INDEPENDENT PLANNING REVIEW

QUEENSLAND TRANSMISSION NETWORK

December 2015

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

Purpose

The purpose of this publication is to provide information in relation to future development needs for the Queensland transmission network.

AEMO publishes this report in its capacity as National Transmission Planner, exercising the functions set out in section 49(2) of the National Electricity Law. This publication is based on information available to AEMO as at 31 October 2015.

Disclaimer

AEMO has made every effort to ensure the quality of the information in this publication but cannot guarantee that information, forecasts and assumptions are accurate, complete or appropriate for your circumstances. This publication does not include all of the information that an investor, participant or potential participant in the national electricity market might require, and does not amount to a recommendation of any investment.

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Acknowledgement

AEMO acknowledges the co-operation and contribution of Powerlink in providing data and information used in this publication.

EXECUTIVE SUMMARY

This planning review provides an independent, technical assessment of emerging transmission network investment requirements in Queensland over the next seven years. This review is intended to provide input and comment for:

- Powerlink, Queensland's Transmission Network Service Provider (TNSP), in preparing its regulatory revenue proposal to the Australian Energy Regulator (AER) for the period 1 July 2017 – 30 June 2022.
- The AER, in its review of Powerlink's revenue proposal.
- Non-network service providers in identifying potential opportunities for non-network development.

The review assessed the requirement for two types of capital expenditure to address localised transmission network needs:

- Capacity-driven expenditure that augments network capacity to meet forecast maximum demand growth.
- Asset reinvestment, proposed by Powerlink in its 2015 Transmission Annual Planning Report (TAPR), to refurbish or replace major transmission infrastructure nearing the end of its technical life.

Powerlink identified no capacity-driven augmentation requirement, and 32 reinvestment projects for the next five years in its 2015 TAPR. Powerlink's proposed alternatives to like-for-like replacement include retirement of transmission lines and transformers, and non-network development options. These proposals could provide cost savings for consumers.

AEMO agrees with Powerlink that:

- No capacity-driven augmentation is required in the Queensland transmission network.
- There is an ongoing need for most of the network assets identified in the reinvestment project proposals.

Of the 32 reinvestment projects proposed by Powerlink, AEMO has identified three possible opportunities where the proposed scope of reinvestment could be further reduced:

- **Belmont substation 275/110 kV transformer replacement** – subject to rebalancing of load in the Greater Brisbane area, two transformers at Belmont substation may be retired with no replacement. Based on Powerlink's transformer replacement cost estimate, this alternative could reduce capital expenditure by up to $11 million. The assessment has not considered any costs associated with rebalancing the load.
- **Bouldercombe 275 kV and 132 kV primary plant replacement** – if two lower rated transformers were to be replaced at the end of their technical life, an option is to replace them with a single, higher rated transformer. In such a case, one set of 275 kV and 132 kV primary plant could be deferred from the proposed reinvestment, depending on the condition of the existing 275 kV and 132 kV primary plant. Based on Powerlink's replacement cost estimate, this alternative could reduce capital expenditure by up to $3 million.
- **Ingham South substation 132/66 kV transformer replacement** – replacement of two 132/66 kV transformers with two lower capacity transformers, possibly combined with non-network services such as demand side participation. Non-network service cost estimates would be required to identify potential cost savings in this case.

These findings are consistent with AEMO's 2015 National Transmission Network Development Plan[1] that highlighted asset replacement expenditure as the predominant type of transmission development across the National Electricity Market (NEM) in recent years. This trend is visible in Queensland and is expected to continue across the NEM for the next two decades.

[1] AEMO. 2015 National Transmission Network Development Plan. Available: http://www.aemo.com.au/Electricity/Planning/National-Transmission-Network-Development-Plan.

TABLES

FIGURES

1 – INTRODUCTION

This review provides an independent, technical assessment of emerging transmission network investment requirements in Queensland over the next seven years. Its purpose is to facilitate efficient, reliable and secure development of the transmission network in consumers' long term interests.

The report is intended to provide input and comment for:

- Powerlink, Queensland's Transmission Network Service Provider (TNSP), in preparing their regulatory revenue proposal to the Australian Energy Regulator (AER) for the period 1 July 2017 – 30 June 2022.
- The AER, in their review of Powerlink's revenue proposal.
- Non-network service providers in identifying potential opportunities for non-network development.

AEMO engaged with the AER and Powerlink throughout this review process to develop and apply an impartial, transparent, technically consistent assessment methodology.

1.1 AEMO's National Transmission Planner role

AEMO undertook this review as part of its National Transmission Planner (NTP) responsibilities under the National Electricity Law. As part of its NTP function, AEMO must:

- Keep the national transmission grid under review and provide advice on grid development or projects that could affect the grid.[2]
- Provide a national strategic perspective for transmission planning and coordination.[3]
- Have regard to the National Electricity Objective.[4]

Under Chapter 6A of the National Electricity Rules (Rules), in deciding whether to accept a TNSP's revenue proposal, the AER considers factors including "…*any submissions made by AEMO, in accordance with the Rules, on the forecast of the TNSP's required capital expenditure*".[5]

AEMO's capacity as National Transmission Planner enables it to provide an independent review of the investment requirements consistently across NEM regions.

This report is one part of an integrated package of AEMO activities that support efficient transmission investment in the NEM. Other measures include:

- Developing long-term planning outlooks for current and potential national transmission flow paths[6], published in the annual National Transmission Network Development Plan (NTNDP).[7]
- Reviewing projects proposed by TNSPs under the AER's network capability incentive scheme[8], designed to improve use of existing network assets through low-cost projects. TNSPs must consult with AEMO before submitting their Network Capability Incentive Parameter Action Plans (NCIPAPs) to the AER.[9] AEMO is currently engaged with Powerlink to review Queensland NCIPAP projects.

[2] National Electricity Law, s49(2)(c).
[3] National Electricity Law, s49(2)(d).
[4] National Electricity Law, s49(3). The National Electricity Objective is set out in s7 of the National Electricity Law. It is "to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to (a) price, quality, safety, reliability and security of supply of electricity; and (b) the reliability, safety and security of the national electricity system".
[5] National Electricity Rules 6A.6.7(e)(11).
[6] National transmission flow paths are defined in the Rules as any portion of transmission networks used to transport significant amounts of electricity between generation centres and load centres.
[7] AEMO. 2015 National Transmission Network Development Plan. Available: http://www.aemo.com.au/Electricity/Planning/National-Transmission-Network-Development-Plan.
[8] The Network Capability Incentive Parameter Action Plan (NCIPAP) is designed to support improved usage of existing network assets through low-cost projects.
[9] AER. Electricity Transmission Network Service Providers Service Target Performance Incentive Scheme. Version 5. s 5.2(h), page 13. October 2015.

- Preparing and publishing independent, consistently-derived operational consumption and maximum demand forecasts for each NEM region in the National Electricity Forecasting Report (NEFR).[10]
- Preparing and publishing detailed, local maximum demand forecasts in Transmission Connection Point Forecasting Reports for each NEM region.[11]
- Developing and publishing a NEM-wide review of the value of customer reliability – the economic value different users place on a reliable supply of electricity – to help network planners, asset owners, and the AER align future network investment with how much customers are willing to pay for a secure and reliable electricity supply.[12]

1.2 Powerlink's revenue proposal

Powerlink's submission of its regulatory revenue proposal to the AER from 1 July 2017 to 30 June 2022 is due by 31 January 2016. The AER's final determination is due by 30 April 2017.

Powerlink's 2015 Transmission Annual Planning Report (TAPR) lists its potential asset reinvestment projects for the next five-year period. Powerlink considers these projects necessary to maintain the reliability and safety of its transmission network, due to the condition of these assets. Powerlink's 2015 TAPR has provided the basis for AEMO's assessment of reinvestment expenditure.

[10] AEMO. National Electricity Forecasting Report. Available: http://www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report.
[11] AEMO. Transmission Connection Point Forecasting. Available: http://www.aemo.com.au/Electricity/Planning/Forecasting/AEMO-Transmission-Connection-Point-Forecasting.
[12] AEMO. Value of Customer Reliability review page: Available at http://www.aemo.com.au/Electricity/Planning/Value-of-Customer-Reliability-review.

2 – REVIEW PROCESS

2.1 Guiding principles

This review is conducted as part of AEMO's statutory National Transmission Planner function, which specifically includes overseeing future transmission network development in the NEM. Part of this role is to provide advice on transmission grid development and projects that could affect the grid[13], as well as fostering a national strategic perspective for transmission planning and coordination.[14]

This review is intended to be:

1) **Impartial**. The review is fact-based. As National Transmission Planner, AEMO has the technical capability to provide an independent appraisal of transmission network investment requirements.
2) **Transparent**. The planning assumptions and assessment methodology are published so parties can replicate this review.
3) **Consistent**. The same methodology as previous reviews in other NEM jurisdictions is applied. For all reviews, AEMO applies its own connection point forecasts and takes into account relevant jurisdictional planning criteria.
4) **Consultative**. The assessment process for this review was developed in consultation with the AER and Powerlink.

2.2 Review scope and methodology

The review focuses on the two main classes of capital expenditure to address localised transmission network needs:

- Capacity-driven expenditure that augments network capacity to meet forecast maximum demand growth.
- Asset reinvestment, proposed by Powerlink in its 2015 Transmission Annual Planning Report (TAPR), to refurbish or replace major transmission infrastructure nearing the end of its technical life.

The agreed methodology used to review capital expenditure projects proposed by Powerlink in the 2015 TAPR is outlined in Sections 2.2.1, 2.2.2 and 2.2.3 below.

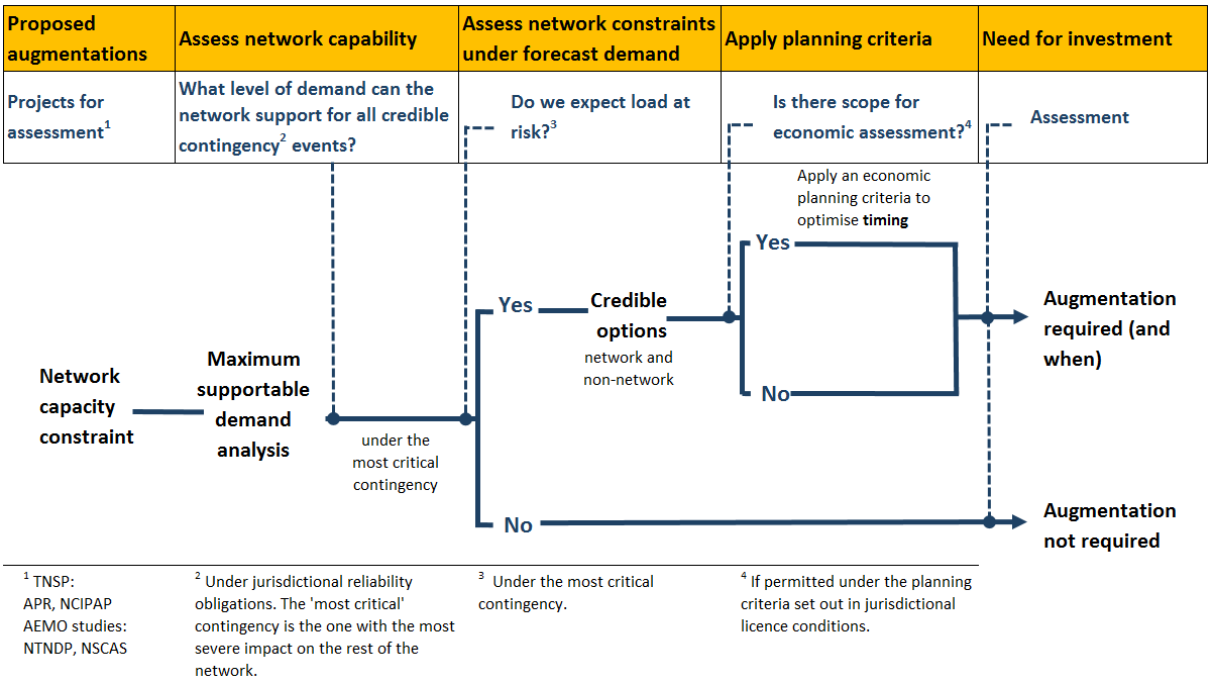
2.2.1 Capacity-driven projects

Capacity-driven expenditure increases network capability to address expected unserved energy. Figure 1 sets out the process AEMO undertook for assessing the requirement for capacity-driven expenditure, summarised below:

1. Network capability: Determine what level of maximum demand the network can support for the most critical contingency events.
2. Network constraints: Apply 2015 NEFR update and AEMO's 2015 connection point forecasts to determine expected load and energy at risk, and/or market congestion over the next seven years under the most critical contingency event.
3. The need for the project under the applicable planning criteria: If load and energy at risk or market congestion is identified, augmentation may be required within the regulatory period, under Powerlink's planning standard. If not, augmentation is not required.

[13] National Electricity Law s49(2)(c).
[14] National Electricity Law s49(2)(d).

Figure 1: Assessment approach for capacity-driven investment

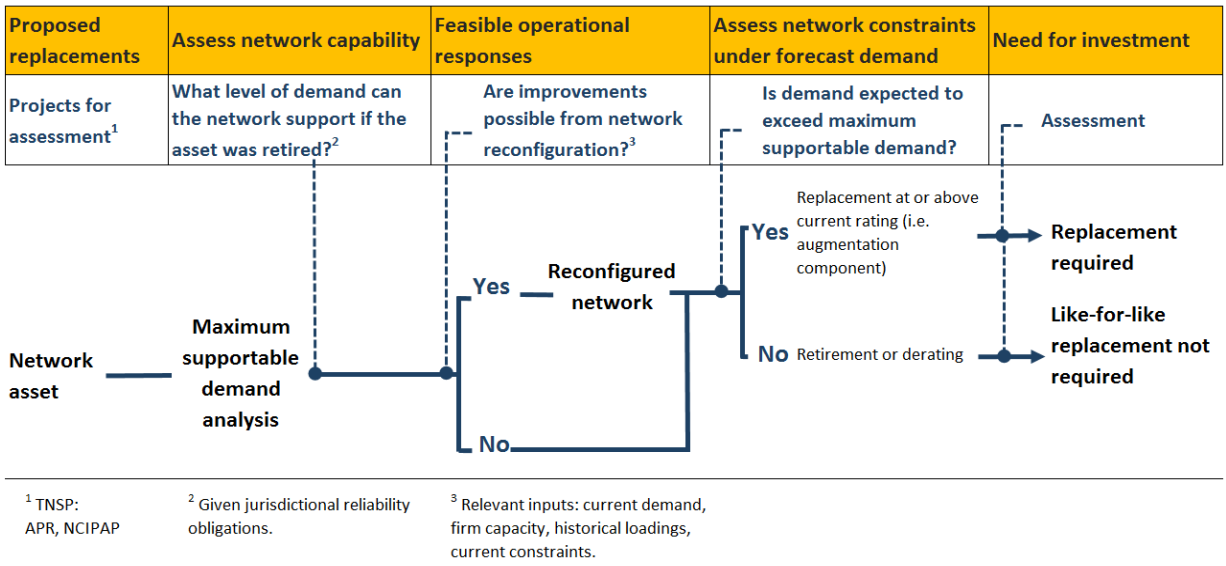


2.2.2 Asset reinvestment projects

Asset reinvestment refers to projects to maintain supply reliability. Figure 2 sets out the process AEMO undertook for assessing Powerlink's proposed reinvestment works, summarised below:

1. Network capability: Determine what level of maximum demand the network could support if the asset was retired. This assessment takes into account Powerlink's planning standard, and considers any other, more efficient configuration of network assets.
2. Network constraints: Apply 2015 NEFR update and AEMO's 2015 connection point forecasts to determine expected load at risk and/or market congestion over the next seven years if the asset was retired.
3. The need for the project under the applicable planning criteria: If load and energy at risk were to exceed the planning standard with the asset retired, reinvestment is required within the regulatory period. If not, reinvestment may not be required. Retirement or replacement with lower than the existing capacity may suffice.

Figure 2: Assessment approach for asset reinvestment



[1] TNSP: APR, NCIPAP

[2] Given jurisdictional reliability obligations.

[3] Relevant inputs: current demand, firm capacity, historical loadings, current constraints.

2.2.3 Common methodology

Development is supported where independent analysis confirms the need, and alternative (potentially lower cost) options to the proposed projects are recommended in some instances.

Non-network services are not considered as an alternative to augmentation or reinvestment if the service could impact Powerlink's ability to maintain a secure and reliable supply.

This review also applied the planning standard that Powerlink must adhere to when making transmission network investment decisions. Under the planning standard, Powerlink is permitted to plan and develop the transmission network on the basis that load may be interrupted during a single network contingency event. The following limits apply during a network contingency event:

- Load at risk not to exceed 50 MW at any one time.
- Unserved energy not to exceed 600 MWh in aggregate.[15]

This report does not attempt to provide advice on the condition of Powerlink's assets. Even if a proposed reinvestment project is justified on grounds that replacement assets are required to meet the reliability standard, the AER may still reject proposed expenditure on the grounds that existing assets are in good condition.

Factors outside the review's scope, but relevant to the AER's decision on forecast expenditure, include:

- Comment on the condition of the assets.
- Assessment of project costs.
- Detailed options analysis.
- Identification of new strategic land and easements.
- Powerlink's operational expenditure.
- Whether the investment provides a prescribed transmission service for the purposes of Chapter 6A of the National Electricity Rules.[16]
- Other capital expenditure such as information technology, metering, security, and telecommunications.

[15] Powerlink 2015 Annual Planning Report. Available: https://www.powerlink.com.au/About_Powerlink/Publications/Transmission_Annual_Planning_Reports/Documents/2015/Transmission_Annual_Planning_Report_2015_(complete_report).aspx. Viewed: 8 December 2015.

[16] National Electricity Rules. Chapter 6A: Economic Regulation of Transmission Services.

3 – FINDINGS OF AEMO'S REVIEW

3.1 Capacity-driven expenditure

No capacity-driven expenditure is identified for the period 2016–17 to 2021–22. This is consistent with Powerlink's 2015 TAPR.

3.2 Asset reinvestment expenditure

Powerlink identified 32 reinvestment projects for the next five years in its 2015 TAPR. Powerlink's proposed alternatives to like-for-like replacement include retirement of transmission lines and transformers, and non-network development options. These proposals could provide cost savings for consumers.

AEMO agrees with Powerlink on the ongoing need for the network assets identified in the reinvestment project proposals, and has identified three possible opportunities where the reinvestment projects' scope could be further reduced from what Powerlink has proposed. These are summarised below:

- **Belmont substation 275/110 kV transformer replacement** – in the TAPR, this potential project includes replacement of two 275/110 kV transformers with a single transformer. Belmont substation has four 275/110 kV transformers with 110 kV meshed connection to a number of 275/110 kV substations in the Greater Brisbane area. With rebalancing of load in these substations, there may be no requirement for new transformers to replace the existing transformers. Based on Powerlink's transformer replacement cost estimate, this alternative could reduce capital expenditure by up to $11 million. The assessment has not considered any costs associated with rebalancing the load.
- **Bouldercombe 275 kV and 132 kV primary plant replacement** – in the TAPR, this potential project includes replacement of all the 275 kV and 132 kV primary plant within the next five years, with the exception of three transformers. The three transformers consist of two relatively old transformers rated at 266 MVA and one relatively new transformer rated at 466 MVA. If the two older transformers were to require replacement in future, a more efficient option could be to replace them with a single higher rated transformer. In such a case, replacing one set of 275 kV and 132 kV primary plant could be deferred from the proposed reinvestment. However, this depends on the condition of the existing 275 kV and 132 kV primary plant. Based on Powerlink's replacement cost estimate, this alternative could reduce capital expenditure by up to $3 million.
- **Ingham South substation 132/66 kV transformer replacement** – in the TAPR, this potential project includes replacement of two 132/66 kV transformers. The forecast summer maximum demand supplied from this substation is declining and there is projected slow growth in winter maximum demand. The 10% POE maximum demand is forecast to be 50% of thermal capacity of the existing transformers. A potential lower cost alternative to the proposed project is replacement with two lower capacity transformers. A further alternative could be replacement with two even lower capacity transformers, combined with non-network services such as demand side participation. However, AEMO acknowledges that other factors may influence the sizing of new transformers, such as the availability of spares from an asset management perspective. Further information on non-network service costs would be required to identify potential cost savings in this case.

AEMO's findings for each of the 32 projects are summarised in the Appendix and detailed assessments are provided in a technical attachment.[17]

[17] AEMO. Independent Planning Review – Technical Assessment. Available: http://www.aemo.com.au/Electricity/Planning/Independent-Planning-Review-QLD-transmission-network.

4 – SUPPLEMENTARY INFORMATION

AEMO has published a technical report as part of the independent planning review of Queensland transmission network on its website. The table below provides links to additional information provided.

Table 1 - Links to supporting information

Information source	Website address
Independent planning review - technical assessment	http://www.aemo.com.au/Electricity/Planning/Independent-Planning-Review-QLD-transmission-network
2015 National Electricity Forecasting Report Update	http://www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report
2015 Queensland connection point forecasts	http://www.aemo.com.au/Electricity/Planning/Forecasting/AEMO-Transmission-Connection-Point-Forecasting/Transmission-Connection-Point-Forecasting-Report-for-Queensland
Generator Information page	http://www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information
Powerlink 2015 Transmission Annual Planning Report	https://www.powerlink.com.au/About_Powerlink/Publications/Transmission_Annual_Planning_Reports/Transmission_Annual_Planning_Report_2015.aspx

APPENDIX A – REVIEW OF POSSIBLE REINVESTMENT WORKS

Table 2 summarises the assessment of Powerlink's possible reinvestment works identified in its 2015 TAPR, and highlights the three possible opportunities where the replacement projects' scope could be further reduced from what Powerlink had proposed.

Table 2 - Results for AEMO's assessment of Powerlink's possible reinvestment works

Region	Asset type	Powerlink's potential project	AEMO Assessment
Northern	Substation	Garbutt 132/66 kV transformers replacement. Reconfigure of 66 kV to supply through a single transformer at Garbutt with non-network services.	Ongoing need exists for a 132/66 kV transformer. Powerlink identified an option with a single transformer at Garbutt substation with non-network services. No other alternatives identified.
	Substation	Ingham South 132/66 kV transformers replacement.	Ongoing need exists for the 132/66 kV transformers. **An alternative option exists with lower rated transformers, possibly combined with non-network services. However, size of the transformer may be subject to optimum management of spare transformers.**
	Substation	Kamerunga substation 132 kV primary plant replacement.	Ongoing need exists for the 110 kV plant at Kamerunga substation. No alternatives identified.
	Transmission line	Collinsville North – Proserpine 132 kV line – line refit works. Retirement of Proserpine–Mackay 132 kV double circuit line.	Ongoing need exists for the Collinsville North – Proserpine 132 kV transmission line. Powerlink identified retirement of the Proserpine–Mackay 132 kV double circuit line. No other alternatives identified.
	Transmission line	Clare South – Invicta Tee – Townsville South 132 kV line – line refit works. Retirement of Townville South – Clare South 132 kV line with a possible solution to address low voltages by installation of a shunt capacitor bank at Proserpine substation.	Ongoing need exists for the Clare South – Invicta Tee – Townsville South 132 kV transmission line. A shunt capacitor bank is identified with retirement of the Townsville South – Clare South 132 kV line. Alternative could be non-network services if cost-effective.
	Transmission line	Eton Tee – Alligator Creek 132 kV line – line refit works.	Ongoing need exists for the Eton Tee – Alligator Creek 132 kV transmission line. No alternatives identified.
	Transmission line	Eton Tee – Nebo and 132 kV lines – line refit works.	Ongoing need exists for the Eton Tee – Nebo 132 kV transmission line. No alternatives identified.
	Transmission line	Eton Tee – Pioneer Valley and 132 kV lines – line refit works. Reconfiguration and retirement of a 132 kV circuit.	Ongoing need exists for the Eton Tee – Nebo and Eton Tee – Pioneer Valley 132 kV transmission lines. Powerlink identified reconfiguration and retirement of one of a 132 kV circuit between Eton tee and Pioneer Valley. No other alternatives identified.
	Transmission line	Kareeya–Chalumbin 132 kV line – line refit works.	Ongoing need exists for the Kareeya–Chalumbin 132 kV transmission line. No alternatives identified.

Region	Asset type	Powerlink's potential project	AEMO Assessment
Central	Substation	Bouldercombe 275 kV and 132 kV primary plant replacement.	Ongoing need exists for the 275 kV and 132 kV plant at Bouldercombe substation. **There are three 275/132 kV transformers at Bouldercombe substation. If two lower rated transformers were to be replaced in future, an option is to replace these transformers with a single transformer with higher rating. In such a case, one set of 275 kV and 132 kV primary plant could be deferred from the proposed reinvestment. However this depends on condition of the existing 275 kV and 132 kV primary asset.**
	Substation	Dysart substation 132 kV primary plant and 132/66 kV transformers replacement.	Ongoing need exists for the 132 kV primary plant and 132/66 kV transformers at Dysart substation. Potential for optimising capacity of new transformers if non-network solution is cost-effective. No other alternatives identified.
	Substation	Gin Gin substation 275 kV and 132 kV primary plant replacement.	Ongoing need exists for the 275 kV and 132 kV plant at Gin Gin substation. No alternatives identified.
	Substation	Lilyvale substation 275 kV and 132 kV primary plant replacement.	Ongoing need exists for the 275 kV and 132 kV plant. No alternatives identified.
	Substation	Lilyvale substation – Replacement of two of the three 132/66 kV transformers. Retirement of a 132/66 kV transformer**.**	Ongoing need exists for two 132/66 kV transformers at Lilyvale substation. Powerlink identified retirement of a 132/66 kV transformer. Potential for optimising capacity of new transformers if non-network solution is cost-effective. No other alternatives identified.
	Transmission lines	Callide A – Moura 132 kV line – line refit works	Ongoing need exists for the Callide A – Moura 132 kV line. No alternatives identified.
	Transmission line	Egans Hill – Rockhampton 132 kV line – line refit works.	Ongoing need exists for the Egans Hill – Rockhampton 132 kV transmission circuits. No alternatives identified.
Southern	Substation	Ashgrove West substation 110 kV primary plant replacement.	Ongoing need exists for the 110 kV plant at Ashgrove substation. No alternatives identified.
	Substation	Belmont substation – Replacement of two 275/110 kV transformers with a single transformer.	Belmont substation has four 275/110 kV transformers with 110 kV meshed connection with a number of 275/110 kV substations in the Greater Brisbane area. **Subject to rebalancing of load in these substations, two transformers at Belmont substation may be retired with no replacement**.
	Substation	Palmwoods 275 kV primary plant replacement.	Ongoing need exists for the 275 kV plant at Palmwoods substation. No alternatives identified.

Region	Asset type	Powerlink's potential project	AEMO Assessment
	Substation	Redbank Plains substation 110 kV primary plant replacement.	Ongoing need exists for the 110 kV plant at Redbank substation. No alternatives identified.
	Substation	Mudgeeraba substation 110 kV primary plant replacement.	Ongoing need exists for the 275 kV plant at Mudgeeraba substation. No alternatives identified.
	Substation	Mudgeeraba substation – Replacement of a 275/110 kV transformer and followed by retirement of the other transformer.	Mudgeeraba substation has three 275/110 kV transformers. Ongoing need exists for two transformers at Mudgeeraba substation. Powerlink identified to retire the third transformer. No alternative option identified.
	Transmission lines	110 kV lines between Belmont and Sumner Tee – line refit works Reconfiguration of 110 kV lines A number of 110 kV and 275 kV transmission line assets could potentially be retired.	Ongoing need exists for Belmont – Sumner Tee 110 kV transmission circuits. Powerlink identified possible reconfiguration and retirement of 110 kV transmission line/s between Belmont and Sumner Tee. No other alternatives identified.
	Transmission lines	110 kV lines between Blackstone and Abermain – line refit works.	Ongoing need exists for Blackstone–Abermain 110 kV transmission circuits. No alternatives identified.
	Transmission lines	110 kV lines between Blackstone and Redbank Plains – line refit works. Reconfiguration of 110 kV lines. A number of 110 kV and 275 kV transmission line assets could potentially be retired.	Ongoing need exists for Blackstone–Redbank plains 110 kV transmission circuits. Powerlink identified possible reconfiguration and retirement of 110 kV transmission line/s between Blackstone and Redbank Plains. No other alternatives identified.
	Transmission lines	110 kV lines between Rocklea and West Darra – line refit works	Ongoing need exists for Rocklea – West Darra 110 kV transmission circuits. No alternatives identified.
	Transmission lines	110 kV lines between South Pine and West Darra – line refit works. Reconfiguration of 110 kV lines. A number of 110 kV and 275 kV transmission line assets could potentially be retired.	Ongoing need exists for South Pine–West Darra 110 kV transmission circuits. Powerlink identified possible reconfiguration and retirement of 110 kV transmission line/s between South Pine and West Darra. No other alternatives identified.
	Transmission lines	110 kV line between Mudgeeraba and Terranora – line refit works.	Ongoing need exists for Mudgeeraba–Terranora 110 kV transmission circuits. No alternatives identified.
	Transmission lines	275 kV lines between Karana Tee to Bergins Hill to Belmont – line refit works.	Ongoing need exists for 275 kV transmission circuits between Karana tee and Bergins Hill to Belmont. No alternatives identified.
	Transmission lines	275 kV lines between South Pine and Karana Tee – line refit works.	Ongoing need exists for 275 kV transmission circuits between South Pine and Karana Tee. No alternatives identified.
	Transmission lines	275 kV line between Greenbank and Mudgeeraba – line refit works.	Ongoing need exists for 275 kV transmission circuits between Greenbank and Mudgeeraba. No alternatives identified.

MEASURES AND ABBREVIATIONS

Units of measure

Abbreviation	Unit of measure
kV	Kilovolts
MW	Megawatts
MWh	Megawatt hours

Abbreviations

Abbreviation	Expanded name
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
COAG	Council of Australian Governments
NCIPAP	Network Capability Incentive Parameter Action Plan
NTNDP	National Transmission Network Development Plan
NEM	National Electricity Market
NEO	National Electricity Objective
NEL	National Electricity Law
NTP	National Transmission Planner
TNSP	Transmission Network Service Provider

GLOSSARY

This report uses many terms that have meanings defined in the National Electricity Rules. The Rules meanings are adopted unless otherwise specified.

Term	Definition
Annual planning report	An annual report providing forecasts of gas or electricity (or both) supply, capacity, and demand, and other planning information.
Augmentation	The process of upgrading the capacity or service potential of some part of a transmission (or a distribution) network.
Connection point	The point at which the transmission and distribution network meet.
Constraint	Any limitation on the operation of the transmission system that will give rise to unserved energy (USE) or to generation re-dispatch costs.
Consumer	See customer.
Contingency event	An event affecting the power system, such as the failure or unplanned removal from operational service of a generating unit or transmission network element.
Credible contingency event	A contingency event AEMO considers reasonably possible, given the circumstances in the power system.
Critical contingency	The specific forced or planned outage that has the greatest potential to impact on the electricity transmission network at any given time.
Customer	A person who engages in the activity of purchasing electricity supplied through a transmission or distribution system to a connection point.
Demand-side participation (DSP)	The situation where customers vary their electricity consumption in response to a change in market conditions, such as the spot price.
Distribution network	A network that is not a transmission network.
Generation	The production of electrical power by converting another form of energy in a generating unit.
Generation capacity	The amount (in megawatts (MW)) of electricity that a generating unit can produce under nominated conditions.
Generator	A person who engages in the activity of owning, controlling or operating a generating system that is connected to, or who otherwise supplies electricity to, a transmission or distribution system and who is registered by AEMO as a generator under Chapter 2 (of the Rules) and, for the purposes of Chapter 5 (of the Rules), the term includes a person who is required to, or intends to register in that capacity.
Jurisdictional planning body (JPB)	An entity nominated by the relevant Minister of the relevant participating jurisdiction as having transmission system planning responsibility (in that participating jurisdiction).
Load	A connection point or defined set of connection points at which electrical power is delivered to a person or to another network or the amount of electrical power delivered at a defined instant at a connection point, or aggregated over a defined set of connection points.
Maximum demand (MD)	The highest amount of electrical power delivered, or forecast to be delivered, over a defined period (day, week, month, season, or year) either at a connection point, or simultaneously at a defined set of connection points.

Term	Definition
National Electricity Law	The National Electricity Law (NEL) is a schedule to the National Electricity (South Australia) Act 1996, which is applied in other participating jurisdictions by application acts. The NEL sets out some of the key high-level elements of the electricity regulatory framework, such as the functions and powers of NEM institutions, including AEMO, the AEMC, and the AER.
National Electricity Market (NEM)	The wholesale exchange of electricity operated by AEMO under the National Electricity Rules (Rules).
National Electricity Objective (NEO)	Defined in Section 7 of the National Electricity Law (NEL). To promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to: • Price, quality, safety, reliability and security of supply of electricity, and • The reliability, safety and security of the national electricity system.
National Electricity Rules (Rules)	The National Electricity Rules (Rules) describes the day-to-day operations of the NEM and the framework for network regulations. See also 'National Electricity Law'.
National Transmission Network Development Plan (NTNDP)	An annual report to be produced by AEMO that replaces the existing National Transmission Statement (NTS) from December 2010. Having a 20-year outlook, the NTNDP will identify transmission and generation development opportunities for a range of market development scenarios, consistent with addressing reliability needs and maximising net market benefits, while appropriately considering non-network options.
Network	The apparatus, equipment, plant and buildings used to convey, and control the conveyance of, electricity to customers (whether wholesale or retail) excluding any connection assets. In relation to a network service provider, a network owned, operated or controlled by that network service provider.
Network capability	The capability of the network or part of the network to transfer electricity from one location to another.
Network congestion	When a transmission network cannot accommodate the dispatch of the least-cost combination of available generation to meet demand.
Non-network option	An option intended to relieve a limitation without modifying or installing network elements. Typically, non-network options involve demand-side participation (DSP) (including post contingent load relief) and new generation on the load side of the limitation.
Planning criteria	Criteria intended to enable the jurisdictional planning bodies (JPBs) to discharge their obligations under the Rules and relevant regional transmission planning standards.
Power system	The National Electricity Market's (NEM) entire electricity infrastructure (including associated generation, transmission, and distribution networks) for the supply of electricity, operated as an integrated arrangement.
Power system reliability	The ability of the power system to supply adequate power to satisfy customer demand, allowing for credible generation and transmission network contingencies.
Power system security	The safe scheduling, operation, and control of the power system on a continuous basis in accordance with the principles set out in clause 4.2.6 (of the Rules).
Probability of exceedance (POE) maximum demand	The probability, as a percentage, that a maximum demand (MD) level will be met or exceeded (for example, due to weather conditions) in a particular period of time. For example, for a 10% POE MD for any given season, there is a 10% probability that the corresponding 10% POE projected MD level will be met or exceeded. This means that 10% POE projected MD levels for a given season are expected to be met or exceeded, on average, 1 year in 10.
Primary plant	Equipment which are directly connected to the high voltage. These include circuit breakers, isolators, current transformers, voltage transformers and bushings etc.

Term	Definition
Region	An area determined by the AEMC in accordance with Chapter 2A of the National Electricity Rules (Rules).
Reliability	The probability that plant, equipment, a system, or a device, will perform adequately for the period of time intended, under the operating conditions encountered. Also, the expression of a recognised degree of confidence in the certainty of an event or action occurring when expected.
Supply	The delivery of electricity.
Transmission network	A network within any National Electricity Market (NEM) participating jurisdiction operating at nominal voltages of 220 kV and above plus: (a) any part of a network operating at nominal voltages between 66 kV and 220 kV that operates in parallel to and provides support to the higher voltage transmission network, (b) any part of a network operating at nominal voltages between 66 kV and 220 kV that is not referred to in paragraph (a) but is deemed by the Australian Energy Regulator (AER) to be part of the transmission network.
Transmission system	A transmission network, together with the connection assets associated with the transmission network (such as transformers), which is connected to another transmission or distribution system.
Unserved energy (USE)	The amount of energy that cannot be supplied because there is insufficient generation capacity, demand-side participation (DSP), or network capability to meet demand.
Value of Customer Reliability (VCR)	A measure of the cost of unserved energy used in Regulatory Test assessments for planned augmentations for the Victorian electricity transmission system.

LIST OF COMPANY NAMES

The following table lists the full name and Australian Business Number (ABN) of companies that may be referred to in this document.

Company	Full company name	ABN/CAN
AEMC	Australian Energy Market Commission	49 236 270 144
AEMO	Australian Energy Market Operator	92 072 010 327
Powerlink	Queensland Electricity Transmission Corporation Limited t/a Powerlink Queensland	82 078 849 233