgear.4

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4 The conversions from outdoor switchyards to indoor switchgear will also improve reliability and decrease maintenance requirements. For further detail, see the fleet strategy for outdoor 33kV switchyards.
Planning also contributes to safety improvements through the application of our Safety by Design principles. While significant progress has been made in relation to safety we are committed to making ongoing improvements as set out in Chapter 4.

### 3.2.2 Service Performance

We have two main service performance drivers: network performance measures and the Grid Reliability Standards. These are discussed below.

#### Network Performance Measures

We have developed a set of customer facing performance measures and associated targets for each point of service (POS). The POS have been categorised based on their criticality. The performance targets are designed to provide customers with an idea of the long-term performance they can expect.

We use the targets to help identify assets that may be contributing to poor performance at certain POS. This is done by comparing actual performance with relevant performance measures and associated targets. The full suite of performance measures are set out in a separate paper and include interruption duration and frequency, availability measures, and other measures including providing timely information.

We use these measures to identify POS that are performing below their targets. The performance is then examined to understand the root cause of performance issues, including the contribution of any specific assets to the poor performance.

In the future, we will look to translate the customer-facing targets down to individual asset performance targets and the associated asset interventions required to maintain performance. This will provide us with internal measures to guide efforts at reducing the risks and durations of outages for customers, improve asset performance and help us better prioritise and target expenditure.

#### Grid Reliability Standards

The Grid Reliability Standards (GRS) are a set of standards against which the reliability performance of the existing Grid and future capability can be assessed. The GRS consists of:

- an economic (probabilistic) standard for the whole Grid, and the associated assessment of the costs and benefits of investment for reliability
- a ‘safety net’ minimum reliability standard of N-1 for contingencies on the core grid.

The core grid can be broadly described as the collection of assets that comprise the transmission links carrying load in excess of 150 megawatts (MW). Should our forecasts of demand for transmission services indicate that we are unlikely to meet the GRS at a grid exit point in the future, we will initiate an investigation to determine the appropriate solution to meet demand. This is described in detail in Section 3.3.2.

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5 Full details can be found in *Safety by Design – Strategy and Application*.
6 See discussion on Asset Criticality in Section 3.2.4.
8 The GRS are specified in Schedule 12.3 of the Electricity Industry Participation Code.
9 N-1 means that the system is planned such that, with all transmission facilities in service, the system is in a secure state, and for any one credible contingency event, the system moves to a satisfactory state. However, if more than one contingency event was to occur, loads may have to be shed to return to a satisfactory state.
Grid planning guidelines describe the criteria we use to determine the need for new grid investment against the backdrop of the requirements of the GRS and Good Electricity Industry Practice.

### 3.2.3 Demand for Service

When considering any grid expenditure, we need to consider the future demand for service as provided by our assets. To ensure we have a robust view of future demand, we produce long-term forecasts for electricity demand and generation on an annual basis. This is set out in the Annual Planning Report (APR) together with potential investments that may be required to meet the capacity constraints.

Each year we carry out, and publish, an assessment of the required capability of the grid in our APR. The role of the APR is to signal proposed and potential transmission investments within a 10–15 year horizon so that stakeholders have a greater degree of information about our plans in order to confirm their own. It provides information on:

- the capabilities of the existing Grid
- demand and generation forecasts for the next 10 to 15 years
- the Grid’s ability to meet future demand and generation needs
- the role of the Grid in facilitating generation
- Grid investment that may be required to meet future needs for the next 10 to 15 years and beyond, by way of:
  - Grid backbone transmission plans for the main North and South Island transmission corridors, and for the HVDC link
  - 13 regional plans.

### Demand Forecasts

The capacity required of the Grid is driven by peak demand and generation locations so long-term (up to 40 years) peak demand forecasting is a key input to Grid planning.

We produce expected forecasts (P50) and prudent forecasts (P90). P90 represents a forecast that has a 10% probability of being exceeded. We use the prudent peak demand forecast to determine the need date for new investment and the expected demand forecasts in our economic assessment of options. As well as determining the need dates for new investments, we consider the forecasts when assets fall due for renewal. Should there be higher demand forecasts in the future, we need to consider increasing the capacity of existing assets to ensure they are fit for purpose over their lifecycle.

Each year, we produce a range of generation scenarios representing possible future generation outcomes over the next 20 years. These scenarios result from making specific assumptions about future fuel availability and environmental policy.

### 3.2.4 Risk of Asset Failure

A key driver of Grid Capex is the risk of asset failure. We use asset condition (including asset health models) as a proxy for the likelihood of asset failure while our criticality framework reflects the consequence of failure at our POS. These models are discussed below.

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10 Full details of our demand forecasts can be found in Planning Input - Demands.
11 Full details of the generation forecasts used in our planning can be found in the Generation Scenario Methodology.
Asset Health

We have recently developed Asset Health Indices (AHI) for estimating the remaining life of assets. This is defined as the time until an asset intervention is likely to be required to reduce asset-related risk. As such, AHI are specified in years of expected ‘remaining life’ for each asset. Asset health is derived using a standard methodology which takes into account the following factors:

- asset condition based on test and inspection results
- predictions of future condition and performance
- fleet failure rate
- model-specific experience
- environmental factors, such as harsh coastal or geothermal environments
- technical experience and expertise.

The AHI methodology has been deployed for three core asset types: transformers, transmission lines, and circuit breakers. Work is underway to expand it to other fleets. Our asset health framework is still in development. In the future, we intend to link measured asset condition and future asset expenditure to future asset performance. This will allow us to identify optimal asset interventions (Capex and Opex) – see Section 4.2 for more detail.

Asset Criticality

Asset criticality is one of the key elements of our asset risk framework and serves as a proxy for the consequences of failure. We have divided our Grid POS into different categories based on the criticality of load they supply. This allows a differentiated approach to service levels, design, operation and maintenance. The criticality categories are high priority, important and standard.

We have also developed a preliminary model for translating the criticality of the POS to the criticality of the network branches that supply the connection point. We have started using asset criticality to derive our asset fleet plans. We will be seeking to embed this in our asset management decision making over the next few years.

Prioritised Investment

In combination, asset health and asset criticality can be used to assign an overall risk to our assets. This enables us to prioritise and optimise the timing of asset interventions. A further application is their use in optimising the level of investment between portfolios (discussed below). This framework has resulted in improvements in the way we quantify, communicate and use asset risk to inform our investment decisions. In addition to managing asset risk, we have used the associated performance measures to target and prioritise our expenditure. We are still developing this approach as tools and models are developed, tested and used. The system supports our decision making and does not provide definitive answers on timing of investments.

3.3 Options Analysis

Once Grid Capex needs are identified, consideration of potential solutions is necessary. The number and type of solutions (or options) that are considered will vary depending on the type of investment; for example, whether the Capex is driven by constraints or asset failure risk.
This process will vary based on the expenditure category, but will generally include technical studies, economic assessments and risk analysis. A number of the identified needs will be recurring and we have specific strategies on how these are to be addressed. This process may also include external consultation.

While options analysis for our Capex follows the same generic process, there are differences between our approach based on the type of Capex. As such, we discuss the approaches used for R & R, E & D and customer investments separately.

### 3.3.1 Replacement and Refurbishment

Our fleet strategies drive long-term programmes of our Replacement and Refurbishment (R & R) work. They set out our strategies for R & R expenditure and are designed to guide our medium-term to long-term planning decisions. Examples of fleet strategies include the conversion (based on failure risk) of outdoor switchyards to indoor switchgear and the replacement of single-phase and three-phase transformers with more reliable new three-phase units.

The range of viable options will vary based on the asset fleet and the originating need. R & R expenditure will generally address safety or risk of asset failure drivers. In general, these issues can be addressed through one of the following conventional intervention options:

- replace the asset
- refurbish the asset
- continue maintaining the asset.

In these cases, we assess the cost and benefit (such as reduced failure risk) of the credible options, including the status quo or ‘do-nothing’ option. It should be noted that the optimum time for asset interventions generally depends on a number of factors, including those needs identified above. Potential options will be assessed based on any known safety concerns and the likely performance impacts, including how an option would contribute to achieving the long-term Grid performance measures. Where fleets have AHI, the analysis includes estimating the future health of assets based on different intervention options.

Total lifecycle cost is a key consideration in Grid Capex decision making and it is particularly important when considering replacement or refurbishment investments. In addition to capital costs it is necessary to assess the cost of maintenance, disposal and other costs incurred over the life of the asset. Using this approach ensures that Capex decisions are not being made based solely on the capital costs of options. In many cases, the longer-term maintenance and operation costs will be a significant proportion of the whole-of-life cost in present value terms.

The output of the options analysis process is an unconstrained list of R & R projects. This is an input to the integration process described below.

### Stakeholder Consultation

When considering large R & R projects, such as substation redevelopments, we will consult with relevant stakeholders, including customers, affected landowners, local Councils and the

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12 The requirement to replace assets will initiate a review of the capacity requirements. If there appears to be a case to change the capacity of an asset, it will transfer into the E & D process whereby we make a case for investments based options analysis.
wider community as appropriate. We undertake stakeholder consultation at some or all stages of the investment approval process. This level of engagement will be commensurate with the scale of the investment and its likely impact on stakeholders.

3.3.2 Enhancement and Development

The options analysis approach for Enhancement and Development (E & D) projects is commensurate with the size and the complexity of the project. For major E & D projects (costing in excess of $20 million), options identification is quite distinct from the options analysis stage and requires us to develop a long list of all potential transmission and non-transmission solutions (NTS), such as demand response.

At this point, we determine if there are any viable NTS we should be pursuing further. Should there be viable NTS options, we will issue a Request for Proposal for sufficient information on NTS to allow us to compare them to the transmission option.

The long list of options generally includes a mix of:

- non-transmission solutions such as demand response or local generation
- enhancements to existing assets
- replacement or refurbishment of existing assets
- creation of new assets
- dismantling and divesting assets
- operational solutions such as special protection schemes.

The long list of options is reduced to a ‘credible options list’ by applying specific criteria. A credible option is one that:

- addresses the identified need
- is commercially and technically feasible,\(^{13}\) including meeting legislative requirements
- meets Good Electricity Industry Practice
- addresses environmental issues, and meets Resource Management Act requirements
- can be implemented in sufficient time to meet the need.

Having developed a list of credible options, we confirm the suitability of each option to fully meet the need, including operational and maintenance requirements and construction feasibility and timeframes. We also complete a high-level scope for each option to determine a cost estimate (including the operation and maintenance costs) at a sufficient level of detail to differentiate between them. In addition to estimating the costs, we estimate the future benefits\(^{14}\) that will arise from each option (for example, the reduction in transmission losses and avoidance of un-served energy).

Investment Test

For Major Capex projects, we apply the regulated investment test as prescribed in the Capex Input Methodology Determination (Capex IM). The test requires the use of whole-of-life

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\(^{13}\) This assessment includes a high-level cost-benefit assessment to determine if it is worthwhile progressing options to the detailed assessment phase.

\(^{14}\) Given the longevity of our assets, it is necessary to consider the whole-of-life costs and benefits that will accrue over the life of the option and in the case of large enhancement or replacement projects. This requires us to create development plans over a minimum period of 20 years.
costing principles to determine a preferred solution which is then submitted to the Commerce Commission for approval.

Where it is applied, we convert the whole-of-life costs and benefits of each option over a given analysis period\(^\text{15}\) into net present values using a prescribed discount rate.\(^\text{16}\) The whole-of-life net present value of each credible option is compared to a ‘do-nothing’ option to derive the expected net market benefit of each option.

For smaller less complex E & D projects we apply the same principles as the regulated investment test, but modify the level of analysis to be commensurate with the size of the investment. One example of this is the use of market development scenarios, which are analytically intensive to model – smaller investments will tend to use an ‘expected’ scenario rather than multiple scenarios. Where appropriate, similar and relatively small E & D projects can be considered together as a programme for the purposes of options analysis.

A key driver in capital investment decision making is the consideration of the total costs of ownership over an asset’s life. This whole-of-life view includes initial capital costs, benefits, and operating and maintenance costs as well as the cost of the eventual disposal of an asset. Assessing whole-of-life costs avoids issues with decisions being made based solely on the capital costs of options. This stage of the process determines the preferred option, which will be the one that meets the GRS\(^\text{17}\) at lowest lifecycle cost.

**Stakeholder Consultation**

Throughout the investment planning process for E & D works, we consult with relevant stakeholders, including customers, affected landowners, local authorities and the wider community as appropriate. The level of engagement is commensurate with the complexity and range of investments.

We undertake stakeholder consultation at some or all stages of the investment approval process. For Major Capex Proposals (MCPs), we consult on the investment need, the preliminary long list of options and also request information on stakeholder proposals that may contribute towards the solution. We also conduct a second round of consultation on the analysis of the credible options and the preferred solution. For other investments, we consult as appropriate, for instance where the proposed investment directly affects stakeholders. If the investment is sufficiently complex, we include additional consultation steps at other stages of the process.

### 3.3.3 Customer Investments

The need for investment generally comes from a customer request to investigate grid investment options to meet their specific current and/or future needs.

Where there is a requirement to build a connection asset, we will provide the customer with as many options as they require. Where the customer pays for the investment through a bilateral investment contract, the investment does not need to be consistent with the GRS. However, if our assessment demonstrates that the investment is not consistent with the GRS

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\(^{15}\) The analysis period tends to be 20 years unless the life of the asset is lower than this, in which case the analysis is conducted over the expected life of that asset.

\(^{16}\) For major Capex, the discount rate is prescribed in the Capex IM.D7(3) at 7%. This is the rate we use for all our whole-of-life costing analysis.

\(^{17}\) GRS is described in Schedule 12.2 4 of the Electricity Industry Participation Code.
there is a requirement on the customer to either consult with affected end users should the investment increase reliability above the GRS or obtain the Electricity Authority’s approval should the investment reduce the reliability below the GRS.\(^{18}\)

We carry out an assessment, similar to that for the E & D process, for each option to identify a preferred solution. This assessment confirms the suitability of each option to fully meet the regulatory requirements, our design standards and customer need.

**Consultation**

In instances where we are replacing a customer’s connection assets such as a supply transformer, we start consulting with them early in the process. In some instances, we will be replacing connection assets with assets that provide differing capability to that provided with the existing assets. This may be due to load growth requiring increased capacity or lower capacity requirement should the load forecast be diminishing over time.

Given we cannot change connection assets without the agreement of our contracted customers,\(^{19}\) we have developed a standard agreement\(^{20}\) that formally documents our agreement on the following:

- assets to be replaced
- rationale for the replacement
- technical solution
- resulting changes to the customer’s transmission pricing
- changes to the schedules in their existing Transmission Agreement.

Further details of this process can be found in our customer connections policy.

### 3.4 Project Integration

The project integration stage includes the optimisation and prioritisation of expenditure in asset portfolios. This is done using a range of techniques to assign relative priorities to the individual projects. The methods used to prioritise projects will vary by fleet and is discussed in the relevant fleet strategy.

For those fleets with AHI, it is possible to use sensitivity analysis to compare the future health of fleets based on alternative investment scenarios. Asset health is used predominantly as a driver for the timing of asset renewal. When applied in conjunction with criticality we also use it to prioritise our expenditure within portfolios. This is depicted in our Prioritisation Matrix in Figure 4 below.

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\(^{18}\) Clauses 12.35 to 12.38 of the Electricity Industry Participation Code.

\(^{19}\) Clause 36.1, Schedule F2, Part 12 of the Electricity Industry Participation Code 2010.

\(^{20}\) Supplementary Agreement for Connection Asset Replacement: SACAR.
The above approach assigns higher priorities to critical assets with lower remaining life. It identifies these as being more likely to require an intervention due to their higher relative risk. The integration process also targets and prioritises projects based on relative criticality and associated performance targets.

Using our integration process makes project integration a continual process that ensures that we reflect changing priorities, including any changes in key investment drivers and resource availability. This is also required to address changes to the asset base (including asset failures) and to allow us to effectively respond to unforeseen events such as needing to replace equipment damaged by storms or earthquakes. Flexibility to further prioritise expenditure in the future is provided by the substitution provisions of the individual price-quality path (IPP).\textsuperscript{21}

The proposed set of projects in a portfolio are reviewed, challenged and approved by the relevant portfolio owner who has specific asset management knowledge and expertise in their portfolio.

### 3.5 Portfolio Integration

Grid Capex portfolio works are continually prioritised and integrated (by timing or location) with our broader works programme (including Opex and Major E & D projects) so as to maximise the benefits from synergies between the work programmes. Benefits of this process include reduced outages and lower costs through improved programme delivery.

Using this process we review and adjust work across our portfolios by rescheduling projects within the next 10 years to optimise their interaction. The adjusted 10-year capital plan is derived by assessing the interaction of constraints on our R & R, E & D and customer investments.

Four constraints considered in the integration process are noted below.

- **Resource Forecast:** We forecast the resource requirements of the plan and make adjustments to ensure efficient loading on internal and external resources. This is done at a high level over a 5-year outlook period with a parallel process that runs monthly to ensure short term feasibility.

- **Deliverability:** Workloads by portfolio are adjusted to account for potential deliverability constraints (such as a lack of tower painting crews). This allows us to more effectively allocate – sometimes scarce – resources across portfolios.

- **Site Integration:** We hold meetings with service providers to consider and challenge all proposed investments at each individual site to ensure these can be delivered optimally. This allows us to maximise opportunities from simultaneous and sequential works. These meetings consider long-term strategies, asset criticality, asset health, available resources, and outages by site and region.\textsuperscript{22}

- **Outage Availability:** We test our ability to secure outages to complete work so that all proposed work is included in the annual outage plan. The outage risk is generally assessed 12 months ahead of the required start date for delivery. Yet we are planning

\textsuperscript{21} Refer Transpower Individual Price-Quality Path Determination 2010.

\textsuperscript{22} If there is significant complexity within a site, then the meeting will highlight the need for a specific site investigation study to confirm the investments are optimal (or whether we should look at a different option to the planned investments). Recent examples include investigations at Wilton, Hawera and Kinleith.
to extend the visibility of outage requirements so that the feasibility can be assessed 24-36 months ahead of time.

The process of portfolio integration is managed by the Capital Governance Team (CGT), which has operational oversight of the Grid Capex plan and continually reviews its suitability. We also have an annual process meeting with our service providers to assess and reaffirm planned Grid Capex and Opex for the upcoming year.

3.6 Governance and Approval

As projects move through the project approval process they are subject to our overall governance processes. The confirmation of individual projects is undertaken using a staged approval process. Each of these stages culminates in a ‘go/no-go’ decision which determines whether a project will proceed to the next stage or not. These decisions are based on factors such as project cost, risk and feasibility and are undertaken at an appropriate management level based on the expenditure and complexity of the project.

Our Grid Capex forecasts have been built up on a ‘bottom-up’ basis where identified projects have been aggregated before being challenged and approved. This ensures that forecasts have been derived in a systematic and rigorous manner, and have undergone appropriate scrutiny. For RCP2 we also applied a top-down review that reflected our cost performance objectives. The following subsections describe the main documents and challenge rounds that are used to approve Grid Capex.

3.6.1 Business Case Management

We use a progressive business case approval or ‘gating’ process to advance projects through our governance process. The level of scrutiny used is commensurate with the level of expenditure involved. The process for developing and approving projects is shown in * Not all projects require a BC2.

Figure 5, which sets out our formal business case approval gates.

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23 The meetings are attended by key Transpower staff, including portfolio managers, regional service managers (who oversee maintenance) and service providers.

24 For high-volume routine works we aim to get the BC3 approved 12 months ahead of the delivery start date.
The Business Case (BC) documents that are used in this process are noted below.

- **BC1**: This business case authorises the entry of works into the overall approvals system. Portfolio owners approve BC1 documents which include confirmation that the project is aligned to overall asset management objectives and strategy. For larger individual projects we prepare a more detailed BC1+ document that captures the scope of these projects and provides an appropriate basis for cost estimation.

- **BC2**: This gives approval for a detailed formal investigation to begin. This is generally only necessary for large complex projects that require detailed design to finalise their cost estimates. A BC2a document also exists for approving strategic investigation projects that do not necessarily lead to a capital project.

- **BC3**: This business case finalises the budget and scope and gives authority for the work to proceed. This requires a description of the options considered and, for larger projects, the procurement plan that will be followed. This also includes a section on the cost benefit analysis method that was used.

- **BCA**: This controls changes to projects and follows the Delegated Financial Authority (DFA) process. Changes requiring a BCA are changes to approved expenditure, commissioning date, project scope, expenditure profile (Capex or Opex), and project status (such as project on hold or deferred).

### 3.6.2 Approvals

Our formal approvals process begins after the choice of a preferred option. This decision-making process includes a defined series of challenges appropriate to the type and level of expenditure. The business case gating process described above requires approval for Capex spend on a case-by-case basis. This requires a formal approval for each project to go ahead at the BC3 level. All our Capex expenditure is scrutinised and approved through this process.

To formulate and substantiate our capital expenditure we have a robust, dedicated challenge and approvals process. This has ensured that proposed projects have been challenged at an appropriate management level. The process includes these steps:
• **Portfolio Approvals**: proposed projects and asset interventions are reviewed, challenged and approved by the portfolio owner who has specific asset management knowledge and expertise in their portfolio.

• **Capital Governance Team (CGT)**: this group of general managers, led by the CEO, approves expenditure in and across portfolios, including setting their relative priorities. The CGT has operational oversight of the 10-year Capex plans, including approvals, monitoring, and approval of any substantial changes to that plan. Details can be found in the CGT Terms of Reference.

• **Board Approval**: based on their size certain projects are submitted to the Transpower Board for final approval.

**Delegated Financial Authority**

Approval authority is determined by the Delegated Authority Policy. Generally, for projects of value greater than $10m approval by the Board is required, while CEO approval is required for projects between $5m and $10m.

**Regulatory Categories**

We are regulated under Part 4 of the Commerce Act using IPP regulation. Based on the IPP rules our Grid Capex is split into three authorisation categories:

- **Base Capex**: all R & R Capex and E & D Capex below a cost threshold set by the Commission (currently set at $20m)
- **Major Capex**: E & D Capex above a cost threshold set by the Commission (currently set at $20m)
- **Customer Capex**: any Capex driven and paid for by a customer investment contract.

The requirements for base and major capital expenditure approval, including the scope and specificity of information required, the required certification, and the extent of consultation, are set out in the Capex IM.

**Customer Approvals**

A BC3 is completed and submitted to the relevant delegated authority for approval prior to signing a contract with the customer for delivery of the works. Customer approval is by signing a bi-lateral Customer Investment Contract (CIC) between Transpower and the customer for the proposed works. The recovery of the capital cost is via this contract and not through the regulated Transmission Pricing Methodology (TPM).

### 3.7 Cost Estimation

Cost estimates are required at various stages in our works planning process, but most importantly at the three business case approval gates BC1, BC2, and BC3. Further detail on our cost estimation processes can be found in the CPA document.

#### 3.7.1 Base Capex - Cost Estimation

For Base Capex forecasts, we use two forms of cost estimates. These are:

- **Customised Estimates**: used for large single projects (> $1 million) that require individual, tailored investigation
• **Volumetric Estimates**: used for smaller, high-volume projects that are reasonably routine and uniform. These are often derived directly from our fleet strategies and don’t require individual investigations.

These two estimate types are discussed below. For both estimate types we have sought to achieve a confidence level of P50. The use of P50 is considered appropriate as it equates to an equal allocation of estimation risk between Transpower and its customers. It is also considered to be consistent with the flexibility to substitute between portfolios in the IPP regime. The manner in which we have sought to achieve P50 for both customised and volumetric estimates is discussed below.

It should also be noted that both of the above estimate types are produced using the Transpower Enterprise Estimation System (TEES) – see Appendix A.

**Customised Estimates**

A key requirement for a customised estimate is an accurate and project-specific scope of work. To determine these scopes, design layout drawings are developed for each project. The likely location of the new assets is determined from a desktop review of aerial photographs, site layout drawings, underground services drawings, and available cable corridors. These assessments provide reasonably accurate estimates for materials and work quantities, such as building extensions, new fencing, new bays, power and control cabling, and fire walls.

The component costs are based on historic costs, manufacturer quotes and period supply cost data as contained in TEES. Material and plant costs are determined with reference to period supply contracts currently in place and historic installation costs respectively. Civil and earthworks costs are determined by a unit rate extrapolated from historic costs. Installation costs are informed by similar previous projects and updated with current budget prices from contractors based on the specific context of each project site.

Given the risks associated with estimating projects up to seven years in advance, we have applied a specific cost estimate risk adjustment to certain cost items within our customised estimates. This is explained below. Other cost items (such as primary plant costs) have not had risk assessments as we are reasonably confident that the cost-estimation risk relating to these items is low and most likely symmetric. The customised estimates are reviewed annually to ensure we capture any change in underlying costs.

**Risk Estimation**

As part of the process we developed a specific risk estimation approach. This approach is used to determine the need for and magnitude of any risk adjustments to be applied to individual cost items. The costs that are subject to material estimation risk will vary by project type. In general the main cost items that were assessed for estimation risk included:

- site locality factor (such as remoteness of site and likely impact on construction costs)

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25 The P50 cost value is an estimate of the project cost based on a 50% probability that the cost will not be exceeded.

26 In contrast, project estimates developed in commercial arrangements tend to be estimated to a higher confidence level, which allocates more risk to customers.

27 The approach used for re-conductoring differs from this generalised description. Further detail on the methodology used can be found in the Conductors and Insulators fleet strategy.

28 Symmetric cost risks will tend to balance out over time as overruns and under runs begin to net off as the number of projects increases.
• cable or conductor lengths
• building and grounds requirements
• geotechnical/ground condition and the potential need for ground improvements
• excavation requirements and the potential for contaminated soil to be present.

We developed three typical scope ranges (high, medium or low cost risk) for each cost category. Each scope range had an associated 3-point estimate range (minimum, most likely and maximum). Based on the particular characteristics of the project, including the proposed site, we chose the most appropriate scenario for each cost item and applied the appropriate 3-point estimate range to that quantity.

Using these ranges, we derived a P50\(^{29}\) estimate based on a Program and Evaluation Review Technique (PERT) distribution. The adjustments are based on likely quantities, as scope has tended to have the largest variance and we have sufficient confidence in our unit rate forecasts.

Volumetric Estimates

Work programmes with relatively large volumes of similar works are categorised as volumetric works for estimation purposes. The key determinant of accurate cost estimates for these volumetric projects is the feedback of historic cost out-turns from completed, equivalent projects. This feedback-based process is used to derive average unit costs for future works. Based on the unit costs, tailored ‘building blocks’ have been developed for various Capex works.

Due to substitutability under the IPP regime, the total cost of a programme is often of more relevance than the costs of individual projects. In view of this, and using appropriate building block costs, we consider that our volumetric costs methodology will produce a P50 estimate. This is based on the following assumptions.

• Building blocks based on historic out-turn costs effectively capture the impact of past risks. The aggregate impact of these risks on out-turn costs of future works is unlikely to vary materially.
• The sample size of historic works is sufficiently large to provide a representative ‘average’ cost.
• Project scope is reasonably consistent and well defined.
• To maintain a ‘portfolio effect’\(^{30}\) a large number of future projects are likely to be undertaken.

3.7.2 Major Capex – Cost Estimation

Early in the planning process, costs are typically difficult to estimate and highly uncertain. Cost estimates become more accurate as projects move further through the approval process and the scope of the project becomes clearer. Similarly, as projects move closer to the date they will be delivered, the uncertainties due to foreign exchange risk, commodity price risk and price escalation risk also reduce.

\(^{29}\) The P50 cost value is an estimate of the project cost based on a 50% probability that the cost will not be exceeded.

\(^{30}\) This refers to the tendency of variances across a large number of projects to net towards zero.
There are differing levels of accuracy expected at different stages through the design cycle process. As projects become more certain, so does their scope and associated cost accuracy.

We categorise our cost estimates into these four classes, depending on the progress of the project through the CPA process.

- **Conceptual**: cost estimates created from a high-level calculation of costs for standard options (largely based on standardised building block costs).
- **High Level Response**: cost estimates that arise from a desktop assessment of high-level scope, and typically used for the high level analysis of the long list of options and in response to customer enquiries.
- **Conceptual Design Report**: cost estimates in a report that advance the design for projects to allow a project programme, technical specification for major plant items and project cost estimate to be developed as inputs into the analysis of options.
- **Solution Study Report**: cost estimates in a report that includes more detailed scope and where cost estimates are built up using individual cost items from the TEES Master Cost Library and quantities extracted from the preliminary design.

### 3.7.3 TEES

Our Grid Capex cost estimation process is built around the TEES estimating tool. The latest version of TEES is a web-based system that offers advanced functionality and wide accessibility for users. Using this tool our staff and service providers can develop robust cost estimates using a centrally managed dataset. We have derived a number of benefits by using TEES, including having a centralised system to manage exposure to commodities and foreign exchange risk. Standardised S-curves and work breakdown structures can be used to aid expenditure planning and cost updates respectively.

When developing project estimates for Base Capex we have sought to achieve an accuracy (or confidence level) equivalent to P50. For Major Capex projects, recognising the larger scope for variance, we use P90-based estimates. To achieve these levels of confidence a number of Grid Capex estimates have estimation risk adjustments. The manner in which these risk adjustments have been derived is discussed above.

Our implementation of TEES is discussed in further detail in Appendix A.

**Feedback**

During RCP1 we have made major improvements to ensure we capture the actual project cost and feed it back into relevant future cost estimates. Upon the completion of a project we review the original estimate with the actual delivery cost and then apply improvements deduced from the comparison across all future relevant estimates.

The cost estimation approach and accuracy needs to be fit for purpose and allow for different types of investment and stages in the project lifecycle. This drives better decision making and efficiency by supporting optimal investment decision making.

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31 The tool is developed by a company called US Cost and is often simply referred to as 'US Cost'.

32 P50 refers to a level of confidence in an estimate where the likelihood of the estimate being exceeded is 50%. P90 has an equivalent meaning.
3.8 Handover to Delivery

Following final approval for the project to proceed, it is passed to delivery. The handover of projects from the 10-year capital plan to delivery is a structured handover process that requires that:

- the BC3 has been approved at the appropriate level
- all documentation (including the scope design documents, associated cost estimate, pertinent contractual information) is centrally located
- key stakeholders are informed and resources are appropriately assigned.

Further detail can be found in the Delivery Lifecycle.
4 PLANNING OBJECTIVES AND STRATEGIES

To achieve its asset management vision and deliver on its commitment to stakeholders, Transpower has set out its asset management objectives in five main areas. The first four relate to aspects of Transpower’s performance that can be directly observed by external stakeholders. The last area relates to Transpower’s internal capability.

1. Safety
2. Service Performance
3. Cost Performance
4. New Zealand Communities
5. Asset Management Capability.

This chapter describes the planning objectives and strategies relating to the five areas above.

The planning objectives articulate the main planning outcomes required to achieve our overall asset management objectives. The planning objectives (noted below) are followed by strategies that outline, at a high level, what we will do to reach the planning objectives. These are complemented by improvement indicators, which are discrete targets that will be used to measure our progress towards the objectives.

4.1 Safety

Planning activities can have a significant impact on the safety performance of the Grid. At this stage we can minimise safety risks by prioritising the replacement of high-risk assets and by selecting assets or solutions with better safety features. The objectives and strategies below support our core safety objectives and show our commitment to integrating safety into our asset management activities.

4.1.1 Safety by Design

Objective: Our designs for new assets will contribute to minimising the risk of injury to our workforce and the public through application of Safety by Design, by ensuring that safety is prioritised in our options analysis and approvals processes.

Strategy

To meet our safety objective, we need to continually improve our approach to, and application of, Safety by Design when planning for new and replacement assets.

Safety by Design will be emphasised in the planning phase when making decisions about design, plant and material selection, and methods of construction. This will ensure the deployed asset can be constructed, maintained and operated as safely as possible throughout its life.

Improvement Indicator: By 2015, we will have embedded the practical application of Safety by Design with a set of clear documented principles. Evidence that we have achieved this will be:

- at least three SCORED (Safety, Constructability, Operability, Risk, Environmental,
Design workshops have been held for all projects over $5m throughout the design phase

- Safety by Design strategy has been revised to reflect our approach to the implementation of Safety by Design.

### 4.1.2 Assessment of Safety Risk

**Objective:** Our risk assessment of safety drivers for new assets will be consistent across fleet strategies and aligned to our asset management risk framework.

**Strategy**

A number of our current fleet strategies are wholly or partially driven by safety requirements. There is a need for consistency in our asset risk assessment as it applies to safety and this will be completed by 2016 as part of the full fleet strategy review.

**Improvement Indicator:** Systematic and quantitative process for safety risk assessment based on industry best practice implemented by 2016.

### 4.2 Service Performance

To ensure we are maximising customer value, we need to ensure our assets are providing the network performance that our customers expect at the lowest whole-of-life cost. The planning process has a large influence on achieving this because it impacts the overall security and resilience of the Grid and seeks to trade-off optimizes our performance with Capex.

By 2020 we will be able to clearly demonstrate the link between what we spend and the grid performance at the bus and circuit level, thereby enabling a whole of system view of performance. The diagrams in Appendix B shows the high level process we will have in place by 2020. The achievement of this will take time, so we have staged the planning objectives and strategies so we can monitor our progress over the coming years.

In order to ensure we can deliver our customers’ expectations of service at lowest whole-of-life costs we need to be able to demonstrate the link between asset performance and service delivery as well as predicting future levels of performance.

As a first step towards this, we need to embed customer performance targets, reliability analysis, whole-of-life costing, and options analysis within our fleet strategies. These core asset management principles must be applied in a consistent manner.

This will enable us to demonstrate that our investment plans can meet service performance expectations (at point of connection) at lowest whole-of-life cost. This will also require us to optimise Capex and Opex through the asset lifecycle.

Successful execution of this strategy will result in better decision making and also demonstrate our increasing asset management capability.

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We will still use the asset fleet categorisation to manage procurement, problem management and maintenance.
4.2.1 Strengthening the Link between Expenditure and Performance

To ensure we can deliver the required level of service to our customers, we need to determine what the future asset performance will be as a function of expenditure.

**Objective:** We can explicitly demonstrate the link between our expenditure and asset performance.

**Strategy**

By 2016, we will have developed a model to forecast the future performance of assets based on the future expenditure on those assets. This model will take our asset degradation curves and the estimates of forced outages as inputs and produce asset health forecasts for different levels of expenditure. Achievement of this objective will enable us to demonstrate the system performance impact of expenditure on our Grid assets.

**Improvement Indicator:** Models to predict future asset performance as a function of current asset condition and future expenditure to determine fleet plans developed by 2016.

4.2.2 Relationship between Asset Performance and Customer Service Level

To demonstrate that we are undertaking the ‘right’ amount of investment to achieve the desired performance, we need to determine the value of the change in reliability experienced by our customers as a function of the change in asset performance.

**Objective:** We can demonstrate our Grid expenditure is at the ‘right’ level to achieve our performance targets.

**Strategy**

By 2018, we will have developed an integrated suite of models to forecast the service (reliability) received by customers as a function of the change of performance of individual or groups of assets. This will be achieved by extending our system planning capabilities to determine the reliability benefits arising from asset interventions, be it changing maintenance regimes, building new assets or renewing existing assets. As an example, if the cost of investment or increased maintenance is lower than the reliability benefit, we can justify investment. This approach will demonstrate that we are spending the right amount of money to get the target performance from our assets.

**Improvement Indicator:** Develop models by 2018 that demonstrate the change in reliability experienced by customers as a function of the change of performance of individual or groups of assets.

4.3 Cost Performance

Planning has a large impact on our total costs because it establishes the scope of our capital works. Through planning, we make complex decisions with various trade-offs to minimise
our total costs while ensuring safety and maintaining an appropriate level of service to customers.

4.3.1 Whole-of-Life Costing

To deliver cost-effective performance it is essential that we embed whole-of-life costing principles into our decision making.

**Objective:** We minimise the whole-of-life cost of our assets by applying a systematic approach to our planning, including options analysis, whole-of-life costing and consistent consideration of risk.

**Strategy**

In order to ensure we can deliver our customers’ expectations of service at lowest whole of life costs we need to be able to demonstrate the link between asset performance and service delivery as well as predicting the future levels of performance.

As a first step towards this, we need to review our fleet strategies and ensure that we embed customer performance targets, risk analysis, whole of life costing and options analysis within them. These core asset management principles must be applied in a consistent manner.

This will enable us to demonstrate that the fleet plans can meet customer performance expectations of service (at point of connection) at lowest whole of life cost. This will use asset health as a proxy for future performance and will also require us to optimise capex and opex through the life of the asset.

Successful execution of this strategy will result in better decision making and also demonstrate our increasing asset management capability in asset management.

We are also seeking to drive cost savings and realise increased performance by improved outage planning.

**Improvement Indicator:** Complete a fleet strategy review to embed whole of life costing, customer performance measures, consideration of risk and options analysis in our decision making by 2016.

4.3.2 Cost Estimation

To ensure we are providing cost certainty to our stakeholders, it is essential that our expenditure plans accurately reflect what will ultimately be spent to deliver the required performance. This will require accurate cost estimation.

**Objective:** Our longer-term cost estimates are of sufficient accuracy to provide customer certainty that we can achieve the target performance within our planned expenditure.

**Strategy**

By 2015, our improved long-term cost estimation processes will be embedded within the business and ensuring that our cost estimates are fit for purpose and consistently reflect project risk.

Feedback loops from completed projects will be closed and forecast cost information will be produced in a systematic and consistent fashion. As a result, our cost libraries will be maintained with current and up-to-date cost information.
The benefit of improved project cost estimation will be less risk of cost overspend and increased certainty for stakeholders.

**Improvement Indicator:** 95% of building blocks validated by project costing (Base Capex) feedback by 2015 to provide better estimates and reducing the risk of overspend.

### 4.3.3 Technology and Innovation

To drive customer value, we need to demonstrate that we are getting the most out of our assets. This will require us to consider new innovative approaches when deploying and using our assets.

**Objective:** We can demonstrate that we are getting increased use from our assets through the application of technology and innovation.

**Strategy**

Our use of research and development in the future will focus on increasing asset use so we get more out of our asset at lower costs to our customers. Innovation through the application of technology will allow us to:

- provide additional capacity and resilience
- deliver lower lifecycle costs while still meeting customer expectations
- deliver on our commitment to safety and to reducing environmental impacts.

This innovation will include further research into current drivers for replacement, such as conductor condition impact on failure, which could potentially defer expenditure.

**Demand Response**

We are well advanced in establishing Demand Response (DR) as a deferral option to transmission investment. We are currently running a market programme to establish a reliable and cost effective approach to DR.

By 2014, we will have developed a long-term DR roadmap that will detail the active contribution we will make to embedding it in the New Zealand electricity landscape, further enabling us to optimise the timing of our new investments and reduce our capital costs.

**Improvement Indicator:** Develop a long-term DR roadmap by 2014 to capture potential benefits of Capex deferral.

**Research and Development Programme**

Our current approach to technology adoption includes focusing on new technologies used elsewhere in the world or by other industries. Recent examples include the introduction of variable line ratings and the deployment of disconnecting circuit breakers.

By 2015, we will have an established long-term programme of research, development and deployment of new technology. Three examples of innovation are noted below.

- **Unmanned aerial vehicles deployed in our vegetation management programme.** Aerial inspections will replace costly foot patrols of our overhead lines and provide valuable information about the rate of vegetation growth.
- **Automated fault response.** This technology will identify the precise location of a fault when it occurs and so negate the need for foot patrols and manual fault identification.
This will increase our response time and reduce the impact of faults, and ultimately cost.

- Further research into conductor failure risk as a result of condition.

**Improvement Indicator:** Implement an enduring Research and Development programme by 2015 to allow us to explore new technologies.

## 4.4 New Zealand Communities

We are committed to asset management approaches that seek to protect natural and cultural environments. This includes compliance with consent conditions, phasing out avoidable practices that have adverse environmental impacts and mitigating the risk posed by hazardous materials.

We are committed to continuing to engage with our communities, including stakeholders and landowners, throughout the planning process and to demonstrating a sense of social responsibility by having regard to the interests of the communities in which we operate. Relationships with landowners and connected customers are important as our assets have potentially significant effects on their day-to-day lives.

### 4.4.1 Coordination with other Infrastructure Providers

To ensure we can efficiently deliver infrastructure, we will seek to collaborate with other providers to ensure we have taken their infrastructure plans into account when assessing potential infrastructure corridors and sites. The shortage of suitable corridors and sites in major urban areas, particularly Auckland, is a potential constraint on all infrastructure providers as optimal investment options are ‘built out’. Increased coordination and communication at the planning stage will result in long-term cost savings by enabling co-optimisation of infrastructure options and avoiding constraints imposed by inappropriate co-location.

**Objective:** Location of our future corridors and sites will be derived through collaboration with other infrastructure providers.

**Strategy**

By 2017, we will have developed a Memorandum of Understanding (MoU) with key infrastructure providers\(^\text{34}\) to ensure there is improved coordination of our respective planning activities with regard to the location of our assets.

We will also seek statutory reforms and regulatory processes where these have the potential to improve our ability to communicate planning requirements, and so facilitate a more collaborative and lower-cost approach with other infrastructure providers.

**Improvement Indicator:** An MoU on future infrastructure location agreed with major providers by 2017.

\(^{34}\) These are likely to include the New Zealand Transport Authority, Auckland Transport, Watercare and large electricity distributors.
4.4.2 Buffer Corridor Provisions

To provide future certainty for those parties affected by the location of our assets, to ensure our safety objectives can be met and ensure a physical space is available to operate, maintain, develop and dispose of our assets, we need to have the appropriate buffer corridor provisions adopted into regional policy statements, and regional and district plans of Local Authorities.

Objective: Our transmission corridor rules will be adopted into the district plans of the six most strategically important districts.

Strategy

By 2015, five of the six major territorial authorities will include our transmission corridors in their district plans to avoid inappropriate under-build. We will achieve this by continuing to work with local authorities and key stakeholders in a collaborative manner. If we can prevent inappropriate under-build, we reduce the risk and duration of outages and ease the maintenance burden, all of which will reduce costs and increase availability.

Improvement Indicator: Transmission corridor rules are adopted in plans of Kapiti Coast, Hutt City, Upper Hutt City and Porirua by 2015, Auckland by 2018 and Canterbury territorial authorities by 2020.

4.4.3 Greenhouse Gas Emissions

We have made significant gains over the last few years in reducing our emissions and we are seeking to make further gains.

Objective: Reduce SF₆ emissions to as low a level as practicable.

Strategy

Over the last few years, we have significantly reduced our SF₆ emissions by deploying SF₆ leak detection cameras and issuing standard equipment to detect leaks. Over the long term we will continue to reduce our SF₆ inventory where cost effective and technically suitable alternatives exist. We are currently trialling non SF₆ circuit breaker technology with a view to eliminating SF₆ circuit breakers over the long term. We will trial these during RCP2.

Improvement Indicator: Annual SF₆ emissions less than 0.75% of installed capacity by 2018.

4.5 Asset Management Capability

We are embarking on a programme to transform asset management and to gain PAS 55 accreditation. Transpower’s objective is to submit its asset management documentation for accreditation to PAS 55 by June 2014.

Given that asset management straddles all asset lifecycles, there are no specific strategic objectives associated with the planning lifecycle and all objectives for this area can be found in the Asset Management Strategy.

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35 The Canterbury date reflects the impact of the Christchurch rebuild.
4.5.1 Training and Competency

Ensuring our people have the requisite asset management competences is critical to success and our objectives around developing this capability flow from the broader asset management objectives in this area.

To effectively deliver the planning lifecycle strategy, we need to build our capability in the ‘group 1’ competences. As detailed in the Asset Management Strategy, group 1 consists of those people who will deliver and embed the integrated, organisation-wide business processes and data that underpin the systematic plan-do-check-act improvement cycle. It must be capable of consistent, risk-based decision making informed by a whole-of-life cost perspective on the asset portfolio and the customer needs it serves. It must also be capable of contributing to an increase in the number of organisation-wide projects targeting Opex reduction, asset information, risk-based decision making, quantifying the cost of risk, procurement and asset costs.

4.5.2 Competence Framework

The core competence areas that we need to develop for Planning are defined in the Competence Framework:

1. Strategy development
2. Asset management planning

**Objective:** Competence framework that supports the core competences required to support the Planning Lifecycle is in place.

**Strategy**

Lifting our asset management planning capability is a process of continuous improvement and, to this end, we have developed a 3-year roadmap that seeks to develop our asset management competences in a measured and systematic manner.

**Improvement Indicator:** By 2017, we will be able to demonstrate that we have embedded the Asset management Competence Framework in our planning activity and that the competence of our people has been raised from where it is today.
TEES is a web-based system that estimates costs at different levels, as shown in Figure 6 below. It is linked to our Asset Management Database (AMDB) and our Financial Management Information System (FMIS).

**Level 1 Base Library**

The base library contains 1600 resources, including materials, external labour, plant and equipment, design and overheads.

**Level 2 Master Cost Library (cost items)**

The master cost library builds up the cost of specific asset or works types using the base resource costs. For instance, the cost of a circuit breaker is made up of the materials, installation, commissioning, testing, control cables and foundation resources. These then form the unit cost, or Cost Item, of an asset or work type. Unit costs are stored for different models of assets and costs are adjusted based on actual out-turn costs from completed projects.

**Level 3A Building Block Costs**

There are over 200 building block costs which are used for the high-volume R & R work. These costs can be described as the weighted average cost of differing models of assets – that is, they are built up from the unit costs but are more specific to the assets up for replacement or refurbishment.

**Level 3B Detailed estimates**

These estimates use the master cost library to build up the required scope from Solution Study Report designs. As such, these are more detailed and are more accurate than the other estimates in TEES.
Please note that Opex includes operations and maintenance expenditure.