2018-22 POWERLINK QUEENSLAND REVENUE PROPOSAL

APPENDIX 5.02

Powerlink Queensland Expenditure Forecasting Methodology

Delivering better value

Contents

Tables

Figures

Introduction

This page is intentionally left blank

Introduction

Powerlink Queensland (Powerlink) is a Queensland Government Owned Corporation, which owns, develops, operates and maintains the high voltage electricity transmission network which extends 1700km from north of Cairns to the New South Wales border.

Powerlink's primary role is to provide a safe, cost effective and reliable network to transport high voltage electricity from generators to electricity distribution networks owned by Energex, Ergon Energy and Essential Energy which then supply more than two million customers.

Powerlink also transports electricity directly to large Queensland customers, such as aluminium smelters and New South Wales via the Queensland/NSW Interconnector.

Powerlink will make its Revenue Proposal for the 2017/18-2021/22 regulatory period to the Australian Energy Regulator (AER) in January 2016. This paper proposes the methodologies by which Powerlink will prepare its forecasts of operating expenditure and capital expenditure for its Revenue Proposal. Powerlink aims to use this paper to assist its engagement with the AER about its approaches to forecasting expenditure and the AER's and other stakeholders' assessments of Powerlink's expenditure forecasts.

Operating Expenditure

Powerlink proposes to adopt the AER's base-step-trend model to forecast its operating expenditure requirements over the next regulatory period.

Capital Expenditure

Powerlink proposes to adopt a mix of both top-down and bottom-up methods to forecast capital expenditure – a hybrid approach. Powerlink considers that the hybrid approach provides a number of advantages, while ensuring the resultant forecasts are prudent and efficient. In particular this approach will significantly reduce the cost to Powerlink (and ultimately consumers) of preparing its Revenue Proposal compared to a fully bottom-up approach, and will similarly assist the AER and stakeholders in terms of the time, effort and cost to review and assess Powerlink's Revenue Proposal.

In the course of developing the proposed capital expenditure forecasting methodology Powerlink engaged with the AER, the Consumer Challenge Panel sub-panel and Powerlink's Customer and Consumer Panel. Feedback from these stakeholders has been varied, with some stakeholders supportive of Powerlink's proposal for an alternative approach, and others wanting to see more detail, similar to a traditional bottom-up approach.

Powerlink's proposed approach to forecasting capital expenditure attempts to balance this diversity of feedback, while still preserving the essential features of the top-down elements and meeting the requirements of the National Electricity Rules (the Rules). The proposed methodology also recognises and addresses the inherent statistical limits of predictive modelling techniques regarding the size of the sample population.

This page is intentionally left blank

Operating Expenditure Forecasting Methodology

Chapter 1

This page is intentionally left blank

1 Operating Expenditure

Powerlink's operating expenditure enables the planning, operation and maintenance of Powerlink's network and other assets, as well as the business activities required to support those areas of work.

This Chapter sets out Powerlink's intended approach to forecasting operating expenditure in a manner that meets the requirements of the National Electricity Rules.

1.1 National Electricity Rules

The Rules require Powerlink's Revenue Proposal to include a forecast of operating expenditure which Powerlink considers is required to achieve the operating expenditure objectives.

The operating expenditure objectives are to:

(1) meet or manage the expected demand for prescribed transmission services over that period;
(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;
(3) to the extent that there is no applicable 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 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.[1]

The Rules also prescribe the minimum informational requirements for the Revenue Proposal relating to operating expenditure. These minimum requirements are:

(1) a forecast of the required operating expenditure that complies with the requirements of clause 6A.6.6 and identifies the forecast operating expenditure by reference to well accepted categories such as:
   (i) particular programs; or
   (ii) types of operating expenditure (for example, maintenance, payroll and materials),
   and identifies in respect of each such category:
   (iii) to what extent that forecast expenditure is on costs that are fixed and to what extent it is on costs that are variable; and
   (iv) the categories of transmission services to which that forecast expenditure relates;
(2) the methodology used for developing the operating expenditure forecast;
(3) the forecasts of key variables relied upon to derive the operating expenditure forecast and the methodology used for developing those forecasts of key variables;

[1] *National Electricity Rules*, Clause 6A.6.6(a)

(4) the methodology used for determining the cost associated with planned maintenance programs designed to improve the performance of the relevant *transmission system* for the purposes of any *service target performance incentive scheme* that is to apply to the *Transmission Network Service Provider* in respect of the relevant *regulatory control period*;
(5) the key assumptions that underlie the operating expenditure forecast;
(6) a certification of the reasonableness of the key assumptions by the directors of the *Transmission Network Service Provider*;
(7) operating expenditure for each of the first three *regulatory years* of the current *regulatory control period*, and the expected operating expenditure for each of the last two *regulatory years* of that *regulatory control period*, categorised in the same way as for the operating expenditure forecast;
(8) an explanation of any significant variations in the forecast operating expenditure from historical operating expenditure; and
(9) any non-network alternatives considered by the *Transmission Network Service Provider*.[2]

1.2 Operating Expenditure Categories

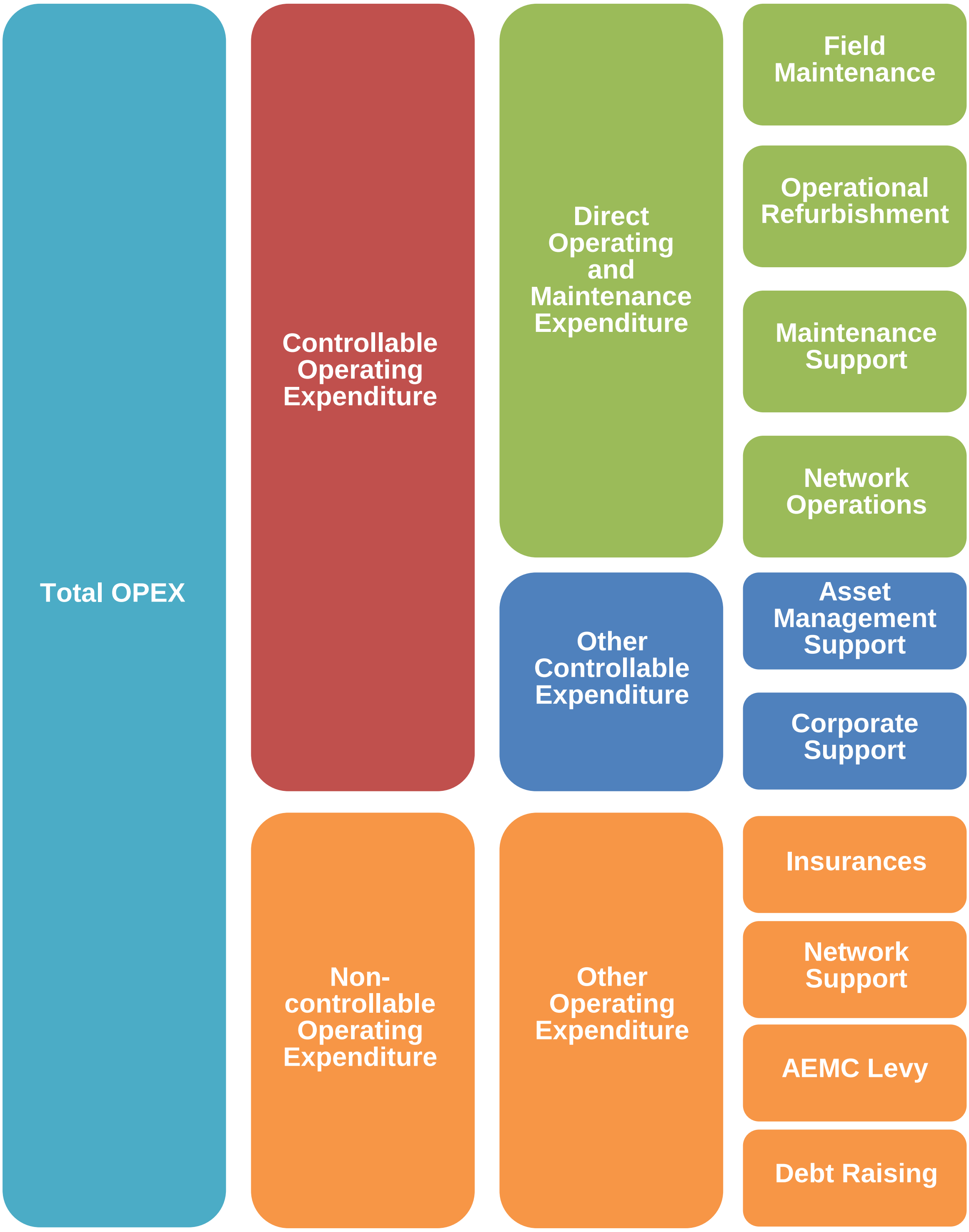
Consistent with the requirements of the Rules, Powerlink's forecast operating expenditure will be presented with reference to well accepted categories of types of operating expenditure, as well as the categories of transmission services to which the forecast operating expenditure relates.

To assist the Australian Energy Regulator (AER) and stakeholders in understanding the nature of the forecast operating expenditure and how it relates to operating expenditure incurred in the current regulatory period, Powerlink will largely retain the same categories of operating expenditure as adopted by the AER for Powerlink for the current regulatory period. Some additional elements and changes to groupings will be made as a result of changes to Powerlink's business operations. These changes will be specifically identified and reflected in both historic and forecast expenditures to allow a like for like comparison.

Figure 1.1 shows how Powerlink's operating expenditure categories fit within the total operating expenditure framework. Definitions of each category are presented in Table 1.1.

[2] *National Electricity Rules*, Schedule S6A.1.2

Figure 1.1 Powerlink's operating expenditure categories



Powerlink's operating expenditure forecast will include only operating expenditure for prescribed transmission services and will not include any amounts relating to a project that is included as a contingent project[3].

[3] *National Electricity Rules*, Rule 6A.8.1(b)

Table 1.1 Categories of operating expenditure

Operating Expenditure Category		Definition	Transmission Service
Controllable Operating Expenditure			
Direct Operating and Maintenance	Field Maintenance	Includes all field activities to ensure plant can perform its required functions. There are four types of field maintenance; *routine, condition-based, emergency and deferred [emergency] maintenance.* Field maintenance costs include all labour and materials needed to perform the required maintenance tasks. Each field maintenance type is further separated into 5 major asset type categories; substations, transmission lines, secondary systems, communications and land.	Exit, entry, TUOS (Transmission Use of System Services) and common services
	Operational Refurbishment	Involves activities that return an asset to its pre-existing condition or function, or activities undertaken on specific parts of an asset to return these parts to their pre-existing condition or function. These refurbishment activities do not involve increasing the capacity or capability of the plant, or extending its life beyond original design.	Exit, entry, TUOS and common services
	Maintenance Support	Includes activities where maintenance service providers represent asset support functions in the field as well as non-field functions supporting maintenance activities for the operate/maintain phase of the asset life cycle such as maintenance strategy development, performance management and maintenance auditing. This category also includes local government rates charges, water charges, electricity charges and charges for permits for Powerlink.	Exit, entry, TUOS and common services
	Network Operations	Includes the 'control centre' functions as well as those additional activities required to ensure the safe, reliable and efficient operational management of the Queensland transmission network.	Exit, entry, TUOS and common services
Other Controllable Expenditure	Asset Management Support	Activities required to support the strategic development and ongoing asset management of the network. AM Support has four major sub-elements: network planning, business development, regulatory management and operations.	Exit, entry, TUOS and common services
	Corporate Support	Corporate Support encompasses the support activities required by Powerlink to ensure adequate and effective corporate governance. This includes corporate and direct corporate support charges and also revenue reset costs.	Common services
Non-Controllable Operating Expenditure			
Other Operating Expenditure	Insurances	This covers both insurance premiums for Powerlink's network and non-network assets and also a self-insurance allowance to provide cover for Powerlink's losses that cannot be insured.	Common services
	Network Support	Network support refers to costs associated with non-network solutions used by Powerlink as a cost effective alternative to network investment.	TUOS services
	AEMC Levy	From the start of the 2014/15 financial year the *Electricity Act 1994* requires gas and electricity transmission networks in Queensland to pay shares of the State's cost to fund the Australian Energy Market Commission.	Common services
	Debt Raising	Debt raising costs relate to costs incurred by an entity over and above the debt margin.	Common services

1.3 Operating Expenditure Forecasting Methodology

This section describes the methodology Powerlink will apply to develop a forecast of operating expenditure.

Powerlink will follow the approach set out in the AER's Expenditure Forecast Assessment Guideline (the EFA Guideline)[4]. As stated in the EFA Guideline, a 'base-step-trend' approach will be applied to the controllable opex categories defined in Table 1.1 and a zero based approach will be applied to other operating expenditure items. A zero based approach uses an external estimate or bottom-up cost build-up to estimate the total cost of a particular activity. This method is appropriate for items that are one-off and non-recurrent in nature.

Powerlink will first identify an efficient base year that reflects the expenditure a prudent operator would require taking into account a realistic expectation of the demand forecast and cost inputs to achieve the operating expenditure objectives[5]. Any one-off or non-recurrent expenditure items will be removed so that the base year represents ongoing recurrent expenditure.

Powerlink will then apply an annual rate of change to controllable opex, consistent with the EFA Guideline,[6] for each year of the forecast regulatory period. The annual rate of change will comprise three parameters (output change, input price change and productivity change).

The EFA Guideline requires that the output growth change parameters and the input price change parameter be the same measures as used to determine the productivity change parameter. Powerlink will adopt the same measure of operating expenditure productivity change as the AER has published in its most recent annual benchmarking report.

Powerlink will source an independent external forecast of the input price change parameter. The output change parameter will be forecast using Powerlink's forecast of the components of the output change parameter used for benchmarking[7]. The productivity change parameter will be established using the industry average Transmission Network Service Provider (TNSP) operating expenditure partial factor productivity index published in the AER's most recent annual benchmarking report.

Powerlink will add or subtract any other costs not captured in the base operating expenditure or rate of change that are required for the forecast. These costs include other operating expenditures and any step changes, to meet the opex criteria.

Where appropriate and consistent with the components of the AER's base-step-trend model, Powerlink may seek adjustments to its forecast opex to reflect, for example, any adjustments to accounting practices.

The overall forecasting methodology is illustrated in Figure 1.2.

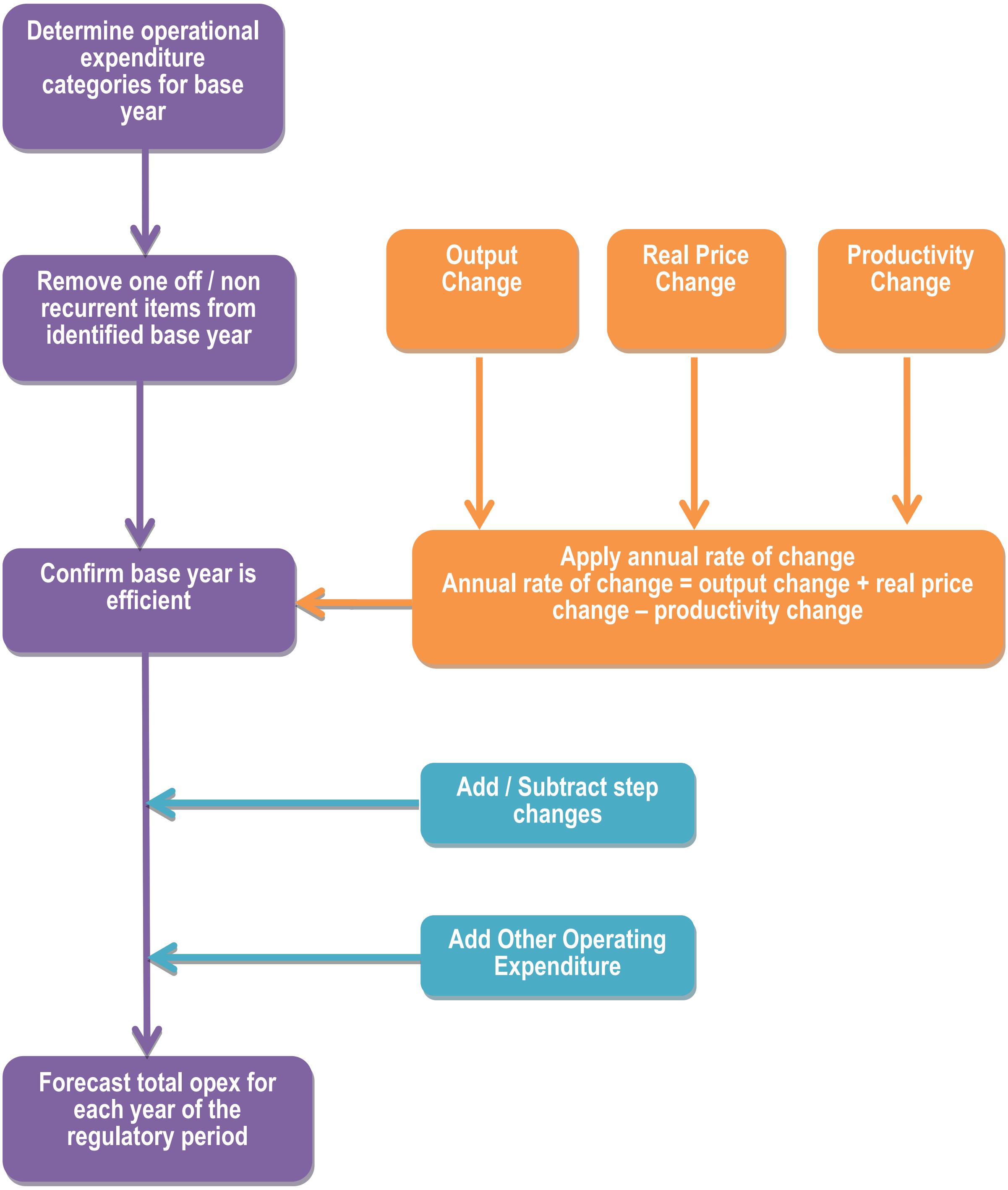
[4] *Better Regulation, Expenditure Forecast Assessment Guideline for Electricity Transmission*, November 2013

[5] *National Electricity Rules*, Rule 6A.6.6(c)

[6] *Better Regulation, Expenditure Forecast Assessment Guideline for Electricity Transmission,* November 2013, page 23

[7] These components are energy throughput, ratcheted maximum demand, voltage-weighted entry and exit connection points and circuit length.

Figure 1.2 Powerlink's proposed operating expenditure forecasting methodology



1.4 Key Variables and Assumptions

The Rules require that Powerlink's Revenue Proposal include the key assumptions and forecasts of the key variables used to derive the operating expenditure forecast. This section discusses some of the key inputs and assumptions that will be included in Powerlink's Revenue Proposal.

1.4.1 Efficient Base Year

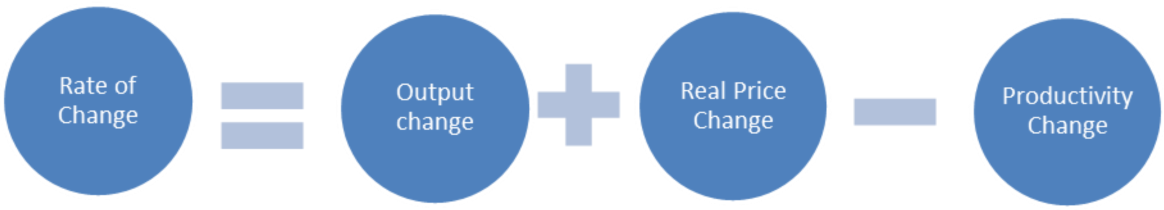
The most recently completed financial year will be assessed as the base year for determining the recurrent expenditure component of total operating expenditure. For Powerlink, this will be the 2014/15 financial year. Any one-off or non-recurrent expenditure will be removed to ensure the proposed base year is an appropriate base year to apply the rate of change calculation.

Powerlink's proposed forecasting methodology is consistent with the EFA Guideline and reflects the approach adopted by the AER in recent Transmission Revenue Determinations. The EFA Guideline sets out the AER's preference for a 'revealed cost' approach to determining the efficient base year. This approach recognises that the application of the Efficiency Benefit Sharing Scheme (EBSS) is a factor in deciding whether or not the selected base year is efficient or not. However, it is not conclusive.

Powerlink's Revenue Proposal will provide supporting information, including benchmarking data, in support of the efficiency of operating expenditure in the nominated base year.

1.4.2 Rate of Change Forecasts

Once an efficient base year operating expenditure is established this is trended forward by the application of the real rate of change in operating expenditure. The overall real rate of change is a function of the forecast change in real input costs (labour and materials), the forecast change in productivity, and the forecast change in network output.



The parameters for the rate of change components are:

1. Output change, the expected change in network output, as specified in the AER's most recent annual benchmarking report:
   - Energy throughput
     - Energy throughput is the forecast medium growth delivered energy within Queensland plus energy delivered through interconnectors to New South Wales measured in GWh;
   - Ratcheted Maximum Demand
     - Ratcheted Maximum Demand is the ratcheted non-coincident maximum demand. Non-coincident maximum demand is the maximum demand of each individual connection point in a year measured in MW;
   - Weighted entry and exit connections
     - Weighted Entry and Exit connections is the summation of the number of connection points weighted by the voltage of each connection point measured in kV; and
   - Circuit length
     - Circuit length is the total transmission line circuit length measured in km;

   These output measures are then weighted by their assessed shares of gross revenue. This is calculated and published by the AER in its most recent annual benchmarking report. Energy not supplied is also included as a negative output with a weighting based on Values of Customer Reliability (VCR) published by AEMO.
2. Price change
   - the forecast real change in input costs (labour and materials); and
3. Productivity change
   - the expected productivity change. This will be the average annual historical change in operating expenditure partial factor productivity across all TNSPs published in the AER's most recent annual benchmarking report.

1.4.3 Cost Escalators

The input cost components of step changes in operating expenditure may escalate at rates different from CPI. Where this is the case Powerlink will apply appropriate labour and materials real cost escalators. Further information is provided in Section 2.5.4.

Capital Expenditure Forecasting Methodology

Chapter 2

This page is intentionally left blank

2 Capital Expenditure

Powerlink's capital expenditure consists of expenditure for new assets that increase capacity on the network, reinvestment in existing assets that are reaching the end of their serviceable life, and other supporting assets such as business IT and vehicles.

This Chapter sets out Powerlink's intended approach to forecasting capital expenditure in a manner that meets the requirements of the National Electricity Rules.

2.1 National Electricity Rules

The Rules require Powerlink's Revenue Proposal to include a forecast of capital expenditure which Powerlink considers is required to achieve the capital expenditure objectives.

The capital expenditure objectives are to:

(1) meet or manage the expected demand for prescribed transmission services over that period;
(2) comply with all applicable regulatory obligations or requirements associated with the provision of prescribed transmission services;
(3) to the extent that there is no applicable 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 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.[8]

The Rules also prescribe the minimum informational requirements for the Revenue Proposal relating to capital expenditure. These minimum requirements are:

(1) a forecast of the required capital expenditure that complies with the requirements of clause 6A.6.7 and identifies the forecast capital expenditure by reference to well accepted categories such as:
  (i) asset class (eg. transmission lines, substations etc); or
  (ii) category driver (eg. regulatory obligations or requirements, replacement, reliability, net market benefit, business support etc),
  and identifies, in respect of proposed material assets:
  (iii) the location of the proposed asset;
  (iv) the anticipated or known cost of the proposed asset; and
  (v) the categories of transmission services which are to be provided by the proposed asset;
(2) the methodology used for developing the capital expenditure forecast;
(3) the forecasts of load growth relied upon to derive the capital expenditure forecasts and the methodology used for developing those forecasts of load growth;
(4) the key assumptions that underlie the capital expenditure forecast;

[8] *National Electricity Rules*, Clause 6A.6.7(a)

(5) a certification of the reasonableness of the key assumptions by the directors of the Transmission Network Service Provider;
(6) capital expenditure for each of the past regulatory years of the previous and current regulatory control period, and the expected capital expenditure for each of the last two regulatory years of the current regulatory control period, categorised in the same way as for the capital expenditure forecast and separately identifying for each such regulatory year:
   (v) margins paid or expected to be paid by the Transmission Network Service Provider in circumstances where those margins are referable to arrangements that do not reflect arm's length terms; and
   (vi) expenditure that should have been treated as operating expenditure in accordance with the policy submitted under paragraph (9) for that regulatory year;
(7) an explanation of any significant variations in the forecast capital expenditure from historical capital expenditure;
(8) any non-network alternatives considered by the Transmission Network Service Provider; and
(9) the policy that the Transmission Network Service Provider applies in capitalising operating expenditure.[9]

2.2 Capital Expenditure Categories

Consistent with the requirements of the Rules, Powerlink's forecast capital expenditure will be presented with reference to well accepted categories of drivers of capital expenditure as well as the categories of transmission services to which the forecast capital expenditure relates.

To assist the AER and stakeholders to understand the nature of the forecast capital expenditure, and how it relates to capital expenditure undertaken in the current regulatory period, Powerlink will retain the same categories of capital expenditure as adopted by the AER for Powerlink for the current regulatory period. However, Powerlink will re-name the Replacement category as Reinvestment, to better reflect the nature of the activities undertaken under this category. These categories are set out in Table 2.1 below.

[9] *National Electricity Rules*, Schedule S6A.1.1

Table 2.1 Categories of capital expenditure

Capital Expenditure Category	Definition	Transmission Service
Network – Load Driven		
Augmentations	Relates to augmentations defined under the Rules. Includes projects to which the Regulatory Investment Test for Transmission (RIT-T) applies. Typically these include projects such as the construction of new lines, substation establishments and reinforcements or extensions of the existing network.	TUOS services and exit services
Connections	Works to facilitate additional connection point capability between Powerlink and DNSPs. Associated works are identified through joint planning with the relevant DNSP.	Exit services
Easements	The acquisition of transmission line easements to facilitate the projected expansion and reinforcement of the transmission network. This includes land acquisitions associated with the construction of substations or communication sites.	Common services, TUOS services and exit services
Network – Non-load Driven		
Reinvestments (Replacements)	Relates to reinvestment to meet the expected demand for prescribed transmission services. Expenditure is primarily undertaken due to end of asset life, asset obsolescence, asset reliability or safety requirements. A range of options is considered as asset reinvestments, including removing assets without replacement, non-network alternatives, line refits to extend technical life or replacing assets with assets of a different type, configuration or capacity. Each option is considered in the context of the future capacity needs accounting for forecast demand.	Common services, TUOS services and entry / exit services
Security / Compliance	Expenditure undertaken to ensure compliance with amendments to various technical, safety or environmental legislation. In addition, expenditure is required to ensure the physical security (as opposed to network security) of Powerlink's assets, which are regarded as critical infrastructure.	Common services, TUOS services and entry / exit services
Other	All other expenditure associated with the network which provide prescribed transmission services, such as communications systems enhancements, improvements to network switching functionality and insurance spares.	Common services
Non-network		
Business IT	Expenditure to maintain IT capability and improve business system functionality where appropriate.	Common services
Support the Business	Expenditure to replace and upgrade business requirements including the areas of commercial buildings, motor vehicles and moveable plant.	Common services

2.3 Planning Approach

Powerlink is responsible for planning the shared transmission network within Queensland. The planning process requires consultation with the Australian Energy Market Operator (AEMO), Registered Participants and interested parties, including customers, generators and Distribution Network Service Providers (DNSPs).

Significant inputs to the network planning process are:

- the forecast of customer electricity demand (including demand side management) and its location;
- location, capacity and arrangement of new and existing generation (including embedded generation);
- condition and performance of assets and an assessment of the risks associated in allowing assets to remain in-service; and
- the assessment of future network capacity to meet the required planning criteria.

The 10-year forecasts of electrical demand and energy across Queensland are used, together with forecast generation patterns, to determine potential flows on transmission network elements. The location and capacity of existing and committed generation in Queensland is sourced from AEMO, unless modified following specific advice from relevant participants. Information about existing and committed embedded generation and demand management within distribution networks is provided by DNSPs.

Powerlink examines the capability of its existing network and the future capability following any changes resulting from committed augmentations. This involves consultation with the relevant DNSP in situations where the performance of the transmission network may be affected by the distribution network, for example where the two networks operate in parallel.

Where potential flows could exceed network capability, Powerlink notifies market participants of these forecast emerging network limitations. If the capability violation exceeds the required reliability standard, joint planning investigations are carried out with DNSPs (or other Transmission Network Service Providers, if relevant). The objective of this joint planning is to identify the most cost effective solution, regardless of asset boundaries, including potential non-network solutions.

In addition to meeting the forecast demand, Powerlink must maintain its current network so that the risks associated with the condition and performance of existing assets are appropriately managed. Powerlink routinely assesses the condition of assets and identifies potential emerging risks related to such factors as reliability, safety and obsolescence.

Therefore, planning of the network optimises the network topology as assets reach the end of their technical life so that the network is best configured to meet current and future capacity needs. Individual asset investment decisions are not determined in isolation. Powerlink’s integrated asset planning process takes account of both future changes in demand and the condition based risks of related assets in the network. The integration of condition and demand based limitations delivers cost effective solutions that manage both reliability of supply obligations and the risks associated in allowing assets to remain in-service.

In response to these risks, a range of options is considered as asset reinvestments, including removing assets without replacement, non-network alternatives, line refits to extend technical life or replacing assets with assets of a different type, configuration or capacity. Each of these options is considered in the context of the future capacity needs accounting for forecast demand.

2.4 Capital Expenditure Forecasting Methodology

This Section describes the methods Powerlink intends to apply to develop a forecast of capital expenditure.

Powerlink will adopt a mix of both top-down and bottom-up forecasting methods to arrive at the total forecast capital expenditure. In general, Powerlink considers that where drivers of capital expenditure are specific and/or one-off, they are best forecast using bottom-up analysis and individual project estimates. However, where the drivers of capital investment are more repeatable and reflect a recurring investment or reinvestment[10] need then Powerlink considers that top-down analysis will be fit for purpose in preparing a forecast. Regardless of the methodologies used for forecasting it remains the case that detailed bottom-up analysis is required to support final investment approval.

Further definition of what Powerlink considers to be top-down and bottom-up forecasting methods is contained in Appendix A.

Powerlink's forecasting approach is tailored to which of the following phases of development the capital expenditure relates:

1. Assets under construction – projects that have already received full financial approval consistent with Powerlink's corporate governance framework;
2. Confirmed investment needs – projects that are not yet approved but the need for investment has been confirmed and options are being assessed in preparation for seeking project approval; and
3. Future investment needs – based on normal business practices there is an expected future investment need but specific project details are not yet settled or ready to seek project approval.

These phases are illustrated in Figure 2.1 below. 2017 marks the start of Powerlink's next regulatory period.

Figure 2.1 Capital expenditure forecasting phases

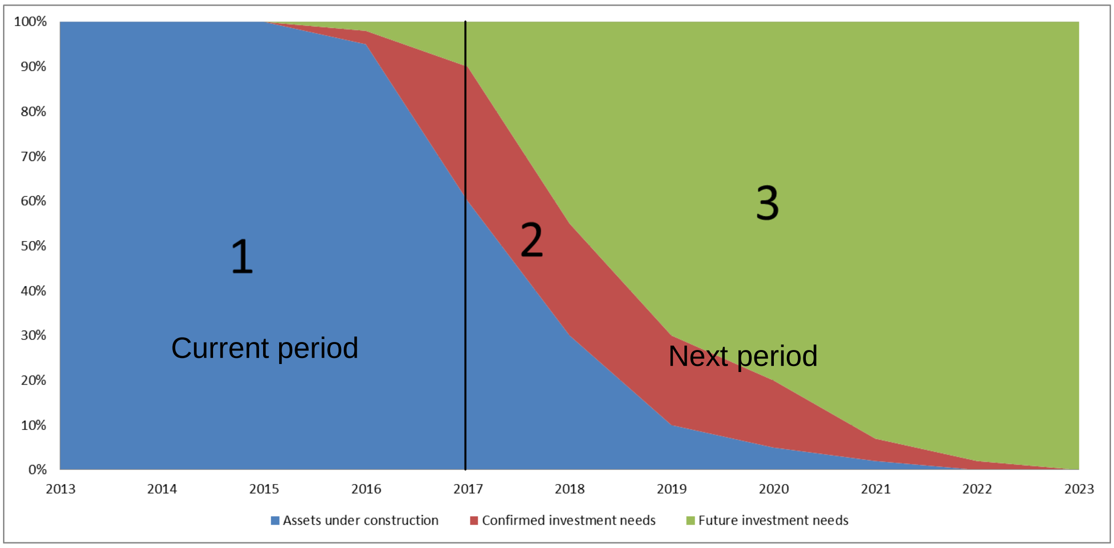


Figure 2.1 illustrates that under normal business practice some of the forecast capital expenditure for the next regulatory period will already be within phases 1 or 2 when Powerlink submits its Revenue Proposal. Within phases 1 and 2, the capital expenditure forecast will be developed bottom-up and will be based on specific project estimates and identification of a preferred option, analysis of project progress and expected outturn costs.

[10] Powerlink uses the term 'reinvestment' to mean any one or more of the actions that may be taken when an asset has reached its end of life. Possible actions include like-for-like replacement, network reconfiguration, asset retirement, or replacement with an asset of lower capacity. For transmission lines it may also be possible to extend the technical life through a combination of structural repairs, foundation works, replacement of line hardware, and/or abrasive blasting of steelwork followed by painting.

This will apply for all categories of capital expenditure and is similar to the approach Powerlink has adopted in previous Revenue Proposals.

Within phase 3, Powerlink will adopt a variety of forecasting methodologies determined by the nature of the future investment need.

These different types of future investment need align with the high-level categories of capital expenditure outlined in Section 2.2 above:

- Load-driven (network) – to comply with mandated reliability obligations as electricity demand grows and/or delivery of net benefits to the market;
- Non load-driven (network) – primarily associated with the reinvestment in assets to maintain the required capacity or capability of the network; and
- Non-network – comprising, in large part, business information technology and support the business assets required in the normal day-to-day course of business.

The forecasting methodologies to be applied to each of the high-level categories are set out in the following sections.

2.4.1 Load-driven Network Capex

Load-driven network projects include augmentations, connections to the distribution networks, and easements and land acquisitions. As triggers for load-driven capital expenditure are based on specific local demand growth forecasts and the amount of existing headroom in network capability in those areas, the forecast expenditure profile tends to be quite lumpy. Powerlink considers that bottom-up analysis remains the most practical means for developing forecasts for load-driven capital expenditure.

Forecast capital expenditure for these future investment needs will be developed from cost estimates for individual projects using Powerlink's standard project estimating processes.

To derive the forecast capital expenditure in these categories Powerlink will consider only the most likely scenario of forecast demand growth (medium economic outlook), taken from its 2015 Transmission Annual Planning Report (TAPR). AEMO also recently published the 2015 National Electricity Forecasting Report (NEFR) which provides AEMO's energy and demand forecasts for Queensland. Powerlink notes that AEMO is forecasting a higher rate of demand growth than Powerlink has forecast. Powerlink will continue to work with AEMO to identify and understand the drivers of the differences between the forecasts and to what extent these should be factored into Powerlink's Revenue Proposal.

The use of a single scenario of forecast demand growth differs from the approach taken in Powerlink's previous Revenue Proposals. The earlier high demand growth environment meant that the existing stock of generation plant was not sufficient to meet the forecast demand through to the end of the next regulatory period. This required Powerlink to plan to meet the forecast demand under potentially different scenarios of new entrant generators. The forecast capital expenditure to meet forecast demand growth, even for medium economic growth, could be highly dependent on the location of this new entrant generation.

Due to the high degree of variability in demand growth forecasts between different scenarios of economic growth, and the uncertainty associated with the location and timing of new entrant generation, there was potential for significant variability in capital expenditure requirements. This was even before any one-off trigger events that might be considered as contingent projects.

In the current environment of little or no forecast growth in future underlying demand, Powerlink considers this risk of significant asymmetry in capital expenditure requirements between economic growth scenarios is no longer present. In addition, AEMO's 2014 Electricity Statement of Opportunities (ESOO) assessed that the existing stock of generation plant was sufficient to meet reliability of supply requirements in Queensland until beyond 2023/24, even under a scenario of high growth. Accordingly, detailed analysis of emerging network limitations and the forecast capital expenditure requirements attributable to demand growth will be conducted for only the medium economic outlook.

Where there are plausible variations in electricity market development away from this central outlook that trigger significant network investment needs Powerlink will manage this through the contingent projects regime. This is discussed further under Section 2.4.4.

2.4.2 Non Load-driven Network Capex

Non load-driven network projects include reinvestment in network assets, physical security of network assets, compliance with mandated asset standards, and other minor network assets. As overall expenditure in these categories is not directly linked to demand growth it typically exhibits a smoother profile of expenditure over time than load-driven capital expenditure.

To develop the forecast capital expenditure requirements for these categories Powerlink, in the first instance, will adopt top-down modelling techniques. For the most significant of these expenditure categories, network reinvestment, Powerlink will utilise predictive modelling techniques, exemplified by the AER's own replacement expenditure model (or repex model). Predictive modelling uses statistical techniques and information from Powerlink's own asset management systems to forecast the level of reinvestment required. This information will reflect the data already provided to the AER through the Economic Benchmarking and Category Analysis Regulatory Information Notices (RINs). The level of reinvestment will reflect any opportunities that Powerlink has identified where like-for-like replacement is not warranted. Standardised unit replacement costs for each of these network asset types will then be applied to these forecast quantities to arrive at the forecast network reinvestment capital expenditure.

Powerlink recognises the importance in statistical modelling, such as the repex model, of having sufficient sample size. This point is highlighted in the AER's Repex Model Handbook[11]. Where there is an insufficient sample size for predictive modelling to be a reliable forecasting method, Powerlink will provide estimates of individual investment needs. While there are no objectively correct rules for setting the threshold of sample size, this is most likely to be relevant for power transformers where there is a relatively small number of high cost units.

The Revenue Proposal will detail the methodology used for calibrating the predictive model so that the forecast reinvestment quantities reflect the expected demand for prescribed transmission services over the regulatory period. Where asset specific information warrants it, this will be used to adjust the forecast of reinvestment capital expenditure.

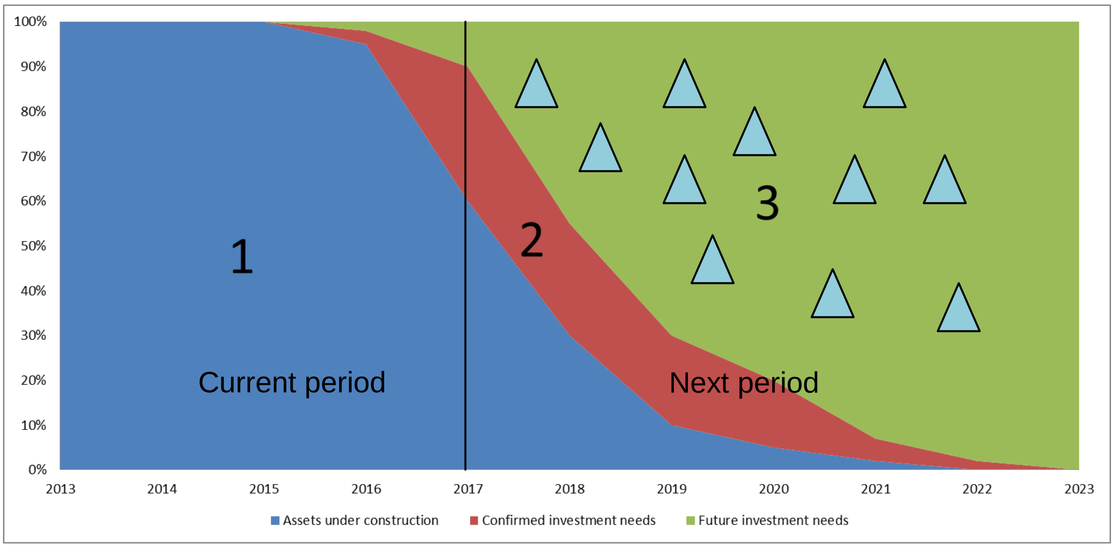
[11] *Electricity network service providers – Replacement expenditure model handbook*, AER, November 2013, pp10-11.

The remaining categories of non load-driven capital expenditure, namely security / compliance and other, will be forecast using trend analysis techniques. Powerlink intends to use a forecasting methodology similar to the base-step-trend approach proposed by the AER for forecasting operating expenditure. The key difference will be that, instead of identifying a single efficient base year as for operating expenditure, the capital expenditure forecast will identify an efficient base trend from historical expenditures.

By adopting more top-down forecasting methodologies for capital expenditure Powerlink recognises that project specific estimates would not ordinarily be available for much of the forecast expenditure that has not yet commenced – see Figure 2.1 above. Powerlink is aware that this approach is a change from past practice and has already received feedback from stakeholders seeking greater visibility of investment needs.

Powerlink will provide additional supporting information for a sample of future investment needs that have not yet commenced their formal project approval process. This is illustrated conceptually by the triangles in Figure 2.2 below. Powerlink has sought advice from consumers and customers on the criteria that should be adopted to select the sample investment needs and will use this feedback to inform its Revenue Proposal.

Figure 2.2 Future investment needs



Forecast significant investment need

2.4.3 Non-network Capex

Non-network projects include business information technology (IT) and expenditure to support the business (that is, buildings, motor vehicles and mobile plant and tools). Similar to non load-driven capital expenditure, expenditure in these categories is not directly linked to demand growth.

For business IT systems, programs of investment will be forecast top-down using external benchmarks to ensure the forecast capital expenditure reflects the efficient costs to provide this business capability. That is, forecasts will be based on actual programs already undertaken and completed by other organisations of a similar size and maturity as Powerlink. Forecast capital expenditure for other IT assets, principally hardware renewal, is largely driven by the useful life of those assets.

Forecast capital expenditure for buildings, motor vehicles and other support the business needs will be largely based on historic trends. Where specific future needs can be identified these will be incorporated into the forecast.

2.4.4 Contingent Projects

The contingent projects regime in the Rules[12] mitigates the risk of uncertainty of specific capital project investments for both consumers and network businesses. It does this by providing TNSPs with a mechanism to trigger additional capital expenditure if necessary, but this expenditure is not included in the ex-ante revenue allowance unless and until the investment trigger is confirmed by the AER.

As noted in Section 2.4.1 above, Powerlink's forecast of load-driven capital expenditure will be based on a single scenario of demand growth. To manage the risk that a significant network investment need may be triggered as a result of material changes in demand or generation mix away from this central scenario Powerlink will analyse and propose relevant contingent projects.

2.5 Key Variables and Assumptions

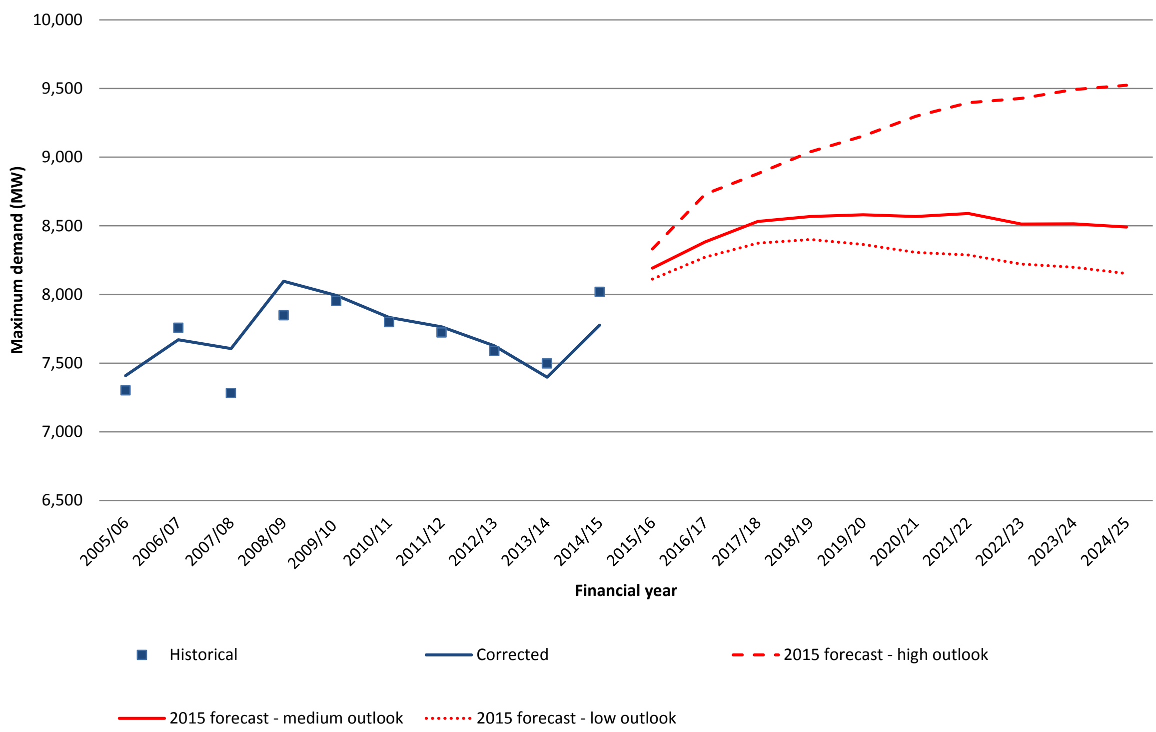
2.5.1 Forecast Demand and Generation

The electricity demand forecast to be adopted for Powerlink's Revenue Proposal will be the medium economic growth (50% Probability of Exceedance (PoE)) outlook published in its TAPR 2015 on 30 June 2015. Under this scenario the summer maximum demand delivered from the transmission network is forecast to increase from 8,019 MW in 2014/15 to 8,491 MW by 2024/25, an average annual growth rate of 0.9% per annum. This growth in total system demand is dominated by new coal seam gas compression loads in the Surat Basin that support the new liquefied gas export facilities at Gladstone. Excluding these new gas compression loads, the average annual growth in maximum demand is only 0.2% per annum.

The maximum demand delivered from the transmission network is forecast to peak at 8,590 MW in 2021/22 and then decline slightly to 8,491 MW by 2024/25. Historical, actual and temperature corrected, and forecast transmission delivered summer maximum demands are shown in Figure 2.3 below.

[12] *National Electricity Rules*, Clause 6A.8.1

Figure 2.3 Historical and forecast transmission delivered summer maximum demand



The high growth scenario includes a proportion of some as-yet-uncommitted new large loads[13]. If the growth assumption for these large loads is removed the underlying growth under the high growth scenario is around 300 MW above the medium growth scenario by 2024/25.

Further details of Powerlink's energy and demand forecasting methodology is provided in Appendix B of the TAPR 2015.

As noted in Section 2.4.1 above, AEMO's 2014 ESOO assessed that the existing stock of generation plant was sufficient to meet reliability of supply requirements until beyond 2023/24, even under a scenario of high growth. Notwithstanding this, Powerlink continues to receive enquiries from prospective developers of new generation. Powerlink will continue to assess the impact of these prospective developments on the future demand for prescribed transmission services and will include any requirements in either the ex-ante forecast for load-driven capital expenditure or as a contingent project as required.

2.5.2 Transmission Reliability of Supply Standard

Powerlink holds Transmission Authority Number T01/98 issued by the Queensland Energy Regulator under the Queensland *Electricity Act 1994*. Clause 6.2 of its Transmission Authority obligates Powerlink to plan and develop its transmission network such that power quality and reliability of supply standards will be met. On 30 June 2014 the Transmission Authority was amended to modify the previous strict N-1 planning criterion to a more flexible approach. Powerlink is now required to:

13 *Transmission Annual Planning Report 2015*, Powerlink Queensland, Table 2.1

> "… plan and develop its transmission grid in accordance with good electricity industry practice, having regard to the value that end users of electricity place on the quality and reliability of electricity services, such that:
> (a) … power quality standards will be met …;
> (b) … even during the most critical single network element outage; and
> (c) the power transfer available through the power system will be such that the forecast of electricity that is not able to be supplied during the most critical single network element outage will not exceed:
> (i) 50 megawatts at any one time; or
> (ii) 600 megawatt-hours in aggregate."

Powerlink will assume that these mandated quality and reliability of supply obligations will be the applicable standards during the next regulatory period.

2.5.3 Asset Information

The use of the AER's repex model for forecasting network reinvestment capital expenditure requires substantial information on the current fleet of assets and equipment installed on the Powerlink network. The required information will be sourced from Powerlink's Enterprise Resource Planning database.

2.5.4 Cost Escalators and Risk

The main input cost components of Powerlink's capital expenditure forecasts are labour costs (internal and external), various metals commodities (aluminium, copper and steel), and general plant and equipment. Powerlink's experience has been that these cost components escalate at rates appreciably different from the generally accepted Consumer Price Index (CPI). In addition, many of the commodities and specialist plant and equipment are sourced from overseas, bringing financial risk through variations in future currency exchange rates.

Where Powerlink considers it is able to demonstrate a causal link between movements in underlying commodities and materials prices, and the end cost to Powerlink of purchasing the resulting manufactured goods the capital expenditure forecasts will be escalated to reflect forecast real changes in those inputs. Where Powerlink considers such a causal link cannot be demonstrated then costs will be assumed to escalate at CPI.

Powerlink will also assess the overall cost estimation risk across the portfolio of forecast capital expenditure and if required, may propose an appropriate Cost Estimation Risk Factor (CERF) as part of its Revenue Proposal.

2.6 Conformance to AER Expenditure Forecast Assessment Guideline

As required by the Rules[14] the AER has published the EFA Guideline. The EFA Guideline sets out the approaches the AER may adopt to assess Powerlink's forecast capital expenditure as well as the AER's likely information requirements to support this assessment.

Powerlink has reviewed the likely information requirements contained in the EFA Guideline. Powerlink considers that its proposed capital expenditure forecasting methodology will facilitate the provision of sufficient supporting information for the AER to apply its preferred assessment approach.

[14] *National Electricity Rules*, Clause 6A.5.6

This page is intentionally left blank

Appendix A

What is ‘BOTTOM-UP’ forecasting?

A bottom-up approach includes detailed analysis and project plans that are costed to give the total capital expenditure requirement.

Powerlink proposes that **load-driven capital expenditure**, which relates to network augmentations and connections to meet growing demand, continue to be forecast using a bottom-up methodology.

Based on Powerlink’s 10-year demand forecast, which is updated annually, Powerlink anticipates the Revenue Proposal will include a relatively small number of these projects. Powerlink also considers that the bottom-up load-driven capital expenditure forecast will be efficiently developed using a single scenario, with possible variations to that forecast being managed through the contingent projects regime.

The contingent projects regime assists in managing large and uncertain projects. It allows certain trigger events to be identified by Powerlink and agreed in advance by the AER as part of the Revenue Determination. Through this mechanism the project is not included in the capex allowance, but if the trigger event occurs it allows Powerlink to apply to the AER to support additional capex that is required to meet a specified trigger event.

Powerlink also proposes that a bottom-up approach be applied to **non-load-driven and non-network expenditure projects that have already been identified**. This includes projects:
- that are already underway or committed
- for which specific investment triggers have been confirmed and which are progressing towards approval.

What is ‘TOP-DOWN’ forecasting?

To complement the bottom-up approach, Powerlink proposes to use top-down forecasting for the **non-load-driven and non-network capital expenditure project needs that have not already been identified**.

These methodologies are likely to include one or more of the techniques already employed by the AER for assessing capital expenditure forecasts, including predictive modelling and base-step-trend analysis.

The common top–down approach relies on historical information and established trends to forecast future needs. Powerlink proposes to use a top-down approach, but one with some additional information about a selection of future investment needs.

This page is intentionally left blank

Glossary

AEMC – the Australian Energy Market Commission which reviews and makes the National Electricity Rules

AEMO – the Australian Energy Market Operator which operates the National Electricity Market to enable the physical trading of electricity

AM – Asset Management

AER – the Australian Energy Regulator which is responsible for the economic regulation of electricity network service providers' revenues and for enforcing compliance with the National Electricity Rules

Capex – Capital Expenditure, which is expenditure to construct, acquire or upgrade physical assets such as property, buildings or equipment

CERF - Cost Estimation Risk Factor

CPI – Consumer Price Index

DNSP – Distribution Network Service Provider (for example, in Queensland Energex and Ergon Energy)

EBSS – Efficiency Benefit Sharing Scheme provided under clause 6A.6.5 of the National Electricity Rules

ESOO – Electricity Statement of Opportunities published by AEMO as required by clause 3.13.3(q) of the National Electricity Rules

GWh – Gigawatt hours

IT – Information Technology

kV – Kilovolt

MW – Megawatt

NEFR – National Electricity Forecasting Report, which is prepared and released by AEMO

National Electricity Rules (the Rules) – which provide, among other things, for the AER's economic regulation of the revenues of electricity network service providers

Opex – Operational Expenditure is the expenditure that a business incurs as a result of performing its normal business operations

PoE – Probability of Exceedance is a measure of the probability that the demand for electricity will be greater than a given quantity

QNI – Queensland/New South Wales Interconnector

Repex – Replacement Expenditure

RIN - Regulatory Information Notice is an instrument by which the AER can require network service providers to provide specified information

RIT-T – Regulatory Investment Test for Transmission, the AER’s cost/benefit analysis test and public consultation process made under clause 5.6.5B of the National Electricity Rules

STPIS – Service Target Performance Incentive Scheme made under clause 6A.7.4 of the National Electricity Rules

TAPR – Transmission Annual Planning Report is a report made under clause 5.12.2 of the National Electricity Rules

TNSP – Transmission Network Service Provider means a business such as Powerlink which engages in the activity of owning, controlling, developing and/or operating a transmission system

TUOS – Transmission Use of System is a service for conveying (high voltage) electricity

VCR – Value of Customer Reliability