



ATTACHMENT B – TASNETWORKS PROJECT ASSESSMENT REPORTS

INDEPENDENT PLANNING REVIEW

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CONTENTS

1 – JURISDICTIONAL PLANNING CRITERIA	5
2 – CAPACITY-DRIVEN NETWORK AUGMENTATION PROJECTS	6
2.1 Waddamana–Palmerston supply security augmentation	6
2.2 Newton–Queenstown supply security augmentation	13
2.3 Rosebery Substation transformer capacity augmentation	16
2.4 Other augmentation projects	20
3 – CONDITION-DRIVEN ASSET REPLACEMENT PROJECTS	21
3.1 Transformers	21
3.2 Spare assets	24
3.3 Substations	24

TABLES

Table 1: TasNetworks' proposed augmentation projects	6
Table 2: Thermal ratings of Waddamana–Palmerston 220 kV and 110 kV transmission circuits	7
Table 3: Outage assumptions for Waddamana–Palmerston 220 kV	8
Table 4: Maximum USE for different generation levels in Southern Tasmania after a double-circuit outage of the Waddamana–Palmerston 220 kV line	12
Table 5: Expected USE after a double-circuit outage of the Waddamana–Palmerston 220 kV line	12
Table 6: Thermal ratings of Farrell–Rosebery–Queenstown 110 kV transmission line	14
Table 7: Outage assumptions for Farrell–Rosebery–Queenstown 110 kV line	14
Table 8: Maximum non-industrial load at risk after outage at Farrell–Rosebery–Queenstown 110 kV circuit	15
Table 9: Maximum USE for a 48-hour period after an outage of the Farrell–Rosebery–Queenstown 110 kV line	15
Table 10: Expected USE after an outage of the Farrell–Rosebery–Queenstown 110 kV line	15
Table 11: Thermal ratings of each of 110/44 kV at Rosebery Substation	17
Table 12: Outage assumptions for transformers at Rosebery Substation	18
Table 13: Maximum load at risk after an outage of one transformer at Rosebery Substation	18
Table 14: Maximum expected USE for an 8-day period after an outage of one 110/44 kV transformer at Rosebery Substation	19
Table 15: Expected USE for an outage of one 110/44 kV transformer at Rosebery Substation	19
Table 16: Other augmentation projects AEMO assessed for this review	20
Table 17: TasNetworks' proposed asset replacement projects	21
Table 18: Lindisfarne Substation transformer replacement	21
Table 19: Strategic spare mobile 110/33/22/11 kV Substation	24
Table 20: George Town 110 kV Substation redevelopment	24

FIGURES

Figure 1: Supply arrangement for southern Tasmania	7
Figure 2: Southern Tasmania 10-year maximum coincident demand forecasts	9
Figure 3: Southern Tasmania annual load duration curve	9
Figure 4: Hydro generation in southern Tasmania	10
Figure 5: Maximum supportable demand for different levels of generation in southern Tasmania, following a double-circuit outage of the Waddamana–Palmerston 220 kV line	11
Figure 6: Queenstown and Newton substations connection arrangement	13
Figure 7: Rosebery Substation connection arrangement	17
Figure 8: Supply to Lindisfarne Substation	22
Figure 9: Lindisfarne Substation 10 year connection point forecast	22
Figure 10: George Town Substation connection configuration	25



1 – JURISDICTIONAL PLANNING CRITERIA

In Tasmania, transmission network planning criteria are set out in the Electricity Supply Industry (Network Planning Requirements) Regulations 2007.

TasNetworks is required to follow a planning process to meet the minimum network performance standards.

According to these obligations, when assessing TasNetworks' proposed projects, augmentations, AEMO has considered the following requirements:

- a) No more than 25 MW of load is to be interrupted by a credible contingency event.
- b) No more than 850 MW of load is to be interrupted by a single asset failure.
- c) A credible contingency should not result in unserved energy (USE) exceeding 300 MWh.
- d) A single asset failure should not result in USE exceeding 3,000 MWh.
- e) For the purpose of calculating unserved energy, any replacement or repairs undertaken must not exceed:
 - 48 hours to repair a transmission line.
 - 8 days to replace a transformer.
 - 18 days to replace an autotransformer.

AEMO also calculated the expected reduction in USE and value of expected USE for TasNetworks' proposed augmentations. The key inputs for this calculation include: probability of network outages, value of customer reliability, and forecast load profile.

This calculation could assist for a cost-benefit assessment if necessary.

2 – CAPACITY-DRIVEN NETWORK AUGMENTATION PROJECTS

Table 1: TasNetworks’ proposed augmentation projects

Project	Proposed commissioning year	AEMO need assessment	Page number
Waddamana–Palmerston supply security augmentation	2018-19	Need contingent on markets benefit assessment.	6
Newton–Queenstown supply security augmentation	2016-17	Need contingent on closure of industrial load.	13
Rosebery Substation transformer capacity augmentation	2016-17	Justified network need. Alternative solutions may be possible.	16

2.1 Waddamana–Palmerston supply security augmentation

The security of supply to southern Tasmania could be affected by a double-circuit outage of the Waddamana–Palmerston 220 kV overhead line at times of low generation in southern Tasmania.

TasNetwork propose to improve the security of supply to southern Tasmania by strengthening the Waddamana–Palmerston 220 kV transmission network corridor. This project involves upgrading the existing Waddamana–Palmerston 110 kV circuit to 220 kV operation by 2018-19.

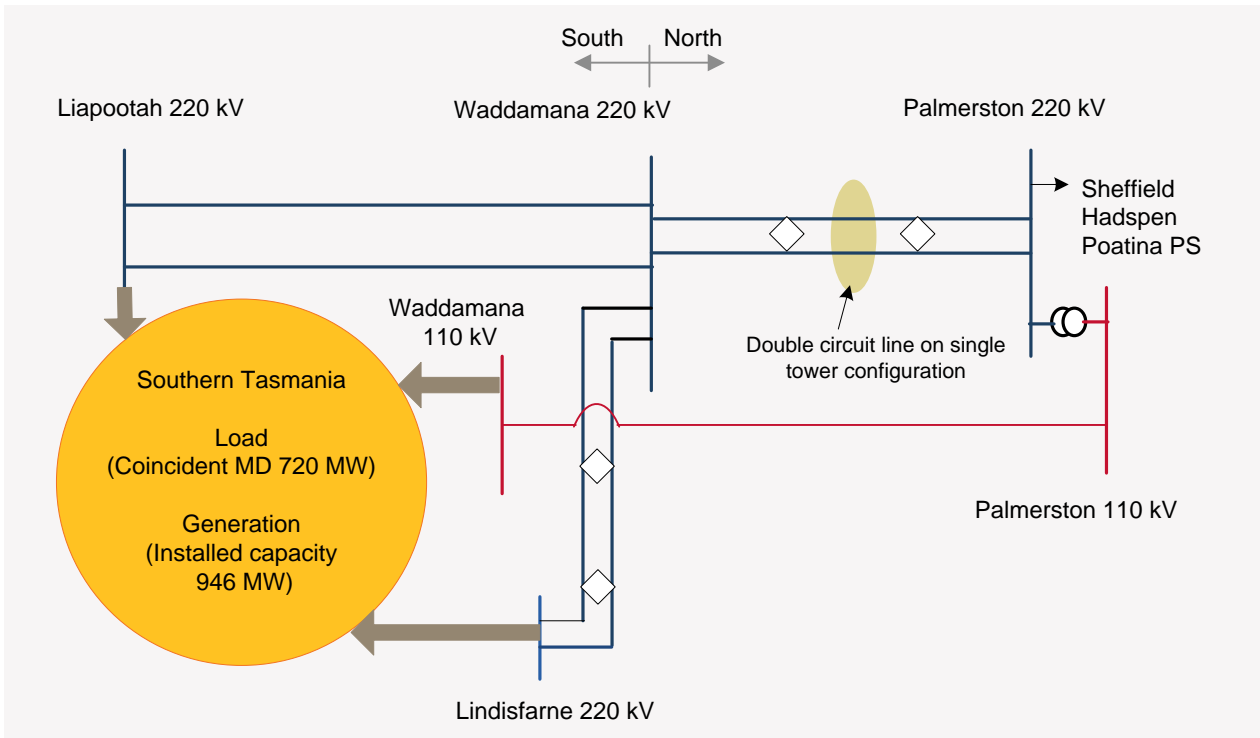
2.1.1 Background

The Waddamana–Palmerston transmission corridor connects the northern and southern parts of the Tasmanian transmission network. It consists of a 220 kV double-circuit line and a single 110 kV line linking substations at Waddamana (in the south) to Palmerston (in the north).

The southern Tasmania area includes Hobart and surrounding suburbs. It is supplied by local hydro generation and power transferred from the northern part of the state via the Waddamana–Palmerston transmission corridor. This supply arrangement is shown in Figure 1.

The 220 kV Waddamana–Palmerston double-circuit line is on a single tower configuration. A tower outage will result in an outage of both 220 kV circuits. After such an outage, maximum supportable demand in southern Tasmania depends on the amount of local generation and the maximum transfer capability of the Waddamana–Palmerston 110 kV line.

Figure 1: Supply arrangement for southern Tasmania



2.1.2 Network capability analysis

Line thermal ratings

Table 2 presents the thermal ratings of the Waddamana–Palmerston 220 kV and 110 kV transmission circuits.

Table 2: Thermal ratings of Waddamana–Palmerston 220 kV and 110 kV transmission circuits

Network element	Continuous ratings (MVA)	
	Summer	Winter
Waddamana–Palmerston 220 kV No.1 circuit	420	453
Waddamana–Palmerston 220 kV No.2 circuit	420	500
Waddamana–Palmerston 110 kV circuit*	140	152

* TasNetworks has proposed a project in its network capability incentive parameter action plan (NCIPAP) to increase the rating of the 110 kV circuit from 138 MVA to 152 MVA.

Outage assumptions

Transmission lines can experience outages due to minor failures requiring relatively short outages to repair; or major failures, requiring longer outage durations.

Table 3 summarises the outage assumptions AEMO has applied for this study.

AEMO’s assumptions for minor outages are based on 20 years of historical outage data sourced from TasNetworks. No data was available for prolonged line outages.

For this study, a double-circuit outage is assumed to take place once every 50 years. In addition, repair times of two hours for minor outages and 48 hours for major outages are assumed.

Table 3: Outage assumptions for Waddamana–Palmerston 220 kV

Line	Type of double-circuit outage	Outage duration	Number of failures per year	Probability of outage
Waddamana–Palmerston 220 kV double-circuit outage	Minor outage	2 hours	2.45	0.0559%
	Major outage	48 hours	0.02	0.0110%

2.1.3 Network capability against projected demand and generation

Projected demand

Substations in Southern Tasmania are located at Boyer, Bridgewater, Chapel Street, Creek Road, Derwent Bridge, Electrona, Huon River, Kermantie, Kingston, Knights Road, Lindisfarne, Mornington, New Norfolk, North Hobart, Risdon, Rokeby, Sorell, Triabunna and Waddamana. AEMO’s 2014 summer and winter maximum coincident demand forecasts for these substations (both 10% and 50% POE) are shown in Figure 2.

The area is winter peaking, with coincident maximum winter demand forecast to be relatively stable around 720 MW at 10% POE (680 MW at 50% POE) over the next 10 years. For the same period, the non-coincident maximum winter demand is forecast to be relatively stable around 800 MW at 10% POE. The coincident maximum recorded demand in Southern Tasmania in 2013 was 690 MW.

The annual load duration curve for southern Tasmania is shown in Figure 3. Maximum demand is expected to occur less than 2% of the year.

Figure 2: Southern Tasmania 10-year maximum coincident demand forecasts

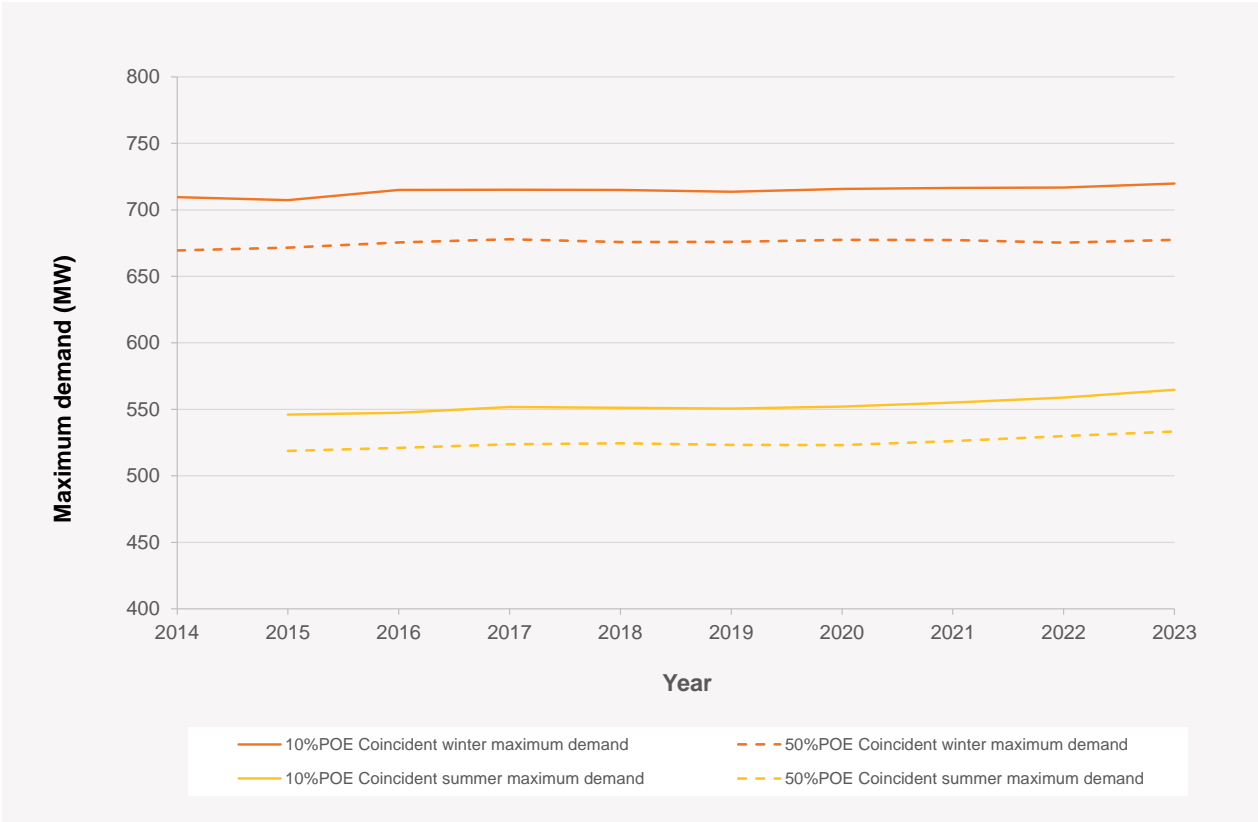
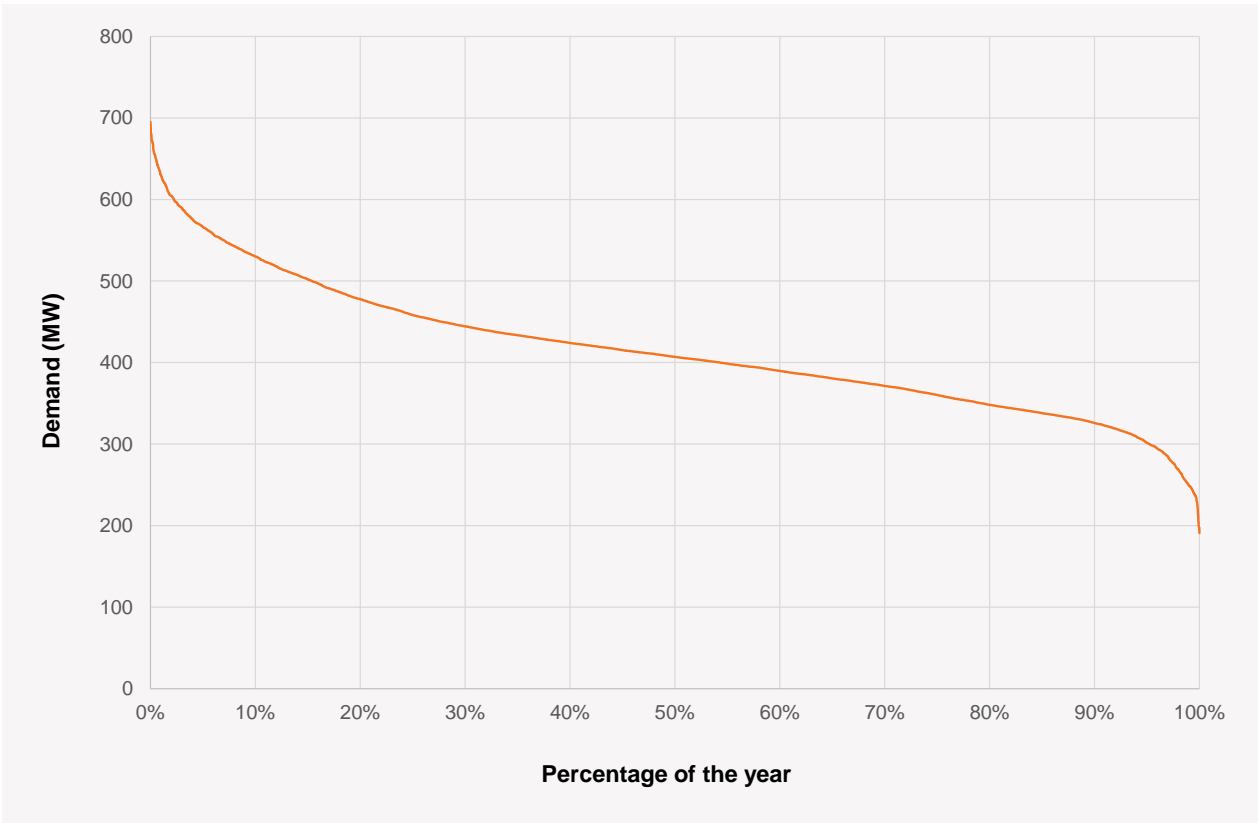


Figure 3: Southern Tasmania annual load duration curve



Generation in southern Tasmania

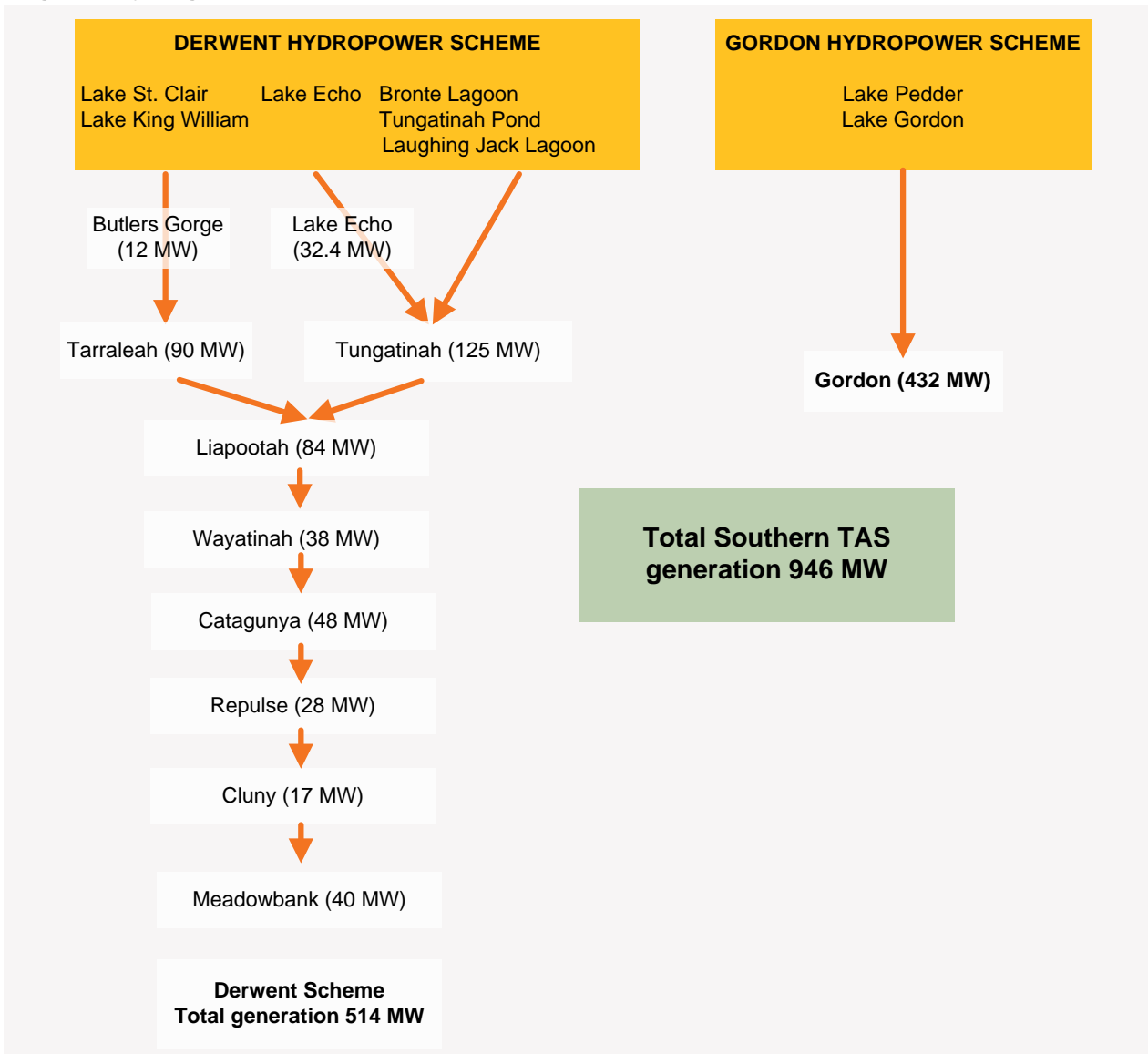
Generation in southern Tasmania area is predominantly through power stations supplied by the Gordon and Derwent hydropower schemes. These are summarised in Figure 4.

Total installed generation capacity is 946 MW, comprising:

- The Gordon scheme supplying the Gordon Power Station with a capacity of 432 MW.
- The Derwent scheme supplying the remaining power stations in southern Tasmania, with a combined capacity of 514 MW.

Power generation from these hydro-electric power stations depends on water management, generator outages, and generation dispatch prices.

Figure 4: Hydro generation in southern Tasmania



Maximum supportable demand

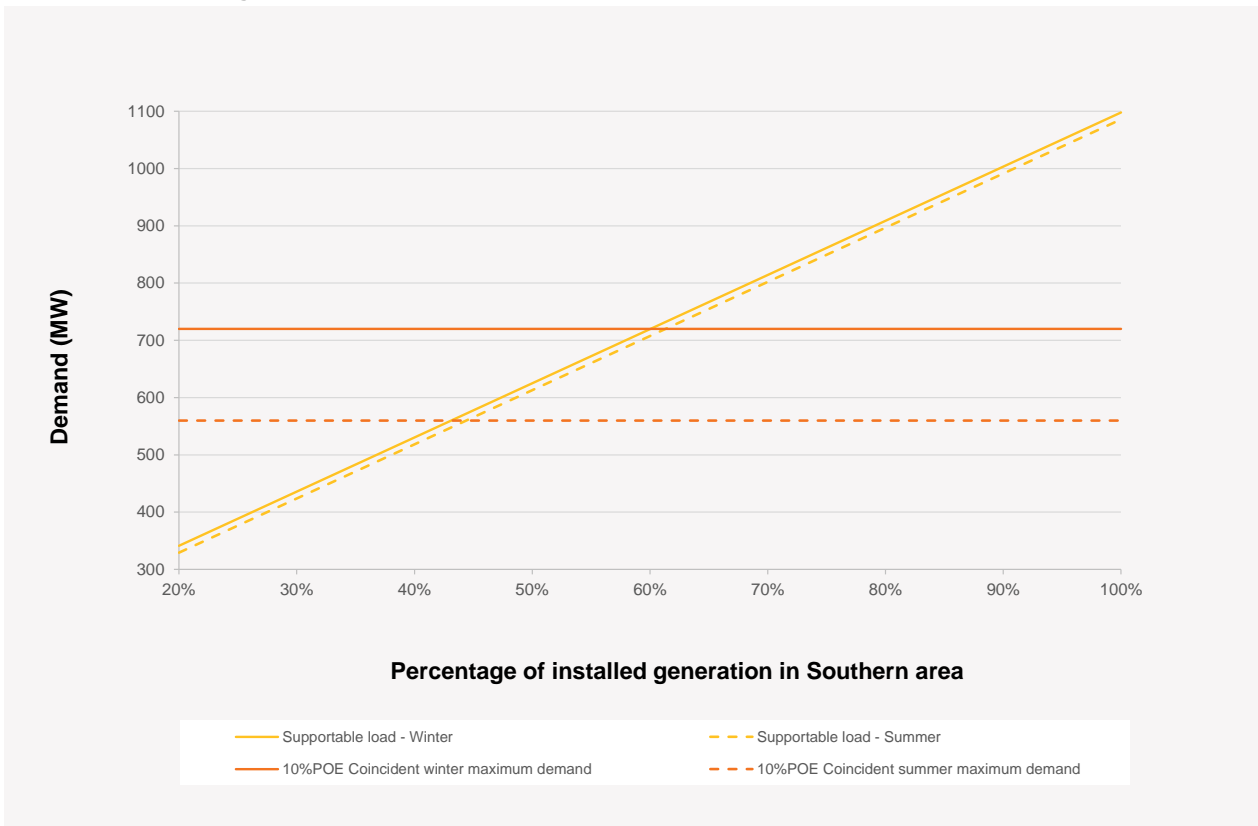
There is no load at risk following a single credible contingency outage of: one Waddamana–Palmerston 220 kV circuit, the Waddamana–Palmerston 110 kV circuit, or the single largest generating unit in Southern Tasmania.

Maximum supportable demand in Southern Tasmania, following a double-circuit outage of the Waddamana–Palmerston 220 kV line, depends on the amount of local generation in Southern Tasmania and the transfer capability of the Waddamana–Palmerston 110 kV line. The Southern Tasmania system may experience angular instability following a double-circuit outage of the Waddamana–Palmerston 220 kV line; however, the stability limit is higher than the continuous thermal rating of Waddamana–Palmerston 110 kV line applied in this study.

Figure 5: Maximum supportable demand for different levels of generation in southern Tasmania, following a double-circuit outage of the Waddamana–Palmerston 220 kV line Figure 5 plots maximum supportable demand in Southern Tasmania (for various levels generation up to the maximum installed capacity of 946 MW) and 10% POE projected maximum demand over the next 10 years.

There is no load at risk following an outage of the Waddamana–Palmerston 220 kV double-circuit line, with local generation of at least 60% of installed capacity.

Figure 5: Maximum supportable demand for different levels of generation in southern Tasmania, following a double-circuit outage of the Waddamana–Palmerston 220 kV line



Unserved energy

AEMO developed a half hourly load profile for the area based on 2012-13 historical load traces, using the 10% POE winter and summer maximum demands. This was used to assess USE.

As per the Tasmanian network planning standards, USE after a double-circuit outage of the Waddamana–Palmerston 220 kV line was calculated for continuous rolling 48-hour periods for each of the years.

Table 4 shows how maximum USE varies for different generation levels in southern Tasmania. Maximum USE for a 48-hour period is not forecast to exceed 3,000 MWh if generation is greater 37% of installed capacity.

Table 4: Maximum USE for different generation levels in Southern Tasmania after a double-circuit outage of the Waddamana–Palmerston 220 kV line

Southern Tasmania generation level (% of installed generation)	60%	50%	40%	37%
Maximum USE for a 48-hour period per year (MWh) (2014-15 to 2020-21)	0	327	2,036	2,819

Table 5 presents the expected USE based on the probability of a double-circuit outage on the Waddamana–Palmerston 220 kV line. AEMO has applied a value of customer reliability (VCR) of \$62,320 (\$/MWh) to convert expected USE to a monetary value.

Table 5: Expected USE after a double-circuit outage of the Waddamana–Palmerston 220 kV line

Southern Tasmania generation level (% of installed generation)	>60%	50%	40%	35%
Annual expected USE (MWh) 2014-15 to 2020-21)	0	0.74	11.17	27.79
Value of expected USE (\$m)	0	0.05	0.70	1.73

The USE depends on the Southern Tasmania generation output, which relies on water availability from the Gordon and Derwent hydropower schemes and generator plant outages. Water availability for generation depends on water storage and its management. Detailed market modelling is required for a period of approximately 10 years to identify the possibility of low generation during high demand periods in the Southern Tasmania.

Non-network and network options

AEMO considers that the following non-network and network options may reduce the load at risk for an outage of the Waddamana–Palmerston 220 kV double-circuit line:

1. Reschedule Southern Tasmania generation to maintain a safe loading on the Waddamana–Palmerston 220 kV and 110 kV circuits.
2. An automatic control scheme to reduce the load following a double circuit outage of the Waddamana–Palmerston 220 kV line.
3. Demand-side participation at transmission and/or distribution level.
4. Source network support services from Southern Tasmania generators.
5. Upgrade Waddamana–Palmerston 110 kV circuit to 220 kV operation (TasNetworks' proposed network option).

2.1.4 Application of planning criteria

Forecast coincident maximum demand for Southern Tasmania is 720 MW for the next 10 years. The worst-case maximum load at risk for a single asset failure resulting in a double-circuit outage of the Waddamana–Palmerston 220 kV line is within the 850 MW limit set out in the Tasmanian planning criteria.

A double-circuit outage of the Waddamana–Palmerston 220 kV line does not result in load shedding if hydro generation in Southern Tasmania exceeds 60% of installed capacity. The maximum USE for any consecutive 48-hour period does not exceed the 3,000 MWh limit set out in the Tasmanian planning criteria if local southern Tasmanian generation exceeds least 37% of installed capacity.

2.1.5 Conclusion

After a double-circuit outage of the Waddamana–Palmerston 220kV transmission line maximum supportable demand in southern Tasmania depends on the level of local generation and the transfer capability of the Waddamana–Palmerston 110 kV line.

AEMO considers the network need for TasNetworks’ proposed augmentation is contingent on the outcome of a detailed market benefits assessment.

AEMO’s analysis indicates that potential load at risk for a double-circuit outage of the Waddamana–Palmerston 220 kV line could be managed by limiting the power flow in the Waddamana–Palmerston transmission corridor to a safe level.

2.2 Newton–Queenstown supply security augmentation

An outage of Farrell–Rosebery–Queenstown 110 kV line will result in loss of supply to the Queenstown and Newton substations.

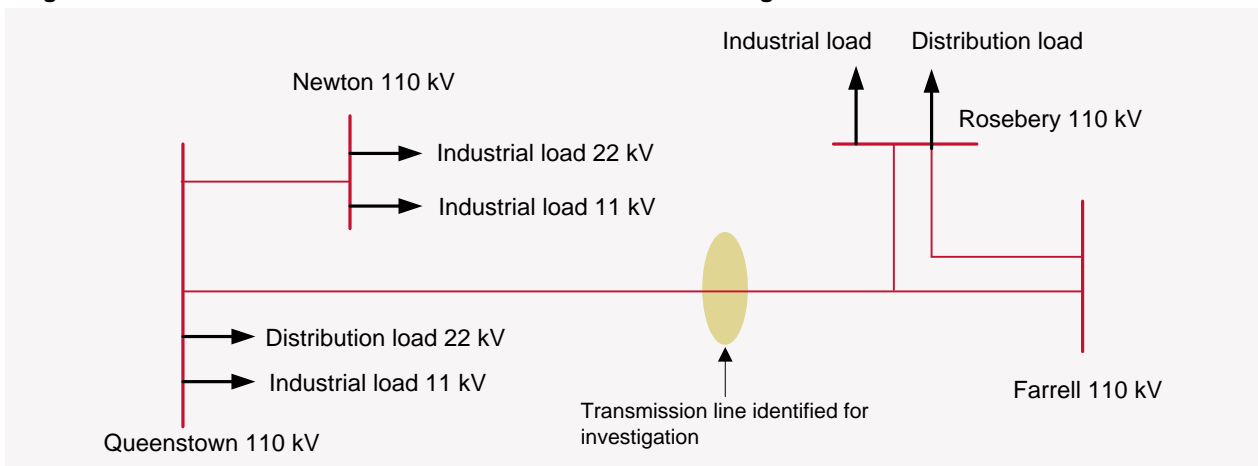
TasNetworks identify a network augmentation to increase the security of supply to these substations. They propose to install a 220/110 kV 30/50 MVA transformer at Queenstown Substation and connection to the Farrell–John Butters 220 kV circuit by 2016-17.

2.2.1 Background

The Queenstown and Newton substations supply mainly the residential, pumping and industrial loads on the Tasmanian West Coast.

The Queenstown Substation is supplied by a single radial 110 kV line from Farrell and Newton Substation is supplied by a single radial 110 kV transmission line from Queenstown. This connection arrangement is shown in the schematic diagram in Figure 6. An outage of Farrell–Rosebery–Queenstown 110 kV line results in total loss of load at both Queenstown and Newton substations.

Figure 6: Queenstown and Newton substations connection arrangement



2.2.2 Network capability analysis

Line thermal ratings

Table 6 presents the thermal ratings of the Farrell–Rosebery–Queenstown 110 kV transmission line.

Table 6: Thermal ratings of Farrell–Rosebery–Queenstown 110 kV transmission line

Season	Normal ratings (MVA)	Emergency ratings (MVA)
Winter	75	75
Summer	63	63

Outage assumptions

Transmission lines can experience forced outages due to minor failures requiring relatively short outages to repair or major failures, requiring longer outage durations.

Table 7 summarises the outage assumptions AEMO has applied for this study:

AEMO's assumptions for minor outages are based on historical outage data sourced from TasNetworks. No data was available for prolonged line outages. For this study, a prolonged line outage is assumed to take place once every 50 years and have a repair time of 48 hours.

Table 7: Outage assumptions for Farrell-Rosebery–Queenstown 110 kV line

Line	Type outage	Outage duration	Number of failures per year	Probability of outage
Farrell–Rosebery–Queenstown 110 kV single circuit outage	Minor outage	228 min	0.4630	0.0201%
Farrell–Rosebery–Queenstown 110 kV outage	Major outage	48 hours	0.0200	0.0110%

2.2.3 Network capability against projected demand

Load forecasts

AEMO's 2014 connection point forecasts with industrial load show a significant reduction in demand at Queenstown and Newton for the next 10 years due to a reduction in industrial loads from 2016 onwards.

Maximum supportable demand

The forecast 10%POE maximum loading on the Farrell–Rosebery–Queenstown 110 kV single circuit is within its continuous rating of 63 MVA for the next 10 years. However for an outage of this single circuit, supply to Queenstown and Newton substations will be lost.

Load at risk

Table 8 presents the maximum load at risk with 10% POE and 50% POE maximum load forecasts following an outage of the Farrell–Rosebery–Queenstown 110 kV circuit. This table does not include industrial loads and Newton connection point load due to confidentiality. However, AEMO has taken these loads into account for the assessment of network loading. AEMO's assessment showed that the maximum load at risk does not exceed 25 MW from 2016 onwards.

Table 8: Maximum non-industrial load at risk after outage at Farrell–Rosebery–Queenstown 110 kV circuit

Year	Maximum load at risk (MW)	
	10% POE forecast	50% POE forecast
2015	7.5	6.9
2016	7.5	6.9
2017	7.5	6.9
2018	7.4	6.9
2019	7.4	6.9
2020	7.4	6.9
2021	7.4	6.9
2022	7.4	6.8

Unserved energy

AEMO developed a half-hourly load profile for the area based on 2012-13 historical load traces, using the 10% POE winter and summer maximum demands. This was used to assess USE.

As per the Tasmanian network planning standards, USE after an outage of the Farrell–Rosebery–Queenstown 110 kV line was calculated for continuous rolling 48-hour periods over the forecast horizon. Maximum USE exceeds 300 MWh for the period up to 2017-18 but does not exceed 300 MWh from 2018-19 onwards. Table 9 presents the maximum USE of 48-hour period.

Table 9: Maximum USE for a 48-hour period after an outage of the Farrell-Rosebery-Queenstown 110 kV line

Year	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Maximum USE for any 48-hour period (MWh)	1,055	1,140	1,004	998	285	285	285

The expected USE is calculated based on the probability of an outage on the Farrell–Rosebery–Queenstown 110 kV line. Table 10 presents expected USE and the value of expected USE.

Table 10: Expected USE after an outage of the Farrell–Rosebery–Queenstown 110 kV line

Year	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Expected USE (MWh)	43.3	46.2	37.1	36.9	10.1	9.9	9.8
Value of expected USE (\$m)	2.70	2.88	2.31	2.29	0.63	0.62	0.61

Non-network and network options

AEMO considers that the following non-network and network options may reduce the load at risk:

1. Contingency plan to reduce the restoration time of the faulted Farrell–Rosebery–Queenstown 110 kV circuit.
2. Demand-side participation.
3. Local generation.
4. Installation of a 220/110 kV 30/50 MVA network transformer at Queenstown Substation and connection to the Farrell–John Butters 220 kV circuit (TasNetworks' proposed network option).

2.2.4 Application of planning criteria

An outage of Farrell–Rosebery–Queenstown 110 kV circuit would result in loss of load at Queenstown and Newton substations. With reference to the limits set out in Tasmanian planning criteria at the time of 10% POE maximum demand:

- This loss of load does not exceed 25 MW from 2016 onwards.
- The maximum USE for any 48-hour rolling period is does not exceed 300 MWh from 2019 onwards.

2.2.5 Conclusion

An outage of the existing single circuit between Farrell and Queenstown will result in total loss of supply to Queenstown and Newton substations. Industrial load is forecast to reduce in the Queenstown and Newton areas from 2016.

AEMO considers that the need for TasNetworks' proposed network augmentation is contingent on the closure of industrial load in the Queenstown and Newton areas, currently expected in 2016.

AEMO recommends a contingency plan for faster restoration of the Farrell–Rosebery–Queenstown 110 kV line. Demand-side management and local generation could also be considered to reduce load.

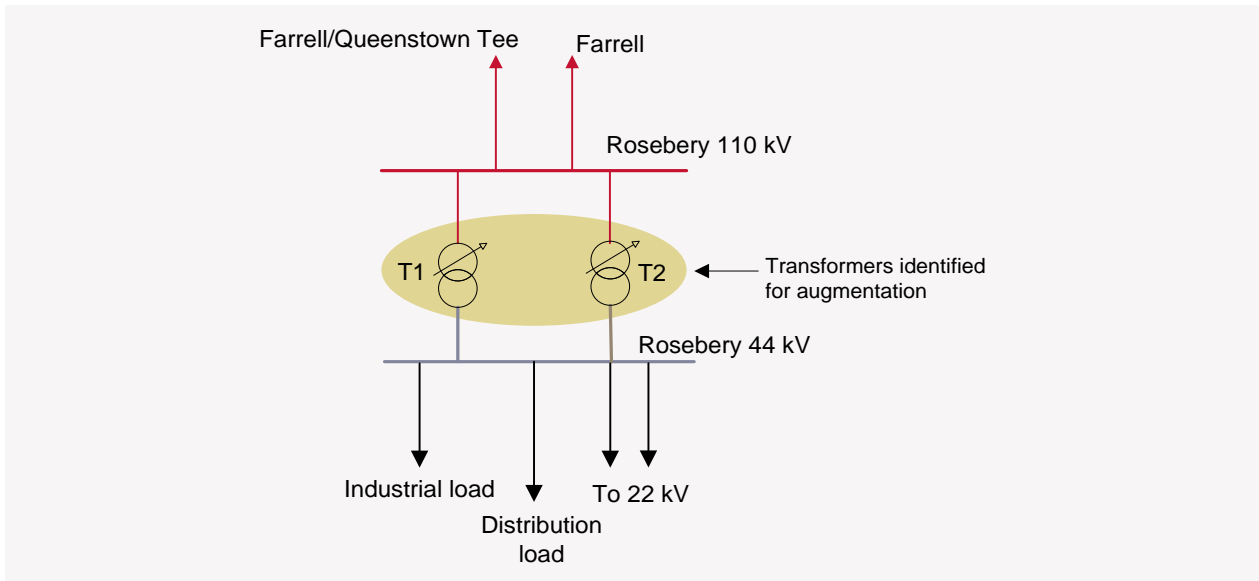
2.3 Rosebery Substation transformer capacity augmentation

Load on the Rosebery Substation 110/44-22 kV transformers is forecast to exceed firm rating during high demand periods.

TasNetworks identify a network augmentation to increase the firm capacity of Rosebery Substation to avoid load at risk. They propose to replace the two existing 20/30 MVA transformers with two new 30/60 MVA transformers by 2016-17.

2.3.1 Background

Rosebery Substation supplies residential, industrial, and agricultural loads on the Tasmanian West Coast. It contains two 110/44 kV 20/30 MVA transformers and is supplied from Farrell Substation. The connection arrangement is shown in the schematic diagram in Figure 7.

Figure 7: Rosebery Substation connection arrangement


2.3.2 Network capability analysis

Transformer thermal ratings

Table 11 shows the thermal ratings for the two 110/44 kV transformers at Rosebery Substation. Each transformer has 20 MVA continuous rating and 30 MVA for a limited time in a 24-hour period. Peak demand is expected to occur for a limited time and the 30 MVA rating for a limited time is useful to meet the peak demand.

Immediately after a parallel transformer outage, overloading on the remaining transformer is permitted up to 36 MVA for a short time. Availability of this short term rating avoids pre-contingency load shedding if potential load exceeds 30 MVA and remains within 36 MVA.

Table 11: Thermal ratings of each of 110/44 kV at Rosebery Substation

Season	Normal rating (MVA)	Emergency rating (MVA)	Short-term rating (MVA)
Winter	30	30	36
Summer	30	30	36

Outage assumptions

Transformers can experience forced outages due to minor failures requiring relatively short outages to repair; or major failures, requiring longer outage durations.

Table 12 summarises the outage assumptions AEMO has applied for this study. This is based on historical outage date sourced from TasNetworks, Tasmanian Electricity Supply Industry Regulations, and the Victorian Transmission Connection Planning Report.

Table 12: Outage assumptions for transformers at Rosebery Substation

Year	Number of failures per year	Outage duration	Outage probability
Minor transformer outages	0.19159* (1 in 5.22 years)	526 Minutes*	0.0192%
Major transformer outages	0.01** (1 in 100 years)	8 days***	0.0219%

*Sourced from TasNetworks

**Major transformer outage rate sourced from 2013 Victorian Transmission Connection Planning Report1

***Sourced from Tasmania Electricity Supply Industry Regulations

2.3.3 Network capability against projected demand

Load forecasts

AEMO's 2014 connection point forecast with industrial load shows a 14% increase in winter maximum demand at Rosebery Substation in 2015 and another increase of 7% winter maximum demand in 2019.

Maximum supportable demand

The maximum supportable load at Rosebery is 36 MW during system normal and 30 MW following an outage of a transformer. Forecast 10%POE maximum demand exceeds the short-term rating of a Rosebery transformer (following an outage of the parallel transformer) from 2015.

Load at risk

Table 13 presents the maximum load at risk under 10% and 50% POE demand forecasts following an outage of one Rosebery 110/44 kV transformer. AEMO has taken into account of industrial loads at Rosebery Substation for the assessment of network loading. As per Tasmania's network performance requirements, the maximum load at risk does not exceed 25 MW.

Table 13: Maximum load at risk after an outage of one transformer at Rosebery Substation

Year	Maximum load at risk (MW)	
	10% POE forecast	50% POE forecast
2015	5.4	5.1
2016	6.4	6.1
2017	6.4	6.1
2018	6.9	6.6
2019	8.2	7.8
2020	9.4	8.9
2021	9.4	8.9
2022	9.4	8.9

Unserved energy

AEMO developed a half hourly load profile for the area based on 2012-13 historical load traces, using the 10% POE winter and summer maximum demands. This was used to assess USE.

¹ SP AusNet. Available [http://www.sp-ausnet.com.au/CA2575630006F222/Lookup/Projects/\\$file/TCPR2010.pdf](http://www.sp-ausnet.com.au/CA2575630006F222/Lookup/Projects/$file/TCPR2010.pdf). Viewed 11 November 2013.

As required under the Tasmanian network planning standards, USE after an outage of one 110/44 kV transformer at Rosebery Substation was calculated for continuous rolling 8-day periods over the forecast horizon. Maximum USE exceeds 300 MWh from 2015-16.

Table 14: Maximum expected USE for an 8-day period after an outage of one 110/44 kV transformer at Rosebery Substation

Year	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Maximum USE for any 48-hour period (MWh)	214	300	432	393	643	935	979

The expected USE is calculated based on the probability of an outage of one 110/44 kV transformer at Rosebery Substation. Table 15 presents expected USE and value of expected USE.

Table 15: Expected USE for an outage of one 110/44 kV transformer at Rosebery Substation

Year	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21
Expected USE (MWh)	1.17	3.42	4.52	7.90	40.32	208.56	256.97
Value of expected USE (\$m)	0.07	0.21	0.28	0.49	2.51	13.0	16.01

Non-network and network options

AEMO considers that the following non-network and network options may reduce the load at risk:

1. Demand-side participation at transmission and/or distribution level.
2. Local generation.
3. Automatic control scheme for removal of overload following an outage.
4. Install an additional new 110/44 kV 30 MVA transformer at Rosebery Substation.
5. Replace the existing two transformers at Rosebery Substation with the new 30/60 MVA transformers (TasNetworks' proposed network option).

2.3.4 Application of planning criteria

An outage of a transformer at Rosebery Substation would result in loss of load at Rosebery Substation during high demand periods. The maximum USE for an 8 hour rolling period is likely to exceed the 300 MWh limit set out in the Tasmanian planning criteria from 2016 onwards.

2.3.5 Conclusion

Load on the 110/44-22 kV transformers at Rosebery Substation is expected to exceed firm rating during high demand periods.

AEMO considers that the network need for TasNetworks' proposed augmentation project is justified.

AEMO considers that non-network options (such as demand-side management and embedded generation) may provide higher net market benefits than TasNetworks' proposed network augmentation. Such strategies should be further explored in a market benefit assessment.

2.4 Other augmentation projects

AEMO engaged with TasNetworks for this review since they commenced developing their NCIPAP proposals in 2013, including the period over which they developed their transitional and substantive regulatory proposals. Table 16 below lists augmentation projects AEMO assessed which TasNetworks included in their transitional proposal in January 2014, but subsequently excluded from their substantive proposal in May 2013.

Table 16: Other augmentation projects AEMO assessed for this review

Driver	Project
Reliability obligation	Northern dynamic reactive support
Reliability obligation	Kingston area Transmission line augmentation
Reliability obligation	Bridgewater substation new 110/33 kV connection point

3 – CONDITION-DRIVEN ASSET REPLACEMENT PROJECTS

Table 17: TasNetworks’ proposed asset replacement projects

Asset type	Proposed replacement year	Project	Connection points	Page in this attachment
Transformer	2016	Lindisfarne Substation transformer replacement	Lindisfarne	21
Spare assets	2017	Strategic spare mobile 110/33/22/1 kV Substation	Various connection points across the state	24
Substation	2014	George Town 110 kV Substation redevelopment	George Town	24

3.1 Transformers

Table 18: Lindisfarne Substation transformer replacement

Project	Lindisfarne Substation T2 and T3 110/33 kV transformer replacement
Year	2016
Alternatives	Non network alternatives for transformer capacity.
Assessment objective	Assess the load forecast to see if replacement with lower capacity asset is possible.

Background

- The Lindisfarne 220/110 kV Substation is supplied by the 220 kV transmission network from Waddamana Substation and 110 kV connections from Risdon and Bridgewater substations.
- The Lindisfarne 220/110 kV Substation feeds local customer load at Lindisfarne, as well as loads at Triabunna, Sorell, Mornington, and Rokeby.
- The Lindisfarne 110/33 kV substation feeds local load via the T2 and T3 transformers, each having a rating of 45 MVA.
- TasNetworks proposes to replace the two 45 MVA 110/33 kV T2 and T3 transformers with two new, modern equivalent transformers with capacity of 30/60 MVA as the existing transformers approach the end of their serviceable lives.

Projected demand

- Figure 9 below shows AEMO’s 10-year connection point winter demand forecasts for the Lindisfarne Substation (both 10% POE and 50% POE). Demand is expected to increase steadily over the 10-year forecast horizon.

Figure 8: Supply to Lindisfarne Substation

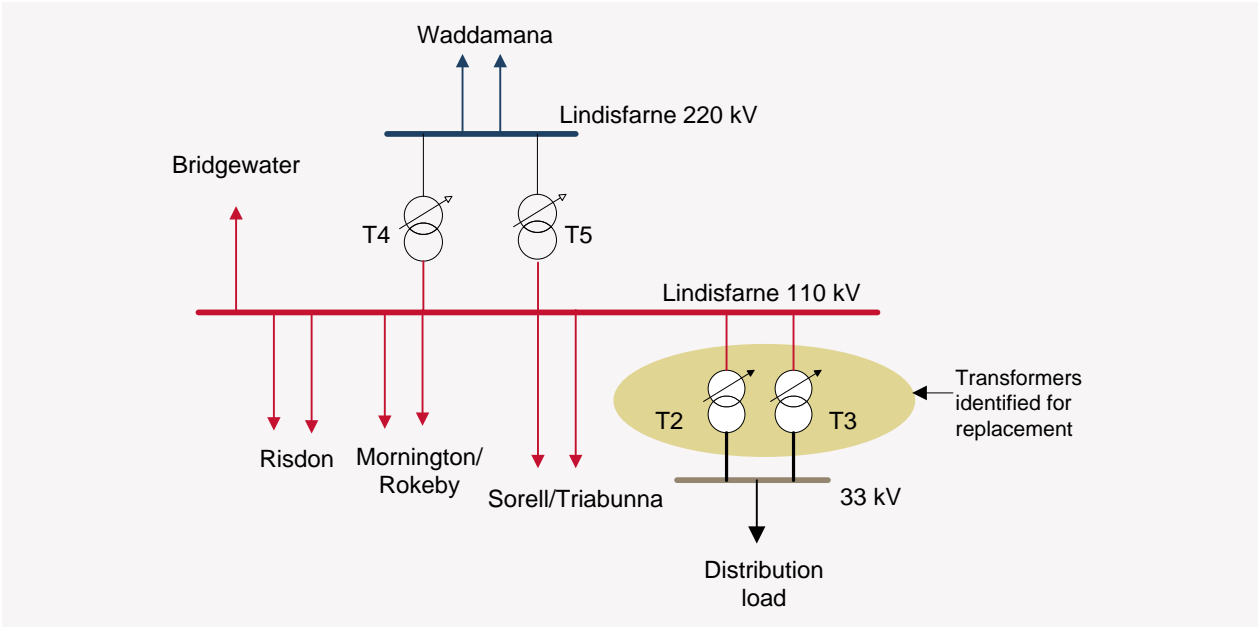
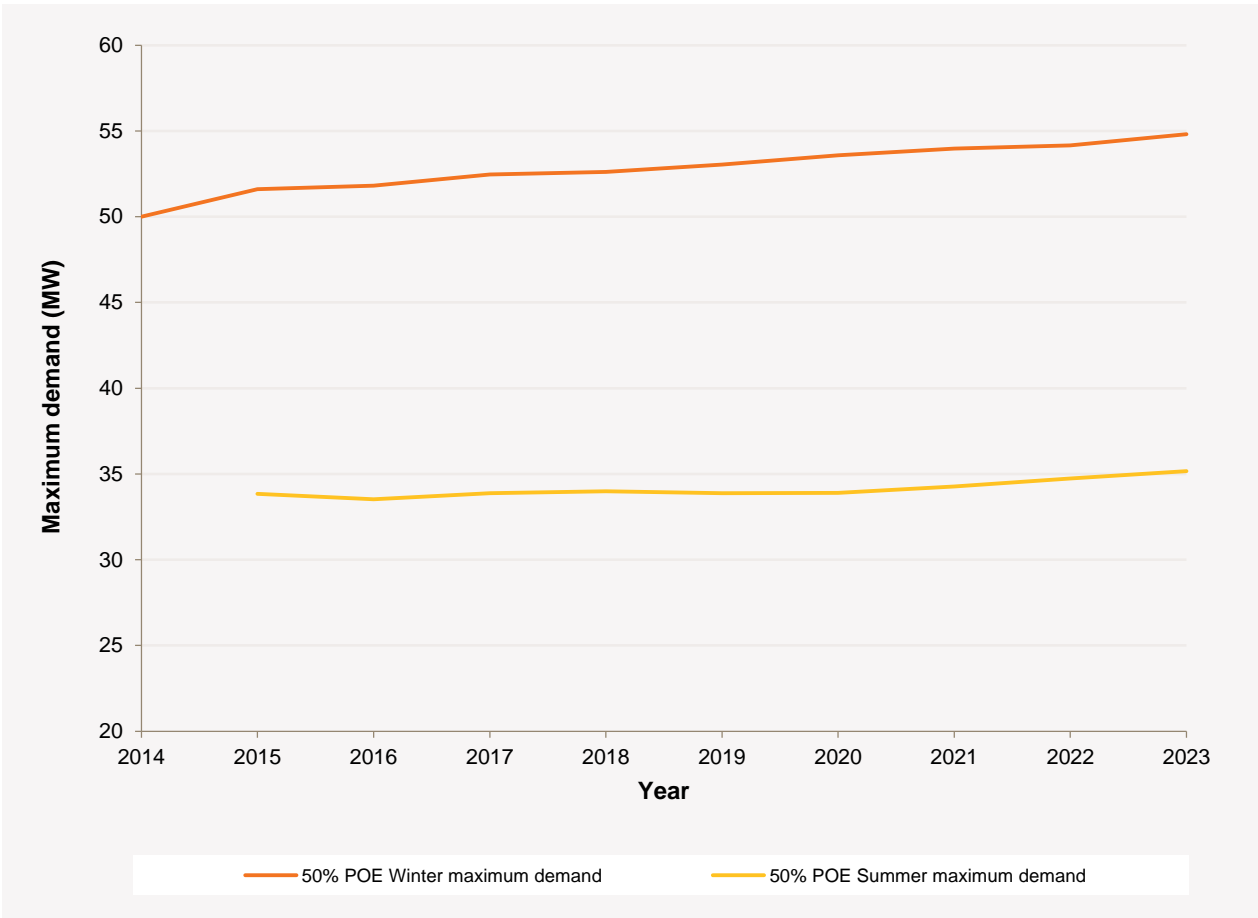


Figure 9: Lindisfarne Substation 10 year connection point forecast



AEMO’s assessment of the requirement for this project

- Lindisfarne Substation is critical to ensuring a secure and reliable electricity supply to customers in the Eastern Shore area of Hobart.
- Lindisfarne Substation has two 110/33 kV 45 MVA transformers.
- Since establishing Mornington Substation in 2011, load transfers from Lindisfarne Substation to Mornington Substation have reduced loading on the 110/33 kV Lindisfarne transformers.
- TasNetworks reported that:
 - The Lindisfarne transformers were installed in 1964 and have undergone regular condition-based testing and maintenance.
 - The useful service life of the transformers was extended by refurbishment work in 2002.²
 - The condition of the transformers has since deteriorated. They have now been identified as having reached the end of their service life.³
- No information on non-network options such as demand side management initiatives is available.
- AEMO did not identify any other transmission alternatives (e.g., reconfiguration of existing assets) for feeding this local load. As such, the existing configuration and voltage level is justified.
- AEMO considers that replacing the existing transformers will improve the security and reliability of electricity supply if these assets are currently in poor condition and have increased likelihood of failure.

Possible replacement options

- Refurbishment of the existing transformers. However, TasNetworks reported that these transformers were already refurbished in 2002.
- Condition-based replacement with new transformers.

Assessment summary

Assessment criteria	AEMO’s assessment
Whether the system configuration could be improved for effective and efficient use of existing assets	The existing configuration is justified.
Demand growth	Steady growth of load.
Transmission need	N-1 transformer capacity is required.
Need for a RIT-T capacity increase associated with the asset being replaced	Not identified. TasNetworks proposed to replace with modern equivalent transformers.
Review of voltage level and capacity of replacement transformer	Replacement with two 110/33 kV transformers is justified.
TNSP assessment of non- network alternatives for transformer capacity	None identified
TNSP assessment of economics of transformer replacement vs transformer refurbishment or rebuild	Refurbished in 2002.

² TasNetworks 2014 Annual Planning Report. <http://www.tasnetworks.com.au/Aurora/media/pdf/TasNetworks-Annual-Planning-Report-2014.pdf>. Viewed 11 July 2014.

³ See previous footnote.

3.2 Spare assets

Table 19: Strategic spare mobile 110/33/22/11 kV Substation

Project	Strategic spate mobile 110/33/22/11 kV 10/15/25 MVA Substation
Year	2017
Alternatives	Having enough strategic spares, especially spare transformers.

Background

TasNetworks has number of 110/33 kV, 110/22 kV, 110/22/11 kV, and 110/11 kV transformers in its network. A sustained loss of supply may result may occur in the event of major transformer failure. TasNetworks proposes to purchase a portable modular 110/33/22/11 kV 10/15/25 MVA Substation which can be used around the state as required.

TasNetworks identified the following uses for the portable Substation:

- Restore supply following a major failure of a transformer or Substation.
- Quick supply provision for a short lead time customer connection.
- Maintain supply to customers when major maintenance is being carried out on a transformer.
- Mitigate the risk associated with failures if Substation assets replacement are deferred.

AEMO’s assessment of requirement for this project

The absence of strategic spares for the main asset categories areas, especially power transformers, may compromise TasNetworks’ ability to operate a reliable transmission network.

Availability of spare transformers is important because the long procurement lead times for Substation transformers, reliability impact, and cost implications of transformer outages. This is especially the case for TasNetworks, given Tasmania’s location and manufacturer lead times of about two years.

TasNetworks have proposed to purchase a portable Substation with multiple ratio spare transformers. As this could be configured in different ways, this would be used as strategic cover for a number of substations.

AEMO supports TasNetworks’ procurement of a portable 110/33/22/11 kV 10/15/25 MVA Substation.

Assessment summary

Assessment criteria	Assessment outcome
Whether the system configuration could be improved for effective and efficient use of existing assets	Not applicable.
Assessment of ongoing need for a spare asset	Need exists for a strategic spare asset.

3.3 Substations

Table 20: George Town 110 kV Substation redevelopment

Project	George Town 110 kV Substation redevelopment
Year	2014
Alternatives	None identified

Background

George Town Substation comprises both 220 kV and 110 kV switchyards and plays a critical role in the Tasmanian transmission network.

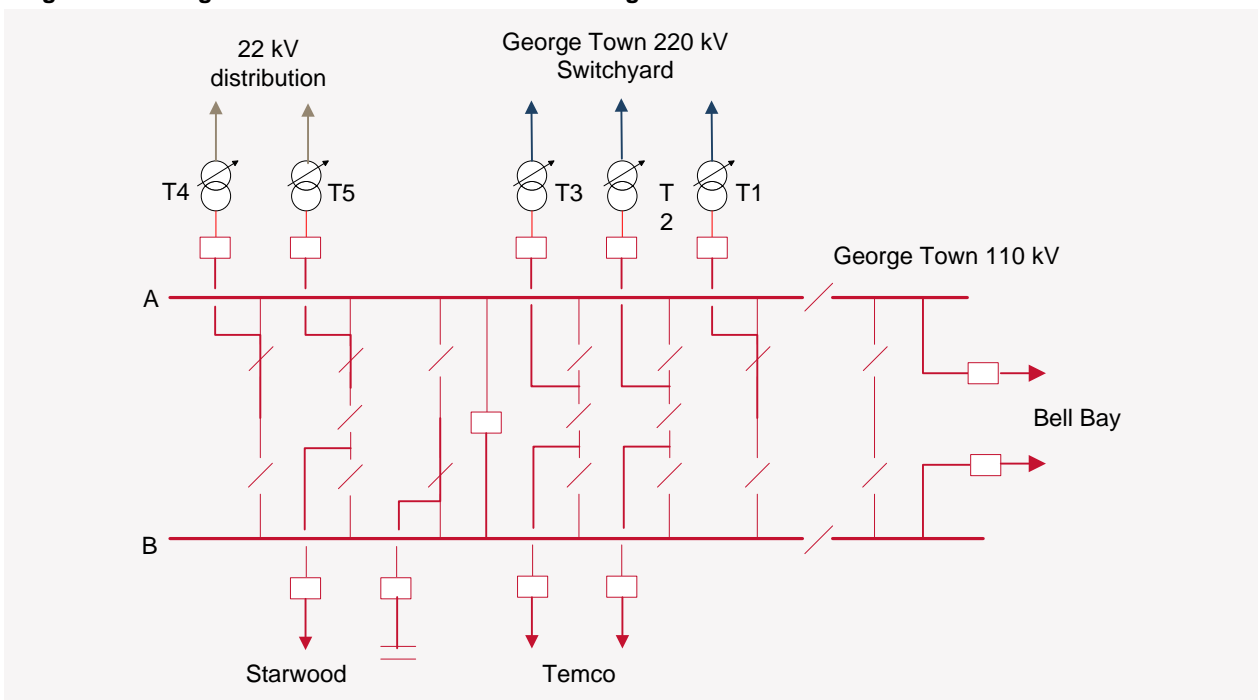
The 220 kV Substation is supplied via two double-circuit 220 kV transmission lines from Hadspen and Sheffield substations. It connects to the Victorian transmission network via Basslink. The 220 kV Substation provides connections to Tamar Valley Power Station as well as supplying a major industrial customer.

The 110 kV substation provides an interconnection to the George Town 220 kV Substation via three 150/200 MVA auto transformers, 110 kV connections to Starwood and Temco substations and to gas turbines at Bell Bay and Tamar Valley, and 22 kV connection via two 110/22 kV transformers.

In the current regulatory period, TasNetworks committed to a project to redevelop the George Town 110 kV Substation by replacing the 110 kV circuit breakers, current transformers, disconnectors, and protection and control equipment.

Connection configuration

Figure 10: George Town Substation connection configuration



Projected demand

Load in the George Town area is mostly large industrial customers: Comalco Substation (Bell Bay Aluminum), Temco Substation (TEMCO), and Starwood Substation (Timberlink Limited). Two 110/22 kV transformers supply distribution load.

AEMO's connection point forecasts including industrial load show more than 100 MW load at George Town 110 kV Substation for the next 10 years.

AEMO's assessment of requirement for this project

- TasNetworks redevelopment involves replacing 110 kV circuit breakers, current transformers, disconnectors, and protection and control equipment at George Town 110 kV Substation.
- Detailed information on asset condition is not available.



- If the assets are of poor condition and susceptible to failure, then the proposed replacement will improve reliability, security and performance of supply.

Possible replacement options

- Refurbish or rebuild assets to extend their useful lives.

Assessment summary

Assessment Criteria	Assessment outcome
Whether the system configuration could be improved for effective and efficient use of existing assets	None identified.
Review of transformation capacity of the Substation	Existing Substation capacity is adequate based on forecast data.
TNSP assessment of economics of asset replacement vs asset refurbishment or rebuild	Not available .