



Chapter I: Introduction

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Key highlights

- The purpose of Powerlink's Transmission Annual Planning Report (TAPR) under the National Electricity Rules (NER) is to provide information about the Queensland electricity transmission network.
- Powerlink is responsible for planning the shared transmission network within Queensland.
- Since publication of the 2015 TAPR, Powerlink has continued to proactively engage with stakeholders and seek their input to Powerlink's business processes and objectives.
- The 2016 TAPR contains detailed discussion on key areas of future expenditure and includes new information on the available network capacity at various locations in the transmission network.

1.1 Introduction

Powerlink Queensland is a Transmission Network Service Provider (TNSP) in the National Electricity Market (NEM) and owns, develops, operates and maintains Queensland's high voltage electricity transmission network. It has also been appointed by the Queensland Government as the Jurisdictional Planning Body (JPB) responsible for transmission network planning for the national grid within the State.

As part of its planning responsibilities, Powerlink undertakes an annual planning review in accordance with the requirements of the NER and publishes the findings of this review in its TAPR.

This 2016 TAPR includes information on electricity energy and demand forecasts, the existing electricity supply system including committed generation and transmission network developments, and forecasts of network capability. Emerging limitations in the capability of the network and risks associated with the condition and performance of existing assets are identified and possible solutions to address these limitations are discussed. Interested parties are encouraged to provide input to facilitate identification of the most economical solution (including non-network solutions provided by others) that satisfies the required reliability standard to customers into the future. This 2016 TAPR also includes information on the capacity of the Powerlink network to connect renewable energy sources.

Powerlink's annual planning review and TAPR play an important part in the planning of the Queensland transmission network and help to ensure that it continues to meet the needs of participants in the NEM and Queensland electricity consumers.

1.2 Context of the Transmission Annual Planning Report

All bodies with jurisdictional planning responsibilities in the NEM are required to undertake the annual planning review and reporting process prescribed in the NER.

Information from this process is also provided to the Australian Energy Market Operator (AEMO) to assist in the preparation of their National Electricity Forecasting Report (NEFR), Electricity Statement of Opportunities (ESOO) and National Transmission Network Development Plan (NTNDP).

The ESOO is the primary document for examining electricity supply and demand issues across all regions in the NEM. The NTNDP provides information on the strategic and long-term development of the national transmission system under a range of market development scenarios. The NEFR provides independent electricity demand and energy forecasts for each NEM region over a 10-year outlook period. The forecasts explore a range of scenarios across high, medium and low economic growth outlooks.

The primary purpose of the TAPR is to provide information on the short-term to medium-term planning activities of TNSPs, whereas the focus of the NTNDP is strategic and long-term. The NTNDP and TAPR are intended to complement each other in promoting efficient outcomes. Similarly, information from the NTNDP is considered in this TAPR, and more generally in Powerlink's planning activities.

Interested parties may benefit from reviewing Powerlink's 2016 TAPR in conjunction with AEMO's 2016 NEFR, ESOO and NTNDP, which are anticipated to be published in June 2016, August 2016 and November 2016 respectively.

1.3 Purpose of the Transmission Annual Planning Report

The purpose of Powerlink's TAPR under the NER is to provide information about the Queensland electricity transmission network to everyone interested/involved in the NEM including AEMO, Registered Participants and interested parties. The TAPR also provides broader stakeholders with an overview of Powerlink's planning processes and decision making on future investment.

It aims to provide information that assists to:

- identify locations that would benefit from significant electricity supply capability or demand side management initiatives
- identify locations where major industrial loads could be connected
- identify locations where capacity for new generation developments exist (in particular renewable generation)
- understand how the electricity supply system affects their needs
- consider the transmission network's capability to transfer quantities of bulk electrical energy
- provide input into the future development of the transmission network.

Readers should note that this document is not intended to be relied upon explicitly for the evaluation of participants' investment decisions.

1.4 Role of Powerlink Queensland

Powerlink has been nominated by the Queensland Government as the entity with transmission network planning responsibility for the national grid in Queensland, known as the Jurisdictional Planning Body as outlined in Clause 5.20.5 of the NER.

As the owner and operator of the electricity transmission network in Queensland, Powerlink is registered with AEMO as a TNSP under the NER. In this role, and in the context of this TAPR, Powerlink's transmission network planning and development responsibilities include:

- ensuring that the network is able to be operated with sufficient capability and augmented, if necessary, to provide network services to customers in accordance with Powerlink's Transmission Authority and associated reliability standard
- ensuring that the risks associated with the condition and performance of existing assets are appropriately managed
- ensuring that the network complies with technical and reliability standards contained in the NER and jurisdictional instruments
- conducting annual planning reviews with Distribution Network Service Providers (DNSPs) and other TNSPs whose networks are connected to Powerlink's transmission network, that is, Energex, Ergon Energy, Essential Energy and TransGrid
- advising AEMO, Registered Participants and interested parties of asset reinvestment needs within the time required for action
- advising AEMO, Registered Participants and interested parties of emerging network limitations within the time required for action
- developing recommendations to address emerging network limitations through joint planning with DNSPs and consultation with AEMO, Registered Participants and interested parties; solutions may include network upgrades or non-network options such as local generation and demand side management initiatives
- assessing whether or not a proposed transmission network augmentation has a material impact on networks owned by other TNSPs; in assessing this impact Powerlink must have regard to the objective set of criteria published by AEMO in accordance with Clause 5.21 of the NER
- undertaking the role of the proponent for regulated transmission augmentations in Queensland.

In addition, Powerlink participates in inter-regional system tests associated with new or augmented interconnections.

1.5 Overview of approach to asset management

Powerlink's approach to planning of future network investment needs is in accordance with Powerlink's Asset Management Policy and Strategy. The principles and strategic objectives set out in these documents guides Powerlink's analysis of key investment drivers to form an integrated network investment plan over a 10-year outlook period.

Powerlink's Asset Management Strategy identifies the systems and processes that guide the development of investment plans for the network, including such factors as expected service levels, investment policy and risk management.

Factors that influence network development, such as energy and demand forecasts, generation development and risks related to the condition and performance of the existing asset base are analysed collectively in order to form an integrated view of future network investment needs.

With reinvestment in existing assets forming such a substantial part of Powerlink's future network investment plans, the assessment of emerging risks related to the condition and performance of assets is of particular importance. Such assessments are underpinned by Powerlink's corporate risk management framework and the application of a range of risk assessment methodologies set out in AS/NZS ISO31000:2009 Risk Management¹. In order to inform risk assessments, Powerlink undertakes a periodic review of network assets to assess a range of factors including physical condition, capacity constraints, performance and functionality, statutory compliance and ongoing supportability.

1.6 Overview of planning responsibilities and processes

1.6.1 Planning criteria and processes

Powerlink has obligations that govern how it should address forecast network limitations. These obligations are prescribed by *Queensland's Electricity Act 1994* (the Act), the NER and Powerlink's Transmission Authority.

The Act requires that Powerlink "ensure as far as technically and economically practicable, that the transmission grid is operated with enough capacity (and if necessary, augmented or extended to provide enough capacity) to provide network services to persons authorised to connect to the grid or take electricity from the grid".

It is a condition of Powerlink's Transmission Authority that it meets licence and NER requirements relating to technical performance standards during intact and contingency conditions. The NER sets out minimum performance requirements of the network and connections and requires that reliability standards at each connection point be included in the relevant connection agreement.

New network developments may be proposed to meet these legislative and NER obligations. Powerlink may also propose transmission investments that deliver a net market benefit when measured in accordance with the Regulatory Investment Test for Transmission (RIT-T).

The requirements for initiating solutions to forecast network limitations, including new regulated network developments or non-network solutions, are set down in Clauses 5.14.1, 5.16.4 and 5.20.5 of the NER. These clauses apply to different types of proposed transmission investments.

While each of these clauses prescribes a slightly different process, at a higher level the main steps in network planning for transmission investments subject to the RIT-T can be summarised as follows:

- publication of information regarding the nature of the network limitation and need for action which examines demand growth and its forecast exceedance of the network capability
- consideration of generation and network capability to determine when additional capability is required
- consultation on assumptions made and credible options, which may include network augmentation, local generation or demand side management initiatives, and classes of market benefits considered to be material which should therefore be taken into account in the comparison of options

¹ AS/NZS ISO 31000:2009 is an international Risk Management standard.

- analysis and assessment of credible options, which include costs, market benefits and material inter-network impact
- identification of the preferred option that satisfies the RIT-T, which maximises the present value of the net economic benefit to all those who produce, consume and transport electricity in the market
- consultation and publication of a recommended course of action to address the identified future network limitation.

1.6.2 Integrated planning of the shared network

Powerlink is responsible for planning the shared transmission network within Queensland. The NER sets out the planning process and requires Powerlink to apply the RIT-T promulgated by the Australian Energy Regulator (AER) to transmission investment proposals. The planning process requires consultation with AEMO, Registered Participants and interested parties, including customers, generators and DNSPs. Section 4.4 discusses current consultations, as well as anticipated future consultations that will be conducted in line with the processes prescribed in the NER.

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
- 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 advice from relevant participants and is provided in Section 5.2. 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 network projects. 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 TNSPs if relevant) in accordance with Clause 5.14.1 of the NER. 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 undertakes an assessment of the condition of assets and identifies potential emerging risks related to such factors as reliability, safety and obsolescence. Further information is provided in Section 4.2.

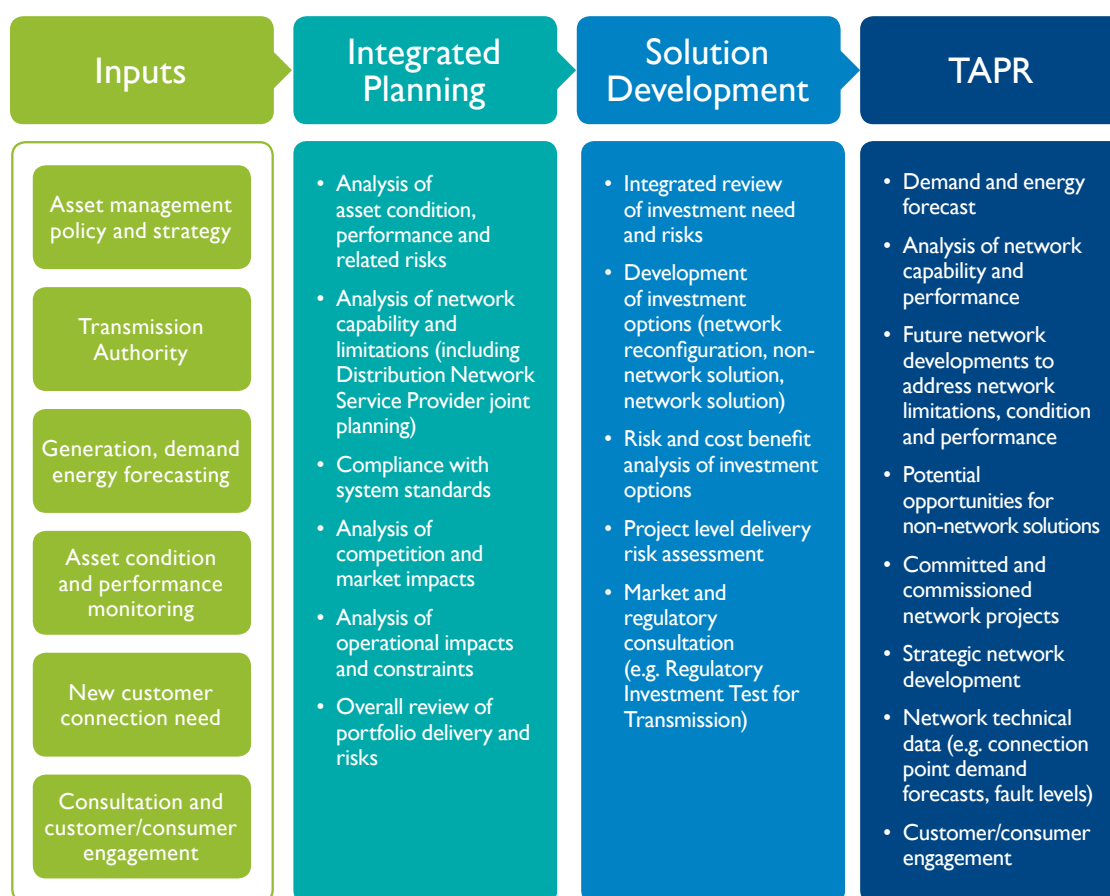
Therefore, planning of the network optimises the network topology as assets reach the end of their technical or economic life so that the network is best configured to meet current and future capacity needs. Individual asset investment decisions are not determined in isolation. Powerlink's integrated 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.

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In response to these risks, a range of options are 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.

A summary of Powerlink's integrated planning approach that considers both asset condition and demand based limitations is presented in Table 1.1.

Table 1.1 Overview of Powerlink's TAPR planning process



1.6.3 Planning of connections

Participants wishing to connect to the Queensland transmission network include new and existing generators, major loads and DNSPs. Planning of new connections or alterations to existing connections involves consultation between Powerlink and the connecting party, determination of technical requirements and completion of connection agreements. The services provided can be prescribed (regulated), negotiated or non-regulated services in accordance with the definitions in the NER or the framework for provision of such services. Investments in new prescribed connections, or augmentations to existing prescribed connections costing more than the threshold specified in the NER, currently \$6 million², may be subject to the RIT-T.

² Following the Australian Energy Regulator's 2015 Cost Threshold Review, from 1st January 2016, the \$5 million cost thresholds referred to in clauses 5.15.3(b)(1),(2),(3)(4) and (6) of the National Electricity Rules have increased from \$5 million to \$6 million.

1.6.4 Planning of interconnectors

Development and assessment of new or augmented interconnections between Queensland and New South Wales (NSW) or other States is the responsibility of the respective TNSPs. Information on potential upgrade activities is provided in Chapter 6.

1.7 Powerlink's asset planning criteria

There is a significant focus on striking the right balance between reliability and cost of transmission services. In response to these drivers, the Queensland Government amended Powerlink's N-I criterion to allow for increased flexibility. This formally came into effect on 1 July 2014. The amended standard permits Powerlink to plan and develop the transmission network on the basis that load may be interrupted during a single network contingency event. The following limits are placed on the maximum load and energy that may be at risk of not being supplied during a critical contingency:

- will not exceed 50MW at any one time
- will not be more than 600MWh in aggregate.

The risk limits can be varied by:

- a connection or other agreement made by the transmission entity with a person who receives or wishes to receive transmission services, in relation to those services; or
- agreement with the Queensland Energy Regulator (QER).

Powerlink is required to implement appropriate network or non-network solutions in circumstances where the limits set out above are exceeded or when the economic cost of load which is at risk of being unsupplied justifies the cost of the investment. Therefore, the amended planning standard has the effect of deferring or reducing the extent of investment in network or non-network solutions required in response to demand growth. Powerlink will continue to maintain and operate its transmission network to maximise reliability to consumers.

Powerlink's transmission network planning and development responsibilities include developing recommendations to address emerging network limitations through joint planning. The objective of joint planning is to identify the most cost effective solution, regardless of asset boundaries, including potential non-network solutions. Joint planning while traditionally focused on the DNSPs (Energex, Ergon Energy and Essential Energy) and TransGrid, can also include consultation with AEMO, other Registered Participants, load aggregators and other interested parties.

Energex and Ergon Energy were issued amended Distribution Authorities in July 2014. The service levels defined in their respective Distribution Authority differ to that of Powerlink's authority. Joint planning accommodates these different planning standards by applying the planning standard consistent with the owner of the asset which places load at risk during a contingency event.

Powerlink has established policy frameworks and methodologies to support the implementation of this standard. These are being applied in various parts of the Powerlink network where possible emerging limitations are being monitored. For example, based on the medium economic forecast in Chapter 2 voltage stability limitations occur in the Proserpine area within the outlook period. However, the load at risk of not being supplied during a contingency event does not exceed the risk limits of the amended planning standard. In this instance the amended planning standard is deferring investment and delivering savings to customers and consumers.

The amended planning standard will deliver further opportunities to defer investment if new mining, metal processing or other industrial loads (discussed in Table 2.1 of Chapter 2) develop. The amended planning standard may not only affect the timing of required investment but also in some cases afford the opportunity for incremental solutions that would not have otherwise met the original N-I criterion.

Chapter 2 provides details of possible new loads whose development status is not yet at the stage that they can be included (either wholly or in part) in the medium economic forecast. These new large loads (Table 2.1) are within the resource rich areas of Queensland or at the associated coastal port facilities. The loads have the potential to significantly impact the performance of the transmission network supplying, and within, these areas. The possible impact of these loads is discussed in Section 6.2.

1.8 Stakeholder engagement

Powerlink aims to share effective, timely and transparent information with our stakeholders using a range of engagement methods. Two key stakeholder groups for Powerlink are customers and consumers. Customers are defined as those who are directly connected to Powerlink's network, while consumers are electricity end-users, such as households and businesses, who primarily receive electricity from the distribution networks. There are also stakeholders who can provide Powerlink with non-network solutions. These stakeholders may either connect directly to Powerlink's network, or connect to the distribution networks. The TAPR is just one avenue that Powerlink uses to communicate information about transmission planning in the NEM. Through the TAPR we aim to increase understanding and awareness of some of our business practices including load forecasting and transmission network planning.

1.8.1 Customer and consumer engagement

Powerlink is proactively engaging with stakeholders and seeking their input to Powerlink's business processes and objectives. All engagement activities are undertaken in line with our Stakeholder Engagement Framework that sets out the principles, objectives and outcomes we are seeking to achieve in our interactions with stakeholders. The framework aims to achieve greater stakeholder trust and social licence to operate, better business decision making and improved management of corporate risks and reputation.

A number of key performance indicators are used to monitor progress towards achieving Powerlink's stakeholder engagement performance goals, including social licence to operate and reputation measures.

Powerlink undertakes a comprehensive biennial survey, the most recent in 2014, to gain insights about stakeholder perceptions of Powerlink, its social licence to operate and reputation. The surveys provide an evidence base to support the Stakeholder Engagement Framework and inform engagement with individual stakeholders.

In 2015, a pulse survey of stakeholders was undertaken as an interim 'health check' of stakeholder perceptions between the larger surveys. The interim pulse survey found there were no significant changes since 2014 whilst most measures had improved.

In late March we held a second Demand and Energy Forecasting Forum with a wide range of experts from across the industry. The forum examined the impact of new technologies and tariff reform on demand and energy forecasting on the Queensland transmission network. The information provided as a result of this forum has supported the development of our TAPR forecast and is detailed further in Chapter 2 and Appendix B.

Powerlink has also established a Customer and Consumer Panel that provides a face to face forum for our stakeholders to give input and feedback to Powerlink regarding our decision making, processes and methodologies. It also provides another avenue to keep our stakeholders better informed about operational and strategic topics of relevance. Members of the Customer and Consumer Panel represent a range of sectors including the resources sector, community advocacy groups, customers and research organisations. More information on the panel and other stakeholder engagement activities is available on our [website](#).

1.8.2 Non-network solutions

Powerlink has established processes for engaging with stakeholders for the provision of non-network services in accordance with the requirements of the NER. These engagement processes centre on publishing relevant information on the need and scope of viable non-network solutions to emerging network limitations. For a given network limitation, the viability and specification of non-network solutions are first introduced in the TAPR. Further opportunities are then explored in the consultation and stakeholder engagement processes undertaken as part of any subsequent RIT-T.

In the past these processes have been successful in delivering non-network solutions to emerging network limitations. As early as 2002, Powerlink engaged generation units in North Queensland to maintain reliability of supply and defer transmission projects between central and northern Queensland. More recently Powerlink has entered into network support services as part of the solution to address emerging limitations in the Bowen Basin area. This is outlined in Section 4.2.

Powerlink is committed to the ongoing development of its non-network engagement processes and where possible and economic expand the use of non-network solutions:

- to address future network limitations within the transmission network; or
- more broadly, in combination with network developments as part of an integrated solution to complement an overall network reconfiguration strategy.

In March 2016, Powerlink initiated a Non-network Solution Feasibility Study process to further improve consultation with non-network providers and to seek potential alternate solutions for network developments which fall outside of NER consultation requirements. In particular, where technically feasible, the process is intended to be applied to augmentations which are below the RIT-T cost threshold of \$6 million and to further explore the potential to expand the use of non-network solutions in relation to network reinvestments. This new process will assist in achieving the right balance between reliability and the cost of transmission services by providing a mechanism to exchange early information on the viability and potential of non-network solutions and how they may be utilised to integrate with the transmission network to meet current and future capacity needs. Powerlink will also continue to request non-network solutions from market participants as part of the RIT-T process defined in the NER.

Since publication of the 2015 TAPR, Powerlink has continued its collaboration with the Institute for Sustainable Futures³ and other Network Service Providers regarding the Network Opportunity Mapping project. This project aims to provide enhanced information to market participants on network constraints and the opportunities for demand side solutions. This collaboration further demonstrates Powerlink's commitment to utilise a variety of platforms to raise and broaden stakeholder awareness regarding possible commercial opportunities for non-network solutions and provide technical information which historically has only been discussed in the TAPR.

The Non-network Solution Feasibility Study process in conjunction with the publicly available data provided via the Network Opportunities Mapping project responds to previous feedback Powerlink has received from a number of stakeholders about the need to provide enhanced information on the potential value and timing of non-network solutions.

Non-network Engagement Stakeholder Register

In 2014 Powerlink established the Non-network Engagement Stakeholder Register (NNESR) to convey non-network solution providers the details of emerging network limitations. The NNESR is made up of a variety of interested stakeholders who have the potential to offer network support through existing and/or new generation or demand side management initiatives (either as individual providers or aggregators).

The NNESR has been introduced to serve as a two-way communication tool to achieve the following outcomes:

- leveraging off the knowledge of participants to seek input on process enhancements that Powerlink can adopt to increase the potential uptake of non-network solutions;
- to provide interested parties with information;
- prior to the commencement of formal public consultation as part of the RIT-T;
- in relation to other augmentation network investments which may fall outside of NER consultation requirements; and
- with respect to network reinvestments which may have the potential to use non-network solutions.

³ Information available at <http://www.uts.edu.au/research-and-teaching/our-research/institute-sustainable-futures/news/network-opportunity-mapping>

Potential non-network providers are encouraged to register their interest in writing to networkassessments@powerlink.com.au to become a member of Powerlink's NNESR.

I.8.3 Focus on continuous improvement

As part of Powerlink's commitment to continuous improvement, the 2016 TAPR builds upon the integrated approach to future network development introduced in the 2015 TAPR and contains detailed discussion on key areas of future expenditure.

In conjunction with condition assessments and risk identification, as assets approach their anticipated replacement dates, possible reinvestment alternatives undergo detailed planning studies to confirm alignment with future reinvestment and optimisation strategies. These studies have the potential to deliver new information and may provide Powerlink with an opportunity to:

- improve and further refine options under consideration; or
- consider other options from those originally identified which may deliver a greater benefit to stakeholders.

Information regarding possible reinvestment alternatives is updated annually within the TAPR and includes discussion on the latest information as planning studies mature.

The 2016 TAPR includes the following enhanced or additional information:

- discussion on the potential for generation developments (in particular renewable generation), including new information on available network capacity at various locations in the transmission network (refer to Chapter 7);
- incorporation of updated information explicitly relating to the future impacts of emerging technologies into Powerlink's forecasting methodology (refer to Appendix B);
- Revenue Proposal alignment – information regarding Powerlink's Revenue Proposal which was submitted to the AER in January 2016 and its relationship to the proposed capital expenditure discussed within the TAPR outlook period (refer to section 4.1.2); and
- non-network solutions – ongoing improvement of information and engagement practices for non-network solution providers (refer to Section 4.2).