CHAPTER 9

Strategic projects

9 Strategic projects

Key highlights

- Plausible new loads within the resource rich areas of Queensland or at the associated coastal port facilities may cause network limitations to emerge within the 10-year outlook period. Possible network options are provided for Bowen Basin coal mining area, Bowen Industrial Estate, Galilee Basin coal mining area, North West Mineral province, Central Queensland to North Queensland (CQ-NQ) grid section and the Surat Basin north west area.
- The changing generation mix also has implications for investment in the transmission network, both inter-regionally and within Queensland, across critical grid sections. The 2020 Integrated System Plan (ISP) and recent Queensland Government announcements identify the development of Renewable Energy Zones (REZs) that could impact the utilisation and adequacy of the Gladstone and Central Queensland to South Queensland (CQ-SQ) grid sections and Queensland to New South Wales (NSW) Interconnector (QNI).
- Potential in Queensland for the future electrification of mining and conversion of gas loads to electric.

9.1 Introduction

Chapter 3 provides details of several proposals for large mining, metal processing and other industrial loads whose development status is not yet at the stage that they have been included (either wholly or in part) in the Australian Energy Market Operator's (AEMO) Steady Progress scenario forecast. These load developments are listed in Table 3.1. The possible impact these uncertain loads may have on the performance and adequacy of the transmission system is discussed in Section 9.2.

This chapter also provides details of AEMO's ISP. The ISP identifies the optimal development path over a planning horizon of at least 20 years for the strategic and long-term development of the national transmission system. The ISP establishes a whole of system plan that integrates generation and transmission network developments. The ISP identifies actionable and future projects, and informs market participants, investors, policy decision makers and consumers on a range of development opportunities.

The 2020 ISP did not identify any actionable projects within Queensland. However, it did identify several projects that are part of the optimal development path and may become actionable in future ISPs. Three such projects were nominated for Preparatory Activities. These include:

- QNI Medium and Large interconnector upgrades
- Central to Southern Queensland reinforcement
- Gladstone Grid reinforcement.

Preparatory activity reports for these projects were provided to AEMO on 30 June 2021 and are discussed further in Section 9.3.

9.2 Possible network options to meet reliability obligations for potential new loads

The proposals for new large mining, metal processing and other industrial loads including hydrogen, listed in Table 3.1 are within the resource rich areas of Queensland or at associated coastal port facilities. The relevant resource rich areas include the Bowen, Galilee and Surat Basins and the North West Mineral Province (Mt Isa). There is also the potential conversion of existing mining, industrial and manufacturing from gas and/or diesel to electricity. Together, these loads have the potential to significantly impact the performance of the transmission network supplying these areas, including power transfers reaching the secure limits of the transmission system.

The new load developments in the Bowen and Surat basins and associated coastal port facilities are within the existing transmission system footprint. However, the connection of new loads in the Galilee Basin and the connection of existing loads in the North West Mineral Province[1] to the interconnected National Electricity Market (NEM) will require transmission network extensions to these remote locations.

[1] CopperString 2.0 is being developed by CuString Pty Ltd, a private Townsville based company with a long history in the energy supply industry in North Queensland. Copperstring has now been granted a Transmission Authority.

The commitment of some or all of these loads may cause power transfers to exceed the capability of the network. This could be due to plant ratings, voltage stability and/or transient stability. However, all of these loads will have a positive impact on the minimum load issues discussed in Section 2.6. This is particularly the case since the load profile for these mining, metal processing and industrial loads are typically relatively flat.

Powerlink has analysed the impact of these new loads on power transfers and assessed the adequacy of the network capability to meet the required needs. Where the capability of the prescribed network is forecast to be exceeded, network developments that could be required to meet those needs have been identified. Options to address the network limitations can also include demand side management (DSM) and generation non-network solutions.

This section focuses on the most likely network development option. As the proposed loads become committed, detailed planning analyses will inform and optimise the project scopes and cost estimates. The Regulatory Investment Test for Transmission (RIT-T) will consult and finally recommend the credible option (which may include a non-network option or component) that maximises the present value of the net economic benefit to all those who produce, consume and transport electricity in the market.

The emergence and magnitude of network limitations resulting from the commitment of these loads will also depend on the location, type and capacity of new or withdrawn generation. For the purpose of this assessment the existing and committed generation in tables 8.1 and 8.2 has been taken into account when discussing the possible network limitations. However, where current interest in connecting further variable renewable energy (VRE) generation has occurred, that has the potential to materially impact the magnitude of the emerging limitation, this is also discussed in the following sections. Powerlink will consider these potential limitations holistically with any emerging condition based drivers as part of the longer term planning process and in conjunction with the ISP.

Details of feasible network options are provided in sections 9.2.1 to 9.2.5, for the transmission grid sections potentially impacted by the possible new large loads in Table 3.1.

9.2.1 Bowen Basin coal mining area

Based on AEMO's Steady Progress scenario forecast defined in Chapter 3, the committed network described in Chapter 11, and the committed generation listed in tables 8.1 and 8.2, network limitations are not forecast to exceed network reliability requirements established under Powerlink's planning standard.

However, there has been a proposal for the development of coal seam gas (CSG) processing load and/or new mining load of up to 80MW (refer to Table 3.1) in the Bowen Basin. These loads have not reached the required development status to be included in AEMO's Steady Progress scenario forecast for this Transmission Annual Planning Report (TAPR).

The new loads within the Bowen Basin area would result in voltage and thermal limitations on the 132kV transmission system upstream of their connection points. Critical contingencies include an outage of a 132kV transmission line between Nebo and Moranbah substations, or the 132kV transmission line between Lilyvale and Dysart substations (refer to Figure 6.6).

The impacts these loads may have on the CQ-NQ grid section and possible network solutions to address these is discussed in Section 9.2.4.

AEMO's Steady Progress scenario forecast does allow for increasing additional electrification load from 2025/26. The total load across the multi-sector industries increases from approximately 50MW in 2025/26 to 500MW in 2031/32. This additional electrification load gives consideration to the responses that multi-sector industries will take in line with global efforts to reduce carbon emissions. Whilst the location of this additional load is uncertain there is a likelihood that a significant contribution will come from mining companies aiming to minimise carbon emissions. To achieve this, mines will need to replace diesel fuel within their operations through the introduction of a modern electrified mining fleet or the substitution of diesel fuel with hydrogen. This may lead to significant increases in electrical demand and also require significant supplies of renewable electricity.

Possible network solutions

Feasible network solutions to address the limitations are dependent on the magnitude and location of load. The location, type and capacity of future VRE generation connections in North Queensland (NQ) may also impact on the emergence and severity of network limitations. The type of VRE generation interest in this area is predominately large-scale solar photo voltaic (PV). Given that the CSG and coal mine load profile would be expected to be relatively flat, it is unlikely that the day time PV generation profile will be able to successfully address all emerging limitations.

Depending on the magnitude and location of load, possible network options may include one or more of the following:

- 132kV phase shifting transformers to improve the sharing of power flow in the Bowen Basin within the capability of the existing transmission assets
- construction of 132kV transmission lines between the Nebo, Broadlea and Peak Downs areas
- construction of 132kV transmission line between Moranbah and a future substation north of Moranbah.

Notwithstanding these potential new loads, the electrification of mines and/or the generation and use of hydrogen on site will significantly increase the demand for electricity in the Bowen Basin. Mining in the Bowen Basin relies heavily on the existing 132kV network to deliver power to the region. Much of this infrastructure has limited thermal capacity. To address the potential shortfall in capacity in the transmission and distribution networks, consultation with the miners in the Bowen Basin is required to assess the likely decarbonisation pathways under consideration (electrification or hydrogen), in order to forecast the potential energy demand, renewable energy supply, and transmission requirements. It would not be unexpected that the Bowen Basin 132kV network would need to be replaced or overlayed with a high capacity 275kV network.

9.2.2 Bowen Industrial Estate

Based on AEMO's Steady Progress scenario forecast defined in Chapter 3, no additional capacity is forecast to be required as a result of network limitations within the 10-year outlook period of this TAPR.

However, electricity demand in the Abbot Point State Development Area (SDA) is associated with infrastructure for new and expanded mining export and value adding facilities. Located approximately 20km west of Bowen, Abbot Point forms a key part of the infrastructure that will be necessary to support the development of coal exports from the northern part of the Galilee Basin. The Carmichael Coal and Rail project requires expansion of the Abbot Point port facility. This expansion would add a further 100MW of demand (refer to Table 3.1) but has not reached the required development status to be included in AEMO's Steady Progress scenario forecast.

The Abbot Point area is supplied at 66kV from Bowen North Substation. Bowen North Substation was established in 2010 with a single 132/66kV transformer and supplied from a double circuit 132kV transmission line from Strathmore Substation but with only a single transmission line connected. During outages of the single 132kV supply to Bowen North, the load is supplied via the Ergon Energy 66kV network from Proserpine, some 60km to the south. An outage of the 132kV single connection will cause voltage and thermal limitations impacting network reliability.

Possible network solutions

A feasible network solution to address the limitations comprises:

- installation of a second 132/66kV transformer at Bowen North Substation and connection of the second Strathmore to Bowen North 132kV transmission line.

9.2.3 Galilee Basin coal mining area

The Galilee Basin, 320km to 450km west of Mackay and Rockhampton, is the last remaining major coal province yet to be developed in Queensland. It is also an emerging asset with many significant energy related proposals including multiple coal mines, underground coal gasification, and oil and gas exploration.

Mining proponents in the Galilee Basin that have proposed to develop several large-scale coal mines include:

- Carmichael Coal and Rail Project (Bravus)
- Alpha Coal Project (joint venture GVK and Hancock Prospecting Pty Ltd)
- Kevin's Corner Mine (joint venture GVK and Hancock Prospecting Pty Ltd) and
- China First Project (Waratah Coal).

None of these loads have reached the required development status to be included in AEMO's Steady Progress scenario forecast for this TAPR. After considering the current development activities within the Galilee Basin, loads up to 400MW are possible (refer to Table 3.1). If new coal mining projects eventuate, voltage and thermal limitations on the transmission system upstream of their connection points may occur.

Depending on the number, location and size of coal mines that develop in the Galilee Basin it may not be technically or economically feasible to supply this entire load from a single point of connection to the Powerlink network.

The Carmichael Coal and Rail project is the most advanced of the proposed new mine developments and early construction works on the rail corridor have already commenced[2]. This project could demand up to 200MW of supply from the transmission network from a connection to Powerlink's Strathmore Substation near Collinsville. The Queensland Department of State Development notes that, as at 1 October 2020, both of the outstanding environmental approvals have now been met and all but one of the other key milestones have also been met[3].

New coal mines that develop in the southern part of the Galilee Basin may connect to Lilyvale Substation via approximately 200km of transmission line extension.

Whether these new coal mines connect at Lilyvale and/or Strathmore Substation, the new load will impact the performance and adequacy of the CQ-NQ grid section. Possible network solutions to the resultant CQ-NQ limitations are discussed in Section 9.2.4.

In addition to these limitations on the CQ-NQ transmission system, new coal mine loads that connect to the Lilyvale Substation may cause thermal and voltage limitations to emerge during an outage of a 275kV transmission line between Broadsound and Lilyvale substations.

Possible network solutions

For supply to the Galilee Basin from Lilyvale Substation, feasible network solutions to address the limitations are dependent on the magnitude of load and may include one or both of the following options:

- installation of capacitor bank/s at Lilyvale Substation
- third 275kV transmission line between Broadsound and Lilyvale substations.

The location, type and capacity of future VRE generation connections in Lilyvale, Blackwater and Bowen Basin areas may impact on the emergence and severity of this network limitation. The type of VRE generation interest in this area is predominately large-scale solar PV. Given that the coal mining load profile would be relatively flat, it is unlikely that the day time PV generation will be able to successfully address all emerging limitations.

2 Bravus Mining & Resources, Bravus.
3 Adani Outstanding Approvals Milestones Reached, Queensland Government.

9.2.4 CQ-NQ grid section transfer limit

Based on AEMO's Steady Progress scenario forecast outlined in Chapter 3 and the committed generation listed in tables 8.1 and 8.2, network limitations impacting reliability are not forecast to occur within the 10-year outlook of this TAPR. However, midday power transfer levels are reversing from northern to southern transfers. The incidence of light loading on the transmission system is forecast to increase as additional VRE generators are fully commissioned in NQ. Voltage control is therefore becoming increasingly challenging and leading to high voltage violations. As outlined in Section 11.1 Powerlink has completed a RIT-T recommending the installation of a 275kV shunt reactor at the Broadsound Substation. This reactor is planned to be commissioned by June 2023.

As discussed in sections 9.2.1, 9.2.2 and 9.2.3 there have been proposals for large coal mine developments in the Galilee Basin, development of CSG processing and electrification-related load in the Bowen Basin and associated port expansions. There is also the potential load in the North West Mineral Province.

The North West Mineral Province transmission project (Copperstring) proposes to connect Mt Isa and the North West Minerals Province to the NEM at a new substation south of Powerlink's existing Ross Substation. One of the key benefits of the Copperstring project is to allow the North West Minerals Province to access cheaper electricity from the NEM and not rely on more expensive local generation in Mt Isa. The project could also enable further renewable generation to be connected.

As a result, the Copperstring project could result in additional demand of up to 350MW to be supplied from the transmission network in North Queensland. In addition, there is up to 100MW of demand that is currently not connected to the Mt Isa grid and supplied from standalone power stations that could rapidly connect once Mt Isa is connected to the NEM.

Therefore, the loads in Table 3.1 could result in a coincident increase in northern Queensland demand of up to 930MW but have not reached the required development status to be included in AEMO's Steady Progress scenario forecast of this TAPR.

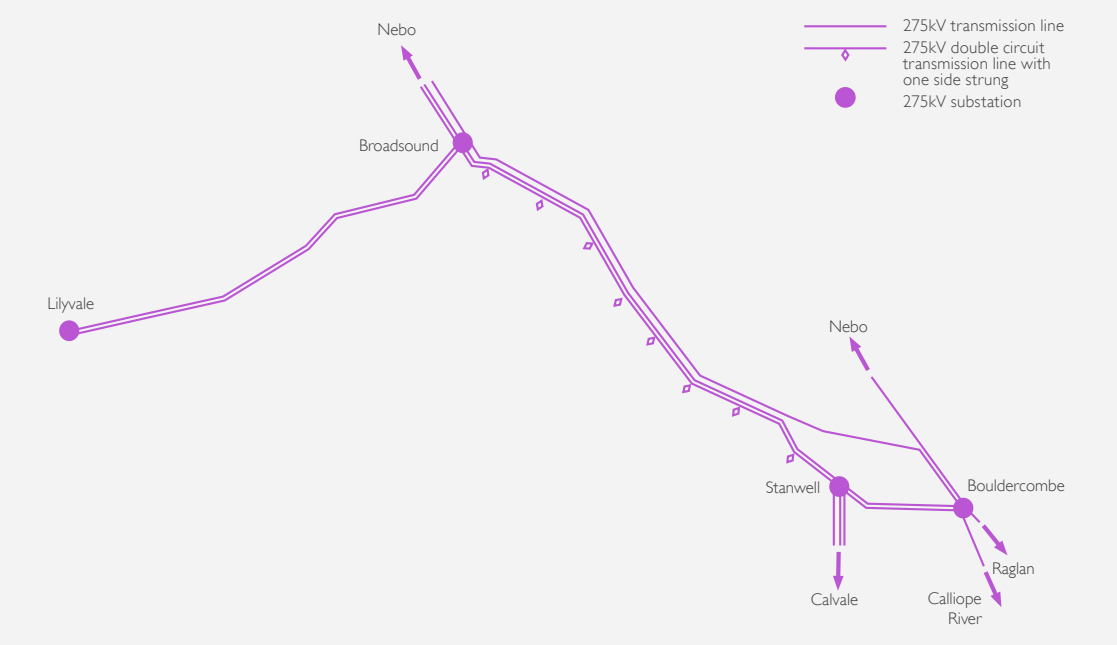
Network limitations on the CQ-NQ grid section may occur if a portion of these new loads commit. Power transfer capability into northern Queensland is limited by thermal ratings and voltage stability. Thermal limitations may occur on the Bouldercombe to Broadsound 275kV line following a critical contingency of a Stanwell to Broadsound 275kV transmission line. Voltage stability limitations may occur following the trip of the Townsville gas turbine or 275kV transmission line supplying northern Queensland.

Based on current network analysis an additional 90MW of load north of Bouldercombe will result in network congestion between Central Queensland and North Queensland that will require dispatch of additional, out-of-merit-order generation in North Queensland. As generation costs are higher in northern Queensland, due to reliance on liquid fuels, it may be economic to advance the timing of augmentation to deliver positive net market benefits. The additional load in northern Queensland that would justify the network augmentation in preference to continued network support could be as low as 250MW.

Possible network solutions

In 2002, Powerlink constructed a 275kV double circuit transmission line from Stanwell to Broadsound with one circuit strung (refer to Figure 9.1). A feasible network solution to increase the power transfer capability to northern Queensland is to string the second side of this transmission line.

Figure 9.1 Stanwell/Broadsound area transmission network



9.2.5 Surat Basin north west area

Based on AEMO's Steady Progress scenario forecast defined in Chapter 3, network limitations impacting reliability are not forecast to occur within the next five years of this TAPR.

However, there have been several proposals for additional CSG upstream processing facilities and new coal mining load in the Surat Basin north west area. These loads have not reached the required development status to be included in AEMO's Steady Progress scenario forecast for this TAPR. The loads could be up to 300MW (refer to Table 3.1) and cause voltage limitations impacting network reliability on the transmission system upstream of their connection points.

Depending on the location and size of additional load, voltage stability limitations may occur following outages of the 275kV transmission lines between Western Downs and Columboola, and between Columboola and Wandoan South substations (refer to Figure 9.2).

Possible network solutions

Due to the nature of the voltage stability limitation, the size and location of load and the range of contingencies over which the instability may occur, it may not be possible to address this issue by installing a single Static VAr Compensator (SVC) at one location.

The location, type and capacity of future VRE generation connections in the Surat Basin north west area may also impact on the emergence and severity of these voltage limitations. The type of VRE generation interest in this area is large-scale solar PV. Given that the CSG upstream processing facilities and new coal mining load has a predominately flat load profile it is unlikely that the day time PV generation profile will be able to successfully address all emerging voltage limitations. However, voltage limitations may be ameliorated by these renewable plants, particularly if they are designed to provide voltage support 24 hours a day.

To address the voltage stability limitation the following network options are viable:

- SVCs, Static Synchronous Compensators (STATCOM) or Synchronous Condensers (SynCon) at both Columboola and Wandoan South substations
- additional transmission lines between Western Downs, Columboola and Wandoan South substations to increase fault level and transmission strength or
- a combination of the above options.

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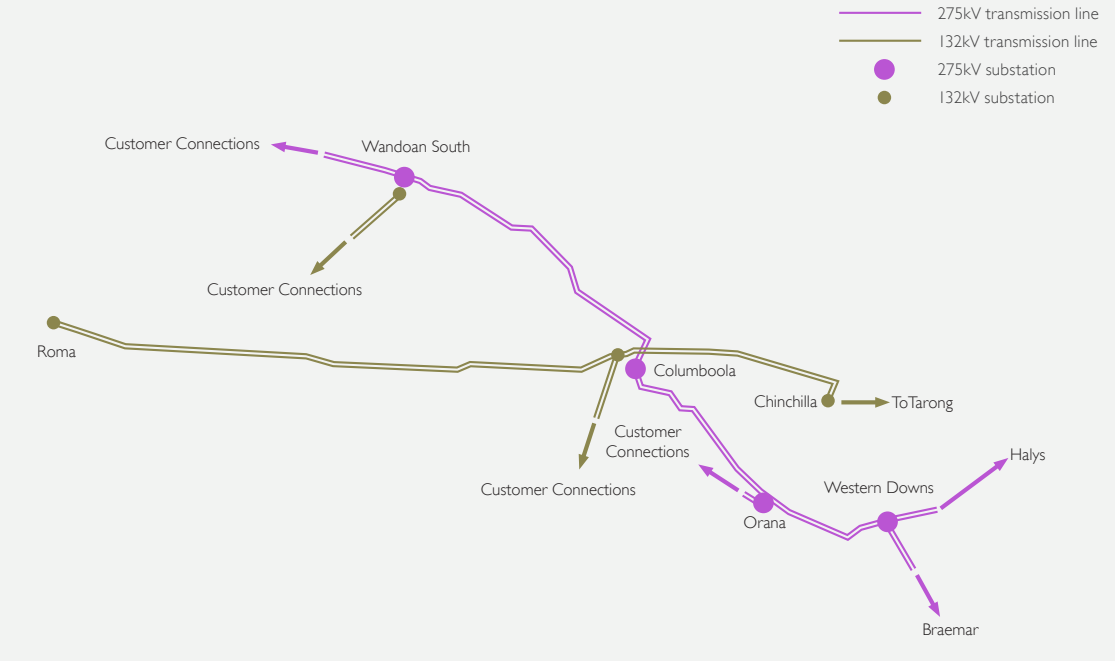
Figure 9.2 Surat Basin north west area transmission network



9.3 Alignment with AEMO's Integrated System Plan

The installation of large-scale VRE generation is changing the mix of generation and impacting the utilisation of existing transmission infrastructure. This has been most evident across the Central to NQ and Central to South Queensland grid sections (refer sections 8.6.2 and 8.6.5 respectively) and the Queensland to NSW interconnector (QNI). This has implications for investment in the transmission network both inter-regional and within Queensland.

These impacts have been investigated in AEMO's 2020 ISP. The 2020 ISP identified that to deliver low-cost, secure and reliable energy, investments in transmission are needed. 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 energy security and reliability, affordability and reduced emissions. Three such projects were nominated for Preparatory Activities. These projects include:

- QNI Medium and Large interconnector upgrades
- Central to Southern Queensland transmission link
- Gladstone grid reinforcement.

For each project a Preparatory Report summarised the following information:

- Project scope and single line diagrams
- Electrical network parameters
- Ratings of network equipment
- Power transfer limits for the existing network and following the augmentation project[4]
- Corridor and route selection
- Project schedule and staging, and
- High level cost estimate.

[4] Power transfer limits were defined as multi-term equations with independent variables observable within AEMO's market modelling software.

Preparatory activities for these projects were provided by 30 June 2021. Links to these Preparatory Reports are footnoted[5]. This information will be used by AEMO to better inform the optimal development path for the 2022 ISP.

9.3.1 Queensland to NSW Interconnector (QNI)

Increasing the capacity of interconnection between NEM regions is essential in order to take advantage of the geographic diversity of renewable resources so regions can export power when there is local generation surplus, and import power when needed to meet demand. Appropriate intra-regional transmission capacity is required to support these objectives.

Powerlink and TransGrid finalised a Project Assessment Conclusion Report on 'Expanding NSW-Queensland transmission transfer capacity' in December 2019. The recommended QNI Minor option (uprating the 330kV Liddell to Tamworth 330kV lines, and installing SVCs at Tamworth and Dumaresq substations and static capacitor banks at Tamworth, Armidale and Dumaresq substations) is now under construction.

The 2020 ISP identified that a further staged upgrade to the transmission capacity between Queensland and NSW (QNI Medium and QNI Large) was an integral part of the optimal development plan. The 2020 ISP identified that the additional transmission capacity would deliver net market benefits from:

- efficiently maintaining supply reliability in NSW following the closure of further generation and the decline in ageing generator reliability
- facilitating efficient development and dispatch of generation in areas with high quality renewable resources through improved network capacity and access to demand centres
- enabling more efficient sharing of resources between NEM regions
- enhancing system resilience and optionality.

These development options can also be coordinated with REZ developments and can be staged by geography, operating voltage and number of circuits to maximise net economic benefits. Powerlink and TransGrid agreed a lower capacity[6] 330kV transmission line to Armidale South Substation would be more likely to form part of the ISP optimal development path. Therefore, the option developed for the preparatory activities was a staged 330kV double circuit line. Each stage is a 330kV line - the first forecast for completion by 2032-33 and the second by 2035-36.

Preparatory activities, as outlined above, were completed by 30 June 2021 so that costs and capacity improvements could be included in the 2022 ISP.

Possible network solutions

The QNI Medium upgrade project proposed by the preparatory activities includes a single 330kV circuit between Braemar Substation and NSW border via a similar alignment to the existing QNI. The proposed route traverses the Central West Orana (within AEMO's North West NSW) and Darling Downs REZs.

Specifically, QNI Medium includes:

- a new 330kV double-circuit line (one circuit strung) from Armidale South to Braemar substations along similar alignment to the existing QNI including connecting to intermediate substations with associated supporting plant.

This augmentation can be expanded with a second stage to form the QNI Large upgrade.

QNI Large comprises a second 330kV circuit (second circuit strung) from Armidale South to Braemar substations connecting to intermediate substations and with associated supporting plant.

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5 Preparatory Activities QNI Medium and Large.
Preparatory Activities CQSQ Transmission Link.
Preparatory Activities Gladstone Grid Reinforcement.

6 Appendix A3.5.1 of the 2020 ISP describes the future ISP project associated with the QNI Medium project as 'single 500kV circuit between NSW and Queensland strung on a double circuit tower via western part of the existing QNI…' and the Large project 'second 500kV circuit…'.

AEMO also flagged in the 2020 ISP that it will work with Powerlink and TransGrid to explore further options in relation to virtual transmission lines (VTLs). The 2020 ISP outlined that VTLs, coupled with suitable wide area protection systems, could provide a technically feasible solution to increase the capacity of QNI. A VTL could comprise of grid-scale batteries on both sides of a QNI (for bidirectional limit increases), or a grid-scale battery on one side and braking resistor or generator tripping on the other side (for unidirectional limit increases).

9.3.2 CQ-SQ grid section reinforcement

In order for power from new and existing NQ and CQ VRE generating systems to make its way to southern Queensland and the southern states, it must be transferred through the CQ-SQ grid section. The utilisation of the CQ-SQ grid sections is therefore expected to increase (refer to Section 8.6.5) and may lead to levels of congestion depending on the response of the central and northern Queensland generators to the energy market. In addition, the utilisation may also increase following the commissioning of the QNI Minor project (refer to Section 6.9.1).

As outlined in Section 9.3.1, the 2020 ISP has identified a further upgrade of QNI capacity from 2032-33. The utilisation and adequacy of the CQ-SQ grid section is closely linked to the required efficient capacity of interconnection with NSW.

As outlined in Section 6.7.6 there are emerging condition and compliance risks related to structural corrosion on significant sections of the coastal CQ-SQ 275kV network between Calliope River and South Pine substations. Strategies to address the transmission line sections with advanced corrosion in the five year outlook are described in Section 6.7.6.

In parallel, Powerlink and AEMO (through the ISP process) continue to investigate the impact of large-scale VRE generation investment in the Queensland region on the utilisation and economic performance of intra-regional grid sections, and in particular the CQ-SQ grid section. The 2020 ISP identified the need for a material upgrade of CQ-SQ as part of the optimal development path. The 2020 ISP identified the early 2030s as the project timing. The upgrade is critical for unlocking renewable resources in the North, Isaac, and Fitzroy REZs for efficient market outcomes.

Powerlink will consider the emerging and forecast constraints holistically with the emerging condition based drivers as part of the planning process. Such decisions will be undertaken using the RIT-T consultation process, where the benefits of non-network options will also be considered.

Possible network solutions

Feasible network solutions to facilitate efficient market operation may differ in scale. The 2020 ISP identified the need for a material upgrade. The proposed project by AEMO included a new 275kV double circuit transmission line between Calvale and Wandoan South substations.

Additional network options that deliver a range of capacity improvements will also be considered in the 2022 ISP. These include:

- establishing a mid-point switching substation on the 275kV double circuit between Calvale and Halys substations
- a grid-scale battery system. A VTL option could comprise of grid-scale batteries on both sides of CQ-SQ, or a grid-scale battery on the south side and a braking resistor or generator tripping on the northern side
- A 1,500MW HVDC bi-pole overhead transmission line from Calvale and South West Queensland.

9.3.3 Gladstone grid section reinforcement

The 275kV network forms a triangle between the generation rich nodes of Calvale, Stanwell and Calliope River substations. This triangle delivers power to the major 275/132kV injection points of Calvale, Bouldercombe (Rockhampton), Calliope River (Gladstone) and Boyne Island substations.

Since there is a surplus of generation within this area, this network is also pivotal to supply power to northern and southern Queensland. As such, the utilisation of this 275kV network depends not only on the generation dispatch and supply and demand balance within the Central West and Gladstone zones, but also in northern and southern Queensland.

Based on AEMO's Steady Progress scenario forecast defined in Chapter 3 and the existing and committed generation listed in tables 8.1 and 8.2, network limitations impacting reliability are not forecast to occur within the 10-year outlook period of this TAPR.

However, the committed VRE generation in tables 8.1 and 8.2 in NQ is expected to increase the utilisation of this grid as generation in the Gladstone zone or southern Queensland is displaced. While not impacting reliability of supply, the committed VRE generation in NQ has the potential to cause congestion depending on how the thermal generating units in CQ bid to meet the NEM demand.

In addition, new loads in the resource rich areas of the Bowen Basin, Galilee Basin, North West Mineral Province and Surat Basin has the potential to further significantly increase the utilisation of this grid section. This may lead to significant limitations impacting efficient market outcomes.

Furthermore, the 2020 ISP has identified significant increases in VRE generation for the North, Isaac, and Fitzroy REZ (refer to Figure 9.5). With this generation the thermal capacity of the network between Bouldercombe, Raglan, Larcom Creek, and Calliope River will be reached. Upgrading this grid section is therefore critical for unlocking these renewable resources in these REZ as part of the optimal development path. The 2020 ISP identified the 2030s as the project timing. The timing could be brought forward with retirement of Gladstone generation[7].

Possible network solutions

Depending on the emergence of network limitations within the 275kV network it may become economically viable to increase its power transfer capacity to alleviate constraints. Feasible network solutions to facilitate efficient market operation may include:

- transmission line augmentation between Calvale and Calliope River substations and rebuild between Larcom Creek and Calliope River substations with a high capacity 275kV double circuit transmission line
- new high capacity 275kV double circuit transmission line between Bouldercombe, Raglan, Larcom Creek and Calliope River
- third Calliope River 275/132kV transformer.

9.3.4 ISP Renewable Energy Zones

As the NEM transforms away from synchronous generation and towards VRE, an additional 34GW to 47GW of new VRE needs to be installed depending on the ISP scenario. This is allowing for strong growth in DER and the large-scale VRE that is already installed or expected to be operational. In Queensland, under AEMO's 2020 ISP Central scenario, approximately 11GW of large-scale VRE still needs to be installed by the early 2040s.

A number of REZ development opportunities for the Queensland region have been identified in the ISP's optimal development path. Under the Central scenario, additional VRE generation is planted in five out of eight candidate REZs; North Queensland (FNQ), Isaac, Fitzroy, Wide Bay and Darling Downs (refer to Figure 9.3).

These REZs are developed in phases. Initially VRE developments are planted to help meet Queensland's Renewable Energy Target (QRET). The additional VRE is planted where there is relatively good access to existing network capacity and system strength. The 2020 ISP identified wind and solar generation in the Darling Downs and Fitzroy REZ using this existing transmission capacity.

Finally VRE developments are associated with future ISP projects. Larger VRE development in the Fitzroy REZ (wind and solar) and Isaac REZ (wind) are supported by future ISP projects which include the Gladstone and Central to Southern Queensland grid section reinforcements and expansions of QNI (refer to sections 9.3.1, 9.3.2 and 9.3.3). Renewable developments in the FNQ REZ also require 275kV upgrades within this REZ.

In recognition of the potential value of REZ developments across Queensland (the three REZ in north, central and southern zones that overlay the REZ identified in the ISP), the Queensland Government announced $145 million for REZ support (refer to Chapter 2). Powerlink will continue to work with Government, AEMO, stakeholders and customers to drive the most efficient and cost effective outcomes from this process.

[7] The potential closure of a large industrial load in the Gladstone zone also influences the required size and timing of this project.

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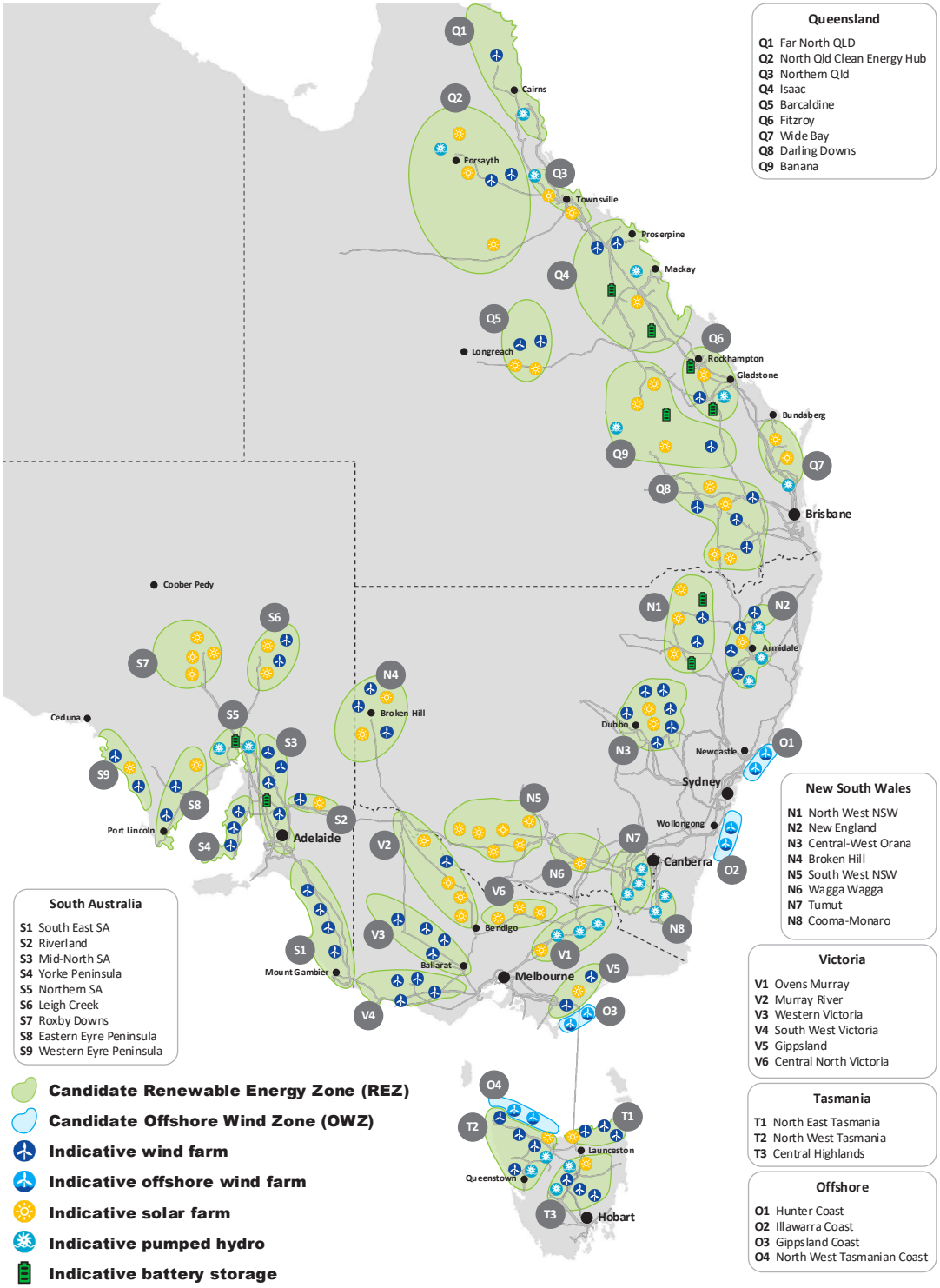
Figure 9.3 2020 ISP Renewable Energy zone candidates in Queensland



Source: AEMO