Powerlink Queensland

Transmission Annual Planning Report

Overview

2017

Message from the Chief Executive

As the industry continues to evolve, so must our approach to the challenges ahead to ensure the continued delivery of safe, reliable and cost efficient transmission services for Queensland consumers.

The past year has seen a significant increase in large-scale variable renewable electricity generation projects progressing across the state.

Seven large-scale renewable energy generators have committed to connect to the transmission network in Queensland, with more on the horizon. In addition further development has also occurred on our innovative concept – Renewable Energy Zones (REZs) – with the Queensland Government undertaking an EOI process for a potential site near Gladstone, and announcing a North Queensland Clean Energy Hub subject to a feasibility study.

Reinvestment in the transmission network remains a core focus for Powerlink, and we have looked at efficient ways to identify risks associated with assets reaching the end of service life and innovative techniques to extend the life of these assets.

The price of electricity continues to be a key issue for consumers. Powerlink made a commitment to deliver better value to consumers and customers in its five year revenue determination process. The Australian Energy Regulator's (AER) Final Decision on Powerlink's Revenue Determination 2017-2022 will see the transmission component of electricity bills reduce by almost a third.

Powerlink has continued its collaborative engagement approach with stakeholders, hosting a number of forums to share information and gather feedback. This feedback has also been used to inform the development of the 2017 Transmission Annual Planning Report (TAPR).

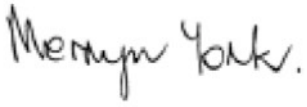
Our annual TAPR publishes Powerlink's comprehensive forecasting analysis providing the industry with valuable information on the outlook and decision-making drivers for the transmission network in Queensland.

Within the 2017 TAPR, you will find information on forecast electricity requirements, the transmission network's capability, the introduction of large-scale variable renewable electricity generation connections to the grid, and future investment required to ensure the ongoing safe and reliable management of our network.

This overview document provides a snapshot of key findings from the 2017 TAPR and outlines Powerlink's important role in the National Electricity Market, renewable energy connections which are occurring and potential, asset reinvestment strategy, plus the rationale behind our demand and energy forecasts.

As the electricity industry continues to transform, it's vital we continue to work with stakeholders to develop strategic solutions to address and navigate the challenges ahead.

Delivering a safe, reliable, and cost efficient transmission network is paramount, and I hope you find our 2017 TAPR a useful resource in understanding Powerlink's strategy to achieve this for Queensland.



Merryn York
Chief Executive
Powerlink Queensland

About Powerlink

Powerlink Queensland is a Government Owned Corporation that owns, develops, operates and maintains the electricity transmission network in Queensland. Our transmission network runs approximately 1,700km from Cairns down to New South Wales.

With electricity being a key enabler of the economy and supporter of our modern lifestyles, we have an important responsibility to deliver electricity to almost four million Queenslanders.

Powerlink's role in the electricity supply chain is to transport high voltage electricity, generated at major power stations, through its transmission grid to the distribution networks owned by Energex, Ergon Energy and Essential Energy (in northern New South Wales) to supply customers.

We also transport electricity to high usage industrial customers such as rail companies, mines and mineral processing facilities, and to New South Wales via the Queensland/NSW Interconnector transmission line.

Electricity prices

Powerlink recognises that the price of electricity continues to be a key issue for Queenslanders.

For the average Queensland residential electricity consumer, use of Powerlink's high voltage grid represents about 8% of the total delivered cost of electricity. Although this is a relatively small component in the supply chain that makes up an electricity bill, we are mindful of our contribution and strive to ensure our transmission services are delivered as cost effectively as possible.

8%

The cost of Powerlink's high voltage electricity grid represents around 8%* of the total delivered cost of electricity for the typical Queensland residential electricity consumer.

Electricity supply chain components	Proportion of electricity bill
Generators and retailers	41%
High voltage transmission	8%
Electricity distribution	42%
Environmental policies	9%

*Australian Energy Market Commission (AEMC) 2016 Residential Electricity Price Trends Report

The Australian Energy Regulator (AER) released its Final Decision on Powerlink's Revenue Proposal in April 2017. The decision provides for a 28.5% reduction in transmission price, with less than CPI increases in future years.

Powerlink's approach was to align with the AER's guidelines as much as possible, proposing a reasonable level of revenue to allow us to safely and efficiently operate our network while responding to the concerns of consumers and customers over electricity prices.

Transmission component of electricity prices

28.5% drop in indicative transmission price in 2017/18

Between **$23 and $38** savings for the average Queensland residential household annual electricity bill

Why we forecast demand and energy

Powerlink's planning processes play an important role in ensuring our network and business priorities continue to meet the needs of participants in the National Electricity Market (NEM) and electricity consumers.

We undertake our annual planning review in accordance with the requirements of the National Electricity Rules, and publish the findings of this review in our TAPR.

The TAPR's purpose is to provide information about the Queensland electricity transmission network to everyone interested or involved in the NEM – including the Australian Energy Market Operator (AEMO, who operates the NEM), Registered Participants (entities registered with AEMO who participate in trading activities or provide services for the operation of the market), and interested parties.

The TAPR also provides broader stakeholders with an overview of Powerlink's planning processes and decision-making on future investments – which offers market intelligence to a range of interested groups.

The TAPR includes information on:

electricity demand and energy forecasts

performance of the existing transmission network

committed generation and network developments

forecast network capability

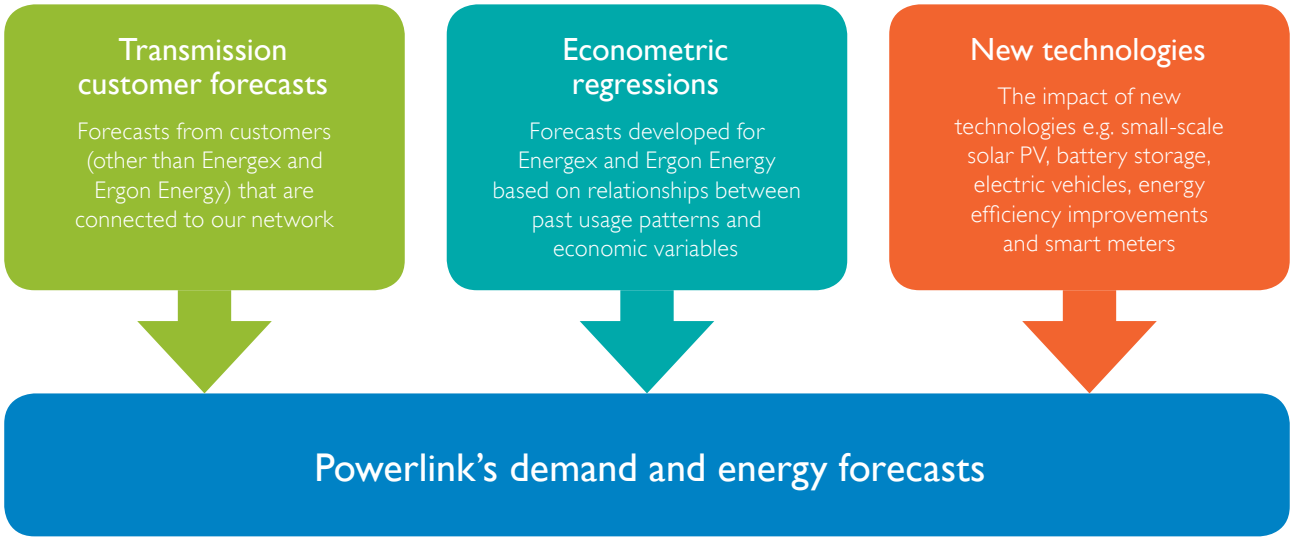
potential future network developments and non-network developments (e.g. demand side management alternatives)

Our forecasting methodology

Powerlink takes a comprehensive and consultative approach to developing and applying a robust forecasting methodology to produce the TAPR.

Transmission network planning is a complex task and requires detailed analysis performed by our specialist planning engineers. We recognise the external pressures shaping the future of our business and strive to identify and respond to these trends in a timely manner.

We look at two major components when developing our forecasts – demand (instantaneous electricity usage) and energy (electricity usage over a full year). To prepare these forecasts, Powerlink uses a 'building block' approach of seeking input from a range of external sources including AEMO, network customers and broader market research.



The energy and demand forecasts presented in this TAPR consider the following factors:

- continued growth of solar photovoltaic (PV) installations, including the impact of large-scale solar PV farms in the distribution network
- changing Queensland economic growth conditions over the forecasting horizon
- continued consumer response to high electricity prices
- the impact of energy efficiency initiatives, battery storage technology and tariff reform.

New technologies continue to have strong industry and consumer interest and influence on our forecasts.

Powerlink continued its commitment to engage with stakeholders, conducting a number of forums with industry experts throughout the year, to share insights and build on our knowledge relating to emerging technologies, demand forecasts and area planning. As a result, we have drawn on the forum findings within this TAPR, to inform the development of more robust and useful forecasts and approach to emerging technologies.

Our demand and energy forecast

The forecasts presented in this TAPR indicate relatively flat growth for energy, summer maximum demand, and winter maximum demand in the first half of the 10 year forecast, with moderate growth highlighted for the latter half.

While there has been significant investment in the resources sector, global price signals for resources such as coal and gas are unlikely to result in further developments in the short-term. Queensland on the whole is still experiencing slow economic growth, however solid growth is expected to return for the second half of the forecast period.

The Australian dollar has remained relatively low, improving growth prospects in areas such as tourism and foreign education, with sustained low interest rates providing a boost to the housing industry. Queensland's population growth has slowed following the resources boom and is expected to increase by around 15% to around 5.6 million over the 10-year forecast period.

Consumer response to electricity prices continues to have a dampening effect on electricity usage. Ongoing developments in battery storage technology coupled with small-scale solar PV could result in significant changes to future electricity usage patterns.

In particular, battery storage technology has the potential to flatten electricity usage, reducing the need to develop transmission services to cover short duration peaks. We remain committed to understanding the future impacts of emerging technologies so that our transmission network services are developed in a way most valued by consumers.

Demand forecast

The information presented in the TAPR indicates that the summer demand is forecast to increase at an average rate of 0.6% per annum over the next 10 years. This is illustrated in Figure 1.

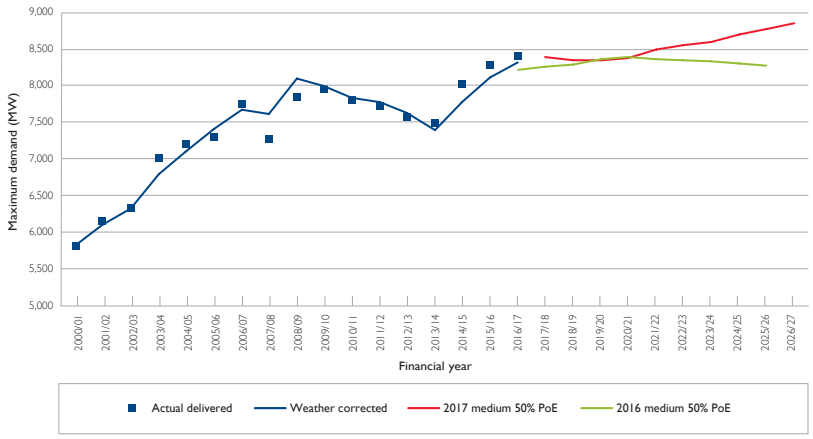


Figure 1: Comparison of summer demand forecasts for the medium economic outlook

Energy forecast

Energy consumption is forecast to increase by an average 0.4% per annum over the next 10 years. This shows a reduction compared to the 2016 TAPR as illustrated in Figure 2.

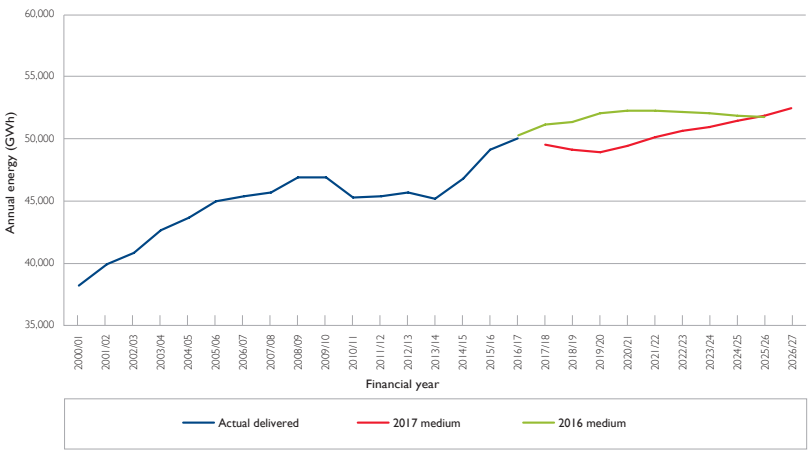


Figure 2: Comparison of energy forecasts for the medium economic outlook

What we do with our planning information

Powerlink's comprehensive planning approach identified a number of opportunities for us to respond to external changes and deliver effective solutions.

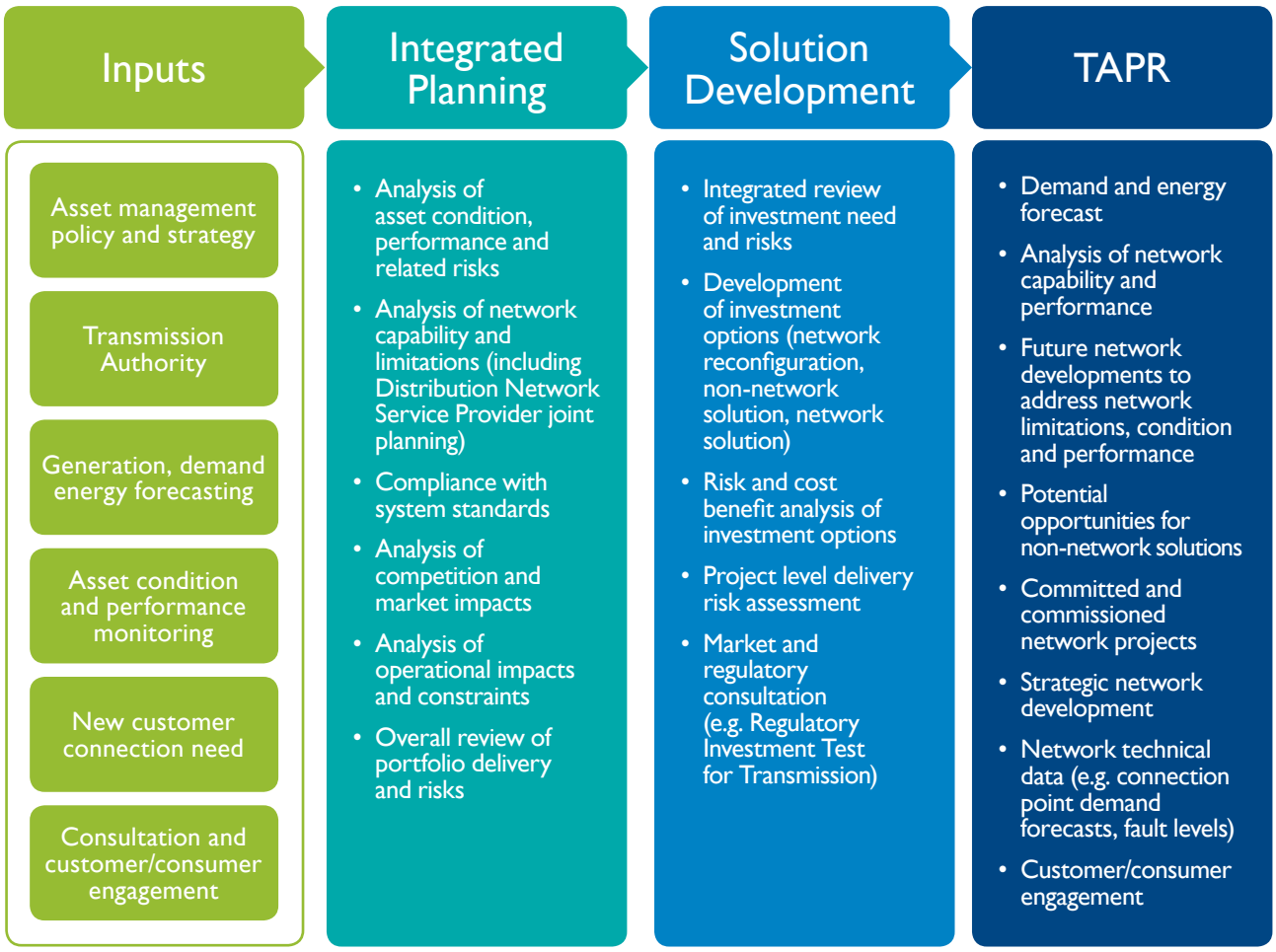
Powerlink's focus continues to be on striking the right balance between reliability and cost of transmission services. Our response to the fundamental shifts in the operating environment has seen Powerlink:

- adapt our approach to investment decisions
- place considerable emphasis on an integrated and flexible analysis of future reinvestment needs.

The reliability planning standard and heightened emphasis on cost-effectiveness, has allowed for increased flexibility in network planning. It has also had the effect of deferring or reducing the extent of investment in network or non-network solutions required in response to demand growth. We will continue to design, operate and maintain our network to reduce costs and maintain reliability to consumers.

Our integrated planning approach has also identified a number of opportunities for reconfiguration of Powerlink's network within the outlook period. Powerlink has also sought to include additional information in the TAPR relating to long-term network reconfiguration strategies that will require further stakeholder engagement and consultation in the coming years.

Overview of Powerlink's TAPR planning process



Growth of renewable energy sources

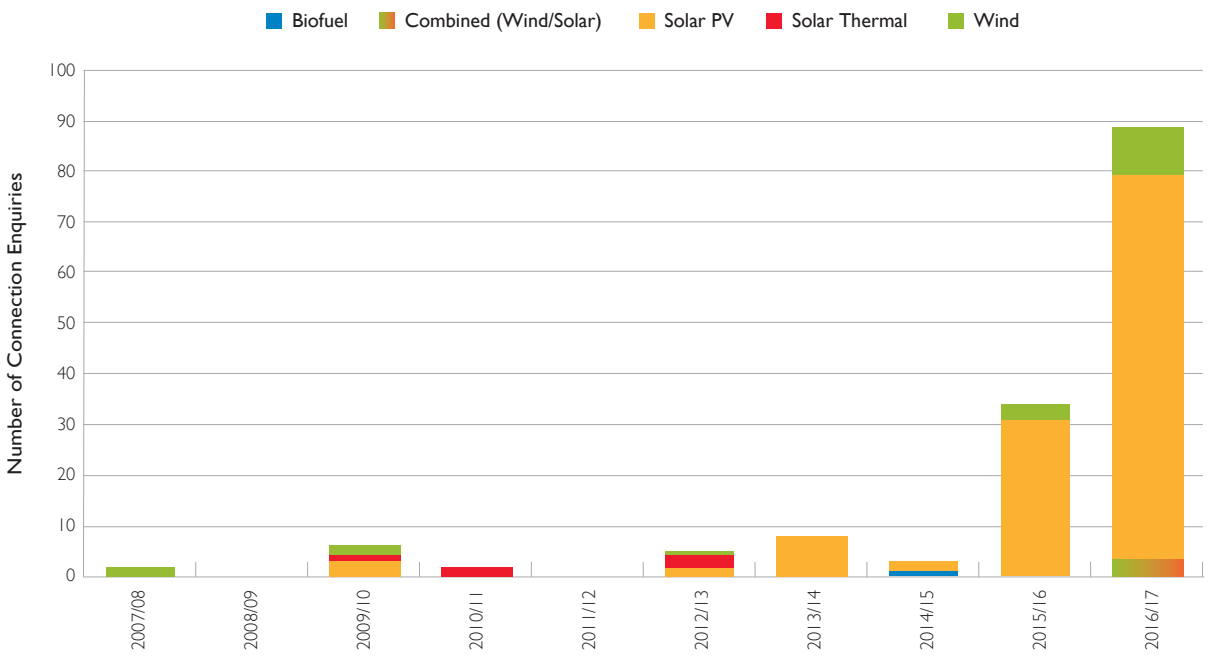
Queensland is very active for large-scale variable renewable electricity generation projects.

Powerlink has significantly built upon its understanding and response to the impacts and opportunities associated with the growing developments in renewable energy generation. For the second time, the TAPR has incorporated a chapter to explore how the diverse range of electricity generation sources can be readily incorporated into the National Electricity Market, and what Powerlink is doing to make the process to connect simpler and more efficient.

Queensland is rich in a diverse range of renewable energy resources – solar, geothermal, biomass, wind and hydro – and Powerlink is committed to supporting all types of energy projects requiring connection to the transmission network.

Powerlink will play a key role in enabling the connection of variable renewable energy infrastructure developments to provide a sustainable, low carbon future for electricity producers and users in Queensland.

Variable renewable electricity generation connection enquiries[1]



Connecting variable renewable electricity generation to the transmission network

To maintain agility and responsiveness to changes in how electricity is generated, Powerlink has refined its renewable project connection process through strategic engagement with industry stakeholders.

Connection costs, provision of information and shared network connections were some of the key considerations explored. Powerlink has implemented targeted changes that provide strategic benefits for proponents, including plant with asset lives matched to the 25 year project life and shortening of lead times and cost through standardisation.

Powerlink understands customer needs and has established a process to provide proponents with key project specific information.

In 2016/17 seven renewable energy generators totalling 718MW committed, and Powerlink received more than 80 new connection enquiries totalling in excess of 15,000MW.

Committed transmission connected renewable generation projects

Zone	Project	Registered capacity (MW)	Connection location
Far North	Mt Emerald Wind Farm	180	New Walkamin Substation near Chalumbin
Ross	Ross River Solar Farm	125	Ross
Ross	Clare Solar Farm	136	Clare South
North	Whitsunday Solar Farm	57	Strathmore
North	Hamilton Solar Farm	57	Strathmore
Wide Bay	Teebar Solar Farm	53	Teebar Creek
Bulli	Darling Downs Solar Farm	110	Darling Downs

*Committed during 2016/17

[1] Connection activity details as at 1 June 2017

Supporting renewable energy infrastructure development

Powerlink recognises the importance of supporting the development of renewable energy projects in Queensland. While the majority of recent interest focuses on solar related activity, we also recognise the considerable opportunity for diversity of electricity generation including wind, biomass, geothermal and hydroelectric projects in Queensland.

We believe our Renewable Energy Zone (REZ) concept will work most efficiently when connecting these diverse forms of generation – sharing the infrastructure capacity between parties with limited congestion.

Positive feedback on the REZ concept is supported by the 1,250 hectare site at Aldoga, near Gladstone, with Powerlink working closely with Economic Development Queensland (EDQ) to progress this opportunity.

More recently the Queensland Government has announced in the *Powering Queensland Plan* a feasibility study into the development of strategic transmission infrastructure in north and north-west Queensland to support a Clean Energy Hub.

These initiatives have the potential to act as a catalyst for further REZ opportunities across Queensland.

economic benefit to customers

energy resource potential

infrastructure availability and access

stakeholder and local authority support

environmental suitability

potential opportunity for deferral or replacement of network investment projects

The future of energy

Powerlink will continue to widely engage with market participants and interested parties across the renewables sector to better understand the potential for renewable energy and to identify opportunities and emerging limitations as they occur.

We are committed to effectively aligning our business with the ever-changing operating environment, and have a strong focus on further exploring efficient connection arrangements for renewable energy developments across Queensland.

An integrated approach to drive future investment

Ultimately, our annual planning review processes holistically analyse, prioritise and validate network investment.

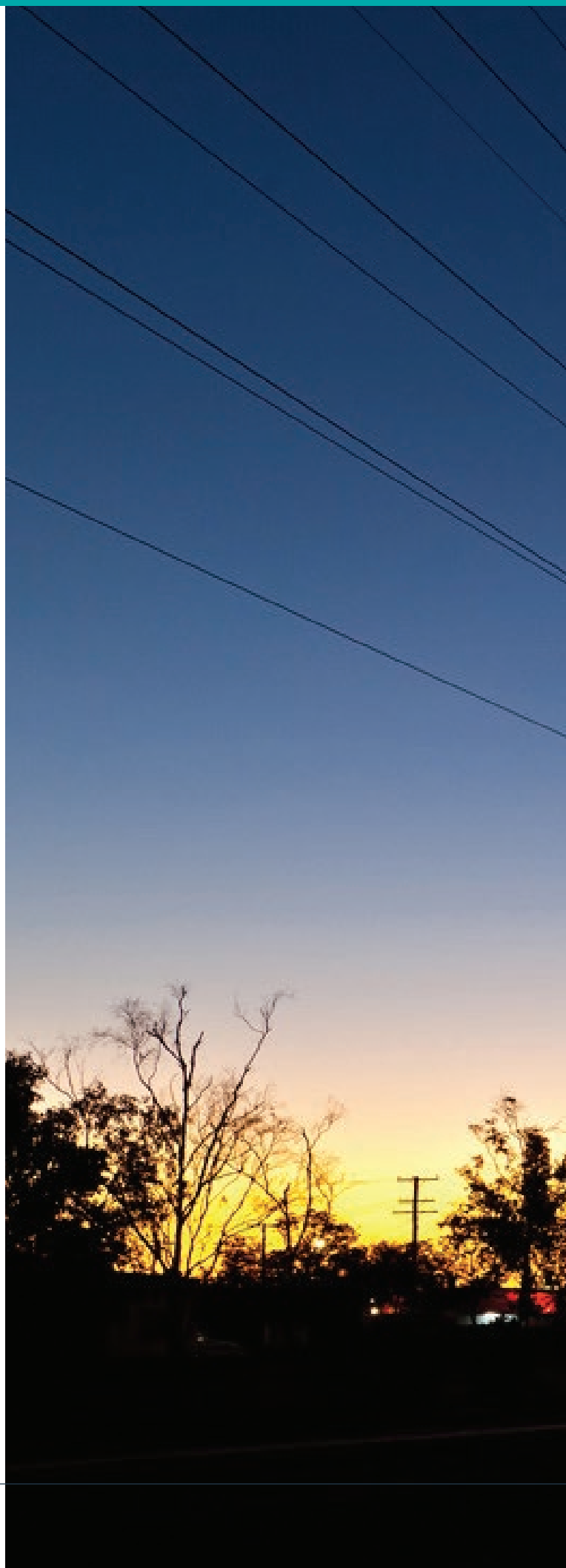
Our planning for future network development focuses on optimising the network topology based on several considerations:

- forecast demand
- new customer supply requirements
- existing network configuration
- condition-based risks related to existing assets.

The energy industry is going through a period of transformation driven by fundamental shifts in economic outlook, electricity consumer behaviour, government policy and regulation and emerging technologies. These are all factors that have reshaped the environment in which Powerlink delivers its transmission services.

Powerlink has adapted its approach to reinvestment decisions, with a particular focus on assessing whether there is an enduring need for particular key assets, and seeking alternative investment options via network reconfiguration to manage asset condition and/or non-network solutions, where feasible.

Assuming demand for electricity remains relatively flat as forecast in this TAPR, Powerlink does not anticipate undertaking any significant augmentation works within the five-year outlook period other than works which could potentially be triggered from economic drivers and/or the commitment of mining or industrial block loads.



Our committed projects

Transmission development and network reinvestment projects that are committed and underway as at June 2017 include:

Project	Purpose	Zone location	Proposed commissioning date
Turkinje secondary systems replacement	Maintain supply reliability in the Far North zone	Far North	Summer 2018/19
Garbutt to Alan Sherriff 132kV line replacement	Maintain supply reliability in the Ross zone	Ross	Summer 2017/18
Garbutt transformers replacement	Maintain supply reliability in the Ross zone	Ross	Winter 2019
Ingham South 132/66kV transformers replacement	Maintain supply reliability in the Ross zone	Ross	Summer 2019/20
Nebo 275/132kV transformer replacements	Maintain supply reliability in the North zone (1)	North	Progressively from summer 2013/14 to summer 2017/18
Proserpine Substation replacement	Maintain supply reliability in the North zone	North	Summer 2017/18
Moranbah 132/66kV transformer replacement	Maintain supply reliability in the North zone	North	Winter 2018
Line refit works on the 132kV transmission line between Collinsville North and Proserpine substations	Maintain supply reliability to Proserpine	North	Summer 2018/19
Mackay Substation replacement	Maintain supply reliability in the North zone	North	Summer 2018/19
Line refit works on the 132kV transmission line between Eton Tee and Alligator Creek Substation	Maintain supply reliability in the North zone	North	Summer 2020/21
Nebo primary plant and secondary systems replacement	Maintain supply reliability in the North zone	North	Summer 2022/23
Calvale 275/132kV transformer reinvestment	Maintain supply reliability in the Central West zone (2)	Central West	Summer 2017/18
Blackwater Substation replacement	Maintain supply reliability in the Central West zone	Central West	Summer 2017/18
Baralaba secondary systems replacement	Maintain supply reliability in the Central West zone	Central West	Summer 2017/18
Moura Substation replacement	Maintain supply reliability in the Central West zone	Central West	Summer 2017/18

Project	Purpose	Zone location	Proposed commissioning date
Line refit works on 132kV transmission lines between Calliope River to Boyne Island	Maintain supply reliability in the Central West zone	Central West	Summer 2017/18
Calvale 275/132kV transformer reinvestment	Maintain supply reliability in the Central West zone (2)	Central West	Summer 2017/18
Stanwell secondary systems replacement	Maintain supply reliability in the Central West zone	Central West	Summer 2018/19
Dysart Substation replacement	Maintain supply reliability in the Central West zone	Central West	Summer 2019/20
Dysart transformer replacement	Maintain supply reliability in the Central West zone	Central West	Summer 2019/20
Calvale and Callide B secondary systems replacement	Maintain supply reliability in the Central West zone (3)	Central West	Winter 2021
Line refit works on 132kV transmission lines between Calliope River to Boyne Island	Maintain supply reliability in the Central West zone	Gladstone	Summer 2017/18
Wurdong secondary systems replacement	Maintain supply reliability in the Gladstone zone	Gladstone	Summer 2018/19
Line refit works on 275kV transmission line between Woolooga and Palmwoods	Maintain supply reliability in the Wide Bay zone	Wide Bay	Winter 2019
Blackwall IPASS secondary systems replacement	Maintain supply reliability in the Moreton zone	Moreton	Summer 2017/18
Tennyson secondary systems replacement	Maintain supply reliability in the Moreton zone	Moreton	Summer 2018/19
Rocklea secondary systems replacement	Maintain supply reliability in the Moreton zone	Moreton	Summer 2018/19
Mudgeeraba 110kV Substation primary plant and secondary systems replacement	Maintain supply reliability in the Gold Coast zone	Gold Coast	Summer 2017/18
Mudgeeraba 275/110kV transformer replacement	Maintain supply reliability in the Gold Coast zone	Gold Coast	Summer 2017/18

Note:

(1) The first transformer was commissioned in August 2013.

(2) Approved works were rescoped as part of the Callide A/Calvale 132kV transmission reinvestment, previously named Callide A Substation replacement. Refer to Section 4.2.4.

(3) The majority of Powerlink's staged works are anticipated for completion by summer 2018/19. Remaining works associated with generation connection will be coordinated with the customer.

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