TransGrid

Approach to Forecasting Expenditure

2018/19 to 2022/23

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1. Introduction

The purpose of this document is to inform the Australian Energy Regulator (AER) of the methodology TransGrid plans to use to prepare the forecasts of operating expenditure and capital expenditure that will form part of TransGrid's revenue proposal for the 2018/19 to 2022/23 regulatory control period.

TransGrid is the operator and manager of the main high voltage transmission network in New South Wales and the Australian Capital Territory. This network is substantial. It comprises 99 bulk supply substations and more than 12,900 kilometres of high voltage transmission lines and cables. TransGrid transports more electricity over its network than any other transmission network service provider in the National Electricity Market (NEM), with 74,400 GWh of electricity delivered in the 2015 financial year. It is essential for the provision of safe, reliable power to businesses and communities across New South Wales and the Australian Capital Territory. It is also the back-bone of the NEM, and supports the efficient and competitive trading of electricity between the states of Queensland, Victoria, New South Wales, South Australia, Tasmania and the Australian Capital Territory. TransGrid provides transmission services to generators, distributors and major customers when they need them, where they need them.

Operating a safe, reliable and efficient transmission network is at the heart of what TransGrid does. To continue doing this, TransGrid must maintain and invest in its network where needed. The world is changing, and TransGrid must respond by continuously adapting and innovating. In this context, TransGrid has developed new methodologies to forecast the capital and operating costs it expects to face during the next regulatory control period, from 1 July 2018 until 30 June 2023.

The forecasting methodologies have been carefully developed based on feedback from the AER about TransGrid's previous revenue submission, and with close regard to the AER's forecast assessment guidelines. They have been designed to provide forecasts that reasonably reflect efficient and prudent costs to provide prescribed transmission services, based on TransGrid's obligations and the needs of the customers and communities that it serves.

In 2015, TransGrid's ownership changed via a long term lease to the private sector. As a result of this transaction, a significant effort has been made to review the organisation for efficiency and cost reduction opportunities. New approaches have been adopted across the business and TransGrid will ensure that these efficiencies are reflected in the forecasts for the next regulatory control period.

2. Forecasting Requirements and TransGrid's Approach

2.1 Obligations

TransGrid must submit both operating and capital expenditure forecasts as part of its revenue proposal to the AER. These forecasts must be compliant with the National Electricity Law (NEL) and the National Electricity Objective (NEO).

The forecasts must also comply with the National Electricity Rules (the Rules) and the operating and capital expenditure objectives for the relevant regulatory control period. The objectives are as follows:

1. Meet or manage expected demand for prescribed transmission services in the period;
2. Comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;

3. To the extent there is no applicable[1] regulatory obligation or requirement in relation to:
   (i) The quality, reliability or security of supply of prescribed transmission services; or
   (ii) The reliability or security of the prescribed transmission system through the supply of prescribed transmission services;

   To the relevant extent:
   (iii) Maintain the quality, reliability and security of supply of prescribed transmission services; and
   (iv) Maintain the reliability and security of the transmission system through the supply of prescribed transmission services; and
4. Maintain the safety of the transmission system through the supply of prescribed transmission services.

TransGrid is mindful of these obligations and will ensure its approach to forecasting expenditure is fully compliant with these requirements. In addition, the AER is obliged to assess whether TransGrid's forecast complies with the operating and capital expenditure criteria and accordingly it is a priority for TransGrid in preparing the forecast to ensure compliance with these criteria.

2.2 Forecasting Principles

TransGrid's prescribed transmission services are essential to the economy and local communities, not only within New South Wales but the wider eastern Australia seaboard. TransGrid's forecast reflects the efficient and prudent costs to provide prescribed transmission services to NSW and ACT customers and support the efficient operation of the NEM in other regions.

In addition to following the obligations set by the NEO, NEL and the Rules, TransGrid has used the AER's assessment principles set out in its Expenditure Forecast Assessment Guideline to guide TransGrid's forecast methodology. These principles and how TransGrid has applied them are set out below:

- Validity: TransGrid's methodology will account for factors beyond TransGrid's control, and use reliable data or reliable estimates of data.
- Accuracy and reliability: TransGrid's methodology will provide unbiased and repeatable results by being based on actual data and avoiding, where possible, subjective judgement.
- Robustness: TransGrid's methodology, to the extent possible, will remain valid under different assumptions, parameters and initial conditions.
- Transparency: TransGrid's methodology will allow the AER and any interested parties to test the results in the context of the underlying assumptions, parameters and conditions.
- Parsimony: TransGrid's methodology will avoid unnecessary detail, and utilise a less complex approach in cases where all other principles are met.
- Fitness for purpose: TransGrid's methodology will meet all relevant obligations, including the expenditure objectives.

[1] The applicable regulatory obligations that apply to TransGrid include the following standards, licenses and codes:
1) The Transmission Network Design and Reliability Standard for NSW (NSW Trade and Investment), currently under review by IPART; 2) Utility Services License under the Utilities Act 2000 (Independent Competition and Regulatory Commission), Dec 2015 for the ACT; 3) Transmission Operators Licence - NSW, granted by IPART and 4) Electricity Transmission Supply Code, May 2016, currently under review.

3. Consumer and Stakeholder Engagement

TransGrid is committed to ensuring the prescribed network services delivered to NSW and ACT customers are appropriately aligned to customers' requirements. TransGrid has further developed and formalised the consumer and stakeholder engagement practices that have been in place since 2013, to ensure that TransGrid's business plans are developed within the context of consumers' needs and preferences driving long term sustainable outcomes. Building upon previous engagement activities, TransGrid has developed a succinct mode of engagement that focuses on identifying consumers' priorities and ensuring where practicable these views are reflected in TransGrid's operations.

TransGrid has created an Advisory Council to ensure an influential and effective mode of engagement. This Council brings together a panel of consumer representatives, customers and large energy users to provide advice and consumer insights to TransGrid on strategic policy issues and business plans to improve the value of TransGrid's transmission services to customers. The TransGrid Advisory Council is a critical interface for other events that aim to engage with a wider range of stakeholders.

Feedback from these groups will help guide TransGrid's business plans and service provision and to that end will also be reflected in TransGrid's expenditure forecasts.

4. Operating Expenditure

This section describes TransGrid's approach to forecasting the operating costs it will need to incur for the provision of prescribed transmission services.

TransGrid's operating expenditure forecast methodology is based on the AER's operating expenditure forecast assessment approach. This is generally referred to as a base-step-trend approach.

As noted in the introduction, the change in ownership is delivering efficiencies and cost reductions. Given the forecasting methodology is based on the revealed costs principle of an efficient base year, TransGrid will ensure that the effects of recent efficiency improvements will be reflected in the base year costs. This will ensure an appropriate base from which to forecast future required operating expenditure. Consequently, the base year expenditure that TransGrid uses in its forecasting process will be screened according to whether it is:

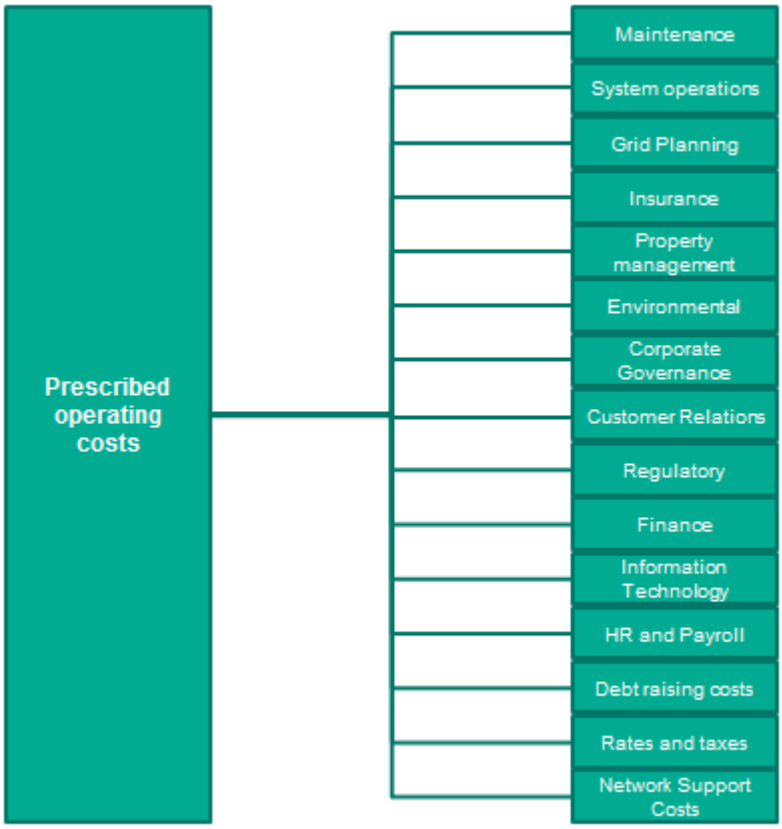
- Reflective of new cost levels, and
- Whether those levels are reasonable, prudent, sustainable and efficient.

Future costs will be escalated (or de-escalated) from this base level of expenditure on the basis of expected changes in costs (eg, labour), output and productivity.

4.1 Operating Expenditure Categories

TransGrid's prescribed operating costs are categorised as follows:

Figure 1 Prescribed operating cost categories



4.2 Operating Expenditure Forecast Methodology

As noted above, TransGrid's forecasting method is based on the AER's preferred approach. Close scrutiny will be applied to the base year costs to ensure they reflect efficient, sustainable costs and all identified efficiency measures are reflected in the base year costs.

TransGrid's methodology will rely on recent information, the analysis of trends, policies, and new efficiency measures recently implemented. Where necessary, TransGrid will engage the help of independent experts to ensure that its forecast is as accurate as possible.

TransGrid will use the nominated base year for forecasting operating expenditure, this will establish an efficient operating expenditure amount from which to apply the escalation and other adjustments as set out above.

The escalators are broadly as follows:

4.2.1 Real price changes

Real price changes relate to expected changes in the price of goods and services that TransGrid must procure to meet its obligations, which deviate from the consumer price index. This applies in particular to the forecast cost of labour.

4.2.2 Output changes

Output changes represent changes in the type and volume of services TransGrid provides to efficiently meet consumer needs and TransGrid's regulatory obligations. It is reasonable to expect that a material increase or decrease in services provided in the future will require an adjustment to the operating expenditure to deliver those services..

4.2.3 Productivity changes

Over the course of time, societal or technological changes affect the productivity of the transmission industry as they do the state and national economy. Productivity can be measured as the ratio of total outputs to inputs. The AER's forecast assessment methodology applies a productivity adjustment to forecast operating expenditure and in accordance with this approach TransGrid will also make a similar adjustment.

4.2.4 Other factors

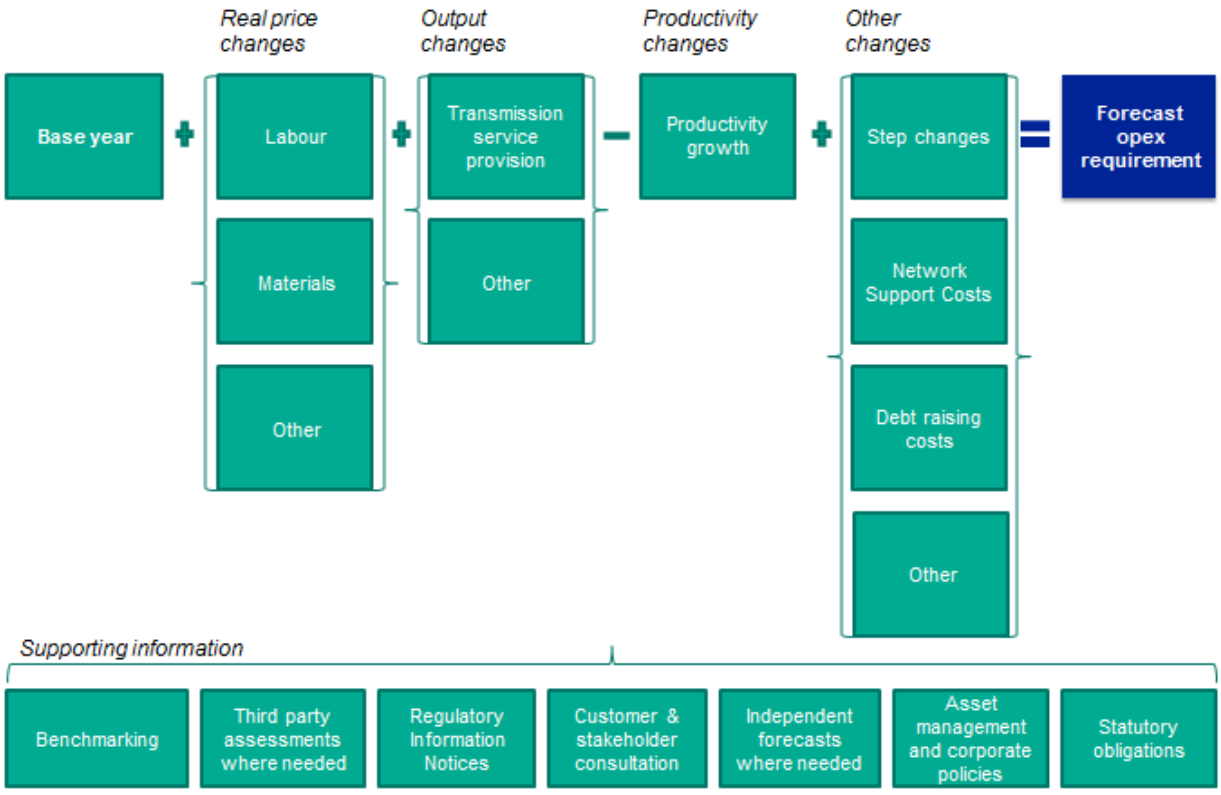
Other factors may have an effect on TransGrid's operating costs. Examples include, but are not limited to, the following:

- Step-changes in operating costs as a result of changes in obligations.
- Costs incurred as the result of a network support agreement. This is an agreement under which TransGrid procures network support and control ancillary services, including network support services to improve network capability by providing a non-network alternative to a network augmentation.
- Step-changes in operating costs as a result of other capex-opex trade-offs.
- Debt raising costs which may be excluded from base-year costs and separately calculated in accordance with the AER benchmark efficiency entity.

The inputs required for the forecast model will be developed using the most up to date information available, including forecasts of efficient costs and consultation with TransGrid's customers and stakeholders.

Figure 2 outlines, on a simplified basis, TransGrid's approach to forecasting operating expenditure.

Figure 2 Operating expenditure forecast model



5. Capital Expenditure

This section describes TransGrid's approach to forecasting the capital costs it will need to incur for the provision of prescribed transmission services.

Prescribed capital investments are made to meet the needs of customers at least cost. The primary investment drivers are:

- replace assets to manage the risk of failure and life cycle costs,
- connect the distribution networks to the high voltage grid,
- increase the capacity of the transmission network to meet forecast customer demand, and
- support the business, (e.g. information technology, motor vehicles and mobile plant).

5.1 Changes from previous methodology

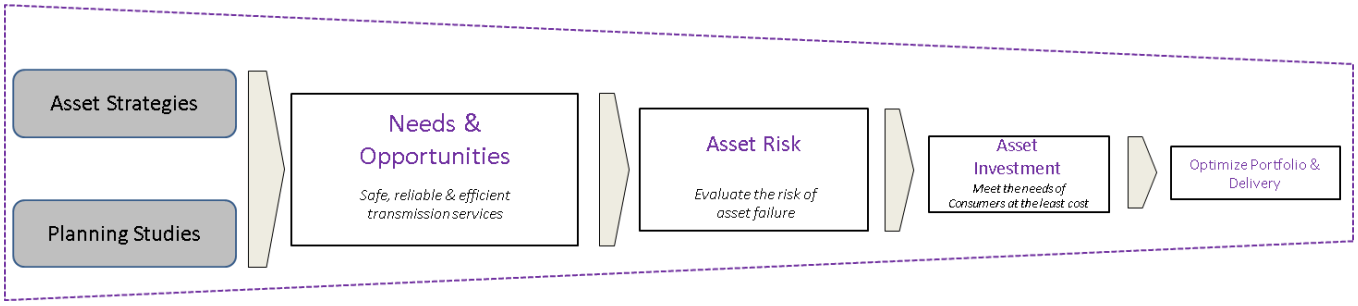
TransGrid continuously seeks opportunities to improve practices and ensure the business continues to demonstrate best practice in the efficient delivery of network services. The recent changes in TransGrid's ownership have further tested the businesses approach to investments and challenged the business to seek out new ways of doing things. These new initiatives are driving further efficiencies and will be reflected in the capital forecasts.

In addition, the AER raised a number of concerns with TransGrid's capital expenditure forecast in the last reset. TransGrid has listened to these concerns and made significant changes to both its asset management strategies and policies, its approach to risk and ultimately to the capital expenditure methodology to address these concerns and ensure it can demonstrate an efficient capital expenditure forecast.

5.1.1 Prescribed Capital Investment Framework

The investment framework and asset management strategies have been substantially redeveloped in 2016. The prescribed capital investment framework generates a capital portfolio containing projects justified and prioritised on the basis of economic decision criteria. Compliance criteria (such as reliability planning standards and safety obligations) are also incorporated as relevant to the project. Figure 3 provides a process flow diagram of the new investment framework.

Figure 3 TransGrid's new prescribed capital investment framework



The main components of the framework are:

Identification of needs and opportunities: Needs and opportunities are identified from condition assessments and the network planning process. Needs are about reducing unacceptable risks to acceptable levels. Examples include the risk of plant failure and the risk of not supplying load. Opportunities include potential market benefits as well as other net present value (NPV) positive savings opportunities.

Investment Risk Tool: This new tool quantifies risk levels. It generates a risk cost for the asset both before and after a proposed investment. Net present value analysis compares the difference between the two with the proposed investment cost to assess whether it has a positive NPV. There may be multiple feasible options with different post-investment risk costs and different expenditure profiles. Application of the risk tool to each feasible option enables selection of the option that delivers the greatest value. The options may be

purely capital expenditure or a mix of capital expenditure and operating expenditure, and may involve a range of treatments.

The risk tool is based on a "bowtie" risk assessment methodology that considers the key hazards associated with each asset and its components, the likelihood of each hazard occurring (based on condition), and the dollar value of the associated consequences which takes into account the likelihood of the consequence eventuating (criticality).

Justify and prioritise asset investments: Various options are investigated to address portfolio needs and opportunities. These options are evaluated using NPV analysis with compliance criteria (such as reliability planning standards and safety obligations) taken into account where relevant. Savings opportunities are also included in the assessment. The application of the decision criteria results in a ranked portfolio of capital projects.

Optimise the portfolio: This process further optimises the chosen portfolio by considering changes in cost produced by bundling and modifying timing to level resource requirements.

The new investment framework is a robust and transparent system, developed for consistent economic justification of required investment in the network. Its development has supported TransGrid's continued accreditation to the ISO 55001 standard, and follows from TransGrid's aspiration to continuously push towards industry best practice

5.1.2 Condition Assessment, Asset Health, Criticality and Risk

The condition assessment process has been improved and focuses on determining the health of assets in respect to their useful lifespan. Asset health indices have been developed for major asset classes. Asset health considers factors such as historical defect rates, technical life, inspection and test reports. An improved risk assessment methodology has been developed that is more asset focused and considers asset health (probability of failure) and criticality (consequence of failure and probability of consequence) to quantify risk. As noted above, the Investment Risk Tool is used to ensure consistent application of the risk assessment methodology that underpins those condition and criticality assessments.

5.1.3 Option Screening, Portfolio Analysis, Prioritisation and Optimisation

The prescribed capital investment framework ensures that the complete set of options (including non-network solutions such as demand management and options that contain a mix of capital and operating expenditure) are considered to address network needs and opportunities, and the screening process used to remove the inefficient options are recorded in formalised documentation.

Prioritisation and optimisation of the capital portfolio is enabled by the risk assessment methodology.

A top down, long term view of replacement capital expenditure has been established using a probabilistic model. This provides a sense check for the more rigorous bottom up forecast. It also places the capital expenditure requirements for the upcoming regulatory period within the context of the longer term expenditure forecast.

5.2 TransGrid's capital expenditure forecasting methodology

TransGrid's capital expenditure is forecast as a bottom-up build of projects and programs of work. Projects are individually scoped to meet specific network needs, such as needs to augment the network or replace assets reaching the end of their serviceable lives. Programs of work are groups of minor projects of the same type, such as replacement of a particular model of equipment that exhibits consistent issues across the network.

Capital investments are broadly categorised into network (with sub-categories of augmentation, replacement, security and compliance, and strategic property acquisition) and non-network capital investments (with sub-categories of information technology, mobile plant and motor vehicles).

Forecasts for each of the sub-categories are made which are then combined and optimised using the new investment framework to produce an investment portfolio. The sub-categories are described in the subsequent sections.

5.2.1 Augmentation

Augmentation projects increase the transmission capacity in the network, meeting the defined reliability standard and accessing low cost electricity by realising market benefits. Key drivers for augmentation projects are local demand growth, the reliability standard, voltage control issues and net market benefits. We will prepare future investment needs for augmentation projects using a bottom up plan of investment requirements. The electricity demand forecast, to be sourced from the 2016 National Electricity Forecast Report (NEFR) published by AEMO, is a key input into this process. The New South Wales transmission reliability standard is presently under review by the Independent Pricing and Regulatory Tribunal (IPART). The capital program will be aligned to the new reliability standards, expected to be published 31 July 2016.

5.2.2 Replacement

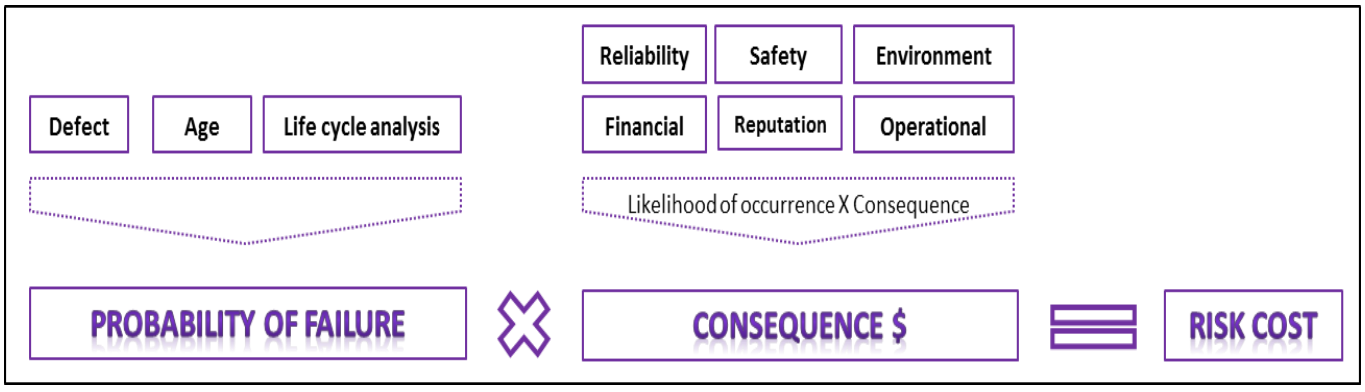
TransGrid has strengthened its approach to forecast network replacement.

The approach to evaluating asset condition has been improved. Asset Health indices have been developed for major asset classes to enable consistent and accurate assessment of condition.

Replacement investments are evaluated with the new risk assessment methodology which is applied through the investment risk tool. The investment risk tool includes a database that captures the evaluated asset condition, probabilities of failure taking into consideration different types of failure, consequences of failure and likelihood of the consequences eventuating. Asset condition evaluations take into account factors such as historical defect rate, age, life cycle analysis, planned maintenance, test reports, and condition assessment from physical inspection. Consequences are considered in each of the corporate risk areas of reliability, safety, environment, financial, reputation and operational. Reliability calculations consider the Value of Customer Reliability set by AEMO. A likelihood of occurrence is assigned to each consequence under the relevant risk areas and multiplied with the associated cost, to arrive at a consequence cost.

Calculated probability of failure is multiplied by the value of the consequence cost to arrive at a risk cost for each hazard. This process is depicted in the figure below. The sum of all such calculations for all consequences attributable to all hazards for the assets is the total risk cost of the asset. All replacement investments are evaluated as described above.

Figure 4 The investment risk tool



All replacement investment options are considered against the do-not-invest and enhanced-maintenance options.

TransGrid is under specific obligations in relation to safety-related investments. The first is to render safety risks as low as reasonably practicable (“ALARP”) under Australian Standard 5577, applicable via the Electricity Supply (Safety and Network Management) Regulation 2014. The second is to reduce safety risks so far as is reasonably practicable (“SFARP”) under the NSW Work Health Safety Act 2011. TransGrid’s investment decision-making process ensures that all feasible options for reducing safety risks are assessed.

A gross disproportionality factor is applied as part of the assessment. This is an established technique that provides a higher permitted investment limit in relation to the safety dimension of an investment when selecting the preferred option.

5.2.3 Security and Compliance

Legislation, external compliance requirements and standards drive the need for security and compliance investment. Security and compliance investments can include remediation of transmission line low spans, oil containment in substations and increased security fencing.

Following need identification, these investment requirements are assessed and costed on the same basis as all other projects. Options for forecast security and compliance investments are tested using the newly developed investment framework to provide a forecast spend for the next regulatory period. This approach assesses the adequacy of the security and compliance within the portfolio, adjusted by risk.

5.2.4 Strategic property acquisition

Strategic property acquisition is the investment in land and easements for future use beyond the current regulatory period. In some cases it is prudent for TransGrid to purchase key strategic properties as they become available on the open market, if it is assessed that such opportunities, or acceptable alternatives, may not be readily available in the future. Property acquisitions are clearly linked to specific longer term network plans and costed at current market prices.

5.2.5 Information Technology

To support the high voltage network and corporate requirements, investments are required in technology infrastructure, platforms, applications and devices. Investment drivers are typically for service continuity and business enablement, or to reduce costs. The expenditure requirement is a forecast based on the information technology strategic plan, considering business requirements across the regulatory period. The portfolio of information technology capital investment will be compared to industry benchmarks and adjusted where appropriate.

5.2.6 Motor vehicles and mobile plant

Forecast investment requirements are based on relevant asset replacement strategies which include an ongoing business need assessment.

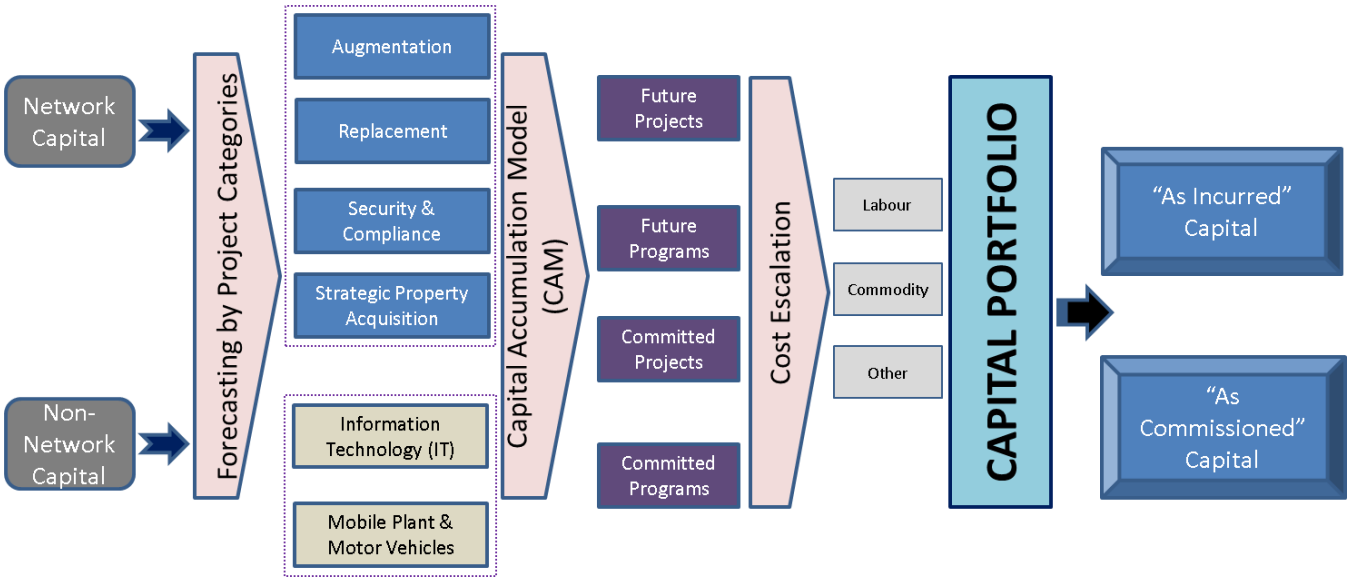
The motor vehicle replacement strategy is based on business requirements and whole of life cycle cost. Yearly depreciation costs based on pre-defined asset lives and yearly maintenance costs are forecast and combined to calculate the cents per kilometre per year to run the fleet. Vehicles are replaced in the year where costs to run the vehicles start to increase, once the business need for the vehicle has been confirmed.

A similar strategy for mobile plant replacement has been developed. However, analysis on whole of life cycle costs is conducted on individual assets, rather than a fleet of assets, as different mobile plant have distinct capital costs and asset lives.

5.3 Capital Accumulation Model

TransGrid has continued the use of a capital expenditure model to consolidate the forecast expenditure. The capital accumulation model methodology is shown in the figure below.

Figure 5 The capital forecasting process, showing the use of the Capital Accumulation Model



5.4 Cost Estimation

TransGrid undertook a significant process to review and test its cost estimation process for the last reset. Evans and Peck found it in accordance with what they consider best practice estimating, delivering very close to a P50 outcome and not requiring any portfolio level adjustment. On this basis, TransGrid has maintained its current practice supported by annual database updates and specific project blind costing by independent engineering consultants to ensure ongoing accuracy.

The network investment process diagram and the various stages of project determination are provided in Appendix A. In summary the approach is as follows:

5.4.1 Future Projects

The Success Enterprise estimating system is used to estimate the full costs of future projects. This estimating methodology will generate the most likely or P50 costs using the standard market costs derived from competitive tender. Initially, TransGrid will conduct a desktop engineering assessment of all the feasible options, project delivery method and timing and scope of work. The estimating process includes a base cost estimate for major work components which is calculated from standard market costs for equipment, materials, factors for design and commissioning. The estimate also includes an allocation of allowances which is developed based on expected undefined scope costs derived from actual data from past projects.

5.4.2 Committed Projects

TransGrid will use the most recent estimate to forecast the committed project costs which will reflect the project contracts sourced by competitive tender, detailed project scope and funding approval. The capital accumulation model will not apply cost escalation to committed projects because the contracts for these projects have been established.

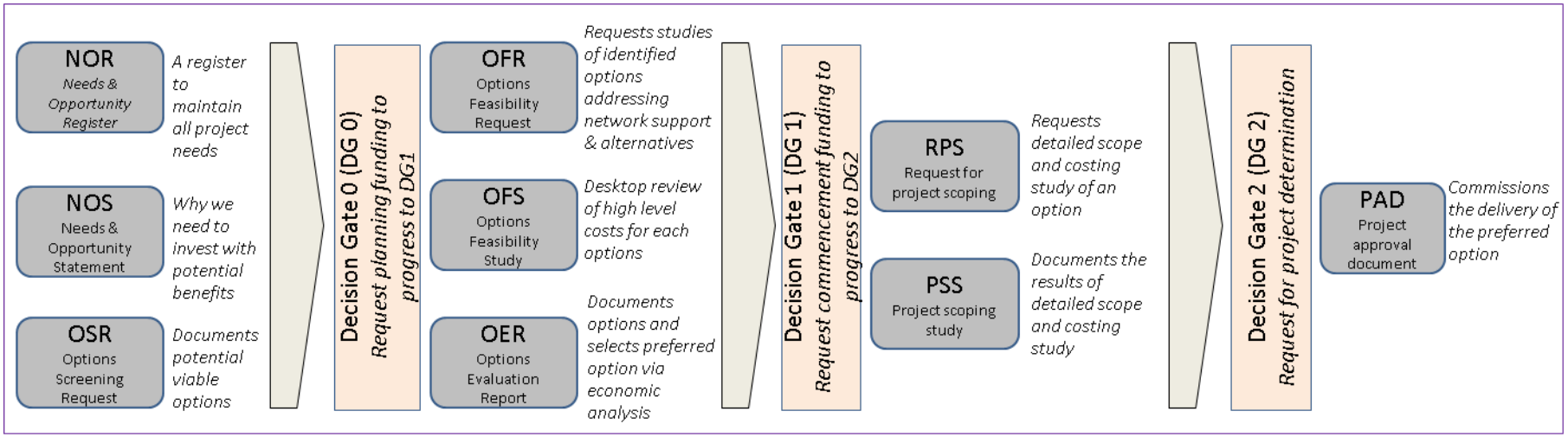
5.4.3 Future and Committed Programs

Future and committed programs are a group of similar projects spanning across multiple years and are related to a particular family of equipment. Estimates for future and committed programs are based on standard costs for each activity which are comprised of standard market costs for equipment and labour rates.

5.5 Contingent Projects

TransGrid may propose contingent projects and associated triggers in the revenue proposal for projects that have uncertainty around timing and cost. Expenditure for these contingent projects is excluded in the ex-ante revenue forecast. However the project need, options, justification and risk will be prepared consistently with all replacement or augmentation projects.

Appendix A : TransGrid prescribed capital investment framework investment evaluation process



All investments included in the capital expenditure forecast will have progressed to DG1 ready or beyond.