Transmission Annual Planning Report Overview 2018

Powerlink QUEENSLAND®

Message from the Chief Executive

The energy industry is undergoing significant change, but our approach remains future focused and takes into account our customers' expectations.

The 2017/18 summer in Queensland set a new record demand of 9,796MW (as generated) in February — well above the 2017 record of 9,412MW. This peak demand reinforces the importance of our continued focus on delivering safe, reliable and cost-efficient transmission services for our customers.

Dynamic changes in the external environment, including the upturn in Variable Renewable Energy (VRE) developments in Queensland, are reshaping the operating environment in which Powerlink delivers its transmission services.

Powerlink is responding to these changes by implementing and adopting the recommendations of the Finkel and other reviews, adapting to changes in electricity customer behaviour and continuing to seek customer input into decision making.

This year Powerlink responded to more than 120 connection enquiries comprising almost 25,000MW of potential VRE generation and finalised seven new VRE generator Connection and Access Agreements (CAAs) totalling 1,012MW.

We have also continued to engage with our customers holding various consultation opportunities including forums, webinars, Customer Panel meetings and a survey of our key stakeholders. Our Transmission Network Forum attracted a record number of participants with the feedback received incorporated into our decision making and planning.

The 2018 Transmission Annual Planning Report (TAPR) is a key part of our planning process and provides stakeholders with an overview of Powerlink's technical analysis and decision making on potential future investments.

Within the 2018 TAPR you will find information on energy and demand forecasts, and committed generation and network developments. It also provides estimates of transmission grid capability and potential network and non-network developments required in the future to continue to safely and reliably meet electricity demand.

This overview document provides you with a summary of the key findings from the 2018 TAPR including our planning approach, commitment to the growth of renewable energy and planned future investments.

I hope you find our 2018 TAPR a useful resource in understanding how we are part of enriching lifestyles and powering economic growth for almost four million Queenslanders, as well as our directly connected customers.

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.

Additional information in the 2018 TAPR

Since the publication of the 2017 TAPR, there have been a number of National Electricity Rule (NER) changes. Based on these changes, additional information in the 2018 TAPR includes:

- new information in relation to joint planning and Powerlink's approach to asset management
- enhanced information in relation to forecasting data, sources of input and assumptions
- information on network control facilities and the outcome of the inaugural Power System Frequency Risk Review
- discussion on recent changes to the network connection and RIT-T process
- possible network reinvestments, non-network opportunities or asset retirements in the next 10 years.

Electricity prices

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

For the average Queensland residential electricity customer, use of Powerlink's high voltage grid represents about 7% 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.

7%

The cost of Powerlink's high voltage electricity grid represents around 7%* 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	42%
High voltage transmission	7%
Electricity distribution	40%
Retail and other^	7%
Environmental policies	4%

* Australian Energy Market Commission (AEMC) 2017 Residential Electricity Price Trends Report

^ Includes costs associated with retail, losses and errors in the estimated value of all other supply chain cost components. The Australian Energy Market Commission 2017 Residential Electricity Price Trends Report refers to the overall component as residual.

Powerlink is committed to engaging with electricity customers

Engaging with customers is extremely important and allows Powerlink to ensure its services better reflect customer values, priorities and expectations.

During 2017/18 Powerlink:

- hosted its Customer Panel which is comprised of members from a range of sectors including energy industry, resources, community advocacy groups, customers and research organisations
- held a Transmission Network Forum and Future Transmission Network webinars to receive stakeholder input on investment and forecasting considerations on a number of key topics, including investment and forecasting considerations
- worked with Energex and Ergon Energy (part of the Energy Queensland Group) to jointly conduct the Queensland Household Energy Survey to improve understanding of customer behaviours and intentions
- continued to build its engagement processes with non-network providers.

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 customers.

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

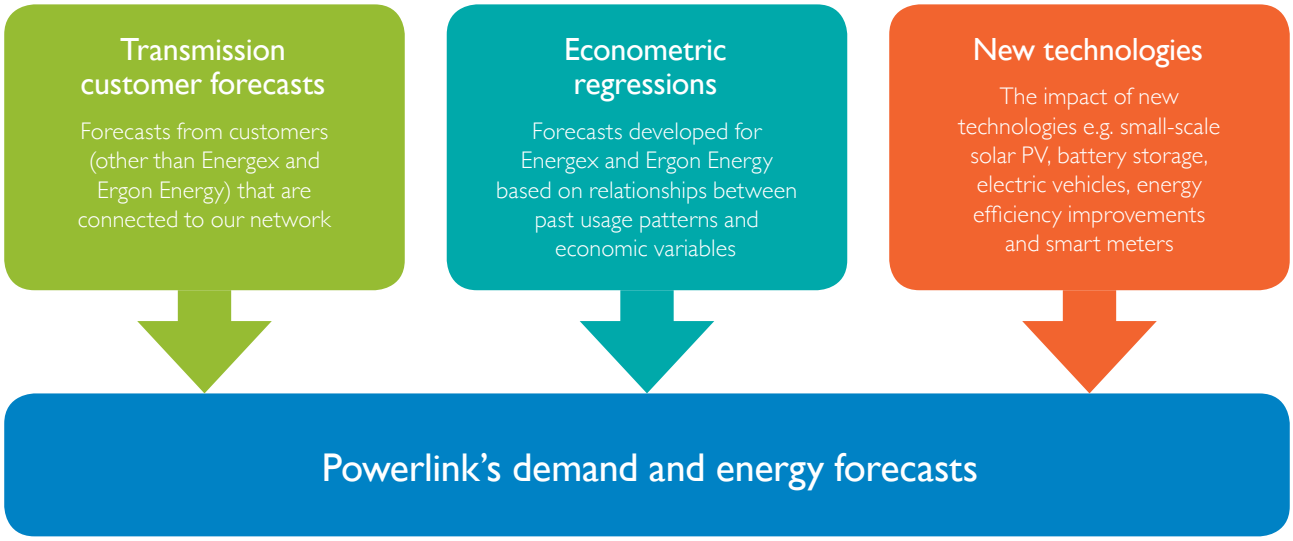
potential future network developments and non-network developments (e.g. demand side management alternatives)

Our forecasting methodology

Powerlink takes a comprehensive and transparent approach to developing and applying a robust forecasting methodology to produce the 2018 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.



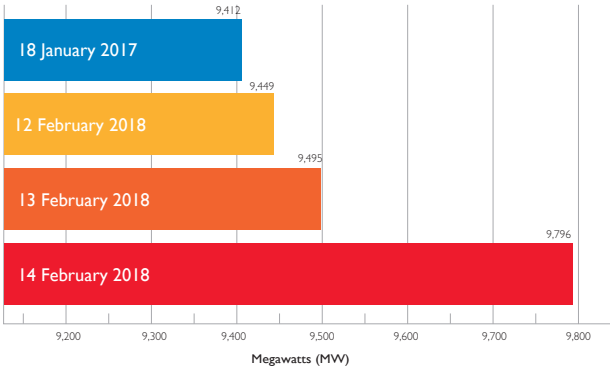
The energy and demand forecasts presented in the 2018 TAPR consider the following factors:

- customer response to forecast reductions in retail electricity prices
- continued growth of solar photovoltaic (PV) installations, including solar PV farms connecting to the distribution network
- forecast improvement in Queensland economic growth conditions over the outlook period
- the impact of energy efficiency initiatives, battery storage technology and tariff reform.

Our demand and energy forecast

Three peak demand records were broken in Queensland in mid-February. The highest demand recorded was 9,796MW (as generated) on 14 February, well above the 2017 record of 9,412MW.

The forecasts presented in the 2018 TAPR indicate low growth for summer and winter maximum demand and a decline in delivered energy for the transmission network over of the 10-year outlook period.



It is expected that Queensland's delivered energy consumption will decline over the next 10 years due to the committed and uncommitted solar and wind farms connecting to the distribution networks in response to market and policy incentives.

Powerlink remains focused on understanding the potential future impacts of emerging technologies so transmission network services are developed in ways that are valued by customers.

Demand forecast

The information presented in the 2018 TAPR indicates that the summer demand is forecast to increase at an average rate of 0.4% per annum over the next 10 years. This is illustrated in Figure 1.

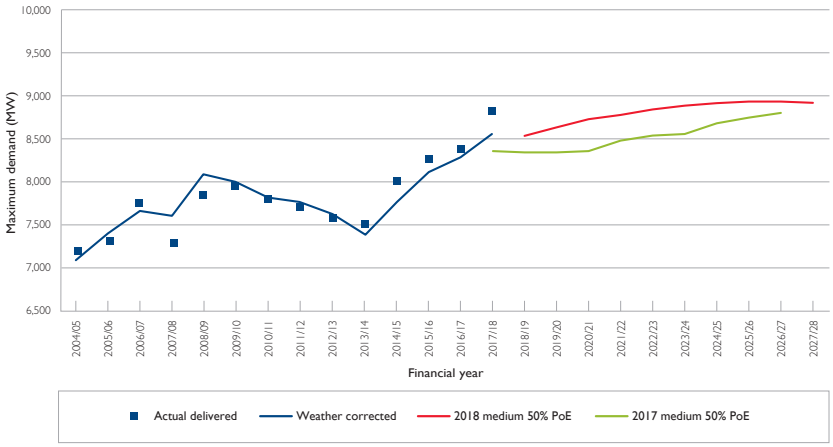


Figure 1: Comparison of summer demand forecasts for the medium economic outlook

Energy forecast

Energy consumption is forecast to decrease by an average 0.7% per annum over the next 10 years. This shows a significant reduction compared to the 2017 TAPR as illustrated in Figure 2.

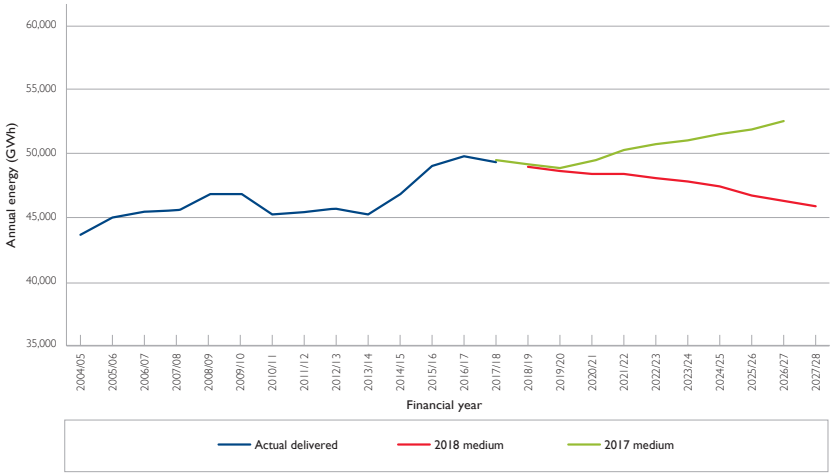


Figure 2: Comparison of energy forecasts for the medium economic outlook

What we do with our planning information

Powerlink is continuing to focus on delivering the right balance between reliability and cost of transmission services.

Changes in the external environment are reshaping the operating environment in which Powerlink delivers its transmission services. Powerlink is responding to these changes by:

- continuing to seek customer input into decision making and planning
- implementing and adopting the recommendations of the Finkel and other reviews
- adapting to changes in electricity customer behaviour and economic outlook
- executing multiple regulatory changes introduced during 2017
- continuing to adapt its approach to investment decisions
- placing considerable emphasis on an integrated and flexible analysis of future reinvestment needs
- supporting diverse generation connection
- continuing to focus on developing options that deliver a secure, safe, reliable and cost-effective transmission network.

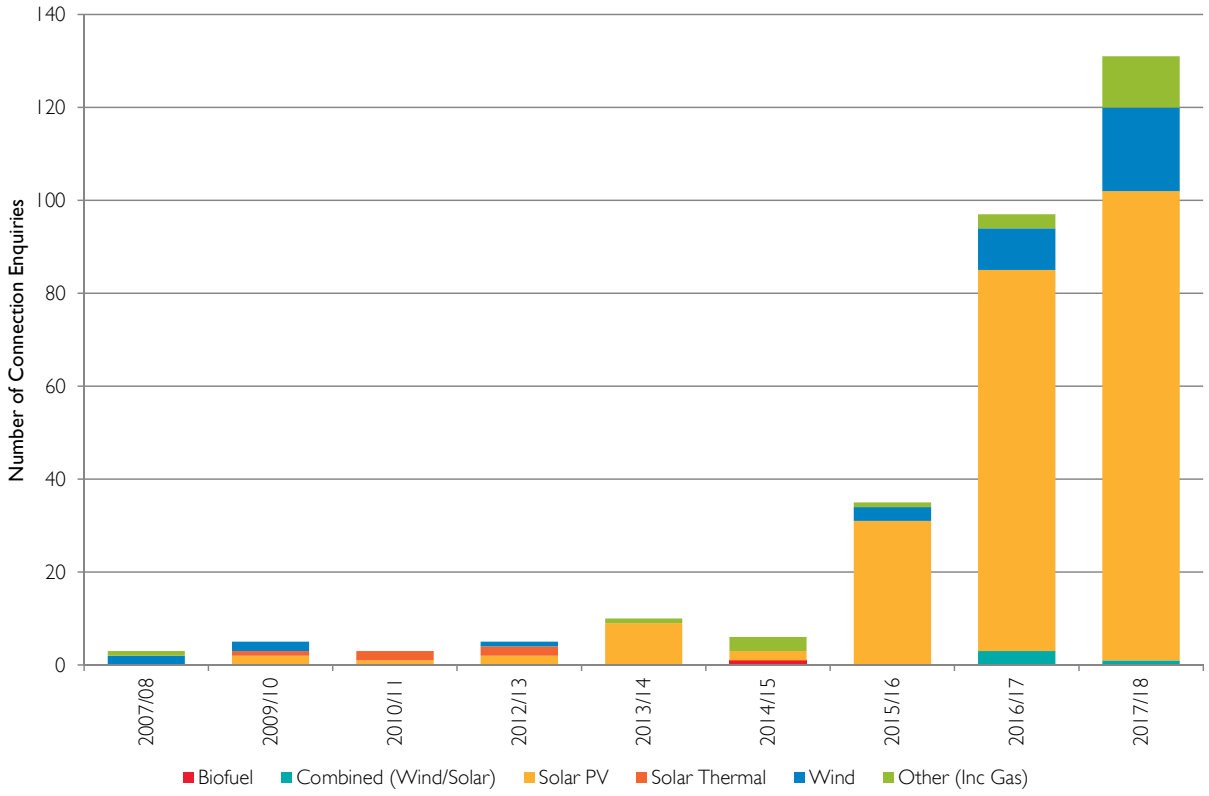
Renewable energy generation connection enquiries

Queensland is rich in a diverse range of VRE resources making the state an attractive location for large-scale VRE generation development projects.

During the past year there has been a significant increase in the development of large-scale solar and wind generation farms. Fundamental external shifts such as these are shaping the operating environment in which Powerlink delivers its transmission services.

Powerlink is committed to supporting the development of all types of energy projects requiring connection to the transmission network. Powerlink also has a key role in enabling the connection of VRE infrastructure developments, which aim to provide a sustainable, low-carbon future for electricity producers and users in Queensland.

Renewable energy generation connection enquiries[1]



Committed transmission connected renewable generation projects

During 2017/18, Powerlink finalised seven CAAs for new semi-scheduled VRE generation, totalling 1,012MW. The following map outlines all of Powerlink's current renewable connection projects.

[1] Connection activity details as at 1 June 2018

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, hydroelectric and hydro pumped storage 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.

Powerlink is working to enhance the concept of the REZ based on recent experience around the connection of VRE, particularly in North 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.

Network planning studies have focused on evaluating the enduring need for existing assets in the context of a subdued demand growth outlook and the potential for network reconfiguration, coupled with alternative non-network solutions.

Based on the medium economic forecast outlook, the planning standard and committed network solutions, network augmentations to meet load growth are not forecast to occur within the 10-year outlook period of 2018 TAPR.

Following the Replacement Expenditure Planning Arrangements Rule which commenced in September 2017, Powerlink anticipates a significant RIT-T program in relation to the replacement of network assets, particularly over the next two years.

During 2017/18, Powerlink commenced regulatory processes associated with proposed future network reinvestments, in particular, where technically and economically feasible, to consider opportunities for non-network solutions to resolve network requirements.

Our committed projects

Transmission development and network reinvestment projects that are committed and underway as at June 2018 include:

Project	Purpose	Zone location	Proposed commissioning date
Turkinje secondary systems replacement	Maintain supply reliability in the Far North zone	Far North	December 2018
Garbutt transformers replacement	Maintain supply reliability in the Ross zone	Ross	June 2019
Moranbah 132/66kV transformer replacement	Maintain supply reliability in the North zone	North	July 2018
Nebo 275/132kV transformer replacements	Maintain supply reliability in the North zone (1)	North	November 2018
Mackay Substation replacement	Maintain supply reliability in the North zone	North	May 2019
Line refit works on the 132kV transmission line between Collinsville North and Proserpine substations	Maintain supply reliability to Proserpine	North	June 2019
Line refit works on the 132kV transmission line between Eton tee and Alligator Creek Substation	Maintain supply reliability in the North zone	North	October 2020
Nebo primary plant and secondary systems replacement	Maintain supply reliability in the North zone	North	August 2022
Calvale 275/132kV transformer reinvestment	Maintain supply reliability in the Central West zone (2)	Central West	May 2019
Moura Substation replacement	Maintain supply reliability in the Central West zone	Central West	May 2019 (1)
Stanwell secondary systems replacement	Maintain supply reliability in the Central West zone	Central West	November 2018
Dysart Substation replacement	Maintain supply reliability in the Central West zone	Central West	October 2019

Project	Purpose	Zone location	Proposed commissioning date
Dysart transformer replacement	Maintain supply reliability in the Central West zone	Central West	October 2019
Calvale and Callide B secondary systems replacement	Maintain supply reliability in the Central West zone (3)	Central West	June 2021
Line refit works on 132kV transmission lines between Calliope River and Boyne Island	Maintain supply reliability in the Central West and Gladstone zones	Gladstone	May 2019
Wurdong secondary systems replacement	Maintain supply reliability in the Gladstone zone	Gladstone	September 2019
Line refit works on 275kV transmission line between Woolooga and Palmwoods	Maintain supply reliability in the Wide Bay zone	Wide Bay	December 2019
Gin Gin Substation rebuild	Maintain supply reliability in the Wide Bay zone	Wide Bay	October 2020
Tennyson secondary systems replacement	Maintain supply reliability in the Moreton zone	Moreton	December 2018
Rocklea secondary systems replacement	Maintain supply reliability in the Moreton zone	Moreton	November 2019
Ashgrove West Substation replacement	Maintain supply reliability in the Moreton zone	Moreton	October 2020

Note:

(1) Major works completed in October 2017. Minor works scheduling is being coordinated with Ergon Energy (Energex and Ergon Energy are part of the Energy Queensland Group).

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

(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.

Contact us

Registered office	33 Harold St Virginia Queensland 4014 Australia ABN 82 078 849 233
Postal address	PO Box 1193 Virginia Queensland 4014 Australia
Telephone	+61 7 3860 2111 (during business hours)
Email	pqenquiries@powerlink.com.au
Website	www.powerlink.com.au
Social media	