Eastern planning area strategy

Area strategies for Tasmania's electricity network

Version number 2.0

October 2017

Authorisations

Action	Name and title	Date	Signature
Prepared by	Network Planning		
Reviewed by	Network Planning	Aug 2015	
Authorised by	Network Planning Team Leader	Oct 2015	
Review cycle	2 Years		

Document control

Date	Version	Description	Author	Approved by
October 2015	1.0	Approved	Network Planning	Network Planning Team Leader
October 2017	2.0	Update and structure modification for R19 submission	Network Planning	Network Planning Team Leader

Responsibilities

This document is the responsibility of the Network Planning Team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299.

Please contact Network Planning with any queries or suggestions.

Minimum Requirements

The requirements set out in TasNetworks' documents are minimum requirements that must be complied with by TasNetworks staff, contractors, and other consultants.

The end user is expected to implement any practices which may not be stated but which can be reasonably regarded as good practices relevant to the objective of this document.

Disclaimer

Record of revisions

Section number	Details
Version 2.0	
Whole document	Update and structure modification for R19 submission

Executive summary

The Eastern planning area covers the east coast of Tasmania, from the Tasman Peninsula to St Helens and extending inland to Campbell Town, Oatlands and Richmond. The area is supplied through the peripheral 110 kV network, supplied from bulk supply points at Lindisfarne and Palmerston substations.

The area is characterised by coastal and rural population centres supplied via long distribution feeders. Issues presented are predominately those where it is difficult to maintain adequate supply and reliability to townships and the end of these long distribution feeders.

Tasmanian Irrigation's embedded Midlands Water Scheme power station is the sole existing large generator in the Eastern planning area. However, there is a current connection enquiry for a [redacted] and a smaller embedded generator [redacted] is progressing. Tasmanian Irrigation is considered the sole material customer in the area. Currently there are no forecast large load connections for the area.

The long term network development plan for the Eastern planning area is small in terms of network augmentation requirements to 2050. The most significant project identified is the establishment of a new connection point at Swansea. This may be required to meet the forecast demand growth in the Swansea, Bicheno and Coles Bay supply areas in the long term. This will require a new transmission line, likely supplied from Avoca Substation.

Within the 15-year planning period, the network development plan at the transmission and major distribution supply level is small and mostly focussed on asset replacements. The proposed development plan for the planning period is listed in Table 1 and detailed within this strategy. Additional limitations identified are community reliability performance to St Helens and the Tasman Peninsula supply reliability communities.

Table 1: Network development plan for the Eastern planning area

Location	Proposed development	Investment need	Estimated cost ($m)	Forecast completion
Triabunna Spur transmission line	Replace Kay pole transmission line support structures	Asset condition	3.7	June 2019
Richmond Rural Zone Substation	Refurbish substation (replace supply transformers)	Asset condition	2.8	June 2019
Colebrook termination of feeders 40002 and 41516	Establish a 22/11 kV transformer to allow interconnection between feeders	Transformer firm capacity (at Richmond Rural Zone Substation)	0.3	June 2019
St Marys Substation	Replace supply transformers	Asset condition	4.0	June 2023
Avoca Substation feeder 56001	Extend feeder to Swansea, Bicheno and Coles Bay supply area	Supply capacity to area exhausted	2.7	June 2024

Table of contents

1 General

1.1 Introduction

TasNetworks prepares a suite of eight area strategies for Tasmania. These area strategies drive the development strategies for each of the seven planning areas, based on a geographic breakup of the network. The development strategies ensure that the network remains adequate under forecast demand, generation and performance scenarios.

1.2 Purpose

The purpose of this document is to identify the development strategy to maintain an adequate electricity network in the Eastern planning area.

1.3 Scope

The area strategy addresses the transmission and distribution electricity networks within the Eastern planning area.

1.4 Objectives

The objectives of this area strategy are to:

- provide an overview of the Eastern planning area, and the electricity network within it
- present the long term transmission and sub-transmission network vision based on generation and maximum demand scenarios to 2050
- present the long term distribution network vision based on improved operability and development opportunities
- identify existing and forecast limitations based on the maximum demand forecast, security and reliability requirements and other factors
- present proposed developments to address the forecast limitations and other planning considerations such as asset retirements, operational constraints, and other factors
- identify opportunities for new network load connections at a transmission-distribution connection point level

1.5 Strategic context

The TasNetworks vision is to be trusted by our customers to deliver today and create a better tomorrow. The area strategies support this vision by ensuring the network continues to be adequate to cater for the demands on it (generation, load, reliability, performance and so on). The strategies also support the changing operation of the network to integrate more distributed energy resources and identifying opportunities to increase utilisation of the network, ensuring the lowest sustainable prices.

Strategic documents which the area strategies support include:

- TasNetworks Corporate Plan
- TasNetworks Business Plan
- TasNetworks Transformation Roadmap 2025
- Strategic Asset Management Plan
- Network Development Management Plan

2 Area overview

The Eastern planning area covers the east coast of Tasmania, from the Tasman Peninsula to St Helens and extending inland to Campbell Town, Oatlands and Richmond. The area is supplied through the peripheral 110 kV network, supplied from bulk supply points at Lindisfarne and Palmerston substations. The Eastern planning area is shown in Figure 1.

Figure 1: Geographic diagram of the Eastern planning area

2.1 The network

The Eastern planning area is supplied via two radial 110 kV transmission network supplies. There are four transmission-distribution connection points (substations) providing supply to the distribution network. The Palmerston–Avoca–St Marys 110 kV transmission network supplies Avoca and St Marys substations and the Lindisfarne–Sorell–Triabunna 110 kV transmission network supplies Sorell and Triabunna substations. The distribution network in the Eastern planning area is predominantly a rural overhead 22 kV network. There is an urban area supply around Sorell supplied from Sorell Substation, and an 11 kV network supplied from the 22/11 kV Richmond Rural Zone Substation.

A single line diagram of the transmission network is presented in Figure 2. The distribution network supply areas for each substation are shown in Figure 3. Detail on the existing assets and transfer capability at the substations is presented in Appendix A.

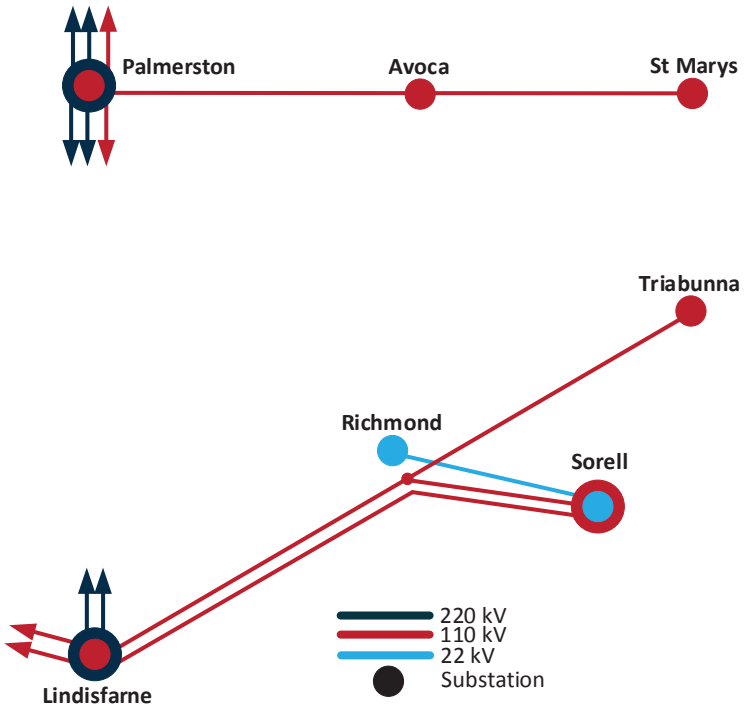
2.1.1 Transmission network

The Eastern planning area transmission network is considered in two localities for the purposes of area planning. As presented in Figure 2, they are the:

- **Avoca–St Marys network:** supplied via the single circuit Palmerston–Avoca and Avoca–St Marys 110 kV transmission lines
- **Sorell–Triabunna network:** supplied via the double-circuit Lindisfarne–Sorell and single-circuit Triabunna Spur 110 kV transmission lines, supplied from one of the Lindisfarne–Sorell circuits

There have been no significant developments in the Eastern planning area transmission network since publication of the previous Eastern planning area strategy in October 2015. There are also no significant committed developments.

Figure 2: Eastern planning area distribution network diagram



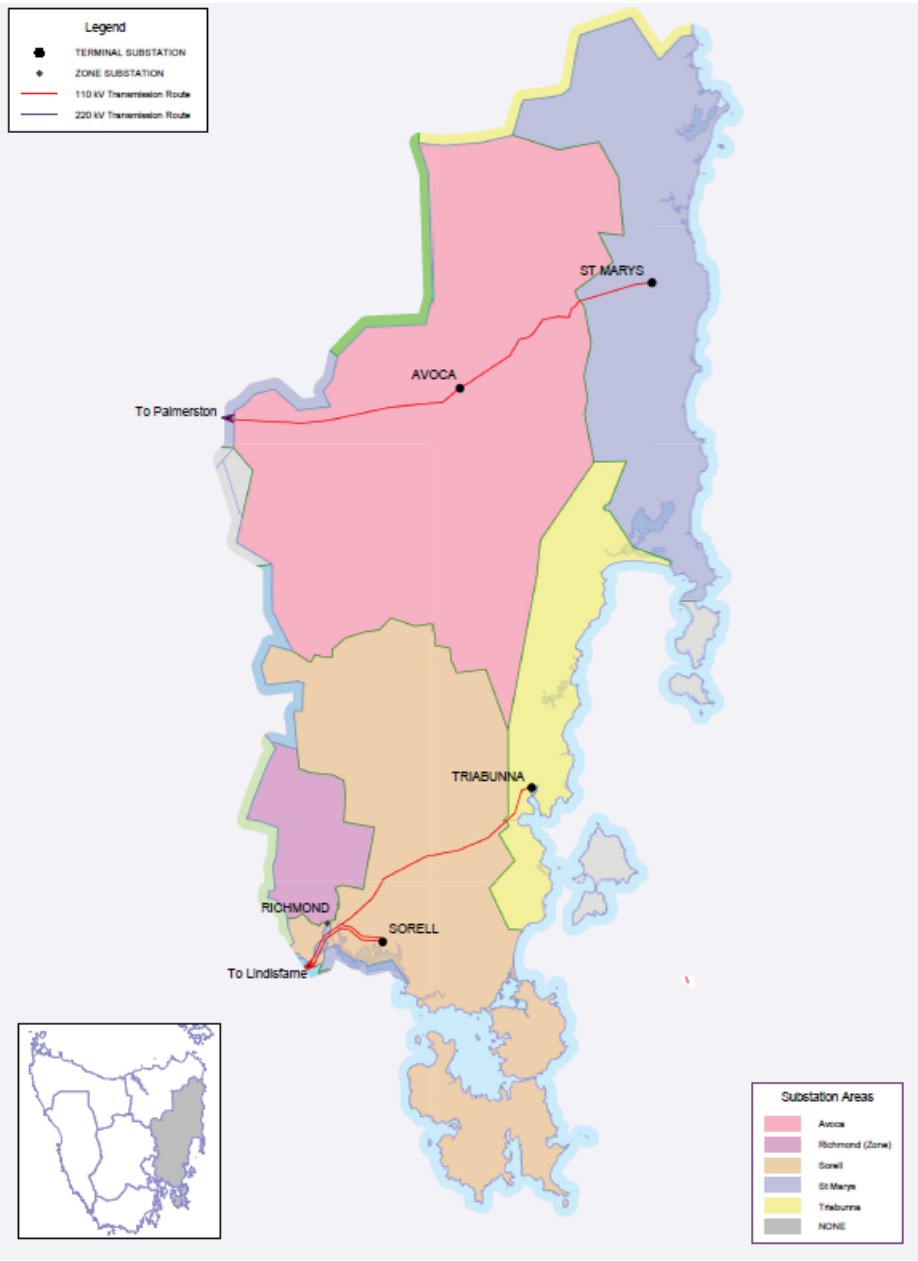
2.1.2 Distribution network

The distribution network in the Eastern planning area is supplied from four transmission-distribution connection points: Avoca, St Marys, Sorell and Triabunna substations. The distribution network supplied from these substations operates at 22 kV, however the Richmond Rural Zone Substation, supplied from a 22 kV feeder from Sorell Substation, provides an 11 kV supply. The distribution network supply areas for each substation are presented in Figure 3.

Areas within the Eastern planning area distribution network of particular focus are characterised by coastal or rural population centres supplied via long distribution feeders, including those at the open points between substations. These localities are:

- **St Helens:** supplied via a single feeder from St Marys Substation. Backup supply is available, but area has a high reliability standard and is a main load point contributing approximately 60 per cent to maximum demand at St Marys Substation.
- **Swansea, Bicheno and Coles Bay:** supplied at the end of two long feeders, one each from St Marys and Triabunna substations. Limited interconnectivity between the two feeders.
- **Oatlands:** supplied at the end of a long feeder from Sorell Substation. Backup supply available via long feeders from Avoca and Meadowbank substations.
- **Tasman Peninsular:** supplied via two long feeders from Sorell Substation with limited geographical diversity and backup capability, this area has had an extended period of poor reliability performance.

Figure 3: Distribution network substation supply areas



Significant developments within the Eastern planning area distribution network since publication of the last Eastern area strategy in October 2015 include:

- establishment of a new distribution feeder from Palmerston Substation: supplying towards Campbell Town it will reduce load on Avoca Substation, improving transfer capability between the substations and local supply reliability.
- replacement of GI conductor on Tunbridge Tier: capacity limitation, from growth in irrigation demand, removed by replacing low capacity GI conductor.
- replacement of limiting copper conductor south of Ross and new voltage regulator installed in Campbell Town: removing output constraint on Tasmanian Irrigation embedded generator due to section of feeder 56004 feeder from Avoca Substation.
- St Helens loop automation scheme established: the scheme aims to improve reliability by automatically restoring supply from backup feeders for supply interruptions to the community.
- replacement and second voltage regulators installed on Triabunna Substation feeder 43507: due to asset condition issues and supply capability to Swansea, Bicheno and Coles Bay area, the single voltage regulator at Lisdillon was replaced with two new regulators, strategically placed to also enable connection of the Swan irrigation scheme.
- increased transfer capability to Richmond Rural Zone Substation: network augmentation to increase transfer capability from Richmond Rural Zone Substation to Bridgewater and Cambridge Zone substations to manage capacity issues until Richmond Rural Zone Substation is refurbished and capacity increased.

The following material projects are committed or underway in the distribution network in the Eastern planning area:

- upgrade of the Mathina SWER line to a 3 phase system to mitigate earthing issues at a local aquaculture processing site.
- upgrade of the Colebrook 11 kV regulator for load on Richmond 40002.
- reliability and quality of supply maintenance activities along the supply feeders from Sorell Substation to Tasman Peninsula.

2.2 Customers

This section details the material existing and proposed generation and load customers in the Eastern planning area.

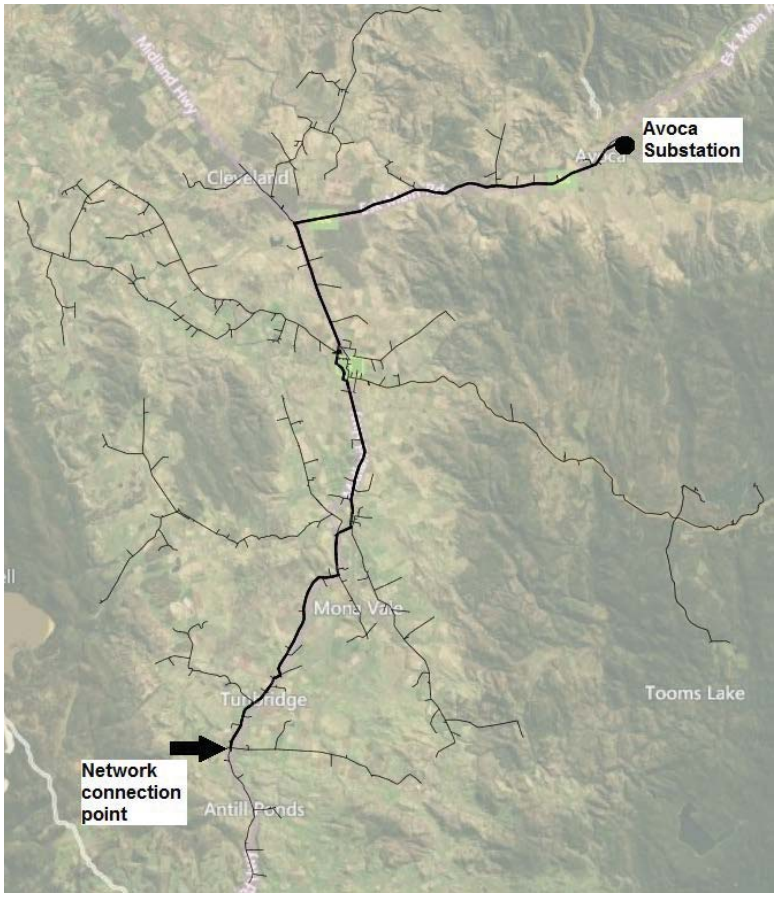
2.2.1 Generation

There is one material existing embedded generator connected and one proposed in the Eastern planning area. There is no existing transmission-connected generation; however there is a proposal for a [redacted]

2.2.1.1 Midlands Water Scheme power station

Tasmanian Irrigation operates its Midlands Water Scheme power station mini-hydro, at Floods Creek (near Tunbridge). It has a capacity of 6.0 MW, with a maximum export to the network of 4.9 MW. The Midlands Power Station connects to Avoca Substation feeder 56004, with the connection point approximately 71 km line length from the substation. Figure 4 shows the power station network connection point to feeder 56004 in relation to Avoca Substation. The load on the feeder is low enough that there is power flow back into Avoca Substation when the Midlands Power Station is operating.

Figure 4: Midlands Water Scheme power station connection point to Avoca Substation feeder 56004



2.2.1.2 [redacted]

[redacted]

[redacted]

2.2.1.3 [redacted]

[redacted]

[redacted]

2.2.2 Load

Tasmanian Irrigation is considered the one material customer within the Eastern planning area. There has been preliminary discussion only on a coal mine development near Fingal. There are no transmission-connected customers in the area.

2.2.2.1 Tasmanian Irrigation

Tasmanian Irrigation has a number of pumping sites across its various schemes in the Eastern planning area. These are:

- [redacted] connecting at Woodbury (Midlands scheme) and [redacted] at Conara (Lower South Esk scheme) on Avoca Substation feeder 56004
- [redacted] at Cranbrook (Swan Valley scheme) on Triabunna Substation feeder 43507
- [redacted] at Tea Tree (South East Stage 3 scheme) on Richmond Rural Zone Substation feeder 40003

These pumping loads have generally connected at weak points of the network. Although only operating during times of high water flow, restrictions have been applied to their operation to maintain network performance.

The [redacted] pumping station load at Woodbury is associated with the Midlands Power Station, described in Section 2.2.1.1. Only under rare circumstances do the pumps operate without the generator. In the case that the pumps operate without the Midlands Power Station, their load is restricted to [redacted] to maintain network performance. Note that the [redacted] is the installed capacity, with the site maximum demand limited to [redacted] due to water flow limits.

Load at the [redacted] pumping station at Cranbrook is constrained down at peak network loading times to maintain network performance. The restrictions are enforced during peak holiday weekends and contingent events of St Marys Substation feeder 57004 when feeder 43507 is required as backup. These restrictions will occur more often as the area load grows.

2.2.2.2 [redacted]

[redacted]

2.3 Reliability

Like most of Tasmania, the Eastern planning area consists mainly of Low Density Rural supply reliability communities, with pockets of High Density Rural supply reliability communities around local townships. There are four Urban supply reliability communities at St Helens, Sorell, Midway Point and Lewisham. There are 26 supply reliability communities in the area.

The area has five loop automation schemes operating to minimise outage durations to some communities. A loop automation scheme is a control scheme to automatically reconfigure the HV network to resupply unaffected areas during fault events.

3 Long term network development

The long term network development presents the load and generation scenarios to 2050 and the likely state of the network required to support them. This long term network development has not been justified economically or deeply considered against alternative options, but provides a reasonable assessment of the solutions forecast in the long term if met by network development.

The long term network development plan informs the path that developments in the transmission and sub-transmission network 15-year planning horizon should follow to ensure that network development remains efficient in the long term.

A distribution network supply vision is also presented. This vision is largely driven by existing network and operational limitations and development opportunities. There are no specified triggers for this vision and it has not been justified.

3.1 Scenarios

We consider planning scenarios for load and generation as a basis for the long term network vision.

3.1.1 Load

The scenario considered in the load change to 2050 is the extrapolated AEMO connection point forecast. Specifically, this forecast is the 2017 AEMO Transmission Connection Point Forecasts for Tasmania[1] (connection point forecast). This connection point forecast is provided to 2026 and has been extrapolated to 2050.

The forecast for each connection point in general is flat or declining to 2021 before recovering. In extrapolating the forecast, 2021 was used as the base year with the growth factor between 2021 and 2026 used to extrapolate the forecast to 2050. The assumption being that this recovering demand growth will continue. This assumption aligns with AEMO's 2016 National Electricity Forecasting Report (NEFR), which provides a regional (state) forecast for Tasmania, which forecasts a decline in early 2020s before recovering and continuing to grow to 2037, the end of the forecast.

AEMO's 2016 National Electricity Forecasting Report[2], including a regional (state) forecast for Tasmania, contains Neutral, Strong, and Weak economic scenarios. The connection point forecast is only provided under the Neutral scenario. Hence, the load scenario presented here is only provided under this single Neutral scenario.

Table 2: 2050 maximum demand forecast

System	2016 maximum demand (MW)		Maximum demand forecast for 2050 (MW)
	Actual	Weather corrected	
Avoca–St Marys locality	19.1	17.2	21.8
Sorell–Triabunna locality	36.6	35.0	46.0
Avoca Substation[3]	7.7	7.8	12.5
St Marys Substation	14.3	12.3	14.2

[1] http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting/Tasmania

[2] http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Electricity-Forecasting-Report

[3] Summer peaking substation

System	2016 maximum demand (MW)		Maximum demand forecast for 2050 (MW)
	Actual	Weather corrected	
Sorell Substation	31.4	30.7	35.2
Triabunna Substation	6.9	5.6	14.8
Richmond Rural Zone Substation	3.1	3.1	5.8

3.1.2 Generation

The long term network development plan is also driven by generation scenarios within the area.

The only identified grid-scale potential generation development in the Eastern area is the [redacted] identified in Section 2.2.1.3. If it proceeds, this development [redacted]

There remains possibility of other grid-scale generation within the Eastern area. Previously publically announced in 2008 was a 'hot rocks' geothermal power station in the Fingal Valley, however initial assessment identified this development was unlikely to be feasible.[4]

Continuation to a low emissions future in the NEM means future renewable energy development in Tasmania is highly likely. In the Eastern planning area, this would most likely be wind farms. As there are currently no specific identified opportunities or any level of certainty, this scenario is not included in the long term network development plan identified here.

There will be a continued increase in embedded generation within the distribution network, including small-scale photovoltaic and batteries, with the effects of this reflected in the demand forecast. We expect that increasing photovoltaic and batteries will increase bi-directional power flows within the distribution network, but this will not be sufficient to material affect flows with the transmission and sub-transmission networks part of this long term network development plan.

3.2 Long term network development plan

A number of network augmentations are expected to be required to meet the load and generation scenario requirements to 2050, presented in Section 3.1. This section presents the long term network development plan forecast requirement under these scenarios.

As discussed the long term network development plan has not been justified economically or deeply considered against alternative options, but provides a reasonable assessment of the solutions forecast in the long term if met by network development.

The long term network development plan of the transmission and sub-transmission network is displayed in Figure 7 and summarised below.

[4] http://www.abc.net.au/news/2008-10-15/doubts-over-fingal-gas-drilling/542362

3.2.1 Avoca Substation second supply transformer

Avoca Substation currently has a single supply transformer. Its capacity is 17 MVA, however can be increased to 25 MVA with the addition of forced cooling. The maximum demand forecast for Avoca Substation for 2050 is 12.5 MVA. This remains within the capacity of the existing transformer, however it is expected that for a transformer contingency there will be insufficient backup capability in the distribution network to maintain unserved energy below 300 MWh, as required by the network planning requirements[5]. The anticipated network solution is to install a new, second supply transformer at Avoca Substation to provide firm capacity to the connected load. A second supply transformer at Avoca Substation will require the establishment of a 110 kV busbar.

3.2.2 St Marys Substation replacement supply transformers

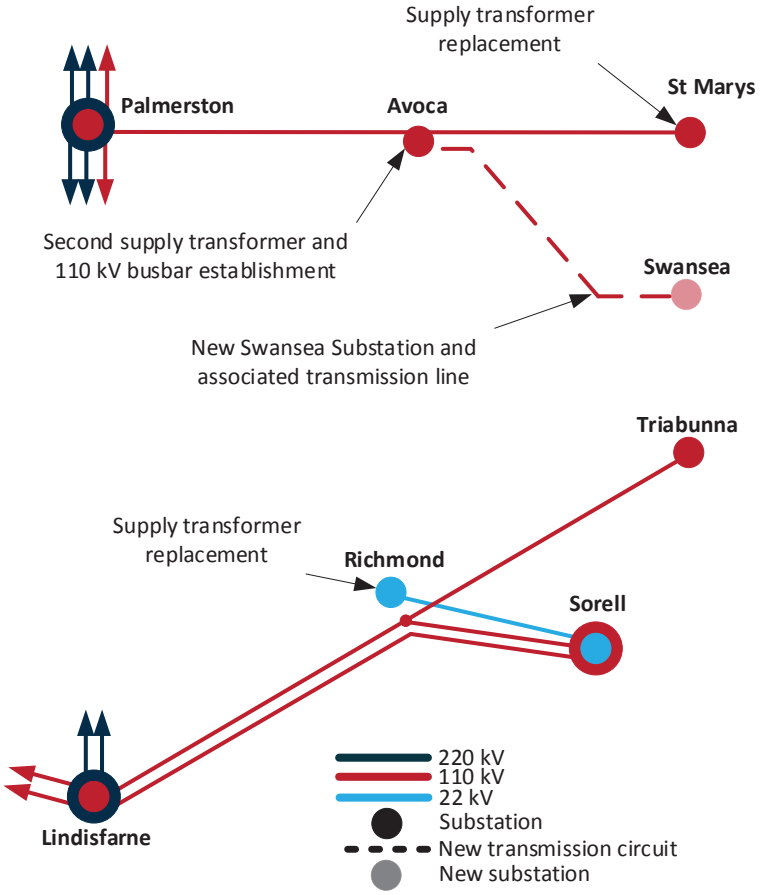
The supply transformers at St Marys Substation are approaching their end of life and will require to be retired within the long term. A project is proposed to replace these transformers within the forthcoming 2019–24 regulatory period.[6] Replacing these transformers with standard units will provide sufficient firm capacity to meet the expected demand in the long term to 2050.

3.2.3 New substation at Swansea and associated transmission line

The Bicheno, Swansea and Coles Bay supply area is currently supplied via two long distribution feeders, one each from Triabunna (to Bicheno and Swansea) and St Marys (to Coles Bay) substations. The maximum demand at Triabunna Substation has large growth forecast to 2050, with the majority of this expected in the Bicheno, Swansea (and Coles Bay) supply area. A project to provide an additional distribution feeder to this area is proposed for the forthcoming 2019–24 regulatory control period[7], however it is expected to be insufficient in the long term. The anticipated network solution in the long term is to establish a new connection point (substation) at Swansea, supplied via a new 110 kV transmission line from Avoca Substation.

[5] *Electricity Supply Industry (Network Planning Requirements) Regulations 2007*
https://www.legislation.tas.gov.au/view/whole/html/inforce/2013-11-13/sr-2007-114
[6] Reference Section 4.1.1
[7] Reference Section 4.1.4

Figure 7: Long term network development plan



3.2.4 Richmond Rural Zone Substation replacement supply transformers

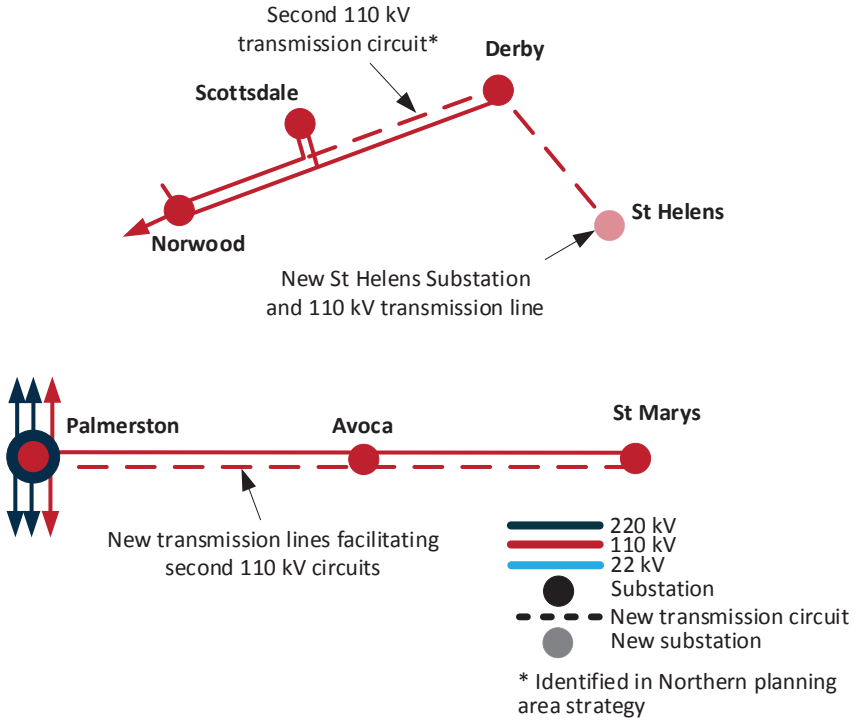
The existing supply transformers at Richmond Rural Zone Substation are in poor condition and require to be retired in the short term. A project to replace these transformers with new units is proposed in the current 2017–19 regulatory control period.[8] The transformers are proposed to be replaced with new, standard 5 MVA units. This is sufficient to provide firm supply in the short term, however in the long term the forecast maximum demand will exceed this firm rating. This is expected to be relieved as part of the distribution strategy for the area, with some of the load transferred to neighbouring substations, discussed in Section 3.3.1.1.

3.2.5 Previously identified long term network development plans

The long term network development plan presented in Figure 7 and this Section 3.2 to Section 3.2.4 is the development plan from the scenarios presented in Section 3.1. There have been a handful of other future projects identified previously under long term scenarios considered at the time. These scenarios were based on higher maximum demand forecast growth, and required additional network augmentation. The network augmentation required under the previous scenarios are shown in Figure 8 and identified in this section.

[8] Reference Section 4.1.3

Figure 8: Previously identified long term development projects



3.2.5.1 New Palmerston–Avoca and Avoca–St Marys 110 kV transmission lines

Avoca and St Marys substations are currently supplied via single circuit 110 kV transmission lines. Under previous higher maximum demand growth scenarios, it was expected that for a contingency of either circuit there will be insufficient backup capability in the distribution network to maintain unserved energy below 300 MWh, as required by the network planning requirements[9].

The anticipated network solution was to establish second transmission circuits to both Avoca and St Marys substations. This would be provided through the construction of new, second Palmerston–Avoca and Avoca–St Marys transmission lines. These lines would be double circuit capable lines, to enable the decommissioning of the existing lines when required by future loading requirements or asset condition.

3.2.5.2 New St Helens Substation and associated transmission line

The St Helens supply area is currently supplied via two distribution feeders from St Marys Substation. At the time of maximum demand, 60 per cent of the load in on these two feeders to St Helens. Under previous higher maximum demand growth scenarios, it was forecast that the St Helens supply area could no longer be supplied through the distribution network only.

The anticipated network solution is to establish a new connection point (substation) at St Helens, supplied via a new 110 kV transmission line from Derby Substation.

[9] *Electricity Supply Industry (Network Planning Requirements) Regulations 2007*
https://www.legislation.tas.gov.au/view/whole/html/inforce/2013-11-13/sr-2007-114

3.3 Distribution network supply vision

A distribution network supply vision is presented for those supply areas within the distribution network where relevant. The vision is largely driven by existing network and operational limitations and development opportunities, and provided where these will likely drive material changes to the distribution network. There are no specified triggers for the vision and the vision has not been justified. In the Eastern planning area, one distribution network supply vision has been identified.

3.3.1.1 Richmond, Colebrook and Oatlands supply areas

This section presents the vision to improve the distribution network to Richmond, Colebrook and Oatlands supply areas. The existing supply arrangement to these areas is shown in Figure 9. Richmond Rural Zone Substation supplied at 11 kV to Richmond township and north to Colebrook. Sorell Substation feeder 41512 supplies west across the Coal River to Grass Tree Hill, with a mix in the area between this 22 kV feeder and 11 kV feeders from Richmond Rural and Cambridge zone substations. Feeder 41516 from Sorell Substation supplies a vast area to Richmond and Campania surrounds, along Tasman Highway towards Orford, and north as the primary supply to Oatlands.

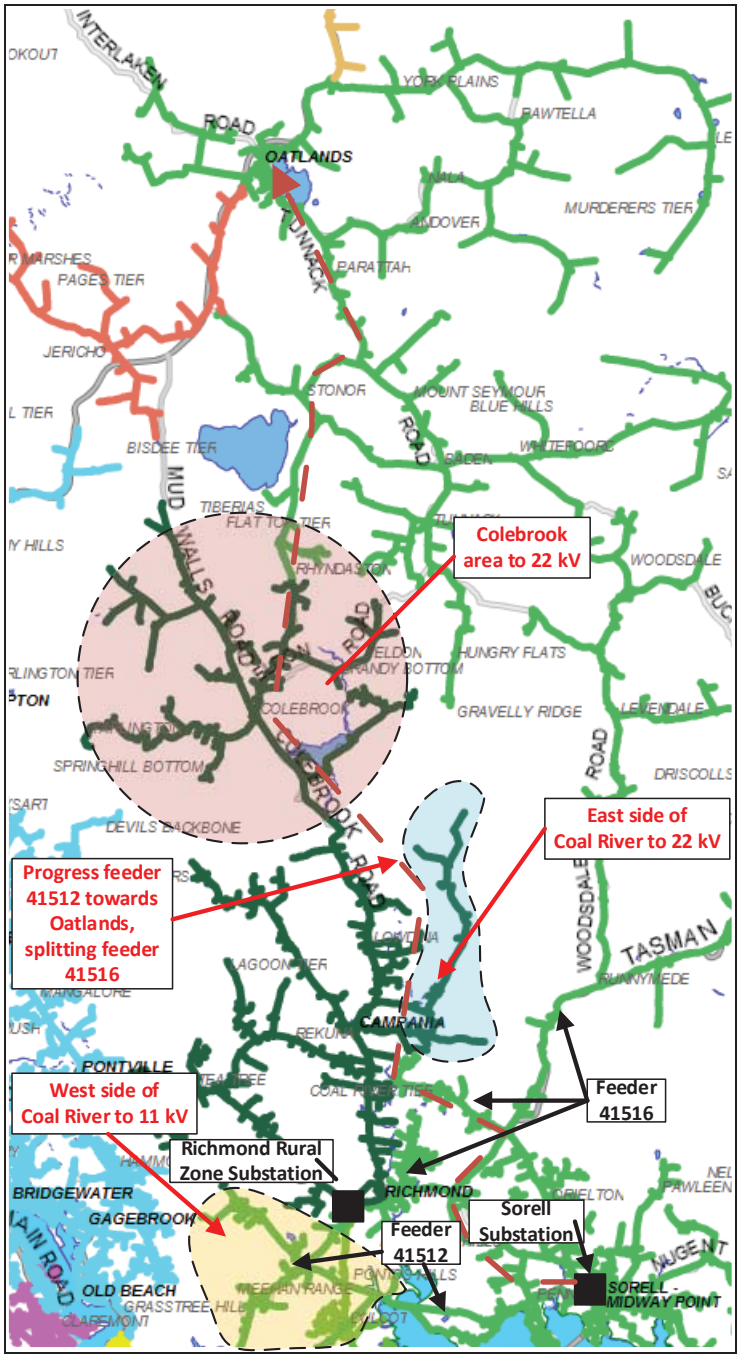
The vision for the Richmond, Colebrook and Oatlands supply areas is to rationalise the mix of voltages around Grass Tree Hill, improve supply performance in the Colebrook area, and provide improve reliability and supply performance and allow for load growth in Oatlands. The developments to support this vision are overlayed in Figure 9 and described below.

Voltage rationalisation around Grass Tree Hill will be achieved by converting the section of feeder 41512 west of Coal River, the majority of feeder, to 11 kV and supplying this from Richmond Rural, Geilston Bay and Cambridge zone substations. This will improve operational flexibility in the area, allowing load transfers between substations and providing backup to customers supplied from the existing isolated 22 kV network in the area. The Coal River would provide a natural barrier between the Hobart 11 kV network and the 22 kV network from Sorell.

To manage the power quality and security issues in the Colebrook area it is proposed to convert the 11 kV network in this area to 22 kV. Sorell Substation feeder 41512, now freed up from supplying Grass Tree Hill, would be extended north to Colebrook. From there it will extend to Oatlands, splitting the existing feeder 41516 supply. This will allow feeder 41512 to focus on supply to the rural load centres Colebrook and Oatlands, with feeder 41516 supplying the wider rural area. This will improve supply performance to Colebrook and Oatlands.

As an interim measure, prior to extending feeder 41512, Colebrook can be transferred to feeder 41516 by providing an 11/22 kV interconnection between Sorell 41516 and Richmond 40002 at Rhyndaston. This would provide an alternative supply to the Colebrook area and allow some load management to improve supply performance in the area.

Figure 9: Richmond Rural Zone Substation strategy



4 Planned investments and forecast limitations

This section presents the planned investments and forecast limitations in the Eastern planning area for the 15-year planning horizon to 2032. The planned investments present the investment need, timing, deferral opportunity and proposed solution with expected cost and other options considered. Forecast limitations present the location and timing of limitations, requirements to defer the limitation, and potential options to alleviate them.

4.1 Planned investments

This section presents the planned investments within the network during the next 15 years. These projects have been identified as the preferred solutions through technical and economic analysis.

4.1.1 St Marys Substation supply transformer replacement

Limitation overview

St Marys Substation comprises two supply transformers, manufactured in 1966. Condition assessment indicates their condition is deteriorating and they are approaching the end of their service life. The transformers are unlikely to be fit for service for more than 10 years.

The supply transformers are 110/22 kV 10 MVA units, with a short-term rating of 12 MVA. The substation maximum demand in 2016 was 14.4 MVA, currently exceeding the short-term firm rating of the substation.

To prevent overloading the remaining in-service transformer in the event of a fault on the alternate unit, a load-shedding scheme is in use.[10] Following the loss of one transformer, the scheme will open distribution line circuit breakers until the load is within the rating of the remaining in-service transformer. This results in interruption to customer supply until supply can be restored either by transferring the interrupted distribution lines to adjacent substations or waiting until demand reduces and the interrupted line can be brought back into service. The amount of unserved energy from this action is less than 300 MWh, the maximum allowed under our jurisdictional network performance requirements.

A mobile diesel generator connection site was established in 2016 at Bicheno. This site enables a diesel generator to be deployed in response to a prolonged outage to prevent repeated load shedding, or deployed as part of contingency planning during forecast high load periods.

Limitation deferral

Table 3 presents the requirements to defer the identified capacity limitation at St Marys Substation. The table presents the reduction in the forecasted load, or amount of generation support, required to defer the capacity limitation by either one (to 2018) or five (to 2022) years. The reduction would maintain the load below 12 MVA, the short-term firm capacity.

Table 3: St Marys Substation capacity limitation deferral

Deferral period	Maximum demand (2016) (MVA)	Generation support or reduction in forecasted load (MVA)
One year	14.4	0.7
Five years		0.2

Load transfer of 11.3 MVA is available from St Marys Substation to Avoca, Triabunna and Derby substations for short periods, under certain network conditions.

Potential solution

We propose to replace these transformers with two standard 110/22 kV 25 MVA units in the 2019–24 regulatory period. We assessed deferring replacement past 2024, however the risk presented by maintaining these units in service at St Marys Substation past 2024 is too great. Due to the increased risk of failure, it is more economical to replace them in the 2019–24 regulatory period. The capacity of the new supply transformers will be sufficient to address the existing capacity constraints.

The estimated cost of the project is $4.0 million and it is planned to be operational by June 2023.

[10] SPS-015 St Marys Transformer Script Calc R405474

We do not propose any investment to address the capacity limitation in the mean time because it is not economical to do so. However we will maintain operation of the load shedding scheme. If we were to address the capacity limitation, potential solutions further to the load shedding scheme include:

- demand management activities, including embedded generation or contracted load shedding;
- strengthening the distribution network to provide either post-contingent (automated) or permanent load transfers away from St Marys Substation;
- real-time (dynamic) rating of the transformers;
- replacement of the transformers with larger units; and
- establishment of a new transmission-distribution connection point.

4.1.2 Triabunna Spur transmission line Kay pole replacement program

Identified need

A Kay pole is a make of transmission line support structure that was designed during the First World War when steel availability was limited. We have 41 Kay pole support structures, reclaimed from a previous installation and now installed as part of the Triabunna Spur 110 kV transmission line. These structures were built in 1927, making them 90 years of age. They are approaching their end of service life and we are monitoring their condition. 33 Kay poles have already been replaced on this transmission line in the past 15 years. The Triabunna Spur transmission line is a radial transmission line, a single asset failure will result in an immediate and sustained interruption to supply until alternate supply is provided via the distribution network.

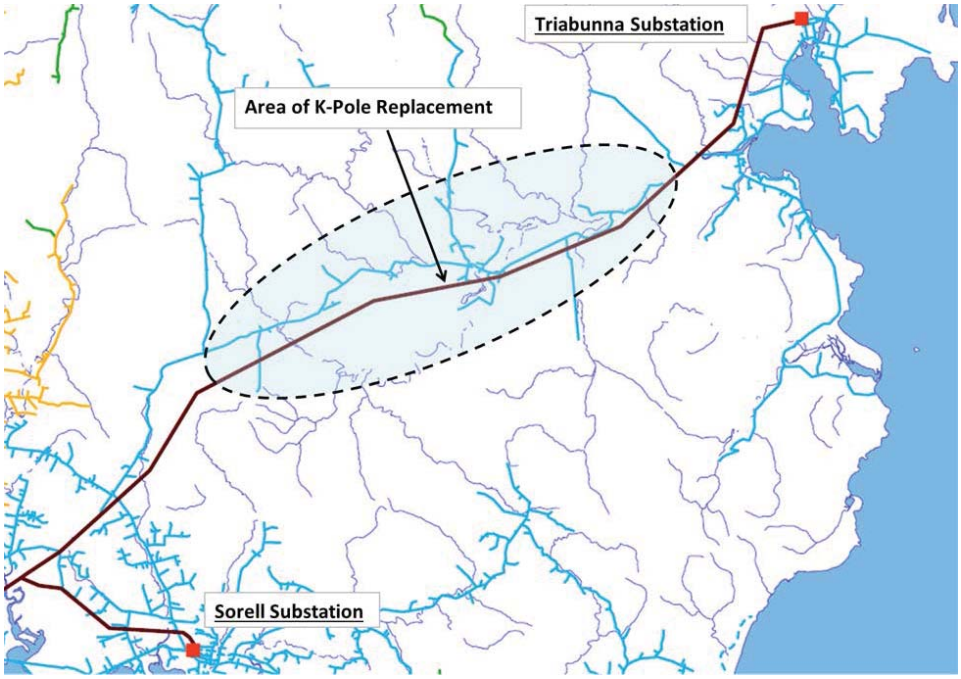
Figure 10: Kay pole installed on Triabunna Spur transmission line

Proposed solution

Our current proposal is to replace the 41 Kay poles on the Triabunna Spur transmission line with new steel poles. We anticipate all structures need to be replaced by 2019. We assessed deferring replacement past 2019. However the risk of failure would be unacceptably high and it is more economical to replace in the next three years, due to the reduced risk of supply interruptions.

The estimated cost of the project is $3.7 million and is proposed to be operational by June 2019.

Figure 11: Triabunna 110 kV transmission line Kay pole replacement



4.1.3 Richmond Rural Zone Substation refurbishment and Colebrook 11/22 kV interconnection

Limitation overview

Richmond Rural Zone Substation has two supply transformers, manufactured in 1960, and an in-series voltage regulator. Condition assessment indicates their condition is deteriorating and they are approaching the end of their service life. The assets are unlikely to be fit for service for more than 5 years.

The supply transformers are 22/11 kV 2.5 MVA units, with a short-term rating of 3.3 MVA. The voltage regulator[11] is 3 MVA. The substation maximum demand in 2016 was 3.3 MVA, currently exceeding the rating of the voltage regulator and the short-term rating of the transformers.

Limitation deferral

Table 4 presents the requirements to defer the identified capacity limitation at Richmond Rural Zone Substation. The table presents the reduction in the forecasted load, or amount of generation support, required to defer the capacity limitation by either one (to 2018) or five (to 2022) years. The reduction would maintain the load below 3.3 MVA, the short-term firm capacity.

Table 4: Richmond Rural Zone Substation capacity limitation deferral

Deferral period	Maximum demand (2016) (MVA)	Generation support or reduction in forecasted load (MVA)
One year	3.3	0.1
Five years		0.3

[11] The 22/11 kV transformers have an off-load tap setting; bus voltage is controlled by a series connected voltage regulating transformer

Load transfer is available from Richmond Rural Zone Substation to Bridgewater and Cambridge Zone substations for short periods, under certain network conditions. Load transfer is not available to Sorell Substation due to the different operating voltage (Sorell Substation supply voltage is 22 kV).

Proposed solution

We propose to replace these supply transformers due to asset condition with two new standard 22/11 kV 5 MVA units in 2018–19. The new transformers will either be fitted with on-load tap changers or a new appropriately sized voltage regulator will also be installed. The capacity of the new supply transformers will be sufficient to address the existing capacity constraints.

The estimated cost of the project is $2.8 million and it is planned to be operational by June 2019.

We also propose to establish an inter-connection between Richmond Rural Zone Substation feeder 40002 and Sorell Substation feeder 41516. This will be provided through the establishment of a 22/11 kV transformer at Colebrook, allowing interconnection between the 11 kV and 22 kV networks. The majority of the Colebrook township load will be transferred to feeder 41516, reducing the loading on Richmond Rural Zone Substation.

The estimated cost of the project is $300,000 and it is planned to be operational by June 2019.

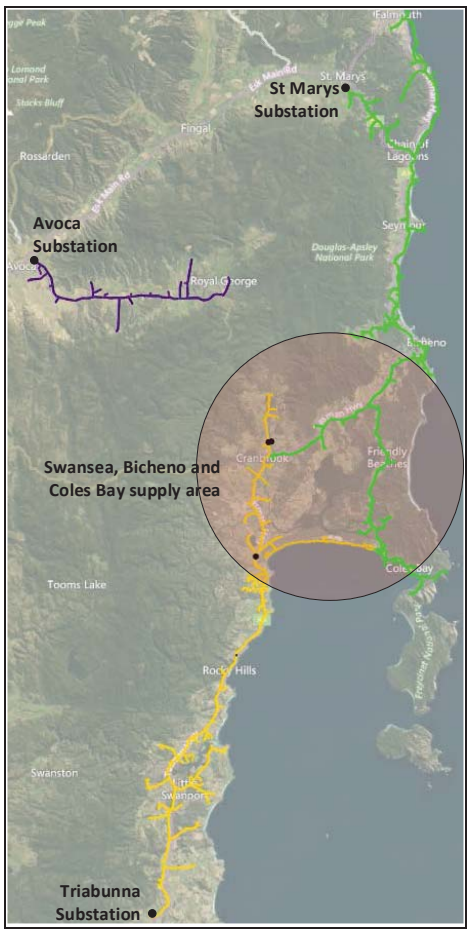
4.1.4 Swansea, Bicheno and Coles Bay supply capacity increase

Limitation overview

The Swansea, Bicheno and Coles Bay area is supplied from two long distribution feeders – one each from Triabunna (feeder 43507) and St Marys (feeder 57004) substations. The connection of Swan irrigation scheme at the northern end of feeder 43507, although having an intermittent operation, has exhausted any remaining network capacity to supply this area.

No spare network capacity exists to supply the Swansea, Bicheno and Coles Bay area. Network augmentation is required to supply any new large customer wishing to connect in this area.

Figure 12: Swansea, Bicheno and Coles Bay supply area



Proposed solution

We propose to increase the network capacity to the Swansea, Bicheno and Coles Bay area. We propose to extend distribution feeder 56001 from Avoca Substation to the area. This will support existing feeders 43507 from Triabunna Substation and 57004 from St Marys Substation in supplying existing and any new large customer load in the Swansea, Bicheno and Coles Bay area. It will also improve reliability and power quality performance in the area.

The estimated cost of the project is $2.7 million and it is planned to be operational by June 2024.

4.2 Forecast limitations

This section presents the forecast limitations, not addressed by a planned investment in Section 4.1, within the network during the 15 year planning period. These limitations identify the points in the network that are currently inadequate to cater for the future demand on the network due to the following considerations:

- demand forecast
- asset refurbishment replacement or retirement requirements
- security and reliability requirements
- regulatory and jurisdictional requirements
- power quality
- fault levels
- generation, demand-side and other developments
- operational constraints
- national transmission network development plan

- power system risk review
- market benefits assessment

The limitations identified here are those in the transmission network and those in the distribution network that are likely to have a material effect on operation of the network.

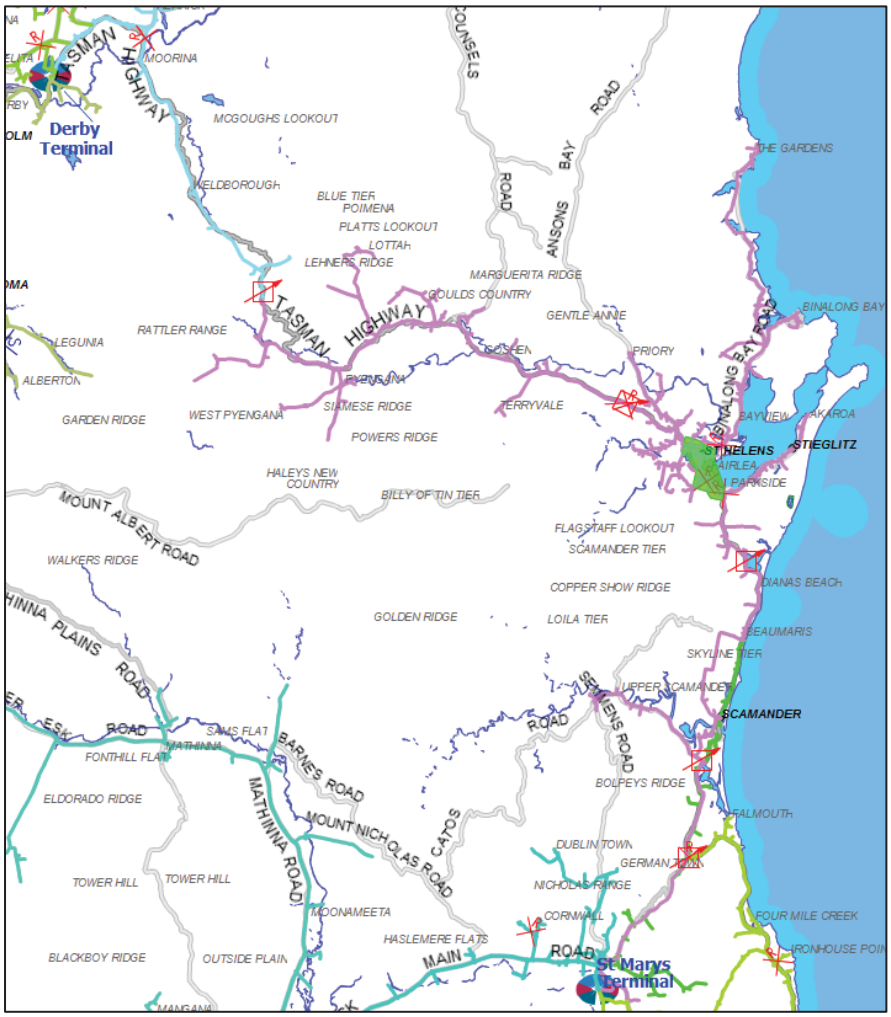
4.2.1 St Helens Urban reliability community performance

Identified need

The St Helens Urban reliability community is the small area around St Helens township. It is enclosed by the St Helens Rural low density rural community, with much lower reliability standards. St Helens is supplied via a single 35 km 22 kV overhead feeder (57006) from St Marys Substation. Backup supply can be supplied from St Marys Substation feeder 57003 that supplies as far north as Scamander, and from Derby Substation feeder 55002.

Figure 13 shows the supply arrangement to St Helens. The St Helens Urban reliability community is shown shaded green, primary supply feeder 57006 is pink, with backup feeders 57003 in green and 55002 from Derby Substation in blue.

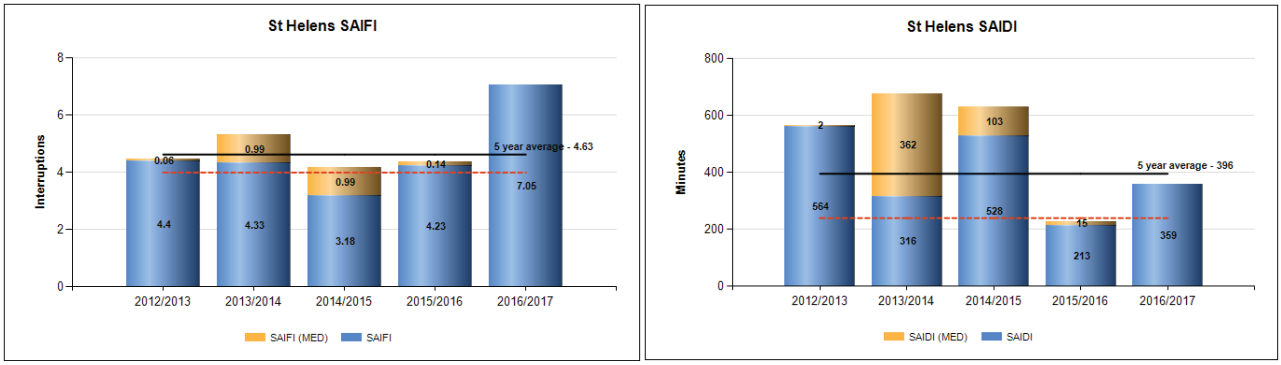
Figure 13: St Helens Urban reliability community supply



The St Helens Urban reliability community is poor performing. It has exceeded its SAIFI and SAIDI thresholds, on average, since 2012–13. Figure 14 presents the SAIFI (frequency) and SAIDI (duration) yearly and five-year average reliability performance against the standards for urban reliability communities.[12]

The SAIDI performance has improved in the last two years and the SAIFI performance has been borderline compliant with the exception of 2016–17. In 2016–17, the leading contributor to outage frequency was those were a cause could not be found, and which was a significant increase on previous those unidentified causes in previous years.

Figure 14: St Helens Urban reliability community performance



Proposed solution

We have recently implemented (October 2017) a loop automation scheme for the St Helens Urban reliability community. This automatically restores supply to the community via either of the backup feeders for a number of predetermined fault scenarios. This results in fast restoration time to the community, improving the performance of the SAIDI performance measure.

We will monitor the performance of the loop automation scheme and assess the suitability of reliability improvement investments under ongoing TRIP-P, TRIP-S and other reliability improvement programs. We may review the reliability management plan for St Helens Urban reliability community should the five-yearly average reliability not improve.

4.2.2 Pirates Bay–Nubeena–Port Arthur and Tasman Peninsula reliability community performance

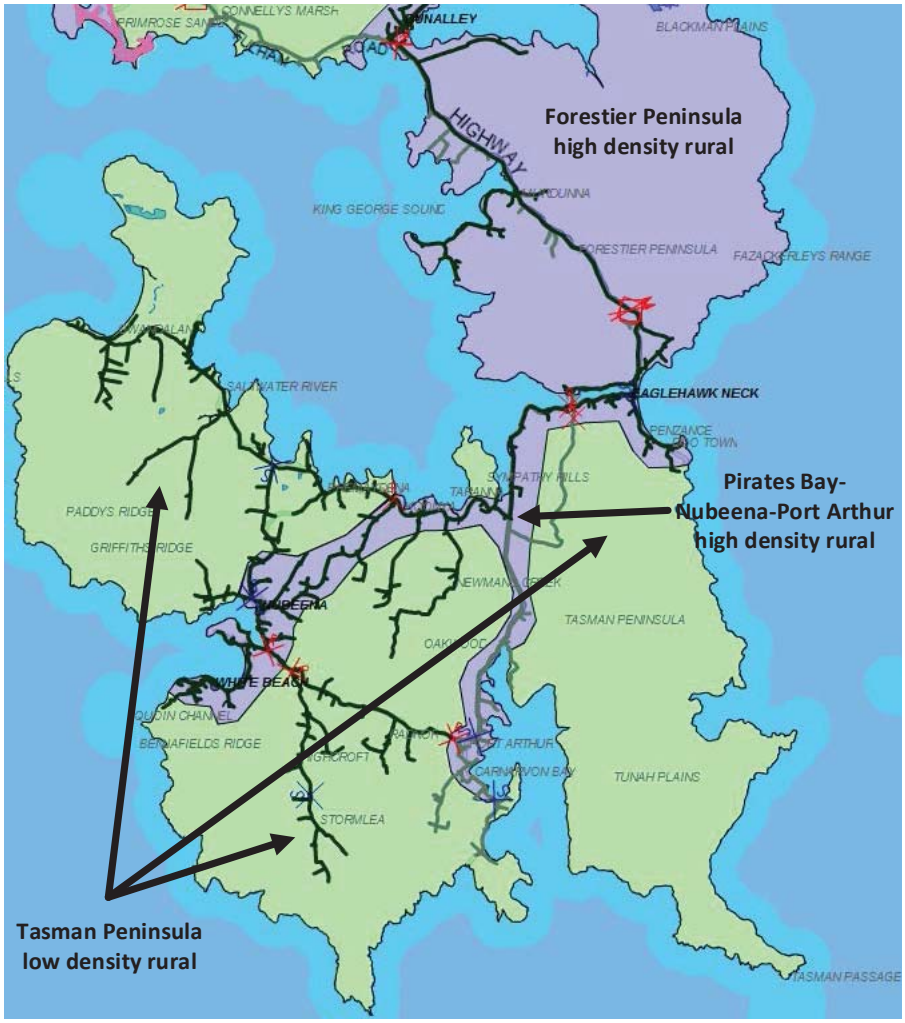
Identified need

The Forestier and Tasman Peninsula areas of Tasmania are supplied via two 22 kV feeders from Sorell Substation. The Tasman Peninsula contains the Pirates Bay–Nubeena–Port Arthur high density rural and Tasman Peninsula low density rural reliability communities. The feeders have limited geographical diversity, both passing through the isthmuses at Dunalley and Eagle Hawk Neck, and following the same route through Forestier Peninsula. There is limited transfer capability between the two. There is a loop automation scheme in operation to the area, coordinating backup supply between the two feeders as required.

Figure 15 shows the supply arrangement to Forestier and Tasman peninsulas. The Pirates Bay-Nubeena-Port Arthur high density rural and Tasman Peninsula low density rural reliability communities are shown, with the two supply feeders from Sorell Substation 41514 (light green) and 41515 (dark green).

[12] Service Performance - Community list by customer, retrieved 13 July 2017. http://reportzone.tnad.tasnetworks.com.au/bi/_layouts/15/ReportServer/RSViewerPage.aspx?rv:RelativeReportUrl=/bi/ASP/Performance%20Report%20-%20Internal/Service%20Performance%20by%20Community%20(Customer).rdl

Figure 15: Pirates Bay-Nubeena-Port Arthur and Tasman Peninsula reliability community supply



The Pirates Bay–Nubeena–Port Arthur high density rural and Tasman Peninsular low density rural reliability communities are poor performing. They have exceeded their SAIFI and SAIDI thresholds, on average, since 2012–13. Figure 16 and Figure 17 present the SAIFI (frequency) and SAIDI (duration) yearly and five-year average reliability performance against the relative standards for these reliability communities.[13]

The five-year average does not include the contribution from outages on major event days (MED); however outages on MEDs have had a significant impact on the duration measure (SAIDI) to supply reliability to both communities in 2015–16 and 2016–17. The dominant contributor to SAIDI in this period was from outages caused by vegetation or weather, as typically experienced on MEDs.

[13] Service Performance - Community list by customer, retrieved 13 July 2017. http://reportzone.tnad.tasnetworks.com.au/bi/_layouts/15/ReportServer/RSViewerPage.aspx?rv:RelativeReportUrl=/bi/ASP/Performance%20Report%20-%20Internal/Service%20Performance%20by%20Community%20(Customer).rdl

Figure 16: Pirates Bay-Nubeena-Port Arthur reliability community performance

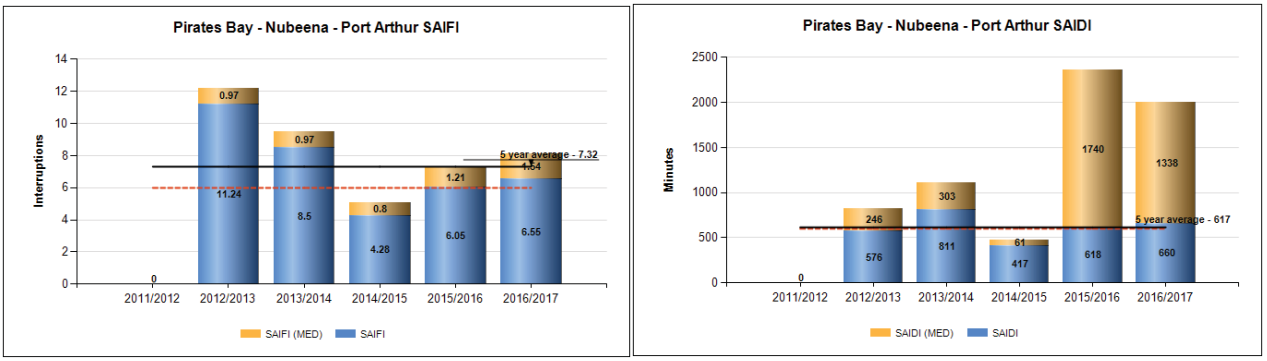
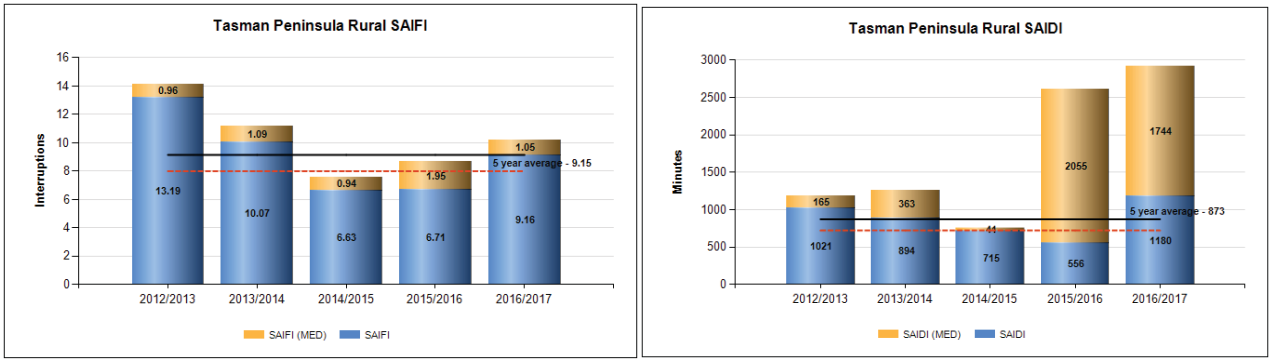


Figure 17: Tasman Peninsula reliability community performance



Proposed solution

We propose to continue to monitor the Pirates Bay-Nubeena-Port Arthur and Tasman Peninsula reliability community performance. It is difficult to identify any reasonable initiatives to improve supply reliability to these communities and, with contribution from MEDs excluded, recent reliability performance does not greatly exceed target levels.

Notwithstanding, we will continue to monitor the performance of the loop automation scheme and assess the suitability of reliability improvement investments under ongoing TRIP-P, TRIP-S and other reliability improvement programs. We may review the reliability management plan for Pirates Bay-Nubeena-Port Arthur and Tasman Peninsula reliability communities, which may include increased vegetation maintenance and spares storage at local depot, if deemed appropriate.

5 Network opportunity

The Eastern planning area has a number of load connection points with sufficient capacity such that new loads could connect with minimal or no augmentation to the connection point substation to accommodate it. Note that although capacity at the substation may be available, the new load may result in other augmentation work required for capacity increases deeper in the transmission network or for network security or reliability reasons.

Table 5 shows the available firm capacity at each connection point substation now and at the end of the planning period where redundancy is available, and the non-firm capacity at single transformer substations.

Table 5: Available substation capacity (MVA)

Substation	Firm capacity	Existing		2032	
		Demand	Available capacity	Forecast demand	Available capacity
Avoca (single transformer)	17	7.7	9.3	9.1	7.8
St Marys	10 (existing) to 25[14]	14.3	0	12.9	12.1
Triabunna	25	6.9	18.1	10.1	14.9
Sorell	60	31.4	28.6	30.9	29.1

[14] We propose to replace the supply transformers at St Marys Substation with new 25 MVA units in June 2023, as identified in Section 4.2.

Appendix A – Area capability information

This appendix provides information on the network capability in the Eastern planning area. The supply transformer capacity at each substation is provided in Table 6. The transfer capability from each substation is provided in Table 7.

Table 6: Substation supply transformer capacity

Substation	Number of transformers	Transformer capacity (MVA)	Transformer primary/secondary voltage
Avoca	1	17	110/22
St Marys	2	10	110/22
Triabunna	2	25	110/22
Sorell	2	60	110/22
Richmond Rural Zone	2	2.5	22/11

Table 7: Transfer capability

Eastern planning area		From			
		Avoca	St Marys	Triabunna	Sorell
To	Avoca		2.8		1.5
	St Marys	4.6		3.0	
	Triabunna		4.5		1.5
	Sorell			1.8	
	Palmerston	4.6			
	Derby		4.0		
	Meadowbank				1.5