

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 (HV) transmission network. It has been appointed by the Queensland Government as the Jurisdictional Planning Body (JPB) responsible for transmission network planning within the State.

## About the Transmission Annual Planning Report

Planning and development of the transmission network is integral to Powerlink Queensland meeting its obligations under the National Electricity Rules (NER), *Queensland's Electricity Act 1994* and its Transmission Authority.

The Transmission Annual Planning Report (TAPR) is a key part of the planning process and provides stakeholders and customers with important information about the existing and future transmission network in Queensland. The report is targeted at everyone interested or involved in the NEM including the Australian Energy Market Operator (AEMO), Registered Participants and interested parties. The TAPR also provides stakeholders with an overview of Powerlink's planning processes and decision-making on potential future investments.

The 2023 TAPR includes information on electricity energy and demand forecasts, existing and committed generation and outlines the key factors impacting Powerlink's transmission network development and operations. It discusses the energy transformation and how Powerlink is proactively planning and engaging with communities to support the rapidly changing power system while providing a valued service to customers. The TAPR also provides estimates of transmission grid capability and discusses the potential network and non-network developments required in the future to continue to meet electricity demand in a timely manner.

## Overview

The forecasts presented in this TAPR indicate mild growth for summer maximum demand, and further reductions in the minimum delivered demand. The forecast delivered energy from the transmission network over the 10-year outlook period remains relatively unchanged but with a slight upward trajectory mainly due to industries beginning to electrify their operations to meet their emission reduction targets from 2030.

Powerlink is playing an active role in shaping and enabling the Queensland power system of the future. Powerlink has continued to work closely with the Queensland Government in developing and actioning the Queensland Energy and Jobs Plan (QEJP), including the establishment of a new SuperGrid transmission backbone and establishment of new Renewable Energy Zones (REZs). Powerlink continues to guide the market and provide context to broader technical aspects associated with the energy transformation.

The capital expenditure required to manage emerging risks related to assets reaching the end of their technical service life continues to represent a substantial program of regulated work over the outlook period. Network planning studies for the 2023 TAPR have focussed on evaluating the enduring need for existing assets and the possible need for new assets to ensure network resilience in the context of increasing diversity of generation, long-term growth in demand outlook and the potential for network reconfiguration, coupled with alternative non-network solutions. Powerlink will also consider these potential needs holistically as part of the longer term planning process and in conjunction with AEMO's ISP and QEJP.

Powerlink's focus on community, customer and stakeholder engagement has continued over the last year, with a range of activities undertaken to seek feedback and input into Powerlink's network investment decision making and planning. This includes regular meetings of Powerlink's Customer Panel across a range of topics, including the Asset Reinvestment Review, a review of Powerlink's Network Development Process and the introduction of a new SuperGrid Landholder Payment Framework to assist landholders and landholders on neighbouring properties adjacent to transmission infrastructure.

As a founding participant since 2018, Powerlink has continued its commitment to the whole of sector Energy Charter initiative. The charter is focussed on driving a customer-centric culture and conduct in energy businesses to create price and service delivery improvements for the benefit of customers. Powerlink played a key role in the development of the Energy Charter [Better Practice Social Licence Guideline](#) released in May 2023. This work was completed within an Energy Charter #BetterTogether collaborative innovation project. The guideline focusses on identifying impacts and opportunities for the communities affected by the energy transformation.

## Moving to 80% renewables by 2035

The transmission system plays a critical role as the platform for the efficient large-scale transportation of renewable energy and storage. The energy system of the future will be characterised by a mix of technologies and infrastructure along the entire energy supply chain to transform to net zero emissions. It will look considerably different to the energy system of the past with large-scale renewable energy generation, long-duration Pumped Hydro Energy Storage (PHES) and Battery energy storage systems (BESS), increased electricity demand from electrified industrial and transport sectors and emerging green hydrogen markets, consumer energy resources, and intelligent control and orchestration being integral components of the decarbonised energy system

Since publication of the QEJP in September 2022 and 2022 TAPR, Powerlink has continued to work closely with the Queensland Government providing technical insights on transmission network development for the Optimal Infrastructure Pathway (OIP) to 80% renewables by 2035.

A key component of the OIP is the establishment of a new high capacity transmission backbone to enable large-scale efficient transportation of renewable energy and storage across the state. The SuperGrid transmission backbone has four stages of development to provide connection capacity for new long-duration PHES facilities and access to Queensland's high quality renewable energy resources. Powerlink is well progressed with preparatory activities for the first stage of the SuperGrid transmission backbone (Borumba PHES connection). Subject to planning approvals, the proposed Borumba PHES is scheduled to be operational circa 2030 and is a cornerstone of Queensland's future clean energy system, providing critical storage and firming for increasing levels of variable renewable generation.

In June 2023, the Queensland Government announced that the fourth stage of the SuperGrid transmission backbone will be advanced and form part of CopperString 2032. The project initially involves constructing 840km of high voltage transmission line from Townsville to Mount Isa that will connect the North West Mineral Province (NWMP) to the NEM. CopperString 2032 is anticipated to significantly bolster new industries and facilities for minerals mining and processing in north west Queensland, and enable the connection of significant quantities of renewable energy to the coastal Queensland transmission backbone. Powerlink will own and lead delivery of CopperString 2032 to completion.

In June 2023, the Queensland Government published the draft 2023 Queensland REZ Roadmap. This Roadmap outlines the pathway for connecting 22GW of new large-scale renewable energy by 2035 and is a key component of the QEJP. Powerlink provided significant input to developing the draft 2023 Queensland REZ Roadmap. The Queensland Government and Powerlink have undertaken analysis to determine where potential REZs could be established. The REZs will be developed over three phases taking into account the sequencing of other large-scale energy infrastructure developments including the SuperGrid transmission backbone, and proposed Borumba and Pioneer-Burdekin PHES facilities. Powerlink is progressing the development of three in-flight REZs located within north and south west Queensland, with the first located in north Queensland scheduled to become operational in early 2024.

Powerlink is implementing new approaches and technologies, and guiding and shaping developments in the market to optimise performance and utilisation of the transmission system. Powerlink is progressively implementing the Wide Area Monitoring Protection and Control (WAMPAC) platform to maximise the utilisation of the network and provide an additional layer of security and resilience to system disturbances and events. The uptake of rooftop photovoltaic (PV) systems within Queensland continues to be strong and is significantly changing the daily load profile and operating profiles of existing synchronous generation. Powerlink is also progressing consultation processes to identify non-network solutions to help address emerging technical challenges associated with the energy transformation.

## Electricity energy and demand forecasts

The 2022/23 summer in Queensland had below average daily maximum and minimum temperatures and above average temperatures in March, which saw an overall summer peak delivered demand of 8,916MW at 6.00pm on 17 March, 116MW below the 2021/22 maximum delivered demand. Operational 'as generated' peak was recorded 30 minutes earlier at 5.30pm reaching 10,070MW.

The 2023 Queensland minimum delivered demand was recorded at 12.30pm on 20 August 2023, when only 2,538MW was delivered from the transmission grid (refer to Figure 3.9 for load measurement definitions). Operational 'as generated' minimum demand was recorded on 17 September 2023 at 11.00am and set a new record for Queensland of 3,387MW, passing the previous minimum record of 3,469MW set in September 2022.

Powerlink has adopted AEMO's 2023 Electricity Statement of Opportunities (ESOO) forecasts in its planning analysis for the 2023 TAPR. The forecast captures impacts of growth in rooftop PV installations, changing Queensland economic growth conditions, energy efficiency initiatives, battery storage and electric vehicles (EV), electrification and tariffs through Step Change, Progressive Change and Hydrogen Export scenarios. Bottom-up forecasts are derived through reconciliation of AEMO's forecast with those from Distribution Network Service Providers at each transmission connection supply point.

### Electricity energy forecast

Based on the Step Change scenario forecast, Queensland's delivered energy consumption is forecast to increase at an average of 1.8% per annum over the next 10 years from 46,214GWh in 2022/23 to 55,157GWh in 2033/34. The increase in energy consumption is mainly due to industries beginning to electrify their operations to meet their emission reduction targets.

### Electricity demand forecast

Based on the Step Change scenario forecast, Queensland's transmission delivered summer maximum demand is forecast to increase at an average rate of 1.8% per annum over the next 10 years, from 9,201MW (weather corrected) in 2022/23 to 10,879MW in 2032/33. Annual minimum transmission delivered demands are expected to decrease in all forecast scenarios presented in the 2023 TAPR. These AEMO 2023 ESOO minimum demand forecasts are provided with simulated solar traces which do not account for economic curtailment or operational measures required to maintain reliability and system security. The anticipated electrification of load, historically supplied by fossil fuels, could see a large increase in demand that may require significant investment in the transmission and distribution networks. Powerlink is committed to working with AEMO and customers to better understand the future impacts that electrification will have on demand and energy forecasts.

## Focussing on a future network that supports the long-term needs of customers

Powerlink undertakes long-term network planning to ensure the long-term needs of customers are met. Powerlink is continuing to:

- ensure its approach to investment decisions delivers positive outcomes for customers
- focus on developing options that deliver safe, reliable and cost effective transmission services
- undertake ongoing active community, customer and stakeholder engagement for informed decision making and planning for transmission and related developments
- provide guidance to enable the energy transformation, to improve wholesale electricity prices and a sustainable energy future including support for the QEJP and Queensland SuperGrid Infrastructure Blueprint
- engage and inform various NEM rule changes and market guideline reviews and implement the recommendations
- emphasise an integrated, flexible and holistic analysis of future investment needs
- support diverse generation connections and technologies
- adapt to changes in customer behaviour and the evolving economic outlook
- ensure compliance with legislation, regulations and operating standards.

Through the information and context provided, the 2023 TAPR continues to support the connection of variable renewable energy (VRE) generation to Powerlink's transmission network, enabling the power system transformation.

Based on the Step Change scenario forecast, the planning standard and committed network solutions, there are no significant network augmentations to meet load growth forecast to occur within the 10-year outlook period of this TAPR.

### Proactively planning to address potential shifts in the external environment

There are proposals for large mining, metal processing and other industrial loads including hydrogen that have not reached a committed development status and are not included in the AEMO ESOO forecasts. These loads have the potential to significantly impact the performance and adequacy of the transmission network. This TAPR outlines the potential network investment and development required in response to these loads emerging in line with a high economic outlook.

Since January 2016, Queensland has seen an unprecedented level of renewable energy investment activity. These investments in VRE generation are changing the dispatch and consequently the energy flows on the transmission network. This is leading to increased utilisation of several grid sections (in particular the Central West to Gladstone grid section). It is also important that the high voltage transmission network has the capacity to unlock VRE investment opportunities that enable market efficiencies and deliver benefits to customers. Powerlink will consider these potential transmission needs, holistically with the emerging condition based drivers as part of the planning process. Feasible network solutions are outlined within the TAPR.

### Applying a flexible and integrated approach when reinvesting in the existing network

The Queensland transmission network experienced significant growth from the 1960s to the 1980s. The capital expenditure needed to manage the condition risks related to this asset base, some of which is now reaching end of technical service life, represents a sizeable portion of Powerlink's program of work within the outlook period.

Considerable emphasis has been given to a flexible and integrated approach to the analysis of future reinvestment needs and options. Powerlink has systematically assessed the enduring need for assets at the end of their technical service life taking into account future renewable generation and considered a broad range of options including non-network solutions, network reconfiguration, refit strategies which extend the service life of transmission lines and transformers, and asset retirement.

## Renewable energy and generation capacity

To date Powerlink has completed connection<sup>1</sup> of 22 large-scale solar and wind farm projects in Queensland, adding 3,155MW of renewable generation capacity to the grid. In addition, a significant number of connection applications, totalling 14,543MW of new generation capacity, have been received to date and are at varying stages of progress. This includes under construction connections for approximately 1,675MW of VRE.

To ensure sufficient system strength for the current and future VRE network requirements, Powerlink is working closely with customers, suppliers and AEMO to model system strength in the Queensland network. This work has provided important insights into the complexity of system strength and how it can be managed with changing technologies moving forward. Powerlink will apply this integrated system strength model to existing and new connection applications and engage through its regulatory consultations to ensure there is adequate system strength in Queensland.

## Grid section and zone performance

During 2022/23, the Powerlink transmission network performed reliably. Record peak transmission delivered demand was recorded for the Wide Bay, South West and Gold Coast zones. Minimum transmission delivered demand levels continued to reach record lows in the majority of zones with Ross, Wide Bay and South West zones all experiencing periods of negative transmission delivered demand.

Inverter-based resources in northern Queensland experienced approximately 262 hours of constrained operation during 2022/23. This is a reduction in the constraint times experienced over the last two years.

## Consultation on network investments

Powerlink is committed to regularly reviewing and developing its transmission network in a timely manner to meet the required levels of reliability and manage the risks arising from aged assets remaining in-service.

The TAPR highlights anticipated upcoming Regulatory Investment Tests for Transmission (RIT-Ts) for which Powerlink intends to seek solutions and/or initiate consultation with AEMO, Registered Participants and interested parties in the near future (refer to Section 6.6.2). To enhance the value and outcomes of the RIT-T process to customers, Powerlink undertakes a range of engagement activities for each RIT-T, determined on a case by case basis. This engagement matrix for RIT-Ts was developed in consultation with Powerlink's Customer Panel.

<sup>1</sup> For the purposes of customer connection statistics, Powerlink defines:  
 'completed projects' as those for which Powerlink's scope of works has been completed. However generation may not be at full capacity as remaining works associated with generation connection may not yet be complete (e.g. construction and/or commissioning)  
 'fully operational' as customer connections where all works are complete, commissioned and capable of delivering to full generation potential.

## Power system security services

### *Power system security services in central, southern and broader Queensland regions*

In May 2022, Powerlink published an Expression of Interest (EOI) Request for Power System Security Services in central, southern and broader Queensland regions to address an immediate Network Support Control and Ancillary Services (NSCAS) gap in southern Queensland and a system strength shortfall at the Gin Gin fault level node. Powerlink published the findings for the NSCAS gap in December 2022 and has entered into a Network Support Agreement with CleanCo Queensland to address the immediate gap. Longer term NSCAS requirements have been considered in conjunction with the Managing voltages in South East Queensland RIT-T which has recommended installation of a 120MVAR bus reactor at Belmont Substation in 2024 and network support services from CleanCo Queensland to operate during times of reactive power shortfall as the preferred option for implementation.

Discussions with proponents of non-network solutions to address the system strength shortfall are continuing as at the publication of the 2023 TAPR and Powerlink continues to work closely with non-network solution proponents and AEMO to meet the declared system strength gap.

### *Addressing system strength requirements in Queensland from December 2025*

As the System Strength Service Provider for Queensland, Powerlink commenced the RIT-T process, publishing a Project Specification Consultation Report (PSCR), Addressing System Strength Requirements in Queensland from December 2025, calling for submissions from non-network solution providers to meet the minimum and efficient fault levels of system strength identified in AEMO's 2022 System Strength Report.

Powerlink is progressing the technical and economic analysis for the optimal portfolio of solutions anticipated to be required and expects publication of the Project Assessment Draft Report (PADR) in the second quarter of 2024.

## Integrated System Plan projects in Queensland

### Expanding New South Wales to Queensland transmission transfer capacity

The QNI 'minor' upgrade construction works are complete and inter-network testing is progressing to release additional capacity to the market in a staged approach. These tests are expected to continue until mid-2024.

### Future actionable Integrated System Plan projects

The 2022 Integrated System Plan (ISP) identified upgrades in Queensland as part of the optimal development path for the NEM. Although no 'actionable' projects were identified for Queensland, several Queensland projects were identified as part of the optimal development path that may become 'actionable' in future ISPs. These projects will be vital to achieving lower cost solutions that meet security, reliability, affordability and reduced emissions.

Two projects were nominated for preparatory activities. These include:

- Darling Downs REZ Expansion (Stage 1)
- QNI Connect (500kV option).

Preparatory activities for these projects were provided to AEMO to inform the development of the 2024 ISP by June 2023.

Three additional projects were identified as requiring no action as AEMO will leverage the estimated project costs from previous preparatory activities. These include:

- Central to Southern Queensland reinforcement
- Gladstone Grid reinforcement
- QNI Connect (330kV option).

For Gladstone Grid reinforcement and QNI Connect (330kV option) Powerlink has provided AEMO with updates to the project scopes to enable AEMO to reflect these changes into its updated project estimates.

## Committed and commissioned projects

Powerlink continues to ensure the safe and reliable supply of electricity to townships, local communities, industry and businesses across Queensland with five reinvestment projects completed since publication of the 2022 TAPR.

Projects completed in 2022/23 include:

- Baralaba secondary systems replacement
- Bouldercombe primary plant replacement
- Tarong secondary systems replacement
- Palmwoods secondary systems replacement
- Line refit works between South Pine and Upper Kedron.

As at the publication of the 2023 TAPR and having finalised the necessary regulatory processes, the committed projects for investment across Powerlink's network include:

- Establishment of a 3rd connection into Woree (Stage 1 Northern Queensland REZ)
- Broadsound bus reactor
- Line refit works between Townsville South and Clare South substations
- Townsville South primary plant and secondary systems replacement
- Ross 275/132kV primary plant and transformers replacement
- Strathmore transformer establishment and secondary systems replacement
- Nebo primary plant, secondary systems and transformer replacements
- Blackwater transformers replacement
- Lilyvale primary plant and transformer replacement
- Several secondary system replacements including Cairns, Woree, Chalumbin, Mt England and Mudgeeraba.

## Increasing opportunities for non-network solutions

As the power system transforms, non-network solutions will be essential to address the changing needs of the power system.

Powerlink is committed to genuine engagement with providers of non-network solutions and the implementation of these solutions where technically feasible and economic to ensure reliable and cost effective transmission services for customers. Future non-network solutions may be implemented to:

- address inertia, system strength and NSCAS requirements, ensuring the secure operation of the transmission network
- address future network limitations or address the risks arising from ageing assets remaining in-service within the transmission network
- more broadly, in combination with network developments as part of an integrated solution to complement an overall network reconfiguration strategy
- provide demand management and load balancing.

## Engaging with customers, community and other stakeholders

Powerlink customers include more than five million Queenslanders and 253,000 businesses who receive electricity through the energy network. Powerlink is committed to proactively engaging with customers, communities, First Nations Peoples and other stakeholders in seeking their input into Powerlink's business processes and decision-making. All engagement activities are undertaken in accordance with Powerlink's Stakeholder Engagement Framework and Community Engagement Strategy, which set out the principles, objectives and outcomes Powerlink seeks to achieve in its interactions with stakeholders and the broader communities in which Powerlink operates. A number of key performance indicators are used to monitor progress towards achieving Powerlink's stakeholder engagement performance goals. In particular, Powerlink undertakes a comprehensive biennial stakeholder survey to gain insights about stakeholder perceptions of Powerlink, its social licence to operate and reputation. Most recently completed in November 2022, it provides comparisons between baseline research undertaken in 2012 and year-on-year trends to inform engagement strategies with individual stakeholders.



Engaging with communities is essential to providing electricity transmission services that are safe, reliable and cost effective. Transmission network infrastructure stays in-service for up to 50 years and Powerlink is focussed on building positive relationships and partnering with local communities to deliver benefits for the longer term. Powerlink's Community Engagement Strategy was developed and implemented to support delivery of the energy transformation and ensure Powerlink is focussed on driving mutually beneficial outcomes for impacted communities.

Throughout 2021/22 Powerlink undertook targeted community engagement research across the state to gauge community acceptability of renewable development and related transmission infrastructure. The research findings support Powerlink's engagement going forward and ensure a focus on key factors that are important to communities. Powerlink is looking to undertake another round of community sentiment research across the state in late 2023.

Since publication of the 2022 TAPR, Powerlink has undertaken a review of the process formerly called the Network Development Process used to secure new easements as part of its project delivery. The process has been renamed to the Transmission Easement Engagement Process. As part of this review, Powerlink has launched a new SuperGrid Landholder Payment Framework that significantly boosts payments to landholders hosting new transmission infrastructure. Powerlink will also become the first transmission company in Australia to offer payments to landholders on properties adjacent to transmission infrastructure.

As Powerlink continues to operate and maintain the existing network through to embarking on planning and building the transformational network of the future, local communities will be front and centre in Powerlink's planning and decision-making.

Powerlink recognises the importance of transparency for stakeholders, particularly when:

- undertaking transmission network planning
- developing meaningful and relevant data for publication in the TAPR portal in relation to potential future investments
- engaging in public consultation under the RIT-T and other regulatory processes.

Powerlink will also discuss the technical information provided in the TAPR with stakeholders at a dedicated session at the Transmission Network Forum to be held in November 2023.