Network Capability and Performance

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Queensland's power system continues to evolve through the rapid growth of new generation, battery storage and hybrid developments. These changes are altering the location, timing and direction of electricity flows across the transmission network, while declining minimum demand is creating new operational and planning challenges. Maintaining a secure and efficient transmission network requires a detailed understanding of how these changes affect network utilisation, transfer capability and system performance. This chapter examines the changing generation, storage and demand landscape in Queensland, the implications for transmission network performance during 2025/26, and the measures Powerlink is implementing to maximise network capability and maintain system security.

Key highlights

- During 2025/26, new committed projects added 1,767 megawatts (MW) of semi-scheduled generation capacity and 2,880MW of transmission connected Battery Energy Storage System (BESS) capacity. This will increase Queensland's semi-scheduled generation capacity to 9,863MW and total BESS capacity to 5,855MW.
- Queensland's generation portfolio continues to diversify through new generation, battery storage and hybrid developments, with seven hybrid generation projects and five standalone BESS projects committed during the year.
- Connected and committed energy storage capacity now exceeds 25 gigawatt hours (GWh), including over 17GWh of transmission connected battery storage. Battery storage commitments made during 2025/26 alone exceed the storage capacity of the existing Wivenhoe Pumped Storage Hydro Power Station.
- Growth in generation and storage is changing energy flows across the transmission network, with increased generation in the Bulli and Central West zones.
- Maximum demand across Queensland's transmission zones remained broadly unchanged during 2025/26; however, seven of Powerlink's 11 zones recorded new minimum demand records, continuing the trend of declining daytime transmission-delivered demand.
- The Queensland to New South Wales Interconnector (QNI) Minor project is complete, resulting in increased transfer capability in both northerly and southerly directions. Final testing activities are ongoing at these high transfer levels.
- Network constraint performance in 2025/26 remained broadly consistent with historical levels. The Gladstone grid section experienced more than 500 hours of constrained operation due to thermal limitations, while constrained operation in the Gold Coast and Tarong grid sections was primarily associated with maintenance activities.
- Powerlink continues to maximise network capability and maintain system security through advanced network monitoring and control schemes, real-time transmission line rating trials and initiatives to manage priority power system risks.
- Powerlink has published a new supplementary data workbook, and one-page overviews on zone and grid performance, to enhance accessibility and engagement with this chapter.

9.1 Introduction

The capability and performance of Queensland's transmission network are central to the reliable and efficient operation of the power system and the integration of new generation, storage and load. Network capability is not fixed. It varies according to prevailing system conditions, including weather, generation dispatch, demand, interconnector flows and the availability of transmission equipment.

Queensland's transmission network is generally more heavily utilised during summer, when demand is typically higher and elevated temperatures can reduce the power-carrying capability of transmission equipment. Power flows also vary with the location and output of generation and with planned or unplanned outages of network elements. Local maximum demand and reduced embedded generation output can further increase flows on parts of the transmission network.

This chapter explains how changes in generation, storage and demand are affecting the utilisation and performance of Powerlink's transmission network. It provides:

- an overview of existing and committed generation and storage capacity
- analysis of changes to zonal supply and demand
- an explanation of how network transfer capability is assessed
- a summary of material network constraints during 2025/26
- an overview of measures used to maximise network capability and manage power system risks
- diagrams of Powerlink's existing high voltage transmission network.

9.2 Changing generation and storage capacity

9.2.1 Generation mix and project commitments

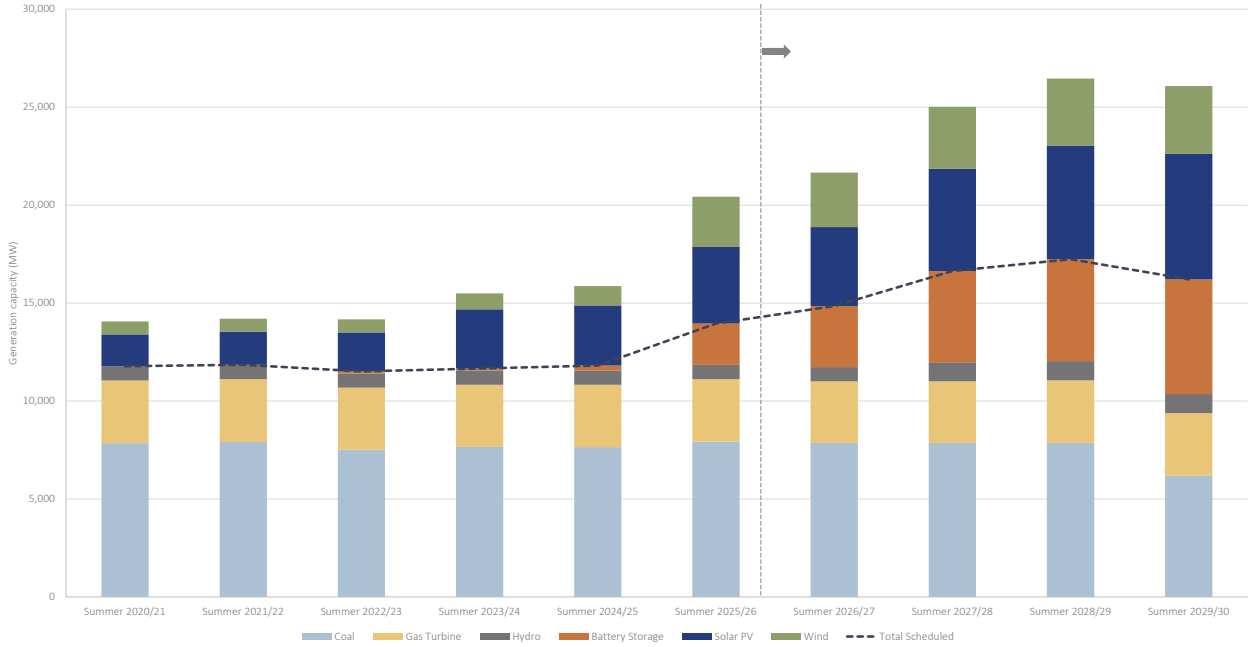
Scheduled generation in Queensland comprises predominantly coal-fired, gas turbine and hydro-electric generation, with an increasing contribution from transmission connected BESS and pumped hydro energy storage (PHES) systems. Semi-scheduled generation comprises wind and solar generation.

For this chapter, Powerlink applies the Australian Energy Market Operator's (AEMO) definition of a committed project under the System Strength Impact Assessment Guidelines (Version 2.2). This includes AEMO being satisfied that the project meets the relevant National Electricity Rules requirements, a connection agreement being in place and any required system strength remediation scheme having been finalised.

9.2.2 Outlook for generation capacity and growth in energy storage

During 2025/26, new commitments added 1,767MW of semi-scheduled generation capacity. This will increase Queensland's semi-scheduled summer capacity to 9,863MW by 2030. Figure 9.1 shows actual and expected large-scale generation capacity in Queensland from summer 2020/21 to summer 2029/30. It includes relevant generation connected or committed to Powerlink's network, Powerlink's directly connected customers and scheduled and semi-scheduled generation connected to Queensland's distribution networks. Non-scheduled, semi-scheduled and scheduled generators are treated differently in AEMO's central dispatch process.

Figure 9.1 Summer available generation capacity by energy source



Energy storage supports the integration of variable renewable generation by shifting electricity from periods of surplus production to periods of higher demand. Until 2022, Wivenhoe Pumped Storage Hydro Power Station was Queensland's only transmission-connected energy storage facility. Since then, a growing number of transmission-connected BESS have been commissioned or committed, alongside the committed Kidston Pumped Storage Hydro Project and other pumped hydro developments in the planning pipeline.

Queensland's generation portfolio continues to expand and diversify, driven by new generation, transmission-connected BESS and hybrid developments. During 2025/26, new committed projects included the Fraser Coast Solar Park, Ganymirra Solar Power Station, Gawara Baya, Guthrie's Gap Solar Power Station, Lower Wonga Hybrid, Major's Creek Solar Power Station and Smoky Creek Solar Power Station hybrid generation projects. Together, these projects contributed 1,767MW of additional semi-scheduled generation capacity, with all facilities incorporating integrated battery storage.

In some cases, the maximum output capacity of a hybrid facility is less than the combined nameplate capacity of the generation and battery components, reflecting connection and operational design considerations.

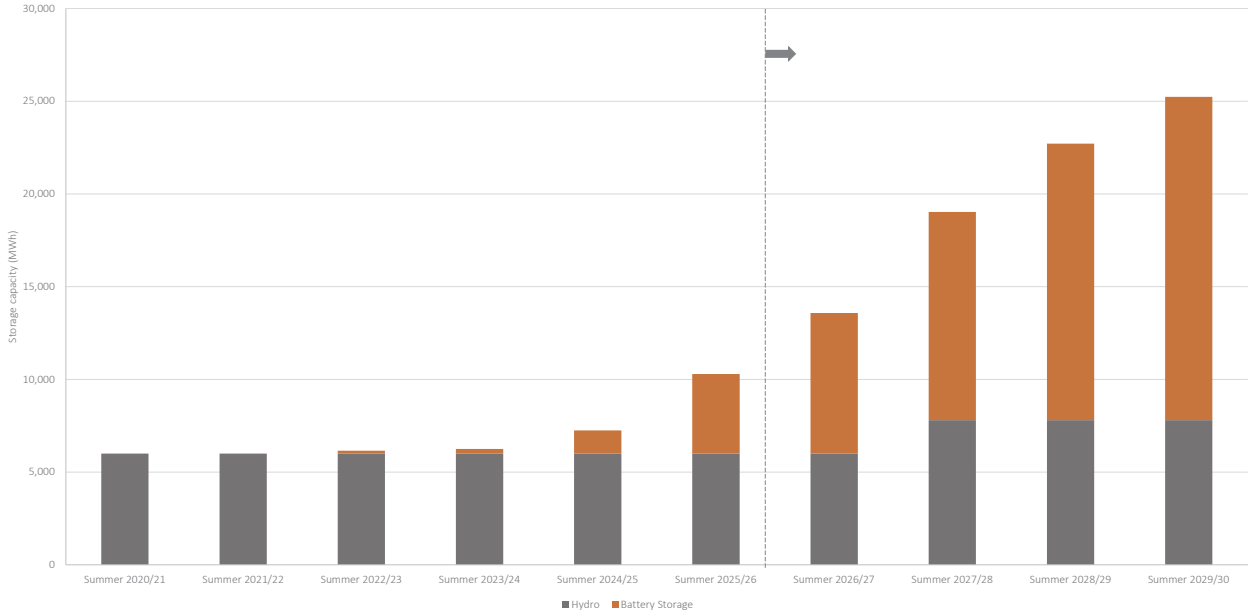
Transmission-connected BESS commitments were also significant, with Stanwell BESS, Supernode BESS Stage 3, Tangkam BESS, Teebar BESS and Yabulu BESS committed during the year. The existing Ulinda Park BESS has committed to increasing generation and storage capacity. In addition, Blue Grass Solar Farm and Broadsound Solar Farm were modified to include battery storage, becoming Blue Grass Hybrid Facility and Broadsound Energy Park respectively.

These developments are driving continued growth in Queensland's scheduled generation capacity and reinforcing the increasing role of transmission-connected BESS as a source of dispatchable capacity. Based on current commitments, total scheduled capacity is expected to continue to grow over the outlook period, despite the potential closure of Gladstone Power Station in March 2029. Transmission connected BESS now provide more generation capacity than wind generation and are approaching the capacity of solar generation.

The increasing prevalence of hybrid facilities reflects a broader shift in project design, with co-located transmission-connected battery storage becoming a standard feature of new renewable developments. This trend is contributing to rapid growth in Queensland's energy storage portfolio while supporting system reliability, network utilisation and the integration of variable renewable energy.

In 2025/26, a total of 2,880MW of transmission-connected BESS capacity was committed, increasing total committed and available transmission-connected BESS to 5,855MW. Connected and committed energy storage capacity now exceeds 25GWh, including over 17GWh of transmission-connected BESS (see Figure 9.2). Transmission-connected BESS commitments made during 2025/26 alone exceed the energy storage capacity of the existing Wivenhoe facility and, based on current commitments, total transmission-connected BESS capacity is expected to surpass existing and committed PHES in the coming years.

Figure 9.2 Available storage capacity by type



Details of the generators and storage facilities included in this chapter are provided in the supplementary data workbook for this chapter.

9.3 Zonal supply and demand changes

Growth in generation and storage is changing the location, timing and direction of electricity flows across Powerlink's transmission network. At the same time, increasing embedded generation is reducing transmission-delivered demand during parts of the day in several zones.

9.3.1 Changes in zonal energy flows

Figures 9.3 to 9.5 compare zonal electricity generation, transmission-delivered energy and transfers between Powerlink's grid sections in 2024/25 and 2025/26. The figures include transmission-connected generation, major embedded generation, energy delivered to distribution network service providers and directly connected customers, and energy transferred between zones. A detailed breakdown of transmission-connected generation by technology and zone is provided in the supplementary data workbook, and detail on the areas covered in each grid section is in Appendix H.

Total transmission-connected generation increased during 2025/26, offsetting an increase in energy flows to New South Wales. Generation increased significantly in the Bulli and Central West zones due to output from newly commissioned wind farms.

Total generation in the South West zone declined. Increased wind generation was more than offset by reduced coal-fired generation. Generation in the other zones was not materially different from 2024/25, although the Gladstone zone experienced a significant shift in its generation mix from coal to solar while total production remained broadly unchanged.

These changes in generation output affected the volume and direction of electricity transferred between zones and contributed to increased utilisation of particular transmission circuits and grid sections.

Note that in figures 9.3 to 9.5 there may be an energy imbalance in some zones due to transmission losses, generator auxiliary loads and use of multiple data sources.

Figure 9.3 Zonal electricity transfers (GWh), 2024/25

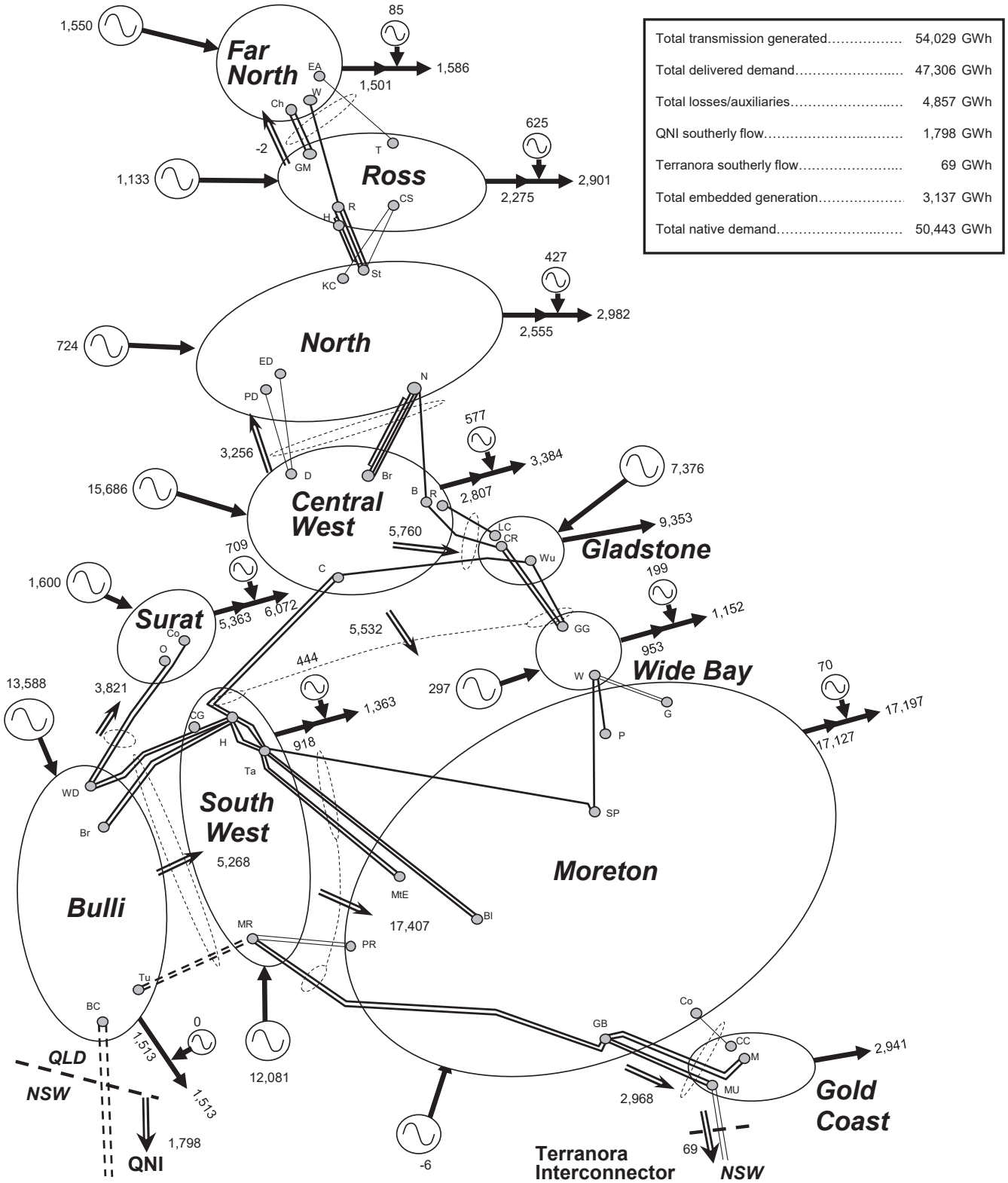


Figure 9.4 Zonal electricity transfers (GWh), 2025/26

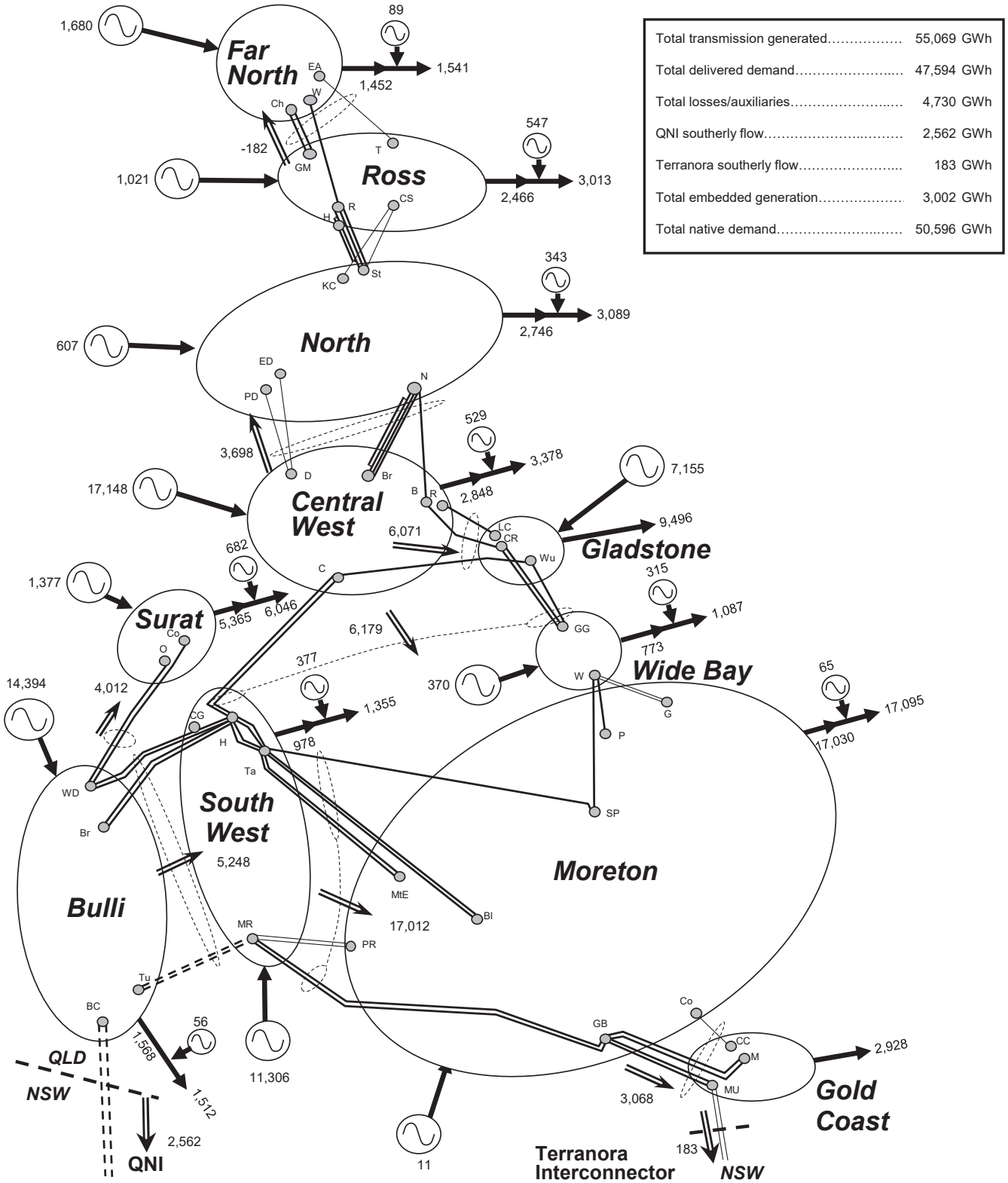
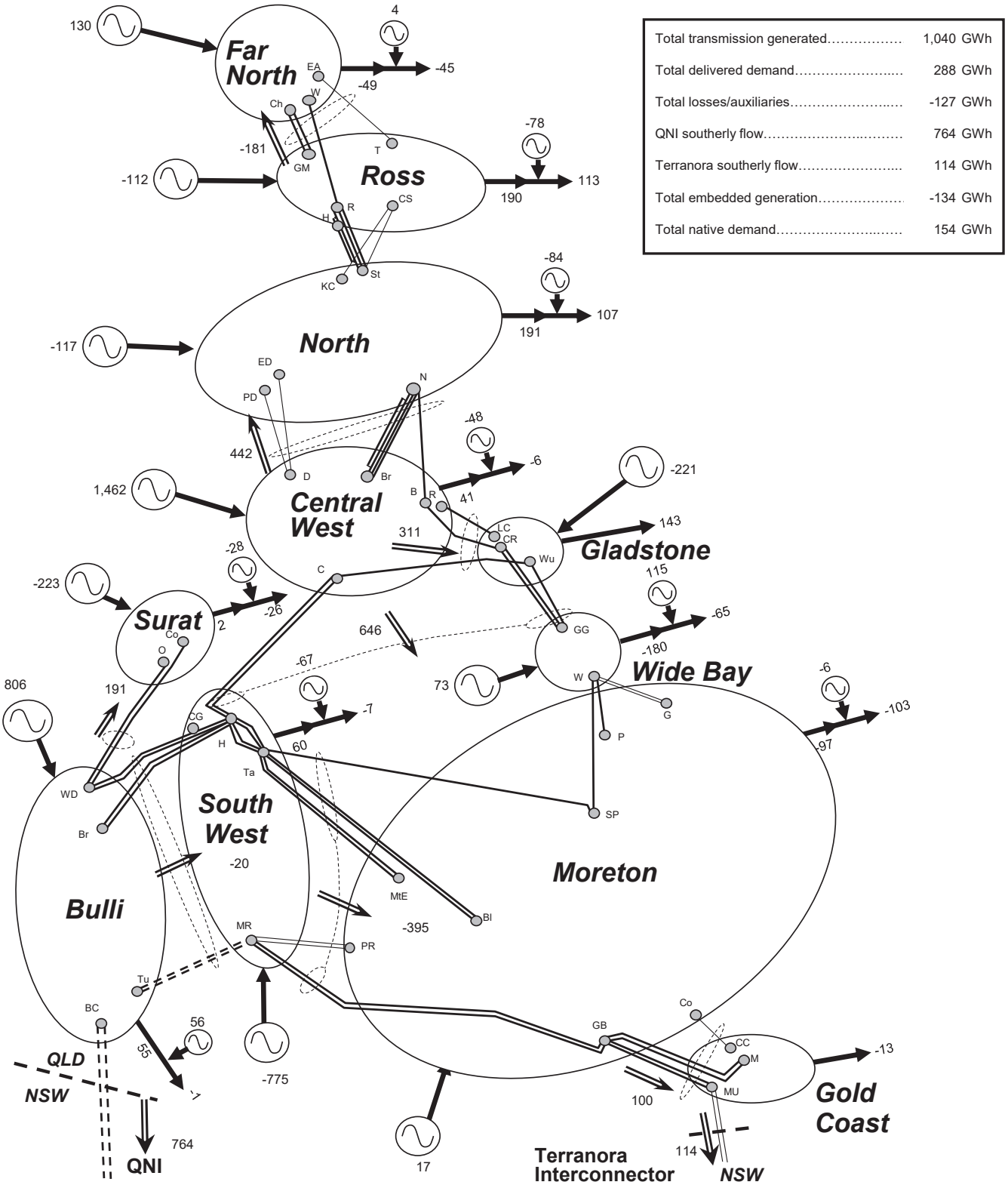


Figure 9.5 Change in zonal electricity transfers (GWh), 2024/25 to 2025/26



9.3.2 Changing daily demand profiles

Declining minimum demand is changing the daily profile of electricity supplied from Powerlink's transmission network. The effect is particularly evident in the Far North and Wide Bay zones, where daytime transmission-delivered demand has reduced materially over the past five years.

Figure 9.6 compares the daily demand profiles recorded on minimum-demand days in the Far North zone. The profiles show a progressively deeper daytime reduction, including periods where the zone is a net generator, during the 2025/26 minimum-demand day.

Figure 9.6 Far North daily profile of minimum demand days over the last five years

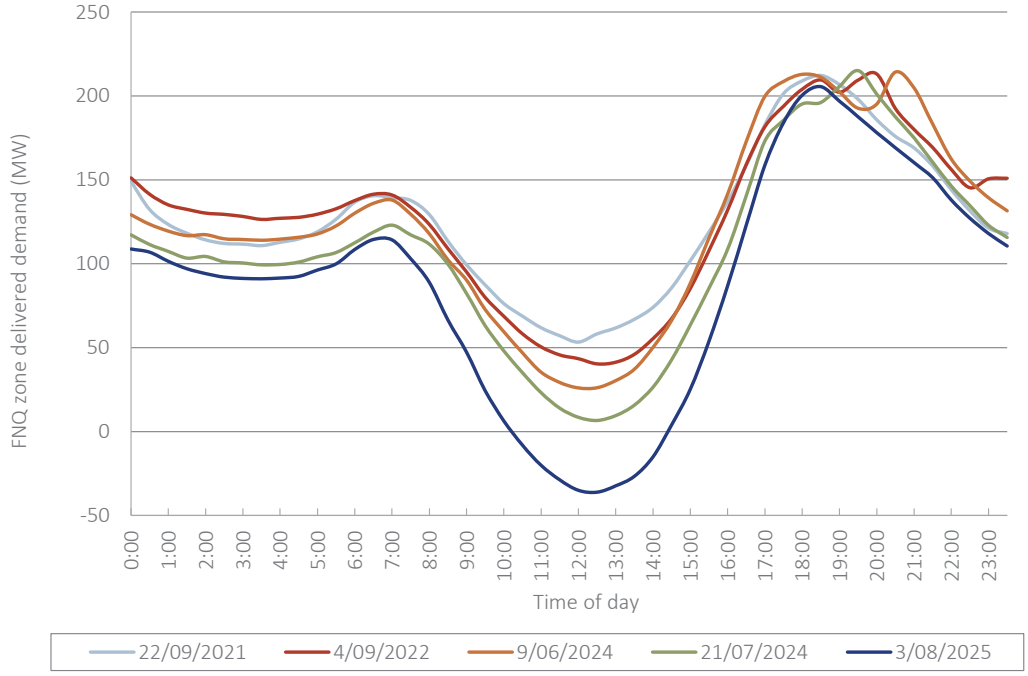
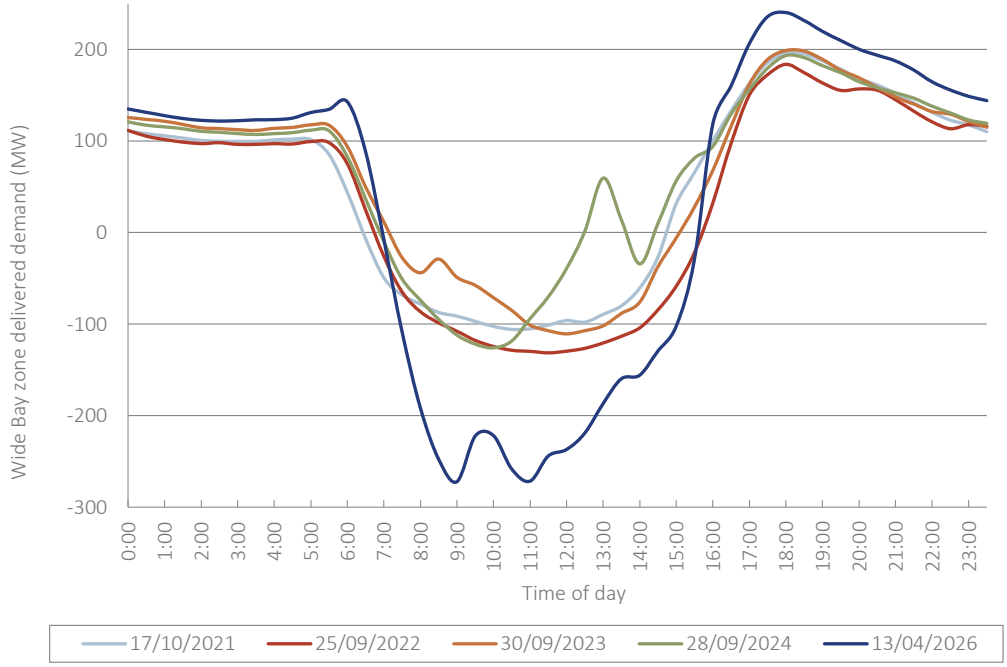


Figure 9.7 presents the equivalent comparison for the Wide Bay zone. The profiles show a substantial deepening of negative daytime transmission-delivered demand in 2025/26.

The minimum demand in the Wide Bay zone is largely driven by the combined output of the embedded solar generation. The sudden variations in the demand profile shown in Figure 9.7 (at 10am on 13 April 2026 for example) are not in fact changes in the underlying demand but rather the solar farms responding to weather conditions (cloud cover reducing available solar generation) or market conditions (negative spot prices resulting in the solar farms not being dispatched).

The significant reduction in the past year is due to the Bundaberg and Munna Creek solar farms being commissioned. This embedded generation further lowers the daytime transmission-delivered demand of the Wide Bay zone.

Figure 9.7 Wide Bay daily profile of minimum demand days over the last five years



9.3.3 Changes in maximum and minimum demand

Maximum demand across Powerlink's zones was broadly consistent with the previous year. Marginal increases occurred in the Central West, Gladstone, Bulli and Surat zones, with Surat being the only zone to record a new maximum demand.

Minimum demand continued to decline, with seven of Powerlink's 11 zones recording new minimum-demand levels during 2025/26. Significant reductions occurred in the Wide Bay and Moreton zones with less significant reductions in Far North, Ross, Central West, South West and Gold Coast zones.

Changes in demand, generation capacity and storage capacity for each zone is summarised in Table 9.1. Future committed generation and storage capacities are also included for reference. A detailed breakdown of existing and committed generation and storage is provided in the supplementary data workbook for this chapter.

Table 9.1 Demand, generation and storage changes since the 2025 TAPR alongside details of committed changes to generation and storage for each zone in the Powerlink network

Zone	Changes Since 2025 TAPR					Future Commitments		
	Maximum Demand (MW)	Minimum Demand (MW)	Existing Generation (MW)	Existing Storage (MW)	Existing Storage Capacity (MWh)	Generation (MW)	Storage (MW)	Storage Capacity (MWh)
Far North	-15	-43	-	-	-	-	-	-
Ross	+12	-16	-	-	-	+ 596	+ 855	+ 3,629
North	-14	+8	-	-	-	-	-	-
Central West	-11	-8	-	+ 480	+1,560	+ 991	+ 600	+ 2,262
Gladstone	-25	-1	+ 387	-	-	-1,680	-	-
Wide Bay	-3	-146	+ 198	-	-	+ 828	+ 580	+ 1,916
South West	-54	-33	+ 247	-	-	-	+ 100	+ 200
Moreton	-251	-176	-	-	-	-	+260	+ 755
Gold Coast	-56	-15	-	-	-	-	-	-
Surat	+2	-111	-	+ 60	+120	+ 293	-	-
Bulli	+2	+83	+ 94	+ 255	+510	+ 399	+ 594	+ 2,380

9.4 Network transfer capability and constraints

Changing generation, storage and demand patterns within zones affect the volume and direction of transfers between zones and the system conditions under which transmission limits may bind.

9.4.1 Grid sections and transfer capability

Powerlink defines grid sections on the main transmission system to measure electricity transfers between zones and assess the maximum secure transfer capability of the network. The grid sections provide a consistent basis for assessing current capability and identifying potential future limitations. Their locations are shown in Figure H.1 and Table H.2 of Appendix H.

The transfer capability of a grid section may be limited by transient stability, voltage stability, or the thermal ratings of transmission equipment. Powerlink develops limit equations that reflect these factors, and AEMO incorporates the equations into constraints used by the National Electricity Market Dispatch Engine (NEMDE).

9.4.2 How transfer capability is determined

Transfer capability varies with prevailing power system conditions and generally cannot be represented by a single fixed value. Transmission network service providers therefore use multi-term equations to describe the relationship between operating conditions and allowable power flows.

In Queensland, transfer capability can be highly dependent on which generators are operating, their output, demand levels, network configuration and the availability of transmission equipment. Following AEMO's due diligence, the relevant equations are implemented in NEMDE to support secure dispatch while maximising network capability under prevailing conditions.

Powerlink's limit equations are provided in Appendix I. They reflect network conditions at the time of publication and are progressively updated in response to changes in demand, generation, network development and network configuration. Expected capability improvements arising from committed network works are incorporated into future planning assessments. For example, commissioning of the third 275kV circuit into Cairns in 2023 resulted in an update to the Far North Queensland grid section voltage stability equation, reflecting the improved transfer capability of the network.

9.4.3 Queensland to New South Wales interconnectors

The transfer capability of the QNI varies with demand, generation dispatch, transmission equipment availability and broader network operating conditions. Transfer limits may be determined by voltage stability, transient stability, oscillatory stability or thermal rating considerations.

For intact system operation, southerly transfers on QNI are most likely to be limited by:

- voltage stability associated with a fault on the Sapphire to Armidale 330kV transmission line in New South Wales or
- the thermal capability of the 330kV transmission network between Dumaresq and Liddell in New South Wales.

For intact system operation, combined northerly transfers across QNI and the Terranora Interconnector are most likely to be limited by:

- transient or voltage stability associated with transmission line faults in New South Wales
- transient or voltage stability associated with the loss of the largest generating unit in Queensland or
- the thermal capability of the 330kV and 132kV transmission networks in northern New South Wales.

The QNI Minor project is complete and inter-network testing activities, required under Clause 5.7.7 of the National Electricity Rules (NER), are in their final stages. The project has increased transfer capability in both northerly and southerly directions with the final transfer tests awaiting favourable market conditions.

AEMO's 2026 Integrated System Plan (ISP) reclassified QNI Connect from an actionable project to a future project. Consequently, Powerlink and Transgrid will not progress QNI Connect to the Regulatory Investment Test for Transmission (RIT-T) process at this stage.

AEMO publishes Monthly Constraint Reports, which include information on the duration of constrained operation for the NEM interconnectors, including QNI and the Terranora Interconnector. Trends in interconnector flows are also reported in AEMO's Quarterly Energy Dynamics reports.

9.4.4 Network constraint performance in 2025/26

Binding network constraints during 2025/26 were broadly consistent with historical levels. The most notable instances occurred in the Gladstone, Gold Coast and Tarong grid sections. The Gold Coast and Tarong constraints were associated with maintenance activities, while Gladstone experienced significantly longer periods of constrained operation, predominantly under system-normal conditions.

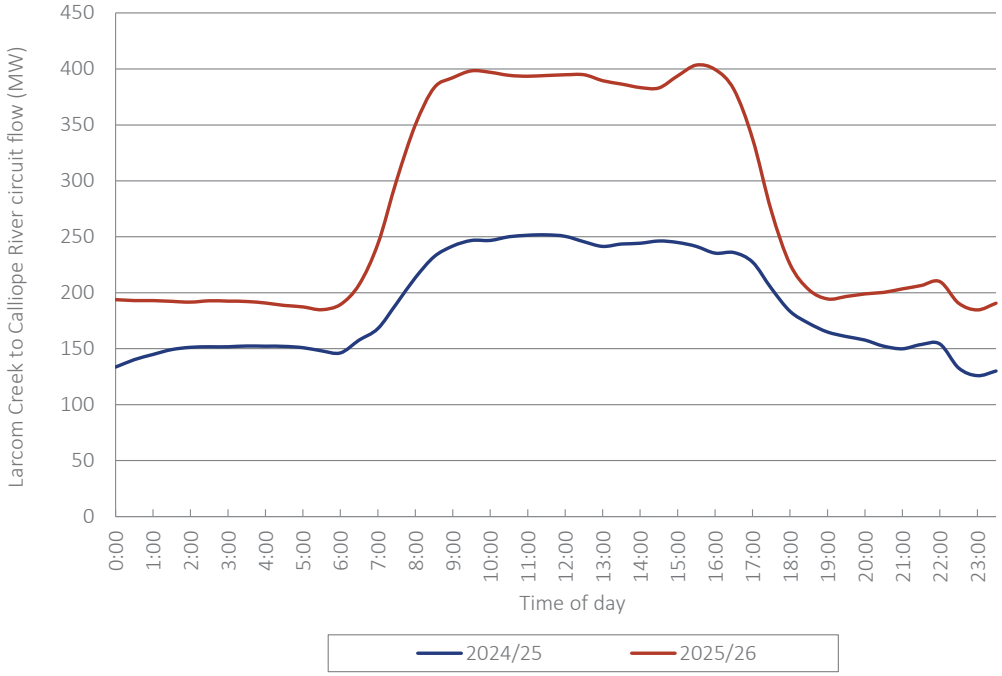
Gladstone Grid Section

The Gladstone grid section experienced approximately 500 hours of constrained operation during 2025/26. This is a large increase from previous years where the section was typically only constrained during outage conditions. The primary cause of the constraint was the thermal limit of the circuit between the Larcom Creek and Calliope River substations.

Increased output from Aldoga Solar Farm increased flows on this circuit during the daytime. Average power flows across the Gladstone grid section into the Gladstone region were also generally higher even without Aldoga Solar Farm due to reduced output from Gladstone Power Station. The combination of these two factors resulted in constrained operation during the daytime.

Figure 9.8 shows the large average increase in flows between Larcom Creek and Calliope River between 2024/25 and 2025/26 which caused the Gladstone grid section to be constrained.

Figure 9.8 Comparison of average daily load on Larcom Creek to Calliope River Circuit



Gold Coast and Tarong Grid Section

The Gold Coast grid section experienced 30 hours of constrained operation during extended maintenance of one of the Greenbank to Mudgeeraba 275kV circuits.

The Tarong grid section experienced 16 hours of constrained operation during maintenance activities that required multiple circuits around Tarong Substation to be out of service.

9.5 Maximising network capability and maintaining security

Powerlink continues to develop operational technologies and network control measures that increase the usable capability of the transmission network while maintaining secure and resilient operation. These measures include advanced wide-area schemes, real-time equipment ratings and facilities designed to manage the consequences of non-credible events.

9.5.1 Advanced measures to increase network capability

Powerlink is continuing to develop its Wide Area Monitoring Protection and Control platform to maximise network capability and provide an additional layer of protection against power system disturbances.

Wide Area Monitoring Protection and Control schemes use information from geographically dispersed transmission assets to rapidly detect abnormal system conditions and initiate an appropriate response. Depending on the event, this may include changing the network configuration or altering generation or load. The schemes can operate within sub-second timeframes, helping to minimise disruption and reduce the likelihood of cascading failure.

Powerlink is also undertaking field trials of equipment that enables overhead line ratings to be determined in real time using weather conditions on critical transmission spans. The trials are intended to identify opportunities to increase thermal capability during favourable conditions, including periods of elevated wind speed, lower ambient temperature or reduced solar irradiation. The Bureau of Meteorology has provided advice and weather data to inform the scope of the trial.

9.5.2 Managing priority risks from non-credible events

Powerlink participated in AEMO's 2026 General Power System Risk Review and continues to work with AEMO to progress priority risks identified through that process.

Work is continuing on measures identified through current and previous reviews, including:

- expanding the Wide Area Monitoring Protection and Control scheme for the non-credible loss of both Calvale to Halys 275kV circuits, including improvements to manage higher flows across the Central Queensland to Southern Queensland grid section
- implementing the Queensland Over Frequency Generator Shedding scheme with participating generators and
- improving the adequacy of the under frequency load-shedding schemes following AEMO's UFLS Adequacy Review.

9.5.3 Network control facilities

Powerlink owns network control facilities that may disconnect load following a non-credible contingency to reduce or manage the consequences of the event. Table 9.2 identifies the relevant facilities and their purpose under system-normal conditions.

Table 9.2 Powerlink-owned network control facilities configured to disconnect load as a consequence of non-credible events during system normal conditions

Scheme	Purpose
Far North Queensland Under Voltage Load Shed (UVLS) Scheme	Manage risk of voltage collapse in Far North Queensland
North Goonyella Under Frequency Load Shed (UFLS) relay	Raise system frequency
Dysart UVLS	Minimise risk of voltage collapse in Dysart area
Eagle Downs UVLS	Minimise risk of voltage collapse in Eagle Downs area
Boyne Island UFLS relay	Raise system frequency
Queensland UFLS inhibit scheme	Minimise risk of Queensland to New South Wales Interconnector (QNI) separation for an UFLS event for moderate to high southern transfers on QNI compared to Queensland demand
CQ-SQ N-2 WAMPAC scheme	Minimise risk of CQ-SQ separation for a non-credible loss of the Calvale to Halys 275kV double circuit transmission line
Surat N-2 WAMPAC scheme	Minimise the risk of losing Surat load for a non-credible loss of two lines between Western Downs and Columboola
Tarong UFLS relay	Raise system frequency
Middle Ridge UFLS relays	Raise system frequency
Mudgeeraba Emergency Control Scheme (ECS)	Minimise risk of voltage collapse in the Gold Coast zone

9.6 Existing high voltage network configuration

Figures 9.9 to 9.12 show Powerlink's system-intact high voltage network configuration across North, Central, South West and South East Queensland at July 2026.

Figure 9.9 Existing high voltage network, July 2026 – North Queensland

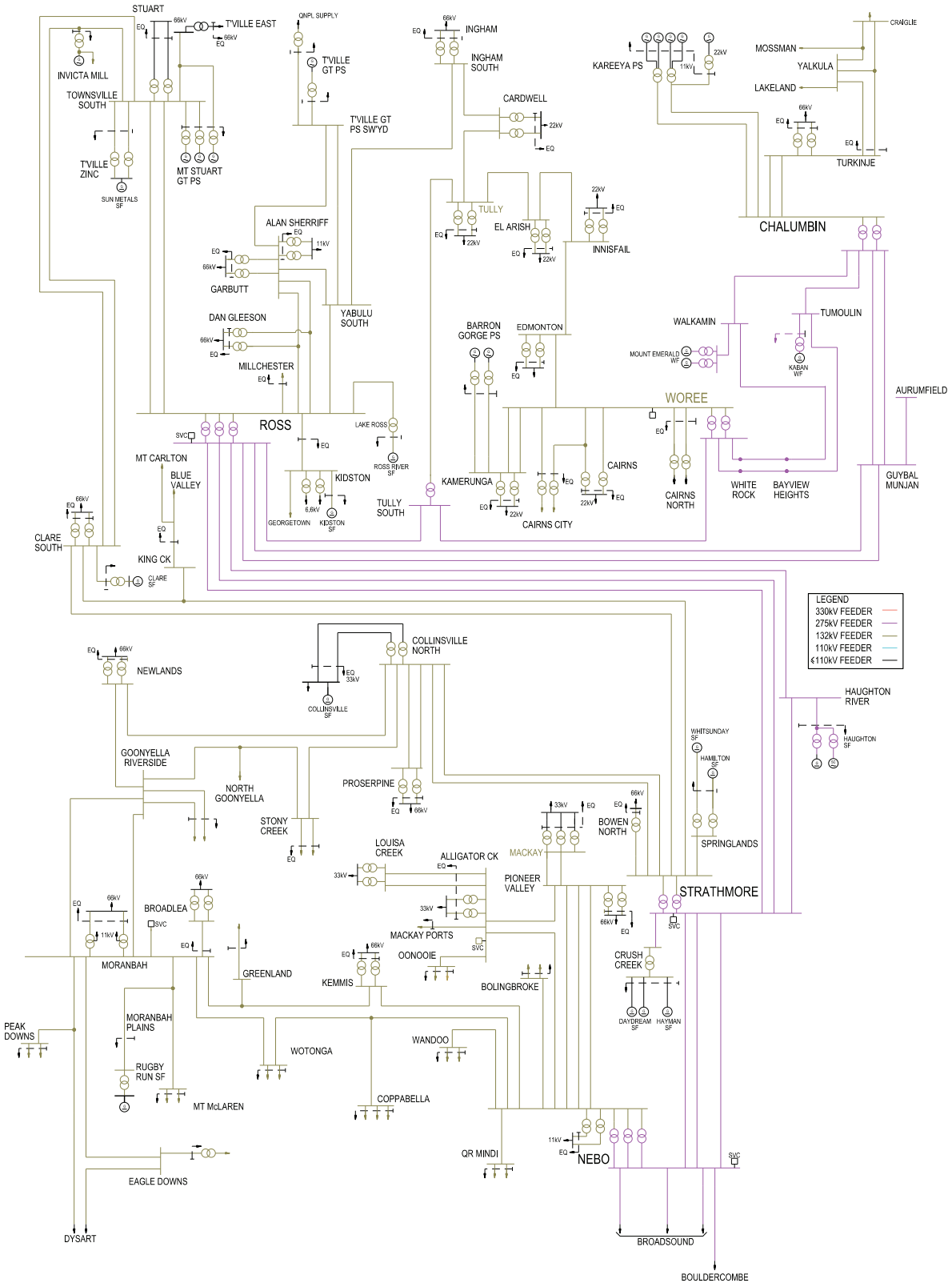


Figure 9.10 Existing high voltage network, July 2026 – Central Queensland

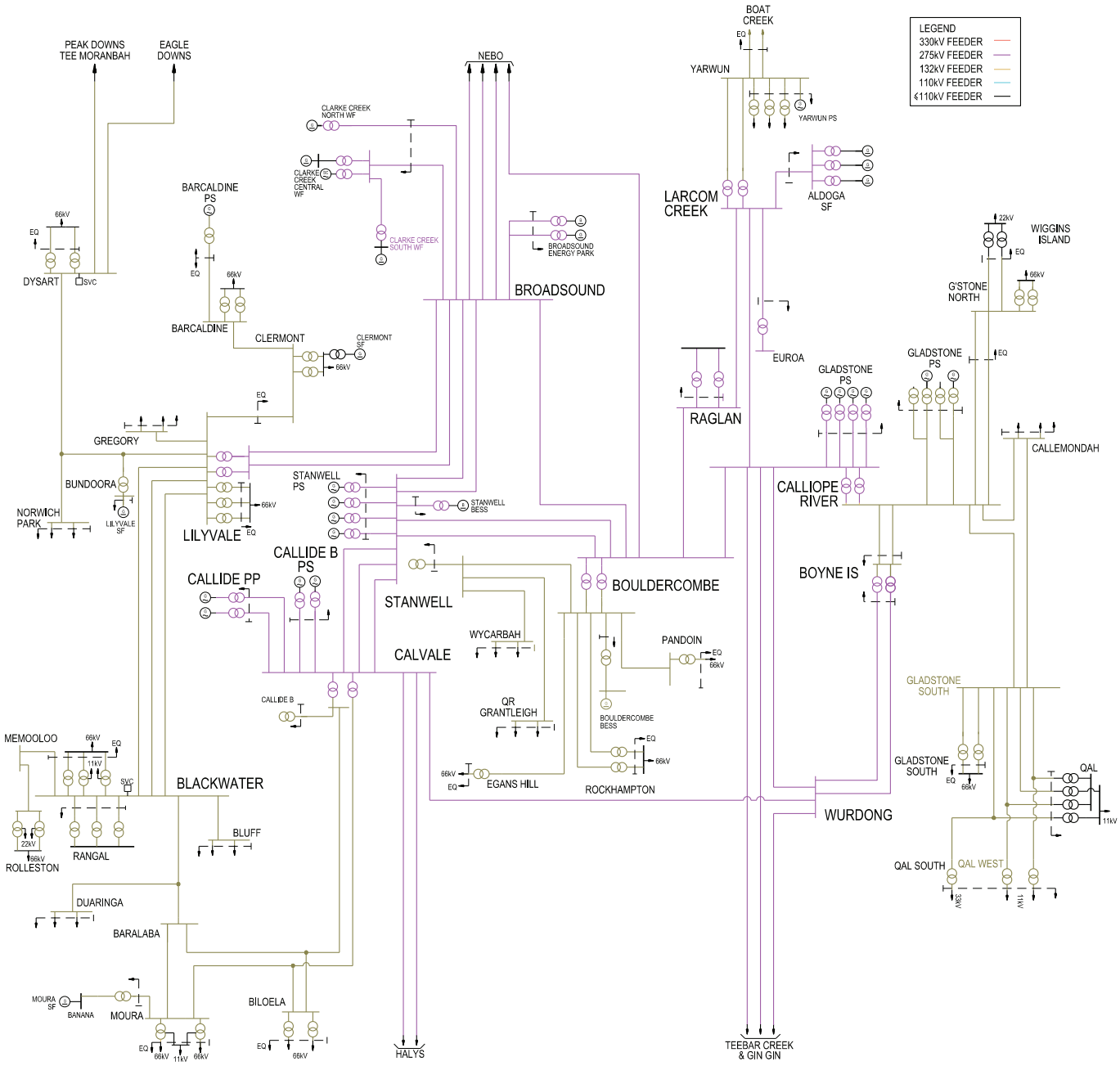


Figure 9.11 Existing high voltage network, July 2026 – South West Queensland

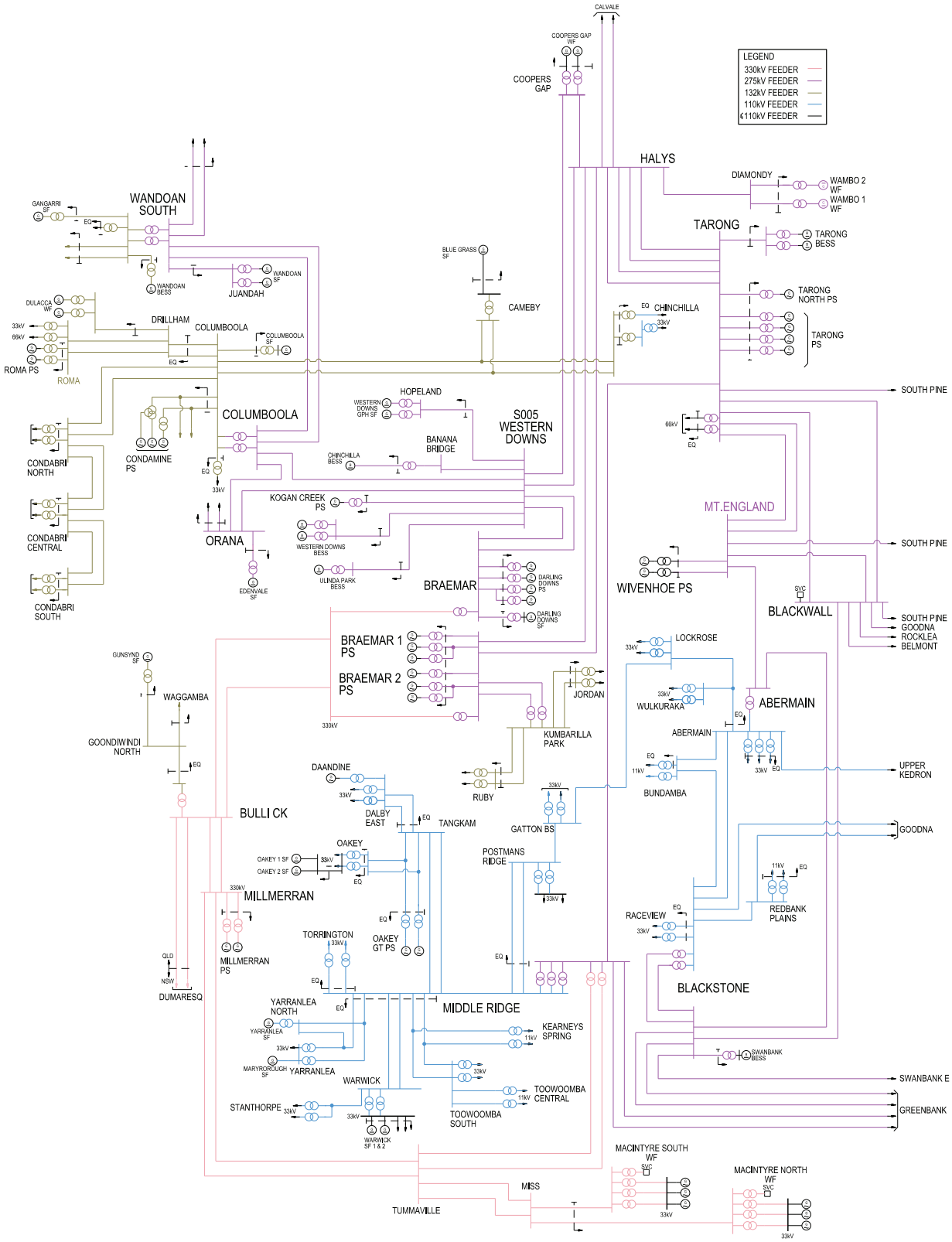


Figure 9.12 Existing high voltage network, July 2026 – South East Queensland

