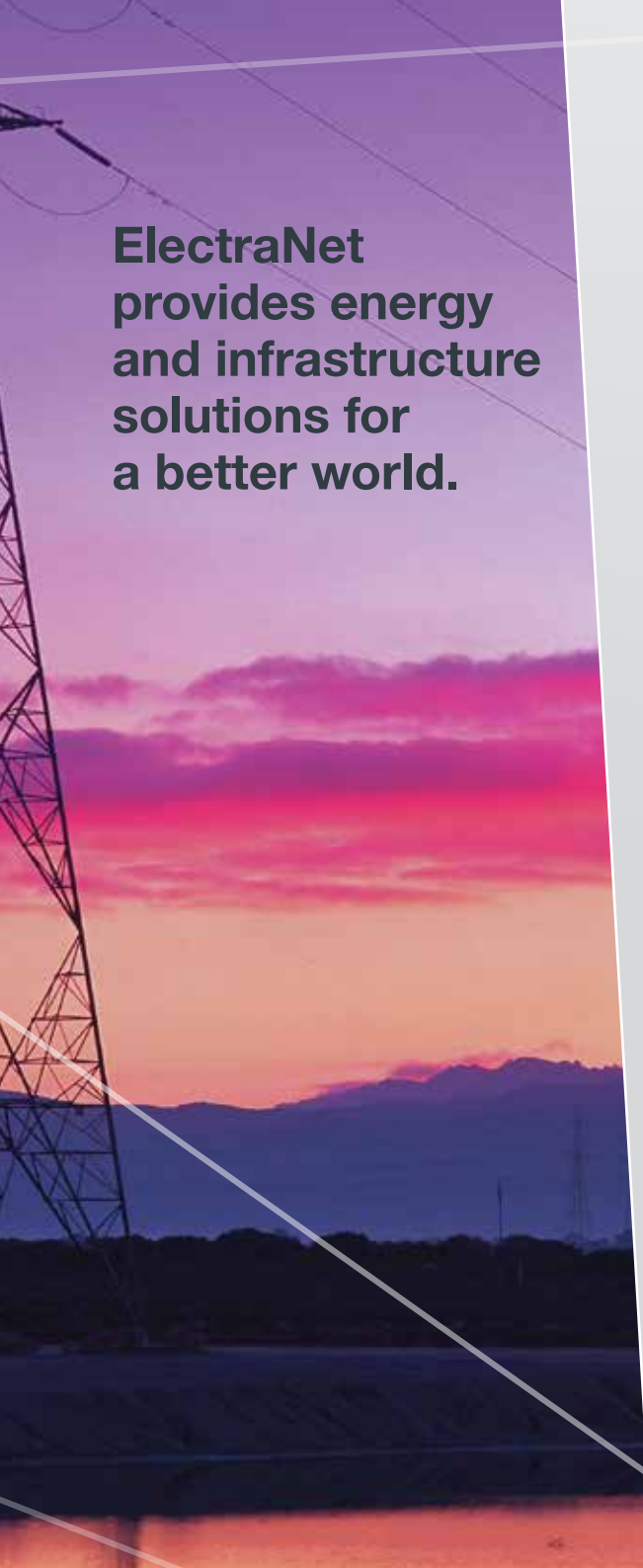




SOUTH AUSTRALIAN TRANSMISSION ANNUAL PLANNING REPORT 2015 **OVERVIEW**

NOVEMBER 2015



**ElectraNet
provides energy
and infrastructure
solutions for
a better world.**

Message from the Chief Executive

The pace of change in the energy industry is increasing.

Slower growth across global, national and state economies, continued uptake of rooftop solar photovoltaic (PV) systems and the refinement of emerging technologies such as battery storage are all contributing to a reduction in the energy consumed from the transmission network.

We will respond and continue to evolve the network to meet the changing needs of consumers and the adoption of new technologies and supply options at both large and small scale.

But the transmission network is still needed, and will continue to play a major role into the future to provide secure, reliable and stable power supply.

As we plan the future of this network, we are focused on providing meaningful opportunities for consumers to have input and ultimately, help us improve the value of electricity transmission services in South Australia.

New additions to this planning process, which are outlined in this year's Transmission Annual Planning Report include expanding the use of scenario planning to consider a wider range of potential futures, and the inclusion of increased detail on the capability of the transmission network to connect new generators.

I hope you find this overview document useful and I look forward to engaging further with you as we respond to consumer priorities and our changing operating environment.

Steve Masters
Chief Executive
ElectraNet

Purpose of ElectraNet's South Australian Transmission Annual Planning Report

The South Australian Transmission Annual Planning Report (TAPR) provides information to interested parties on the current capacity and emerging limitations of South Australia's electricity transmission network.

The report covers a ten year planning period and includes:

- > Projections of electricity demand
- > Emerging network limitations or constraints
- > Information on completed, committed, pending and proposed transmission network developments

This information helps potential generators and customers to identify and assess opportunities to connect to the network.

WHAT'S NEW IN 2015?



EARLIER PUBLICATION DATE

The 2015 TAPR was published earlier than the required end of June publication date to better align with the annual planning cycle and the reliance of the reported planning outcomes on 2014 forecasts of electricity demand.



DEMAND FORECASTS

ElectraNet published the inaugural South Australian Connection Point Forecasts Report in early 2015. This report includes:

- > Demand forecasts used in the 2015 TAPR
- > Load profile information for each transmission network connection point to help with assessing the viability of non-network solution options for addressing network limitations as an alternative network investment



SCENARIO PLANNING

Three planning scenarios were considered, representing a wide range of potential futures:

- > Base scenario (central projections of electricity demand)
- > SA Mining Growth scenario
- > SA Renewable Generation Expansion scenario



NETWORK CAPABILITY

Increased detail is provided regarding the capability of ElectraNet's network to connect new generators, in addition to the capability to connect new loads.



NON-NETWORK SOLUTIONS

The 2015 TAPR provides additional information about ElectraNet's approach to considering non-network solutions for addressing network limitations for the benefit of non-network solution proponents.

ElectraNet's role in electricity supply

ElectraNet is the principal Transmission Network Service Provider (TNSP) in South Australia and operates in the National Electricity Market (NEM).

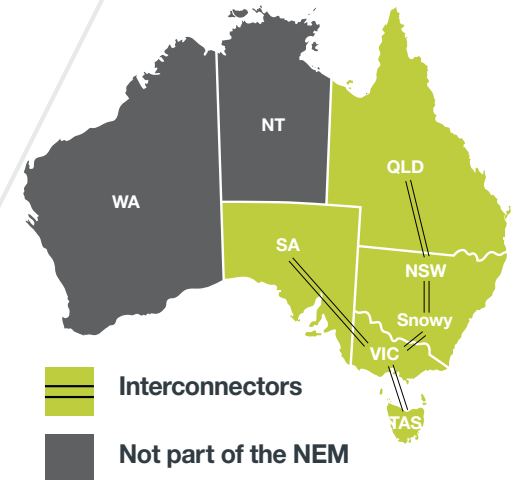
Our network safely transports electricity over long distances. It is made up of over 5600 circuit kilometres of transmission lines that operate at 275,000 Volts (275 kV), 132,000 Volts (132 kV) and 66,000 Volts (66 kV), as well as 30 kilometres of underground 275 kV cable and 89 high-voltage substations.

The network forms the backbone of the electricity supply system, moving electricity from traditional

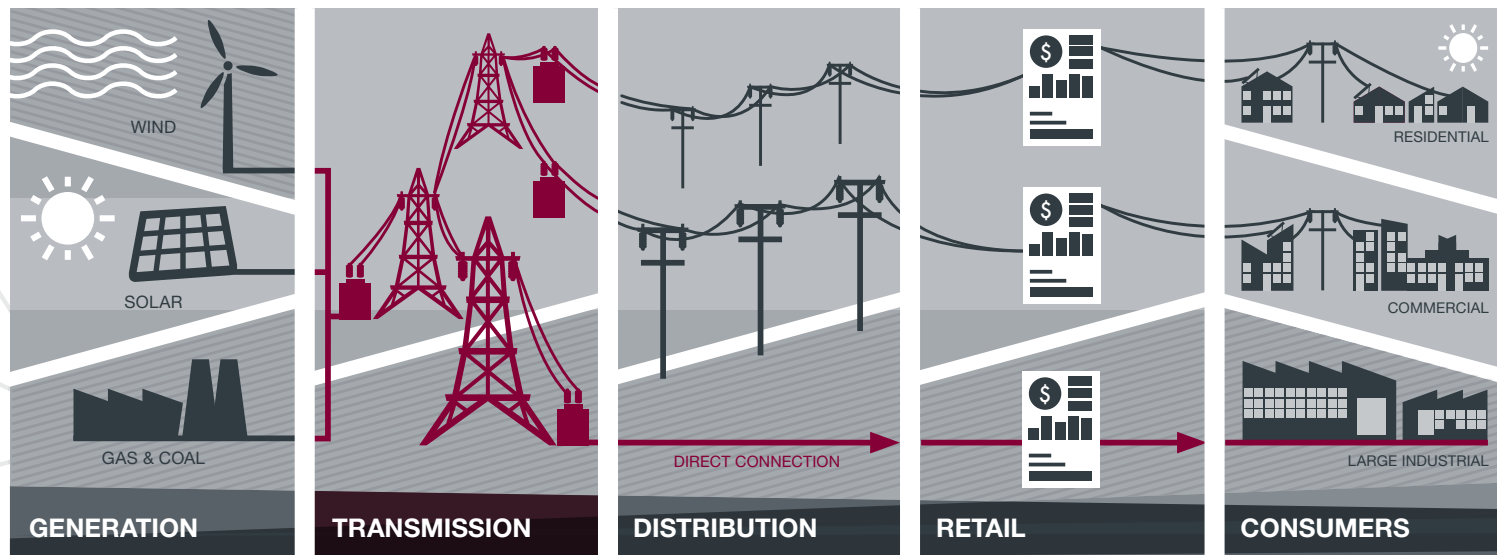
and renewable power generators in South Australia and interstate, to where it is needed.

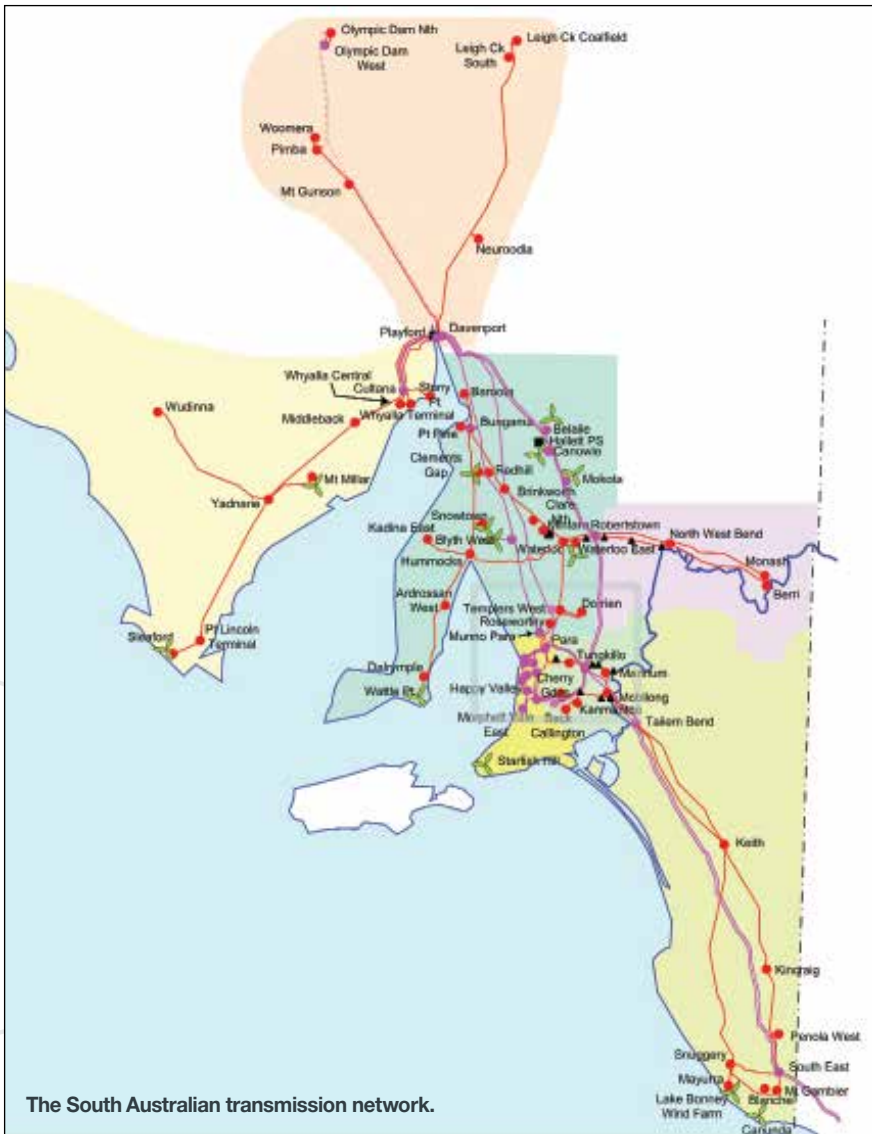
Our customers include power generators, the State's electricity distributor SA Power Networks, and large industry. The electricity transmission services ElectraNet provides also impact on the cost and reliability of electricity to consumers that are connected to SA Power Networks' distribution network.

We are planning for the future – preparing for the changing way that electricity will be generated and consumed.



The Role of ElectraNet in the Electricity Supply Chain





Metropolitan transmission network.



NEW IN 2015

Demand Forecasts

Planning of the transmission network is based on forecasts of maximum electricity demand¹ rather than energy consumption to ensure sufficient capacity to reliably meet maximum demand for electricity. A decline in large industrial demand forecasts, the rapid uptake of rooftop solar PV systems and customer energy efficiency measures have all had an impact on reducing energy consumption from the grid and, to a lesser extent, maximum demand.

AEMO publishes an annual South Australian state-wide demand forecast by 30 June each year, which forms part of AEMO's National Electricity Forecast Report (NEFR). The AEMO NEFR demand forecast is based on econometric modelling and does not consider load requirements at a localised connection point level.

However, AEMO has also published South Australian connection point forecasts, for the first time, in December 2014.

SA Power Networks and customers connected directly to the transmission network provide demand forecasts for their connection points to the transmission network on an annual basis. ElectraNet uses these forecasts as input to develop regional and state level demand forecasts which are a key input to the planning and development of the transmission network.

ElectraNet has worked with SA Power Networks and AEMO to improve demand forecasts at an individual connection point level and to reconcile them with AEMO's state level forecasts. ElectraNet's 2015

South Australian Connection Points Forecasts report shows close agreement between ElectraNet 2015 forecasts and AEMO's 2014 NEFR forecasts.

AEMO's 2014 NEFR forecast South Australian state-wide 10% probability of exceedance (POE)² maximum demand to decrease at an average annual rate of 1.1% over the short term (three year outlook) under a medium economic growth scenario.

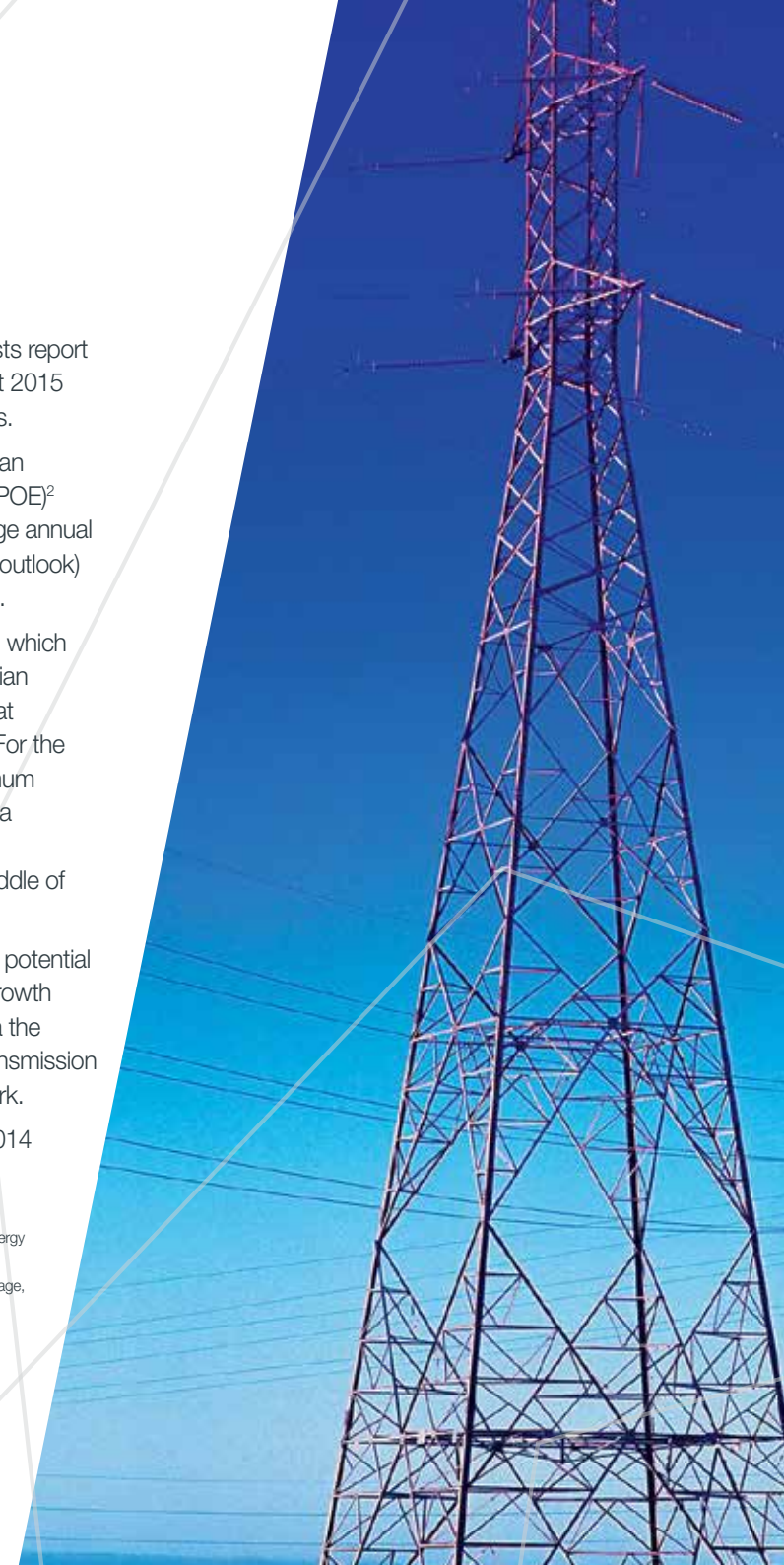
AEMO has since published the 2015 NEFR, which includes updated forecasts of South Australian state-wide 10% POE maximum demand that increase modestly over the outlook period. For the first time, it also includes a forecast of minimum demand levels for South Australia, showing a forecast of zero net demand at times on the transmission network by 2023-24 (in the middle of sunny minimum demand days).

The development of new loads, in particular potential new mining loads under higher economic growth scenarios, would see maximum demand via the transmission network increase, requiring transmission network augmentation in parts of the network.

The graph to the right compares AEMO's 2014 and 2015 NEFR forecasts.

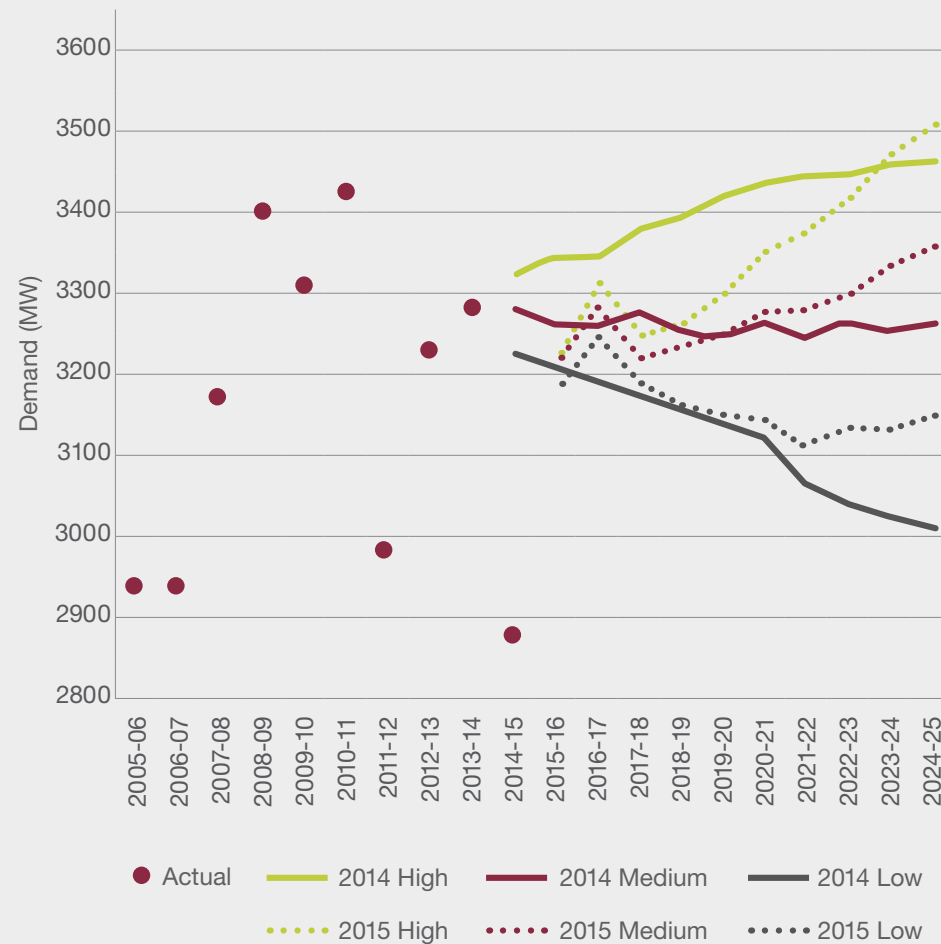
1. Electricity demand is the amount of electrical power (rate at which energy flows) being consumed at any given time.

2. 10% POE indicates a value that is expected to be exceeded, on average, once in every 10 years.





2014 & 2015 NEFR 10% POE operational demand forecast including actual annual maximum demands since 2005-06





NEW IN 2015

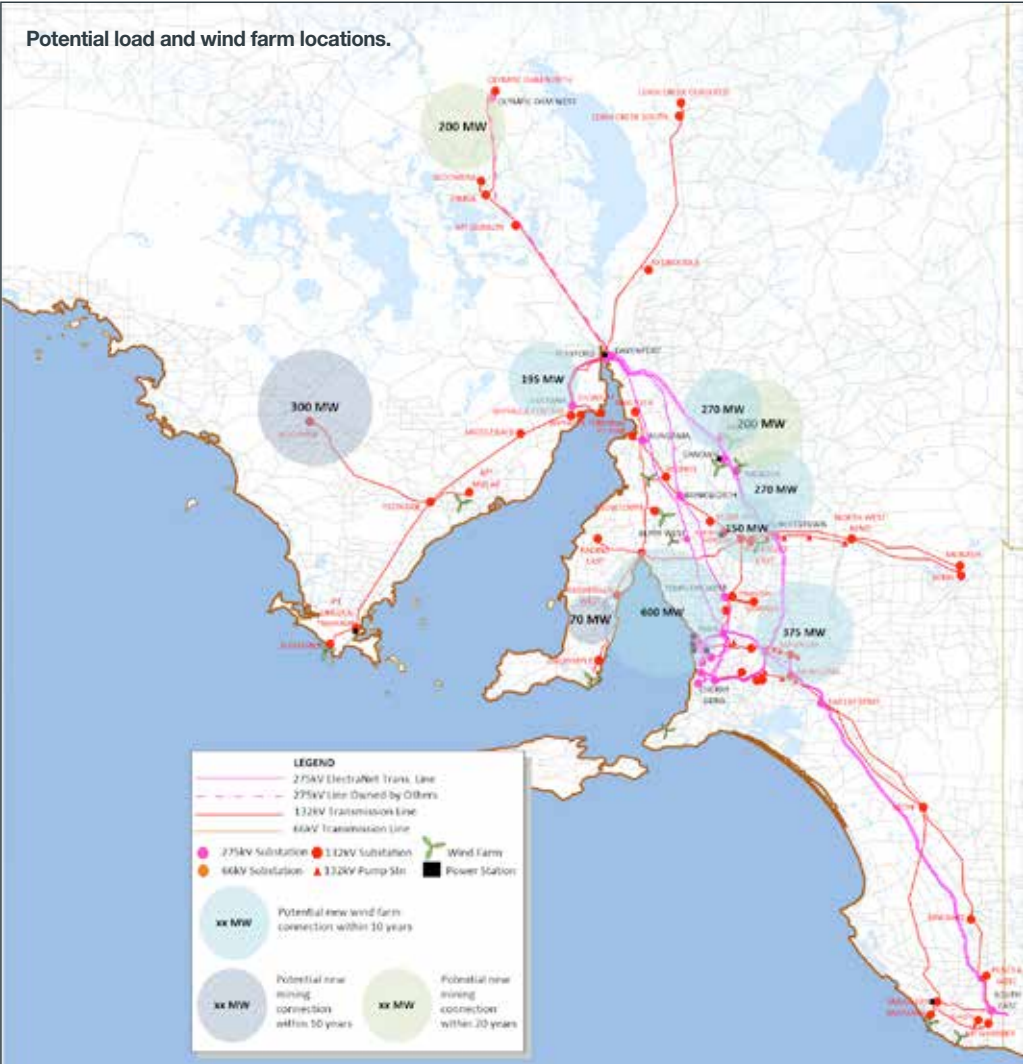
Scenario Planning Outcomes

The information and analysis presented in the 2015 TAPR is based on three planning scenarios, which represent differing assumptions about the future development of demand and generation in South Australia. The three scenarios are summarised in the table to the right.

For all scenarios, other key assumptions including generator plant retirements were unchanged from AEMO's 2014 National Transmission Network Development Plan (e.g. no retirements within the next 10 years).

ElectraNet is assessing the impact of the announced closure of the Northern Power Station at the end of March 2016 and this will be reflected in the 2016 TAPR.

Scenario	Key Characteristics	10-year Planning Outcomes	Status of projects identified under this scenario
Base scenario	<p>Demand forecast: 2014 10% POE</p> <p>Generation plant: Existing fleet</p>	No significant projected network limitations.	Network projects identified in this scenario have a high likelihood of being required, and are included in ElectraNet's business plan. Each project will be closely scrutinised before proceeding.
SA Mining Growth scenario	<p>Demand forecast: 70 – 770 MW of new mining load, 10% increase to base forecast in 2023-24</p> <p>Generation plant: Minimum expansion to conventional fleet</p>	Significant network augmentation required in specific parts of the network depending on actual mining developments driving this investment.	Network projects identified in this scenario are generally caused by the connection of new loads, or the occurrence of higher-than-expected general demand growth. These projects will only be added to ElectraNet's business plan if such connections or demand increases occur.
SA Renewable Generation Expansion scenario	<p>Demand forecast: 2014 10% POE</p> <p>Generation plant: 150 – 1850 MW of new wind generation, existing conventional fleet</p>	<p>Moderate network augmentation required to avoid significant network congestion at maximum demand times.</p> <p>At low demand times wind generation output may be limited by the ability to export power from South Australia.</p>	Network projects identified in this scenario are generally caused by the connection of new wind farms. These projects will only be added to ElectraNet's business plan if a net market benefit can be demonstrated.



Potential future mining connections that were considered as part of the SA Mining Growth scenario, and the potential future wind farm connections that were considered as part of the SA Renewable Generation Expansion scenario.



Interconnector Developments

SA-VIC (HEYWOOD) INTERCONNECTOR UPGRADE

The South Australia - Victoria (Heywood) Interconnector upgrade, which will increase nominal interconnector transfer capability between South Australia and Victoria by about 40% from 460 MW to 650 MW, is expected to be completed by mid-2016.

This project will alleviate most of the existing intra-regional network limitations in south-east South Australia. The net market benefits are estimated at more than \$190 million (in present value terms) over the life of the project, with positive net benefits commencing from the first year of operation.

The project includes works in both South Australia and Victoria. The works in South Australia comprise:

- > Series compensation³ of the two South East to Tailem Bend 275 kV lines
- > Reconfiguration of substation assets and the existing 132 kV transmission system to allow increased utilisation of transmission line thermal ratings along the 275 kV interconnector
- > South East 275/132 kV transformer control scheme, subject to the voluntary participation of the relevant generators
- > A protection and control scheme that will bypass the series capacitors if either sub-synchronous oscillations or a network condition that could lead to the growth of sub-synchronous oscillations is detected

Energisation of the series capacitors is planned for July 2016. Following energisation, inter-network testing will be performed in stages as part of agreed commissioning tests for the series compensation installation. Following each test, the increased transfer capability will be released in steps above the existing capacity. The full 650 MW capacity is expected to be released in the second half of 2016.

The Victorian works are being progressed by AEMO as the Victorian TNSP.

While early indications as reported in 2014 suggested that forecast higher gas prices could make a further interconnector upgrade economic, more detailed investigation has shown this not to be the case at this time.

MURRAYLINK INTERCONNECTOR

ElectraNet and AEMO's studies into the transmission limitations in the Riverland/Western Victoria region to identify potential solutions indicate that there is currently no clear short-term need for a significant increase in Murraylink Interconnector transfer capacity. ElectraNet and AEMO will continue to jointly monitor the need for and ability of Murraylink to provide capacity support for both the South Australian Riverland 132 kV network and the Regional Victorian 220 kV network in future years.

3. Series compensation reduces the "electrical length" of a transmission line thereby increasing the capacity of the line.

The SA-VIC Interconnector Upgrade is expected to have a material impact on inter-regional transfer as it will increase interconnector capability by about 190 MW or 40% in both directions.

Current Planning Investigations

LOW SYSTEM DEMAND AND HIGH 275 KV SYSTEM VOLTAGE PERIODS

Low demand periods are becoming more frequent and the level of minimum demand has been rapidly diminishing, largely due to:

- > The increasing penetration of distributed solar PV
- > Increases in consumers' energy efficiency

The result of these changes is forecast to yield an increased occurrence of operating conditions that are characterised by high-voltage levels on the SA 275 kV main grid. Sustained high voltage levels could lead to deterioration of ElectraNet's assets and result in wide-spread failures on the transmission network. Further, the high voltage levels may cause the Para Static Var Compensators (SVC) to operate at a level that reduces the ability of the SVCs to stabilise the system following a significant system disturbance. Operational experience over recent years shows that the Para SVCs increasingly operate at such levels in the early hours of the morning, to limit the voltage level rise on the 275 kV main grid after the rapid drop in demand that often follows the midnight pumping and water heating peak.

ElectraNet has commenced a study into the best means of addressing the issues described above to ensure system security is maintained.

The study will include consideration of:

- > The ability of the lines and plant that comprise the SA 275 kV main grid to withstand sustained high voltages
- > The ability of the system to remain stable following a significant system disturbance during times of low demand and high system voltage levels
- > A range of solutions that may be able to address specific limitations identified, which may include options such as:
 - Changes to operational procedures
 - Non-network solutions such as demand shifting or control of embedded generation
 - Network solutions such as the installation of switched 275 kV reactors.

An update on the progress of this study is planned for inclusion in the 2016 TAPR.

ENERGY STORAGE FOR COMMERCIAL RENEWABLE INTEGRATION – SOUTH AUSTRALIA (ESCRI-SA)

The ESCRI-SA project is exploring the role of utility scale non-hydro storage in South Australia's transmission network in the 5-30 MW range, particularly to assist with renewable energy integration. The project is partly funded by the Australian Renewable Energy Agency (ARENA) and is being undertaken by a consortium consisting of AGL, ElectraNet and WorleyParsons (the Consortium).

In Phase 1 of the project, the Consortium has investigated the business case of such a storage asset. If the project progresses to Phase 2, we would build and test such an asset as a trial of the technology at utility scale.

The ESCRI-SA project is the first in Australia to examine the value of energy storage across three broad areas:

- > The time-shifting of renewable energy generated
- > The network value to the transmission system
- > The ancillary service value that could be provided to the South Australian system

The project is also considering the technical, commercial and regulatory issues involved with energy storage system deployment within the NEM.

Current Planning Investigations continued

The Consortium issued a Request for Information to a wide range of proponents to gather information on technical capability and estimated cost of utility scale storage. Seventeen responses were received from local and international companies/consortia, and eight proponents have been shortlisted.

The ESCRI project is in the process of concluding Phase 1, before the end of 2015, with industry knowledge sharing being a key deliverable. Phase 2 would likely begin in 2016, subject to a Phase 2 funding agreement being reached with ARENA.

RIT-T Consultations

There is only one Regulatory Investment Test for Transmission (RIT-T⁴) process active, which is for an upgrade of the Baroota connection point.

BAROOTA SUBSTATION UPGRADE

The South Australian Electricity Transmission Code (ETC) required equivalent N-1 transformer capacity at the Baroota connection point from 1 December 2017.

A Project Specification Consultation Report (PSCR) was published in May 2014. One submission was received from generators and a late submission accepted from a non-network proponent.

ElectraNet undertook a comprehensive review and option analysis to determine the overall solution that maximises net economic benefits to consumers. This work included revisiting the assumptions that underpinned the 2010 AEMO analysis, which resulted in the Essential Services Commission of South Australia (ESCOSA) changing the Baroota ETC reliability standard from category 1 to category 2, and thereby requiring equivalent N-1 transformer capacity.

While the 2010 analysis indicated that the benefits to consumers from improved reliability would outweigh the costs, ElectraNet's revised economic analysis has shown a significantly lower consumer benefit from the upgrade than the original analysis and that the least cost network solution to meet the category 2 reliability standard does not produce a positive net market benefit.

ElectraNet actively engaged with the non-network proponent to refine the technical and commercial characteristics of the solution it proposed. Despite the efforts of the proponent to reduce costs, the economic analysis shows that the identified non-network solution does not produce a positive net market benefit either.

In summary, no technically feasible option was identified that meets the category 2 reliability standard and results in a positive net benefit to consumers. Details are provided in the Project Assessment Draft Report (PADR), which was published in May 2015.

Given this outcome, ElectraNet engaged with ESCOSA to seek to remove the requirement for equivalent N-1 transformer capacity at Baroota from 1 December 2017, as the updated assumptions do not support the N-1 re-categorisation. This was considered to be in the best interests of South Australian consumers, and ESCOSA published a final decision in late October 2015, removing the requirement for the connection point to be upgraded.

However, the RIT-T option analysis has indicated that a non-continuous N-1 equivalent transformer solution at Baroota connection point may deliver positive net benefits to consumers. ElectraNet is exploring this option further.

4. The public economic cost benefit test administered by the Australian Energy Regulator that must be undertaken for all augmentation projects estimated to cost more than \$5 million.

Major Network Developments

Completed Projects

During 2014-15 ElectraNet completed the following major projects to remove network limitations and address deteriorating asset condition (note that some of these projects were completed after publication of the 2015 TAPR).

Project Description	Region	Project Category	Asset in Service
Magill – Happy Valley 275 kV Line Insulator Replacement Replaced porcelain disc insulator assemblies that had reached end of life	Metropolitan	Refurbishment	December 2014
Torrens Island (TIPS) 66 kV Unit Asset Replacements Replaced selected primary plant, secondary systems, two control rooms and associated equipment at TIPS 66 kV substation. Note: work on the TIPS 66 kV substation will continue, with further unit asset replacements required in the 2013 – 2018 period	Metropolitan	Replacement	January 2015
Munno Para New 275/66 kV Connection Point ElectraNet and SA Power Networks have established a new 275/66 kV connection point substation	Metropolitan	Connection	July 2015
Mt Gunson 132/33 kV Connection Point Replacement Replaced selected end-of-life plant	Upper North	Replacement	June 2015
Neuroodla 132/33 kV Connection Point Rebuild Rebuilt the substation within the existing substation site	Upper North	Replacement	July 2015
National Grid Meter Replacements Replaced end-of-life revenue meters at various connection points	Various	Replacement	July 2015
Robertstown – North West Bend #1 132 kV Line Uprate Increased the line rating by providing increased conductor clearances	Riverland	Augmentation	October 2015

ElectraNet plans the South Australian transmission network consistent with the requirements of the National Electricity Rules and ETC.

Major Network Developments continued

Committed Projects

Committed projects are those projects which have completed the RIT-T⁵ where required, and are fully approved by the ElectraNet Board. ElectraNet is currently undertaking the following major committed projects:

Project Description	Region	Project Category	Expected Service Date ⁶
South East Circuit Breaker Upgrade Install additional circuit breakers and associated equipment to reduce constraints on the Heywood interconnector	Main Grid/ South East	Security and compliance	December 2015
Para Unit Asset Replacements Replace the 275 kV, 132 kV and 66 kV secondary systems, associated telecommunications systems, control buildings and selected primary plant at Para substation as a result of detailed condition assessment and asset replacement risk analysis	Metropolitan	Replacement	March 2016
Penola West – South East 132 kV Line Insulator Replacement Replace porcelain disc insulator assemblies that have reached end of life	South East	Replacement	February 2016
Tailem Bend – Keith #2 132 kV Line Insulator Replacement Replace porcelain disc insulator assemblies that have reached end of life	South East	Replacement	March 2016
Brinkworth - Mintaro 132 kV Line Insulator Replacement Replace porcelain disc insulator assemblies that have reached end of life	Mid North	Replacement	May 2016
Heywood Interconnector Upgrade Incrementally upgrade Heywood interconnector from a nominal transfer limit of ± 460 MW to ± 650 MW. The upgrade includes installation of a third 500/275 kV transformer at Heywood terminal station, series compensation on the South East to Tailem Bend 275 kV lines, and reconfiguration of the 132 kV transmission system between Snuggery, Keith and Tailem Bend	Main Grid/ South East	Augmentation	July 2016
Para SVC Secondary Systems Replacement Replace SVC thyristor valves and valve cooling, protection and control systems that have reached end of life	Main Grid	Replacement	November 2016
Dalrymple Substation Upgrade Install a second 25 MVA 132/33 kV transformer and associated switchgear to meet ETC ⁷ category 2 reliability requirements	Main Grid	Connection	November 2016
Morgan – Whyalla Pump Station #1, 2, 3 and 4 Transformer Replacements Replace end-of-life plant and align these sites with current policies and environmental practices	Riverland	Replacement	Various dates in 2016
Para – Brinkworth – Davenport 275 kV Line Hazard Mitigation Replace load releasing cross arms and all porcelain disc insulators to achieve a 15-year life extension	Main Grid	Replacement	September 2017

5. The public economic cost benefit test administered by the Australian Energy Regulator that must be undertaken for all augmentation projects estimated to cost more than \$5 million.

6. Subject to change – dates accurate at time of writing.

7. South Australia Electricity Transmission Code.



ElectraNet welcomes feedback on the Transmission Annual Planning Report, including suggestions for improving the value of the information provided in the future to all interested parties. Feedback can be provided to consultation@electranet.com.au



**Copies of the Transmission
Annual Planning Report for
2015 are available from:**

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November 2015

The purpose of this document is to provide information about ElectraNet's assessment of the transmission system's likely capacity to meet demand in South Australia over the next ten years. It also provides information about ElectraNet's intended plans for augmentation of the transmission network. This document is not to be used by any party for other purposes, such as making decisions to invest in further generation, transmission or distribution capacity. This document has been prepared using information provided by, and reports prepared by, a number of third parties.

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