INDEPENDENT PLANNING REVIEW – TECHNICAL ASSESSMENT

QUEENSLAND TRANSMISSION NETWORK

December 2015

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

Purpose

The purpose of this publication is to provide a technical assessment to support the Independent Planning Review for the Queensland transmission network.

AEMO publishes this report in its capacity as National Transmission Planner, exercising the functions set out in section 49(2) of the National Electricity Law. This publication is based on information available to AEMO as at 31 October 2015.

Disclaimer

AEMO has made every effort to ensure the quality of the information in this publication but cannot guarantee that information, forecasts and assumptions are accurate, complete or appropriate for your circumstances. This publication does not include all of the information that an investor, participant or potential participant in the national electricity market might require, and does not amount to a recommendation of any investment.

Anyone proposing to use the information in this publication (including information and reports from third parties) should independently verify and check its accuracy, completeness and suitability for purpose, and obtain independent and specific advice from appropriate experts.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this publication:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the information in this publication; and
- are not liable (whether by reason of negligence or otherwise) for any statements, opinions, information or other matters contained in or derived from this publication, or any omissions from it, or in respect of a person's use of the information in this publication.

Acknowledgement

AEMO acknowledges the co-operation and contribution of Powerlink in providing data and information used in this publication.

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

This technical assessment is a supplement to the Independent Planning Review of the Queensland Transmission Network. It provides a detailed review of asset reinvestment works proposed in Powerlink's 2015 Transmission Annual Planning Report (TAPR).

The following are summarised for each of the proposed asset reinvestment projects that have been assessed:

- Background of the assets identified for reinvestment.
- Powerlink's proposal for asset reinvestment.
- AEMO's connection point forecasts.
- Existing network capacity in relation to the proposed project.
- AEMO's assessment.

2 QUEENSLAND TRANSMISSION NETWORK PLANNING STANDARD

In this review, AEMO applied the planning standard that Powerlink must adhere to when making transmission network investment decisions. These obligations are prescribed by *Queensland's Electricity Act 1994* (the Act), the NER, and Powerlink's Transmission Authority. [1]

The Queensland transmission network planning standard permits Powerlink to plan and develop the transmission network on the basis that load may be interrupted during a single network contingency event. The following limits apply during a critical contingency:

- Maximum load at risk not to exceed 50 MW at any one time.
- Unserved energy not to exceed 600 MWh in aggregate.

Powerlink is required to implement appropriate network or non-network solutions in circumstances where the limits set out above are exceeded, or when the economic cost of load which is at risk of not being supplied justifies the cost of the investment.[2]

The assessment of each proposed project depends on an analysis of the network's ability to meet projected demand. In making this assessment, AEMO uses its own Queensland connection point forecasts[3], published in June 2015, and energy forecasts from the 2015 National Electricity Forecasting Report (NEFR) Update published in December 2015.[4]

[1] Powerlink, Transmission Annual Planning Report 2015. Available: https://www.powerlink.com.au/About_Powerlink/Publications/Transmission_Annual_Planning_Reports/Transmission_Annual_Planning_Report_2015.aspx. Viewed: 8 December 2015.
[2] See note 1.
[3] AEMO. Transmission Connection Point Forecasting. Available: http://www.aemo.com.au/Electricity/Planning/Forecasting/AEMO-Transmission-Connection-Point-Forecasting. Viewed: 8 December 2015.
[4] AEMO. National Electricity Forecasting Report. Available: http://www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report. Viewed: 8 December 2015.

3 CAPACITY-DRIVEN NETWORK AUGMENTATION PROJECTS

No capacity-driven investment is identified for the regulatory period 2016–17 to 2021–22. This is consistent with Powerlink's 2015 TAPR.

4 ASSET REINVESTMENT WORKS

Table 1 provides a summary of reinvestment works proposed by Powerlink in the 2015 TAPR.

Table 1 Powerlink's proposed asset reinvestment works

Asset type	Proposed replacement year	Project	Connection points	Region
Substation	Summer 2018–19	Garbutt 132/66 kV transformers replacement	Garbutt substation	Northern
Substation	Winter 2018	Ingham South 132/66 kV transformers replacement	Ingham South substation	Northern
Substation	Winter 2018	Kamerunga substation 132 kV primary plant replacement	Kamerunga substation	Northern
Transmission lines	Summer 2017–18	Collinsville North – Proserpine 132 kV line – line refit works	Collinsville North and Proserpine substations	Northern
Transmission lines	Winter 2018	Clare South – Townsville South 132 kV line – line refit works	Townsville South and Clare South substations	Northern
Transmission lines	Summer 2018–19	Eton Tee – Alligator Creek 132 kV line – line refit works	Alligator Creek, Nebo and Pioneer Valley substations	Northern
Transmission lines	Summer 2020–21	Eton Tee – Nebo 132 kV line – line refit works	Nebo, Mackay and Alligator Creek substations	Northern
Transmission lines	Summer 2019–20	Eton Tee – Pioneer Valley 132 kV line – line refit works	Pioneer Valley and Nebo substations	Northern
Transmission lines	Summer 2017–18	Kareeya–Chalumbin 132 kV line – line refit works	Kareeya power station and Chalumbin substation	Northern
Substation	Summer 2019–20	Bouldercombe 275 kV and 132 kV primary plant replacement	Bouldercombe substation	Central
Substation	Summer 2019–20	Dysart 132 kV primary plant replacement	Dysart substation	Central
Substation	Summer 2019–20	Dysart 132/66 kV transformer replacement	Dysart substation	Central
Substation	Summer 2019–20	Gin Gin substation primary plant replacement	Gin Gin substation	Central
Substation	Summer 2020–21	Lilyvale 275 kV and 132 kV primary replacement	Lilyvale substation	Central
Substation	Summer 2020–21	Lilyvale 132/66 kV transformer replacement	Lilyvale substation	Central
Transmission lines	Summer 2019–20	Callide A–Moura 132 kV line – line replacement works	Callide A and Moura substations	Central
Transmission lines	Summer 2019–20	Egans Hill – Rockhampton 132 kV line – line refit works	Rockhampton and Bouldercombe substations	Central
Substation	Summer 2019–20	Ashgrove West substation 110 kV primary plant replacement	Ashgrove substation	Southern

Asset type	Proposed replacement year	Project	Connection points	Region
Substation	Summer 2019–20	Belmont 275/110 kV transformer replacement	Belmont substation	Southern
Substation	Summer 2017–18	Mudgeeraba 110 kV primary plant replacement	Mudgeeraba substation	Southern
Substation	Summer 2017–18	Mudgeeraba 275/110 kV transformer replacement	Mudgeeraba substation	Southern
Substation	Summer 2019–20	Palmwoods 275 kV primary plant replacement	Palmwoods substation	Southern
Substation	Summer 2020–21	Redbank Plains substation 110 kV primary plant replacement	Redbank Plains substation	Southern
Transmission lines	Winter 2016 to Winter 2017	110 kV lines between Belmont and Sumner Tee – line refit works	Belmont, Runcorn, Algester, Richlands, West Darra and	Southern
Transmission lines	Summer 2019–20	110 kV lines between Blackstone and Abermain – line refit works	Blackstone, Bundamba and Abermain substations	Southern
Transmission lines	Summer 2018–19	110 kV lines between Blackstone and Redbank Plains – line refit works	Blackstone, Redbank Plains and Goodna substations	Southern
Transmission lines	Winter 2017 to Summer 2017–18	110 kV lines between Rocklea and West Dara – line refit works	Rocklea, Sumner and West Darra substations	Southern
Transmission lines	Summer 2016–17	110 kV lines between South Pine and West Darra – line refit works	South Pine, Upper Kedron and West Darra substations	Southern
Transmission lines	Winter 2020 to Summer 2020–21	275 kV lines between Karana Tee to Bergins Hill to Belmont – line refit works	Belmont, Blackwall and Goodna substations	Southern
Transmission lines	Summer 2020–21	275 kV lines between South Pine and Karana Tee – line refit works	South Pine, Blackwall and Rocklea substations	Southern
Transmission lines	Summer 2018–19	Greenbank–Mudgeeraba 275 kV lines – line refit works	Greenbank and Mudgeeraba substations	Southern
Transmission lines	Summer 2020–21	Mudgeeraba–Terranora 110 kV lines – line refit works	Mudgeeraba and Terranora substations	Southern

4.1 Northern Region

This section outlines each of the individual reinvestment works that Powerlink proposed for the Northern Region of Queensland in the 2015 TAPR.

4.1.1 Substations

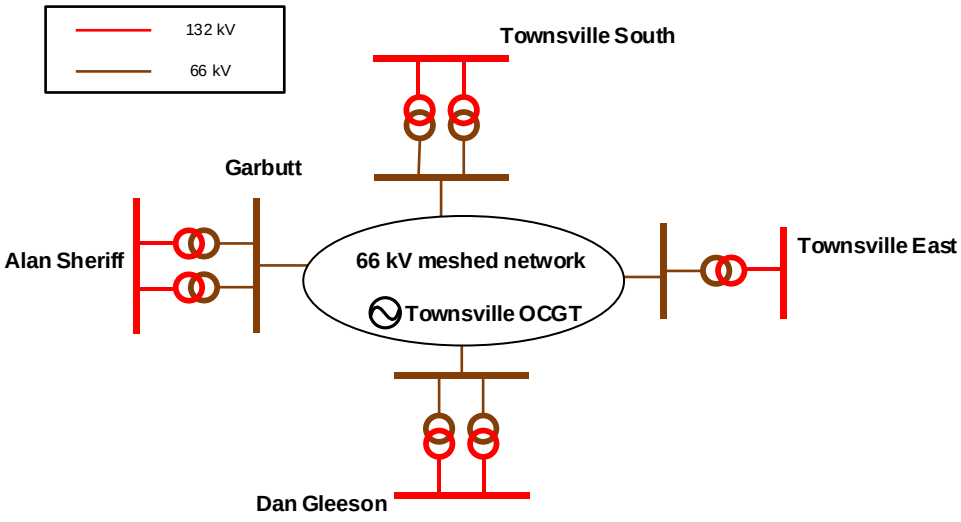
4.1.1.1 Garbutt 132/66 kV transformer replacement

Powerlink 2015 TAPR summary	
Potential project	Garbutt 132/66 kV transformer replacement
High level scope	Replacement of both 132/66 kV transformers
Possible commissioning date	Summer 2018–19
Alternative	Staged replacement of 132/66 kV transformers and 66 kV network reconfiguration

Background

The Townsville load includes the city of Townsville as well as the townships and surrounding rural areas north, including Ingham. This area is supplied by six 132/66 kV substations (one in Ingham and five in Townsville), and one 132/11 kV substation. The 66 kV network in the Townsville area is meshed and connected with four of the five 132/66 kV substations in the Townsville area (Figure 1). Garbutt, one of these four substations, has two 132/66 kV transformers. A gas turbine generator of 82 MW capacity is connected to the same 66 kV network.

Figure 1 Townsville 66 kV meshed network supply



Powerlink proposal for asset reinvestment

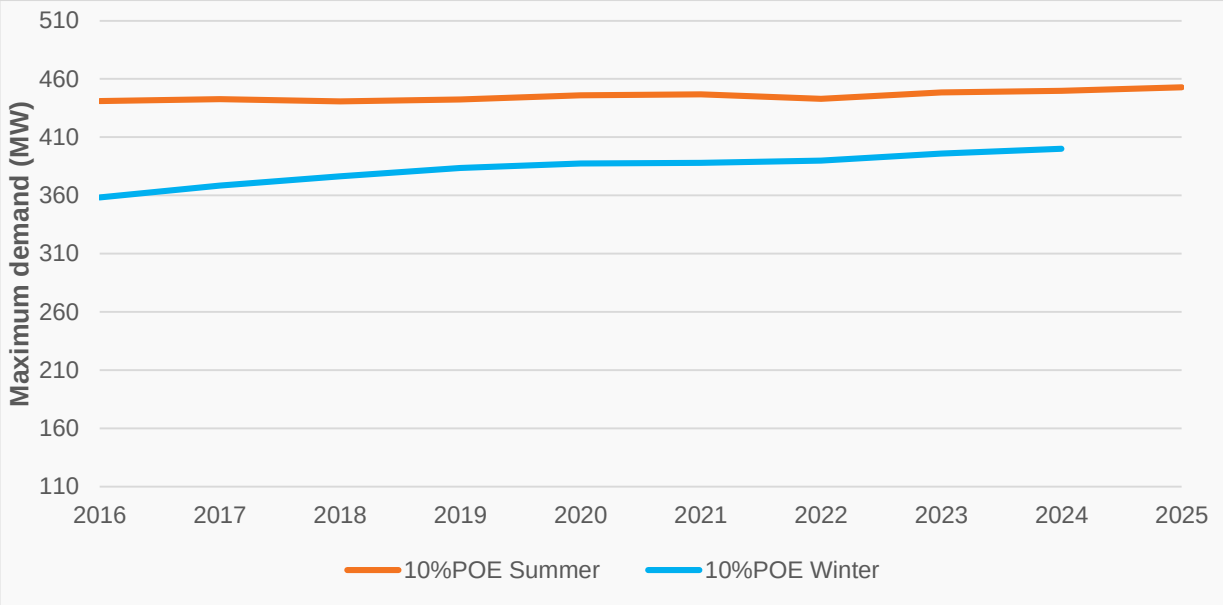
Powerlink's 2015 TAPR identified possible replacement of two 132/66 kV transformers at Garbutt substation with a commissioning date in summer 2018–19. Powerlink has proposed the following options:

- Replace both 132/66 kV transformers.
- Staged replacement of the two 132/66 kV transformers.
- Reconfigure supply through a single transformer and seek support from alternative non-network solutions in the Townsville area.

AEMO connection point forecasts

The 10% POE summer maximum demand in Townsville meshed network is forecast to be 460 MW for the period 2015–16 to 2024–25. Figure 2 shows the connection point forecasts for the demand at 66 kV supplied by the 132/66 kV transformers in the Townsville meshed network.

Figure 2 AEMO connection point maximum demand forecasts of 66 kV meshed network in the Townsville area



Network capacity

There are seven 132/66 kV transformers connected to 66 kV meshed network in the Townsville area. The total thermal capacity of these transformers, excluding a transformer at Garbutt, is 568 MVA. The N-1 capacity of the remaining six transformers is 455 MVA with a short-term capacity of 574 MVA.

AEMO assessment

The maximum demand forecast is within the total capacity of the 132/66 kV transformers, excluding the 132/66 kV transformer at Garbutt substation. The maximum demand exceeds the N-1 normal capacity of the remaining transformers but remains within the short-term capacity.

Garbutt substation is one of the four substations connected to the 66 kV meshed network and supplying Townville area. AEMO agrees with Powerlink's assessment that there is an ongoing need for a 132/66 kV transformer at Garbutt substation to supply Ergon Energy's meshed 66 kV distribution network serving the Townsville area.

AEMO agrees with Powerlink's alternative proposal for retiring one transformer with support from non-network services to maintain supply security following a contingency.

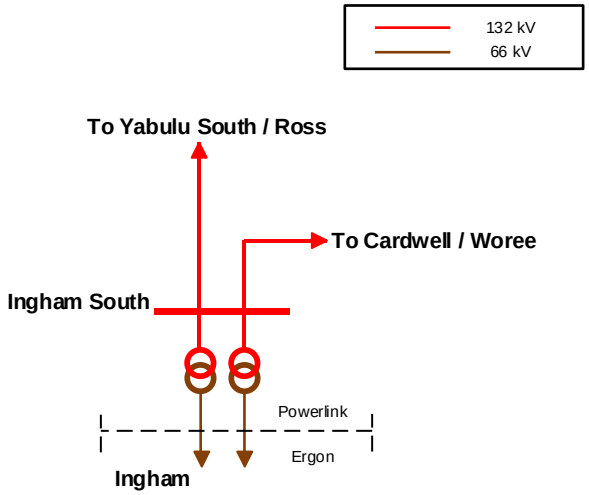
4.1.1.2 Ingham South 132/66 kV transformer

Powerlink 2015 TAPR summary	
Potential project	Ingham South 132/66 kV transformer replacement
High level scope	Replacement of both 132/66 kV transformers
Possible commissioning date	Winter 2018
Alternative	Staged replacement of the two 132/66 kV transformers

Background

The Ingham South 132/66 kV substation is located in the north-west area of Townsville and connected with the Ross and Woree 275/132 kV substations via 132 kV transmission circuits. This substation has two 132/66 kV transformers and supplies Ergon Energy's local 66 kV distribution network (Figure 3).

Figure 3 Ingham 132 kV substation



Powerlink proposal for asset reinvestment

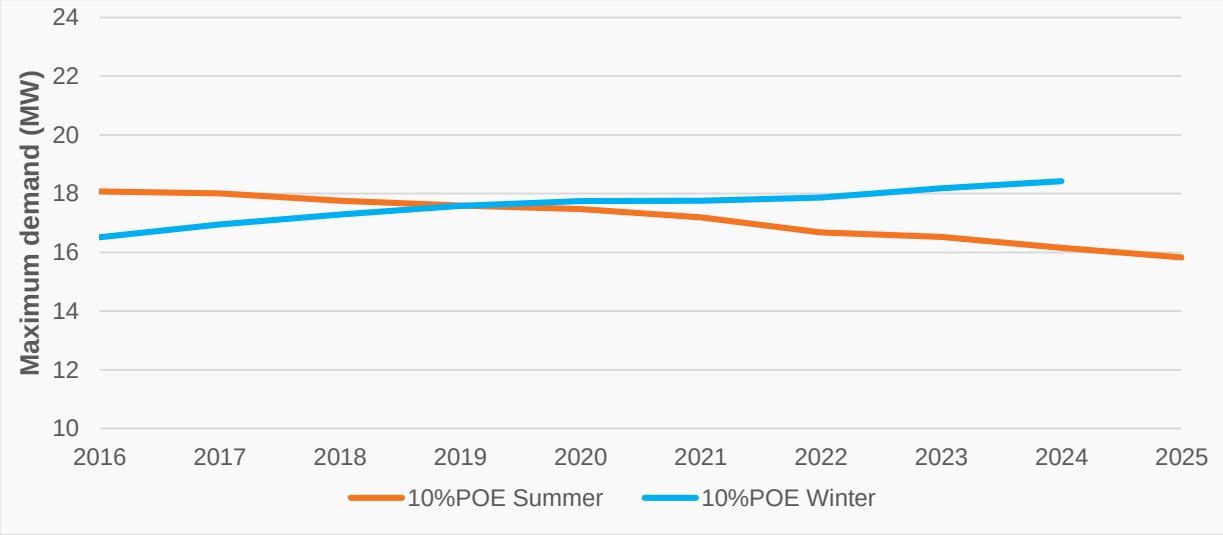
Powerlink's 2015 TAPR identified possible replacement of two 132/66 kV transformers at Ingham South with a commissioning date in winter 2018. Powerlink has proposed the following options:

- Replacement of both 132/66 kV transformers.
- Staged replacement of the two 132/66 kV transformers.

AEMO connection point forecasts

The 10% POE summer maximum demand in Ingham 132/66 kV substation is forecast to be about 18 MW for the period 2015–16 to 2024–25. Figure 4 shows 10-year connection point forecasts for the 66 kV load at the Ingham South substation. The connection point is currently summer peaking, however it is projected to become winter peaking over the outlook period. The winter maximum demand is forecast to increase over the period 2015–16 to 2024–25, whereas the summer maximum demand is forecast to decrease in the outlook period.

Figure 4 AEMO connection point maximum demand forecast at Ingham South substation



Network capacity

The normal rating of each of the existing 132/66 kV transformers is 35 MVA with an emergency rating of 40 MVA. The name plate rating of each of the transformers is 26 MVA.

AEMO assessment

There is an ongoing need for the 132/66 kV transformers at the Ingham South substation, as these assets are the primary source of supply for a number of Ergon Energy's 66 kV connection points in the North-western Townsville and Ingham region.

The 10% POE maximum demand is forecast to be 50% of thermal capacity of the existing transformers. There is potential for a lower cost alternative, that is, replacement with two lower capacity transformers. A further alternative could be replacement with two even lower capacity transformers, combined with non-network services such as demand side participation. However, AEMO acknowledges that other factors may influence the sizing of new transformers, such as the availability of spares from an asset management perspective. Further information on non-network costs would be required to identify potential cost savings in this case.

4.1.1.3 Kamerunga substation replacement

Powerlink 2015 TAPR summary	
Potential Project	Kamerunga substation 132 kV primary plant replacement
High level scope	Full replacement of the 132 kV substation
Possible commissioning date	Winter 2019
Alternative	Staged replacement of the 132 kV primary plant Network reconfiguration in the Kamerunga area

Background

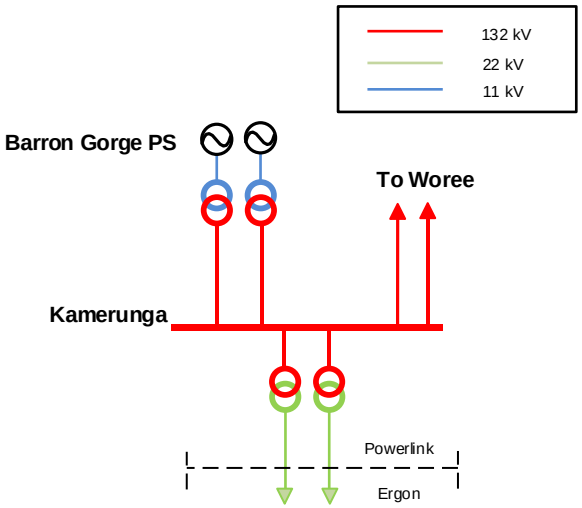
Kamerunga 132/22 kV substation supplies local load connected to Ergon Energy's distribution network via two 132/22 kV transformers. It connects Barron Gorge power station (hydro power generation) via two 132 kV transmission circuits. Figure 5 shows the Kamerunga 132 kV substation connection configuration.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible replacement of the Kamerunga substation 132 kV primary plant and secondary systems by winter 2019. Powerlink has proposed the following options:

- Full replacement of the 132 kV substation.
- Staged replacement of the 132 kV primary plant and secondary systems.
- Network reconfiguration in the Kamerunga area.

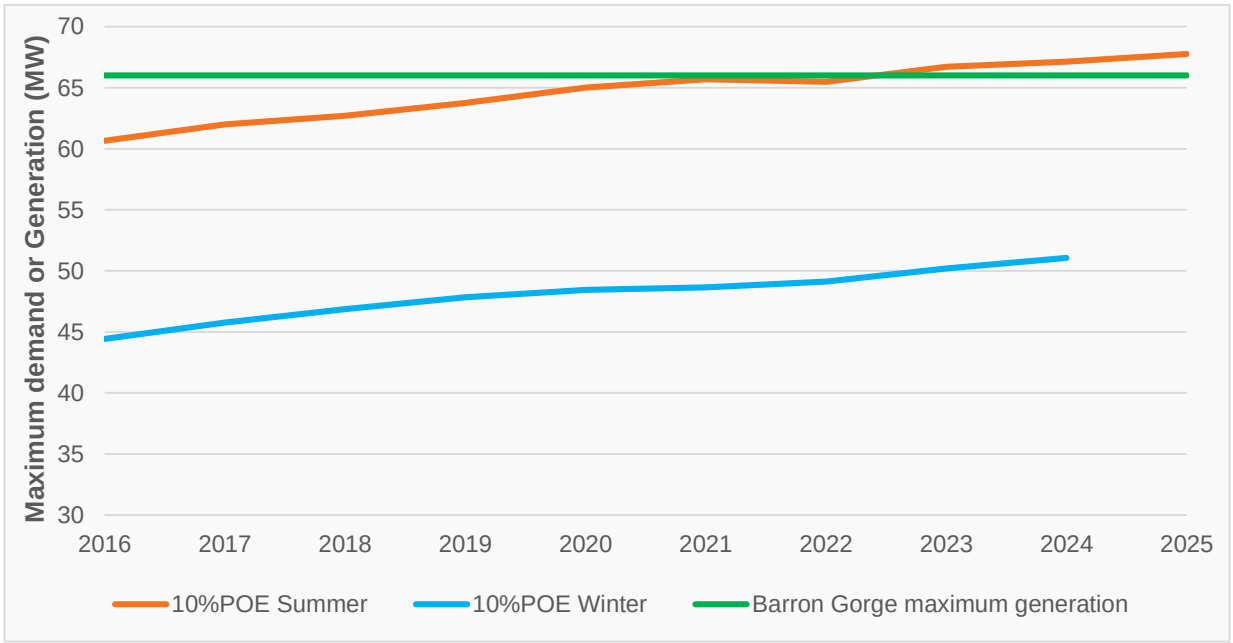
Figure 5 Kamerunga 132 kV substation



AEMO connection point forecasts

Figure 6 shows connection point forecasts for the Kamerunga substation and the maximum generation at the Barron Gorge power station, which is transferred to the distribution network through the 132 kV switchyard of the Kamerunga substation. The maximum demand forecast of this substation projects the summer maximum demand to increase from 60 MW in 2015–16 to 68 MW in 2024–25.

Figure 6 AEMO connection point maximum demand forecast and generation at Kamerunga



AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the 132 kV primary plant at the Kamerunga substation, to enable reliable supply for growing load in the area. Moreover, this infrastructure connects the Barron Gorge hydro power station to the transmission network.

4.1.2 Transmission lines

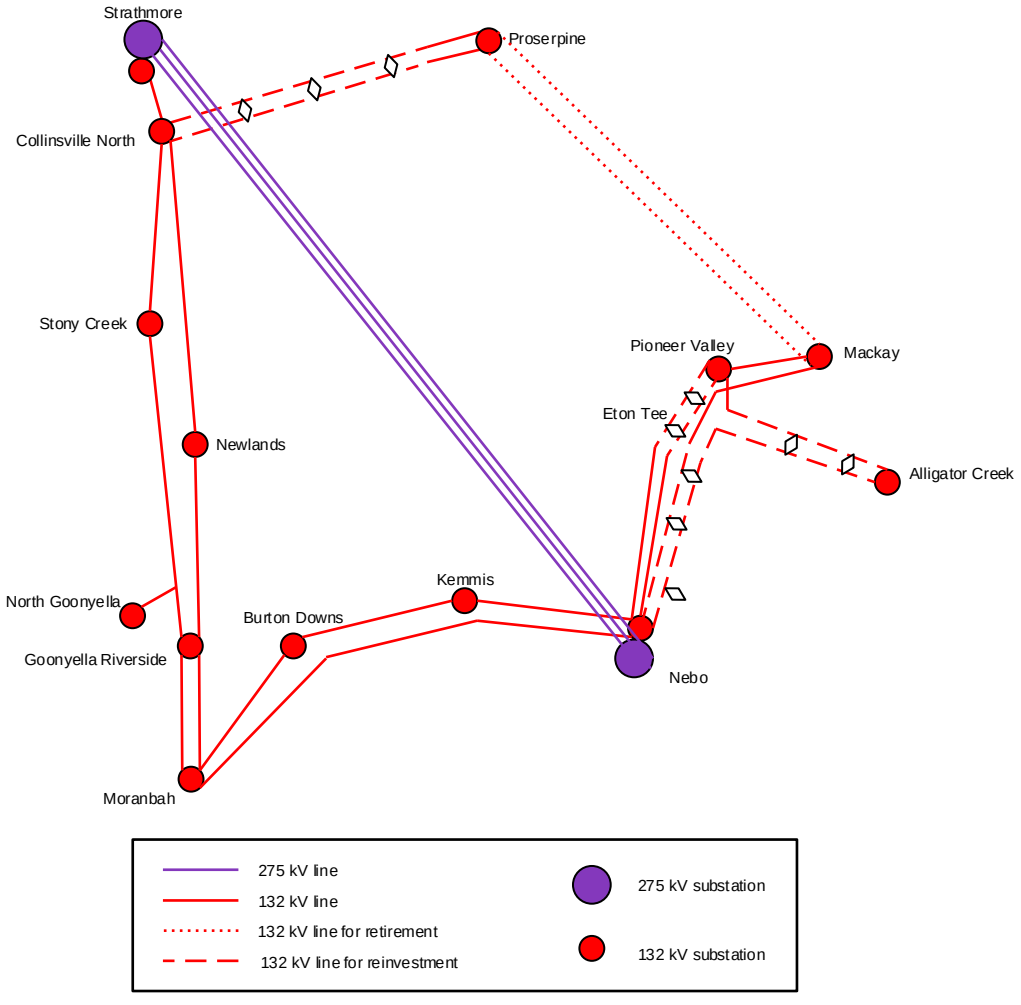
4.1.2.1 Collinsville North–Proserpine 132 kV transmission line

Powerlink 2015 TAPR summary	
Potential project	Line refit works on the Collinsville North – Proserpine 132 kV transmission line
High level scope	Line refit works on all steel lattice structures
Possible commissioning date	Summer 2017–18
Alternative	New 132 kV transmission line

Background

A double circuit 132 kV transmission line connects Collinsville North and Proserpine substations. These circuits are tapped at Proserpine to form a double circuit 132 kV transmission line connecting the Mackay substation. The length of each circuit between Proserpine and Mackay substation is about 114 km (Figure 7).

Figure 7 North zone transmission network



Powerlink proposal for asset reinvestment

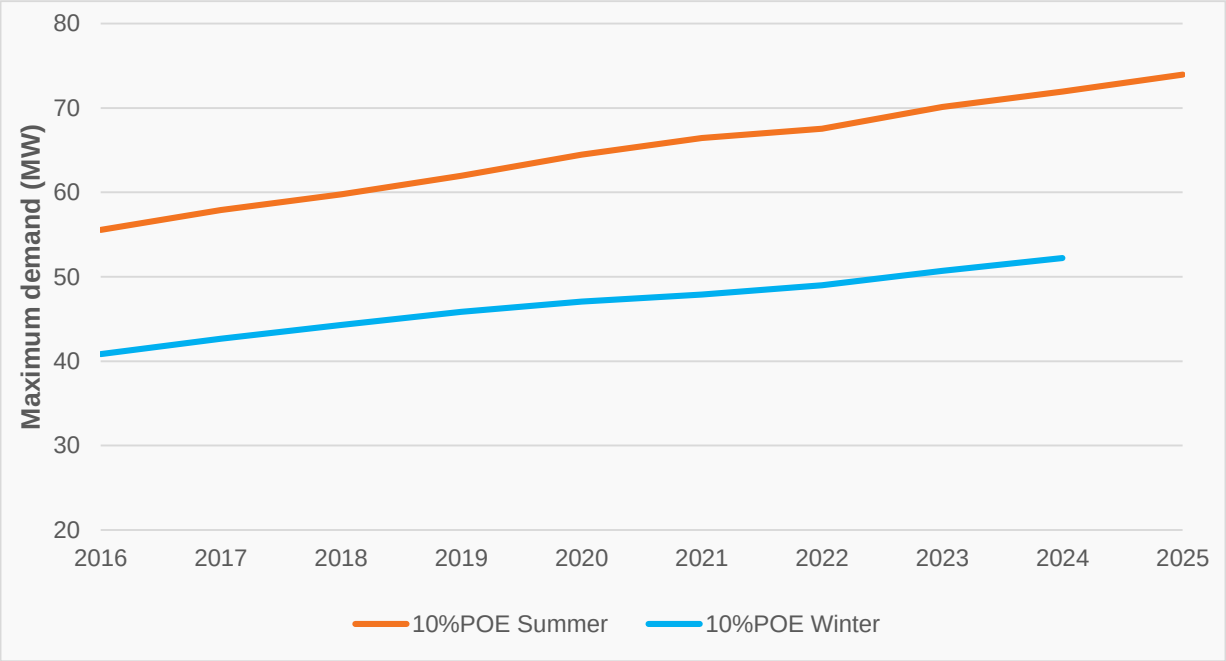
Powerlink's 2015 TAPR identified possible line refit works on steel lattice structures on both of the Collinsville–Proserpine 132 kV circuits.

Powerlink also identified possible retirement of the double circuit 132 kV transmission line between Proserpine and Mackay substations.

AEMO connection point forecasts

The 10% POE summer maximum demand at this substation is projected to increase from 55 MW in 2015–16 to 74 MW in 2024–25. Figure 8 shows connection point forecasts for the Proserpine substation.

Figure 8 AEMO connection point maximum demand forecast at Proserpine substation



Network Capacity

Each Collinsville North – Proserpine 132 kV transmission circuit has a normal summer rating of 71 MVA and summer emergency rating of 82 MVA. These ratings are adequate to meet the forecast 10% POE maximum demand.

AEMO assessment

Following retirement of the Proserpine–Mackay 132 kV line, the only connection to the Proserpine substation is from the Collinsville North substation.

AEMO agrees with Powerlink that there is an ongoing need for the Collinsville North – Proserpine 132 kV circuits to supply the load connected to the Proserpine substation.

4.1.2.2 Clare South – Townsville South 132 kV transmission line

Powerlink 2015 TAPR summary	
Potential project	Line refit works on the Clare South – Townsville South 132 kV transmission line (#7130)
High level scope	Line refit works on steel lattice structures
Possible commissioning date	Winter 2018
Alternative	New 132 kV transmission line

Background

The Townsville South and Clare South substations are connected by two 132 kV transmission circuits in separate coastal and inland alignments (Figure 9). The circuit in the coastal alignment provides connection to a load and 50 MW embedded generation at Invicta.

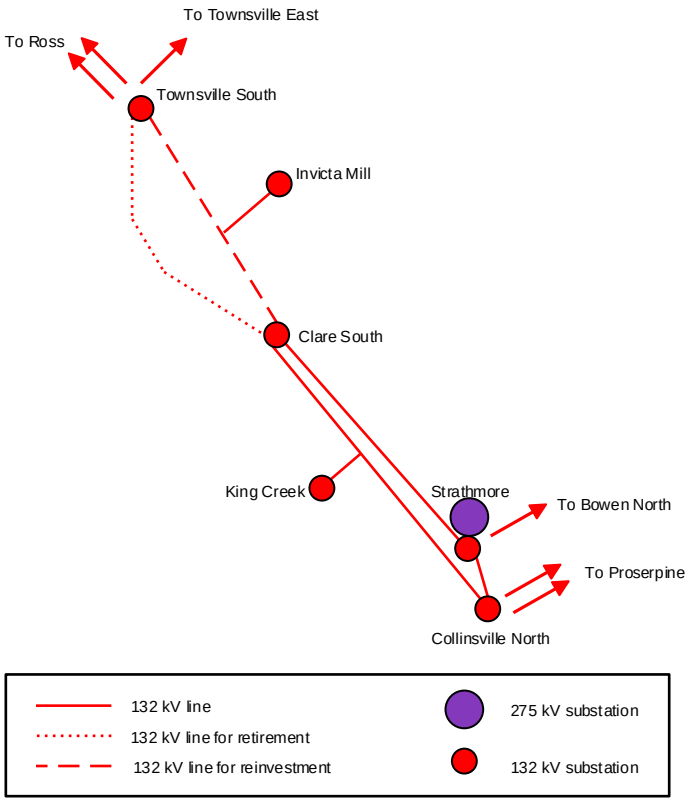
The Clare South substation is connected to the Strathmore and Collinsville North substations by two additional 132 kV transmission circuits.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible line refit works on steel lattice structures on the Townsville South – Invicta Tee – Clare South 132 kV circuit, which was constructed on coastal alignments.

Powerlink also identified possible reconfiguration involving retirement of the Clare South – Townsville South 132 kV circuit and installation of a 132 kV shunt capacitor bank at the Proserpine substation to address low voltage levels (beyond the current outlook period).

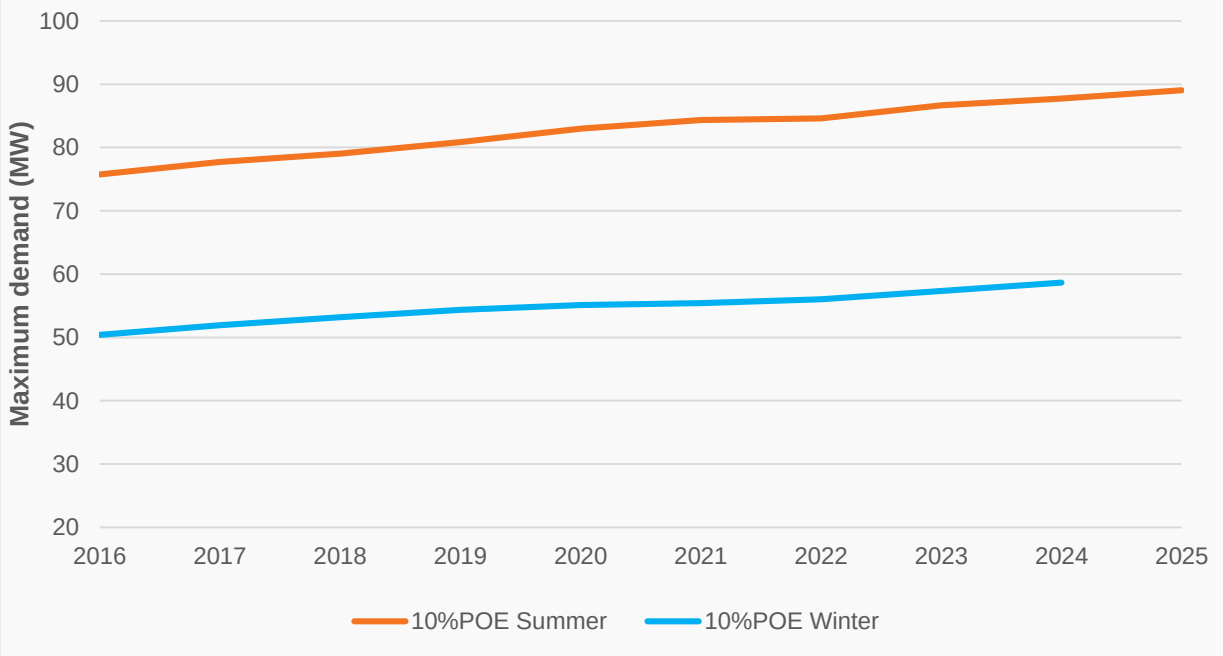
Figure 9 Townsville–Clare South transmission circuits



AEMO connection point forecasts

Figure 10 shows connection point forecasts for the Clare South substation. The 10% POE maximum demand at this substation is forecast to reach 90 MW during the 10-year outlook period.

Figure 10 AEMO connection point maximum demand forecast at Clare South substation



Network Capacity

The network capability is assessed without considering the Clare South – Townsville South 132 kV line (#7131) due to possible retirement of the line. Table 2 below summarises the existing transmission capacity at Clare South.

Table 2 Clare South 132 kV transmission line capacity

Circuit description	Summer Rating (MVA)	Winter Rating (MVA)
	Normal	Normal
Townsville South – Invicta Tee – Clare South 132 line #7130	108	127
Clare South – Strathmore 132 kV line	173	194
Clare South – Collinsville North 132 kV line	173	194

The transmission line thermal capacity, excluding the capacity of the proposed retirement of the Townsville – Clare South 132 kV line, is sufficient to meet the forecast maximum demand at the Clare South substation.

AEMO assessment

AEMO agrees that there is an ongoing need for the Townsville South – Invicta Tee – Clare South 132 kV circuit for connecting the load and embedded generation at Invicta to the Powerlink's 132 kV network.

AEMO agrees with Powerlink's assessment that the retirement of the Clare South – Townville South 132 kV transmission line will require reactive power support at the Proserpine substation. This could be provided either through a shunt reactive capacitor bank as Powerlink proposed in the 2015 TAPR, or through non-network services, subject to cost benefit analysis.

4.1.2.3 Eton Tee – Alligator Creek 132 kV circuits

Powerlink 2015 TAPR summary	
Potential project	Line refit works on the Eton Tee–Alligator Creek 132 kV transmission line
High level scope	Line refits works on steel lattice structure
Possible commissioning date	Summer 2018–19
Alternative	New 132 kV transmission line

Background

The Alligator Creek substation is connected by a 132 kV transmission circuit from Pioneer Valley and another 132 kV transmission circuit from Nebo via Eton Tee (Figure 7). This substation supplies Ergon Energy's 33 kV network.

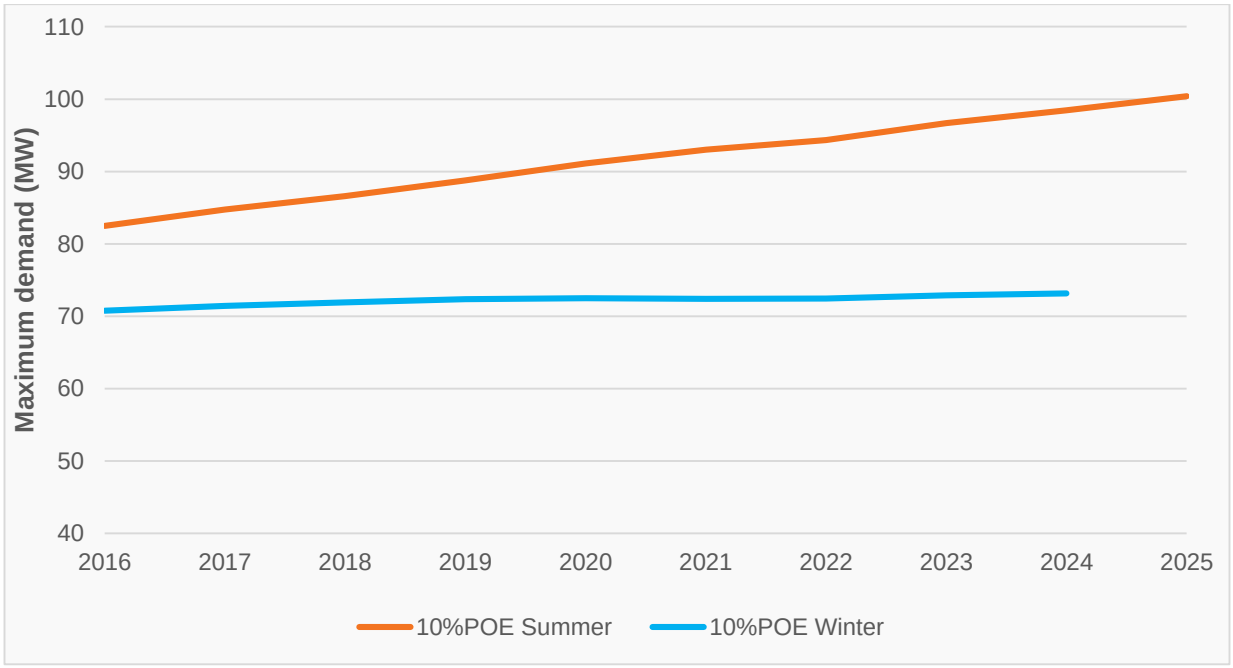
Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible line refit works on steel lattice structures on both of the Eton Tee – Alligator Creek 132 kV circuits.

AEMO connection point forecasts

The 10% POE summer maximum demand at this substation, including the 132 kV load supplied from this substation, is projected to increase from 82 MW in 2015–16 to 100 MW in 2024–25. Figure 11 shows connection point maximum demand forecasts at the Alligator Creek substation.

Figure 11 Connection point maximum demand forecast at Alligator Creek substations – 33 kV and 132 kV



Network Capacity

The normal summer ratings of Nebo–Alligator 132 kV circuit and Pioneer Valley – Alligator Creek 132 kV circuit are 135 MVA and 142 MVA respectively. These ratings are adequate to meet the forecast 10% POE maximum demand.

AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the Eton Tee – Alligator Creek 132 kV circuits to supply load connected at the Alligator Creek substation.

4.1.2.4 Eton Tee – Nebo and Eton Tee – Pioneer Valley 132 kV circuits

Powerlink 2015 TAPR summary	
Potential project	Line refit works on the Eton Tee – Pioneer Valley and Nebo – Eton Tee 132 kV transmission lines
High level scope	Staged line refit of steel lattice structures
Possible commissioning date	Summer 2019–20, 2020–21
Alternative	New 132 kV transmission line Network reconfiguration and line retirement (reconfiguration option is for the Eton Tee-Pioneer Valley 132 kV line section)

Background

The Pioneer Valley, Alligator Creek and Mackay substations are supplied by Nebo – Pioneer Valley, Pioneer Valley – Alligator Creek, Pioneer Valley – Mackay 132 kV transmission circuits as shown in Figure 7.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible line refit works on steel lattice structures on the sections between:

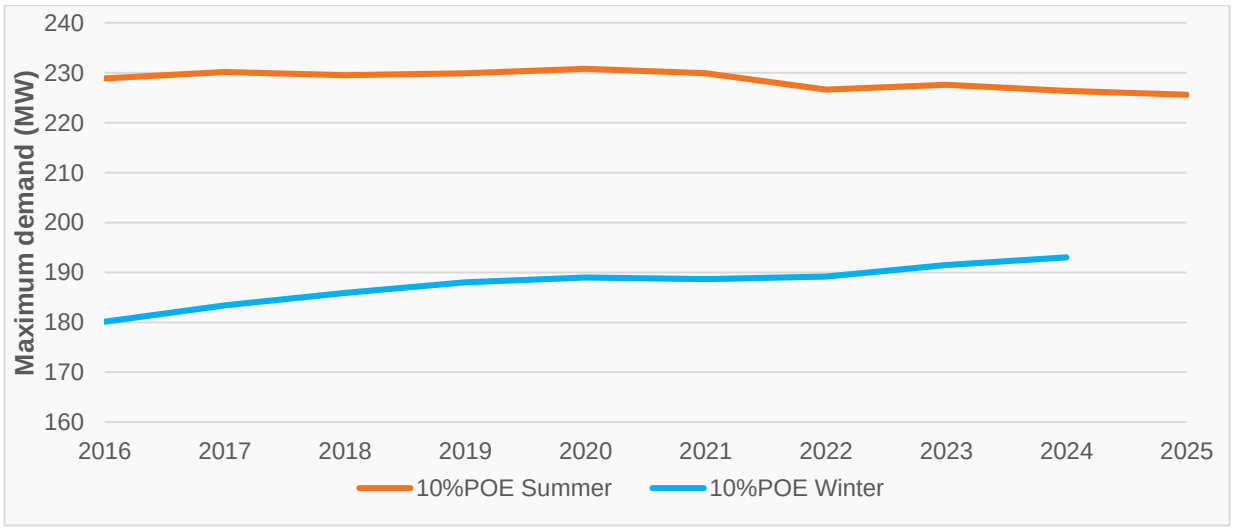
- Eton Tee and Pioneer Valley of the directly connected Pioneer Valley – Nebo 132 kV transmission line.
- Nebo and Eton Tee of the Nebo – Alligator Creek 132 kV and Nebo – Mackay 132 kV transmission circuits.

Powerlink also identified possible reconfiguration involving retirement of a 132 kV line between Eton Tee and Pioneer Valley substation.

AEMO connection point forecasts

The 10% POE summer maximum demand at Alligator Creek, Pioneer Valley and Mackay substations is projected to be 225–230 MW during the period 2015-16 to 2024-25. Figure 12 shows connection point forecasts for these substations.

Figure 12 Connection point maximum demand forecast at Pioneer Valley, Alligator Creek and Mackay substations



Network Capacity

Table 3 presents thermal capacity of the Nebo – Pioneer Valley, Nebo – Alligator Creek and Nebo – Mackay 132 kV transmission circuits. Powerlink's alternative proposal is to retire one of these transmission circuits and reconfigure the network. With only three circuits from the Nebo substation to the Pioneer Valley/Mackay/Alligator Creek substations, the firm thermal capacity will be 270 MVA with an emergency thermal capacity of 301 MVA. This capacity is adequate to meet the forecast maximum demand.

Table 3 Thermal capacity of Nebo – Pioneer Valley, Nebo – Alligator Creek and Nebo – Mackay 132 kV transmission circuits

Circuit description	Summer Rating (MVA)	Summer Rating (MVA)	Winter Rating (MVA)	Winter Rating (MVA)
	Normal	Emergency	Normal	Emergency
Nebo – Pioneer Valley 132 kV circuit #7120	134	154	136	180
Nebo – Pioneer Valley 132 kV circuit #7304	135	154	159	180
Nebo – Alligator Creek 132 kV circuit #7119	135	147	147	147
Nebo–Mackay 132 kV circuit #7305	143	156	167	182

AEMO assessment

AEMO agrees that there is an ongoing need for three 132 kV circuits connecting the Nebo substation and the Alligator Creek/Pioneer Valley/Mackay substations.

The Pioneer Valley, Alligator Creek and Mackay substations are supplied by four 132 kV circuits from the Nebo substation. Powerlink identified single 132 kV circuit retirement and network reconfiguration between the Nebo and Pioneer Valley/Alligator Creek/Mackay substations. Thermal capacity of the remaining three circuits is adequate to meet the forecast maximum demand of the Pioneer Valley, Alligator creek and Mackay substations.

AEMO agrees with Powerlink's proposal of reconfiguration involving retirement of a 132 kV line between Eton Tee and Pioneer Valley substation.

4.1.2.5 Kareeya–Chalumbin 132 kV transmission line

Powerlink 2015 TAPR summary	
Potential project	Line refit works on the Kareeya–Chalumbin 132 kV transmission line
High level scope	Line refit works on steel lattice structures
Possible commissioning date	Summer 2017–18
Alternative	New 132 kV transmission line on new easement

Background

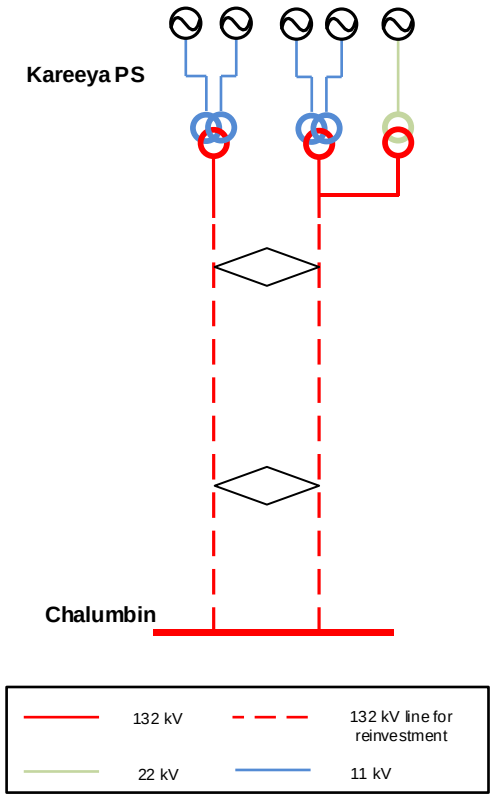
The Kareeya power station is connected to the Chalumbin substation by a double circuit 132 kV transmission line.

The Kareeya power station has four scheduled hydro generators with a total capacity of 86 MW. Two of these generators are connected to one 132 kV transmission circuit. The remaining two generators and an additional 7 MW non-scheduled generator are connected to the other 132 kV transmission circuit. Figure 13 shows a single line diagram of the connection configuration.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible line refit works on steel lattice structures of the Kareeya–Chalumbin 132 kV double circuit line with a commissioning date in summer 2017–18.

Figure 13 Kareeya–Chalumbin 132 kV line configuration



Projected generation

Generation at Kareeya Power Station is forecast to remain constant at 93 MW over the period 2016–25.[5]

Network capacity

The thermal capacity of each Kareeya–Chalumbin 132 kV circuit is 70 MVA (summer or winter rating). Therefore, the existing thermal capacity of both circuits is adequate to accommodate the generation at the Kareeya power station.

AEMO assessment

The Kareeya–Chalumbin 132 kV double circuit transmission line connects the Kareeya power station to the National Electricity Market (NEM). The existing thermal capacity of the Kareeya–Chalumbin 132 kV circuits is adequate to accommodate the maximum generation at the Kareeya power station.

AEMO agrees that there is an ongoing need for the Kareeya–Chalumbin 132 kV circuits to connect the Kareeya power station to the NEM, if it continues to operate at its current capacity over the outlook period (7 years). Since there is no customer load supplied by these circuits, it is unclear whether the expenditure associated with the Kareeya–Chalumbin 132 kV circuits will be included in Powerlink's regulated asset base. Such a determination is outside AEMO's scope of works.

[5] AEMO. Generation information. http://www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information. Viewed 30 November 2015.

4.2 Central Region

This section outlines each of the individual reinvestment works that Powerlink proposed for the Central Region of Queensland in the 2015 TAPR.

4.2.1 Substations

4.2.1.1 Bouldercombe substation primary plant replacement

Powerlink 2015 TAPR summary	
Potential project	275 kV and 132 kV primary plant replacement at the Bouldercombe substation
High level scope	Staged replacement of the 275 kV and 132 kV primary plant
Possible commissioning date	Summer 2019–20
Alternative	Full replacement of the 275/132 kV substation

Background

The Bouldercombe substation is located in the central west zone. This is a key 275 kV substation, which connects the northern and southern Queensland regions (Figure 14). This substation is connected to the Broadsound, Calliope River, Nebo, Raglan and Stanwell substations by 275 kV transmission circuits.

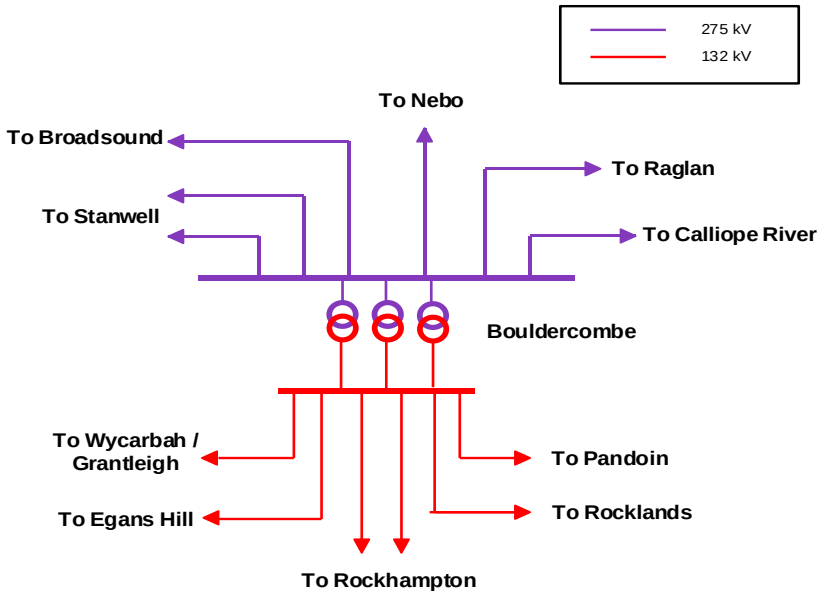
The Bouldercombe substation supplies a number of 132 kV substations in the Rockhampton area via three 275/132 kV transformers. Two of these transformers are rated at 206 MVA each and the third transformer is rated at 466 MVA.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible replacement of all the 275 kV and 132 kV primary plant with a commissioning date in summer 2019–20, with the exception of three transformers. The three transformers consist of two relatively old transformers rated at 266 MVA and one relatively new transformer rated at 466 MVA

Powerlink's alternative proposal is a full replacement of the 275/132 kV substation at Bouldercombe.

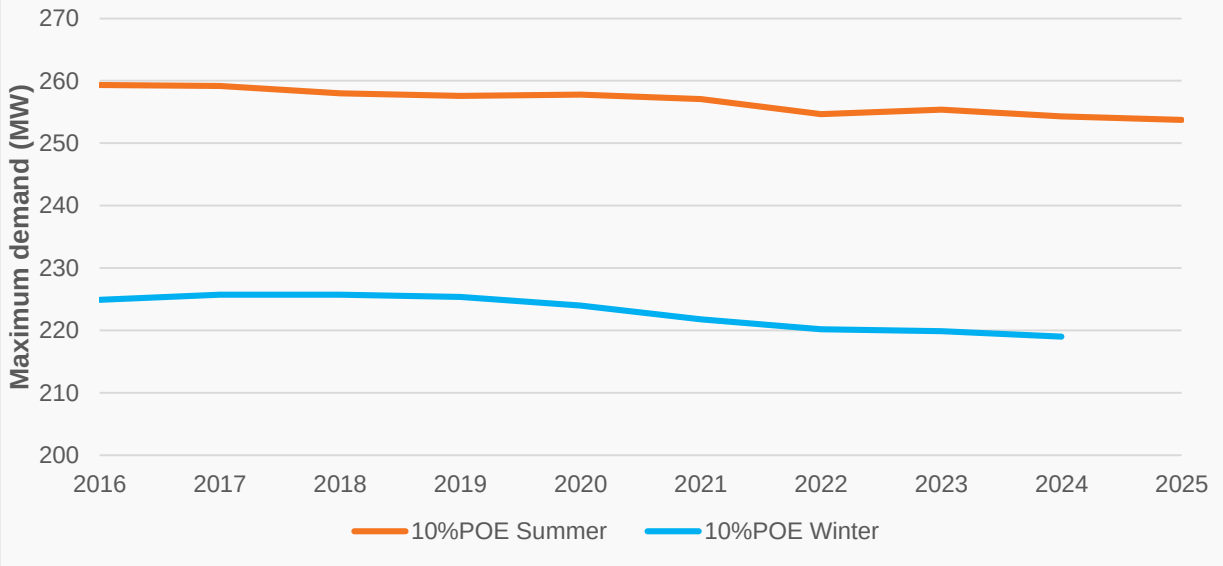
Figure 14 Bouldercombe substation connection



AEMO connection point forecasts

Figure 15 shows connection point forecasts for the Egans Hill, Grantleigh, Pandoin, Rockhampton, Rocklands, and Wycarbah substations.

Figure 15 Connection point maximum demand forecast for load supplied from Bouldercombe substation – 132 kV



Network capacity

There are three 275/132 kV transformers at the Bouldercombe substation. Two of these transformers are nominally rated at 266 MVA each and the third transformer is nominally rated at 466 MVA.

AEMO assessment

The existing function and services provided by the Bouldercombe substation cannot be transferred or performed by any other substation or generation facilities in proximity of the existing substation.

AEMO agrees that there is an ongoing need for the Bouldercombe 275 kV and 132 kV switchyard to connect the northern and southern Queensland regions and supply the Rockhampton area.

AEMO proposes Powerlink review the proposed replacement of the 275 kV and 132 kV primary plant relating to one of the two 275/132 kV, 266 MVA transformers. If the two old transformers were to require replacement in future, a more efficient option could be to replace them with a single higher rated transformer. In such a case, replacing one set of 275 kV and 132 kV primary plant could be deferred from the proposed reinvestment. However, this depends on condition of the existing 275 kV and 132 kV primary plant. Based on Powerlink's replacement cost estimate, this alternative could reduce capital expenditure by up to $3 million.

4.2.1.2 Dysart substation and 132/66 kV transformer replacement

Powerlink 2015 TAPR summary	
Potential project	Primary plant and 132/66 kV transformer replacement at the Dysart substation
High level scope	Staged replacement of the 132 kV primary plant and replacement of two 132/66 kV transformers
Possible commissioning date	Summer 2019–20
Alternative	Full replacement of the 132 kV substation, and staged replacement of the two transformers

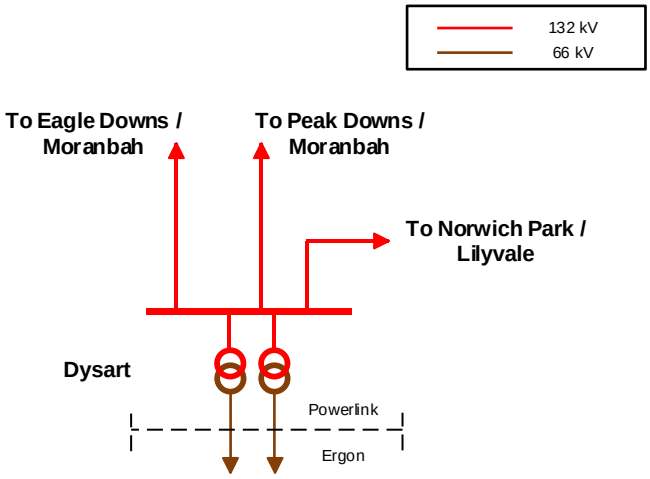
Background

The Dysart substation is supplied by 132 kV connections from the Calvale and Lilyvale 275 kV/132 kV substations in Central West Queensland. The Dysart substation supplies predominantly industrial and Bowen Basin mining load via Ergon Energy's local 66 kV and 22 kV distribution network. Figure 16 shows the Dysart 132 kV substation connection configuration.

The Dysart substation contains:

- Two 132/66/22 kV transformers supplying the local community and mining loads.
- A 132/7.7 kV transformer connecting -30/+39 MVAr static var compensator providing dynamic reactive support.

Figure 16 Dysart substation connection



Powerlink proposal for asset reinvestment

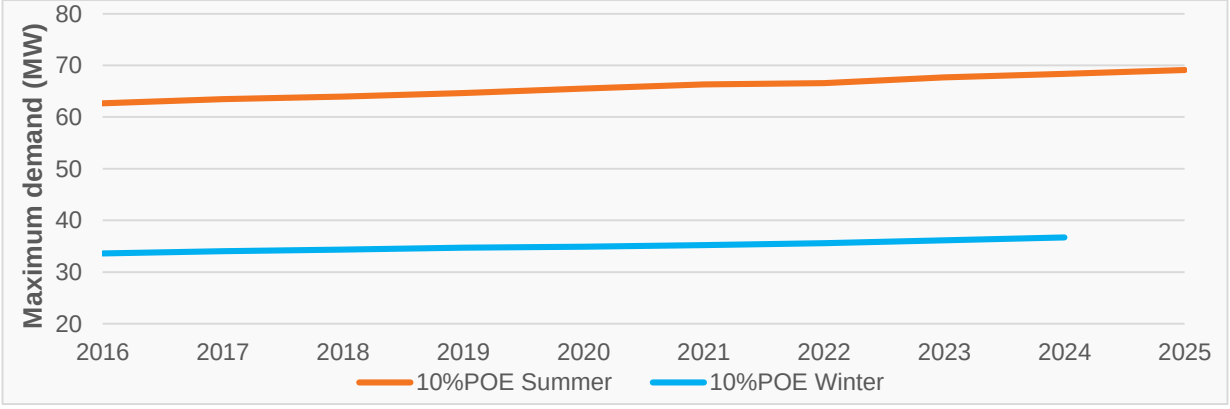
Powerlink's 2015 TAPR identified replacement of two 132/66 kV transformers, 132 kV primary plant and secondary systems at the Dysart substation by summer 2019–20. Powerlink has proposed the following alternative options:

- Staged replacement of the two 132/66 kV transformers.
- Full replacement of the 132 kV substation.

AEMO connection point forecasts

The 10% POE summer maximum demand at the Dysart substation is projected to increase from 63 MW in 2015–16 to 70 MW in 2024–25. Figure 17 shows connection point forecasts for the 66 kV load at this substation.

Figure 17 AEMO connection point maximum demand forecast at Dysart substation



Network capacity

The name plate and normal cyclic ratings of each transformer at the Dysart substation are 53 MVA 80 MVA respectively.

AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the 132 kV primary plant, to enable connection of the 132 kV supply feeders, the reactive support devices (capacitor banks and an SVC), and the 132/66 kV transformers at the Dysart substation. There could be potential for optimising capacity of new transformers if a non-network solution is cost effective.

4.2.1.3 Gin Gin substation primary plant replacement

Powerlink 2015 TAPR summary	
Potential project	Gin Gin substation 275 kV and 132 kV primary plant replacement
High level scope	Staged replacement of 275 kV and 132 kV primary plant
Possible commissioning date	Summer 2019–20
Alternative	Full replacement of 275/132 kV substation In-situ replacement of the 275/132 kV substation

Background

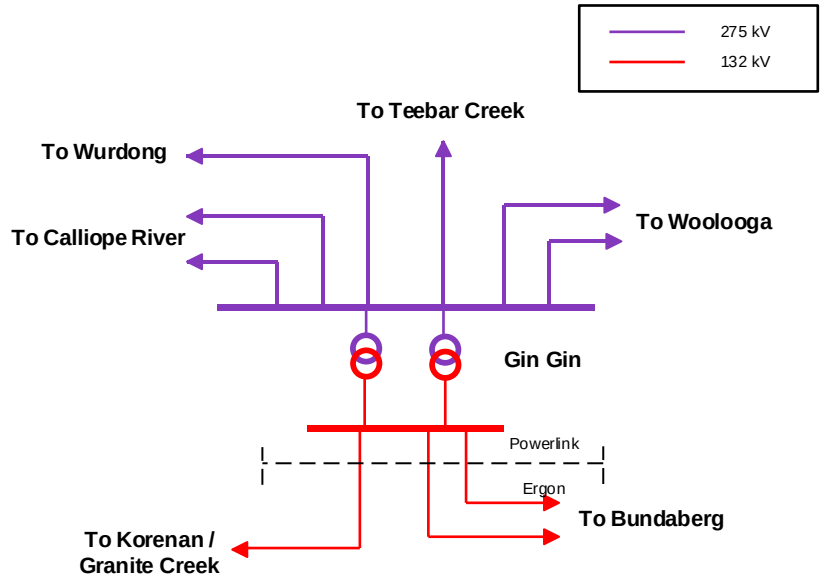
The Gin Gin substation located in the southern region connects with the Calliope River, Teebar Creek, Woolooga, and Wurdong substations at 275 kV (Figure 18). This substation supplies Ergon Energy's network via two 275/132 kV transformers.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible staged replacement of the 275 kV and 132 kV primary plant at the Gin Gin substation with a commissioning date in summer 2019–20.

Powerlink's alternative proposal is full replacement or in-situ replacement of the 275/132 kV substation at Gin Gin.

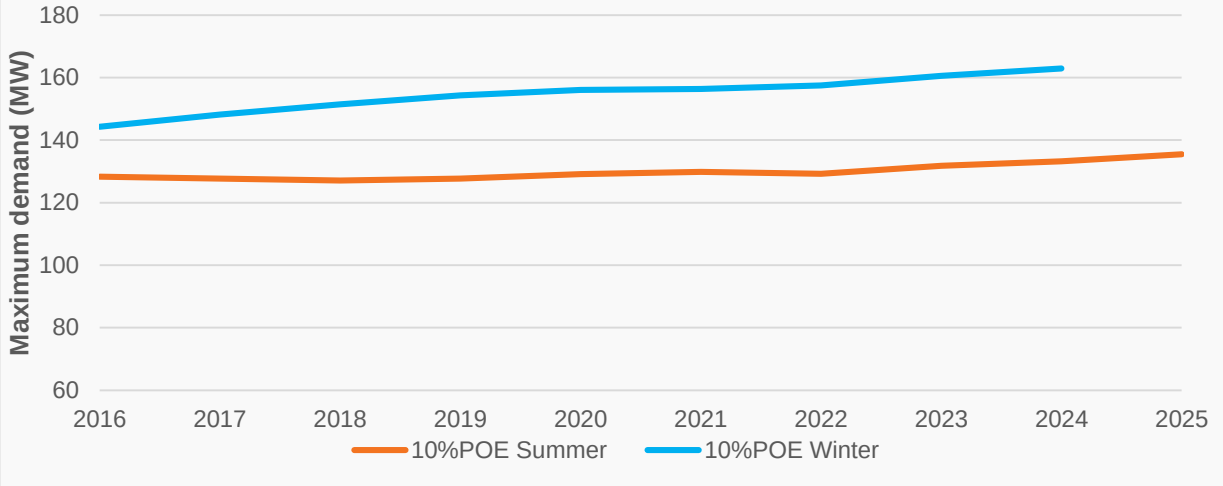
Figure 18 Gin Gin substation connection



AEMO connection point forecasts

The 10% POE summer maximum demand at the Gin Gin substation is projected to increase from 145 MW in 2015–16 to 160 MW in 2024–25. Figure 19 shows connection point forecasts for the Gin Gin substation.

Figure 19 Maximum demand forecast at the Gin Gin substation



AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the 275 kV and 132 kV primary plant at the Gin Gin substation.

4.2.1.4 Lilyvale primary plant and 132/66 kV transformer replacement

Powerlink 2015 TAPR summary	
Potential project	Primary plant and 132/66 kV transformer replacement at the Lilyvale substation
High level scope	Staged replacement of the 275 kV and 132 kV primary plant, and replacement of two of the three 132/66 kV transformers
Possible commissioning date	Summer 2020–21
Alternative	Full replacement of the 275/132 kV substation, and replacement of three 132/66 kV transformers

Background

The Lilyvale 275/132/66 kV substation in Central West Queensland connects to the Broadsound substation by a double circuit 275 kV transmission line (Figure 20). The main substation assets include:

- Two 375 MVA 275/132 transformers.
- Three 132/66 kV transformers feeding Ergon Energy's 66 kV network, that supply local coal mines and the Emerald, Foxleigh, Middlemount, and Tieri 66/22 kV substations.

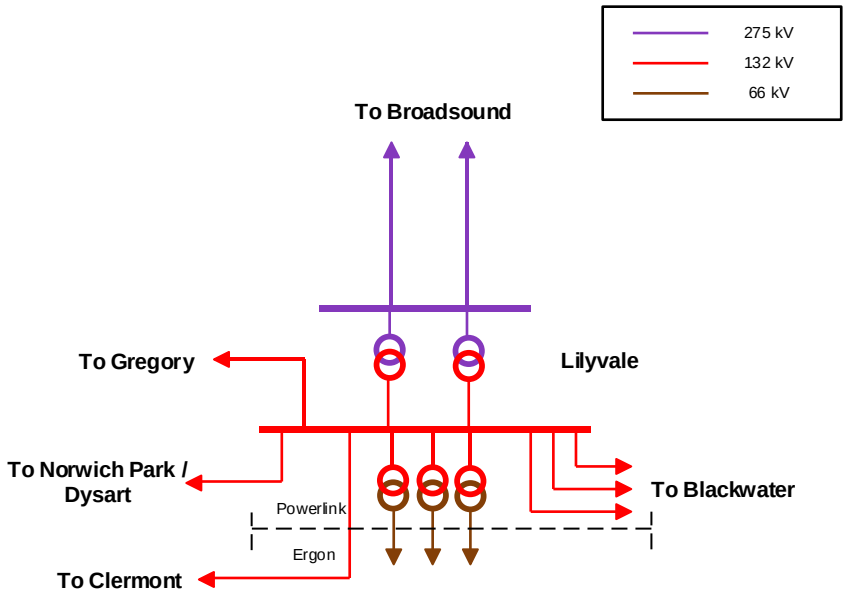
Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified the following assets at the Lilyvale substation for possible replacement in summer 2019–20.

- The 275 kV and 132 kV primary plant.
- Two of the three 132/66 kV transformers.

Powerlink's proposal also includes retirement of a 132/66 kV transformer at Lilyvale substation.

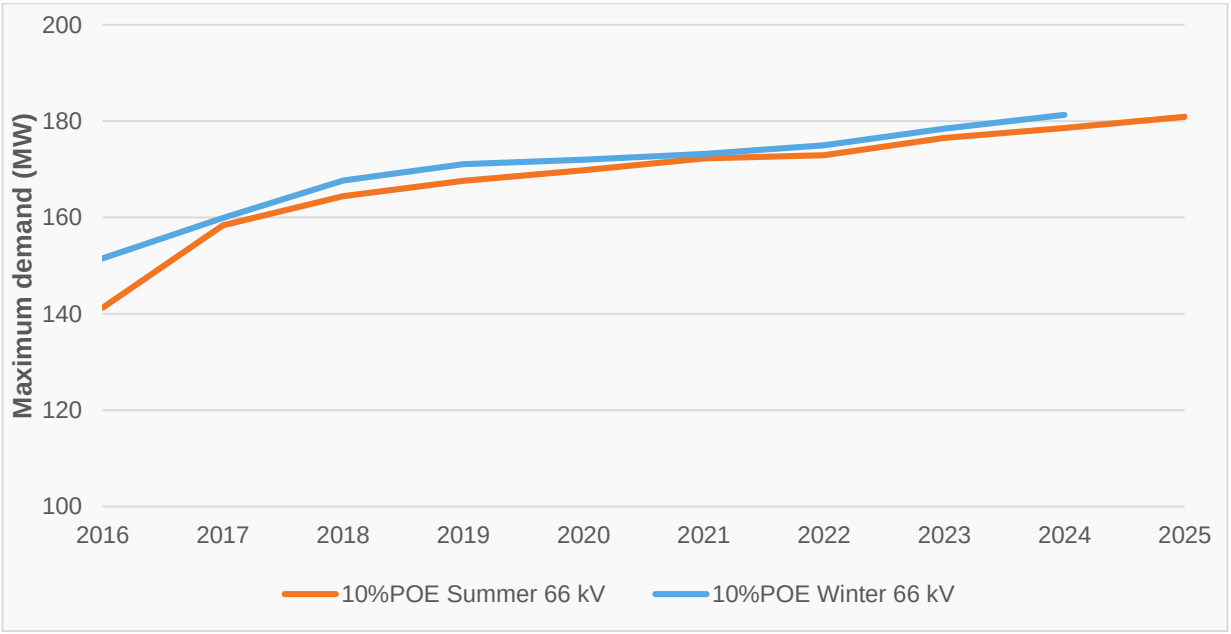
Figure 20 Lilyvale substation configuration



AEMO connection point forecasts

Figure 21 shows connection point maximum demand forecasts for the 66 kV loads at the Lilyvale substation. The maximum demand forecast indicates that there is an ongoing level of demand in excess of 140 MW, rising to about 180 MW by 2025.

Figure 21 AEMO connection point maximum demand forecast at the Lilyvale 66 kV substation



Network Capacity

Table 4 summarises the existing 132/66 kV transformer capacity at the Lilyvale substation.

Table 4 The existing 132/66 kV transformer capacity at the Lilyvale substation

Transformer	Normal rating (MVA)	Emergency rating (MVA)
Lilyvale 132/66 kV No.3 transformer	85	107
Lilyvale 132/66 kV No.4 transformer	85	107
Lilyvale 132/66 kV No.7 transformer	90	115

AEMO assessment

This substation connects significant load in the Bowen Basin mining area to the transmission network, and supplies the local Ergon distribution network.

AEMO agrees with Powerlink that there is an ongoing need for the 275 kV and 132 kV primary plant and the 132/66 kV transformers at the Lilyvale substation.

AEMO also agrees with Powerlink's proposal of retirement of one of three 132/66 kV transformers and replacement of two 132/66 kV transformers. There may be potential for optimising the new transformer capacity if a non-network solution in this area is found to be cost-effective.

4.2.2 Transmission lines

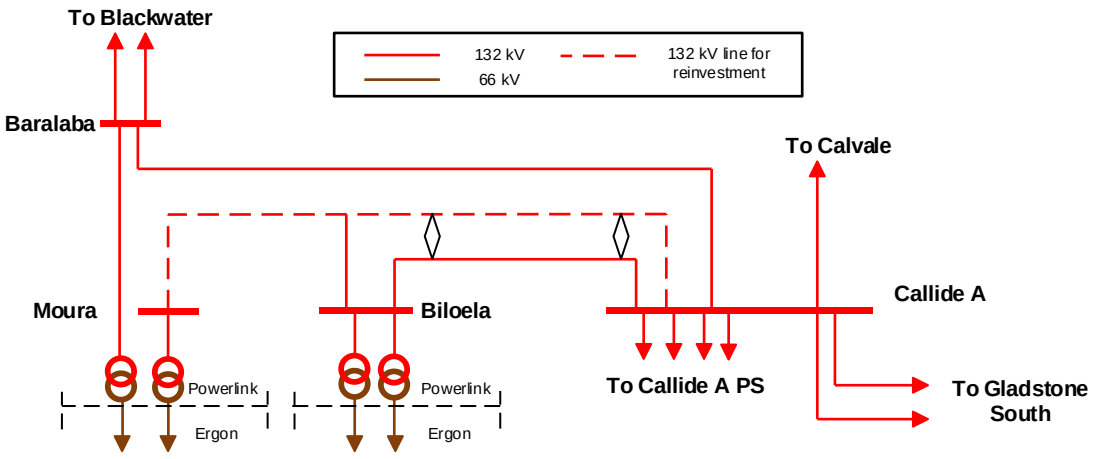
4.2.2.1 Callide A – Moura 132 kV circuit

Powerlink 2015 TAPR summary	
Potential project	New 132 kV transmission line between Callide A and Moura substations
High level scope	New 132 kV transmission line between Callide A and Moura substations
Possible commissioning date	Summer 2019–20
Alternative	Foundation repair and line refit works

Background

The Biloela and Moura substations in the central region supply the local area load. A 132 kV double circuit transmission line connects the Biloela substation to the Callide A substation. A 132 kV transmission circuit tapped to one of the Callide A – Biloela 132 kV circuit connects the Moura substation. The Moura and Baralaba substations are also connected by a single circuit 132 kV transmission line. Figure 22 below shows the network connection configuration between the Callide A and Moura substations.

Figure 22 Callide A – Biloela – Moura connection configuration



Powerlink proposal for asset reinvestment

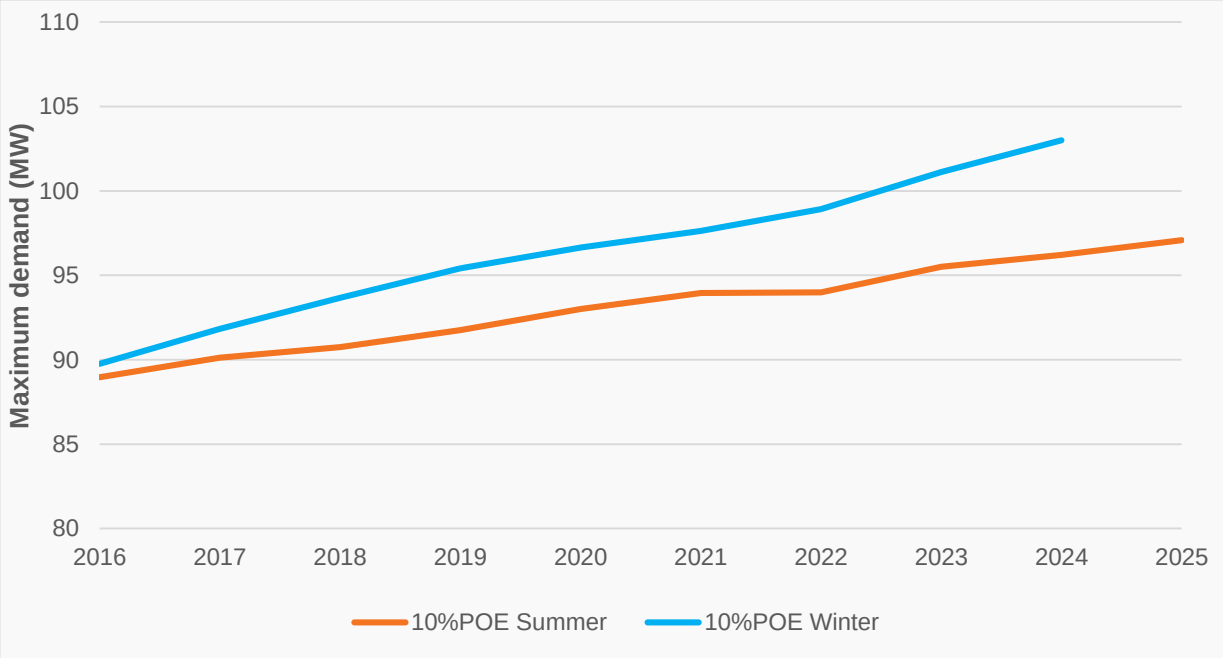
Powerlink's 2015 TAPR identified the existing Callide A – Moura 132 kV transmission line for possible replacement with new assets during summer 2019–20.

The alternative option identified by Powerlink is to repair foundations and undertake line refit works.

AEMO connection point forecasts

The 10% POE forecast at the Biloela and Moura substations projects an increase in maximum demand from 90 MW in 2015–16 to 103 MW in 2025. Figure 23 shows connection point maximum demand forecasts for the Biloela and Moura substations.

Figure 23 AEMO connection point maximum demand forecast at the Biloela and Moura substations



Network Capacity

The Callide A – Biloela – Moura 132 kV transmission circuit has a normal summer rating of 84 MVA and an emergency rating of 92 MVA. There is an overload management scheme to prevent line overloading following a 132 kV circuit contingency.

AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the Callide A – Moura 132 kV transmission circuit.

4.2.2.2 Egans Hill – Rockhampton 132 kV circuit

Powerlink 2015 TAPR summary	
Potential project	Line refit works on Egans Hill–Rockhampton 132 kV transmission line
High level scope	Line refit works on steel lattice structure
Possible commissioning date	Summer 2019–20
Alternative	New 132 kV transmission line

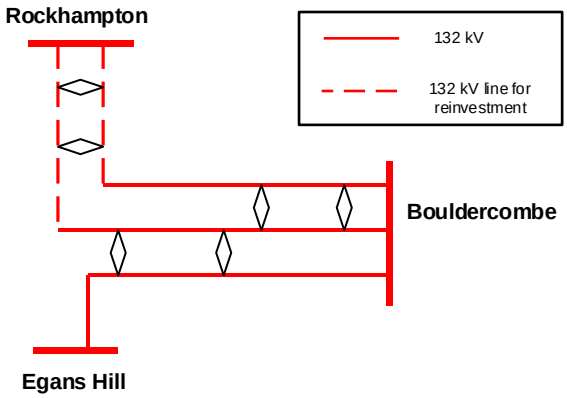
Background

A 132 kV double circuit line via the Egans Hill substation connects the Rockhampton and Bouldercombe substations (Figure 24).

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible line refit works on steel lattice structures on the section between Rockhampton and Egans Hill of the Rockhampton–Bouldercombe 132 kV transmission line during summer 2019–20.

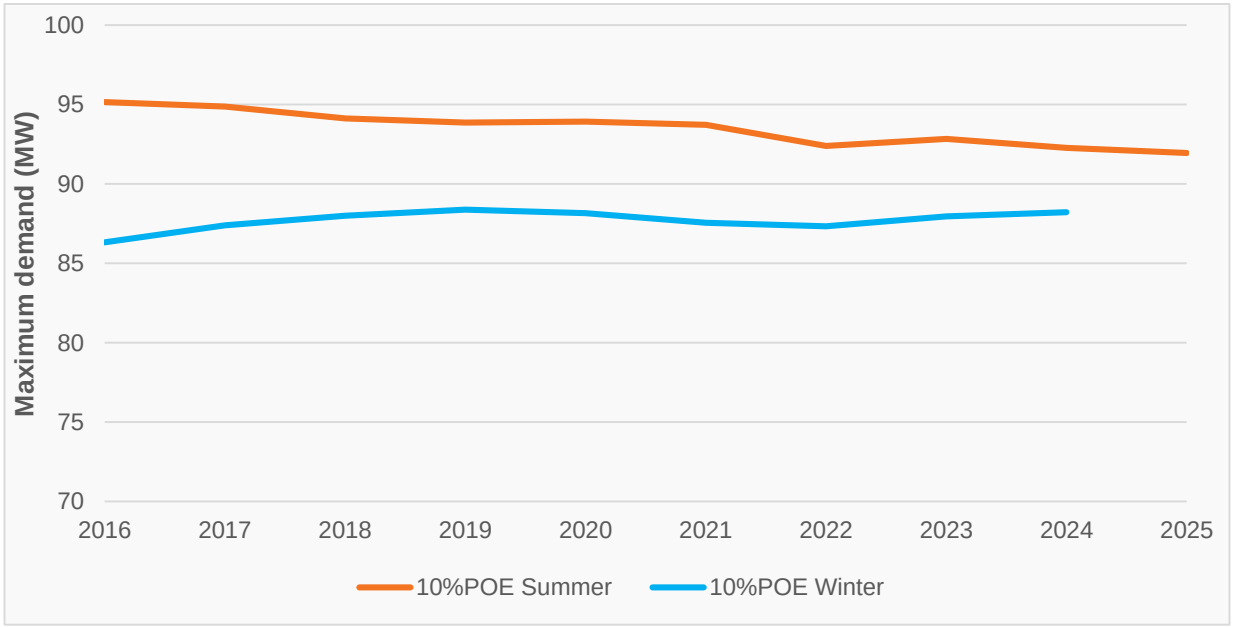
Figure 24 Bouldercombe–Rockhampton, Bouldercombe – Egans Hill 132 kV transmission circuits



AEMO connection point forecasts

The 10% POE maximum demand forecast at the Rockhampton substation projects gradual decline of summer maximum demand and of 95 MW in 2015–16 and then a gradual decline in the 10-year outlook period. Figure 25 shows connection point forecasts for this substation.

Figure 25 AEMO connection point maximum demand forecast at Rockhampton substation



Network Capacity

Each Bouldercombe–Rockhampton 132 kV transmission circuit has a summer normal rating of 89 MVA and an emergency rating of 98 MVA.

AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for Bouldercombe–Rockhampton 132 kV transmission circuits.

4.3 Southern Region

This section outlines each of the individual reinvestment works that Powerlink proposed for the Southern Region of Queensland in the 2015 TAPR.

4.3.1 Substations

4.3.1.1 Ashgrove West 110 kV substation replacement

Powerlink 2015 TAPR summary	
Potential project	Ashgrove West substation replacement
High level scope	Full replacement of 110 kV substation
Possible commissioning date	Summer 2019–20
Alternative	Staged replacement of 110 kV primary plant and secondary systems

Background

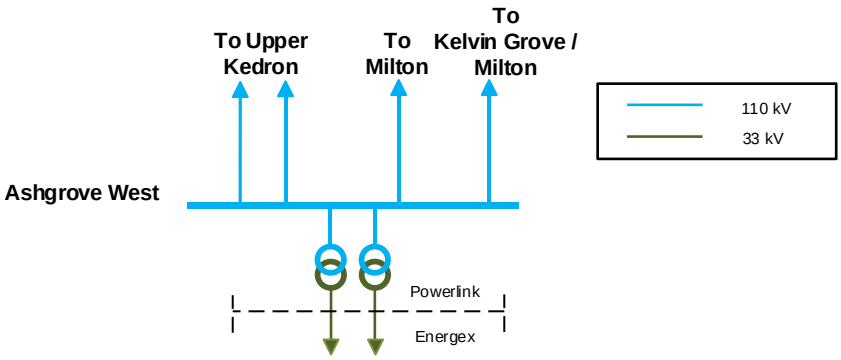
The Ashgrove West substation, being part of the 110 kV meshed network in Central Moreton zone, supplies the localities of Ashgrove, The Gap, and Toowong via two 110/33 kV transformers. Figure 26 shows Ashgrove West substation connection configuration.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified the 110 kV assets at the Ashgrove West substation for possible replacement during summer 2019–20.

Powerlink has also identified an alternative option of staged development of the 110 kV primary plant and secondary systems.

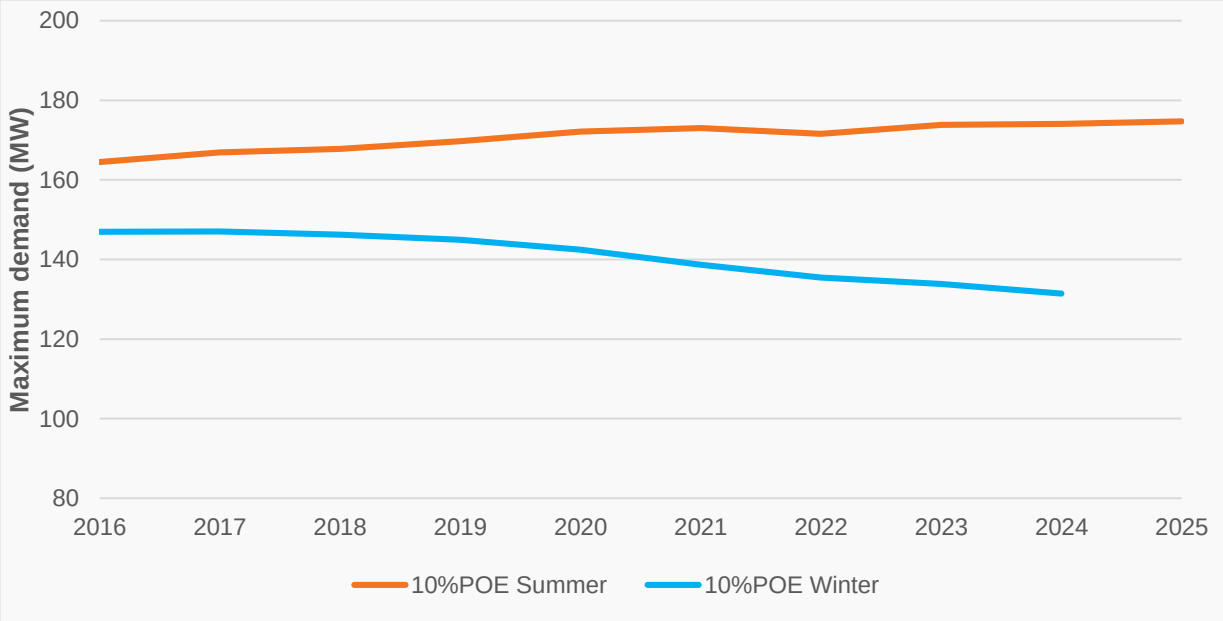
Figure 26 Ashgrove West substation connection configuration



AEMO connection point forecasts

The 10% POE maximum demand forecast at the Ashgrove substation projects an increase in summer maximum demand from 164 MW in 2015–16 to 175 MW in 2024–25. Figure 27 shows connection point maximum demand forecasts for the Ashgrove West substation at 110 kV and 33 kV.

Figure 27 AEMO connection point maximum demand forecast at the Ashgrove West substation



AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the Ashgrove West substation to supply the forecast local demand growth.

4.3.1.2 Belmont 275/110 kV transformer replacement

Powerlink 2015 TAPR summary	
Potential project	Belmont 275/110 kV transformer replacement
High level scope	Replacement of two 275/110 kV transformers with a single transformer
Possible commissioning year	Summer 2019–20
Alternative	Replacement of two 275/110 kV transformers

Background

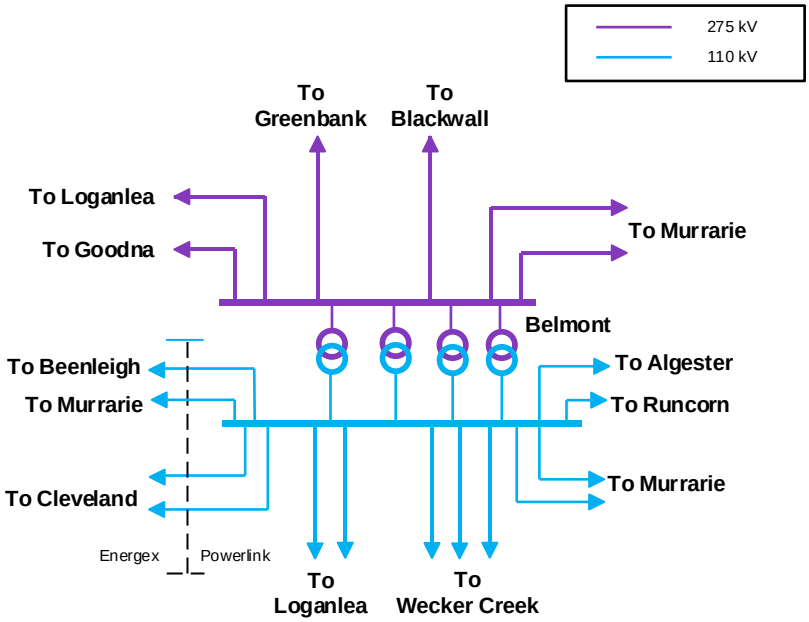
The Belmont substation located in the Moreton South zone is one of the substations supplying the Greater Brisbane area. There are eight 275/110 kV substations in the Greater Brisbane area, and all these substations are connected by transmission lines at 275 and 110 kV. The Belmont substation has four 275/110 kV transformers, with two transformers rated at 375 MVA and the other two rated at 250 MVA. Figure 28 shows the Belmont substation connection configuration.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified two 275/110 kV 250 MVA transformers for possible replacement with a single transformer during summer 2019–20.

Powerlink had also identified an alternative option of like-for-like replacement of the two 275/110 kV 250 MVA transformers.

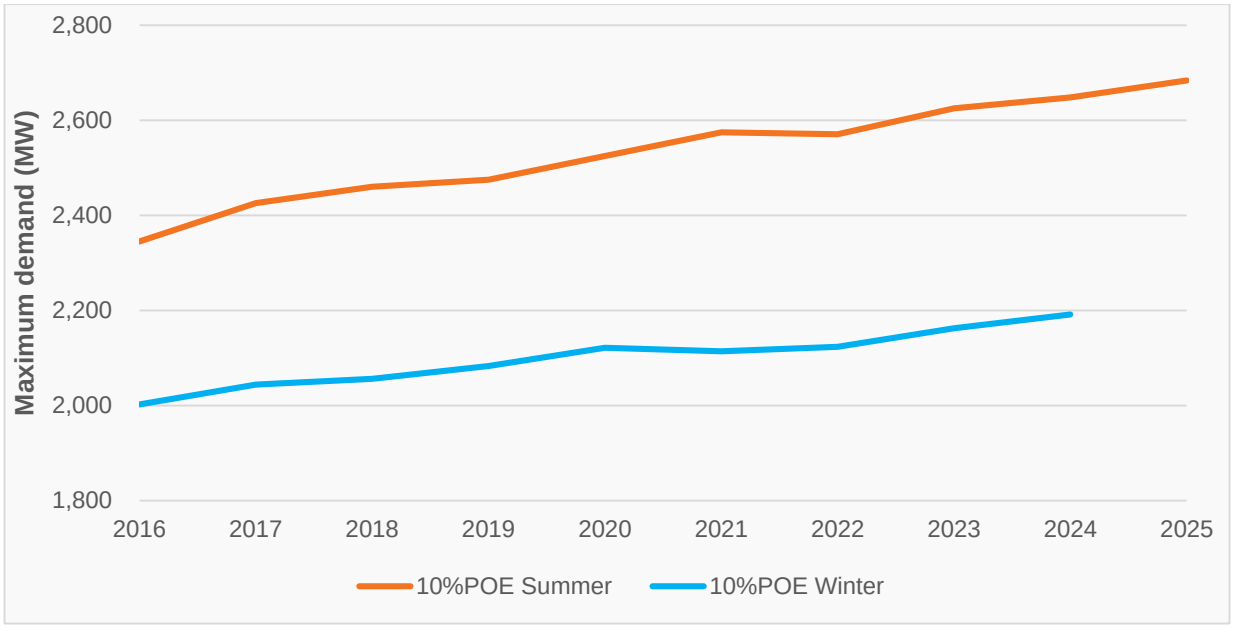
Figure 28 Belmont substation connection configuration



AEMO connection point forecasts

Figure 29 shows connection point maximum demand forecasts for the Greater Brisbane area. This forecast represents load supplied from the Abermain, Belmont, Blackstone, Goodna, Murarrie, Loganlea, Rocklea, and South Pine (except South Pine East 110 kV) 275/110 kV substations. The 10% POE maximum demand forecast at these substations projects an increase in summer maximum demand from 2,345 MW in 2015–16 to 2,685 MW in 2024–25.

Figure 29 Connection point maximum demand forecast for loads in the Greater Brisbane area



Network capacity

There are sixteen 275/110 kV transformers supplying the Greater Brisbane area from the Abermain, Belmont, Blackstone, Goodna, Murarrie, Loganlea, Rocklea and South Pine (except South Pine East 110 kV) 275/110 kV substations. Excluding the two transformers that are identified for replacement at Belmont, the total capacity (normal rating) of the remaining transformers in Greater Brisbane area is 5665 MVA and N-2[6] capacity is 4,719 MVA. The forecast 10% POE maximum demand is 57% of the N-2 capacity. However, these transformers experience unbalanced loading as transformer loading is dependent on load distribution as well as 110 kV connection configuration among substations.

AEMO assessment

Excluding the two transformers that are identified for replacement, the total capacity of the 275/110 kV transformers in the Greater Brisbane area is 5,665 MVA. Loading on these transformers would be influenced by load distribution and 110 kV transmission circuit configuration among substations within the Greater Brisbane area.

The possible options following the retirement of the two 250 MVA 275/110 kV transformers at Belmont are dependent on load rebalancing of the 110 kV lines and other 275/110 kV transformers within the Greater Brisbane area. These options include:

- No replacement of transformers at the Belmont substation.
- Replacement of two transformers with single transformer.

AEMO proposes no replacement following retirement of two 275/110 kV transformers at Belmont substation. This substation has four 275/110 kV transformers with 110 kV meshed connection to a number of 275/110 kV substations in the Greater Brisbane area. With rebalancing of load in these substations, there may be no requirement for new transformers to replace the existing transformers. Based on Powerlink's transformer replacement cost estimate, this alternative could reduce capital expenditure by up to $11 million. The assessment has not considered any costs associated with rebalancing the load.

4.3.1.3 Mudgeeraba 275/110 kV transformers and 110 kV primary plant replacement

Powerlink 2015 TAPR summary	
Potential project	Mudgeeraba 275/110 kV transformer and 110 kV substation primary plant and secondary system replacement
High level scope	Replacement of a transformer (followed by retirement of the other transformer in summer 2019–20) and staged replacement of 110 kV primary plant and secondary systems equipment
Possible commissioning date	Summer 2017–18
Alternative	Replacement of two 275/110 kV transformers and full replacement of 110 kV substation

Background

The Mudgeeraba substation, located in the Gold Coast zone, is one of the two key 275/110 kV substations supplying the Gold Coast area. The other substation is the Molendinar 275/110 kV substation. The Mudgeeraba substation also connects the New South Wales transmission network via the Terranora interconnector and HVDC link. This substation has three 275/110 kV 250 MVA transformers. Figure 30 shows the Mudgeeraba substation connection configuration.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified the following assets for possible replacement at the Mudgeeraba substation:

[6] N-2 refers to unavailability of two 275/110 kV transformers in addition to two 275/110 kV transformers at Belmont.

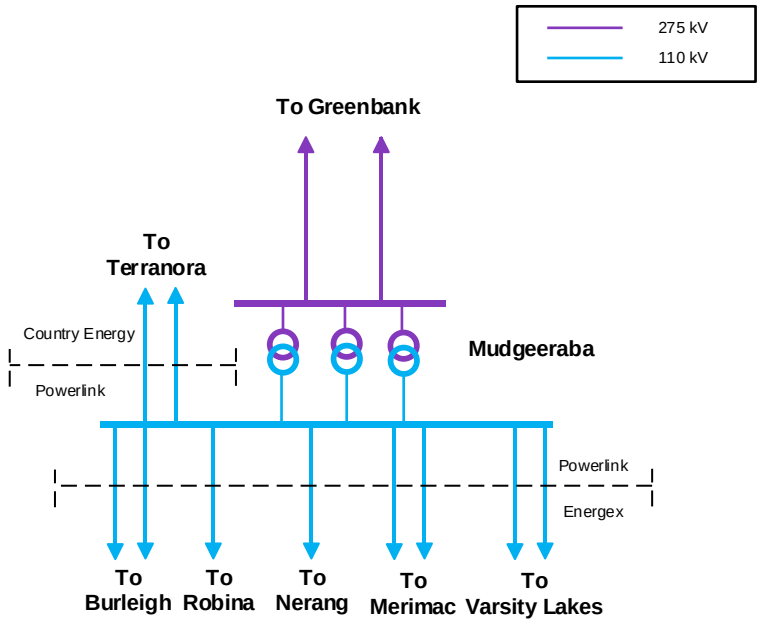
- A 275/110 kV transformer and retiring another 275/110 kV transformer.
- The 110 kV primary plant (staged replacement).

Powerlink has also identified an alternative option of:

- Replacement of two 275/110 kV 250 MVA transformers.
- Full replacement of the 110 kV substation.

Powerlink proposes a possible commissioning date of summer 2017–18.

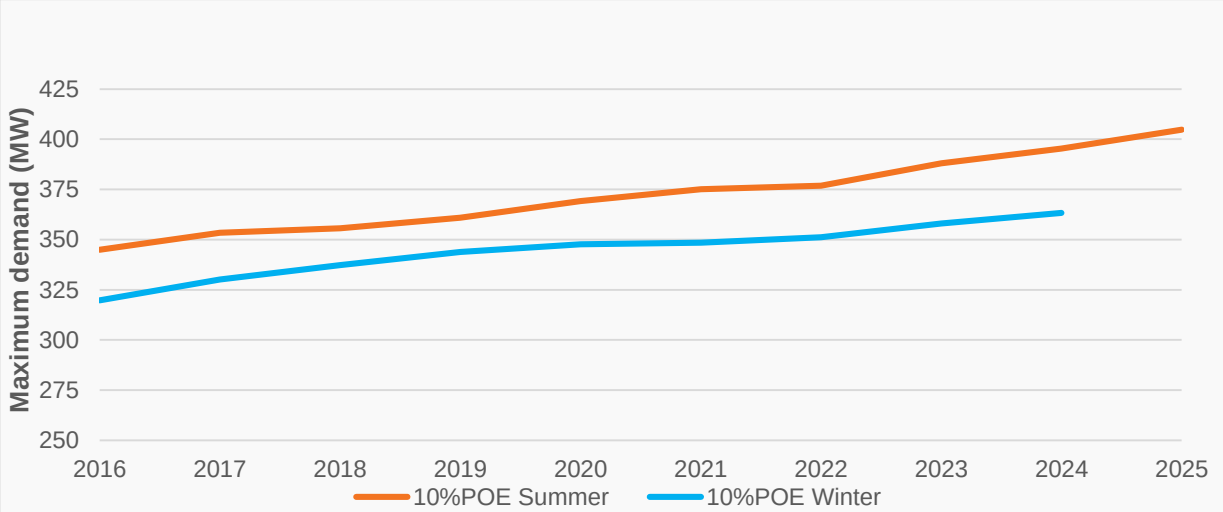
Figure 30 Mudgeeraba substation connection configuration



AEMO connection point forecasts

The 10% POE maximum demand forecast at the Mudgeeraba substation projects an increase in summer maximum demand from 345 MW in 2015–16 to 405 MW in 2024–25. Figure 31 shows connection point maximum demand forecasts for the Mudgeeraba substation.

Figure 31 AEMO connection point maximum demand forecast at Mudgeeraba substation



Network capacity

Presently, three 275/110 kV transformers at Mudgeeraba substation and 110 kV transmission lines between Mudgeeraba and Molendinar substations supply the Mudgeeraba 110 kV load. Loading on the Mudgeeraba transformers can increase or decrease depending on the direction of power flow between Queensland and New South Wales via Terranora interconnector.

The normal and emergency ratings of each of the transformers at Mudgeeraba substation are 250 MVA and 287 MVA respectively.

AEMO assessment

Powerlink proposes to retire a 275/110 kV transformer at Mudgeeraba substation. With a transformer retired, loading on the remaining two transformers are within the continuous transformer rating. With this arrangement, following an outage of one of the two transformers, loading on the remaining transformer is within the 2-hour emergency rating. Power flow through the Terranora interconnector can be controlled to reduce the loading on the Mudgeeraba transformer to keep within the continuous rating.

AEMO agrees with Powerlink that there is an on-going need for the Mudgeeraba substation to supply load.

AEMO also agrees with Powerlink's proposal to retire one 275/110 kV transformer and replace the other 275/110 kV transformer at Mudgeeraba substation.

4.3.1.4 Palmwoods 275 kV substation primary plant replacement

Powerlink 2015 TAPR summary	
Potential project	Palmwoods 275 kV primary plant replacement
High level scope	Staged replacement of the 275 kV and 132 kV primary plant and secondary system panels
Possible commissioning date	Summer 2019–20
Alternative	Full replacement of 275/132 kV substation

Background

The Palmwoods substation located in the northern part of Moreton zone has two 275/132 kV and two 275/110 kV transformers. It connects the:

- South Pine substation at 110 kV and supply load of the 110 kV network between South Pine and Palmwoods substations.
- Woolooga substation at 132 kV and supply load of the 132 kV network between Woolooga and Palmwoods substations.

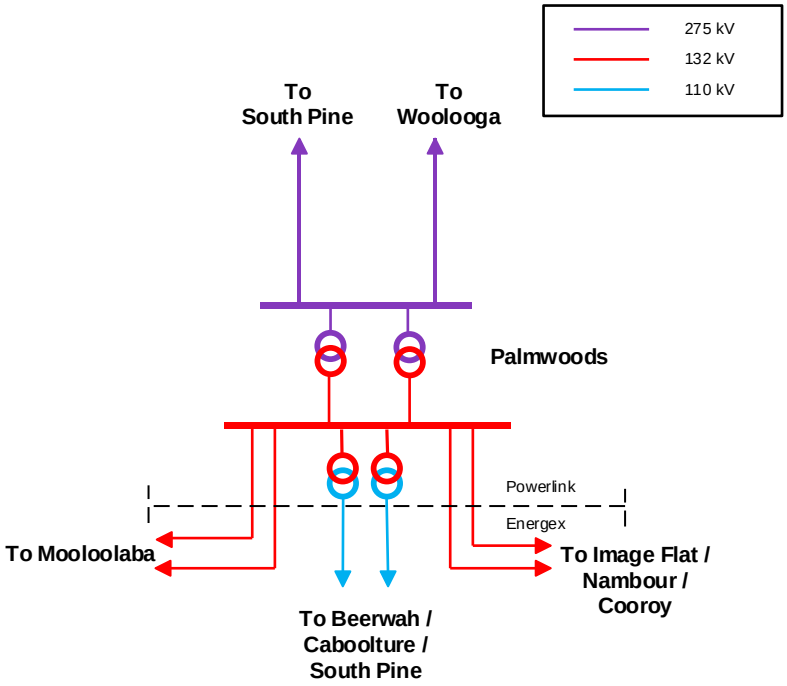
Figure 32 shows Palmwoods substation connection configuration.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified the 275 kV and 132 kV primary plant and secondary system equipment at the Palmwoods substation for possible replacement in summer 2019–20.

Powerlink has also identified an alternative option of fully replacing the 275/132 kV substation.

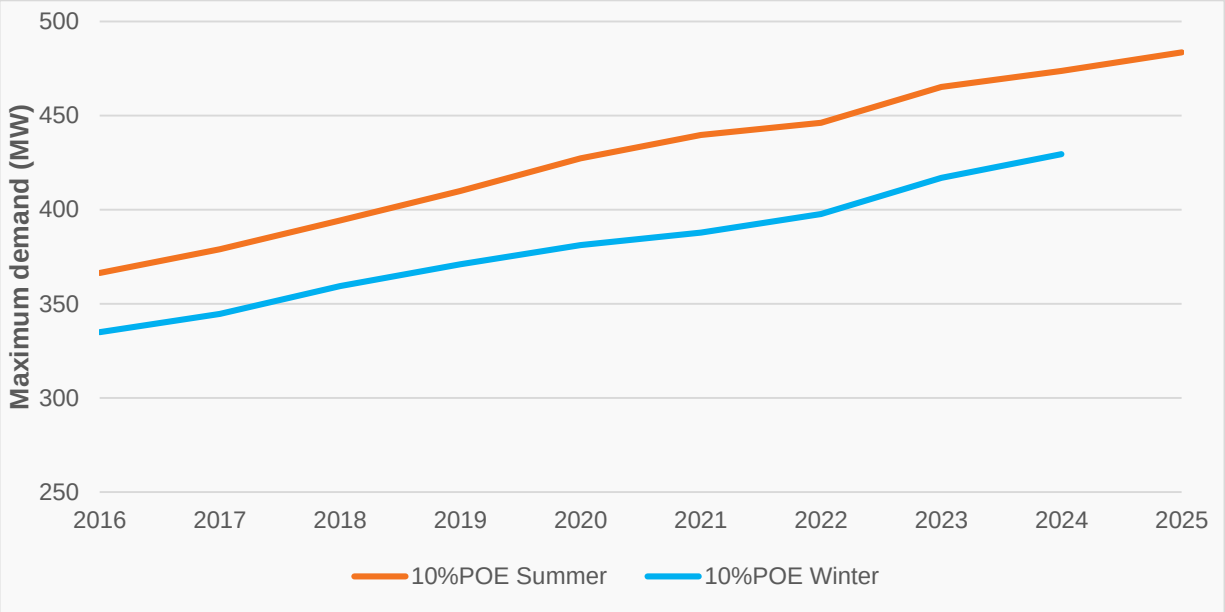
Figure 32 Palmwoods substation connection configuration



AEMO connection point forecasts

The 10% POE maximum demand forecast at the Palmwoods substation projects an increase in summer maximum demand from 365 MW in 2015–16 to 485 MW in 2024–25. Figure 33 shows connection point maximum demand forecasts for the Palmwoods substation at 132 kV and 110 kV.

Figure 33 AEMO connection point maximum demand forecast at Palmwoods substation



AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the Palmwoods substation to supply growing load.

4.3.1.5 Redbank Plains primary plant replacement

Powerlink 2015 TAPR summary	
Potential project	Redbank Plains substation 110 kV primary plant replacement
High level scope	Staged replacement of the 110 kV primary plant
Possible commissioning date	Summer 2020–21
Alternative	Full replacement of 110 kV substation

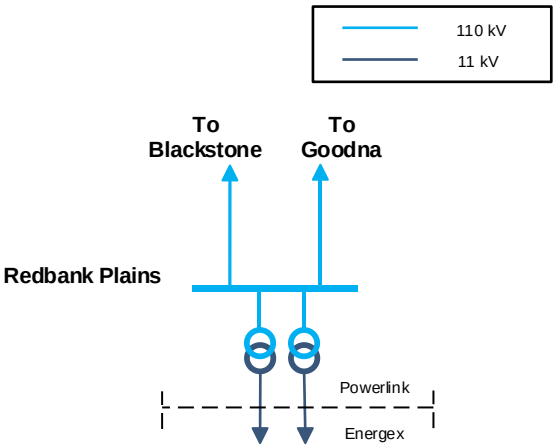
Background

Redbank Plains substation, located in the Moreton zone, supplies the localities of Bellbird Park, Brookwater, Collingwood Park, Goodna, New Chum, Redbank, Redbank Plains, and Swanbank. This substation has two 110/11 kV transformers with 110 kV connection to the Goodna and Blackstone substations. Figure 34 shows the Redbank Plains substation connection configuration.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified the 110 kV primary plant at Redbank Plains substation for possible replacement in summer 2020–21.

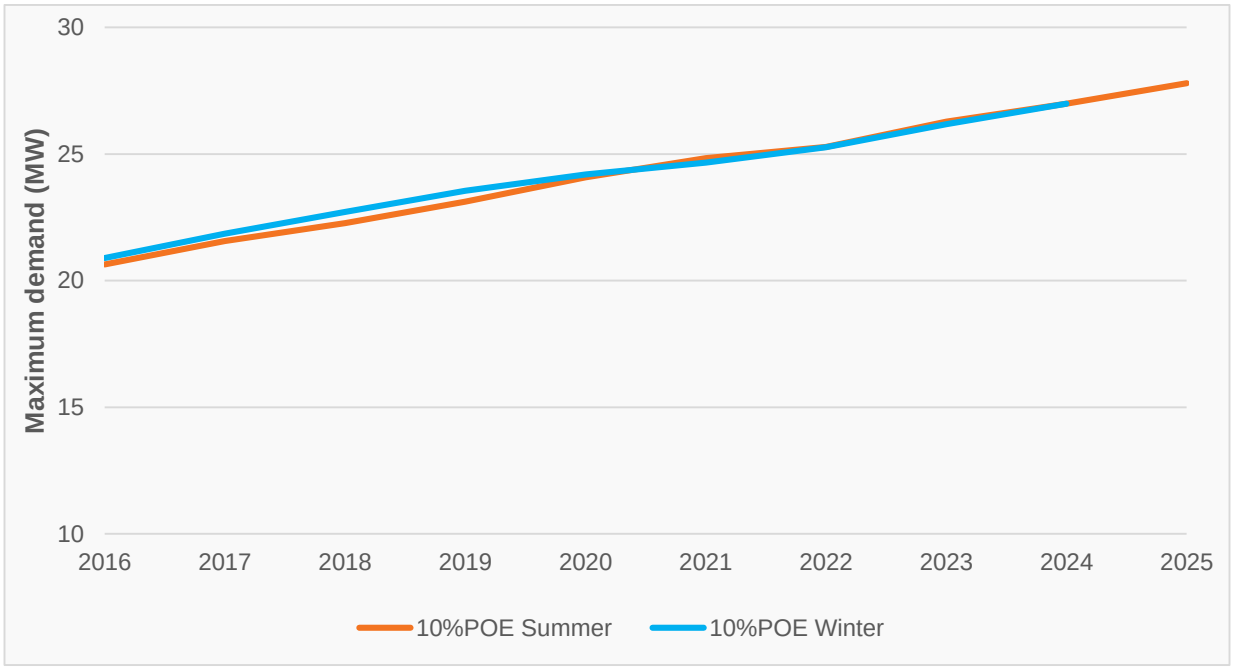
Figure 34 Redbank Plains substation connection configuration



AEMO connection point forecasts

The 10% POE load forecast at the Redbank Plains substation projects an increase in summer maximum demand from 21 MW in 2015–16 to 28 MW in 2024–25. Figure 35 shows connection point maximum demand forecast for the Redbank Plains substation.

Figure 35 AEMO connection point load forecast at Redbank Plains substation



AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the Redbank Plains substation to meet local forecast demand growth.

4.3.2 Transmission lines

4.3.2.1 Greater Brisbane area 110 kV circuits

Powerlink 2015 TAPR summary	
Potential project	Line refit works on Belmont – Sumner Tee, South Pine – West Darra, Rocklea – West Darra, Blackstone – Redbank Plains – West Darra and Blackstone–Abermain 110 kV circuits
High level scope	Line refit works on lattice structures
Possible commissioning date	Winter 2016 to Summer 2019–20
Alternative	(1) Reconfiguration and retirement of selected 110 kV transmission circuits and (2) New 110 kV transmission lines

Background

The 10% POE summer maximum demand forecast for the Greater Brisbane area exceeds 2,300 MW that includes loads at a number of 110 kV substations. These 110 kV substations are supplied from eight 275/110 kV substations within the Greater Brisbane area. The 275 kV and 110 kV of substations are connected by 275 kV and 110 kV transmission circuits, as shown in Figure 36.

Powerlink proposal for asset reinvestment

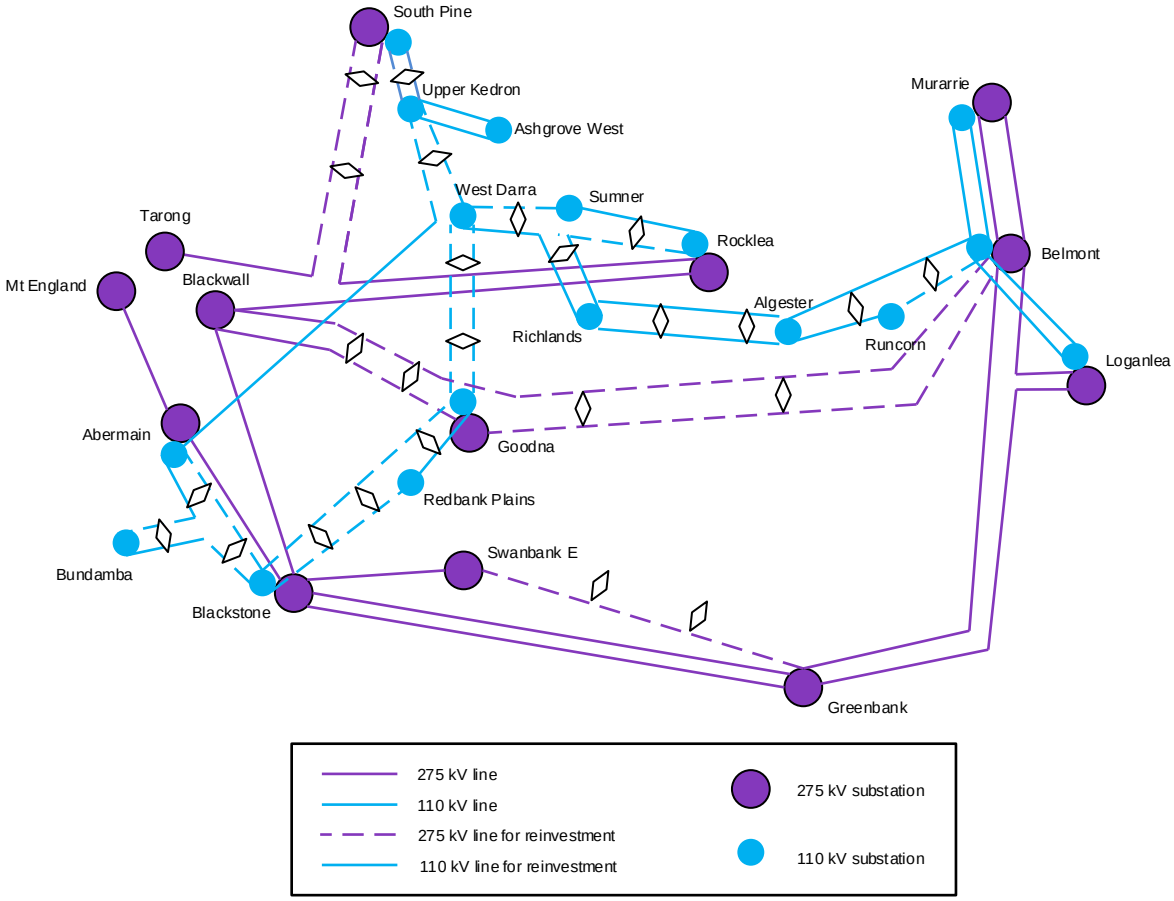
Powerlink's 2015 TAPR identified possible line refit works on steel lattice structures of

- Belmont – Sumner Tee 110 kV circuits (winter 2016 to 2017).
- South Pine – West Darra 110 kV circuits (summer 2016–17).
- Rocklea – West Darra 110 kV circuits (winter 2017 to summer 2017–18).
- Blackstone – Redbank Plains – West Darra 110 kV circuits (summer 2018–19).
- Blackstone – Abermain 110 kV circuits (summer 2019–20).

Powerlink has also identified the following alternative options:

- Network reconfiguration and retirement of the110 kV sections of Belmont to Sumner Tee, South Pine to West Dara and Blackstone to Redbank Plains to West Darra.
- New 110 kV transmission lines.

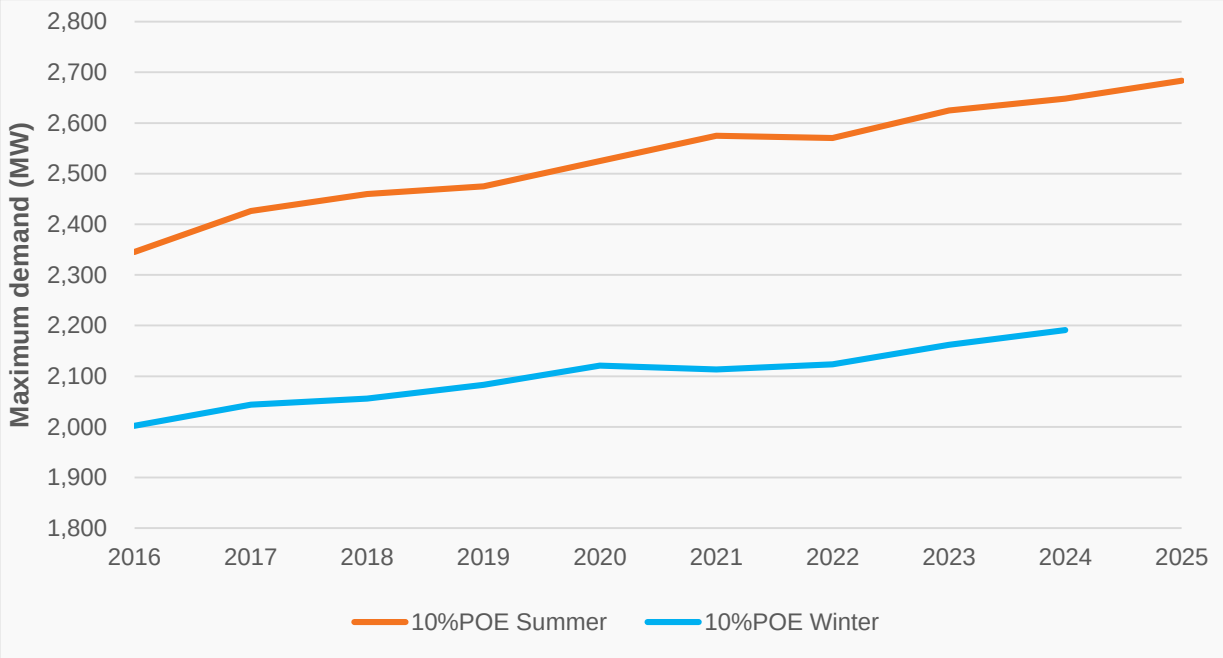
Figure 36 Greater Brisbane transmission network.



AEMO connection point forecasts

Figure 37 shows connection point load forecasts for the Greater Brisbane area. The 10% POE load forecast projects an increase in summer maximum demand from 2,345 MW in 2015–16 to 2,683 MW in 2024–25.

Figure 37 AEMO connection point loads forecasts in the Greater Brisbane area



AEMO assessment

Load in the Greater Brisbane area is supplied by a number of local 110 kV substations. AEMO agrees with Powerlink that there is an ongoing need for the 110 kV transmission circuits to supply the area.

As there are a number of 275/110 kV substations in the Greater Brisbane area, it would be possible to re-configure the 110 kV transmission line and reduce the number of 110 kV transmission circuits. Powerlink identified reconfiguration of the 110 kV network and retirement of circuits between Belmont and Sumner Tee, South Pine and West Darra and Blackstone and Abermain.

AEMO also agrees with Powerlink's proposal to reconfigure 110 kV transmission line configuration and reduce the number of 110 kV transmission circuits in the Greater Brisbane area.

4.3.2.2 Belmont to Bergins Hill to Karana tee and South Pine to Karana tee 275 kV transmission lines

Powerlink 2015 TAPR summary	
Potential project	Line refit works on the Belmont – Bergins Hill – Karana Tee and South Pine – Karana Tee 275 kV transmission lines
High level scope	Line refit works on steel structures
Possible commissioning date	Winter 2020 to Summer 2020–21
Alternative	New 275 kV transmission line/s

Background

The 10% POE summer maximum demand forecast for the Greater Brisbane area exceeds 2,300 MW, and includes loads at a number of 110 kV substations. These 110 kV substations are supplied from eight 275/110 kV substations within the Greater Brisbane area. The 275 kV and 110 kV of substations are connected by 275 kV and 110 kV transmission circuits, as in Figure 36.

Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible line refit works on steel lattice structures of the:

- Belmont – Bergins Hill – Karana Tee section of the Belmont–Blackwall and Belmont–Goodna–Blackwall 275 kV transmission circuits.
- South Pine – Karana Tee section of the South Pine – Tarong and South Pine – Rocklea 275 kV transmission circuits.

The proposed work is expected to commission during summer 2020–21.

AEMO connection point forecasts

Figure 37 (above) shows connection point load forecasts for the Greater Brisbane area. The 10% POE load forecast projects an increase in summer maximum demand from 2,345 MW in 2015–16 to 2,683 MW in 2024–25.

AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the Belmont–Blackwall, Belmont–Goodna–Blackwall, South Pine – Tarong and South Pine – Rocklea 275 kV transmission circuits to supply the Greater Brisbane area.

4.3.2.3 Greenbank–Mudgeeraba 275 kV circuits and Mudgeeraba–Terranora 110 kV circuits

Powerlink 2015 TAPR summary	
Potential project	Line refit works on the Greenbank–Mudgeeraba 275 kV Mudgeeraba–Terranora 110 kV transmission lines
High level scope	Line refit works on steel structures
Possible commissioning date	Summer 2018–19 and Summer 2020–21
Alternative	New 110 kV transmission line on new easement New 275 kV transmission line

Background

The Mudgeeraba substation is one of the two substations supplying the Gold Coast zone, and provides interconnection with the New South Wales network via the Terranora substation. A double circuit transmission line connects the Mudgeeraba and Greenbank substations at 275 kV. This substation is also connected to the Molendinar and Terranora substations at 110 kV. Figure 38 shows the Gold Coast transmission network.

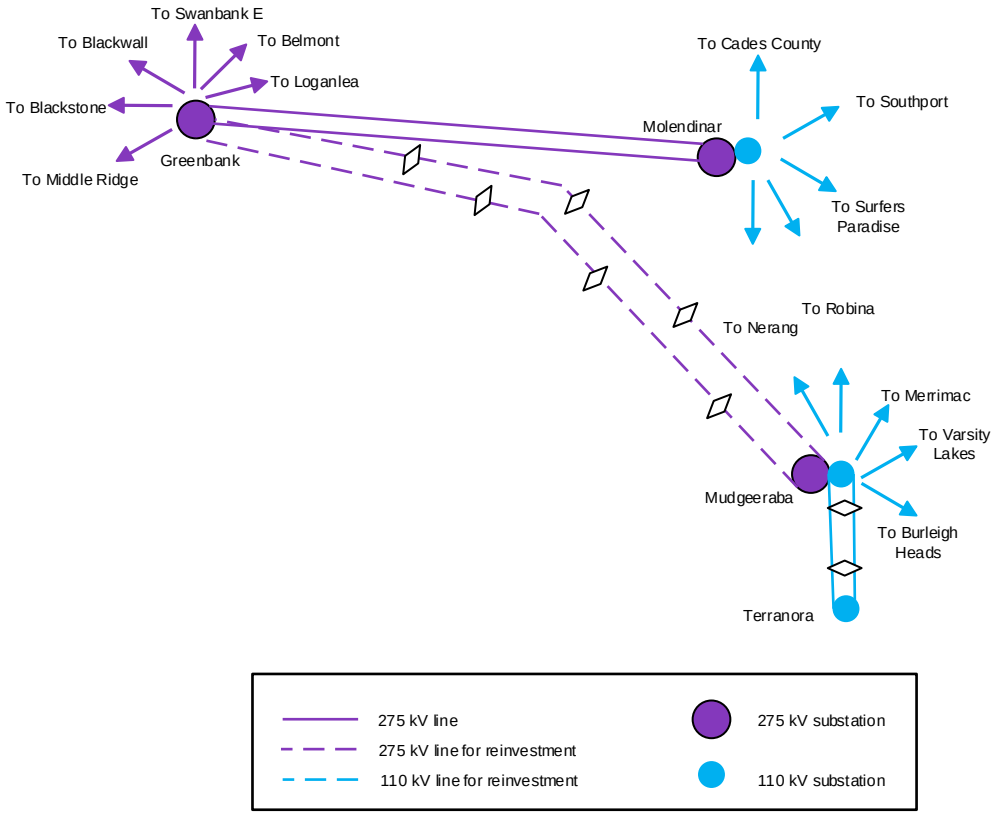
Powerlink proposal for asset reinvestment

Powerlink's 2015 TAPR identified possible line refit works on steel lattice structures of the:

- Greenbank–Mudgeeraba 275 kV transmission line.
- Mudgeeraba–Terranora 110 kV transmission line.

The proposed work is expected to commission during summer 2017–18.

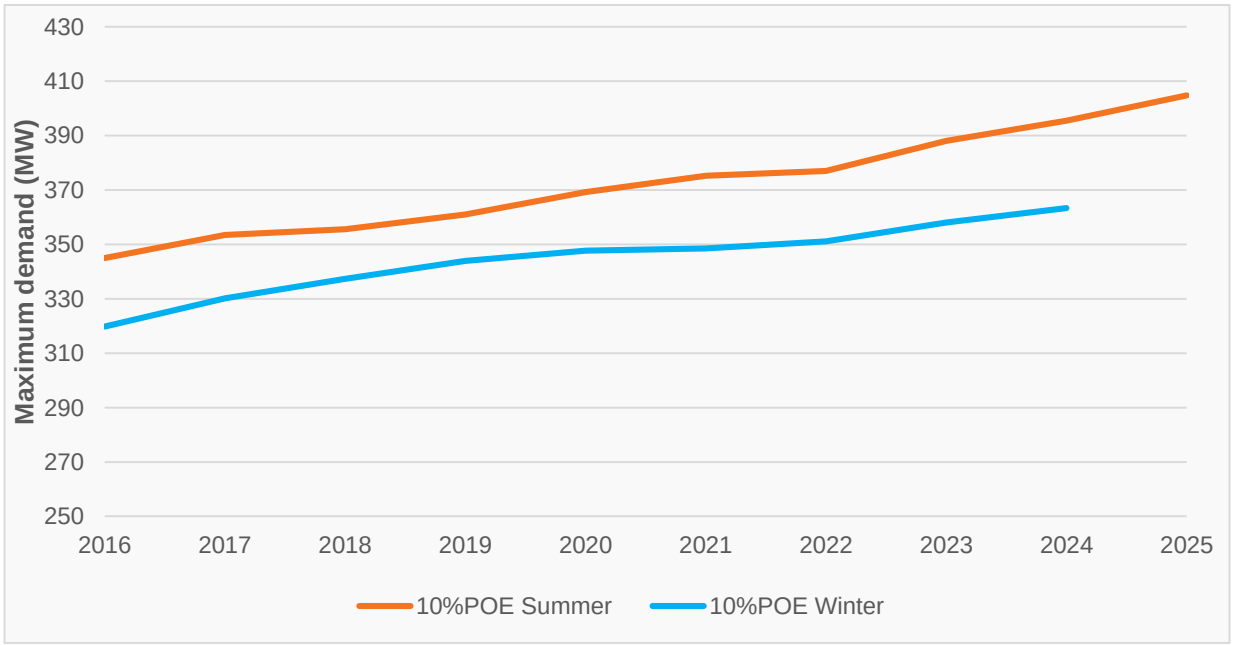
Figure 38 The Gold Coast transmission network.



AEMO connection point forecasts

The 10% POE load forecast at the Mudgeeraba substation projects an increase in summer maximum demand from 345 MW in 2015–16 to 405 MW in 2024–25. Figure 39 shows connection point maximum demand forecasts for the Mudgeeraba substation.

Figure 39 AEMO connection point load forecast at the Mudgeeraba substation



The nominal capacity of the Terranora interconnector is 107 MW from New South Wales to Queensland and 210 MW from Queensland to New South Wales.

AEMO assessment

AEMO agrees with Powerlink that there is an ongoing need for the Greenbank–Mudgeeraba 275 kV and Mudgeeraba–Terranora 110 kV transmission lines.

MEASURES AND ABBREVIATIONS

Units of measure

Abbreviation	Unit of measure
kV	Kilovolts
MW	Megawatts
MWh	Megawatt hours
MVA	Megavolt amperes
MVar	Megavolt amperes reactive

Abbreviations

Abbreviation	Expanded name
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
COAG	Council of Australian Governments
NCIPAP	Network Capability Incentive Parameter Action Plan
NTNDP	National Transmission Network Development Plan
NEM	National Electricity Market
NEO	National Electricity Objective
NEL	National Electricity Law
NTP	National Transmission Planner
TNSP	Transmission network service provider

GLOSSARY

This report uses many terms that have meanings defined in the National Electricity Rules. The Rules meanings are adopted unless otherwise specified.

Term	Definition
Annual planning report	An annual report providing forecasts of gas or electricity (or both) supply, capacity, and demand, and other planning information.
Augmentation	The process of upgrading the capacity or service potential of some part of a transmission (or a distribution) network.
Connection point	The point at which the transmission and distribution network meet.
Constraint	Any limitation on the operation of the transmission system that will give rise to unserved energy (USE) or to generation re-dispatch costs.
Consumer	See customer.
Customer	A person who engages in the activity of purchasing electricity supplied through a transmission or distribution system to a connection point.
Demand-side participation (DSP)	The situation where customers vary their electricity consumption in response to a change in market conditions, such as the spot price.
Distribution network	A network that is not a transmission network.
Generation	The production of electrical power by converting another form of energy in a generating unit.
Generation capacity	The amount (in megawatts (MW)) of electricity that a generating unit can produce under nominated conditions.
Generator	A person who engages in the activity of owning, controlling or operating a generating system that is connected to, or who otherwise supplies electricity to, a transmission or distribution system and who is registered by AEMO as a generator under Chapter 2 (of the Rules) and, for the purposes of Chapter 5 (of the Rules), the term includes a person who is required to, or intends to register in that capacity.
Jurisdictional planning body (JPB)	An entity nominated by the relevant Minister of the relevant participating jurisdiction as having transmission system planning responsibility (in that participating jurisdiction).
Load	A connection point or defined set of connection points at which electrical power is delivered to a person or to another network or the amount of electrical power delivered at a defined instant at a connection point, or aggregated over a defined set of connection points.
Maximum demand (MD)	The highest amount of electrical power delivered, or forecast to be delivered, over a defined period (day, week, month, season, or year) either at a connection point, or simultaneously at a defined set of connection points.
National Electricity Law	The National Electricity Law (NEL) is a schedule to the National Electricity (South Australia) Act 1996, which is applied in other participating jurisdictions by application acts. The NEL sets out some of the key high-level elements of the electricity regulatory framework, such as the functions and powers of NEM institutions, including AEMO, the AEMC, and the AER.
National Electricity Market (NEM)	The wholesale exchange of electricity operated by AEMO under the National Electricity Rules (Rules).
National Electricity Rules (Rules)	The National Electricity Rules (Rules) describes the day-to-day operations of the NEM and the framework for network regulations. See also ‘National Electricity Law’.

Term	Definition
Network	The apparatus, equipment, plant and buildings used to convey, and control the conveyance of, electricity to customers (whether wholesale or retail) excluding any connection assets. In relation to a network service provider, a network owned, operated or controlled by that network service provider.
Network capability	The capability of the network or part of the network to transfer electricity from one location to another.
Non-network option	An option intended to relieve a limitation without modifying or installing network elements. Typically, non-network options involve demand-side participation (DSP) (including post contingent load relief) and new generation on the load side of the limitation.
N-1	A level of reliability where supply to customers is not effected when one network element is out of service.
Planning criteria	Criteria intended to enable the jurisdictional planning bodies (JPBs) to discharge their obligations under the Rules and relevant regional transmission planning standards.
Power system	The National Electricity Market's (NEM) entire electricity infrastructure (including associated generation, transmission, and distribution networks) for the supply of electricity, operated as an integrated arrangement.
Power system security	The safe scheduling, operation, and control of the power system on a continuous basis in accordance with the principles set out in clause 4.2.6 (of the Rules).
Probability of exceedance (POE) maximum demand	The probability, as a percentage, that a maximum demand (MD) level will be met or exceeded (for example, due to weather conditions) in a particular period of time. For example, for a 10% POE MD for any given season, there is a 10% probability that the corresponding 10% POE projected MD level will be met or exceeded. This means that 10% POE projected MD levels for a given season are expected to be met or exceeded, on average, 1 year in 10.
Primary plant	Equipment which is directly connected to the high voltage network. This includes circuit breakers, isolators, current transformers, voltage transformers, etc.
Region	An area determined by the AEMC in accordance with Chapter 2A of the National Electricity Rules (Rules).
Reliability	The probability that plant, equipment, a system, or a device, will perform adequately for the period of time intended, under the operating conditions encountered. Also, the expression of a recognised degree of confidence in the certainty of an event or action occurring when expected.
Secondary plant	Equipment which is not directly connected to the high voltage network. This includes protection, communication and metering equipment.
Supply	The delivery of electricity.
Transmission network	A network within any National Electricity Market (NEM) participating jurisdiction operating at nominal voltages of 220 kV and above plus: (a) any part of a network operating at nominal voltages between 66 kV and 220 kV that operates in parallel to and provides support to the higher voltage transmission network, (b) any part of a network operating at nominal voltages between 66 kV and 220 kV that is not referred to in paragraph (a) but is deemed by the Australian Energy Regulator (AER) to be part of the transmission network.
Transmission system	A transmission network, together with the connection assets associated with the transmission network (such as transformers), which is connected to another transmission or distribution system.

Term	Definition
Unserved energy (USE)	The amount of energy that cannot be supplied because there is insufficient generation capacity, demand-side participation (DSP), or network capability to meet demand.