Executive Summary

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), Renewable Energy Zone (REZ) Delivery Body (RDB) and REZ TNSP responsible for transmission network planning and development 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, its Transmission Authority and the Energy (Renewable Transformation and Jobs) Act 2024 (ERTJ Act).

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 2024 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

Based on Powerlink's 2024 Central scenario forecast reported in this TAPR, the summer maximum demand is expected to grow steadily over the next 10 years, but show further reductions in the minimum delivered demand. The forecast delivered energy from the transmission network over the 10-year outlook period shows a steady increase mainly due to new anticipated loads and electrification of existing loads to meet emission reduction targets.

Powerlink has continued to work closely with the Queensland Government and market participants in developing and actioning the Queensland Energy and Jobs Plan (QEJP), including the establishment of a new SuperGrid transmission backbone and establishment of new 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 2024 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 the QEJP and AEMO's Integrated System Plan (ISP).

Powerlink's focus on stakeholder engagement has continued, 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 Powerlink's activities relating to the QEJP, in particular REZs and Priority Transmission Investment (PTI), changing network operating conditions, Powerlink's work as part of the Energy Charter and an update on progress in implementing the recommendations of the Asset Reinvestment Review Working Group Report. Powerlink also held webinars on the Gladstone Project candidate Priority Transmission Investment and Queensland's SuperGrid planning update.

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 customers.

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 industrial loads, 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 2023 TAPR, Powerlink has continued to work closely with the Queensland Government and market participants 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[1]. Powerlink is well progressed with preparatory activities for the first stage of the SuperGrid transmission backbone (Halys to Woolooga, which also enables the Borumba PHES connection).

In July 2024, an update was made to the second stage of the SuperGrid strategy to shift the original location from a coastal to an inland route. This alignment change is based on the significant interest from renewable energy companies to develop wind farms to the west of the original alignment. This will result in a more coordinated solution and a significant reduction in the overall footprint of transmission infrastructure.

Powerlink commissioned the Far North Queensland REZ in July 2024 and there are currently two inflight REZs, the Southern Downs and Western Downs REZ located in South Queensland. Powerlink is now negotiating with foundation customers for the next three REZs.

Legislative developments since publication of the 2023 TAPR

On the 18 April 2024, the Queensland Government passed the Clean Economy Jobs Act 2024 making a significant move towards realising a clean economy future for Queensland and enshrining in legislation Queensland's commitment to net zero emissions by 2050.

The Queensland Government also passed the Energy (Renewable Transformation and Jobs) Act 2024 (ERTJ Act) on the 18 April 2024. The Act enshrines three State Renewable Energy Targets in legislation and creates frameworks for building the Queensland SuperGrid. The Act also sets out the process to allow the Queensland Government to identify and assess Priority Transmission Investment (PTI) projects within a new State-based planning and investment framework.

In July 2024, Powerlink commenced consultation on the first candidate PTI as referenced in the QEJP, namely the Gladstone Project for the reinforcement of the Gladstone network to support decarbonisation in the region.

Delivering a transmission network that will support the energy transformation

Powerlink is implementing new approaches and technologies, as well as 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.

[1] SuperGrid stages are subject to shareholding Minister approval.

Electricity energy and demand forecasts

The 2023/24 summer in Queensland had above average daily maximum and minimum temperatures, which saw an overall summer peak transmission delivered demand of 9,429MW at 5.00pm on 22 January, 513MW above the 2022/23 maximum transmission delivered demand. Operational 'as generated' peak demand was recorded at the same time reaching 11,005MW (refer to Figure 3.9 for load measurement definitions).

The 2024 Queensland minimum transmission delivered demand was recorded at 10.00pm on 5 October 2024, when only 2,389MW was delivered from the transmission grid. Operational 'as generated' minimum demand was recorded at the same time and set a new record for Queensland of 3,091MW, passing the previous annual minimum record of 3,387MW set in September 2023.

The 2024 TAPR reports on the Low, Central and High scenario forecasts produced by Powerlink. The load forecast takes into consideration AEMO's demand and energy forecasts, published for the 2024 Electricity Statement of Opportunities (ESOO) as well as EQL's Customer Energy Resource (DER) forecasts and block loads. Powerlink's forecast allows a more granular focus on potential load developments in the Queensland region.

Electricity energy forecast

Based on Powerlink's Central scenario forecast, Queensland's delivered energy consumption is forecast to increase at an average of 2.5% per annum over the next 10 years from 47,477GWh in 2023/24 to 60,516GWh in 2033/34. The increase in energy consumption is mainly due to new anticipated loads and industries beginning to electrify their operations to meet their emission reduction targets.

Electricity demand forecast

Based on Powerlink's Central scenario forecast, Queensland's transmission delivered summer maximum demand is forecast to increase at an average rate of 3.1% per annum over the next 10 years, from 9,218MW (weather corrected) in 2023/24 to 12,524 in 2033/34. Annual minimum transmission delivered demands are expected to decrease in all forecast scenarios presented in the 2024 TAPR. These Powerlink minimum demand forecasts are provided with simulated solar traces which do not account for economic curtailment or operational measures required to maintain reliability and 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.

Focussing on a future network that supports the 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 on-going 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
- 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 2024 TAPR continues to support the connection of variable renewable energy (VRE) generation to Powerlink's transmission network, enabling the power system transformation.

Notwithstanding the QEJP network developments required to support the decarbonisation of the electricity industry and the Gladstone Project PTI, there are no other significant network augmentations to meet load growth forecast to occur within the 10-year outlook of this TAPR under Powerlink's 2024 Central scenario forecast.

Proactively planning to address potential shifts in the external environment

There are proposals for large mining, metal processing and other industrial loads including emerging green industries that have not reached a committed development status and are not included in the forecast. 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[2] 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 16,846MW of new generation capacity, have been received to date and are at varying stages of progress. This includes connections under construction of approximately 2,615MW of VRE and 755MW of BESS.

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 2023/24, the Powerlink transmission network performed reliably. Record peak transmission delivered demand was recorded for the Far North, Wide Bay, Surat, Moreton, and Gold Coast zones. Minimum transmission delivered demand was recorded for the Far North, North, South West, Moreton and Gold Coast zones. The Ross, Wide Bay and South West zones all continue experiencing periods of negative transmission delivered demand.

Inverter-based resources in northern Queensland experienced approximately 310 hours of network constrained[3] operation during 2023/24.

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.

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[2] 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.

[3] Constrained operation includes both full or partial generation constraints.

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 Regulatory Investment Test for Transmission (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.

Powerlink remains consistent with this approach, applying a similar range of engagement activities to consultations which are being/or will be undertaken as part of the PTI framework.

Power system security services

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

Since publication of the 2023 TAPR, Powerlink has concluded the engagement activities and assessment in relation to the system strength shortfall at the Gin Gin fault level node declared in AEMO's 2021 System Security Reports. In January 2024, Powerlink published a report identifying the non-network solution of the addition of a clutch to the Townsville Power Station, owned by Ratch Australia, by mid-2025 as the option which meets the system strength shortfall.

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 2023 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 November 2024.

Integrated System Plan projects in Queensland

Expanding New South Wales to Queensland transmission transfer capacity

The Queensland to New South Wales Interconnector (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-2025.

Future actionable Integrated System Plan projects

The 2024 Integrated System Plan (ISP) identified upgrades in Queensland as part of the optimal development path for the NEM. It identified three projects in Queensland as requiring action prior to the release of the 2026 ISP. These projects include:

- Gladstone Grid Reinforcement (now referred to as the Gladstone Project)
- Queensland SuperGrid South
- QNI Connect.

Powerlink had already identified the need for the first two projects. These projects will progress under the candidate PTI framework (refer to Section 6.16), with the Gladstone Project consultation currently in progress.

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 11 reinvestment projects completed since publication of the 2023 TAPR.

Projects completed in 2023/24 include:

- Strathmore transformer establishment
- Strathmore secondary systems replacement
- Calvale and Callide B secondary systems replacement
- Nebo primary plant and secondary systems replacement
- Lilyvale transformers replacement
- Boyne Island secondary systems replacement
- Wurdong secondary systems replacement
- Line refit works on the transmission line between Woolooga and Palmwoods
- Line refit works on the transmission lines between West Darra and Sumner
- Line refit works on the transmission lines between Rocklea and Sumner
- Abermain secondary systems replacement

As at the publication of the 2024 TAPR and having finalised the necessary regulatory processes, the committed projects for investment across Powerlink's network include:

- Maintaining power transfer capability and reliability of supply at Kemmis
- Addressing the reliability of supply to Nebo local area
- Addressing the secondary systems condition risks at Sumner.

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 Network Support and Control Ancillary Services 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 241,000 businesses in the State. 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 annual stakeholder survey to gain insights about stakeholder perceptions of Powerlink, its social licence to operate and reputation. Most recently completed in September 2024, it provides important data to inform engagement strategies with individual stakeholders.

Engaging with communities is essential to providing transmission services that are safe, reliable and cost effective. Transmission network infrastructure stays in-service for around 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 the year, 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 undertaking a new round of community sentiment research across the state in late 2024.

Since publication of the 2023 TAPR, Powerlink has been embedding the Transmission Easement Engagement Process established in the previous year. Work is also continuing to roll out the new SuperGrid Landholder Payment Framework that increases payments to landholders hosting new transmission infrastructure. Powerlink is also now 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 PTI framework, 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 2024.