electranet

Transmission Annual Planning Report

June 2025

Copyright and Disclaimer

The purpose of this document is to provide information about ElectraNet's assessment of the South Australian transmission system's likely capacity to meet demand in South Australia over the next 10 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, storage, transmission or distribution capacity. This document has been prepared using information provided by, and reports prepared by, a number of third parties.

Anyone proposing to use the information in this document should independently verify and check the accuracy, completeness, reliability and suitability of the information in this document, and the reports and other information relied on by ElectraNet in preparing it.

This document contains certain predictions, estimates and statements that reflect various assumptions concerning, amongst other things, economic growth scenarios, demand forecasts and developments within the National Electricity Market. These assumptions may or may not prove to be accurate. The document also contains statements about ElectraNet's future plans. Those plans may change from time to time and should be confirmed with ElectraNet before any decision is made or action is taken based on this document.

ElectraNet makes no representation or warranty as to the accuracy, reliability, completeness or suitability for particular purposes of the information contained within this document. ElectraNet and its employees, agents and consultants shall have no liability (including liability to any person by reason of negligence or negligent misstatement) for any statements, opinions, information or matter expressed or implied arising out of, contained in, or derived from, or for any omissions from, the information in this document, except in so far as liability under any statute cannot be excluded.

Reasonable endeavours have been used to ensure that the information contained in this report is accurate at the time of writing. However, ElectraNet gives no warranty and accepts no liability for any loss or damage incurred in reliance on this information.

Acknowledgement of Country

In the spirit of reconciliation, ElectraNet acknowledges the Traditional Owners throughout South Australia and their ongoing connections to land, sea and community.

ElectraNet's transmission network operates across many traditional lands, and we value the opportunity this provides to build positive relationships with the communities.

We pay our respect to Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples.

Artwork by Kaurna, Ngarrindjeri, Narungga, Wirangu artist Gabriel Stengle

Prominent Hill
Roxby Downs
Olympic Dam North
Olympic Dam West
Leigh Creek
Leigh Creek Coalfield
Leigh Creek South
Upper North Region
Woomera
Pimba
Pernatty
Mount Gunson
Mount Gunson South
Neuroodla
Port Augusta
Emeroo
Davenport
Corraberra Hill
Eyre Region
Mid North Region
Cultana
Stony Point
Whyalla Central
Whyalla Terminal
Baroota
Mount Lock
Wudinna
Middleback
Port Pirie
Bungama
Belalie
Canowie
Willalo
Mokota
Redhill
Brinkworth
Riverland Region
Mount Millar
Yadnarie
Snowtown
Blyth West
Clare North
Mintaro
Bundey
Kadina East
Waterloo
Robertstown
North West Bend
Hummocks
Monash
Murraylink
Berri
Ardrossan West
Templers
Dorrien
Roseworthy
Munno Para
Para
Port Lincoln
Sleaford
Dalrymple North
Dalrymple
Adelaide
Magill
Tungkillo
Mannum
Mobilong
Morphett Vale East
Mount Barker
Cherry Gardens
Tailem Bend
Metropolitan Region
Eastern Hills Region
South East Region
ENLARGEMENT AREA
Pelican Point
Para
Metropolitan Region
Adelaide
0 3 6 9km
Keith
Black Range
Kincraig
Penola West
Snuggery
Mayurra
South East
Blanche
Mount Gambier
Heywood
NEW SOUTH WALES
SOUTH AUSTRALIA
VICTORIA
South Australia Transmission Network
Wind Farm
Solar Farm
Battery Energy Storage System
Power Station
Synchronous Condenser
Connections under construction
330 kV Substation
275 kV Substation
132 kV Substation
< 66 kV Substation
Pump Station
De-Energised line
DC Cable
330 kV Project Energy Connect
275 kV
275 kV OWNED BY OTHERS
132 kV
132 kV OWNED BY OTHERS
electranet
0 30 60 90km

Contents

Appendices

About ElectraNet

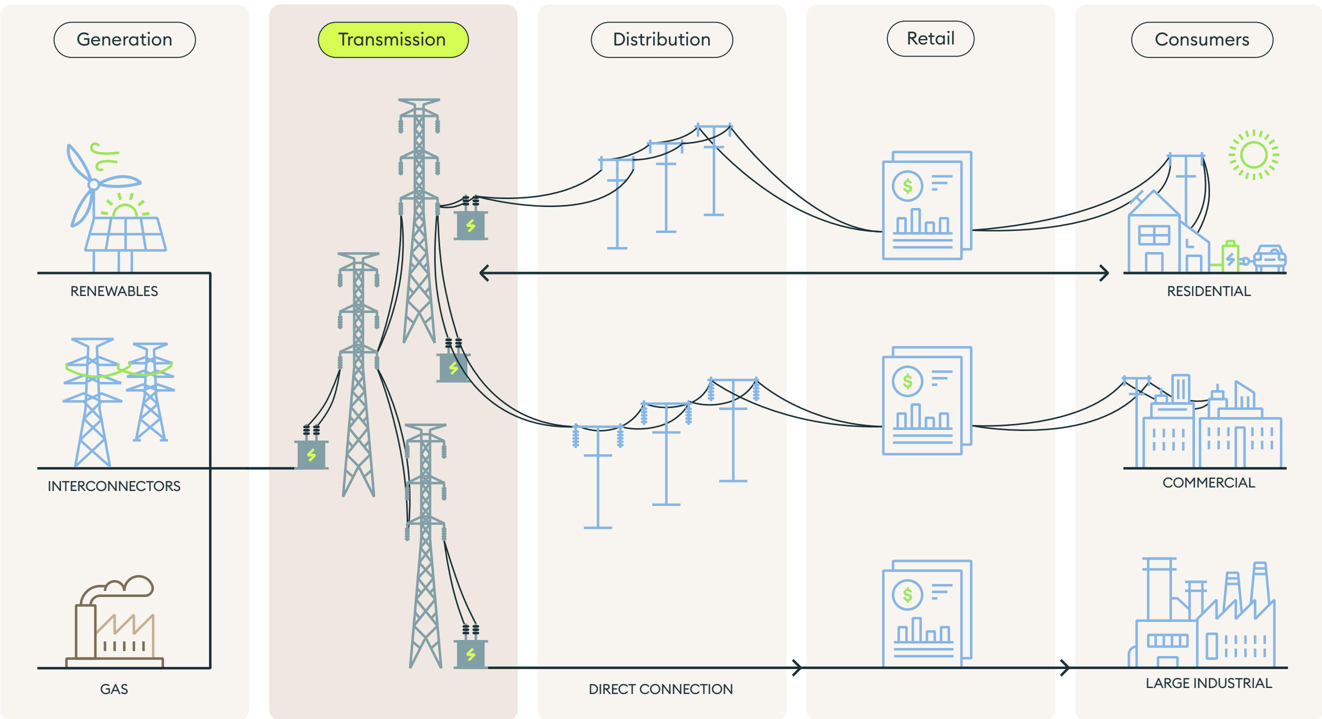
We're enabling the transition to a clean energy future for South Australia

Today, with the majority of our state's electricity coming from renewable sources, and with a South Australian Government target of 100% net renewable energy by 2027, we're leading the world in the green energy transition and doing things many wouldn't have thought possible.

ElectraNet is the owner and operator of South Australia's electricity transmission network, which transports energy from local and distant generation sources to where it is needed to serve electricity consumers. We play a critical role in enabling South Australia to be a leader in the global energy transformation. The electricity transmission network powers homes, businesses and communities, enabling the transition to a clean energy future.

As the state's principal electricity Transmission Network Service Provider (TNSP) we also provide system services, such as system strength and inertia to support the growth in renewable energy, and connection services to customers and generators wanting to connect to the transmission network.

We are committed to navigating this transition with our customers and stakeholders while maintaining affordable, reliable and sustainable electricity supply.



Electricity is generated from traditional and renewable energy sources such as wind, solar, gas and coal.

Electricity enters ElectraNet's network where it is converted to higher voltages for efficient long-distance transport to cities and towns around South Australia. The voltage is then lowered so it can enter the distribution network or be supplied directly to some large industrial customers.

The distribution network, operated in South Australia by SA Power Networks, transports low-voltage electricity to residential and commercial customers.

Retailers are the primary point of contact for residential and commercial customers. They coordinate connections and manage billing and payments.

The traditional flow of electricity supply is changing. Over one in two South Australian homes now combines the electricity they draw from the network with power generated by rooftop solar panels. They also contribute surplus electricity back to the network.

Our Vision

Energising South Australia's clean energy future

Our Purpose

We are leaders in the clean energy transition, delivering reliable and sustainable electricity transmission services and valued customer connections

Our Strategy

To deliver on our Vision, ElectraNet has developed a Network Transition Strategy to provide a pathway and framework for working with our customers and stakeholders to manage the challenges and opportunities of the energy transition. The strategy is guided by our asset management objectives and is underpinned by three key themes to ensure we continue to develop and implement solutions to enable the energy transition.

Priorities

- Safety
- Affordability
- Reliability
- Sustainability

Energy reliability

Plan and deliver timely and efficient transmission infrastructure to connect customer loads with renewable energy and storage and maintain reliability of supply.

Power system security and resilience

Deliver system services and protection and emergency control schemes to maintain power system security and resilience during the energy transition.

Operability

Uplift network planning and operations capabilities, systems and tools to manage the increasing complexity and risk of the power system.

Purpose of the Transmission Annual Planning Report

Each year, ElectraNet reviews the capability of South Australia's electricity transmission network and customer connection points to ensure they are able to meet the ongoing and increasing demand for electricity transmission services, under a wide variety of forecast operating scenarios.

ElectraNet undertakes joint planning with SA Power Networks, which is responsible for the electricity distribution network throughout South Australia, and with the Australian Energy Market Operator (AEMO) as the National Transmission Planner, to complete the review. ElectraNet also provides input to and considers the findings of AEMO's Integrated System Plan and the outcomes of joint planning with AEMO in its role as Victorian Transmission Planner, along with interstate TNSPs such as Powerlink in Queensland, Transgrid in New South Wales and AusNet Services in Victoria (Appendix A).

This report presents the outcomes of the annual planning review and forecasts to help you understand the current capacity of the transmission network and how we think this may change in the future. The report covers a 10-year planning period to June 2035 and identifies potential network capability limitations and possible solution options. Significant changes from the 2024 Transmission Annual Planning Report are presented in Appendix B.

We also publish supporting data for our Transmission Annual Planning Reports on our website.[1] We will publish the supporting data for this Transmission Annual Planning Report later in 2025.

The Transmission Annual Planning Report provides deep insight across several key focus areas:

- the state of the transmission network and the drivers behind increasing demand (chapter 1)
- evolving electricity demand, particularly the rise of large industrial load and the impact of rooftop solar output (chapter 2)
- connection opportunities for both load and generation customers, alongside technical advice for new entrants (chapter 3)
- ElectraNet's approach to community engagement and environmental sustainability (chapter 4)
- network constraints and ongoing development projects (chapter 5)
- challenges of maintaining security, system strength, and resilience in a rapidly changing operating environment (chapter 6).

This report forms part of an ongoing consultation process to ensure the efficient and economical development of the transmission network to meet forecast electricity demand and support the transition to renewable energy sources over the planning period. Decisions by ElectraNet to invest in the South Australian transmission system are subject to further detailed investigation and economic assessment that will be undertaken closer to the time the investments are needed.

We are committed to ongoing improvement of the Transmission Annual Planning Report, and its value to our customers, consumers, and industry stakeholders.

We invite feedback on any aspect of this report. Your feedback will help us to serve you better and ensure we can continue to provide reliable and affordable electricity transmission services.

Comments and suggestions can be directed to:

consultation@electranet.com.au

Phone: +61 8 8404 7966

[1] ElectraNet | Transmission Annual Planning Report

Message from the Chief Executive Officer

South Australia continues to show the nation and the world what leadership looks like in the energy transition. But this next chapter is different.

We're moving beyond simply generating renewable energy. We're now entering a phase where clean energy is being used to reshape our economy. Industries are choosing to invest here because of the strength of our renewable grid. Projects are scaling up faster. Expectations are higher. And our transmission network must rise to meet this moment.

At ElectraNet, we are seeing demand and ambition that would have seemed unimaginable only a few years ago. What was once a slow and steady transition is becoming a rapid and transformative wave of industrial electrification, green steel, data centres, hydrogen hubs, and critical mineral developments.

This Transmission Annual Planning Report outlines not only the opportunities ahead but also highlights that our frameworks, planning assumptions and regulatory settings need to keep up with the pace of change. We need to plan for what's coming, not just what's already committed. And we need to ensure South Australia is not held back by models built for the past.

Our team at ElectraNet stands ready to deliver. We are working closely with AEMO, SA Power Networks, government, customers, and industry stakeholders to make sure we build the right infrastructure, in the right places, at the right time.

Our clean energy future is no longer a distant goal. It's happening now. And South Australia must be equipped to maximise the opportunity for all South Australians.

Simon Emms
Chief Executive Officer
ElectraNet

Executive Summary

South Australia's energy transition is accelerating, and so too is the need for a transmission network that can keep pace with today's reality.

This 2025 Transmission Annual Planning Report highlights the growing urgency and complexity of this task as ElectraNet prepares for an electricity future driven by large-scale industrial demand and decarbonised generation. The urgency in the transition requires ElectraNet to publish this Transmission Annual Planning Report only seven months after the previous report. This also improves the alignment of our planning report with the timing and growing prominence of AEMO's Integrated System Plan (ISP), the next draft of which is expected in December.

Since the early 2000s, South Australia has transformed from a fossil fuel-dependent state to one that is now powered by 74% net renewables annually and on track to achieve 100% net renewable energy by 2027. This transition has laid the foundation for a new phase of growth, one in which clean energy becomes the bedrock of industrial development, economic opportunity, and sovereign capability.

Large industrial loads – across mining, green steel, desalination, and data centres – are now driving record levels of connection enquiries. Active interest in new load connections in the short to medium-term currently exceeds 2,500 MW, with about 1,300 MW of additional demand forecast by 2035.

This surge is driven by ambitious State and Federal policy settings, including the State Prosperity Project and the Future Made in Australia plan, which together are catalysing billions in green industrial investment. The combination of abundant renewable resources, supportive government policy and an established record of delivering transmission solutions is placing South Australia at the forefront of Australia's clean energy economy.

The first key observation of this report is that recent forecasts utilised in the ISP underestimate future electricity demand in South Australia and do not reflect the emerging reality. In an environment of growing demand and rapid change it is critical that demand forecasts and scenario plans are sufficiently flexible to capture expected load growth to support efficient and timely transmission development to deliver the transition to net zero at least cost to consumers.

The scenario weightings that were utilised in the 2024 ISP will likely lead to an undervaluing of the need for and estimated benefits of potential ISP projects in South Australia. The rate of developments in South Australia continues to track the *Green Energy Exports* scenario. As such, ElectraNet believes the weighting of the *Green Energy Exports* scenario is unrealistically low to the point that the assessment of ISP projects will be incapable of supporting the investment required to enable the scenario. This risks underinvestment in, or late development of, electricity infrastructure in South Australia, negatively impacting the prosperity of South Australia.

The second key observation of this report is that existing transmission planning arrangements and economic regulatory approvals are lagging the South Australian demand outlook and should be reviewed in the context of the state's rapidly accelerating energy transition. Past regulatory approaches are becoming an increasingly unreliable method to meet current and emerging demand signals.

South Australia's clean energy transition is well advanced–but staying ahead of demand will require coordinated, strategic and forward-leaning investment. This Transmission Annual Planning Report is both a roadmap and a call to action to ensure that our infrastructure keeps pace with the opportunity. By working together, industry, government, market bodies and the community can ensure that South Australia remains a global leader in the net zero economy and continues to unlock its clean energy future.

Chapter 1

State of Transmission

1.1 Enabling South Australia's Energy Transition

South Australia leads the national energy transition.

Its world leading levels of variable renewable energy resources have frequently been providing the state with 100% or more instantaneous variable renewable energy generation since October 2021.

In addition, South Australia now averages 74% net variable renewable energy on an annual basis, driven by the uptake of large-scale wind and solar resources, and rooftop solar photovoltaic (PV).

More than 3,500 MW of large-scale wind and solar generation has connected to the network, and over the past six years rooftop solar PV capacity has increased threefold to over 2,400 MW.[2]

With South Australia at the forefront of the energy transition, ElectraNet, as the state's principal electricity Transmission Network Service Provider (TNSP) is a key enabler of the transition to net zero.

We play a vital role in powering homes, businesses and communities, with both our transmission infrastructure and expert workforce being centrally important to maintenance and growth of South Australia's electricity supply chain.

Our award-winning network engineering solutions[3] are meeting the challenges and opportunities presented by this 'once in a generation' shift as we continue to manage and develop ElectraNet's almost 7,000 circuit kilometres of transmission line to meet the state's energy needs.

ElectraNet plays a central role in delivering South Australia's energy transition at increasing scale and speed and we continue to work closely with energy market regulators in monitoring the impact of new activity on the network, forecast and advise of potential challenges, and invest appropriately to address them.

The complexity of re-engineering the state's electricity system, while also continuing to ensure energy reliability and security, cannot be overstated. In the face of this challenge, ElectraNet continues to build on its solid track record of delivering efficient and timely network solutions in one of the world's most rapidly evolving operating environments.

This theme of rapid evolution is central to this 2025 Transmission Annual Planning Report.

1.1.1 Demand Growth

The energy transition is entering a new phase in South Australia, as we progress from integrating and stabilising renewable generation across the network, to an environment where renewable generation and low-emissions energy provides the basis for economic and industrial growth.

Policy and funding measures enacted by state and federal governments are demonstrably catalysing 'green' industrial growth across South Australia, with ElectraNet receiving historically unprecedented levels of inquiry from proponents seeking connection to South Australia's transmission network.

Consistent with the advice provided in ElectraNet's 2024 Transmission Annual Planning Report, we continue to expect significant increases in large industrial load consumption as the number of large industrial load connection enquiries continues to accelerate.

A key message of this report is that changes in approach to scenario modelling, regulatory approvals and funding processes are needed to enable the timely and efficient delivery of new transmission infrastructure and to meet the rapidly increasing demand outlook we are seeing in South Australia.

Failure to adequately plan for transmission and connection of new large industrial loads, generation and storage projects risks putting a handbrake on the energy transition and the new economic activity it is creating. In turn, this risks creating higher cost outcomes for customers and threatens the ability to meet a range of State and Federal policy objectives.

This is most acutely the case in South Australia with its world-leading penetration of variable renewable generation, and where the blueprint for the nation's energy transition and green reindustrialisation is being developed at a faster-than-anticipated pace.

[2] AEMO | South Australian Electricity Report

[3] September 2024: ElectraNet | ElectraNet claims major SA Energy Award
September 2024: Energy Networks Australia | ElectraNet wins Energy Networks Industry Innovation Awards
December 2024: ElectraNet | ElectraNet wins at 2024 Premier's Energy and Mining Awards

Our Transformational Journey

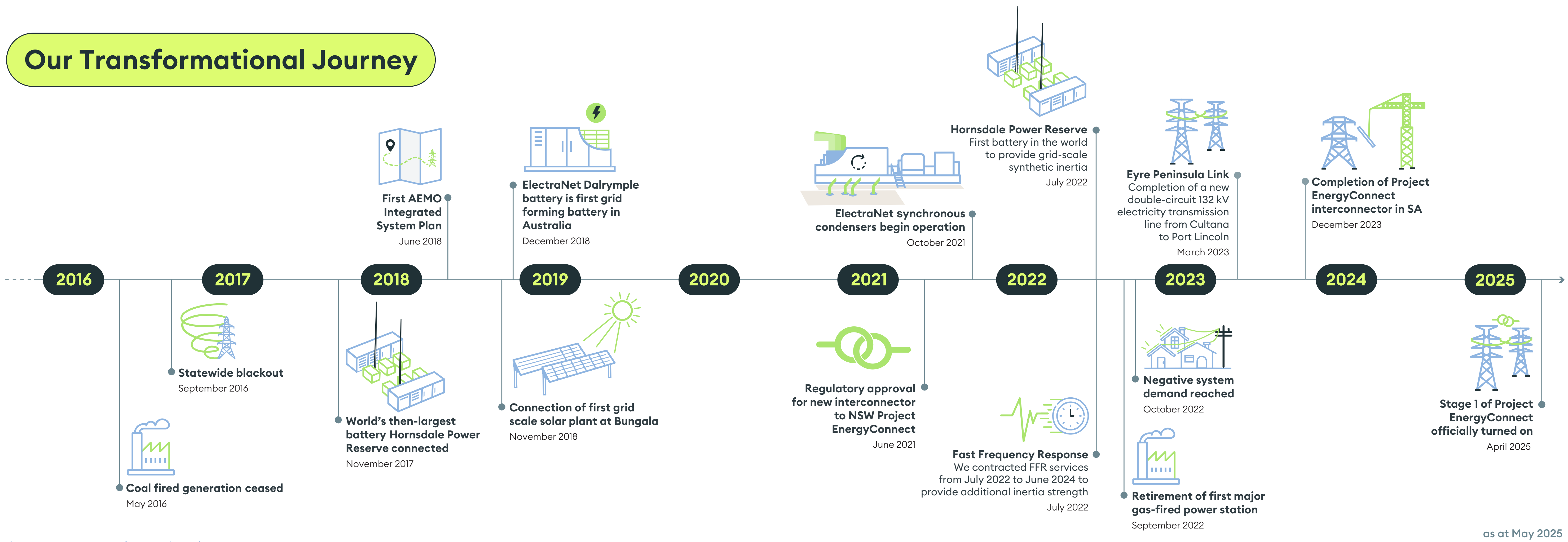


Figure 1: Our Transformational Journey

1.1.2 South Australia's Energy Transition – Historical Context, Present Challenges & Future Direction

South Australia's energy transition commenced in earnest in 2003 with the connection of the first major South Australian wind farm, driven by the Mandatory Renewable Energy Target enacted by the Federal Government in 2001. In 2004 the Government of South Australia enacted the first South Australian Renewable Energy Target, comprising a target of 15% renewable energy generation by 2014 and 26% by 2020.

In two decades, the state's electricity system has gone from being made up of 90% fossil fuels and 10% renewables to one where 74% of South Australian demand is met by South Australian renewables with the balance largely provided by gas-fired generation and interconnector imports.

Successive South Australian governments have maintained and expanded renewable energy and decarbonisation objectives, including mapping the state for the most prospective areas for renewable energy development, resulting in an environment which has catalysed clean energy investment in a manner distinct from other Australian jurisdictions.

There are several historical considerations that have been influential on South Australia's electricity transition journey, including:

- South Australia has excellent wind resources located near the existing transmission network, especially in the Mid North of the state. Additionally, wind farm approvals are streamlined in South Australia making it historically faster and less expensive to obtain approval compared to other jurisdictions. This made South Australia a jurisdiction of choice for early wind farm proponents
- Successive South Australian governments have incentivised rooftop solar PV adoption, resulting in South Australia having a higher penetration of rooftop solar PV on both a per-capita and a per-residence basis than any other jurisdiction
- The relatively small size of the South Australian system compared to other mainland NEM jurisdictions means that the rapid development of wind farms and rooftop solar PV has had a significant and noticeable impact in net demand patterns
- Earlier retirement of the coal-fired generator fleet compared to other mainland NEM jurisdictions meant that South Australia had to solve issues of system strength and voltage control at times of declining minimum demand far sooner than other jurisdictions, which are just beginning to address these issues as part of their own energy transition journeys.

Today, South Australia has over 3,500 MW of large-scale wind and solar generation capacity and over 2,400 MW of installed rooftop solar PV capacity.[4] This compares to average grid demand of about 1,300 MW and peak demand of about 3,300 MW (section 2.6).

The South Australian electricity system is already being constrained at times, as South Australia rapidly approaches 100% net renewable electricity supply by 2027. As such, ElectraNet is undertaking proactive planning of future projects. This work encompasses analysis of potential projects to understand likely constraints on the network ahead of time. ElectraNet's actions to address system constraints are detailed in Chapter 5 of this Transmission Annual Planning Report.

[4] AEMO | South Australian Electricity Report

South Australia's influx of variable renewable generation has shifted the timing of peak demand. It is also necessitating network solutions to manage periods of excess renewable generation when electricity is in oversupply, and insufficient renewable generation where gas generators are used to ensure no supply shortfall. ElectraNet's efforts to ensure system resilience and security are detailed in Chapter 6 of this Report.

South Australia's high penetration of renewables, along with the extensive work done to integrate and stabilise renewable generation across the South Australian transmission network, has provided a foundation for the next phase of the state's energy transition.

Investments made by ElectraNet that have been critical to the transition include:

- Project EnergyConnect, an 800 MW interconnector to New South Wales spanning 900 km which is being built in coordination with Transgrid, and which will be essential to achieving the South Australian Government's 100% net renewable targets
- Four synchronous condensers in the north of the state to provide inertia and system strength services that stabilise the network during unexpected events
- Delivery of the flexible Eyre Peninsula Link that has improved reliability for the Eyre Peninsula and will be able to support massive load growth on the Eyre Peninsula and Upper Spencer Gulf regions.

Combined with supportive government policy settings South Australia is attracting high levels of interest from large industrial load proponents seeking to develop 'green' industrial projects, as well as interest from renewable generation proponents investigating connections to supply these anticipated large industrial loads.

Active interest in new load connections in the short to medium-term currently exceeds 2,500 MW, driven by electrification and green reindustrialisation of the economy as loads seek access to South Australia's clean energy. This includes new mining activity, electrification of industrial processes, data centres and other new economic activity.

ElectraNet is also aware of a range of other potential industrial loads that have not yet started connection discussions, which would bring total interest in new connections to over 15,000 MW.

Even if only 10 to 20% of the large industrial loads seeking to connect are ultimately connected, this could result in an increase in maximum electricity demand in the range of 1,500 to 3,000 MW. ElectraNet's analysis indicates that of these proposed loads, approximately 1,300 MW is forecast to connect to the transmission network by 2035.

Interest in Battery Energy Storage Systems (BESS) connections to the transmission network is also expected to increase installed and committed capacity in South Australia far beyond today's nearly 1,400 MW, with almost 4,000 MW pursuing connection.

1.2 Scenarios of South Australian Growth

Scenario weightings applied in the 2024 ISP will likely lead to an undervaluing of the estimated need for and benefits of ISP projects in South Australia relative to the rate of economic and industrial development. This risks underinvestment in, or late development of, electricity infrastructure in South Australia.

AEMO's 2024 Integrated System Plan (ISP) finds that the lowest-cost way to supply electricity to homes and businesses through Australia's transition to a net zero economy is:

- renewable energy
- connected with transmission and distribution
- firmed with storage
- backed up by gas-powered generation.

The ISP provides a comprehensive road map for the NEM and seeks to facilitate the efficient development and connection of renewable energy zones across it.

The ISP identifies an Optimal Development Path for development of the NEM, which will see fossil fuelled legacy assets replaced with low-cost renewables, the addition of energy storage and other new forms of firming capacity, and reconfiguration of the grid to support two-way energy flow.

Importantly, the ISP undertakes scenario modelling to capture a broad spectrum of possible futures to help guide long-term planning of the Australian energy system. By modelling different scenarios, AEMO can assess the impact of key uncertainties on the power system and identify the investments needed to ensure reliability, affordability, and sustainability in each case.

This modelling informs key decisions about infrastructure, market design, and policy direction in the transition to a low-carbon energy system.

Each of these scenarios is based on different assumptions about how quickly new technologies will emerge, how policies will evolve, and how the global energy landscape will shift; allowing stakeholders to understand the risks and opportunities associated with different futures.

AEMO assessed three scenarios in the 2024 ISP and assigned a percentage-based weighting to them.

- ***Green Energy Exports (15% weighting)***
  Reflects a very rapid decarbonisation rate to support Australia's contribution to limit global temperature rise to 1.5°C, including strong electrification and a strong green energy export economy.
- ***Step Change (43% weighting)***
  Reflects a pace of energy transition that supports Australia's contribution to limit global temperature rise to less than 2°C, with consumer energy resources (CER) contributing strongly to the transition.
- ***Progressive Change (42% weighting)***
  Also reflects Australia's current policies and commitments to decarbonisation, but more challenging economic conditions and supply chain constraints mean slower investment in utility-scale assets and CER.

AEMO's Draft 2025 IASR proposed to introduce a *Green Energy* scenario to refine and replace the previously defined *Green Energy Exports* scenario. AEMO proposes to define the *Green Energy* scenario according to one of two potential variants:

- ***Green Energy Exports***
  Similar to the existing *Green Energy Exports* scenario, this variant would include development of a hydrogen industry, focusing on value-add hydrogen products, such as green iron and steel, for domestic use and export. It would also consider the significant opportunity for hydrogen production and associated manufacturing users to develop products for export, including hydrogen as an energy carrier.
- ***Green Energy Industries***
  This variant would include development of a hydrogen industry, focusing on value-add hydrogen products, such as green iron and steel, for domestic use and export. It would exclude those developments that are expected to support hydrogen exports as an energy carrier, thereby representing a materially smaller hydrogen impact on investment requirements than the *Green Energy Exports* variant.

ElectraNet supports *Green Energy Industries* as the more appropriate variant for selection as the *Green Energy* scenario in AEMO's 2025 IASR scenario collection, replacing the *Green Energy Exports* scenario that was used for the 2024 ISP. This variant aligns with ElectraNet's advice to focus more on domestic development of energy intensive industries exporting value-added products, rather than direct energy exports.

ElectraNet supports AEMO's proposal in the Draft 2025 Inputs, Assumptions and Scenarios Report[5] (IASR) to continue using the *Step Change* and *Progressive Change* scenarios in addition to the refined *Green Energy* scenario, recognising their general relevance and utility for national assessments.

While ElectraNet also supports the assigned scenario weightings at a national level, the weightings attached to these scenarios understate South Australia's expected economic development, advanced position in the energy transition, and significant interest in connecting new large industrial loads.

For these reasons, ElectraNet does not see the *Progressive Change* scenario as relevant for network development in South Australia. The *Progressive Change* scenario should be excluded from consideration in the analysis of the need for and benefits of ISP projects that relate to South Australia.

The weightings used in the 2024 ISP will likely lead to an undervaluing of the estimated need for and benefits of ISP projects in South Australia relative to the anticipated rate of economic and industrial development.

Specifically, the 15% weighting of the 2024 ISP's *Green Energy Exports* scenario is sufficiently low that the assessment of ISP projects may be incapable of supporting the investment required to enable the scenario.

AEMO's *Progressive Change* scenario is not representative of network development requirements in South Australia. *Green Energy Industries* is the more appropriate variant for application as the *Green Energy* scenario in AEMO's 2025 IASR scenario collection. It reflects South Australia's focus on domestic development of energy intensive industries exporting value-added products, rather than direct energy exports. The 2026 ISP should reflect this.

ElectraNet emphasises that this risks underinvestment in, or late development of, electricity infrastructure in South Australia if developments in South Australia continue to track the *Green Energy* scenario more closely (and the *Progressive Change* scenario less closely) than the rest of the NEM does. This would delay the ability of some new large industrial load customers to connect in their preferred timeframes and negatively impact the prosperity of South Australia.

[5] AEMO | ElectraNet's Draft 2025 Inputs, Assumptions and Scenarios Report

1.2.1 Accounting For Future South Australian Demand Growth

Forecasts used in the ISP underestimate future electricity demand in South Australia. ElectraNet expects to connect an additional 1,300 MW of additional load to the transmission network by 2035, representing an approximate 100% increase in connected loads over a ten-year period. Large industrial loads represent the majority of this demand.

ElectraNet's key observation of recent forecasts used in the ISP is that they underestimate future electricity demand in South Australia. This tendency to underestimate can be seen in the forecast maximum, average and minimum demands in the 2024 Electricity Statement of Opportunities[6] (ESOO).

These forecasts describe an electricity system that in the two most heavily weighted scenarios is forecast to either grow very slowly or drop between 2025 and 2035. This is contrary to our expectation of significant leaps in demand in the near term even if only a small proportion of large industrial load proposals eventuate.

ElectraNet's 50th percentile demand forecast for AEMO's *Step Change* scenario narrative anticipates electricity demand almost 50% higher than the maximum electricity demand in 2024–25 (section 1.4). Such an increase in load would also require the connection of commensurate levels of renewable generation to supply this load and maintain South Australia's 100% renewables target. ElectraNet would need to undertake substantial network augmentation and development to service this level of demand and generation growth. Most importantly, lead times for network development are generally longer than for load and generation development, underlining the importance of a sufficiently forward-looking approach to demand to support timely transmission planning and development.

In an environment of growing demand and rapid change it is critical that demand forecasts and scenario plans are sufficiently flexible to capture expected load growth, given the need to ensure timely and efficient transmission development to deliver the transition to net zero at least cost to consumers. Chapter 2 of this Report addresses demand considerations in greater detail.

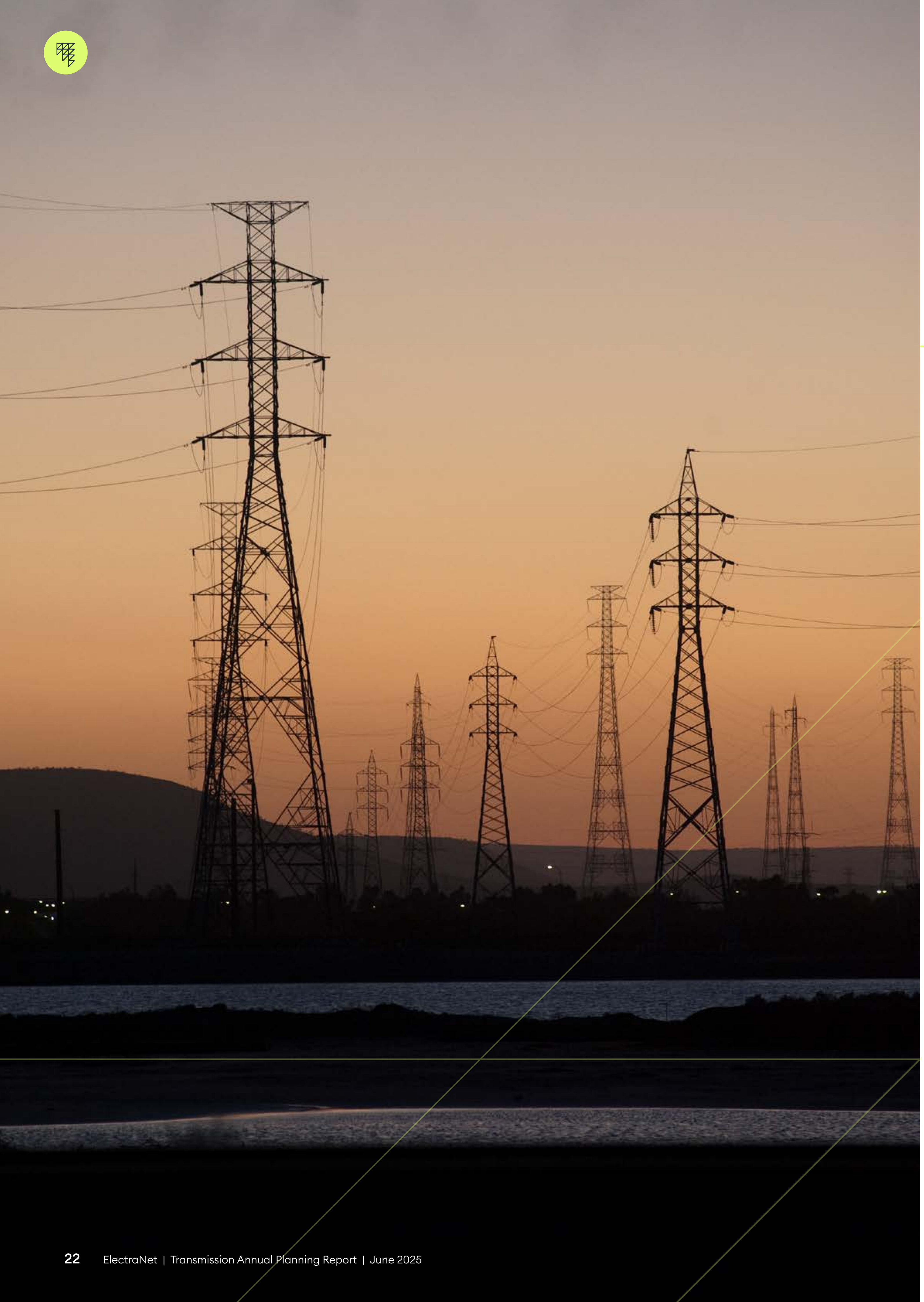
Recognising the pace of change, ElectraNet emphasises the importance of accounting for South Australia's distinctive circumstances in scenario planning. Based on historical methods, new large industrial loads are not included in demand forecasts until they reach the significant threshold of 'committed'.

ElectraNet's submission to the AEMO's 2024 Electricity Demand Forecasting Methodology Draft Report consultation[7] supports the proposal to expand the definitions of new large industrial loads projects to include 'committed', 'anticipated', and 'proposed' to reflect different development stages of a project's lifecycle and capture a more realistic assessment of the demand outlook.

This change is especially helpful in the South Australian context as it enables non-committed large industrial load projects to be better incorporated into transmission planning and increases the likelihood of optimised outcomes for the community-based on a planning outlook that reflects expected load growth.

[6] AEMO | 2024 Electricity Statement of Opportunities

[7] AEMO | ElectraNet's 2024 Electricity Demand Forecasting Methodology Draft Report



1.3 Government Policy Settings are driving new Economic Activity

Government policy settings have become strong drivers of new economic activity.

In recent years, the South Australian and Australian Governments have funded major policy measures aimed at driving net zero, economic transformation and green reindustrialisation.

These represent a significant shift toward interventionist industry policy settings designed to catalyse new economic activity.

The significant levels of financial investment and regulatory support that now attach to State and Federal policies are translating to new industrial activity in South Australia, such that ElectraNet is experiencing historically unprecedented levels of enquiry for network connection.

Government policy settings and funding commitments are creating new economic activity and driving historically unprecedented connection demand in South Australia. Targeted industry policy and funding support are catalysing energy transition and green industry activity.

The intense policy focus afforded to net zero, energy transition and green industry outcomes is having a significantly larger impact when compared to earlier years (Figure 2).

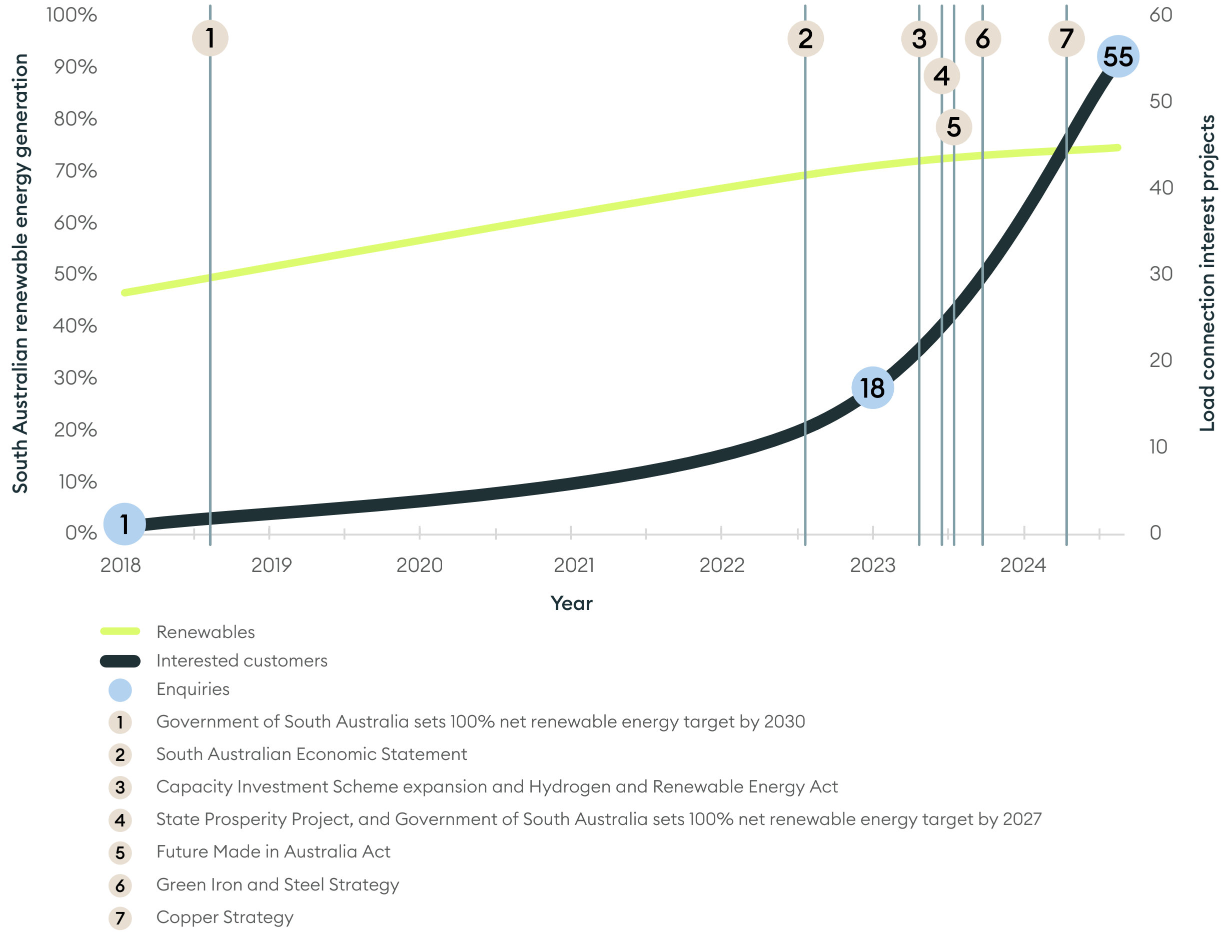


Figure 2: Correlation of policies and connection interest

These policy measures are attracting new proponents to South Australia that need to be connected to the transmission network. ElectraNet expects impacts on the energy system from both the supply and demand sides.

As such, ElectraNet believes that greater regard must be given to the effect of State and Federal policy measures by AEMO and the Australian Energy Regulator (AER) for the purpose of scenario modelling, network development planning and funding.

For example, the various projects supported by the State Prosperity Project, which include increased mining, various green iron and steel projects and the Port Bonython Hydrogen Hub must be reflected in future demand forecasts. These projects enjoy the support of both industry and the Government of South Australia.

AEMO's approach to demand forecasting must support the inclusion of the South Australian government policies outlined here.

1.3.1 Government of South Australia Policy

The following is a summary of major Government of South Australia policy initiatives aimed at decarbonising the state's economy, while increasing its economic complexity and driving new 'green' industrial activity.

These policy measures build upon the Government of South Australia's headline target of "net zero emissions by 2050" and the aspirations set out in the **South Australian Economic Statement**,[8] published shortly after the election in 2022.

Central to the South Australian Economic Statement is the aim to "capitalise on the global green transition,"[9] to accelerate the state's energy transition, and to promote the reindustrialisation of South Australia through green energy and green product investments.

State Prosperity Project[10]

The focus of the State Prosperity Project is to transform the Upper Spencer Gulf to become a hub for the sustainable industries necessary for achieving the state's net zero and economic transformation goals.

The Government of South Australia views the convergence of renewable energy resources close to the state's abundant mineral resources as a historic opportunity for development of major resource provinces that will also support the production of green iron and steel, consistent with both its net zero and economic development ambitions.

Projects under the umbrella of the State Prosperity Project, such as the **Port Bonython Hydrogen Hub**[11] and the **Green Iron & Steel Strategy**,[12] have received strong industry buy-in and are supported by both the South Australian and Australian Governments.

This is expected to drive significant increases in demand as new industrial customers connect, and also drive significant increases in renewable energy generation to support the increasing demand.

Northern Water Project[13]

The Northern Water Project aims to deliver a reliable and sustainable new commercial water source to meet the growing needs of a broad range of mining, including for copper and other valuable minerals, defence, hydrogen and pastoral industries in the northern part of South Australia. Its goal is to develop a seawater desalination plant and 600 km pipeline system, to provide a new, climate-independent water supply for industry on the Eyre Peninsula, Upper Spencer Gulf and Far North of South Australia.

The Northern Water Project has potential to contribute an additional average $5.2 billion to South Australia's gross domestic product. Over its lifetime it would create an average 4,200 additional jobs in resources, renewables and the net zero transformation.[14]

Once complete, the Northern Water Project will unlock economic growth in industries and regions that are crucial to achieving net zero targets. This is expected to enable the connection of new industrial customers, significantly increasing demand and also drive significant increases in renewable energy generation to support the increased demand.

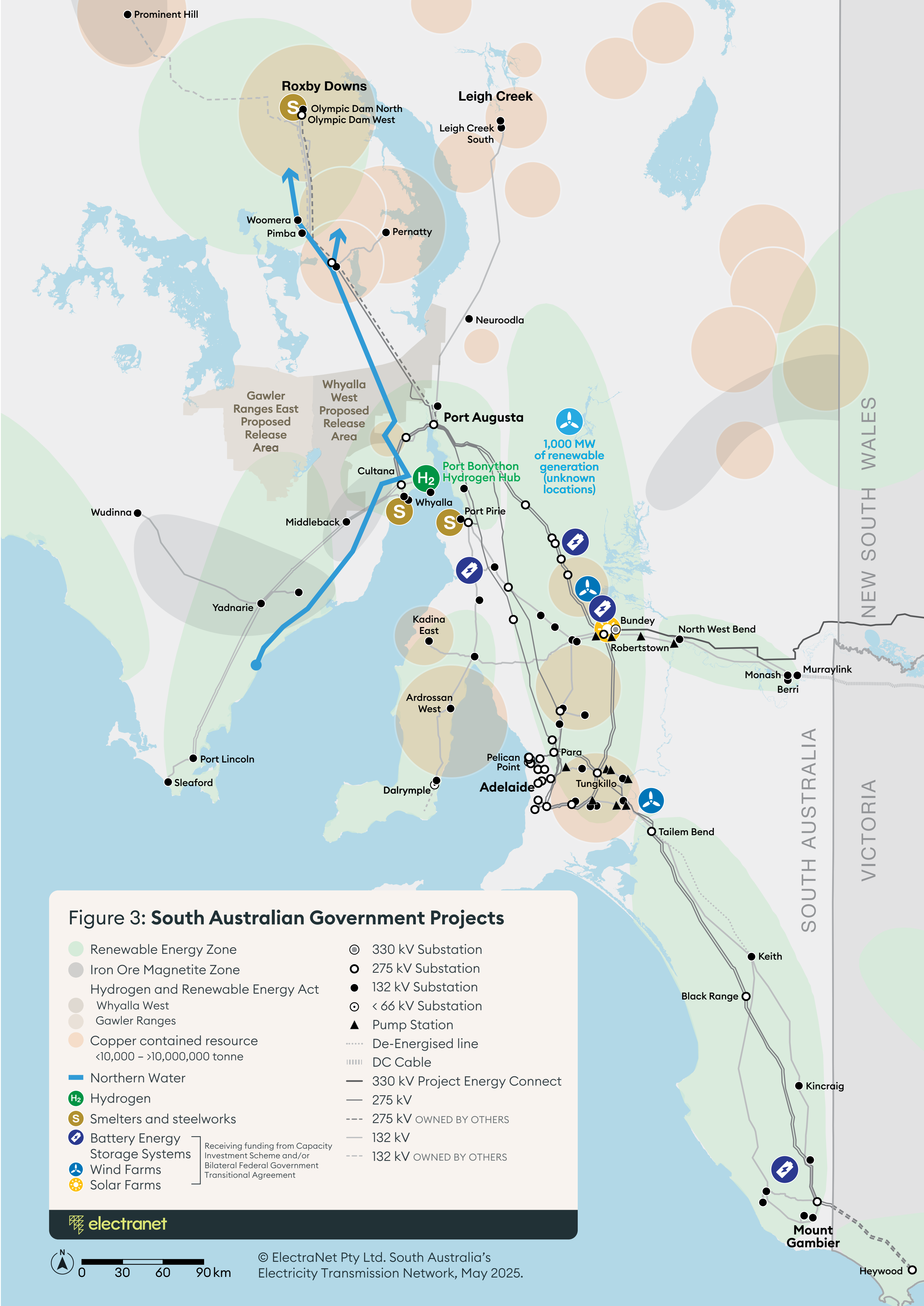


Figure 3: **South Australian Government Projects**

© ElectraNet Pty Ltd. South Australia's Electricity Transmission Network, May 2025.

[8] Government of South Australia | South Australian Economic Statement
[9] Government of South Australia | South Australian Economic Statement, page 19
[10] Government of South Australia | State Prosperity Project
[11] Office of Hydrogen Power SA | Port Bonython Hydrogen Hub
[12] Energy & Mining | South Australia's Green Iron and Steel Strategy
[13] Northern Water | Project Overview
[14] Northern Water | Business Case Summary

Hydrogen and Renewable Energy Act 2023[15]

The Hydrogen and Renewable Energy Act 2023 (HRE Act) represents a significant advancement in South Australia's commitment to renewable energy and hydrogen production.

Enacted in November 2023, the HRE Act establishes a comprehensive regulatory framework to oversee the development of large-scale hydrogen and renewable energy projects throughout their entire lifecycle including stages from initial exploration and land acquisition to construction, operation, maintenance, decommissioning, and rehabilitation.

The HRE Act introduces a process to facilitate renewable energy development on designated land through the designation of specific 'release areas'.

Once a release area is declared, renewable energy companies submit competitive tenders to develop projects there.

This process ensures only the most suitable and sustainable projects are awarded access, while also supporting regional development objectives and allowing for co-existence with existing land uses.

Consultation on an initial two release areas was concluded in October 2024:

- **Gawler Ranges East proposed release area** which spans approximately 5,200 km^2 on the Upper Eyre Peninsula
- **Whyalla West proposed release area** which spans approximately 6,500 km^2 in the Upper Spencer Gulf region.

The HRE Act is expected to drive load and connection opportunities, require strategic network development, and influence the location and extent of renewable energy generation development in South Australia.

State Development Coordination & Facilitation Bill 2025[16]

This legislation is intended to drive rapid development in statutorily declared State Development Areas.

Creation of State Development Areas and expedited approval powers afforded to the Coordinator General are intended to significantly reduce the timeframes associated with project development and facilitate enabling measures like common user infrastructure corridors.

Through this legislation, the Government of South Australia aims to:

- Facilitate economy-wide decarbonisation and net zero industry growth
- Ensure that South Australia's regulatory and planning system is effective, efficient, competitive and fit-for-purpose for our transition to net zero
- Provide new powers through creation of the office of the Coordinator General to better coordinate, consolidate and streamline regulatory processes
- Proactively address known challenges faced by major and complex projects
- Enact 'State Development Areas' – environmentally and economically suitable 'go zones', such as net zero industry precincts – that have been proactively assessed by regulators as environmentally and economically suitable for key developments to be facilitated at pace, while leaving existing planning and regulatory legislation otherwise unchanged.

This Act will streamline major project approvals, making it easier for the State to attract businesses and projects that boost economic complexity and increase electricity demand.

Whyalla Steelworks Support[17]

In February 2025 the South Australian and Australian Governments announced a $2.4 billion joint funding package to stabilise the Whyalla Steelworks, support employment and attract more investment into Australian made iron and steel.

Whyalla is critical to Australian steel production and underpins sovereign manufacturing capability. It is one of only two Australian steelworks, produces 75% of Australian structural steel and is the only domestic producer of long steel products.

$1.9 billion of the joint funding package is earmarked to work with a new owner to invest in the upgrades and infrastructure to ensure the Steelworks has a sustainable, long-term future.

[15] Energy & Mining | Hydrogen and renewable energy regulation

[16] Premier of South Australia | New legislation to accelerate housing, jobs

[17] Energy & Mining | Australian and South Australian Governments supporting Whyalla Steelworks and local jobs with $2.4 billion package

1.3.2 Australian Government Policy

The following is a summary of major Australian Government policy initiatives that will continue to drive the development of renewable energy generation, energy storage, and 'green' industrial activity in South Australia.

Future Made in Australia[18]

The Australian Government's Future Made in Australia policy, introduced in the 2024–25 Budget, is a comprehensive economic plan aimed at maximising the economic and industrial benefits of the net zero transition.

Key development priorities include renewable hydrogen, critical minerals processing, green metals, low carbon liquid fuels, and clean energy manufacturing.

$13.7 billion in hydrogen and critical minerals production tax incentives was made available in the 2025–26 Federal Budget, with an additional $1.5 billion in support for priority areas through the Future Made in Australia Innovation Fund. This includes $750 million for green metals, $500 million for clean energy technology manufacturing capabilities, and $250 million for low carbon liquid fuels.

Additionally,a $1 billion Green Iron Investment Fund was introduced to accelerate the development of the green iron and steel industry. Up to $500 million of the Australian Government's $1 billion Green Iron Investment Fund has been earmarked to support long-term transformation of the Whyalla Steelworks.

Initial funding of $22.7 billion in 2024-25 has been committed to a range of initiatives over the next decade under this policy umbrella. As part of this, the Australian Government provided $65 million in the 2024-25 Federal Budget to investigate and progress planning for the Northern Water Project.

Capacity Investment Scheme[19]

The Capacity Investment Scheme (CIS) is an Australian Government revenue underwriting scheme to accelerate investment in:

- Renewable energy generation, such as wind and solar
- Clean dispatchable capacity, such as battery storage.

On 23 November 2023, the Australian Government announced an expansion of the CIS to drive development of a total of 32 GW of new capacity by 2030, comprising:

- 23 GW of renewable capacity representing $52 billion in investment
- 9 GW of clean dispatchable capacity representing $15 billion in investment.

The expanded CIS will be rolled out across 2024 to 2027.

Renewable Energy Transformation Agreements[20]

As an action under the CIS, the Australian Government is negotiating bilateral Renewable Energy Transformation Agreements (RETAs) with all states and territories.

RETAs build on the National Energy Transformation Partnership[21] to address the unique needs of each state and territory in the energy transition. Governments are working together through RETAs to address barriers to delivering new renewable energy, aiming to speed up renewable energy investments, drive better social and economic outcomes, deliver a coordinated approach across Australia, and support an affordable, reliable and resilient energy system for all Australians.

South Australia was the first state to sign a final RETA, to ensure the delivery of enough new renewable energy infrastructure to power every household in Adelaide, in return for dedicated Federal funding support.[22]

Through the SA RETA, the South Australian and the Australian Government have agreed a cumulative allocation for the CIS of about 1.2 GW of generation and 0.9 GW of four-hour equivalent dispatchable capacity.[23]

Taken together, the Capacity Investment Scheme and SA RETA will support further investment in renewable energy generation and firming capacity in South Australia.

[18] Australian Government Treasury | Future Made in Australia

[19] Australian Government DCCEEW | Capacity Investment Scheme

[20] energy.gov.au | Renewable Energy Transformation Agreements

[21] energy.gov.au | National Energy Transformation Partnership

[22] Minister for Climate Change and Energy | Joint media release: Delivering more Reliable Renewables in South Australia

[23] Australian Government DCCEEW | Capacity Investment Scheme

1.4 Managing South Australia's Accelerating Demand

South Australia is attracting growing interest from new electricity loads due to its green energy credentials, facilitative policy settings and government subsidies to drive green industry development.

This has led to a rapid and significant uplift in the electricity demand outlook (Figure 4).

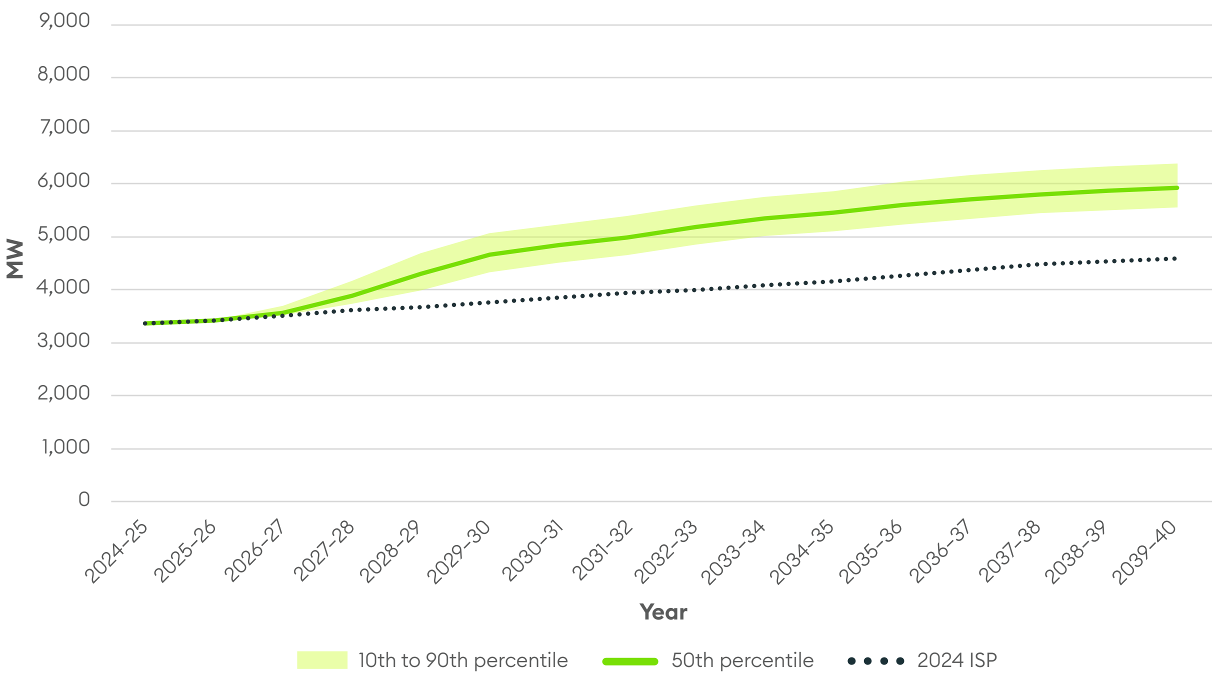


Figure 4: ElectraNet's forecast of future South Australian demand growth

As indicated in section 1.1.2, ElectraNet is actively engaged with a range of existing and potential customers seeking to expand or connect to the South Australian transmission network, with potential load interest in the short to medium-term exceeding 2,500 MW.

ElectraNet is also aware of a range of potential loads that have not yet started connection discussions.

ElectraNet's assessment of the potential connections indicates that 1,300 MW of additional load is forecast to connect to the transmission network by 2035.

The 1,300 MW of additional load that ElectraNet forecasts to connect to the transmission network by 2035 represents a significant increase compared to current average demand of about 1,300 MW.

Timely and efficient transmission development is required to ensure we build the right infrastructure at the right time to connect this load, unlock the renewable generation required to supply this load and deliver least cost outcomes for customers.

Connection of new large industrial loads will typically improve the utilisation of the electricity transmission system.

1.5 Key Transmission Projects

An important focus for ElectraNet is ensuring that connection to the transmission network is well-planned and occurs in a timely and efficient manner to optimise the long-term cost to all users.

ElectraNet is advancing key transmission projects over a five-year timeframe to support South Australia's energy transition and provide adequate and efficient capability and capacity for existing and future customers. These projects will address current and emerging constraints, unlock capacity for new and existing customer demand, and build capability for new generator connection with the transition to renewable energy. These projects are detailed in Chapter 5 of this report at section 5.2.

Eyre Peninsula Upgrade

- New Yadnarie North substation and Cultana – Yadnarie line upgrade
- New switching station near Carrierwerloo, with new double circuit connection to Cultana and connection to both 275 kV lines that pass Carrierwerloo from Davenport.

Northern Transmission Project (NTx)[24]

- New line construction options between Adelaide, Bundey and Cultana
- Templers West new second transformer and Mid North reconfiguration.

South East Expansion (Stage 1)

- String the Tailem Bend to Tungkillo vacant circuit.

Mid North Reinforcement

- Wilmington switching station to be established and upgrading of lines to Davenport and Brinkworth
- Munno Para – Para lines upgrade
- Munno Para – Templers West new line build
- Blyth West – Brinkworth new line build.

ElectraNet also proactively assesses non-network options where these are viable to economically meet growing demand where opportunity and circumstance presents. For example, ElectraNet is currently seeking low-cost network support agreements for provision of **system strength services** to augment the capability of existing synchronous condensers. This will ensure that the continued growth of inverter-based systems is not constrained by a lack of available system strength.

[24] Northern Transmission Project | More information about NTx

1.6 Need for a South Australian Transmission Framework

A key observation of this report is that the cumulative effect of government policy and funding designed to accelerate the energy transition and 'green' industrial growth is now being felt in South Australia.

Interventionist policy specifically intended to catalyse the energy transition is having its intended effect of significantly increasing demand for connection to the transmission network from the specifically targeted industrial sectors.

Existing regulatory processes are lagging South Australia's demand outlook and should be reviewed in the context of the state's rapidly accelerating 'energy transition' environment.

While the additional 1,300 MW of demand that ElectraNet anticipates by 2035 represents a 'medium case' scenario, even a conservative 'low case' scenario of an additional 250 MW would represent a major increase in connected load and corresponding generation and storage to supply it.

ElectraNet's position is that past regulatory approaches are becoming an increasingly unreliable method to meet current and emerging demand signals. An inability to make timely investments in the interests of customers would delay the connection of new large industrial loads.

ElectraNet acknowledges the ongoing efforts of AEMO to set the Optimal Development Path under the ISP; the AER to frequently review and update key aspects of its revenue setting approaches, to ensure they remain fit for purpose; and the AEMC to set the National Electricity Rules (Rules), from which the revenue setting process is derived.

Timely and efficient transmission development is required to ensure ElectraNet builds the right infrastructure at the right time, to unlock the renewable generation required to supply this load and deliver least-cost outcomes for customers and avoid the risks of delayed or under-investment.

In recent years, the NSW, Queensland and Victorian Governments have introduced specific jurisdictional arrangements to address asymmetric risks in the national framework that act as a barrier to scale-efficient development of their transmission networks to connect renewable generation and deliver on state decarbonisation targets and energy policy objectives on a timely basis. The Tasmanian Government is developing similar arrangements.

To date, specific jurisdictional arrangements have not been needed in South Australia. The national framework has enabled the transmission development and generator connections required for South Australia to lead the transition to low emission renewable energy.

Jurisdictional specific arrangements now need to be considered for South Australia to ensure that the transmission network is ready to support our clean energy future and meet the demand for connections arising from new large industrial loads and the need for additional renewable energy to achieve and maintain the state's 100% renewable energy target, firmed by storage and backed by gas generation.

However, the national framework as it currently applies in South Australia can no longer be expected to meet South Australia's needs moving forward and enable this development in the timeframes required. Similar arrangements to those introduced elsewhere now need to be considered for South Australia to ensure that the transmission network is ready to support our clean energy future and meet the demand for connections arising from:

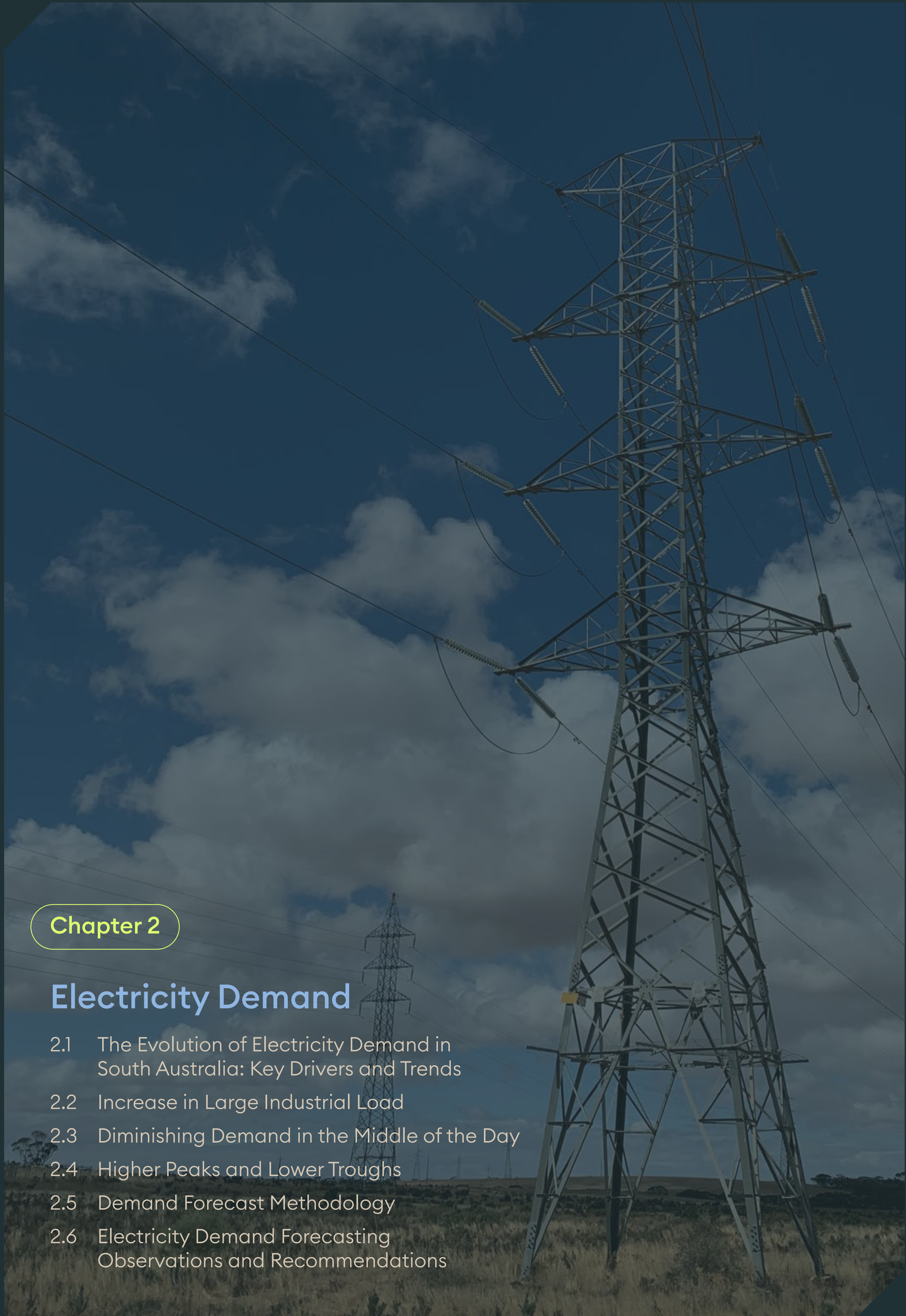
- an expected significant increase in load growth including from the State Prosperity Project, driven by opportunities in the mining of copper and magnetite iron ore, and the production of green hydrogen and green steel
- additional renewable energy to achieve and maintain the State's 100% renewable energy target, firmed by storage and backed by gas generation.

We are also concerned that the jurisdictional transmission development arrangements and associated energy policies in NSW, Queensland and Victoria are unduly influencing AEMO's national planning outlook. This exposes South Australia to risks to its energy security in the event of delays in proposed developments interstate and threatens to crowd out efficient generation and transmission developments that are needed in the state, underlining the need for a South Australian transmission framework. The need for reform of the transmission planning framework has also been recognised as a key priority in South Australia's 20-Year State Infrastructure Strategy 2025.[25]

1.7 Summary of Key Themes

1. The theme of rapid evolution is central to ElectraNet's 2025 Transmission Annual Planning Report. Government policy settings and funding commitments are creating new economic activity and driving historically unprecedented connection demand in South Australia. Targeted industry policy and funding support are catalysing energy transition and green industry activity.
2. Forecasts used in the ISP underestimate future electricity demand in South Australia. ElectraNet expects to connect an additional 1,300 MW of additional load to the transmission network by 2035, representing an approximate 100% increase in connected load over a ten-year period. Large industrial loads represent the majority of this demand.
3. Existing regulatory processes are lagging South Australia's demand outlook and should be reviewed in the context of the State's rapidly accelerating 'energy transition' environment.
4. AEMO's Progressive Change scenario is not representative of network development requirements in South Australia. *Green Energy Industries* is the more appropriate variant for application as the *Green Energy* scenario in AEMO's 2025 IASR scenario collection. It reflects South Australia's focus on domestic development of energy intensive industries exporting value-added products, rather than direct energy exports. The 2026 ISP should reflect this.
5. Similar jurisdictional arrangements to those introduced in other states now need to be considered for South Australia to ensure that the transmission network is ready to support our clean energy future and meet the demand for connections arising from new large industrial loads and the need for additional renewable energy to achieve and maintain the state's 100% renewable energy target, firmed by storage and backed by gas generation.

[25] 20-Year-State-Infrastructure-Strategy-2025



Chapter 2

Electricity Demand

2.1 The Evolution of Electricity Demand in South Australia: Key Drivers and Trends

This year's Transmission Annual Planning Report demonstrates the challenge that South Australia is facing – as the state, its economy, energy users and providers together respond to the ongoing energy transformation.

This challenge is underpinned by the rapid evolution of South Australia's demand for electricity, as it advances towards 100% net renewable electricity generation in 2027. This change to the state's energy demand requires South Australia's electricity transmission network to also change. Consequently, understanding the nature of demand is critical to ensuring appropriate and adequate planning is in place.

In this chapter ElectraNet examines three key factors impacting forecasts of electricity demand, the cumulative effect of which is forecast to not only continue but gather pace. These three key factors are described below and expanded upon throughout this chapter:

1. **Exponential increase in Large Industrial Load**
   Transmission connected large industrial load demand enquiries are increasing by greater amounts each year as a result of both increased economic activity in key sectors and an increasing positive response to the state's decarbonisation.
2. **Diminishing consumption from distribution connected customers**
   Increased residential uptake of solar PV is resulting in a reduction in energy consumption from South Australia's distribution connected customers, year on year. This trend may be counteracted in future years by increases in consumption due to electrification (for example for transport, cooking, hot water heating, etc).
3. **Higher demand peaks, and lower demand troughs**
   South Australia's high extremes of summer temperature create a high demand for cooling – that is driving higher demand peaks or increased 'peakiness' as new customers connect and summers get hotter – while increased uptake of residential solar PV is producing lower demand troughs.

2.2 Increase in Large Industrial Load

Transmission connected large industrial load consumption is by far the single largest factor in South Australia impacting the nature of electricity demand. Its impact must be properly accounted for in determining the appropriate transmission infrastructure investments across the state.

Over the past 15 years large industrial load consumption has grown in the state, typically increasing by an average of nearly 5% per year, with some years experiencing more than a 10% increase. In 2024, large industrial load consumption grew by nearly 7%, demonstrating the ongoing trend for this segment.

Large industrial load consumption was once relatively modest in South Australia, making up less than 9% of the state's total load in 2009–10; but with its consistent growth this segment has increased its share of the pie, today (2024–25) representing 18% of electricity consumption (Figure 5). This share of the pie is expected to continue to rise as large industrial load consumption grows.

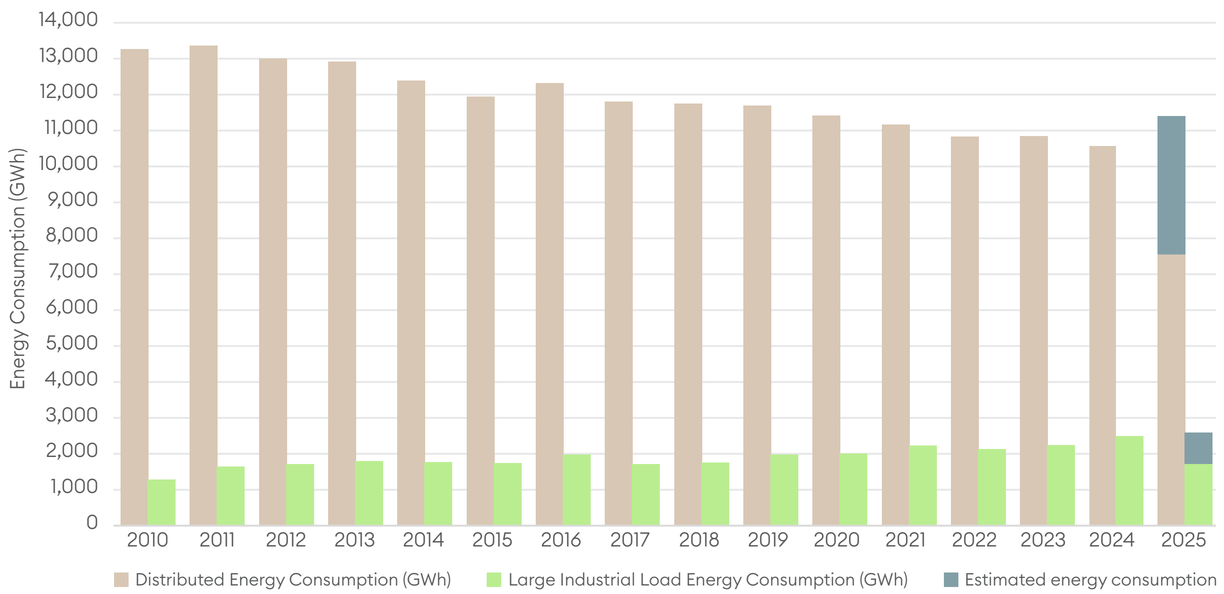


Figure 5: Distributed and Large industrial load energy consumption

Because of its increasing share of electricity demand, understanding how large industrial load consumption is projected to grow, and the drivers of that growth, is critical. In this report ElectraNet has explored 'push' and 'pull' factors: those important factors influencing large industrial load consumption growth in South Australia.

2.2.1 Push Factors: Industry-Led Expansion of Electricity Demand

South Australia's electricity demand outlook is being pushed upward by the anticipated connection of new energy-intensive industries. Most of the projected growth in large industrial load consumption is drawn from five specific industries outlined below. These industries require large-scale, reliable power supply to support their operations, particularly as they scale up production and integrate advanced technologies.

Industries Driving Electricity Demand

1. **Mining**
   South Australia's mining sector is a cornerstone of its industrial economy, contributing $10.7 billion in direct and indirect spending to the state's economy.[26] This growth is largely due to the state's endowment of large resource deposits including copper, gold, magnetite and rare earths. The projects to develop these resources all require substantial and reliable electricity supply. As mining projects are approved, and as miners shift towards electrified haul trucks, conveyor systems and processing facilities demand for grid electricity is set to rise. Additionally, increasing global demand for natural resources, particularly those used in supplying the energy transition and technologies essential to modern economies, is accelerating investment in a new generation of mining projects.
2. **Green Iron and Steel**
   South Australia is positioning itself as a future hub for green steel and iron production,[27] leveraging its quality magnetite resources, access to renewable energy and the potential for hydrogen-based steelmaking. Traditional steelmaking relies heavily on coal-fired blast furnaces placing it amongst the most emissions-intensive industrial processes, responsible for approximately 8% of the world's carbon emissions.[28] However, emerging green steel pathways use Direct Reduced Iron (DRI) technologies, which replace coal with natural gas or hydrogen and require electric arc furnaces. This evolution of steelmaking will significantly increase electricity demand and reduce emissions. Several mining companies and consortia are pursuing projects to develop suitable magnetite resources in the state and ultimately produce green steel. Each of these projects will require continuous, high-load electricity consumption, and some are set to occur in parts of the state that are far away from existing electricity transmission infrastructure such as the Braemar Iron Ore Zone or the North Gawler Iron Ore Zone.
3. **Desalination**
   With increasing demand for industrial water supply for mining, minerals processing, green steel and agriculture, desalination is emerging as a major industrial electricity consumer. The Northern Water Project is a multi-billion-dollar initiative that involves the construction of a new, large-scale 130-megalitre-a-day desalination plant, with capacity to expand to 260 ML, and a 600 km pipeline to deliver the water to the Upper Spencer Gulf and northern South Australia by 2031 – two areas critical to the state's economic prosperity. This project, and other potential expansions of existing desalination assets, will further amplify electricity consumption, enable other energy-intensive industries and support the development of key resource developments in the state.
4. **Data centres**
   The accelerating demand for cloud computing, artificial intelligence (AI), and high-performance computing is leading to both an increase in the size of planned data centres around the world, and a rapid expansion of data centres being planned in South Australia. These facilities operate 24/7 and require consistent, large-scale electricity supply to power server farms, cooling systems, and backup infrastructure.
5. **Hydrogen projects**
   Hydrogen production is an emerging driver of electricity demand in South Australia, with long-term potential to create a large impact on the network due to the high energy intensity of electrolysis. While at the time of the preparation of this report the Government of South Australia has recently deferred its plans to build a major hydrogen electrolyser and power plant near Whyalla, it is expected that international demand for clean hydrogen will grow. In the long-term, capitalising on the state's ability to generate and store excess renewable energy is expected to lead to renewed efforts to develop hydrogen projects. The Government of South Australia has also identified locations for hydrogen export potential including Port Bonython which has already received significant interest from companies and investors proposing to develop hydrogen production facilities.

[26] South Australian Chamber of Mines & Energy | Annual Reports
[27] Energy & Mining | Green iron and steel
[28] ACCR | Forging pathways: insights for the green steel transformation

Each of these five industries is individually significant as can be seen in the data presented in 2.2.3, and each project is economically viable on its own. However, it is worth pointing out that many of the project proponents seeking to connect to the network are themselves connected across the value chain, ensuring that the development of one increases the probability of the other. For example, the development of a magnetite mine, with ore suitable for use in a DRI furnace, increases the probability of an industry developing around green steel and will itself increase the demand for desalinated water and the use of green hydrogen. Each of these steps in the value chain will require a significant increase in the volume of electricity, but combined the demand will require significant changes to the existing transmission network.

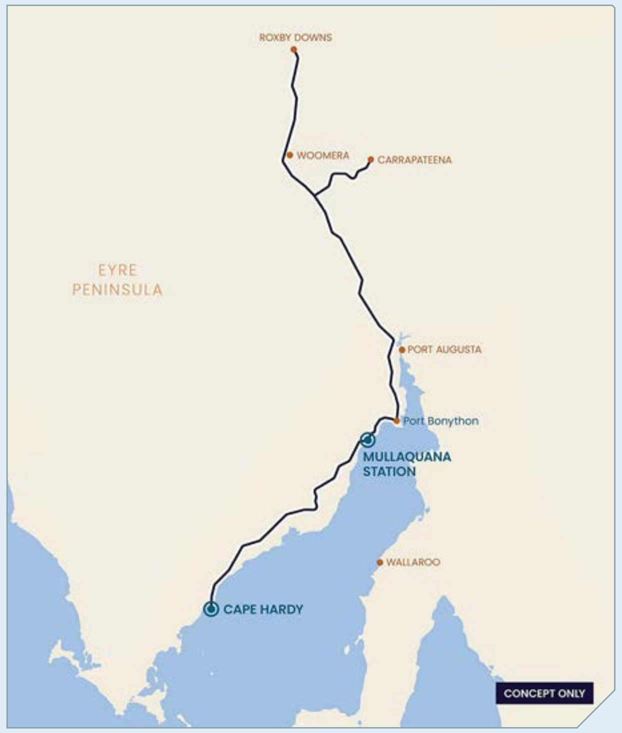
Northern Water Project

The Northern Water Project is considered to be a critical enabler to the growth of the South Australian resources sector. It centres around the construction of a new large-scale desalination plant and the delivery of sustainable commercial water to the Gawler Craton – South Australia's world class mineral province.

The Project is aligned with the Government of South Australia's vision to develop key industries that are consistent with the decarbonisation of its economy, including green iron, steel, and copper. The Project will reduce reliance on the Great Artesian Basin and the River Murray.

The plant would include renewable energy integration including electricity substations and transmission lines to power the plant with renewable energy sources.

The Project is currently in the planning, assessment and procurement phase, with design and construction planned to commence in 2026 to enable operation to commence in 2031.

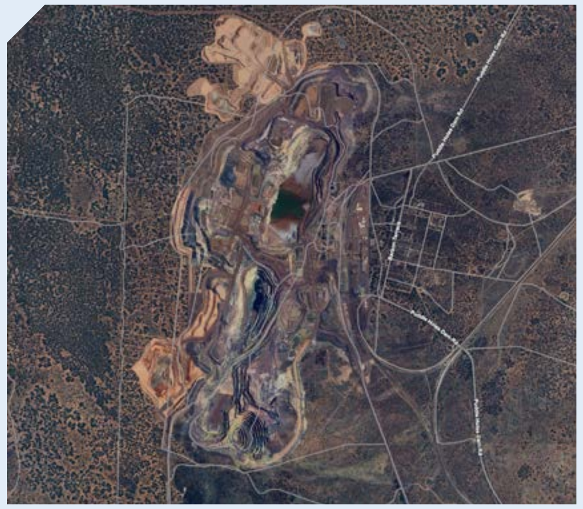


2.2.2 Pull Factors: Attraction to South Australia's Decarbonised Energy Advantage

While industrial electricity demand in South Australia is being pushed higher by the direct connection of energy-intensive industries, it is also being pulled upward by businesses and industries actively seeking to take advantage of the state's unique value proposition of a decarbonised electricity mix. At ElectraNet, through engagement with large industrial customers, we are observing first-hand two different but related pull factors working to increase energy demand in the state.

1. **Low-Carbon Supply Chains as a Competitive Advantage**
   Industries that rely on energy-intensive processes, such as green metals, data centres, advanced manufacturing and defence platforms and systems, are under increasing pressure to decarbonise their supply chains. South Australia's progress in renewable energy integration allows companies to power their operations with lower-emission electricity compared to jurisdictions still reliant on fossil fuels and enables fuel switching from operations currently utilising fossil fuels to renewable electricity. This pull factor is particularly strong in industries that serve markets with strict sustainability standards: where there is a drive to prioritise low-carbon materials; and sourcing electricity from South Australia's renewable-heavy grid provides a strategic advantage in meeting customer and investor expectations.
2. **Renewable Energy Contracts and Corporate Sustainability Goals**
   A growing number of businesses are actively seeking renewable energy power purchasing agreements to meet their net zero commitments. South Australia's high proportion of wind, solar, and battery-backed energy means that companies operating in the state can access long-term renewable energy supply contracts, enabling them to reduce their Scope 2 emissions, meet stringent carbon border adjustment mechanisms (such as those being introduced in the European Union) while maintaining price stability. This is particularly attractive for large energy users which need certainty around both electricity costs and emissions intensity over the long term.

Ultimately, South Australia's transition to a high-renewable grid is not just reshaping its own economy – it is attracting global industries that view access to clean energy as a competitive differentiator. As regulatory environments tighten and consumer preferences shift towards sustainable products, businesses in manufacturing, resources, and technology sectors will increasingly look to locate or expand operations in regions where clean energy is abundant and reliable. It is expected that this will continue to be a significant driver of electricity demand in South Australia.



Middleback Expansion

The Middleback Ranges in South Australia are undergoing significant expansion to enhance iron ore production, particularly focusing on magnetite and hematite deposits.

The project is seeking to expand its existing hematite operation and to increase the production of magnetite concentrate and ultimately magnetite pellets as part of its planned evolution to carbon-neutral steel production.

The expansion, known as the Cook's North and Cook's North West project is situated on the Eyre Peninsula, approximately 60 kms from Whyalla and includes the construction and operation of new mining pits and associated infrastructure on land already approved for exploration and mining.

The expansion will extend the mine life and is aligned with the Government of South Australia's Green Iron and Steel strategy and the company's aspiration to be carbon neutral by 2030.

2.2.3 Large Industrial Load Demand Requests

Scale of Demand

As a result of the push and pull factors described in the previous sections ElectraNet is observing a significant increase in requests for load connections in South Australia.

To help appreciate this increase, it is useful to understand that over the 10 years between 2012 and 2022 ElectraNet received interest to connect to its network from one large industrial load representing an approximate 50 MW in additional load. This low volume of new large industrial load connections is no longer the case. At present the company has been engaged by a total of 37 individual large industrial customers to explore direct connections to its transmission infrastructure. Many of these individual customers are requesting connections across multiple projects indicating that overall potential number of connections to South Australia's transmission infrastructure is in fact much larger than perceived at first glance.

It is not just the number of customers seeking connection that is important, but also the sheer scale of demand and energy consumption growth represented by these customers. The total potential increase in maximum demand, resulting from the new combined load of all 37 of these customers, is over 15,000 MW. This is equal to nearly 5 times the maximum demand experienced in South Australia during 2024–25.

While ElectraNet recognises that the probability of all customers and their respective projects being approved and becoming operational in the next 10 years is very low, it remains conceivable, if not highly probable, that many of these do progress and more emerge – requiring new investment in electricity transmission infrastructure. It is therefore critical that ElectraNet continues to work with AEMO to provide increased insight of near-term developments and prospective demand.

South Australia's total maximum demand is much smaller than for other mainland states in the NEM such as New South Wales (13,000 MW) and Queensland (11,000 MW). As a result, it only takes a small increase in large industrial loads connected to the network to deliver a significant impact on the network. Even if only 10 to 20% of the large industrial loads seeking to connect are ultimately connected it could result in an increase in maximum electricity demand in the range of 1,500 to 3,000 MW. That is, an increase in electricity demand that is at least 50% higher than the maximum electricity demand in 2024–25.

Connecting one large industrial load customer to the network, as occurred between 2012 and 2022, could be suitably managed by ElectraNet in a reactive way, with any investment in the transmission network likely to be modest and able to be achieved in a timely manner. However, this approach is no longer sustainable. Instead, the need to appropriately and adequately manage the risk to the network, existing customers, and the customers seeking to be connected from the potential for a significant increase in requests as is being observed by ElectraNet, demands a more proactive approach – with robust planning and investment to commence now.

Large Load Demand Forecast Inclusion

Of the more than 50 potential load connections being explored by the 37 prospective unique customers, ElectraNet has used the proposed definition of 'anticipated' load projects aligned with AEMO's 2024 update to the Electricity Demand Forecasting Methodology as guidance to classify 2 of these as 'Anticipated Projects'. These are projects that have a high likelihood of being developed based on their status of enquiry, progress of approvals or other specific information to help classify their likelihood of being developed. ElectraNet includes these anticipated projects in all scenarios. They are projected to increase demand by about 440 MW by 2035.

ElectraNet includes other loads in the scenarios consistent with the scenario narratives. Broadly speaking, the *Progressive Change* scenario includes less additional loads than does the *Step Change* scenario, and the *Green Energy* scenario is the only scenario to include hydrogen hubs.

When a load is included in multiple scenarios, it keeps the same probability. Of the more than 50 projects, 8 are considered probable with a probability of 50% or more (Figure 6). While only included in the *Green Energy Exports* scenario, hydrogen hubs individually have a relatively low probability at around 5–10%. This leads to a scenario with a very wide range of future possibilities.

Based on information received in late May 2025, ElectraNet has reclassified a further load project – previously considered probable – as anticipated. The impact of this change has not yet been reflected in ElectraNet's load forecasts. It is likely to result in a net uplift of about 50 MW across the forecasts.

Figure 7 shows that the additional load that is Anticipated or Probable is overwhelmingly from four of the key industries outlined in 2.2.1, those being mining, green steel, desalination and data centres. The mining sector accounts for almost half, demonstrating the importance of this industry to growing electricity demand.

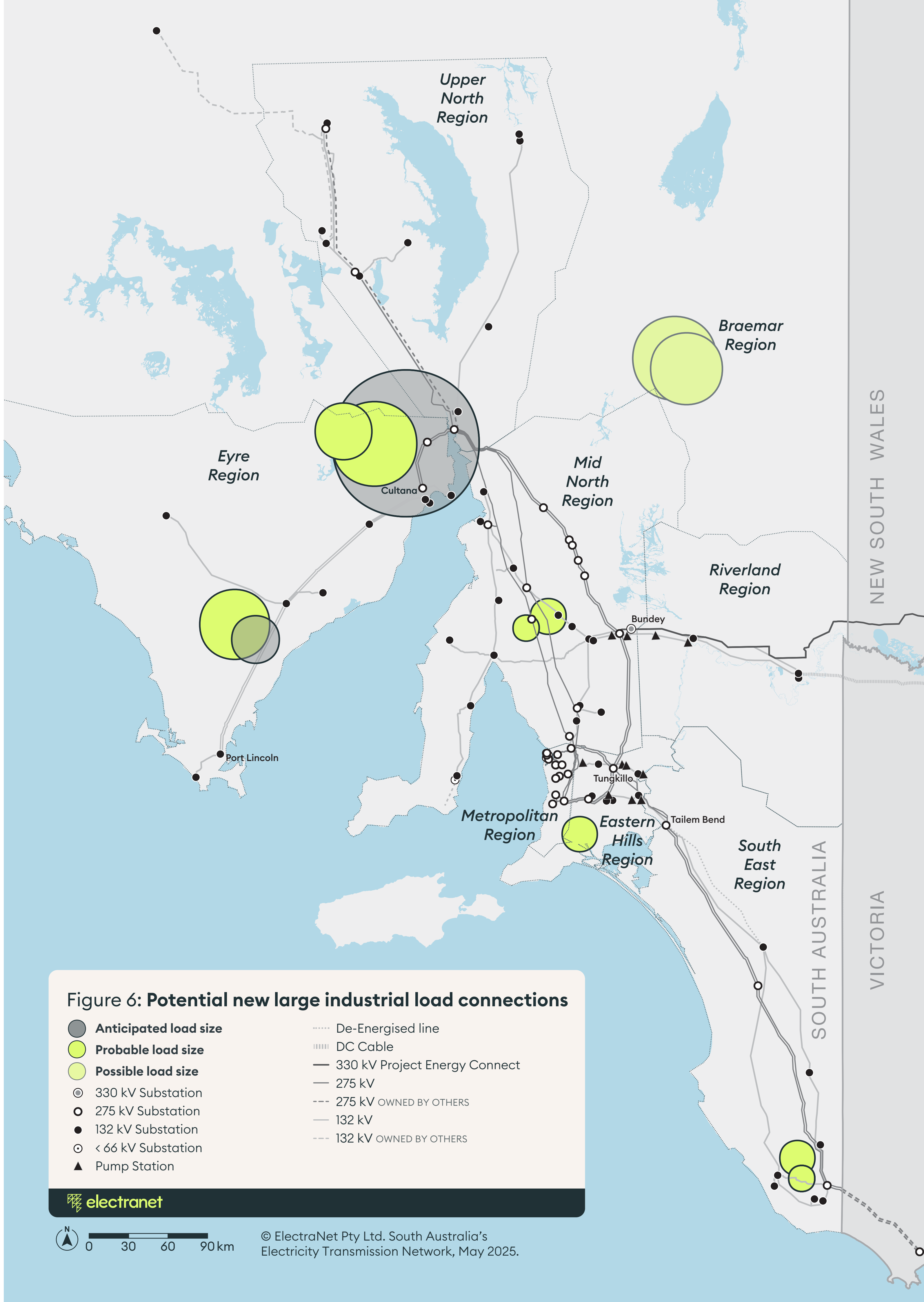


Figure 6: **Potential new large industrial load connections**

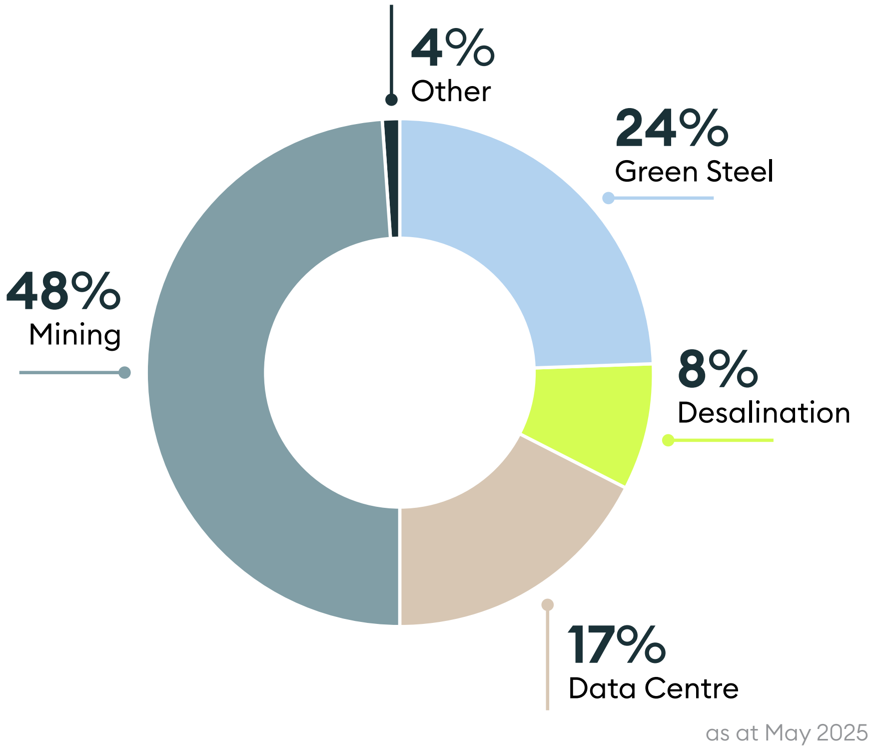


Figure 7: Connection interest breakdown by anticipated maximum demand

2.3 Diminishing Demand in the Middle of the Day

While large industrial loads have contributed to a growth in electricity demand, South Australia has simultaneously experienced a significant reduction in daytime electricity demand over the last 15 years – primarily due to a world leading uptake of residential rooftop solar PV systems and ever-improving appliance and building efficiency standards. As shown earlier in Figure 5, consumption from distribution connected loads has typically decreased year on year over this period, with drops of as great as 4% per year.

The uptake of solar PV in South Australia has resulted in more than 50% of homes today being equipped with solar panels. This widespread solar PV adoption has fundamentally altered the state's electricity demand profile (Figure 8). Historically, electricity demand peaked in the midafternoon due to commercial and residential air conditioning, industrial activity, and general consumption. However, with the proliferation of rooftop solar PV, midday demand has been hollowed out, especially on weekends and public holidays. At times, and more frequently, ElectraNet is even seeing demand become negative, where rooftop solar generates more electricity than the state requires. In fact, 90% of transmission connection points to the SA Power Networks distribution network have experienced times when this has occurred. This phenomenon, often referred to as the "duck curve", has shifted peak demand periods into the late afternoon and evening when the sun sets, and household electricity consumption rises.

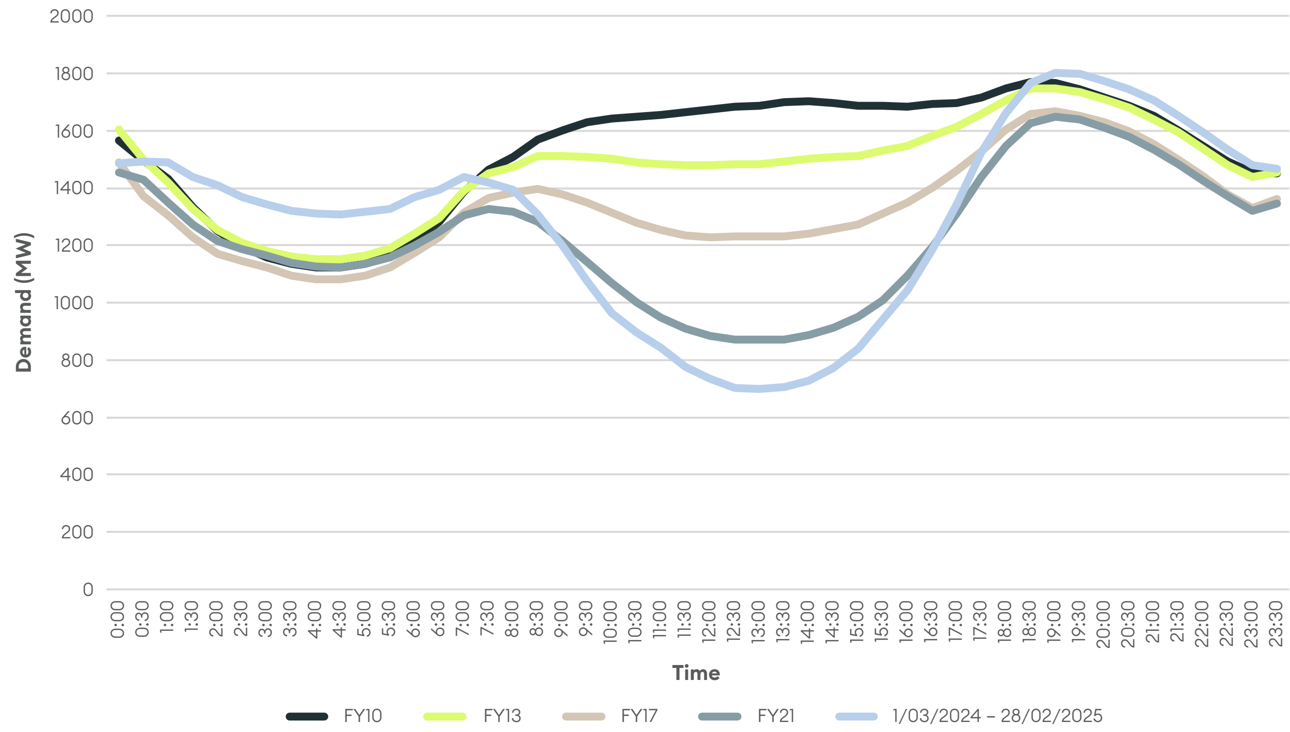


Figure 8: Changes in South Australia's average daily demand curve

This change in South Australia's demand profile has created new challenges for the stability and management of the distribution network, as the quick ramp up and down of demand can cause voltage fluctuations that require interventions, such as increasing demand through grid-connected storage solutions or new voltage control capability. These conditions which are occurring more frequently also increase South Australia's reliance on interconnection with the eastern states to balance supply and demand.

With increasing integration of residential battery systems, ElectraNet anticipates better integration of residential solar into the broader electricity system. Today, South Australia has more than 49,000 embedded battery systems installed, representing over 350 MW and 540 MWh of storage, which equates to 22% of the NEM's CER battery capacity[29] – and the penetration of embedded battery systems in South Australia is expected to continue to grow. This growth in battery storage, while positive, will create its own change to the demand profile, that may need to be managed in turn. ElectraNet is monitoring this trend to better understand and respond appropriately as it develops.

Despite the historical decline of distribution connected consumption in the middle of the day, there are emerging signs that the extent of the decline may have been reached, and the direction of the distribution connected demand and consumption outlook could reverse. Movements like Electrify Everything are acknowledging the advantages of electrification including the transition to electric vehicles.[30] ElectraNet is working closely with SA Power Networks to monitor this closely and ensure it is reflected in future demand projections.

[29] AEMO | South Australian Electricity Report; Distributed Energy Resource Dashboard

[30] Electrify Everything

2.4 Higher Peaks and Lower Troughs

This summer, South Australia electricity demand has witnessed a recovery in maximum electricity demand to levels commensurate with historical levels.

2.4.1 High Demand Peaks

The high demand peaks are very much weather related. As part of appropriate planning for both operations and strategic investment in electricity transmission infrastructure it is important for ElectraNet to understand climate trends, comparing temperature data each year against long term trends to understand whether patterns are emerging, and if so whether there are any relevant impacts on planning.

Due to the high demand for air-conditioning in South Australia during hot days or heat waves, weather conditions over summer are the most important climate variation that ElectraNet considers in its approach to planning. High temperatures are an important driver of maximum demand for electricity in this state, with extended high temperatures leading to extreme demand at levels that can be more than double the average.

High day-time temperatures not only drive higher electricity usage, but they can impact the performance of solar panel efficiency, which would normally help to reduce the peakiness of demand. Heat waves with typically high overnight minimums are an important factor in driving high demand outcomes on the following day as homes get hotter with the accumulation of heat.

The 2024-25 Summer is worth taking particular note of, as it has contributed to exceptionally 'peaky' demand, with weather conditions varying significantly above the long-term average. Average maximum temperatures were over 2 degrees higher than the long term average on each and every month – with the difference reaching over 3 degrees in February and over 4 degrees in March (Table 1).

Table 1: Summer 2024-25 temperature data compared with long term trends

	November		December		January		February		March	
	Long-term trend	2024–25	Long-term trend	2024–25	Long-term trend	2024–25	Long-term trend	2024–25	Long-term trend	2024–25
Max temp (°C)	42.7	37.5	45.3	40.1	46.6	38.7	43.4	43.3	41.8	41.7
Date of max temp	30/11/62	22/11/24	19/12/19	5/12/24	24/01/19	19/01/25	1/02/12	12/02/25	3/03/42	15/03/25
Average max temp (°C)	24.5	26.7	26.9	28.9	28.7	30.8	28.6	31.5	26.1	30.3
Days > 30	6	9	9.1	11	11.8	18	10.8	15	7.1	16
Days > 35	1.5	3	3.7	5	5.5	6	4.4	7	1.6	5
Days > 40	0.1	0	0.6	1	1.1	0	0.6	3	0.2	2
Difference between 2024–25 average max temp and long-term trend (°C)		2.3		2		2.2		3		4.2

ElectraNet also observes that this summer recorded a significantly greater number of days over 30 degrees compared to the long-term trend, as well as an increase in the number of days over 35 for every month. December, February and March also recorded more days over 40 degrees compared to the long-term trend.

It is also worth observing how this summer's heat wave impacted electricity demand. The state-wide demand reached a maximum during 2024–25 of 3,336 MW on Wednesday 12 February 2025 (Table 2). This maximum demand was almost 20% higher than in the 2023–24 summer, the highest since 2011, and was one of eleven days where the maximum exceeded 2,500 MW during the 2024–25 summer and one of 13 days in the twelve months from April 2024 to March 2025. This compares to only one day on which demand exceeded this level during summer 2023–24.

Table 2: High demand days from April 2024 to March 2025

Date	Maximum Demand (MW)	Maximum Temperature	Preceding day maximum temperature	Preceding overnight minimum temperature	Day
12/02/2025	3336	43.1°C	38°C	23°C	Wednesday
3/02/2025	3172	40.9°C	39.9°C	24.2°C	Monday
11/02/2025	2958	38°C	33.3°C	23°C	Tuesday
15/03/2025	2837	41.7°C	35.9°C	22.5°C	Saturday
2/02/2025	2759	39.9°C	35°C	21.7°C	Sunday
5/12/2024	2745	39.7°C	31.5°C	24.6°C	Thursday
10/03/2025	2699	40°C	36.7°C	25.3°C	Monday
19/01/2025	2598	38.1°C	33.9°C	23.9°C	Sunday
15/12/2024	2583	37.7°C	30°C	18.5°C	Sunday
9/03/2025	2574	36.7°C	35.6°C	21.3°C	Sunday
16/12/2024	2542	37.9°C	37.7°C	33.1°C	Monday
19/07/2024	2540	12.2°C	12.9°C	9.7°C	Friday (winter)
3/07/2024	2501	14.7°C	13.6°C	0.7°C	Wednesday (winter)

These variances in recorded summer temperature data are considered to be extreme heat conditions. The maximum demand of 3,336 MW experienced during the 2024-25 summer almost reached the forecast 10% PoE level of 3,383 MW: a level of forecast demand that is expected over the long-term average to occur only one year in ten, considered to be the prudent level for designing an electricity system. As a result, data from the 2024–25 summer is likely to be considered important by both SA Power Networks and AEMO when they are revising their forecasts.

It is also worth pointing out that 2 of the days that exceeded 2,500 MW were recorded in South Australia's winter. Winter demands exceeding 2,500 MW have been growing over the last few years, demonstrating growing demand for electricity during winter.

2.4.2 Low Demand Troughs

As discussed in Section 2.3, the increased uptake of residential solar PV has not only reduced daytime electricity demand but has created a phenomenon where, on some days, households are pushing electricity into the transmission network, creating a very low or in the extreme case negative energy demand.

During 2024–25 South Australia recorded 27 days with a very low demand trough, where the minimum demand was less than 100 MW. This phenomenon when it first appeared in South Australia tended to occur on weekends and public holidays, when industry and business demand is very low. However, extremely low demand levels are now also being observed on weekdays.

Demand below 100 MW is a relatively new phenomenon (Figure 9). Minimum demand levels for the SA grid until 2015 when solar PV adoption skyrocketed were typically just over 1,000 MW. Before 2022–23, there are no records of days with minimum demand below 100 MW. In 2022–23 ElectraNet recorded 3 such days, and this jumped markedly to 21 days in 2023–24. These very low minimum demand levels are now also being observed in spring during sunny but mild weekdays. These are significant changes in energy demand and reflect the energy transformation South Australia has experienced.

Table 3: Days with minimum demand less than 100 MW (April 2024 to March 2025)

Date	Maximum Demand (MW)	Maximum Temperature	Preceding day maximum temperature	Preceding overnight minimum temperature	Day
27/09/2024	98	22.1°C	6.7°C	17.3°C	Friday
9/10/2024	91	27.4°C	12.1°C	19.9°C	Wednesday
11/10/2024	88	21.7°C	6.8°C	21.5°C	Saturday
24/12/2024	86	28.8°C	12.3°C	22.2°C	Tuesday
2/10/2024	86	24.8°C	11.7°C	19.8°C	Wednesday
21/12/2024	75	26°C	17.6°C	29.9°C	Saturday
1/01/2025	75	27°C	14.4°C	28.2°C	Wednesday
26/10/2024	75	28.2°C	15.3°C	20.4°C	Saturday
1/11/2024	53	23°C	9.2°C	22.2°C	Friday
8/12/2024	42	22.7°C	12.6°C	26.4°C	Sunday
1/12/2024	40	24.9°C	16.1°C	24.1°C	Sunday
12/10/2024	37	22.9°C	6.8°C	21.7°C	Saturday
30/03/2025	33	23.1°C	29.6°C	15.2°C	Sunday
24/10/2024	30	19.1°C	10.3°C	20.2°C	Thursday
8/10/2024	30	19.9°C	7.2°C	20.5°C	Tuesday
22/12/2024	30	21.8°C	13.5°C	26°C	Sunday
25/10/2024	28	20.4°C	7.7°C	19.1°C	Friday
3/11/2024	23	21.4°C	14.8°C	33.3°C	Sunday
23/10/2024	1	20.2°C	11.6°C	25°C	Wednesday
29/10/2024	-21	24.6°C	8.5°C	22.8°C	Tuesday
10/11/2024	-22	27.4°C	11°C	22.5°C	Sunday
17/11/2024	-44	19.6°C	13.1°C	35°C	Sunday
28/10/2024	-52	22.8°C	10.5°C	26°C	Monday
16/02/2025	-54	24°C	13.7°C	23.2°C	Sunday
27/10/2024	-105	26°C	12.5°C	28.2°C	Sunday
20/10/2024	-201	24.7°C	9°C	21.2°C	Sunday
19/10/2024	-215	21.2°C	8.2°C	21.4°C	Saturday

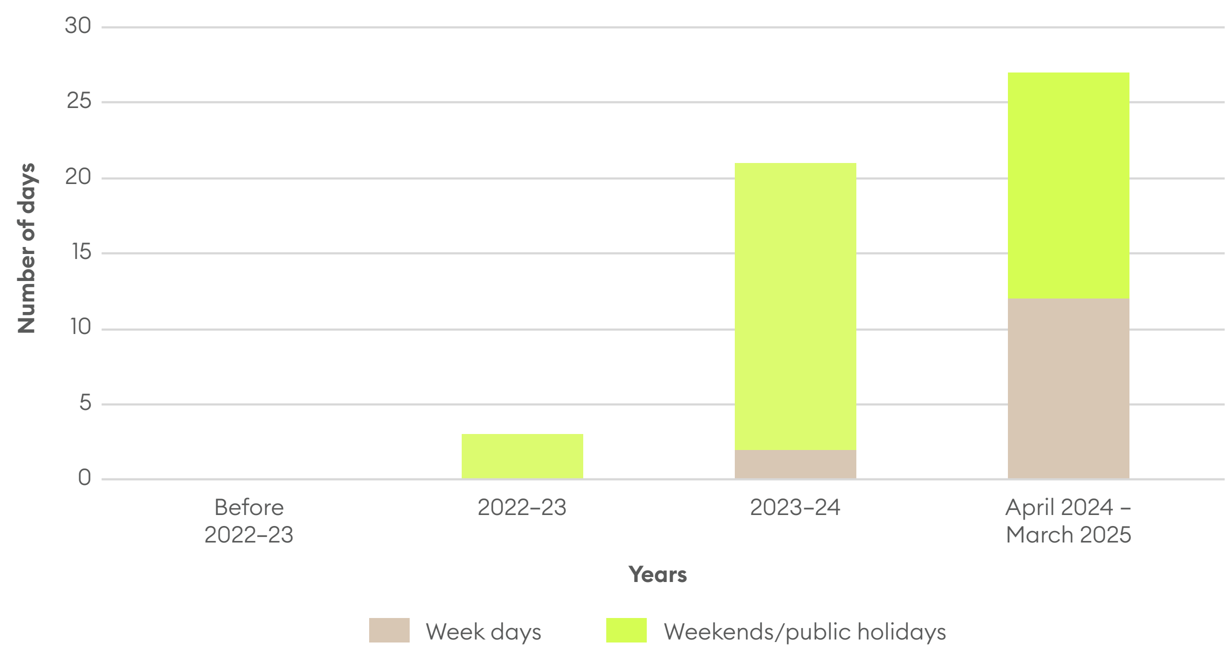


Figure 9: Days with minimum demand less than 100 MW in recent years

The extent to which solar PV can reduce demand was observed in South Australia on 16 February 2025, a day on which the record minimum demand for the state was observed (when days during which demand was affected by large industrial load outages are excluded). On this day the minimum demand was -54 MW meaning that all demand in the state was met by distribution connected generators, which are predominantly solar PV. This minimum was recorded only four days after the maximum demand recorded during the summer period, further reflecting the significant extremes in demand experienced by the transmission network as a result of the mass adoption of solar PV (Figure 10).

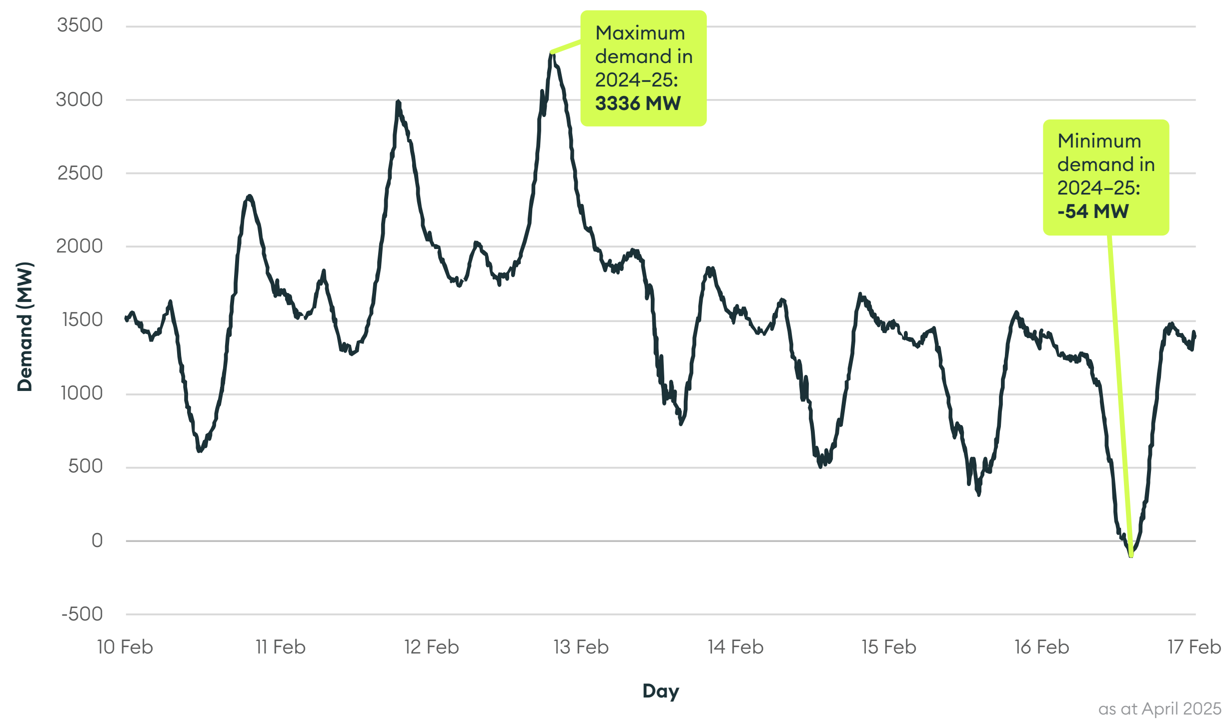


Figure 10: South Australian demand in the week commencing 10 February 2025

2.5 Demand Forecast Methodology

Electranet annually receives 10-year demand forecasts from SA Power Networks and direct connect customers.

A description of the load forecasting process used by SA Power Networks is provided in their most recent Distribution Annual Planning Report.[31] ElectraNet and SA Power Networks collaborate to determine and agree on any adjustments required to account for embedded generators and major customer loads connected directly to the distribution network.

In August 2024, AEMO presented and published forecasts of energy maximum and minimum demand for South Australia in the 2024 Electricity Statement of Opportunities (ESOO). SA Power Networks' forecasts are derived from AEMO's *Step Change* scenario.

AEMO's *Step Change* forecast only includes large industrial loads in the short-term, if they meet the following commitment criteria:

- Publicly announced Final Investment Decision and/or commenced construction
- Connection approvals with a TNSP
- Environmental approvals.

SA Power Networks develops connection point forecasts by reconciling them with AEMO's state-level growth rate for the *Step Change* scenario forecast. As a result, core demand forecasts do not include the potential for near-to-medium term large industrial load customers. Alternatively, loads that have Government support via policies or approved funding may be included in the forecast.

Transmission network development plans are revised as connection point demand forecasts are updated. The development plans presented in this report were based on the connection point maximum demand forecasts that were provided by SA Power Networks in September 2024. Details of the 2024 connection point forecasts will be published on ElectraNet's Transmission Annual Planning Report webpage.[32]

ElectraNet uses both the AEMO state-wide forecasts and their own connection point forecasts, depending on the needs of a particular study. For example, ElectraNet is required to use AEMO's forecasts when assessing an actionable ISP project.

Currently, a forecast incorporating ElectraNet's assessment of anticipated large industrial loads in the near to medium term (which are not included in AEMO's forecasts) combined with a probabilistic forecast of longer-term demand growth is ElectraNet's preferred methodology (Figure 11).

[31] SA Power Networks | Annual Network Plans

[32] ElectraNet | Transmission Annual Planning Report

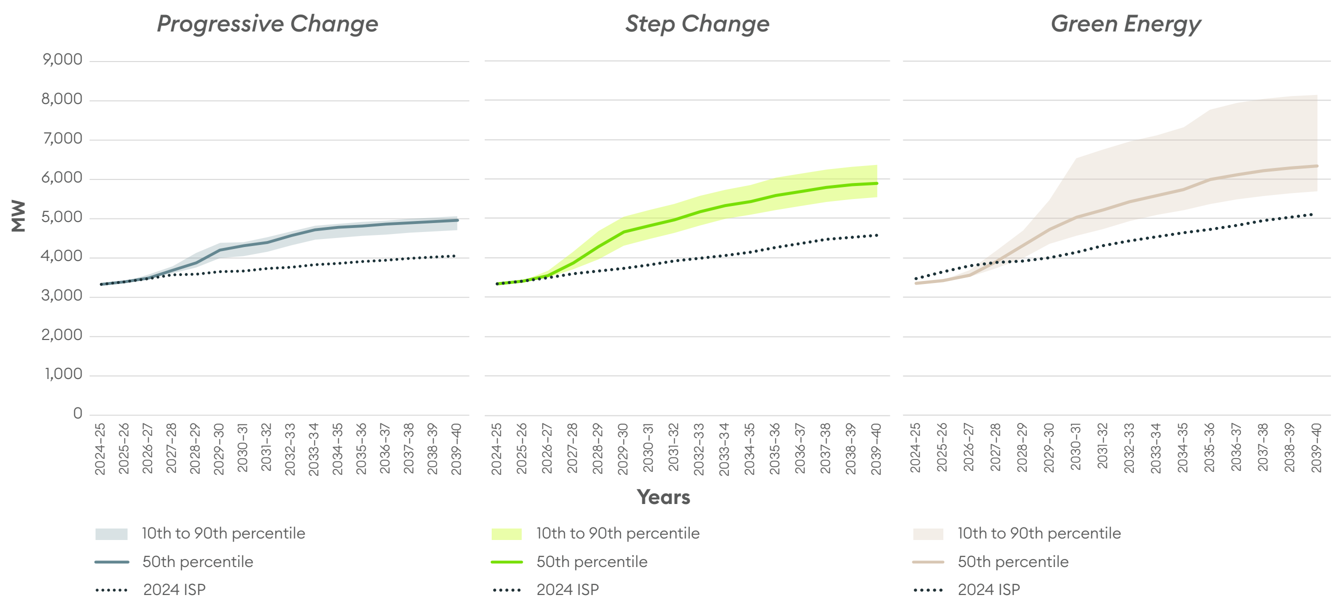


Figure 11: ElectraNet's forecasts of future South Australian demand growth

2.6 Electricity Demand Forecasting Observations and Recommendations

Electricity Demand Forecasting is critical in ensuring that prudent and efficient investments in electricity transmission infrastructure are consistent with the long term nature of the National Electricity Objective, promoting efficient investment in the long term interests of consumers balancing security, reliability, price and emissions reduction.

In the preceding sections of this chapter, ElectraNet has outlined the different factors at play that are working together to rapidly evolve the demand for electricity. In this environment it is imperative that data and information from all sources are considered to provide the best forecast possible. Better, more robust demand forecasts will help to ensure timely and efficient transmission development and minimise the risk to customers and communities.

ElectraNet has compared the *Step Change* forecasts that underpinned the 2024 ISP with those that were used in the 2022 ISP (Figure 12). Minimum demands are forecast to drop rapidly to below -1000 MW from the early 2030s, while maximum and average demands are forecast to grow very slowly.

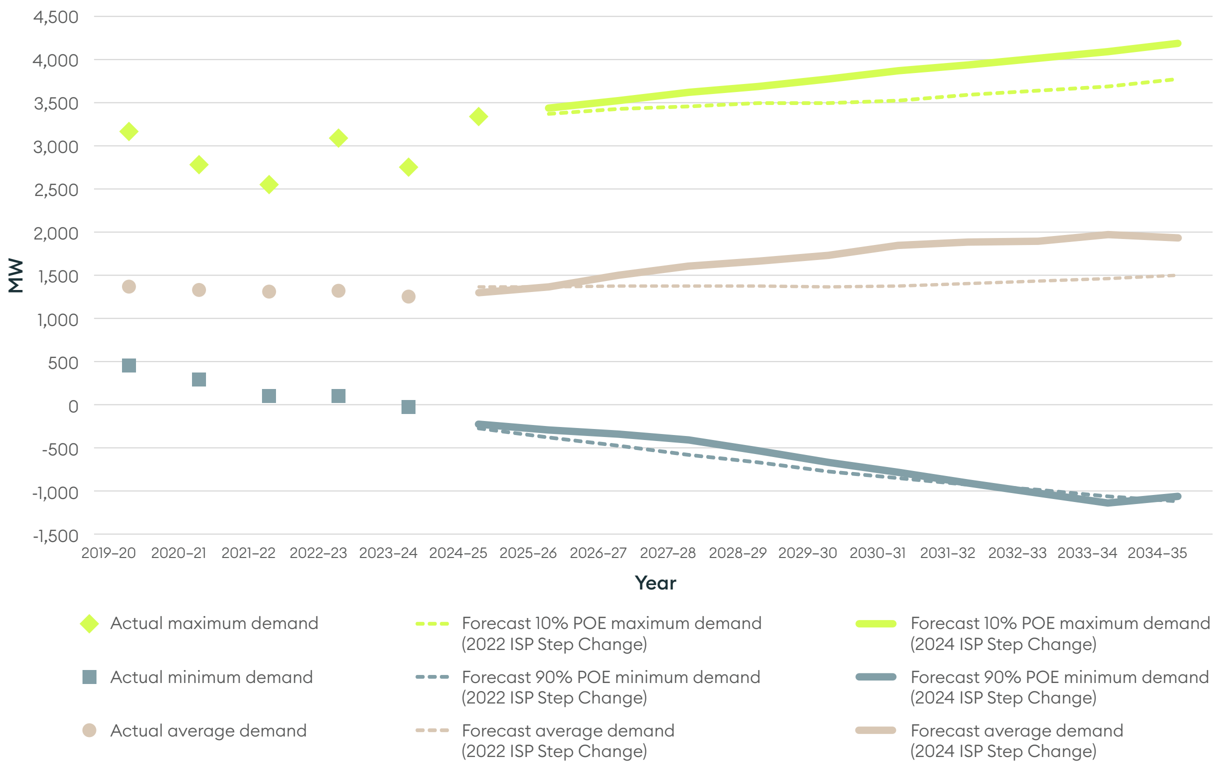


Figure 12: Comparison of AEMO's 2022 ISP and 2024 ISP South Australian demand forecasts

2.6.1 Observations

ElectraNet's main observation of the most recent ISP forecasts is a strong belief that they underestimate future electricity demand in South Australia.

This tendency to underestimate can be seen in the forecast maximum, average and minimum demands used in the 2024 ISP. These forecasts describe an electricity system that in all-but-one scenario is forecast to either grow very slowly or drop rapidly between 2025-2035 and is contrary to our expectation of significant leaps in demand in this near term even in the scenario where only a small proportion of large industrial load proposals eventuate.

2.6.2 Recommendations

Based on the information provided throughout this chapter and the observations in Section 2.5.1 there are a number of forecasting recommendations ElectraNet believe are necessary to better achieve the combined goals of customers, NSPs and governments. These are as follows:

1. **Include all anticipated load in demand forecasts**
   Currently AEMO's ISP demand forecasts only include near term load connections that are considered committed. Given the rapid growth in large industrial load demand in South Australia, this approach is a reactionary forecasting method ensuring that large industrial load demand will outpace network investment. Increased accuracy in demand forecasting can be achieved by including industrial loads that are considered to have a high likelihood of reaching committed status in the very near term, as per AEMO's definition of 'Anticipated Projects'. These projects should be included in all scenarios, consistent with AEMO's Electricity Demand Forecasting Methodology Draft Report.
2. **Adopt a probabilistic approach to forecasting large industrial load demand**
   Defining the status of new large industrial loads is important, however even within each large industrial load category there will be some that progress to connection and some that won't. Taking a probabilistic approach to inclusion of all active projects depending on the forecasting growth scenario will result in better recognition of the full funnel of projects in development and increased accuracy in forecasting.
3. **Continue engagement with NSPs to gather information on large industrial load status**
   Confirming the status and likelihood of prospective projects in consultation with NSPs is an efficient, effective and accurate way to create a greater understanding of all large industrial load projects in South Australia. The direct and regular engagement that ElectraNet has with existing and potential customers ensures that information is up to date.
4. **Increase flexibility to accommodate new information**
   The growth in large industrial load connections being proposed requires adjustment annually, however at times the speed at which projects or companies are moving through their development process will require flexibility in forecasting to ensure planning too can be agile in its response. Agility should not be replaced by volatility in the forecasts. Forecasts based on consistent scenario narratives should not undergo unreasonable revision from one year to the next that hinders the planning decisions that are made based on the demand forecasts.
5. **Include multisector modelling**
   Multisector modelling looks at the role of a range of technologies driving a low emissions economy in Australia. This modelling can have an impact on electricity demand and is included in AEMO's demand modelling. ElectraNet encourages continued utilisation of multi-sector modelling to ensure latest trends and data informs both long-term and near-term demand projections, however this should not be given greater weight than actual activity if the two are not aligned.

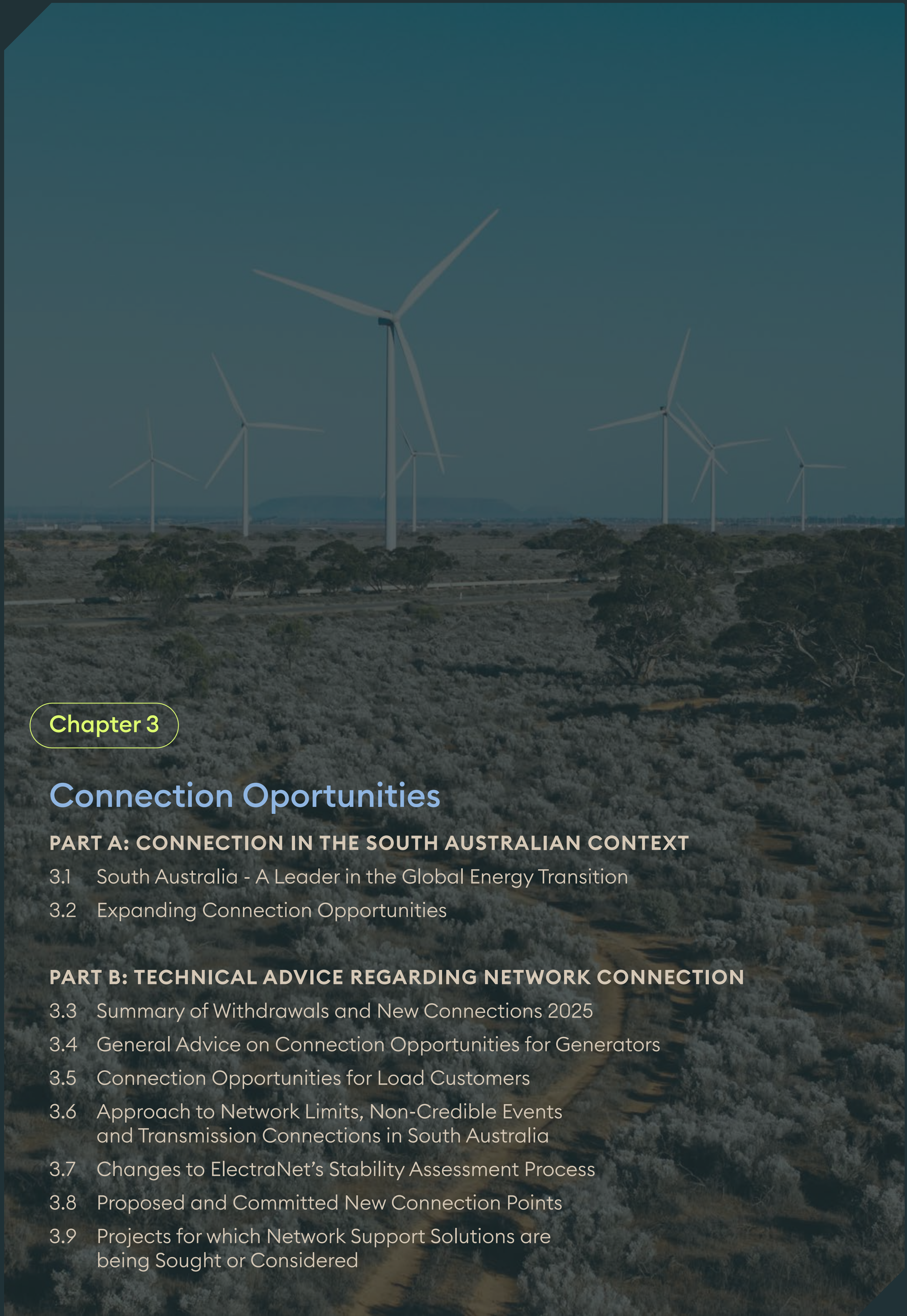
ElectraNet believes that adoption of these recommendations in full will support earlier investment at conservative levels but in the projects most able to support South Australia's growth in evolution in electricity demand and economic growth.

Forecasting Studies

Continuous improvement in forecasting demand is essential to improving the approach to investment in electricity transmission infrastructure. An example of the approach to improving forecasting is the Upper Spencer Gulf Pilot Project that AEMO together with the Government of South Australia, Australian Government, SA Power Networks and ElectraNet are currently progressing. This involves the study of a range of different scenarios for load forecasting of large industrial loads in the Upper Spencer Gulf, a key economic zone in the state that includes Whyalla, Port Augusta and Port Pirie.

This study is designed to inform future approaches to forecasting in a state that is advanced in its energy transformation, developing an approach that is more appropriate to its energy system, and which considers the impacts of a range of emerging projects that are currently not catered for in existing forecasting models.

Initial results of this study shows that a probabilistic method for forecasting is important in South Australia as it ensures that new investment caters for even the small percentages of growth as they translate to large increases in demand. Without adopting this approach to forecasting the risks are that the state will be unable to rapidly adapt to new large industrial load demand or to secure the growth of important industries due to a lack of suitable transmission infrastructure.



Chapter 3

Connection Oportunities

3.1 South Australia – A Leader in the Global Energy Transition

As the owner and operator of South Australia's electricity transmission network, ElectraNet is playing a central role in the provision of novel network engineering solutions to meet the 'once in a generation' challenges and opportunities presented by the energy transition.

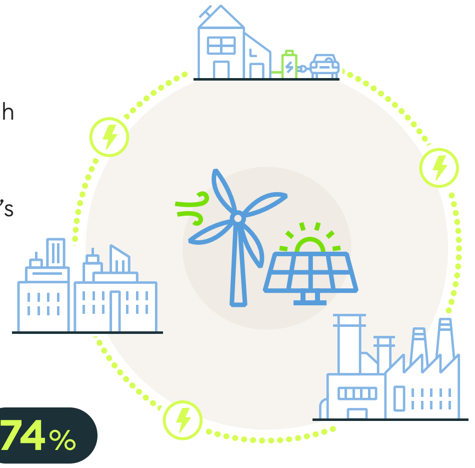
ElectraNet has decades of experience delivering connections within the NEM and confidently provides clients with high voltage electricity transmission services, facilitates new connections and provides highly reliable electricity transmission services to customers.

South Australia has one of the most advanced electricity networks in the world, regularly achieving 100% instantaneous variable renewable energy, driven by its world-leading uptake of grid scale renewable energy resources and rooftop solar PV. When Project EnergyConnect Stage 2 has been fully commissioned, the South Australian electricity system will be able to operate with no conventional generators in service.

In the **2024** calendar year:

299 days

the number of days on which South Australia renewable wind and solar energy supplied all South Australia's electricity demand for at least part of the day



27%

the amount of time that renewable wind and solar energy supplied 100% of South Australia's electricity demand

74%

of South Australian consumption was met through renewables output

Through headline policies like the South Australian Economic Statement,[33] the Government of South Australia has set an ambitious agenda aimed at meeting its net 100% renewables target by 2027; decarbonising the state's economy; developing new sources of renewable generation linked to Renewable Energy Zones (REZs); and enabling development of green industries proximate to, and supported by, renewable generation.

The Hydrogen and Renewable Energy Act 2023 is being used to open new parts of the state for renewable energy project development, with the Government of South Australia recently consulting on the Gawler Ranges East and Whyalla West proposed release areas, which span approximately 5,200 km^2 and 6,500 km^2 respectively on the Upper Eyre Peninsula.[34]

AEMO's 2024 ISP forecasts a strong increase in the need for South Australian renewable wind and solar projects in both the *Step Change* and *Green Energy Export* scenarios highlighting the value and efficiency of renewable energy in South Australia to the state and national economy (Figure 14).

[33] Government of South Australia | South Australian Economic Statement

[34] Energy & Mining | Release Areas – Hydrogen and Renewable Energy Act

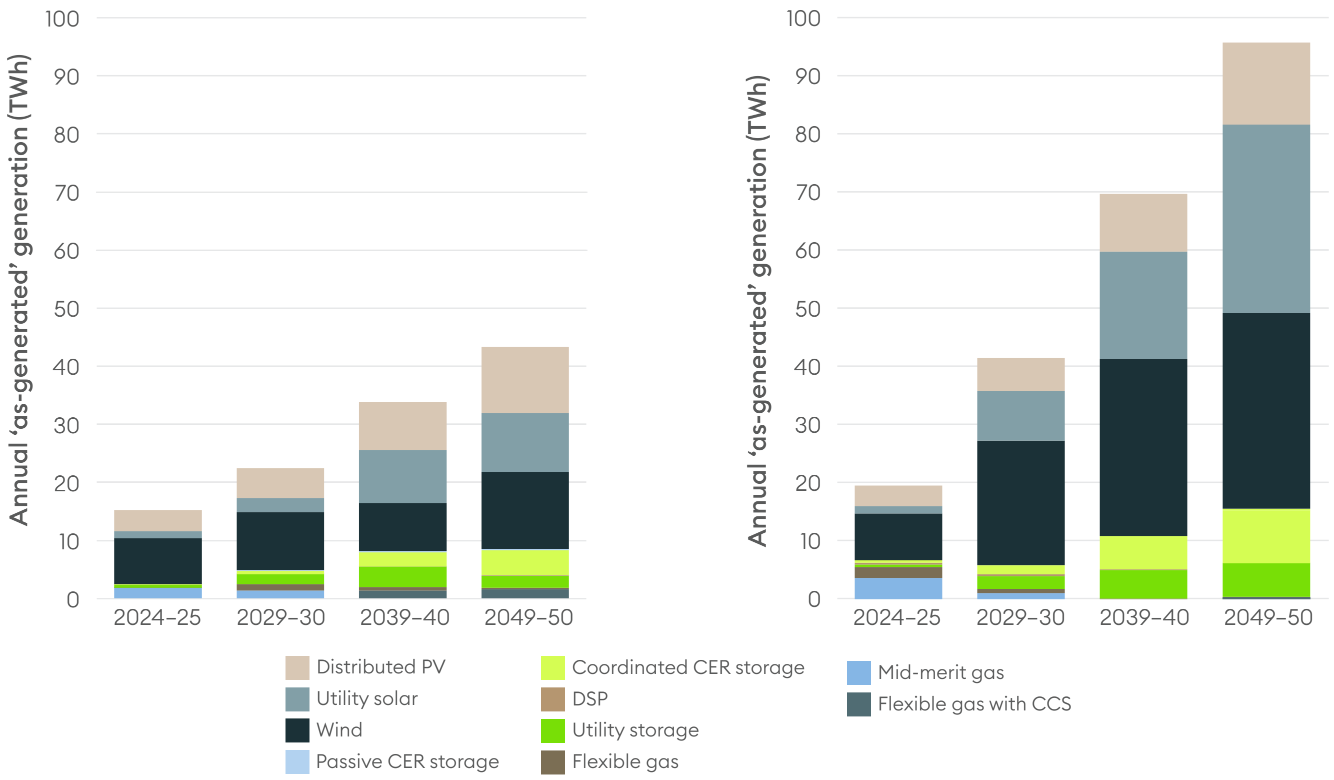


Figure 14: Comparison of future generation outlooks in the 2024 ISP *Step Change* and *Green Energy Export* scenarios

Recognising the need for forward planning, to coordinate connection of new generation and new loads to the transmission network, ElectraNet seeks to work collaboratively with customers to ensure efficient and timely connection to the transmission network.

We encourage proponents to engage with ElectraNet early from the project's inception to ensure ElectraNet can adequately plan the network to deliver the best outcomes for the community and maximise utilisation of the proponent's plant.

ElectraNet welcomes connection inquiries and encourages interested parties to contact its Corporate Development Team: connection@electranet.com.au

Further detail about the connection services ElectraNet offers can be found on the website.[35]

[35] ElectraNet | Connection Capabilities

3.2 Expanding Connection Opportunities

ElectraNet's Network Transition Strategy is focused on timely and efficient development of adequate transmission infrastructure.[36] New transmission is essential to connect new renewable generation and storage to supply existing customer demand, and to meet increasing demand from electrification and new industrial loads.

Through this strategy, ElectraNet is delineating areas of the state where the best opportunities for connection to the transmission network can be found. Accordingly, we encourage proponents to consider points on the network that offer best available connection relevant to their project location.

Completion of the Eyre Peninsula Link in 2023 increased our capacity to connect more users to the electricity network, enables new renewable energy projects to connect to the network, and provides opportunity to expand the network in future. The Eyre Peninsula Upgrade (anticipated by 2027) will make the most of this opportunity to expand the capacity of the transmission network on the Eyre Peninsula by enabling the lines between Cultana and Yadnarie to be operated at 275 kV (instead of their existing 132 kV), further increasing the opportunities for new loads and generators to connect on the Eyre Peninsula.

Construction of the South Australian component of Project EnergyConnect (full capacity release expected in 2027) improves the security and resilience of the power system, and will enable more renewable energy development and exports from South Australia once complete.

Project EnergyConnect is supported by the recent completion of the Bundey Substation. As South Australia's first 330 kV substation, Bundey facilitates power exchange between South Australia and NSW, and serves as a hub for future renewable energy integration, extending the project's benefits far beyond those which were considered in the project's original benefits analyses. Bundey houses the state's largest electricity transformers, essential for managing power flow across this new interstate energy corridor.

The Northern Transmission Project (NTx) is planned to extend the footprint and capability of the transmission network to meet projected demand growth and unlock renewable energy resources in the northern and eastern regions of the state where massive growth in mining, renewable generation, green iron and steel, and other industry is being planned for.

The southern component of the project will also enable higher transfers of renewable energy to meet demand growth and ensure security of supply through a diverse transmission path to Adelaide as its supply becomes more dependent on distant renewable sources.

In addition, ElectraNet's analysis of the South East Expansion is showing significant benefits. ElectraNet is planning to initiate a stand-alone RIT-T to progress this project.

This suite of recently completed and near-term developments provides proponents with a geographical understanding of where the transmission network can best be accessed, as well as ElectraNet's commitment to development of the network in a manner that supports both individual project connections and the shared goal of an orderly energy transition through rigorous planning and well-sequenced construction of new transmission.

[36] ElectraNet | Network Transition Strategy

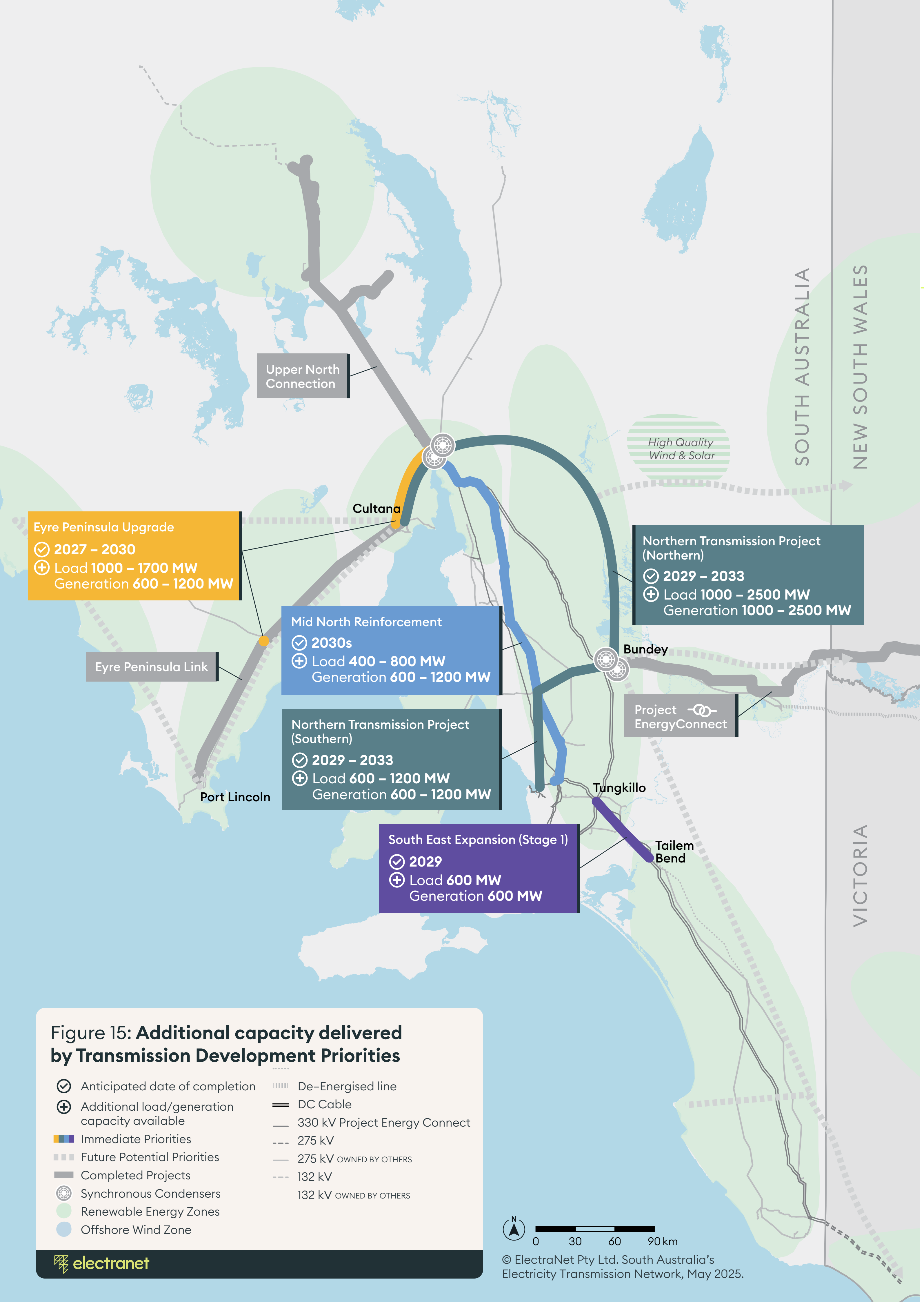


Figure 15: **Additional capacity delivered by Transmission Development Priorities**

PART B: Technical Advice Regarding Network Connection

ElectraNet is committed to providing timely and accurate advice to customers and stakeholders regarding connection opportunities to the transmission network.

The South Australian network is subject to jurisdiction-specific operating requirements that proponents should understand when considering connection.

ElectraNet aims to provide advice to proponents so that they understand underlying factors relevant to generation and load connection in South Australia, and to ensure that their connection decisions are informed by best-available technical information.

Considerations relating to connection to ElectraNet's transmission network are set out in greater detail below.

This section provides advice on the following:

- Withdrawals and new connections
- Connection opportunities for generators
- Connection opportunities for load customers
- Approach to network limits, non-credible events and transmission connections in South Australia
- Changes to ElectraNet's stability assessment process
- Proposed and committed new connection points
- Projects for which network support solutions are being sought or considered.

Network Capacity for Connections Reports

ElectraNet advises that it will develop a series of Network Capacity for Connections Reports from 2025, setting out the extensive technical data that has previously been provided via the 'Summary of Connection Opportunities' section in previous Transmission Annual Planning Reports.

This series of new reports will set out connection opportunities on a region-by-region basis, with the first of the series focusing on the Mid North and providing an update of hosting capacity in that part of the state.

Network Capacity for Connection Reports will not be available at the time of this 2025 Transmission Annual Planning Report's publication. As an interim measure, ElectraNet refer customers to the 'Summary of Connection Opportunities' in section 5.2 of the 2024 Transmission Annual Planning Report.

ElectraNet will provide updates regarding availability of Network Capacity for Connection Reports to customers as they are published. ElectraNet plans to publish the first Network Capacity for Connection Report, for the Mid North, in mid-2025.

3.3 Summary of Withdrawals and New Connections 2025

ElectraNet provides a summary of South Australian generator connections, generator withdrawals, commitments to connect, and announcements of intention to withdraw (Table 4, Table 5 and Figure 15).

This summary provides an update on data and advice on changes that have occurred since release of the 2024 Transmission Annual Planning Report.

A full accounting of expected retirements and connection status is available on the AEMO website.[37]

Table 4: Generators that have announced planned withdrawal

Generators	Type	Size	Announced closure date
Torrens Island B	Turbine – Steam Sub Critical	800 MW	June 2026
Osborne	Turbine – CCGT	180 MW	December 2027
Port Lincoln GT	Turbine – OCGT	74 MW	January 2028
Snuggery	Turbine – OCGT	84 MW	January 2028

Table 5: Generators that have connected since October 2024 or are committed or anticipated to connect in future

Generators	Type	Size	Status
Blyth BESS	Storage – Battery	200 MW	In Service December 2024
Bungama Solar	Storage – Battery	150 MW	Committed Mar 2026
Clements Gap – BESS	Storage – Battery	60 MW	Committed CIS SA-VIC tender May 2026
Goyder South Wind Farm 1A	Wind	209 MW	In commissioning
Goyder South Wind Farm 1B	Wind	203.5 MW	In commissioning
Mannum Solar Farm 2	Solar	30 MW	In commissioning
Mannum BESS	Storage – Battery	100 MW	Anticipated Sep 2025
Templers BESS	Storage – Battery	111 MW	Committed Aug 2025
Summerfield BESS	Storage – Battery	240 MW	Has a TCA Dec 2025
Goyder North Renewable Energy Facility	Wind	300 MW	CIS tender 1 Dec 2028
Palmer Wind Farm	Wind	274 MW	CIS tender 1
Hallett BESS	Storage – Battery	50 MW	CIS SA-VIC tender
Limestone Coast West BESS	Storage – Battery	250 MW	CIS SA-VIC tender
Solar River	Solar Storage – Battery	230 MW 170 MW	CIS SA-VIC tender

[37] AEMO | Forecasting and Planning Data

Figure 15: **New Connections & Withdrawals**

3.4 General Advice on Connection Opportunities for Generators

Almost any point on the Main Grid 275 kV transmission system should be suitable for a new generator to connect.

Several 275 kV substations in the Mid North represent strategic locations close to fuel resources, including wind.

Sites that are electrically favourable for connecting generation are located along the 275 kV backbone from Cultana (near Whyalla) to South East (near Mount Gambier).

Location-Specific Advice

Generators should note the following advice applicable to connections in the locations listed below:

- Connections on the Davenport – Bungama – Blyth West – Munno Para – Para 275 kV lines may be subject to constraints or forced outages under N-1 conditions, and may become increasingly subject to constraints at times of high aggregate generation output under system normal conditions.
- Connections on the Davenport – Robertstown 275 kV lines may become subject to constraints under N-1 conditions.
- Connections on the Torrens Island – Le Fevre – Pelican Point – Parafield Gardens West – Para 275 kV lines may be subject to constraints under N-1 conditions, and may become subject to constraints at times of high aggregate generation output under system normal conditions.
- Generation connected anywhere from Tungkillo through to Tailem Bend and South East may be subject to co-optimised dispatch with the Heywood interconnector, due to its potential impact on the ability to import power from Victoria and the rest of the NEM.
- Connection between Tailem Bend and South East is complicated by series compensation at Black Range and may not be cost effective, subject to but not limited to the technical requirements to mitigate the impact of the new connection and the scale of the connection proposal.
- Due to physical space constraints, Davenport (near Port Augusta), Cultana (near Whyalla) and Robertstown are each approaching the limit of their ability to physically accommodate new connections. Further connections at any of these locations are likely to require substantial investment by the connecting party to either expand the site or establish a nearby new substation. Bundey is a suitable site for proponents near Robertstown to connect.
- At times of coincident high wind generation output and high solar generation output, including from distributed rooftop solar PV, generation constraints can be onerous. Conversely, such conditions could be favourable for energy storage proposals. Again, we recommend that parties seeking connection to the network carry out a detailed network access and market impact assessment.
- While the existing Metropolitan transmission system may have capacity to accept new generation connections, population density may limit the ability to economically extend the network. Existing maximum fault levels are also approaching the plant capability limits of our assets, particularly in the vicinity of Torrens Island, LeFevre, New Osborne, Kilburn, Northfield, Magill and within the Adelaide Central Business District. Connection of new synchronous generation could initiate a need for major replacement of transmission assets to address fault level issues.

Technical Considerations for New Connections

Technical considerations that apply to new connections in South Australia are provided in Appendix E of this report.

3.5 Connection Opportunities for Load Customers

ElectraNet advises that almost any point in the proximity of the Main Grid 275 kV transmission system and the 132 kV sub-transmission system should be suitable for a new load to connections. Substantial load connections may require coordination with deep network augmentation and this may come at a cost to the proponent.

An under-voltage load shedding scheme is applied to major loads that are connected at or near Davenport (at the northern end of the transmission system) to allow for secure operation under outage conditions.

New load connections in this area may be incorporated into this scheme to ensure that voltage levels continue to be adequately managed.

3.6 Approach to Network Limits, Non-Credible Events and Transmission Connections in South Australia

Network planning and design is about ensuring the efficient, safe and secure operation of the power system for energy consumers when the network is 'under stress'.

TNSPs make extensive efforts to ensure that their network will withstand stress conditions in accordance with obligations under the Rules alongside upholding stringent electricity industry standards as a matter of operational practice.

The Rules define two levels of 'stress', known as 'credible' and 'non-credible' contingency events.

A credible contingency event is defined in clause 4.2.3(b) of the Rules as an event which AEMO considers reasonably possible in the surrounding circumstances, such as the unexpected loss of either one generating unit in South Australia or a single item of transmission plant such as a single circuit of a transmission line.

The power system is generally designed to withstand these events without disruption to customers.

A non-credible contingency event is defined in clause 4.2.3(e) of the Rules as a contingency event that is not a credible contingency event, therefore an event that AEMO does not consider reasonably possible.

The example given in the Rules includes the simultaneous failure of multiple elements. The power system is not necessarily designed to withstand these without disruption but there is an expectation that emergency controls such as load or generation shedding will reduce but not eliminate the probability of cascading failure following this type of event. It would be prohibitively expensive to design and build a transmission system that can withstand any and all non-credible contingencies.

To date, ElectraNet has planned and operated the power system to withstand the loss of the single largest generating unit in South Australia without disruption. Historically, that was a Northern Power Station generating unit at 273 MW.

In practice, therefore, ElectraNet has sought to ensure that South Australia's electricity transmission network could continue to operate securely even if 273 MW of generation was lost unexpectedly.

More recently the Snowtown 2 wind farm and Port Augusta Renewable Energy Park have been connected which are now the equal largest credible contingencies in South Australia at 273 MW each.

As the network has continued to evolve with the ongoing uptake of renewable generation and the expected increase in interconnection capacity with the eastern states, ElectraNet's approach to identifying and quantifying credible contingencies has shifted to rely on system studies demonstrating the network's capacity to withstand contingencies of a certain size.

Accordingly, ElectraNet's approach to managing the network has become to identify the maximum amount of generation or load that could be lost and the network maintained without disrupting others (i.e. without activating load or generation shedding schemes).

The focus has been on the total load or generation quantity whose loss could be sustained without disruption. This then defines the largest credible contingency.

There are technical considerations for managing credible contingencies which can influence the ability to connect to the NEM in South Australia:

- Contingencies below 273 MW are proven and likely to be technically feasible, subject to local conditions
- Contingencies beyond 400 MW are unlikely to be feasible in South Australia.

Contingencies between 273 MW and 400 MW would be new for SA, and would require significant work between the connecting party, ElectraNet and AEMO to ensure technical and economic validity.

ElectraNet and AEMO (as the market advisory body for connections) work with connecting parties to ensure that their plant design incorporates the ability to maintain the single largest contingency at the value currently defined within South Australia.

The South Australian Interconnector Trip Remedial Action Scheme (SAIT RAS) is being designed for the total loss of either the Project EnergyConnect or Heywood interconnector corridor. This is expected to be as high as 800 MW for system normal conditions, representing an increase in the largest non-credible contingency event from the current multiple generation loss of up to 500 MW in South Australia.

SAIT RAS may not be effective for a single non-credible contingency within South Australia that exceeds 800 MW. Any proposed (double circuit) generator connections exceeding 800 MW in capacity are therefore likely to be constrained to prevent them exceeding that level in practice to meet power system security and stability requirements.

ElectraNet's analysis shows that all generator connections made after 2010 ride through the non-credible loss of the Heywood Interconnector.

ElectraNet has already received multiple connection enquiries that are exploring the 400 MW limit.

More detail about the SAIT RAS is provided at 6.3.3.

3.7 Changes to Electranet's Stability Assessment Process

The South Australian energy transformation has created two key challenges in relation to the stability assessment process:

- Network complexity: South Australia is the most globally advanced variable renewable penetration network which has created new challenges and network complexities due to the variability of electricity generation and usage patterns which require innovative solutions
- High connection demand: our world-leading reputation has resulted in unprecedented levels of interest in connecting to the South Australian electricity network.

As it currently stands, ElectraNet can only undertake about eight stability assessments per year. We are constrained in part by computing capacity, but more so by access to the specialised skills required to complete and review these assessments.

Given the unprecedented interest in connecting to the network ElectraNet are currently exploring all options to increase the number of stability assessments able to be undertaken at any one time. Every part of ElectraNet's stability assessment approach has been reviewed including processes, resourcing and use of technology.

From April, ElectraNet has commenced a trial which will increase the stability assessment options available to customers. These options will allow ElectraNet to undertake up to six stability assessments at any one time, up from the current maximum of two.

ElectraNet will continue to run its established process for stability assessment, with two stability assessments run by ElectraNet at any one time.

A new option will be introduced for customers under a 'start when ready' approach, with up to four projects having their stability assessment completed by an external provider. Following the successful completion of a stability assessment the project will be integrated into ElectraNet's network models.

A high-level overview of these approaches is included below (Figure 16):

- **Traditional**: Utilises the base model to assess all committed project and system variables
- **Start When Ready**: Utilises a parallel model to assess most committed project and system variables to gain comfort of stability. Conditional TCA offered and committed status while waiting for final assessment and integration to the base model.

The successful completion of both approaches will result in the issuance of a 5.3.4 A/B letter from AEMO and subsequent offer to connect from ElectraNet.

Additional options will be available under special circumstances with heavily provisioned offers to enable customers' specific business goals while increasing their risk materially.

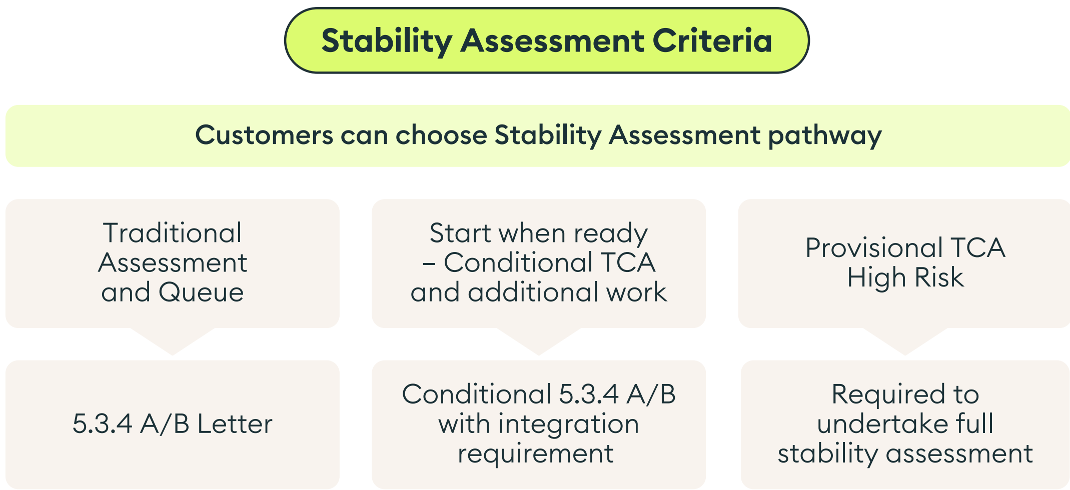


Figure 16: Stability assessment pathways

3.7.1 Details of Stability Assessment Options

ElectraNet conducts system strength impact assessments in line with clause 4.6.6 of the Rules and AEMO's System Strength Impact Assessment Guidelines.[38]

The assessment utilises models supplied by the customer and maintained by the Network Service Provider in a wide area (typically across the whole of South Australia).

Traditional assessment process

The traditional assessment process utilises the current base model to build and operate a set of scenarios against all the committed and considered projects on the transmission network. These assessments are the primary pathway to be assessed against the network. This pathway is limited to two projects at a time to ensure separation and identification of issues or responses during the assessment process.

This overall assessment ensures a minimum level of risk and issues to be included in either a 5.3.4 letter or Transmission Connection Agreement.

Start When Ready assessment process

Differing from the traditional assessment process, the "Start When Ready" assessment process utilises a parallel model to the traditional process, being built to operate a similar set of scenarios against most committed and considered projects on the transmission network. These assessments are the secondary pathway which will require additional assessment against the primary model later. This pathway is limited to four projects at a time to ensure the complexity can be managed and any issues can be identified during the assessment process.

This overall assessment ensures an understanding of the performance and interactions to minimise the customer risk, allowing the issue of a conditional 5.3.4 letter and a conditional Transmission Connection Agreement.

A subsequent assessment is required as soon as practical (as defined by ElectraNet) to integrate this parallel model into the base model, ensuring a full assessment has been conducted and allowing the issue of an unconditional 5.3.4 letter and Transmission Connection Agreement.

Other assessment processes

Additional options will be available under special circumstances with heavily provisioned offers to enable customers' specific business goals while increasing their risk materially.

3.8 Proposed and Committed New Connection Points

There are no new connection sites that have recently been energised, committed, or are proposed to enable the connection of new generators or loads. All recent and committed connections are to existing connection points.

[38] AEMO | System Strength Impact Assessment Guidelines

3.9 Projects for which Network Support Solutions are being Sought or Considered

There is one planned and three current consultations for forecast limitations for which we plan to seek proposals for network support solutions (Table 6).

Future dates are indicative only. Reports will be published on ElectraNet's website,[39] with a summary on AEMO's website.[40]

ElectraNet also liaises with AEMO to notify interested parties when we publish new Regulatory Investment Test for Transmission (RIT-T) reports through the "AEMO Communications" email notifications.

Table 6: Projects for which ElectraNet is seeking proposals for non-network solutions

RIT-T	Expected project commitment date	Consultation status
Eyre Peninsula Upgrade	2026	ElectraNet published the Project Assessment Draft Report (PADR) for this project in March 2025.[41] The preferred solution identified by the PADR is to upgrade operation of the Cultana to Yadnarie double circuit lines from 132 kV to 275 kV by performing 275 kV works at Cultana and establishing a new 275/132 kV substation at Yadnarie North. The PADR also identifies that if sufficient new customer load connections become committed, then the construction of new double circuit 275 kV lines between Carriewerloo and Cultana should also form part of the preferred solution. ElectraNet plans to publish the Project Assessment Conclusions Report (PACR) by March 2026.
System Strength Requirements in SA	2026	ElectraNet published the PADR for this project in April 2025.[42] The PADR has identified that action is not required to meet the 'efficient level' system strength requirement under the ISP *Step Change* scenario. However, the addition of clutches to new synchronous generators would provide prudent insurance against increased system strength needs in the future, and ElectraNet considers that these contracts should be the basis of the preferred option. ElectraNet plans to publish the PACR by April 2026.
Northern Transmission Project (NTx)	2026	The RIT-T on this project was initiated when AEMO's 2024 ISP declared the Mid North SA REZ Expansion to be an actionable project. ElectraNet plans to publish the PADR by the end of 2025.
South East Expansion (Stage 1)	2026	ElectraNet plans to commence a stand-alone RIT-T for this project before the end of 2025.

[39] ElectraNet | Reports & Publications

[40] AEMO | Current and Closed Consultations

[41] ElectraNet | Eyre Peninsula Upgrade Project Assessment Report

[42] ElectraNet | Meeting System Strength Requirements in SA

Chapter 4

Community & Sustainability

4.1 Community Engagement

A Cornerstone of Transmission Development

Central to the success of delivering the electricity transmission infrastructure needed in South Australia is meaningful, early, and ongoing community engagement.

Transmission infrastructure is highly visible, has a long asset life, and often crosses privately held land or areas of environmental or cultural sensitivity. Across the NEM, opposition from communities has resulted in delays or increased projects costs. For this reason, community engagement is not a stakeholder management exercise for ElectraNet, instead it is seen as integral to our ongoing operations and essential for earning and maintaining social and community acceptance to build, operate and maintain the transmission network and enable the transition to net zero.

ElectraNet's approach to community engagement is aligned with industry best practice and has regard to:

- The South Australian Planning Commission's Community Engagement Charter
- The International Association for Public Participation
- The Energy Charter's Better Practice Social Licence Guideline
- The Energy and Climate Change Ministerial Council's National Guidelines for Community Engagement and Benefits for Electricity Transmission Projects
- The Australian Energy Infrastructure Commissioner's Observations and Recommendations in relation to Community Engagement
- The South Australian Department of Energy and Mining's Principles for Engagement with Communities and Stakeholders
- The South Australian Chamber of Mines and Energy's Land Access Engagement Guidelines
- The Australian Energy Regulator's Regulatory Investment Test for Transmission Guidelines.

ElectraNet Principles for Community Engagement

Clear, Accurate and Timely
Comprehensive forward planning and accurate and timely communication are essential.

Accessible and Inclusive
Ensure that every member of the community is included, well informed and listened to.

Transparent
Communicating the same information to the same people at the same time avoids confusion and misunderstandings.

Measurable
We are committed to monitoring our community engagement strategy and building in feedback loops.

This approach has seen engagement grounded in proactive consultation with landholders, Traditional Owners, and local communities throughout all stages of project planning and delivery – with a view to minimise the impact of the project where possible. This includes early engagement to inform route selection, dedicated land access teams to support negotiations, and the development of tailored community benefit programs.

Throughout its history, ElectraNet has built a strong reputation for community engagement. By fostering open dialogue, addressing concerns proactively, and creating an inclusive environment where everyone feels valued and heard, ElectraNet has developed robust relationships with the communities it serves.

ElectraNet's work was recently recognised in a Premier's Award for the collaboration with the Barngarla Determination Aboriginal Corporation, in the development of the 270 km transmission line from Cultana to Port Lincoln. Over two and a half years of construction, 86 Barngarla people were engaged to create one of the largest cultural heritage monitoring programs in Australia, ensuring their country and culture were protected while works on the new line progressed through to completion.

By prioritising genuine engagement, ElectraNet is helping ensure that transmission development in South Australia delivers not only energy system benefits, but also tangible, lasting value for the communities that host this critical infrastructure. ElectraNet believe this approach can also work to enhance broader public confidence nationally in the energy transition.

4.2 Sustainability Factors Impacting the Network

Operating sustainably is integral to ElectraNet's role in the transition to a clean energy future – that means developing, operating and maintaining the network in a way that creates opportunities for both people and nature to thrive.

With guidance from internationally recognised frameworks, ElectraNet is committed to setting targets, monitoring and reporting on Environmental, Social and Governance (ESG) sustainability performance, as well as improving the resilience of the business to climate and other ESG-related risks tailored to the nature and objectives of the business.

Our sustainability focus areas ensure we operate responsibly, support South Australia's energy transition, and create lasting value for our stakeholders. These focus areas are as follows:

- Renewable Energy Transition
- Greenhouse Gas Emissions
- Biodiversity and Habitat
- Health and Safety
- Diversity, Equity and Inclusion
- Human Rights
- Reconciliation and Engagement with Traditional Owners
- Engagement with Landholders and Communities
- Governance, Compliance and Ethical Conduct
- Cyber and Physical Security
- Understanding and Managing Climate Risk.

Sustainability governance is embedded in our operations. Our commitment to sustainability is supported by robust policies, management oversight, and regular reporting to meet standards and regulations.

ElectraNet's environmental management approach is underpinned by a systematic approach to environmental management, and is supported by robust procedures that all staff and contractors are expected to understand and apply. In recognition of this, ElectraNet's environmental management system is certified to the International Standards Organisation for environmental management, ISO14001.

ElectraNet's policies ensure that every effort is taken to safeguard the environment for future generations to enjoy. ElectraNet strives to incorporate these aspects into the planning of new developments, and to ensure this approach is consistently maintained throughout the asset lifecycle.

The guiding principle of ISO14001 is continual improvement, and ElectraNet strives to be authentic in applying this approach to all aspects of our activities. ElectraNet is committed to minimising, or where possible preventing, environmental impacts in pursuit of energy and infrastructure solutions that help South Australia transition to a clean energy future.

4.2.1 South Australian Net Zero Strategy Implementation

South Australia's Net Zero Strategy Targets

South Australia's Net Zero Strategy is crucial to the government's response to the climate emergency declared in May 2022. It outlines objectives, policies, and actions to reduce greenhouse gas emissions, enhance prosperity, and improve wellbeing. The strategy aims to meet interim emissions targets and achieve net zero emissions by 2050.

More specifically the Government of South Australia's greenhouse gas emissions reduction targets are to:

1. Reduce net greenhouse gas emissions by at least 60% by 2030 (from 2005 levels)
2. Achieve net zero emissions by 2050
3. Achieve 100% net renewable electricity generation by 2027.

The South Australian Net Zero Strategy prioritises energy generation, including transmission and storage, to achieve targets by accelerating sustainable development and deployment of renewable energy, energy storage, demand management technologies, and transmission infrastructure.[43]

ElectraNet's role in South Australian Net Zero

Enabling the renewable energy transition through our major transmission projects and supporting our clean energy-focused customers, ElectraNet plays a key role in energy transmission and energy storage for the South Australian Net Zero Strategy. ElectraNet considers the Renewable Energy Zone (REZs) development that AEMO identifies for potential development in the ISP along with the results of our own analysis to identify potential projects to provide additional capacity.

ElectraNet's key proposed developments (section 5.2.1) would unlock capacity in a substantial number of South Australian REZs:

- **Eyre Peninsula Upgrade**: S9 Eastern Eyre Peninsula
- **Northern Transmission Project (NTx)**: S3 Mid North SA, S2 Riverland, S5 Northern SA, S9 Eastern Eyre Peninsula
- **South East Expansion (Stage 1)**: S2 South East SA
- **Mid North Reinforcement:** S3 Mid North SA, S5 Northern SA.

4.2.2 Low Carbon Energy Transition

Australian Electrical Grid Emissions Scenario

Electricity emissions have decreased since 2016, driven by renewable generation and transmission expansion. Estimated to be 153 Mt CO2-e in 2024, emissions are projected to decrease by 62% to 59 Mt CO2-e by 2030 and 81% to 29 Mt CO2-e in 2040.

The electricity emissions projections use the AEMO forecast of underlying electricity demand from the 2024 ISP Step Change scenario with further adjustments.

Through the CIS the government seeks competitive tender bids for variable renewable capacity and clean dispatchable capacity projects to deliver an additional 32 GW of capacity by 2030.

NEM Emissions

Emissions in the NEM are projected to decrease from 126 Mt CO2-e in 2024 to 41 Mt CO2-e in 2030 and 14 Mt CO2-e in 2040 in the baseline scenario, a decrease of 112 Mt CO2-e or 89% from 2024 to 2040. The share of renewable generation in the baseline scenario is projected to continue to grow to 84% in 2030.

South Australia Emissions Factors

South Australia's electricity emissions are expected to decrease significantly, due to increased renewable energy use, reducing reliance on fossil fuels and resulting in a 0.05 tonnes CO2-e per MWh emissions intensity by 2040.[44]

[43] Government of South Australia | South Australia's Net Zero Strategy 2024–2030
[44] Australian Government DCCEEW | Australia's Emissions Projections 2024

4.2.3 Electrical Vehicle Growth Impact on the Grid

Electrical Vehicle Growth

Electric vehicle (EV) sales in Australia have shown steady growth, with 85,319 units sold by the end of September 2024. EVs now account for 9.5% of all new car sales in Australia, marking an increase from 8.4% in 2023 and a 150% increase in market share compared with 2022.

The ACT continues to lead the country on EV sales (as a proportion of new vehicle sales) at 25.1% at September 2024, followed by Queensland (9.6%), New South Wales (9.5%), Victoria (9.4%), Western Australia (9.3%), South Australia (8.2%), Tasmania (8.0%) and the Northern Territory (4.0%).[45]

South Australian Electric Vehicle Growth

EVs are forecast to become the default choice for new vehicle purchases by 2040 in South Australia.[46]

The Government of South Australia's goal for 170,000 EVs by 2030 and one million EVs to be integrated into the electricity system over the next 20 years.[47]

EV Load on the Grid Infrastructure

EV charging is forecast to become a major component of grid demand in South Australia. EV Load is forecast to increase by 5.01 Terawatt hours (TWh) in South Australia, with the potential to drive the need for upgrades to transmission infrastructure (Figure 16).

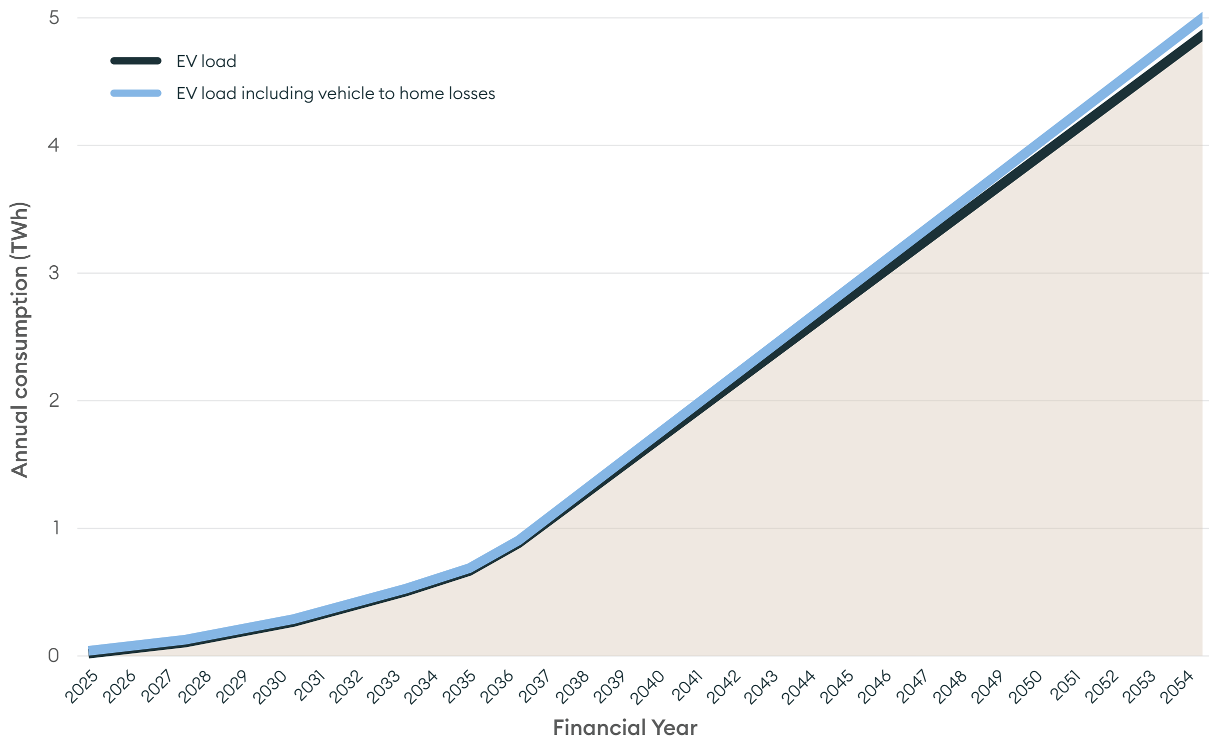


Figure 16: Forecast EV load in South Australia

[45] Electric Vehicle Council | State of Electric Vehicles 2024
[46] Energy & Mining | South Australia's Electric Vehicle Action Plan
[47] AEMO | Draft 2025 Inputs, Assumptions and Scenarios Report

4.2.4 Climate Change

Bushfire risk

Climate change is expected to increase temperatures and influence rainfall patterns, increasing the incidence of extreme weather such as drought. These factors are expected to combine to increase the incidence and severity of bushfires.[48]

Studies have determined that due to climate change by 2030 the number of days with a severe fire danger rating will increase from the baseline by 35% in the Rangelands, 28% in the Murray Basin and 12% in the Southern and Southwestern Flatlands.[49]

Intermittent and short duration interruptions to transmission services can occur due to the presence of smoke, meaning even small fires in the wrong location could have consequences for electricity transmission services.

Longer, more persistent outages could eventuate if fires damaged lines or substations. Such events are more likely to occur with catastrophic outcomes.

An example of this is the bushfires of January 2021, close to ElectraNet's Cherry Gardens substation. The bushfires did not directly affect the site, as they were never closer than several kilometres from the substation. However, three transmission lines, two 275 kV and one 132 kV, were tripped because of the smoke of fires close to or running under these lines.

As a result, the transfer capacity of the Heywood Interconnector was greatly limited, challenging the available supply capacity in South Australia.

Due to the potential impacts a bushfire might have on electricity supply to the Adelaide area during a natural disaster, we consider the potential impact of this risk in our medium-term and long-term planning of the transmission network and seek to design network solutions to mitigate it.

Coastal inundation

With South Australia's population typically situated on the coast, electrical transmission infrastructure is often quite close to the coast.

Climate change is forecast to lead to increases in sea level, which may cause coastal inundation. By mid-century, sea levels are projected to rise around 24 cm along the South Australian coast.[48] Regions such as the Lefevre Peninsula and Torrens Island are low-lying and exposed to this risk. Other areas such as Davenport may be exposed but at a lesser risk.

Sea levels are not forecast to rise quickly, however major tidal storm surges can occur at short notice. The rise of sea levels will increase the extent and frequency of coastal flooding.

Using tools like the web portal for Coastal Risk Australia 2100 it is possible to observe some probable outcomes.[50]

For example, the tool shows that all the substations located on Torrens Island and Garden Island (Snapper Point, Pelican Point, Lefevre Substation, Torrens Island North and Torrens Island A & B) and associated transmission lines are at high risk of being flooded or stranded due to flooding of access roads (Figure 17).

Similarly, Port Pirie substation would be at high risk, while Hummocks substation has a medium risk.

ElectraNet will continue monitoring water level rise projections, to have a better understanding of the potential future risk to the network and the need to consider it in long-term planning.

Increasing temperatures

Climate change is forecast to increase global temperatures. By the mid-century, annual mean maximum temperatures are projected to increase by up to 2.2°C in South Australia, with a greater increase projected in the north of the state.

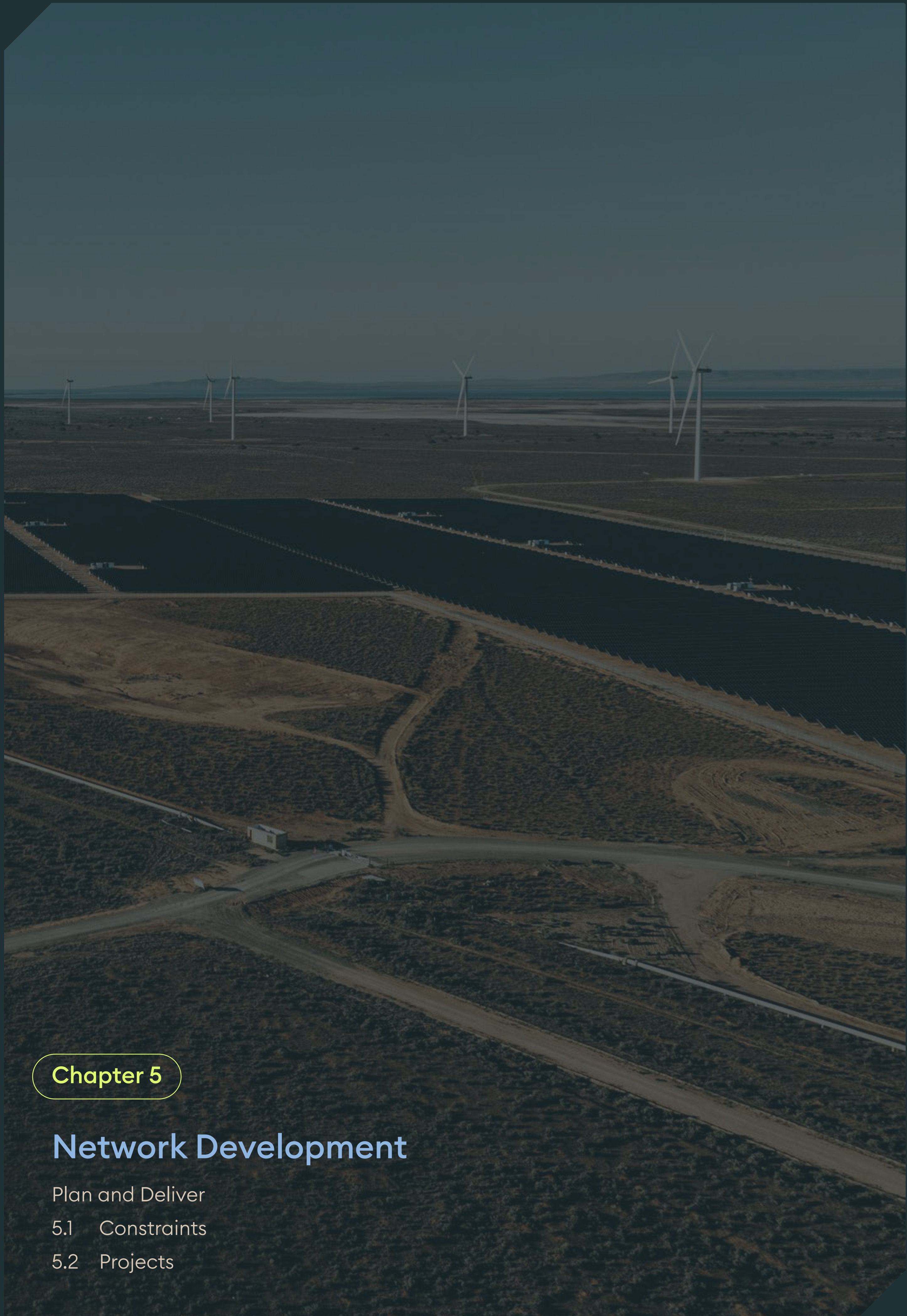
Additionally, the number of days per year above 35°C is projected to increase by more than 40%.[48]

An increase in temperature is expected to lead to derating of transmission network assets. Deratings will be correlated with maximum demand conditions which are driven by high temperatures.[48]

In medium-term planning of the transmission network, ElectraNet is considering the potential impact of these factors.

Figure 17: Potential sea level rise at Torrens Island

[48] Climate Change in Australia | Bushfire risks for transmission 2021
[49] Department for Environment and Water | Guide to climate projections for risk assessment and planning in South Australia 2022
[50] Coastal Risk Australia | Viewer



Chapter 5

Network Development

Plan and Deliver

ElectraNet plans and implement projects to consistently and continually improve our delivery of timely and efficient transmission infrastructure to connect customer loads with renewable energy and storage and maintain reliability of supply.

This chapter focuses on four key projects that aim to ensure the South Australian energy transmission grid will continue to provide adequate capability and capacity for future new customers and generators. It will also provide a high-level summary of significant projects ElectraNet have recently completed, committed to or have become anticipated over the last year.

ElectraNet is also addressing constraints on the transmission system, as well as forecasting emerging constraints that could impact future efficacy of the transmission system, without proposed network development.

In the planning and delivery of these projects, ElectraNet recognises the importance of effectively engaging with community stakeholders in a manner that aims be respectful, inclusive, transparent, genuine, accountable and flexible (section 4.1). Further to this, ElectraNet continually strives to understand and respect Traditional culture, underpinned by a commitment to the protection of sites of cultural significance and provision of support in the preservation of them for current and future generations.

5.1 Constraints

Constraints on the transmission network can impact energy reliability and the price of electricity, as AEMO uses constraint equations to manage system security and market pricing.

The South Australian energy system is already being constrained by the state's nation-leading share of variable renewable energy. This is instigating proactive planning of efficient and cost-effective future projects – both on-grid development and off-grid solutions with third parties and customers – by ElectraNet, to ensure South Australian homes and businesses aren't caught-out by an expensive 'too-late' reactive approach. It is important to understand the constraints on the system, before exploring project solutions.

5.1.1 Constraints in 2024

AEMO uses constraint equations to manage system security and market pricing. When a constraint binds on dispatch it is a system limitation altering the level of power from either a generator or an interconnector from what it would have been if there was no constraint. Generators and interconnectors can be either constrained 'on' (above the level that would otherwise be set by the market) or constrained 'off' (below the level that would otherwise be set by the market).

AEMO publishes the marginal value of a constraint when it binds. The marginal value indicates its impact on market prices, but this measure is only an approximation and can be misleading in some instances. At times, constraints that have a relatively small impact can report large marginal values due to interactions between the network limitation, price at the time and the bids of generators affected by the constraint. As a result, ElectraNet also considers the hours of the year a constraint impacts on the market. Together, these two metrics provide insights into the market benefits that may be achieved by alleviating the constraint.

The binding constraints reflecting the top 20 constraints by impact in 2024 are presented below (Table 7). Alleviating, or un-binding, these constraints are predominantly reliant on the next phases of the current MurrayLink, EnergyConnect and Northern Transmission (NTx) projects. Some constraints have contributed to the identification and planning of ElectraNet's key potential developments for the SA transmission network in 2025.

Table 7: South Australia's top 20 binding constraints in 2024

Network limitation	Binding impact in 2024 [$]	Binding duration in 2024 [hours]	Comments, with proposed implemented actions
S>NIL_MHNW1_MHNW2 Avoid overload of Monash – North West Bend #2 132 kV line if the Monash – North West Bend #1 132kV line was to trip	10,842,475.8	1673.1	This constraint will be alleviated when project EC.15175 Increase Murraylink Transfer Capacity upgrades the existing runback control scheme to include bi-directionality and allow it to run forward if required
S>NIL_HUWT_STBG3 Limit Snowtown WF generation to avoid overload of Snowtown – Bungama 132 kV line if the Hummocks – Waterloo 132 kV line was to trip	3,220,099.2	316.3	ElectraNet is monitoring this constraint to determine if the implementation of our proposed EC.15571 10-band rating NCIPAP project is likely to alleviate this constraint
S>NIL_BWMP_HUWT Avoid overload of Hummocks – Waterloo 132 kV line if the Blyth West – Munno Para 275kV line was to trip	1,625,369.4	144.6	ElectraNet is monitoring this constraint to determine if the implementation of our proposed EC.15571 10-band rating NCIPAP project is likely to alleviate this constraint, or if options such as automatic runback control schemes for 132 kV wind farms in the Mid North could be needed to alleviate this constraint
S-NIL_WTPT_SC+INV_2 Limit output of Wattle Point Wind Farm based on Wattle Point Wind Farm STATCOM status and the number of in-service Dalrymple battery inverters	1,334,758.9	115.3	This constraint is applied to manage system security during STATCOM unavailability at Wattle Point Wind Farm
S>NIL_NWRB2_NWRB1 Avoid overload of North West Bend – Robertstown #1 132kV line if the North West Bend – Robertstown #2 132kV line was to trip	1,073,772.0	158.0	This constraint will be alleviated when project EC.15175 Increase Murraylink Transfer Capacity upgrades the existing runback control scheme to include bi-directionality and allow it to run forward if required
S>>NIL_TWPA_TPRS Avoid overload of Templers – Roseworthy 132 kV line if the Templers West – Para 275kV line was to trip	491,580.3	62.3	This constraint would be alleviated by the installation of a second 275/132 kV transformer at Templers West and reconfiguration of the Mid North 132 kV system as part of the Northern Transmission Project
S>>NIL_RBTX_RBTX_1 Avoid overload of one Robertstown 275/132 kV transformer if the other Robertstown 275/132 kV transformer was to trip	186,603.6	60.4	This constraint will be alleviated when project EC.15175 Increase Murraylink Transfer Capacity upgrades the existing runback control scheme to include bi-directionality and allow it to run forward if required
SVML^NIL_MH-CAP_ON Upper limit of SA to Vic transfer across Murraylink interconnector to avoid voltage collapse at Monash	170,153.7	293.7	Project EC.15175 Increase Murraylink transfer capacity will alleviate this constraint
S>>NIL_TBTU_TBTU_1 Avoid overload of one Tailem Bend – Tungkillo 275 kV of the other Tailem Bend – Tungkillo 275 kV line was to trip	74,054.6	22.8	Project EC.11011 South East Expansion will alleviate this constraint
S>>NIL_TBTX4_TBMO_1 Avoid overload of the Tailem Bend – Mobilong #1 132kV line if the Tailem Bend 275/132 kV transformer was to trip	68,225.9	12.0	ElectraNet is investigating whether Project EC.11011 South East Expansion or the installation of a second 275/132 kV transformer at Tailem Bend would best alleviate this constraint
S_PPT+SNPT_270 Combined output of Pelican Point and Snapper Point generation limited to no more than 270 MW	66,435.6	4.8	This constraint is applied to maintain system security when 275 kV lines are out of service in the Western Suburbs
S_LB2WF_CONF Lake Bonney 2 & 3 generation limited based on DVAR availability	46,657.1	6.3	This constraint is applied to manage system security during DVAR unavailability at Lake Bonney Wind Farms 2 and 3
V::S_NIL_MAXG_1 Limit transfers from Victoria to South Australia to maintain transient stability for loss of the largest generation block in South Australia	42,854.7	22.8	The commissioning of Project EnergyConnect Stage 2 is expected to alleviate this constraint
SVML_ROC_80 Limit the rate of change of flows across Murraylink from South Australia to Victoria to no more than 80 MW / 5 Min	33,664.1	74.3	Constraint based on limit advice provided by Murraylink operator
S>NIL_BWMP_RHBR-T Avoid overload of Redhill – Brinkworth tee 132 kV line if the Blyth West – Munno Para 275 kV line was to trip	33,042.4	4.2	ElectraNet is monitoring this constraint

Table 7: South Australia's top 20 binding constraints in 2024 (cont.)

Network limitation	Binding impact in 2024 [$]	Binding duration in 2024 [hours]	Comments, with proposed implemented actions
V_S_NIL_ROCOF Limit Victoria to South Australia Heywood interconnection flows to prevent Rate of Change of Frequency exceeding 2 Hz/sec in SA if loss of Heywood interconnector was to occur	26,362.5	50.8	The commissioning of Project EnergyConnect Stage 2 is expected to alleviate this constraint
S>NIL_SGBN_SGSE-T2 Avoid overload of the Snuggery/Mayura – South East 132 kV line if the Snuggery – Blanche 132 kV line was to trip when the line component of the South East Control Scheme (SECS) is out of service	18,375.1	2.1	ElectraNet is monitoring this constraint
S>>NIL_BWMP_WTTP Avoid overload of the Waterloo – Templers 132 kV line if the Blyth West – Munno Para 275 kV line was to trip	17,786.5	7.4	This constraint would be alleviated by the installation of a second 275/132 kV transformer at Templers West and reconfiguration of the Mid North 132 kV system as part of the Northern Transmission Project
V_S_HEYWOOD_UFLS Limit Heywood flows when South Australian under frequency load shedding (UFLS) is insufficient (i.e. when UFLS blocks in SA <1000 MW) to manage for double-circuit loss of Heywood IC	10,739.1	16.4	Market impacts expected to be alleviated by fully operational Project EnergyConnect
S>NIL_NIL_SETX12 Void overload of either South East 132/275 kV transformer 1 or transformer 2 under system normal conditions	9,743.0	1.3	ElectraNet is monitoring this constraint

5.1.2 Emerging and Future Constraints

The committed implementation of Project EnergyConnect, establishing a new interconnector between South Australia and New South Wales, is already changing dispatch patterns of existing generators – with the Northern Transmission Project (NTx) to only impact further. Pairing this with the significantly growing renewable energy generation and anticipated new large industrial loads in the state is expected to lead to substantial changes in congestion patterns on the transmission network.

ElectraNet's most recent forecast of congestion focuses on rating limitations as the primary future constraint priority facing South Australia.

ElectraNet has based assessment of the thermal limitations in South Australia on the existing 3-band operational ratings. When considering new builds, some non-network options are selected to avoid network congestion. As a consequence, the congestion in this forecast may be underestimated. The 275 kV corridors where congestion is potentially underestimated include Davenport to Cultana, Tailem Bend to Tungkillo, and Robertstown to Tungkillo. Thermal limitations are also forecast across interconnectors Project EnergyConnect, MurrayLink and the Heywood Interconnector.

A high-level summary of this modelling, including thermal limitations, is represented in the mapping (Figure 18)

Figure 18: **Forecast Constraints**

© ElectraNet Pty Ltd. South Australia's Electricity Transmission Network, May 2025.

5.2 Projects

5.2.1 Key Proposed Developments

To ensure South Australia's electricity transmission network will continue to provide adequate and efficient capability and capacity for future new customers and generators, ElectraNet has four key projects that are being prioritised for the coming five to fifteen years. These projects, outlined in Figure 19, will address current and emerging constraints, unlock capacity for new and existing customer demand, and build capability for new generator connection with the transition to renewable energy.

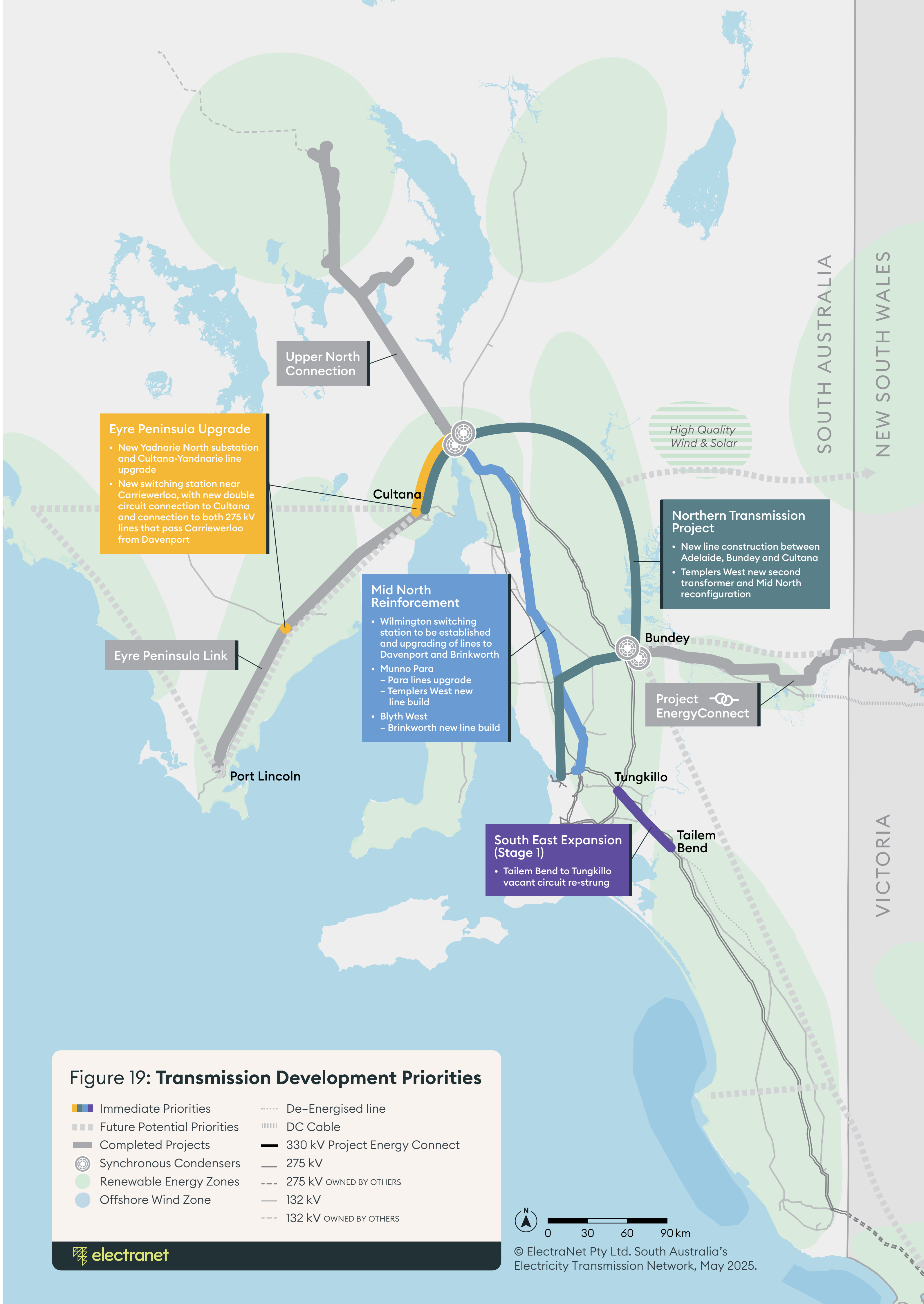


Figure 19: **Transmission Development Priorities**

Eyre Peninsula Upgrade

The Eyre Peninsula region spans from Sleaford in the South, to Wudinna in the West and Davenport in the North East. Key components of the project (Figure 20) include a new Yadnarie North substation adjacent to Yadnarie, works at Cultana to enable the Cultana – Yadnarie lines to be operated at 275 kV, and if required by future large industrial load connections a new switching station near Carriewerloo with new connections to Cultana and the two Davenport to Upper North lines.

Figure 20: Eyre Peninsula Upgrade

Yadnarie North Substation

- Establish a new 275/132 kV substation adjacent to Yadnarie
- Upgrade the Cultana-Yadnarie lines from 132 kV to 275 kV operation.

Carriewerloo Switching Station

- Establish a new switching station near Carriewerloo
- Build a new double circuit 275 kV line from Cultana to Carrierwerloo
- Connect the Davenport-Mt Gunson South 275 kV line to Carriewerloo
- Connect the Davenport-Olympic Dam West 275 kV line to Carriewerloo.

UNLOCKING

- Increased low-cost renewable energy connection in the Eastern Eyre Peninsula REZ, due to an increase in the capacity to supply large new loads to the region
- Increased ability for Eyre Peninsula renewable generation to supply potential large industrial loads located in the upper Spencer Gulf
- Potential to support future westward expansion of the transmission network to unlock solar energy that is time-shifted from the rest of the NEM.

NEXT STEPS

- The PADR published on ElectraNet's website 17 March 2025 identified the preferred solution is to upgrade operation of the Cultana to Yadnarie double circuit lines from 132 kV to 275 kV by performing 275 kV works at Cultana and establishing a new 275/132 kV substation at Yadnarie North. It also identified that if sufficient new customer load connections become committed, then construction of new double circuit 275 kV lines between Carriewerloo and Cultana should also form part of the preferred solution
- If found to be the preferred option, and with the commitment of sufficient additional load on the Eyre Peninsula, ElectraNet will apply to the AER for funding of the Eyre Peninsula Upgrade contingent project that was included in the 2023–28 revenue determination
- A PACR is planned to publish by March 2026.

Northern Transmission Project (NTx)

AEMO's 2024 ISP declared the expansion of South Australia's Mid North REZ, now titled the Northern Transmission Project (NTx) by ElectraNet, as an actionable project with a tentative completion date by July 2029. The identified need formulated by AEMO for the project is to increase power system capability of the transmission network in the region (Figure 21). This is with a view to support the expected increase in renewable generation north of Adelaide that will be required to meet the growing demand in Adelaide, ensure adequate network capacity for large industrial loads, and alleviate congestion of renewables from the Mid North to the rest of the NEM.[51]

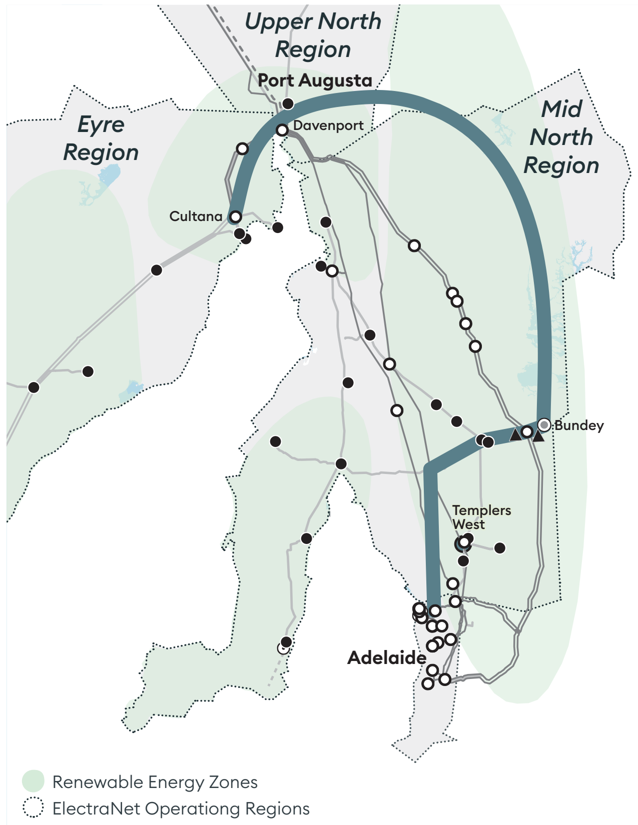


Figure 21: Northern Transmission Project

Adelaide New Line Construction

- Build new lines between Adelaide, Bundey and Cultana. Lines to be constructed as high-capacity 275 kV, 330 kV or 500 kV lines.

Mid North System Reconfiguration

- Install a second 275/132 kV transformer at Templers West
- Reconfigure the 132 kV system in the Mid North to alleviate constraints caused by the parallel operation of the 275 kV and 132 kV systems.

UNLOCKING

- Growth of low-cost renewables to the Adelaide metropolitan load centre, due to the new high-capacity transmission path from the Mid North, Riverland and Northern SA REZs.
- Improved security of Adelaide metropolitan electricity supply, due to increased geographical diversification of transmission corridors mitigating risk of climate change impacts, such as bushfire risks to transmission corridors in the Adelaide Hills.
- Increased renewable catchment area of the Mid North REZ by expanding further northeast.
- Enablement of large industrial load connections north of Adelaide, such as future mining, green steel, data centres and other potential developments.

NEXT STEPS

- ElectraNet is progressing the options analysis as part of the RIT-T process and expect to publish the PADR by December 2025.
- If found to deliver net market benefits, ElectraNet will seek full contingent project funding in accordance with the process for ISP projects.

In the interim, ElectraNet is seeking contingent project funding for early works in support of this major project.

[51] Northern Transmission Project | More information about NTx

South East Expansion (Stage 1)

The South East Region, spanning from Mt Gambier to Tailem Bend (Figure 22), is the key transmission corridor that connects the SA Mid North REZ and the Adelaide metropolitan area to the Heywood interconnector. This one key project could significantly enhance the growth and security of the South East REZ, as well as the capacity and capability of the Mid North REZ and Heywood interconnector.

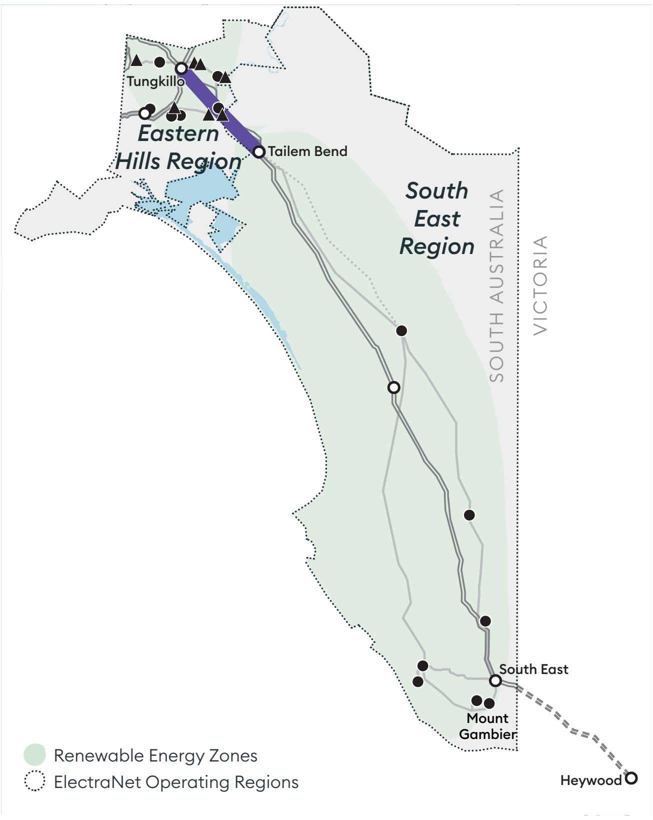


Figure 22: South East Expansion (Stage 1)

Additional Tailem Bend to Tungkillo Circuit

- String the vacant circuit that exists on one of the Tailem Bend – Tungkillo 275 kV lines
- There are no other comparable options.

UNLOCKING

- Increased connection of low-cost renewables near Tailem Bend, due to an increase in transfer capacity between the South East REZ and the rest of South Australia
- Increasing capacity for new renewable generation in the Mid North REZ, due to increase in transfer capacity between the South East REZ and the rest of the NEM via the Heywood interconnector
- Improve firmness of South East REZ's Heywood interconnector limit to 750 MW.

NEXT STEPS

- Based on modelling undertaken by ElectraNet, given the demand outlook this project would deliver substantial net market benefits
- ElectraNet considered whether this project was best progressed as a standalone RIT-T, or if it should be incorporated into the scope of the Northern Transmission Project (NTx). Analysis showed significant benefits, resulting in a plan to initiate a standalone RIT-T to progress the project.

Mid North Reinforcement

ElectraNet has identified this further incremental opportunity across the Mid North REZ that could further enhance the efficiency, strength and security of the region's transmission network (Figure 23).

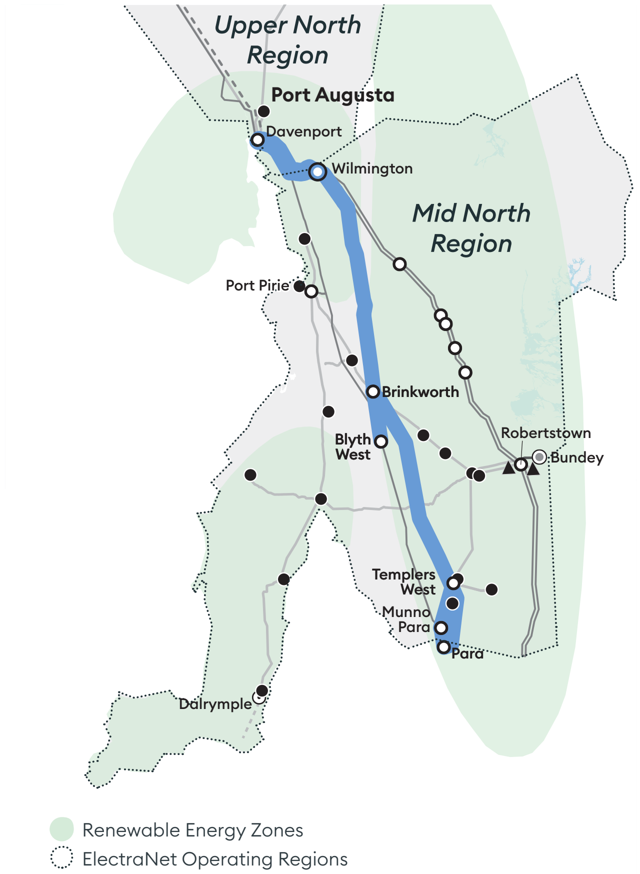


Figure 23: Mid North Reinforcement

Wilmington Switching Station

- Establish a 275 kV switching station in Wilmington, where the Davenport to Brinkworth, Mt Lock and Belalie 275 kV lines converge
- Rebuild all Davenport – Wilmington 275 kV lines as high-capacity 275 kV lines
- Rebuild the Wilmington – Brinkworth – Templers West – Para 275 kV lines as high-capacity double circuit 275 kV lines.

New Mid North Lines

- Rebuild Para-Munno Para 275 kV line as a high-capacity double circuit 275 kV line
- Construct new single circuit 275 kV line between Munno Para and Templers West
- Construct new single circuit 275 kV line between Blyth West and Brinkworth.

UNLOCKING

- Increased access for new low-cost renewable generation in the Mid North that, in the current state, would need to connect in locations that don't optimally utilise the existing transmission network.

NEXT STEPS

- ElectraNet are currently liaising with AEMO to provide scope and capacity benefit details for consideration in the Draft 2026 ISP.

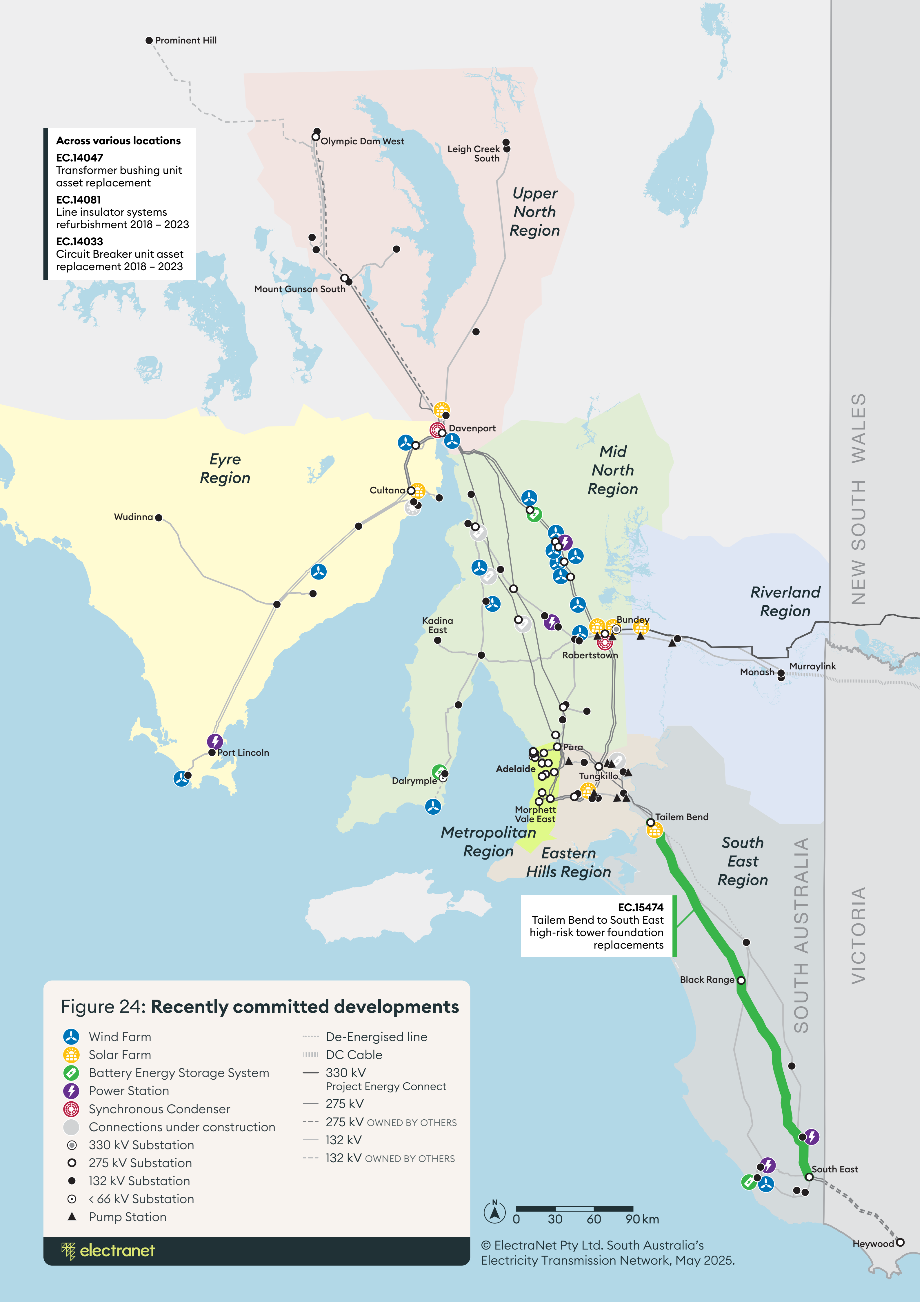


Figure 24: **Recently committed developments**

5.2.2 Committed developments

ElectraNet is committed to the following projects, having completed the RIT-T (where required) and received ElectraNet Board approval. These projects predominantly address asset condition and performance, security, stability, with some power quality and market benefit impact (Figure 24 and Table 8).

Table 8: Committed projects

Project Description	Region	Constraint Driver and Investment Type	Planned Asset in Service
EC.14171 Project EnergyConnect: South Australia to New South Wales interconnector Construct a new 330 kV, 800 MW interconnector from Robertstown in South Australia to Wagga Wagga in New South Wales, via Buronga.	Riverland	Market benefit Augmentation	Stage 1 (Robertstown to Buronga): 150 MW transfer capacity released in April 2025 Stage 2 (Buronga to Wagga Wagga): Full transfer capacity expected to be released in 2027
EC.14131 Motorised Isolator LOPA Improvement Modify 876 isolators and replace 33 isolators to provide satisfactory mechanical and electrical isolation lock-off points on all motorised air insulated isolators identified as safety hazards by a Layer of Protection Analysis (LOPA).	Various	Safety Asset renewal	June 2025
EC.11646 Eyre Peninsula and Upper North Voltage Control Scheme Implement an automated voltage control scheme to ensure the complex voltage interactions throughout the Eyre Peninsula and Upper North regions are managed efficiently.	Eyre Peninsula and Upper North	Power Quality Operational	June 2025
EC.14032 Instrument Transformer Unit Asset Replacement Replace instrument transformers at 19 substations which are at the end of their technical lives, due to an increased risk of failure which may result in an increasing rate of explosive asset failure.	Various	Asset condition and performance Asset renewal	June 2025
EC.14034 Isolator Unit Asset Replacement 2018–2023 Remove, and replace where required, approximately 73 isolators at 18 substations that no longer have original manufacturer support and create inventory spares to support the ongoing maintenance of ElectraNet's ageing isolator fleet	Various	Asset condition and performance Asset renewal	June 2025
EC.14176 Surge Arrestor Unit Asset Replacement 2018–2023 Replace porcelain surge arrestors and arcing horns at 18 substations that are at the end of their technical and economic lives due to their increasing risk of failure and potential to cause injury to personnel and collateral damage to other plant within the substation as a result of an explosive failure.	Various	Asset condition and performance Asset renewal	June 2025
EC.15272 Wide Area Monitoring Scheme 2023–2028 Expand the existing WAMS by installing phasor measurement units (PMUs) as required by AEMO at candidate sites across the SA transmission network.	All	Stability Operational	June 2025

Table 8: Committed projects (cont.)

Project Description	Region	Constraint Driver and Investment Type	Planned Asset in Service
EC.14236 Capacitor Bank Infrastructure Safety Improvement Improve the safety of personnel accessing enclosed high voltage areas having low height high voltage equipment at 18 substations, so far as is reasonably practicable, by: • upgrading fences on low height high voltage equipment to current standards • improving earthing of high voltage equipment within enclosures • upgrading entry points to current standards	Various	Safety Asset renewal	August 2025
EC.14218 Spencer Gulf Emergency Bypass Preparation Undertake preparatory site works and procure spares to support a rapid restoration of Spencer Gulf high tower crossings for the Davenport – Cultana 275 kV transmission lines, which supply the entire Eyre Peninsula region.	Eyre Peninsula	Operational Operational	September 2025
EC.14046 AC Board Replacement 2018–2023 Replace and improve AC auxiliary supply equipment, switchboards and cabling at 23 substations that are at the end of technical life.	Various	Asset condition and safety Asset renewal	January 2026
EC.14031 Protection System Unit Asset Replacement 2018–2023 Replace protection relays aged between 38 and 60 years old at 23 substations that are at the end of their technical and economic lives, having an increased risk of failure which may result in increased safety and reliability issues and cause involuntary load shedding on parts of the network.	Various	Asset condition and performance Asset renewal	June 2026
EC.11645 Transmission Network Voltage Control Install a total of four 60 Mvar 275 kV reactors around the Adelaide metropolitan region and a single 50 Mvar 275 kV reactor at South East. These and other reactive and voltage control devices on the main 275 kV transmission network will be upgraded to enable coordinated automatic switching of existing and planned reactive power devices. This will require the installation and modification of secondary plant items for monitoring, control and protection covering multiple substation sites including automating Onload Tap Changer operation at SA Power Networks connection points.	Main Grid	Reactive support Augmentation	Installation of five 275 kV reactors by mid-2026 Automated switching by mid-2028

Table 8: Committed projects (cont.)

Project Description	Region	Constraint Driver and Investment Type	Planned Asset in Service
EC.14084 Line Conductor and Earthwire Refurbishment 2019 to 2023 Program to replace transmission line conductors and earthwire to extend the life of seven 132 kV transmission lines in the Mid North and Riverland regions	Mid North and Riverland	Asset condition and performance Asset renewal	December 2026
EC.15279 Emergency Unit Asset Replacement 2023–24 to 2027–28 Emergency replacement of individual assets is undertaken for assets that fail unexpectedly, to meet reliability standards	Various	Asset condition and performance Asset renewal	June 2028
EC. 15568 Northfield Transformer 8, 9 and 10 Interface Connection Requirement SA Power Networks are planning to replace their aging/failing 66 kV GIS switchgear at Northfield substation with a new AIS 66 kV switchyard. To support this replacement, we will need to upgrade the 66 kV GIS to AIS connection points to transformers #8 and #9 and install new transformer #10 at Northfield substation. Transformer 10 has been included in the scope since the 2023 TAPR. Through detailed engineering investigations as part of the project it has been determined that the scope of works required to deliver the original brief has increased significantly, this is largely due to complexity of GIS to AIS interfaces, the requirement for a new transformer (TF10) and the decommissioning and demolition of the out of service synchronous condenser and building to accommodate cable paths and location of new TF10.	Metropolitan	Asset condition and performance Asset renewal	Connection of transformer #9 by November 2026 Connection of transformer #10 by November 2027 Connection of transformer #8 by August 2028

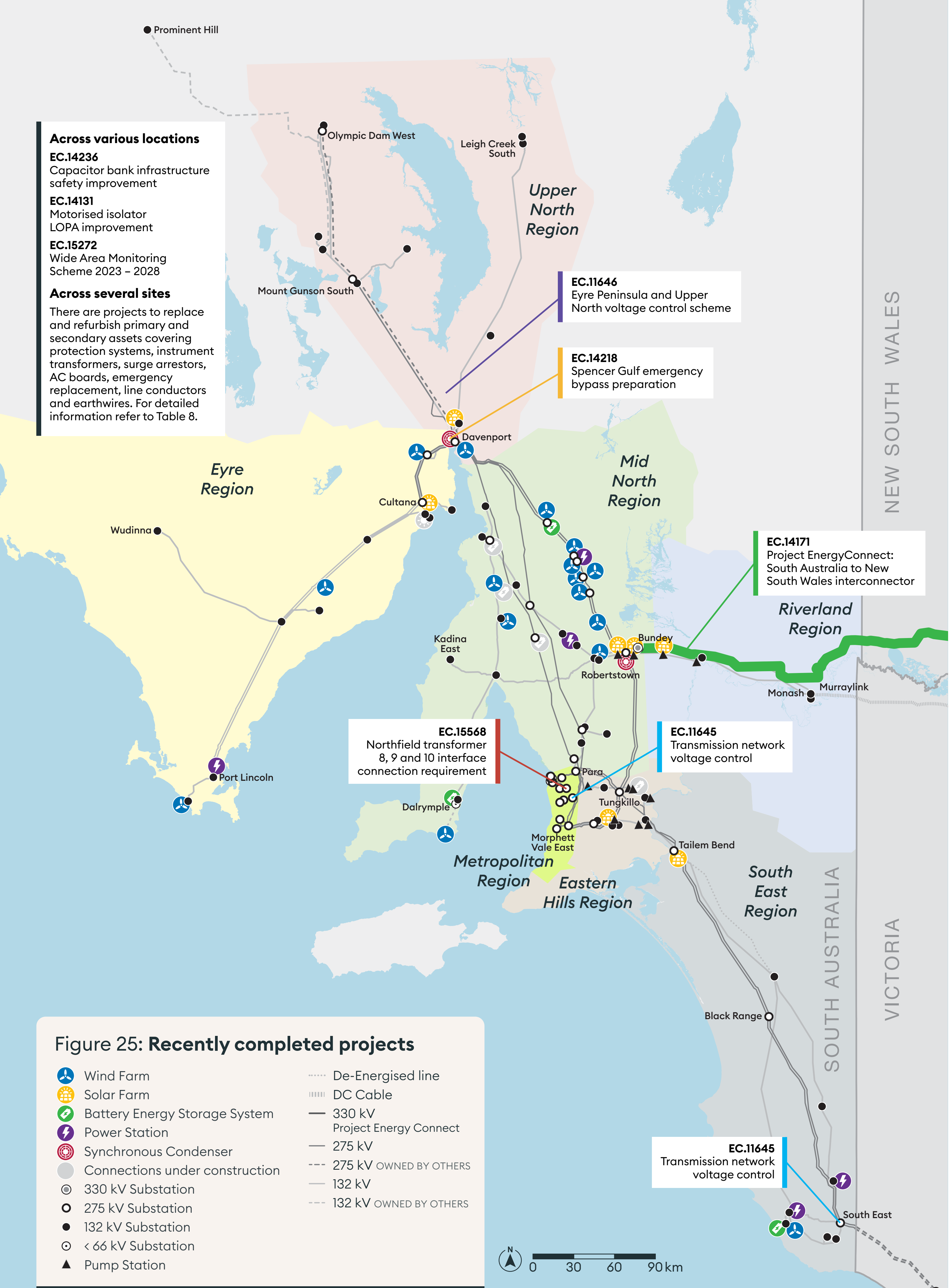


Figure 25: **Recently completed projects**

5.2.3 Recently Completed Developments

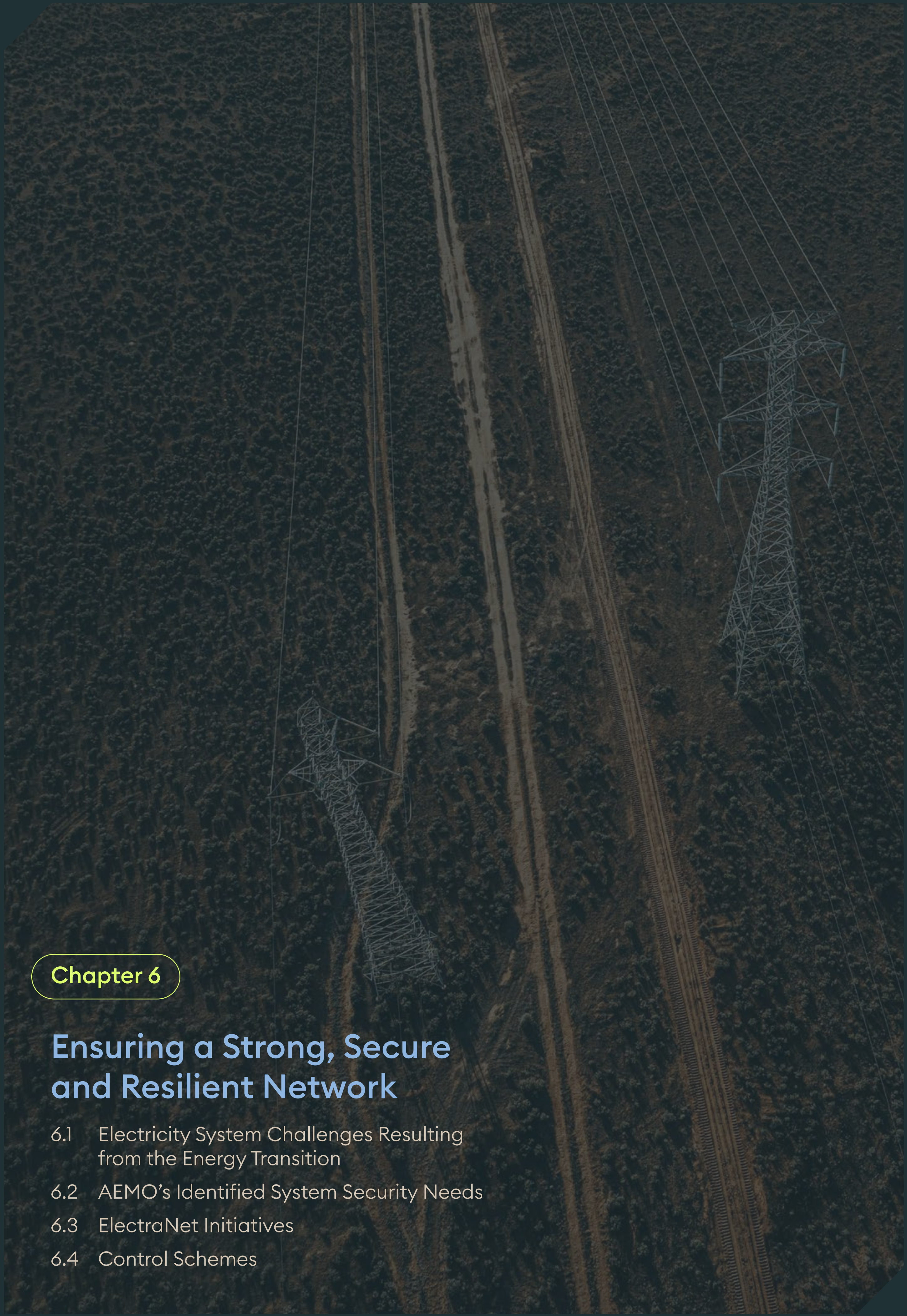
ElectraNet has completed several significant projects to remove network limitations, address asset condition, and increase capacity and capability of the South Australian Transmission Network (Figure 25 and Table 9).

Table 9: Recently completed developments

Project Description	Region	Constraint Driver and Investment Type	Planned Asset in Service
EC.14033 Circuit Breaker Unit Asset Replacement 2018–2023 Replace 15 circuit breakers located in six substations that are at the end of their technical lives and require replacement based on their condition due to an increasing risk of catastrophic failure.	Various	Asset condition and performance Asset renewal	November 2024
EC.14047 Transformer Bushing Unit Asset Replacement 2018–2023 Replace transformer bushings fitted on 20 power transformers located in nine substations that are at the end of their technical lives and require replacement based on their condition, due to an increasing risk of failure that may result in safety and reliability issues, or in the worst case, catastrophic failure of the transformer and the resultant loss and associated damage.	Various	Asset condition and performance Asset renewal	February 2025
EC.14081 Line Insulator Systems Refurbishment 2018–2023 Program to refurbish transmission line support systems and extend the life of 18 transmission lines by renewing line asset components.	Various	Asset condition and performance Asset renewal	April 2025
EC.15474 Tailem Bend to South East High-Risk Tower Foundation Replacements Replace foundations on 12 high-risk towers along the Tailem-Bend to South-East 275kV double circuit interconnector, following an incident on 22 November 2022 when a tower foundation failed on this transmission line.	South East	Asset condition and performance Asset renewal	March 2025

5.2.4 Future Developments

ElectraNet has planned projects in the near-term (pending approval process) and anticipated projects in the long-term (in scoping or to be scoped). ElectraNet has also identified potential projects that are contingent on the progression, and additional funding approval, of other projects (Appendix F).



Chapter 6

Ensuring a Strong, Secure and Resilient Network

As South Australia's primary TNSP, ElectraNet ensures a strong, resilient and secure transmission network in the state in accordance with the Rules.

The change to South Australia's electricity system due to the ongoing energy transition has been steep. In less than 20 years the state's electricity system has gone from being made up of 90% fossil fuels and 10% renewables to a system today where all coal fired generation has been retired, and 74% of South Australian generation is from renewables with gas and diesel providing the balance and continuing to drop (Figure 26).

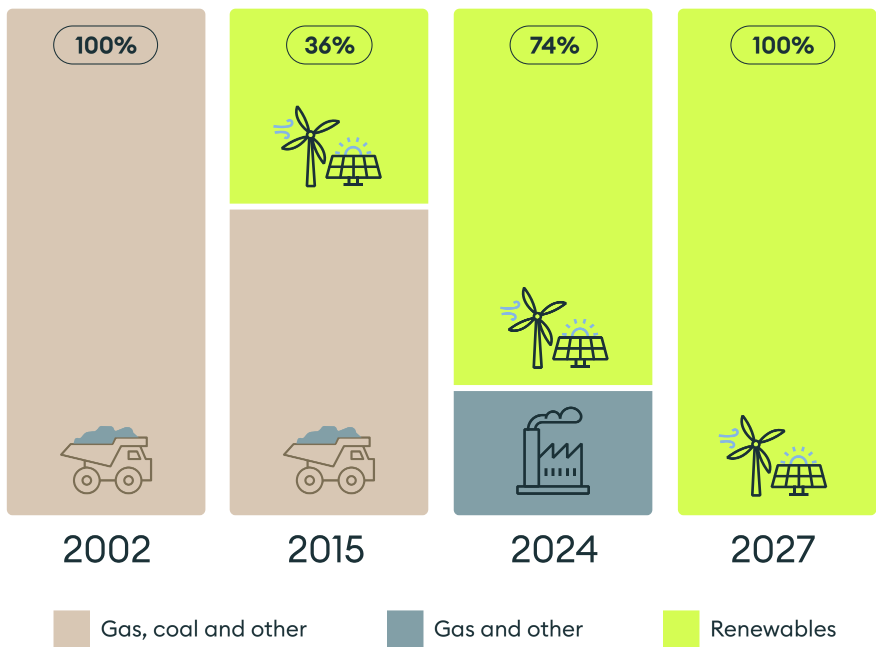


Figure 26: The transition to 100% variable renewable energy in South Australia

It is important to understand that the scale and speed of South Australia's energy transition is achieved by the corresponding ability of the electricity network to accommodate it and relies on ElectraNet working closely with AEMO to continually monitor the impact of the network, forecast potential challenges and invest appropriately to address them. ElectraNet is doing just that, dedicating its expertise and prudent resource management to ensure that emerging challenges from the transition don't negatively impact customers.

This chapter explores the challenges facing the network as a result of South Australia's energy transition, the findings and guidance from AEMO on how to address these challenges, and the work that ElectraNet is doing to both manage existing change and prepare for the future.

6.1 Electricity System Challenges Resulting from the Energy Transition

The success South Australia has had in decarbonising its network brings significant and varying challenges to the network.

For example, the variability of wind and solar energy resources leads to an increasing rate of change of power flows on the network. This needs to be managed appropriately to maintain a secure and reliable supply. For example:

- On 26 July 2023 in the middle of the day wind and solar were providing 106% of South Australia's electricity demand
- Six hours later this had dropped to 4%, with minimal wind output
- After another nine hours this was back to 132% with high levels of wind output.

The transition has also resulted in a change in timing of peak demand. The transmission network has the capacity to meet peak demand, however there may not always be the dispatchable capacity available at times of renewable drought.

To address these challenges the 2024 South Australian Electricity Development Plan[52] has identified that South Australia will require what is referred to as 'firming capacity' to meet electricity demand peaks. This is particularly so during evening demand peaks in winter when solar PV is often unavailable. This firming capacity can be provided by technologies such as conventional generation and increased battery storage locally, or by interstate connections to conventional generation, pumped hydro (such as Snowy 2.0) and installed storage capacity.

The Government of South Australia is proposing to create a Firm Energy Reliability Mechanism (FERM) whereby long duration firm capacity generators annually tender for contracts to meet a rolling five-year Firm Energy Target.

The South Australian Electricity Development Plan estimates the combined firming capacity required to support this challenge through to 2029–30 is about 2,300 MW of long duration capacity (generators that are over 30 MW and are capable of being dispatched for a minimum of eight hours). This will support the reliability and resilience of the network while also preventing barriers to investment for large, energy intensive industries. The development of the network will need to accommodate different locations and capacity of firming generation as the deployment of the FERM progresses.

The key challenges facing South Australia's electricity system and how the energy transition can impact each of them, and hence the network, are outlined in Table 10.

[52] Energy & Mining | South Australian Electricity Development Plan

Table 10: Key challenges facing South Australia's electricity system

Challenge	Description	Impact of Energy Transition
System strength	The ability of an electricity system to maintain stable voltage levels at any given location in the network when subjected to disturbances, such as sudden changes in power flows or faults.	Synchronous generation in the form of coal and gas fuelled generators has traditionally supplied system strength. The energy transition has however seen these rapidly replaced by inverter-based resources (IBR) creating the potential for supply interruptions to end consumers.
System security	The ability of an electricity system to operate reliably under both normal and abnormal conditions.	Shortfalls in frequency control, system strength and inertia services, historically provided by synchronous generators.
Resilience	The ability of an electricity system to recover from major disruptions including extreme weather or widespread blackouts.	As the frequency and severity of extreme weather events increase, the power system requires improved resilience measures, including rapid restoration capabilities, emergency response, islanding capability and enhanced grid flexibility.
Inertia	The ability of an electricity system to withstand disturbances while maintaining stable system frequency.	Traditionally provided by synchronous generators, inertia is now reduced due to the transition to IBRs, requiring alternative solutions such as fast frequency response mechanisms.
Voltage control	The ability to maintain voltages throughout an electricity system within stable and safe limits.	Increasing penetration of IBR reduces minimum demand and creates changes in customer load characteristics leading to increasing voltage control challenges.
Frequency control	The ability to maintain the frequency of the power system within stable limits.	Traditional frequency control utilised inertia as a natural buffer, preventing rapid frequency swings when generation or demand fluctuated. IBRs don't inherently provide inertia and hence managing rapid frequency changes or peaks and troughs in frequency requires new solutions. New developments are however enabling IBRs to provide inertia with the right controls.
Protection adequacy	The ability of the electricity system's fault detection and protection systems to operate correctly under evolving grid conditions.	Fault currents were more predictable when the system was dominated by synchronous generators. Changing requirements require more frequent review, including for minimum fault level conditions from IBR generation and bi-directional power flows from rooftop solar PV. Faster voltage swings also require protection systems that can react instantly.
Increasing system complexity and risk	As the electricity network becomes more decentralised, its complexity has increased, requiring different approaches to operation and planning.	More distributed energy resources, renewable generation, and increased interconnection between markets have created a wider range of operating conditions with more frequent stress points, and higher variability including zero and negative minimum demand conditions.
Extreme events	Extreme weather events such as storms, heatwaves, bushfires and flooding, all pose significant risks to the electricity system's stability and resilience.	Increased risk to the system has created a greater reliance on complex special protection schemes to manage risk and maximise power transfer capability.
Harnessing customer energy resources	Consumer energy resources (CER) refer to small-scale, distributed energy assets owned by households and businesses, including rooftop solar PV, batteries and electric vehicles.	Integrating millions of individual CER to manage excess generation while delivering lowest cost outcomes and addressing system security risks.

6.2 AEMO's Identified System Security Needs

AEMO published three reports relating to system security in December 2024:

- 2024 System Strength Report
- 2024 Inertia Report
- 2024 Network Support and Control Ancillary Services (NSCAS) Report.

In them, AEMO identifies system security needs across the NEM.

6.2.1 System Strength

From December 2 this year, a new system strength framework will begin under the NER under which ElectraNet is required to deliver system strength services for South Australia on a forward-looking basis, based on forecasts from AEMO for IBRs.

The new framework goes beyond ensuring that 'shortfalls' are met and instead seeks to ensure that system strength is met in full throughout the year through a portfolio of solutions. The new framework is designed to ensure that solutions are put in place that achieve economies of scale, while also preserving the option for new entrants to bring their own solutions. This approach will ensure that competition drives not only the best solution, but lowest long run costs to the consumer, and is biased towards early procurement of services rather than late procurement.

The system strength framework identifies a minimum requirement and a higher efficient level of services. AEMO's forecasts indicates that minimum level requirements will be met for the next three years in South Australia without intervention by AEMO or ElectraNet.

The efficient level must also be met by ElectraNet to ensure system strength is in place to enable the more rapid connection of IBRs such as solar and wind. The efficient level is however based on AEMO's forecast of IBR in the *Step Change* scenario, as presented in AEMO's 2024 System Security Report. In South Australia, this delivers a forecast of around 5,000 MW of IBR (including existing transmission connected IBR, but excluding distribution connected IBR).

While the *Green Energy Exports* scenario is not used to determine the efficient level, ElectraNet is increasingly seeking to use this scenario to inform planning assumptions in South Australia – given the higher demand forecast from large industrial loads and interest from proponents seeking to develop renewable energy projects in the state. A much higher efficient level is obtained under the *Green Energy Exports* scenario exceeding 11 GW of IBR.

6.2.2 Inertia

AEMO's 2024 Inertia Report provides an outline of the inertia requirements for the coming 10-year period for the NEM. This report includes an assessment of the minimum inertia requirements, a "secure inertia level" and the likelihood of each region becoming islanded from the remainder of the NEM – with the aim of ensuring all regions have adequate frequency control services in place to operate securely and independently, when needed. ElectraNet is required to ensure sufficient supplies are available to meet its inertial sub-network allocation from 1 December 2027.

The minimum or 'satisfactory' level of inertia required to be maintained in South Australia was determined to be 4,100 MWs and the secure operating level is 5,600 MWs.

Table 11: South Australian inertia requirements from 2 December 2024 to 1 December 2034

Quantity	Value
Assumed level of 1-second FCAS	315 MW
Satisfactory inertia level	4,100 MWs
Secure inertia level	5,600 MWs
Inertia sub-network allocation	4,300 MWs
Likelihood of islanding	Likely*

** AEMO does not consider South Australia to be sufficiently likely to island following the expected commissioning of PEC Stage 2 and necessary protection schemes are in place to manage the non-credible loss of either PEC itself or the Heywood Interconnector.*

Source: AEMO's 2024 Inertia Report.

In addition, AEMO does not consider the islanding of South Australia to be sufficiently likely. This is following the expected commissioning of Project Energy Connect Stage 2 and once necessary emergency control schemes are in place to manage the non-credible loss of Project Energy Connect itself or the Heywood interconnector.

Furthermore, AEMO has determined that no inertia shortfalls are forecast for South Australia over the three-year investment horizon, noting that an earlier inertia shortfall has been addressed by ElectraNet's deliberate intervention in the form of synchronous condensers installed in 2021, along with additional registrations in the 1-second Frequency Control Ancillary Services (FCAS) market.

Given South Australia's increasing energy demand ElectraNet will continue to work with AEMO to monitor whether the state's relative share of demand increases as a proportion of the NEM, as this may alter the inertia requirements necessary to maintain the required inertia levels.

6.2.3 Network Support and Control Ancillary Services (NSCAS)

AEMO's 2024 NSCAS Report released in December 2024 has identified new system security needs across the NEM over the coming five years. Across the NEM, AEMO reports declining minimum operational demand, reduced operation of synchronous generators, and rapid uptake of variable renewable energy have combined to create an increased need for essential power system services.

In the most recent report AEMO has confirmed that while it has not identified any system strength or inertia shortfalls in South Australia, that the magnitude and timing of the voltage control gap that was declared in the 2023 NSCAS Report remains unchanged.

In the 2023 NSCAS report, AEMO declared an ongoing Reliability and Security Ancillary Service (RSAS) gap of 200 MVAr during periods when South Australian demand is below 600 MW, and South Australia is not islanded or at credible risk of islanding.[53] ElectraNet has addressed this gap through a RIT-T process, with additional shunt reactors to be installed in the Adelaide metropolitan region (3x60 MVAr and 2x50 Mvar) and South East (1x50 MVAr). These reactors will be deployed progressively by 2026. AEMO is progressing a commercial tender process to seek potential service providers for the intervening period.

As part of the 2024 NSCAS assessment, AEMO also undertook an additional sensitivity to assess the impact of changes in the power factor of demand under minimum demand conditions following input from ElectraNet and SA Power Networks indicating a longer-term trend in this direction for overnight demands. This assessment indicates that this trend is likely to further exacerbate challenges with voltage control over time, and AEMO will continue to work with ElectraNet and SA Power Networks to address this emerging risk.

AEMO also identified in the 2024 NSCAS report that rooftop solar PV output continues to hit record highs in South Australia and conducted some further studies to understand the impact of increasing solar penetrations on the system's ability to meet future ramping requirements. These studies show that unexpected ramping of solar PV under very low demand conditions results in thermal overload presenting an emerging risk to the system. ElectraNet will continue to work with AEMO to explore this challenge and identify if additional remediation is required.

6.2.4 General Power System Risk Review (GPSRR)

In addition to the three reports just discussed, AEMO published the final report for the 2024 General Power System Risk Review (GPSRR), in July 2024.[54] The GPSRR is intended to help AEMO, Network Service Providers (NSPs) and other market participants to better understand the nature of new risks and monitor them over time.

The GPSRR is completed annually, and it has a broad scope to explore a wide range of risks that could have adverse impacts on the power system. It requires AEMO to work in collaboration with NSPs to identify and assess risks to power system security that it expects would be likely to lead to cascading outages or major supply disruptions. Risks to be reviewed include:

- Non-credible contingency events, the occurrence of which AEMO expects would be likely to involve uncontrolled increases or decreases in frequency, alone or in combination, leading to cascading outages, or major supply disruptions
- Other events and conditions (including contingency events) the occurrence of which AEMO expects, alone or in combination, would be likely to lead to cascading outages, or major supply disruptions.

The GPSRR considers how the effects of these type of events will impact the NEM, their risk level and recommends possible actions to mitigate them.

[53] AEMO | 2023 and 2024 NSCAS reports at System Security Planning

[54] AEMO | General Power System Risk Review

Recommendations and findings related to South Australia

There is currently a constraint which limits import into South Australia over the Heywood interconnector based on the net Under Frequency Load Shedding (UFLS) load, distributed solar PV generation, power system inertia and the availability of Fast Active Power Response (FAPR). There is also currently a constraint set in place to maintain South Australia's rate of change of frequency (RoCoF) below 2 Hz/s immediately following the non-credible loss of the Heywood interconnector, which was introduced to meet the requirements of under regulation 88A of the Electricity (General) Regulations 2012 (SA). Given Project EnergyConnect Stage 1 will be inter-tripped for the non-credible loss of the Heywood interconnector, AEMO recommends that these constraints will remain in place following commissioning of Project EnergyConnect Stage 1.

Due to the South Australian rollout of dynamic arming of UFLS and additional battery head room the minimum emergency under frequency response defined by AEMO can be met approximately 99.8% of the time in South Australia. This delivers a similar level of residual risk to historical levels. Therefore, no further action is required in South Australia to meet the minimum emergency under frequency response.

At present a 250 MW import limit is applied to the Heywood Interconnector for destructive wind conditions that could result in the loss of multiple transmission elements causing generation disconnection in South Australia to reduce the risk of South Australia islanding. The studies completed as part of the 2024 GPSRR indicate that the existing 250 MW limit for South Australia import under destructive wind conditions could be increased after the full capacity of Project EnergyConnect Stage 1 is released. The revised destructive wind transfer limits will be formally defined in an update to the Interconnector Capabilities report after the release of the full capacity of Project EnergyConnect Stage 1. This is distinct from the South Australia import constraints that are invoked for destructive wind conditions impacting Heywood where South Australia islanding is reclassified as credible. As Project EnergyConnect Stage 1 will be inter-tripped with Heywood, the South Australia destructive wind transfer import limit for the credible loss of Heywood will remain at 250 MW.

Given the growing number and complexity of NEM Remedial Action Schemes (RASs), AEMO recommends that, as part of the existing obligations under NER S5.1.8 and S5.14, NSPs in collaboration with AEMO engage in extensive and detailed joint planning. In the design and testing of RASs, the impact on other NEM regions/inter-regional interconnectors should be considered – so as to ensure that all existing and future RASs operate effectively and do not cause adverse interactions or exacerbate non-credible contingency events. Given the increasing consequences of non-credible events, AEMO plans to review the RAS guidelines to ensure adequate guidance is provided regarding:

- Provision of limit advice associated with operational conditions where emergency controls are ineffective
- Consideration of system strength impacts
- Consideration of anticipated generator retirements
- Requirement for NSP joint planning under NER S5.14.

To reduce the number of transmission line trips due to lightning in South Australia, AEMO recommends that ElectraNet investigate South Australia transmission tower earthing and lightning protection, based on recent contingency events, to identify or rule-out any existing design weaknesses. Additionally, consistent with NER 5.20A.1, AEMO has identified the potential need for a RAS to manage South Australia intra-regional separation. Therefore, to reduce the likelihood that multiple trips due to lightning, or other risk factors in South Australia, result in severe cascading failures; AEMO recommended, in accordance with NER S5.1.8, that ElectraNet investigate the suitability of a RAS to prevent South Australia intra-regional separation.

As a proportion of peak demand South Australia has significantly greater large-scale BESS capacity installed when compared to the rest of the mainland NEM. This means that the aggregate response of South Australian BESS presents an increasing risk for a remote generation contingency during South Australia export conditions, and for a remote load contingency during South Australia import conditions. ElectraNet is collaborating with AEMO to consider suitable remedial measures to address this risk as part of the 2025 GPSRR.

6.3 ElectraNet Initiatives

To continue to appropriately address the changes to the network from the energy transition in South Australia and maintain the stability of the power system, ElectraNet is pursuing a range of solutions that are designed to not only address the evolving requirements of the system; but also ensure an efficient approach to delivering the benefits needed for the investment required.

A full list of projects is included in Appendix F.6.

These solutions include as a priority initiatives addressing the following six areas:

- System Strength
- System Security
- Resilience
- Voltage Control
- Control Schemes
- Operability.

6.3.1 System Strength

In 2021, ElectraNet installed and began operating the state's first large synchronous condenser: a large motor that spins freely without fuel combustion or power generation. South Australia now has four synchronous condensers: two at Davenport, near Port Augusta; and two at Robertstown, north of Adelaide. Together, this infrastructure provides increased reactive power to the grid – enabling it to better meet system strength and inertia requirements, to maintain grid stability.

AEMO's 2022, 2023 and 2024 System Strength Reports indicated that 'minimum level' system strength requirements are forecast to be sufficient within a three-year period in South Australia without intervention by ElectraNet or AEMO. Further, ElectraNet is not forecasting a shortfall beyond that horizon.

Modern wind farms, solar farms, and BESSs are based on voltage inverter technology and are known collectively as IBR. ElectraNet's analysis of AEMO's System Strength Reports identified that there may be a need for ElectraNet to provide additional system strength services to meet the 'efficient level' system strength requirements based on forecast volumes of IBR.

In late 2023 we commenced a RIT-T to examine this identified need, and we published the PADR in April 2025.[55] Detailed modelling completed by ElectraNet has shown that the existing network, including the infrastructure outlined above and following the commissioning of Project EnergyConnect stage 2 (330 kV double circuit interconnector between Bundey, Buronga and Wagga Wagga to be operational in 2027), will have sufficient system strength to meet the efficient level required under the Rules.

There are some uncertainties with this analysis, including:

- the rate of growth in IBR investments
- the rate at which IBR generators will improve and contribute to satisfying system strength services
- the assumed representation of the forecast generation included in the PSCAD models more than three years ahead.

As a result, ElectraNet does not consider there to be a requirement for large capital expenditure on additional synchronous condensers at this point under the ISP *Step Change* scenario. This position differs from that in the PSCR and is due to changes in the IBR forecasts since the PSCR was published, as well as the more refined methodology we have applied at the PADR stage.

Looking to the 2024 ISP *Step Change* scenario after December 2029, ElectraNet considers it prudent to identify low-cost generic system strength services as a low regret back up. ElectraNet also recognises that AEMO's forecast on IBR volume under the *Green Energy Exports* scenario exceeds 11 GW of wind, solar and batteries over the next 10 years (Figure 14, section 3.2).

The interest in new large industrial load connections to the transmission network also raises the potential for a much more rapid increase in IBR connections than forecast in the *Step Change* scenario. This would require a significant increase in the efficient level of system strength.

[55] ElectraNet | Meeting System Strength Requirements in SA

ElectraNet considers the *Green Energy Exports* scenario is a useful proxy for the potential connection of large industrial loads. If this scenario unfolds, and no action is taken to meet the efficient level, there could potentially be significant and rapid investment in further system strength services requirements. It may not be possible to deliver this investment sufficiently quickly, due to the long lead times for some of these investments, which could result in insufficient system strength. Alternatively, while it may be possible to deliver an urgent investment in time, it could come at a significant cost to customers.

Proactively preparing the network with low-cost mechanical clutches to new synchronous generators, enabling them to operate as synchronous condensers, may partially or completely avoid the need for any such 'emergency investment' (as well as any reliability implications for customers).

Based on submissions to the PSCR/EOI and the Government of South Australia's proposed development of a FERM, ElectraNet considers it likely that new synchronous generators will develop in the next few years.

The use of clutches provides an opportunistic, low cost and 'low regret' insurance against the need to provide additional system strength in South Australia due to a greater volume of IBR connecting (e.g. through large industrial load connections) in the next three to five years.

Specifically, while these solutions would ultimately be provided by non-network proponents (the costs of which would be recovered via network support contracts with ElectraNet), the incremental capital cost of fitting clutches during construction is estimated to be in the order of $5 million.

The addition of clutches to new synchronous generators provides prudent insurance against needing to provide additional higher-cost system strength services in the future, and these contracts should be considered the basis of the preferred option for the ongoing provision of an efficient level of system strength. ElectraNet considers this conclusion to be consistent with the recent AER guidance on managing uncertainty beyond the compliance years (i.e. that System Strength Service Providers may procure system strength solutions for beyond the next three years if they demonstrate net economic benefits).[56]

6.3.2 System Security

As the South Australian generation mix changes and ElectraNet's transmission network expands to deliver the energy from existing and proposed energy projects in the state's REZs, it will be important to ensure that geographical diversity is maintained in the network to avoid disruption. This is particularly the case when seeking to manage the risk in areas prone to bushfire, high wind speeds or other climate related events that have the potential to impact on the electricity network are increasing in frequency and intensity.

The Greater Adelaide area is responsible for the majority of South Australia's economic activity. Adelaide is bordered to the south and east by the Adelaide Hills, which is a high bushfire risk area. The major transmission substations of Para, Magill, Tungkillo and Cherry Gardens are all located in the Adelaide Hills.

With the retirement and mothballing of gas fired generation at Torrens Island, these locations are becoming more important for the transmission of electricity to Adelaide. These substations are all within 50 km of each other, covering an area of 200,000 hectares. By comparison, the NSW bushfires of 2019–20 burnt an area that covered over 17 million hectares. Individual fires in NSW in 2019-20, such as Hospers Mountain (Hawkesbury), Green Wattle Creek (Wollondilly) and Currowan (Shoalhaven) each burnt areas of more than 200,000 hectares.[57]

ElectraNet is pursuing two investments to mitigate the risks posed by bushfire or high winds, building increased system security as the network grows. The Northern Transmission Project includes a proposed southern circuit from Bundey to Adelaide, with a route that avoids the existing transmission line through the bush fire prone Adelaide Hills. Also being included as part of the scope of NTx is a northern circuit from Bundey to the Upper Spencer Gulf, with a route that avoids the region south of Port Augusta where high winds have previously damaged multiple existing lines (such as in the system black event of 2016).

[56] AER | Guidance on the efficient management of system strength framework page 18

[57] Parliamentary Library & Information Service | 2019–20 Bushfires: Quick Guide

6.3.3 Resilience

A RAS is an advanced grid protection system designed to automatically detect and respond to abnormal conditions on the electricity network. A RAS is designed to monitor the grid at a holistic level, taking coordinated actions to maintain stability and prevent cascading failures.

RAS systems are today being used across the NEM to prevent minor disturbances from escalating into major system failures. As South Australia continues its transition to more renewables, RAS systems are becoming even more essential in managing the increased risk of destabilisation, due to the unpredictable fluctuation of generation, and increasingly frequent extreme weather events.

As part of Project EnergyConnect, ElectraNet is developing the SAIT RAS. SAIT RAS is designed to detect the non-credible loss of either the Heywood Interconnector or Project EnergyConnect, and will take remedial action to prevent the remaining interconnector from tripping due to power system instability. SAIT RAS is important for building greater resilience in the network, ensuring that it is easier and quicker to restore load – compared to what would be possible if recovering from a system black state.

The SAIT RAS comprises three main components, planned for commissioning in Q2 2026:

- Event-Driven Component (EDC)
- Response-Driven Component (RDC)
- Resource Controller Component (RCC).

The RCC monitors the loads/generators/BESS response availability using ElectraNet's Supervisory Control and Data Acquisition (SCADA) system and issues trip/control signals to individual loads/generators/BESS based on the output from the EDC and the RDC. Three different trigger levels will be available, including:

- Level 3 response, which is initiated by the EDC when a double circuit interconnector outage is detected. The required amount of response depends on the pre-contingency flows and the strength of the remaining interconnector path. In the event of a double circuit interconnector outage, the EDC Level 3 response has been designed to activate first and will initiate tripping of loads/generators
- Level 1 and Level 2 responses, which are initiated by the RDC based on two sets of thresholds. Level 1 response initiates increasing or decreasing the output power of BESS, whereas a Level 2 response initiates tripping of additional loads or generators. The required amount of response depends on the power imbalance within South Australia and the strength of the interconnector path.

SAIT RAS will be a critical and complex wide area emergency control scheme with high dependability and reliability requirements. Given the above, and fast response times required, customers will be tripped at the connection point breaker when required as part of the SAIT RAS response, unless specific arrangements can be made to trip a few breakers within the customer's plant.

The cost of installation, maintenance and operation of the emergency controls must be borne by ElectraNet as the TNSP. ElectraNet is entitled to include this cost when calculating the Transmission Use of System price.

In addition to RASs, ElectraNet is responsible for ensuring that all network planning and design is conducted to ensure the network withstands stress conditions. This is covered in more detail in section 3.7.

6.3.4 Voltage Control

ElectraNet is working closely with SA Power Networks to enhance voltage control across South Australia's electricity network. Part of this approach involves pursuing a range of cost-effective voltage control enhancements that reduce peak demand in the evenings and facilitate increased solar energy exports during peak generation times. This approach enables the deferral of large investments in the transmission network by instead accessing ex ante project funding; including through the Demand Management Innovation Allowance Mechanism that promotes innovative demand management projects.

A challenge experienced with this approach to reduce cost has been the simultaneous increase of project costs, resulting in a reduced ability of ElectraNet to deliver the network changes required. One option to address this would be to enable Ex Ante funding to be indexed to enable project cost increases to be absorbed more effectively, and in doing so enable greater benefits to flow through to consumers from efficient energy management projects.

6.3.5 Operability

The significant changes to South Australia's energy system requires improvements and changes to the way the network is operated. To address this ElectraNet has developed a program to establish the foundations for 100% renewables operation by December 2027. The program is the Network Operational Technology Enhancements (NOTE) program. NOTE seeks to develop and implement sufficient network planning and operations capabilities to manage power system changes in an increasingly complex and volatile environment. It identifies the changes that are required to ElectraNet's systems, people and processes to ensure the right capability is in place, and is flexible enough to allow the program to continue to support changes to operations in supporting a 5 GW network.

The NOTE Program looks at five key dimensions of operations (Figure 27).

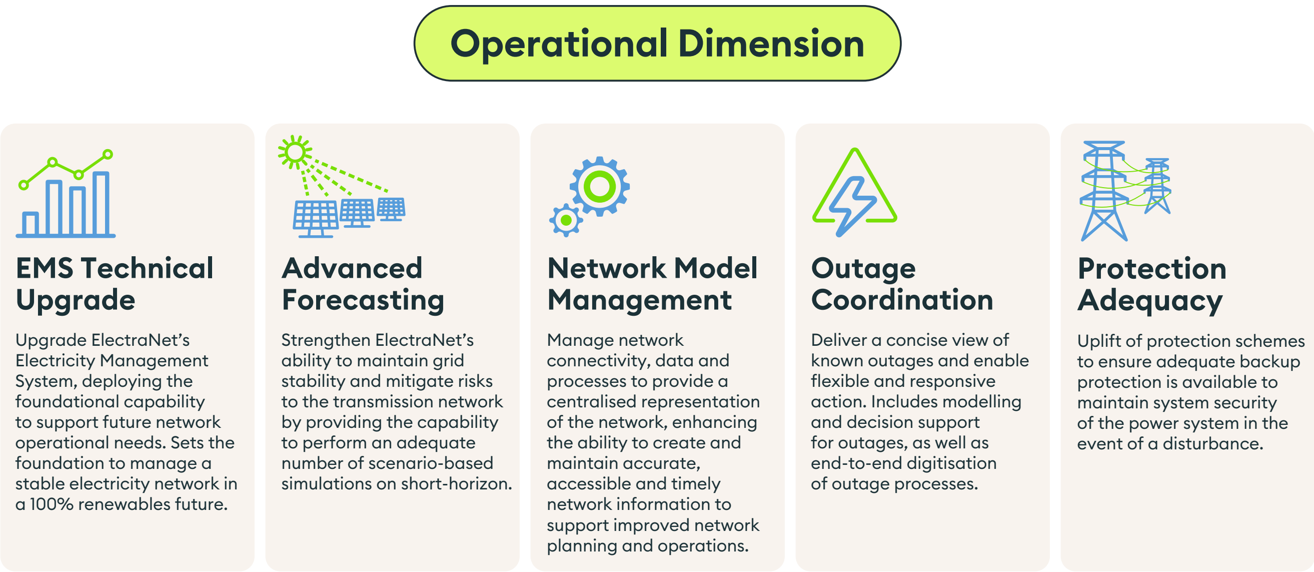


Figure 27: ElectraNet's NOTE Program

6.4 Control Schemes

ElectraNet has implemented, continues to implement and is planning for a range of different control schemes designed to allow the energy system to adapt to variable generation, changing demand patterns and evolving technical challenges. These control schemes maximise the efficiency, reliability and security of the existing network, utilising existing capacity rather than requiring major new infrastructure investments.

6.4.1 Frequency Control Schemes

There are currently three frequency control schemes implemented in South Australia that are designed to contribute to system frequency control.

- a distributed automatic UFLS scheme
- a distributed automatic OFGS scheme
- emergency control schemes

Automatic under-frequency load shedding (UFLS)

South Australia's existing UFLS scheme is designed to return system frequency to normal following an event that leads to South Australia separating from the rest of the NEM while importing across the Heywood interconnector.

The basic design premise of the UFLS scheme is that in response to a separation event or a multiple contingency event, the frequency fall should be limited to 47 Hz by the controlled disconnection of load.

AEMO has set the UFLS requirements within South Australia, based on system studies to a maximum of either:

- 700 MW, or
- 60% of operational demand

ElectraNet has worked with AEMO to develop a power system constraint that limits import into South Australia on the Heywood interconnector to an appropriate level such that the risk of cascading failures is reduced if a non-credible separation of South Australia from the NEM were to occur.

ElectraNet has worked with transmission network direct-connect customers to ensure UFLS arrangements for each customer comply with Rules obligations. SA Power Networks met targets to roll out "dynamic arming" of UFLS relays (relays designed to dynamically disarm if the circuit is in reverse flows), by September 2024. Over 700 MW of BESS are either committed or in commissioning in South Australia, which will significantly increase the amount of BESS headroom that will be typically available to provide emergency frequency response.

As a consequence, AEMO's analysis suggests no further action is required at this time to increase UFLS availability in South Australia; the actions already underway (dynamic arming of UFLS and additional BESS capacity) appear sufficient at this time.

UFLS requirement will be reviewed again following the commissioning of Project EnergyConnect Stage 2.

Automatic over-frequency generator shedding (OFGS)

The purpose of OFGS is to manage the frequency performance during islanding events resulting from non-credible or multiple contingencies during high export to Victoria. The South Australia OFGS operates in the frequency range of 51 to 52 Hz. Generation to be tripped is split into eight blocks, each with around 150 MW of wind generation, set to trip between 51 Hz and 52 Hz.

AEMO made the following recommendations when they most recently reviewed the OFGS scheme:

- Increasing OFGS capacity by adding additional generators to the scheme, helping to contain and reduce the frequency peak
- Adding a delayed trip setting to some generators in the OFGS scheme, helping to reduce the settled frequency to within frequency operating standards.

ElectraNet is working with AEMO and the generators to implement these recommendations.

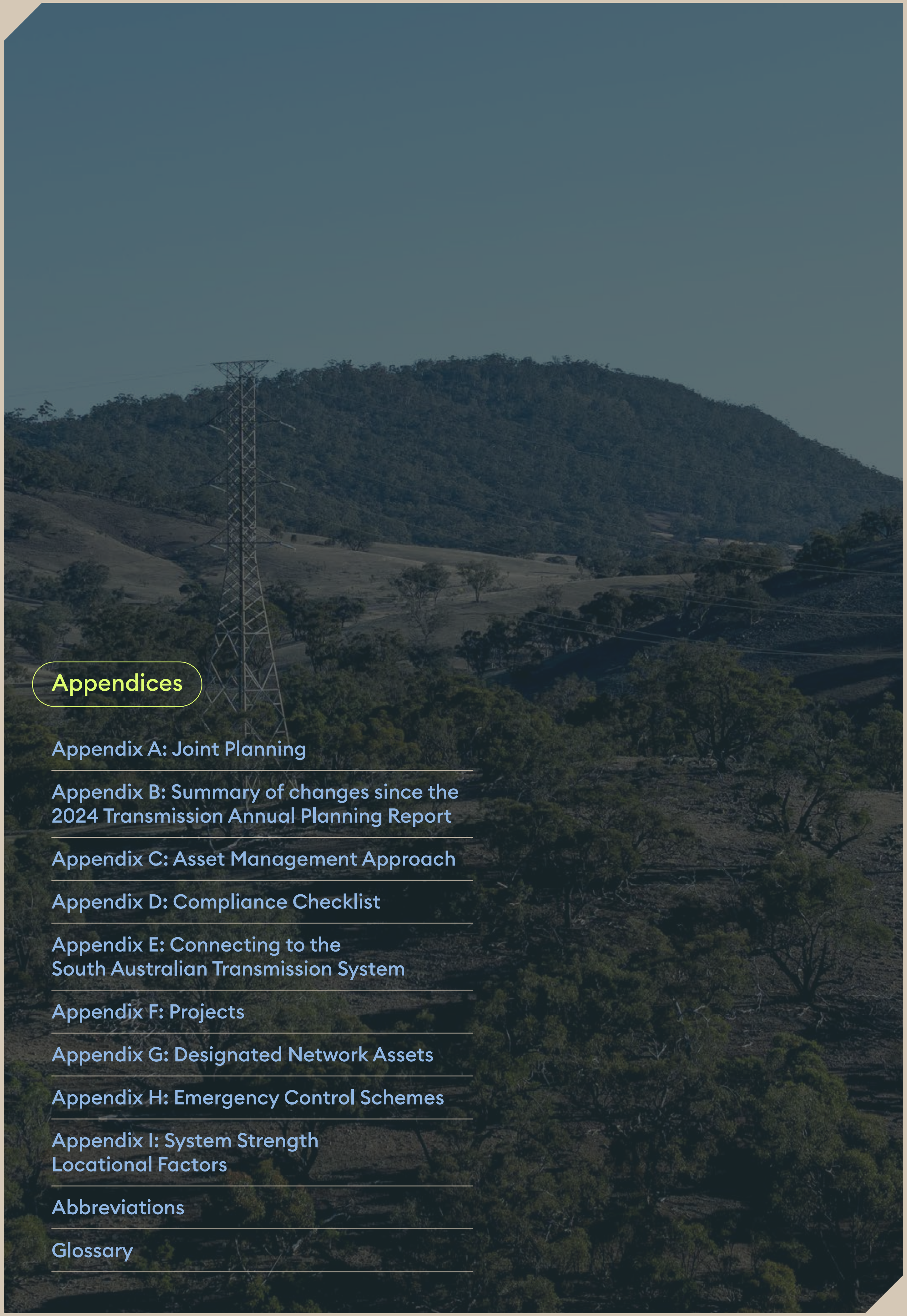
6.4.2 Emergency Control Schemes

With increasing complexity in South Australia's electricity network emergency control schemes are becoming an increasingly important part of the system. These schemes are automated or manual systems designed to maintain the stability and security of the electricity network during unexpected or extreme events. They kick in when normal operations are threatened and are often thought of as the network's emergency breaks. This includes a sudden loss of a generator or major transmission line, and natural disaster or equipment failure.

However, if designed appropriately emergency control schemes can play a more strategic role, enabling system security, while also maximising the capability of the network, without the need for significant capital investment to augment the system.

It is important to ensure that putting in place an emergency control scheme doesn't trigger the very event they were designed to prevent. To avoid this, ElectraNet ensures that it monitors potential interactions between different emergency control schemes to avoid conflicting actions, prevent cascading failures and preserve system integrity.

A list of emergency control schemes that are in development, or being considered, in South Australia is provided in Appendix H.



Appendix A
Joint Planning

We undertake a wide range of joint planning activities with both transmission and distribution entities on a regular and as-needed basis, and through a range of forums. This includes working closely with SA Power Networks to ensure optimal solutions for South Australian customers are identified and implemented.

Joint planning activities also include significant engagement with AEMO (as both national planner and Victorian transmission planner), Transgrid, APA (owner of Murraylink interconnector), AusNet Services, Powerlink, and major customers.

Our joint planning activities over the last year are described more fully in the following sections.

A.1 National transmission planning working groups

ElectraNet has collaborated with the other NEM jurisdictional planners through active involvement in the following groups:

- Executive Joint Planning Committee
- Joint Planning Committee
- Operational Transition Planning Working Group
- Future Transition Points Working Group
- Regulatory Working Group
- Market Modelling Reference Group
- Forecasting Reference Group
- Power System Modelling Reference Group
- System Strength Service Providers Working Group
- ENA.[58]

Executive Joint Planning Committee

The Executive Joint Planning Committee facilitates effective collaboration and consultation between Jurisdictional Planning Bodies and AEMO on electricity transmission network planning issues to:

- collaborate on development of the Integrated System Plan
- improve network planning practices
- coordinate on energy security across the NEM.

The Executive Joint Planning Committee directs and coordinates the activities of the Joint Planning Committee, the Regulatory Working Group, and the Market Modelling Working Group.

Joint Planning Committee

The Joint Planning Committee supports the Executive Joint Planning Committee to achieve effective collaboration, consultation and coordination between Jurisdictional Planning Bodies, Transmission System Operators and AEMO on electricity transmission network planning issues.

Operational Transition Planning Working Group

The Operational Transition Planning Working Group identifies and assesses operational transition points from today to two years ahead, to facilitate preparation for when they materialise within the NEM.

Future Transition Points Working Group

The Future Transition Points Working Group identifies and assesses potential upcoming operational transition points in the planning timeframe (from 2–5 years ahead), to enable sufficient preparation for when they materialise within the NEM. The Future Transition Points Working Group coordinates with the Operational Transition Planning Working Group for potential transition points in the timeframe from today to two years ahead.

[58] Energy Networks Australia

Regulatory Working Group

The Regulatory Working Group supports the Executive Joint Planning Committee to achieve effective collaboration, consultation and coordination between Jurisdictional Planning Bodies, Transmission System Operators and AEMO on key areas related to the application of the regulatory transmission framework and suggestions for improvement.

Market Modelling Working Group

The Market Modelling Working Group supports the Executive Joint Planning Committee in effective collaboration, consultation and coordination between Jurisdictional Planning Bodies, Transmission System Operators and AEMO. The committee focuses on modelling techniques, technical knowledge, industry experience, and a broad spectrum of perspectives on market modelling challenges.

Forecasting Reference Group

The Forecasting Reference Group is a monthly forum with AEMO and industry's forecasting specialists. The forum seeks to facilitate constructive discussion on matters relating to gas and electricity forecasting and market modelling. It is an opportunity to share expertise and explore new approaches to addressing the challenges of forecasting in a rapidly changing energy industry.

Power System Modelling Reference Group

The Power System Modelling Reference Group is a quarterly forum with AEMO and industry power system modelling specialists. The forum seeks to focus on power system modelling and model development to ensure an accurate power system model is maintained for power system planning and operational studies.

System Strength Service Providers Working Group

The System Strength Service Providers Working Group is a regular working group with AEMO and each of the five system strength service providers. It is intended to support collaboration, consultation, and coordination between system strength service providers on implementing the System Strength Framework. The group is intended to workshop ideas, encourage consistent practices, and facilitate joint planning across regions.

A.2 Joint Planning with SA Power Networks

We have a long-standing relationship with South Australia's electricity distribution business, SA Power Networks. We collaborate through joint planning on things like annual demand forecast updates, network development options and voltage control strategies.

The purpose of routine joint planning is to deliver lowest long run costs by identifying efficient network solutions across both transmission and distribution. We hold joint planning meetings every two months, attended by planning personnel from both organisations, including discussion of items such as:

- Demand forecasting
- Connection point planning
- Network connections
- AEMO joint planning and the ISP
- System security matters and initiatives
- Network operations
- Working group status reporting.

Voltage Control Working Group

The Voltage Control Working Group reports to the regular Joint Planning meeting between ElectraNet and SA Power Networks. Its purpose is to coordinate cost effective reactive power and voltage control management outcomes for South Australian electricity customers by developing joint voltage management strategies and plans that efficiently support the distributed energy future.

A.3 Other joint planning engagements

For effective network planning, ElectraNet also engages in joint planning activities with:

- AEMO (in their roles as National Planner and Jurisdictional Planning Body for the Victorian transmission system)
- Transgrid.

A.4 Joint Planning Projects

ElectraNet has coordinated with other jurisdictional planners on the following projects:

Integrated System Plan development

Through engagement with AEMO and other TNSPs through the Executive Joint Planning Committee, Joint Planning Committee, and joint planning meetings we have provided advice about constraints and limitations in the South Australian electricity transmission system, and scopes and costs for projects that could address those limitations. AEMO used that information in the modelling that underpinned the 2024 ISP.

Project EnergyConnect

We continue to engage with AEMO and Transgrid on project implementation planning for Project EnergyConnect. The PEC System Integration Steering Committee, a collaboration between AEMO, ElectraNet, Transgrid and AusNet Services, is preparing procedures and documentation to coordinate a timely integration of Project EnergyConnect into the NEM.

Northern Transmission Project

We are engaged with AEMO on the delivery of the RIT-T for this project to determine the preferred option and improve the accuracy of cost estimation for the options.

Northfield Transformer Replacement

We have engaged with SA Power Networks in joint planning to ensure the identified need is appropriately defined, and to develop the transmission requirements to meet the identified need.

Appendix B
Summary of changes since the 2024 Transmission Annual Planning Report

Demand forecast

ElectraNet has developed a forecast that includes anticipated large industrial load connections, and which incorporates outcomes of a probabilistic assessment of new large industrial loads.

A forecast incorporating ElectraNet's assessment of anticipated large industrial loads in the near to medium term (which are not currently included in AEMO's forecasts) combined with a probabilistic forecast of longer-term demand growth is ElectraNet's preferred methodology.

System Strength Requirements in SA

ElectraNet published the PADR for System Strength Requirements in SA RIT-T in April 2025.

Costly investment in additional South Australian synchronous condensers is no longer considered necessary. As a result of consultation, ElectraNet has identified that the addition of clutches to new synchronous generators would provide prudent insurance against increased system strength needs in the future, and ElectraNet considers that these contracts should be the basis of the preferred option.

Eyre Peninsula Upgrade

ElectraNet published the PADR for the Eyre Peninsula Upgrade RIT-T in March 2025.

The preferred solution identified in the PADR is to upgrade operation of the Cultana to Yadnarie double circuit lines from 132 kV to 275 kV by performing 275 kV works at Cultana and establishing a new 275/132 kV substation at Yadnarie North.

The PADR also identifies that if sufficient new customer load connections become committed, then the construction of new double circuit 275 kV lines between Carriewerloo and Cultana should also form part of the preferred solution.

Mid North Reinforcement

ElectraNet proposes this project for consideration in AEMO's 2026 ISP. This proposed project would alleviate constraints for generators and BESSs that may not be optimally sited in the Mid North region.

This project had been included as a potential future project in ElectraNet's 2024 Transmission Annual Planning Report.

Future connection point upgrades

Based on the connection point forecast that was provided by SA Power Networks in September 2024, ElectraNet has identified a range of connection points that may need to be upgraded in the future (Appendix F.3). In addition to the projected requirement to upgrade Tailem Bend 132/33 kV connection point in 2034 which was identified in the 2024 Transmission Annual Planning Report, these are:

- Baroota 132/33 kV connection point
- Mount Barker 132/66 kV + Mount Barker South 275/66 kV meshed connection point
- Davenport West 132/33 kV connection point
- Mount Gambier 132/33 kV connection point and/or Blanche 132/33 kV connection point
- Southern Suburbs 275/66 kV meshed connection point
- Western Suburbs 275/66 kV meshed connection point
- Yadnarie 132/66 kV connection point
- Northern Suburbs 275/66 kV meshed connection point
- Whyalla Central 132/33 kV connection point
- Mobilong 132/33 kV connection point
- Angas Creek 132/33 kV connection point
- Berri/Monash 132/66 kV meshed connection point
- Kanmantoo 132/11 kV connection point
- Kincraig 132/33 kV connection point
- Eastern Suburbs 275/66 kV meshed connection point.

Appendix C
Asset management approach

C.1 ElectraNet's Asset Management Strategy

Figure 28: Our Asset Management Objectives guide our asset management plans and activities

Safety
Ensure the safety of staff, contractors, and the public.

Affordability
Reduce the overall cost of electricity to customers by removing network constraints, operating the network, and delivering our capital and maintenance works as efficiently as possible.

Reliability
Maintain the reliability of transmission services and the security and resilience of the network while balancing risk and service outcomes.

Sustainability
Operate our network in a way that enables people and nature to thrive.

These objectives guide our asset management plans and activities.

The Asset Management Objectives were developed in consultation with ElectraNet's Consumer Advisory Panel and are consistent with the National Electricity Objective and the capital expenditure objectives set out in the Rules.[59]

Most of our investment program in the planning period relates to risk-based asset replacement and line refurbishment and targeted network security measures, with the remainder relating to recurrent and other capital expenditure required to maintain the systems and facilities needed to efficiently run the network.

Our asset management strategic planning framework is designed to deliver a safe and reliable network at an efficient cost (Table 12). The table below summarises how we ensure that our capital expenditure forecasts are efficient and prudent. Further detailed information is provided in the later sections of this appendix.

[59] NER clauses 6.5.6(a), 6.5.7(a), 6A.6.6 and 6A.6.7

Table 12: How ElectraNet ensures efficient and prudent capital expenditure forecasts

Inputs and analysis	Our approach
Demand forecasts and reliability	Forecast demand is an important driver of reliability capital expenditure. We use estimates of the Value of Customer Reliability (VCR)[60] and Value of Network Resilience (VNR)[61] as determined by the AER. Adopting these independent values provides confidence in these inputs. The demand forecasts are compared against the ability of the transmission system to meet the reliability standard set by the Electricity Transmission Code (ETC) and the Rules.
Project cost estimates and efficiencies	An efficient capital expenditure forecast relies on accurate project cost estimates. To ensure that our project cost estimates are accurate, we update our estimates for the latest actual project costs and market rates. We also incorporate efficiencies expected to arise as we combine the delivery of related projects. We obtain check estimates of project costs from independent experts to verify the efficiency and prudency of our estimates. This ensures our project cost estimates are accurate and reasonable.
Economic assessments	We conduct economic assessments to determine whether the benefits of undertaking a project exceed its costs and we review all available options. We examine the optimal timing of each project, so that customers obtain the maximum net benefit from the expenditure and projects are deferred when this is more economic. The RIT-T is applied for all relevant projects that have a credible option with a cost that exceeds the threshold set in the Rules
Risk and reliability analysis	Any decision to replace an asset is driven by asset condition, risk and reliability considerations balanced against cost. Our risk analysis considers the: • probability of an asset failure • likelihood of adverse consequence(s) • likely cost(s) of the consequence(s) This is based on a systematic process for collecting, recording and analysing detailed information on the condition of network assets, and balances the expected risk reduction against the costs of the proposed expenditure to ensure safety and reliability requirements are met at lowest cost. The risk cost reduction and other benefits of a proposed asset replacement are compared to the cost of the replacement project to determine whether the proposed expenditure delivers a net market benefit.

[60] AER, Values of customer reliability final decision, available from www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/values-of-customer- reliability/final-decision.

[61] AER, Value of Network Resilience 2024 | Australian Energy Regulator (AER)

C.2 Capital expenditure

In developing our capital expenditure plans we are guided by the requirements of:

- our transmission licence and the Electricity Transmission Code (ETC)
- the National Electricity Rules
- our Safety, Reliability, Maintenance and Technical Management Plan (SRMTMP), which is required by our transmission licence.

Transmission licence and ETC

Under section 15 of the Electricity Act 1996 (SA), we are required to be licensed to operate a transmission network in South Australia. The transmission licence authorises us to operate the transmission network in accordance with the terms and conditions of the licence.

Our transmission licence sets out obligations in relation to network performance, which have implications for our capital expenditure requirements. These obligations require us to:

- maintain connection point reliability standards
- maintain regulated voltage levels and reactive margins
- manage fault levels
- manage equipment ratings
- manage system stability and security
- manage quality of supply (frequency, harmonics and flicker).

The transmission licence is issued by the Essential Service Commission of South Australia (ESCOSA).[62]

A central part of ESCOSA's licensing function is to set standards of service under the terms of each licence. ESCOSA undertakes this task through the provisions of the ETC, made pursuant to Part 4 of the Essential Services Commission Act 2002 (ESC Act). Compliance with the ETC is a mandatory licence condition for ElectraNet as well as a regulatory obligation in accordance with clause 6A.6.7 of the Rules.

Section 1.6.1 of the ETC makes it clear that any obligations imposed under the ETC are in addition to those imposed under the Rules and the Electricity Act 1996 (SA) (and regulations). We must therefore comply with both the ETC and the Rules.

The ETC forms part of a broader regulatory scheme for transmission in the NEM, with regulation of the system occurring at two levels:

- the Rules establish technical standards dealing with matters such as frequency, system stability, voltage and fault clearance[63]
- jurisdictional standards, such as those set out under the ETC, provide for security and reliability standards which align with technical standards set out under the Rules.

In particular, the ETC contains provisions relating to service standards, interruptions, design requirements, technical requirements, general requirements, access to sites, telecommunications access and emergencies.

Clause 2 of the ETC mandates specific reliability standards at each transmission exit point (a customer connection point) or group of exit points and supply restoration standards (Table 13).

[62] ESCOSA | Our transmission licence as currently in force (last varied 16 October 2019)

[63] AEMC | National Electricity Rules, Schedule 5.1

Table 13: Connection point reliability categories

<table>
<tr><th>Load category</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>Generally applies to...</td><td>Small loads, country radials, direct connect customers</td><td>Significant country radials</td><td>Medium-sized loads with non-firm backup</td><td>Medium-sized loads and large loads</td><td>Adelaide central business district</td></tr>
<tr><td colspan="6">Transmission line capacity</td></tr>
<tr><td>'N' capacity</td><td colspan="5">100% of agreed maximum demand (AMD)</td></tr>
<tr><td>'N-1' capacity</td><td colspan="2">Nil</td><td colspan="3">100% of AMD</td></tr>
<tr><td>'N-1' continuous capability</td><td colspan="3">Nil</td><td colspan="2">100% of AMD for loss of single transmission line or network support arrangement</td></tr>
<tr><td>Restoration time to 'N' standard after outage (as soon as practicable – best endeavours*)</td><td colspan="2">2 days</td><td>1 hour</td><td>12 hours(or 4 hours if grouped with category 5 connection point)</td><td>4 hours for 176 MW</td></tr>
<tr><td>Restoration time to 'N-1' standard after outage</td><td colspan="2">N/A</td><td colspan="3">As soon as practicable – best endeavours</td></tr>
<tr><td colspan="6">Transformer capacity</td></tr>
<tr><td>'N' capacity</td><td colspan="5">100% of AMD</td></tr>
<tr><td>'N-1' capacity</td><td>Nil</td><td colspan="4">100% of AMD</td></tr>
<tr><td>'N-1' continuous capability</td><td>None stated</td><td>100% of AMD for loss of single transformer or network support arrangement</td><td>Nil</td><td colspan="2">100% of AMD for loss of single transformer or network support arrangement</td></tr>
<tr><td>Restoration time to 'N' standard after outage (as soon as practicable – best endeavours*)</td><td colspan="2">8 days</td><td>1 hour</td><td>12 hours (or 4 hours if grouped with category 5 connection point)</td><td>4 hours for 176 MW</td></tr>
<tr><td>Restoration time to 'N-1' standard after outage</td><td>N/A</td><td colspan="4">As soon as practicable – best endeavours</td></tr>
<tr><td>Spare transformer requirement</td><td colspan="5">Sufficient spares of each type to meet standards in the event of a failure</td></tr>
<tr><td>Allowed period to comply with required contingency standard following a change in forecast AMD that causes the specific reliability standard to be breached</td><td>N/A</td><td colspan="4">12 months</td></tr>
</table>

Note that the provision of 'N' and 'N-1' equivalent capacity, as described by the ETC, includes the capacity that is provided by in-place network support arrangements through distribution system capability, generator capability, load interruptibility, or any combination of these services.

The full version of the ETC version TC/09.4 is available at ESCOSA – Codes.

Rules requirements

ElectraNet is the principal TNSP and the Jurisdictional Planning Body for South Australia under clause 11.28.2 of the Rules. As such, we have specific obligations under Chapter 5 of the Rules regarding network connection, network planning and establishing or modifying a connection point, including technical obligations that apply to all registered participants.

As part of our planning and development responsibilities, we must:

- consider public and worker safety paramount when planning, designing, constructing, operating and maintaining the network
- operate the network with sufficient capability to provide the minimum level of transmission network services required by customers
- comply with the technical and reliability standards contained in the Rules and jurisdictional instruments such as the ETC
- plan, develop and operate the network such that there is no need to shed load under normal and foreseeable operating conditions to achieve the quality and reliability standards within the Rules
- conduct joint planning with Distribution Network Service Providers (DNSPs) and other TNSPs whose networks can impact the South Australian transmission network
- provide information to registered participants and interested parties on projected network limitations and the required timeframes for action
- develop recommendations to address projected network limitations through joint planning with DNSPs, and consultation with registered participants and interested parties.

The planning process considers network and non-network options, such as local generation and demand side management initiatives, on an equal footing. We select the solution (which may include 'do nothing') that maximises net benefits.

Safety, Reliability, Maintenance and Technical Management Plan

In accordance with clause 7 of our transmission licence, we are required to:

- prepare and submit to ESCOSA for approval a SRMTMP dealing with the matters prescribed by regulation
- annually review, and if necessary update, the plan to ensure its efficient operation, and submit the updated plan to ESCOSA for approval
- not amend the plan without the approval of ESCOSA
- comply with the plan (as updated from time to time) as approved by ESCOSA
- undertake annual audits of our compliance with our obligations under the plan and report the results of those audits to the Office of the Technical Regulator (OTR), in a manner approved by the OTR.

The SRMTMP must address, amongst other things, the safe design, installation, commissioning, operation, maintenance and decommissioning of electricity infrastructure owned or operated by a licensed person. As such, the SRMTMP, in addition to the obligations described in Sections 6.5.1 and 6.5.2, is an important driver of our future capital expenditure requirements.

C.3 Capital expenditure categories

We apply a range of categories to our capital expenditure. The table below describes the expenditure categories that are relevant to Transmission Annual Planning Reports. For each category, we also identify the AER's reporting category as indicated in their TAPR Guideline (Table 14).[64]

Table 14: Expenditure categories

ElectraNet Expenditure Category	Definition	Service Category	AER's TAPR Guidelines project driver
Network – Load or Market Benefit Driven			
Augmentation	Works to enlarge the system or to increase its capacity to transmit electricity. This includes projects to which the RIT-T applies and involves the construction of new transmission lines or substations, reinforcement or extension of the existing shared network. The projects may be driven by reliability or market benefits requirements, and are inclusive of any supporting communications infrastructure, land and IT systems.	Transmission Use of System Services (TUoS)	Capacity, reliability, market benefit, stability or reactive support
Connection	Works to either establish new prescribed customer connections or to increase the capacity of existing prescribed customer connections based on specific customer requirements. Includes projects driven by the ETC reliability standards. In accordance with the Rules, new connection works between regulated networks are treated as prescribed services. Other new connections are treated as negotiated or contestable transmission services.	Exit Services	Capacity
Network Non-Load and Non-Market Benefit Driven			
Replacement	Nil Works to replace transmission lines, substation primary plant, secondary systems, communications equipment and other transmission system assets to maintain reliability of supply. Replacement projects are generally undertaken due to the increased risk of plant failure due to asset age, asset condition, obsolescence or safety issues.	Exit Services and TUoS	Asset condition and performance
Refurbishment	For some assets, refurbishment is an alternative to asset replacement. Refurbishment works are generally undertaken based on the asset condition, performance and asset risk to efficiently extend asset life as a more economical alternative to wholesale asset replacement.	TUoS	Asset condition and performance
Security/ Compliance	Projects that address network compliance requirements set out in legislation and regulations, and industry standards. Projects required to ensure the physical and system security of critical infrastructure assets.	Entry Services, Exit Services, TUoS, Common Services	Power quality, operational, compliance, environmental or safety

[64] Australia Energy Regulator | Transmission Annual Planning Report Guidelines

C.4 Expenditure forecasting methodology

Our capital expenditure forecasting methodology is outlined below.

Customer and stakeholder requirements

The starting point for our capital expenditure forecasting methodology is understanding our customers' requirements through effective engagement. Our expenditure priorities are shaped by the feedback we have received through our customer engagement process.

Planning process

The planning process operates within a strategic framework informed by our Network Transition Strategy, and industry planning documents prepared by AEMO such as the ISP. The planning process also relies on inputs such as demand forecasts and connection applications.

Assessment of network limitations

In developing our forecast capital expenditure, we consider projected network limitations, the condition and performance of the existing assets and the associated supporting facilities and business systems required to efficiently operate the network over the forecast period. The application of this approach differs by expenditure category:

- Load and market benefit driven network investment requirements are identified through modelling of future power system capability and analysis of network constraints
- Non-load and non-market benefit driven network investment requirements are determined in accordance with our asset management framework, which takes a risk-based approach to the replacement or refurbishment of assets based on assessed risk, condition and performance.

Options analysis

A range of solutions (including both network and non-network options) are considered to address identified network limitations, and to efficiently defer the need for major capital investments for as long as possible, while maintaining safety, security, reliability and resilience, following a risk-based approach.

Economic analysis and risk assessment techniques are applied to investigate the potential options. The preferred solution must be technically and economically feasible, be deliverable in the timeframe required and minimise long-run total costs.

Scope and estimate

All network solutions are designed to meet the identified need while complying with legislated safety, environmental and technical obligations.

Project cost estimates are developed for each solution based on a detailed database of materials and transmission construction costs, and recent outturn cost information from delivered projects.

Approved projects that are currently in progress have been subject to a more detailed cost assessment than those which have yet to commence.

For non-network projects, cost estimates are generally developed based on independent expert advice and market cost information.

C.5 Key inputs and assumptions

The key inputs and assumptions underlying the network expenditure forecast comprise:

- demand forecasts
- asset health and condition assessments
- planning and design standards
- network modelling
- economic assessments
- risk assessments
- project cost estimation
- project timing and delivery.

These are discussed in turn below.

Demand forecasts

Refer to Chapter 2 in this report for information on how we develop and use demand forecasts.

Asset health and condition assessments

Our transmission asset life cycle assessment framework employs a range of factors to determine where an asset is in its life cycle. The framework assists in optimising our asset management decisions. Our assessment considers both the technical health (condition, serviceability, maintainability, operability and safety) of the asset and its strategic importance in the network (related to the level of risk).

We apply a systematic, continuous process for collecting, recording and analysing detailed information on the condition of our network assets.

These asset health and condition assessments and the ongoing improvement in our understanding of our assets are key inputs to the asset management planning process and the development of asset replacement and refurbishment programs.

Planning and design standards

Our planning standards are derived from the Rules and the ETC, and are presented in more detail in Appendix C.2. The ETC establishes the specific reliability standards that apply to each exit point on the transmission network. Connection point power factor requirements are reflected in customer connection agreements. We have developed and maintain a comprehensive set of design and construction standards in order to comply with the requirements of our SRMTMP. This plan is required by section 15 of the Electricity Act 1996 (SA) to demonstrate that our infrastructure complies with good electricity industry practice and the standards referred to in the Act.

Network modelling

We use the Siemens Power Technologies International PSS/E suite of power system analysis programs as the platform for identifying both operational and future network limitations, as is the case for most other Australian TNSPs, DNSPs and AEMO. Our network model is provided to AEMO and is, therefore, subject to regular scrutiny by independent power industry experts.

Plant data is based on primary sources such as transmission line impedance tests, generator commissioning and compliance tests, power transformer test certificates and on secondary sources such as line impedances calculated from first principles.

Economic assessments

We conduct an economic assessment to review the available options, costs, benefits, and optimal timing for all large projects to ensure that any investment we make maximises the net benefit to customers. The outcomes of these assessments reflect current information and are updated as further information and analysis becomes available.

The options generally considered include 'business as usual', network solutions, deferred network investment, and non- network alternatives. Only if a network investment is clearly shown to be the least cost solution do we include such a project in our capital expenditure forecast.

Inputs considered in these assessments include:

- capital and operating costs of alternative options
- reliability benefits – where unserved energy is measured by the VCR and VNR estimates published by the AER
- cost savings – for example avoided maintenance costs
- risk reduction – as measured by the quantified value of the risk reduced or avoided through the project (for example avoided environmental contamination)
- standard discount rate assumptions – based on a range of estimates including commercial rates and the prevailing regulated rate of return
- optimal timing – including the potential for deferral of an investment to a subsequent regulatory period
- Sensitivity testing is also conducted to determine the robustness and level of confidence in the outcomes of these economic assessments.

The RIT-T is applied to all projects that meet the criteria that are set in the Rules.

Non-network alternatives

We consider the scope for non-network alternatives when we address identified needs on the network.

Risk assessments

For projects driven primarily by risk mitigation (including, for example, safety, reliability and environmental risks), a detailed risk assessment is undertaken to estimate and quantify the risk involved, as a key input to the economic analysis of available options to address the risk.

This risk analysis considers:

- probability of an asset failure
- likelihood of adverse consequence(s)
- likely cost(s) of the consequence(s).

This is based on a systematic process for collecting, recording and analysing detailed information on the condition of network assets, and balances the expected risk reduction against the costs of the proposed expenditure to ensure safety and reliability requirements are met at lowest cost.

We rely on detailed asset condition and risk information to develop specific plans for capital replacement and refurbishment projects for different asset categories and key risk areas, such as asset operational integrity, and safety and environmental issues. A decision to replace an asset is driven by considerations of detailed asset condition, risk, and reliability, balanced against the cost of replacement.

Project cost estimation

Project cost estimates are derived as described earlier in section C.4.

Project timing and delivery

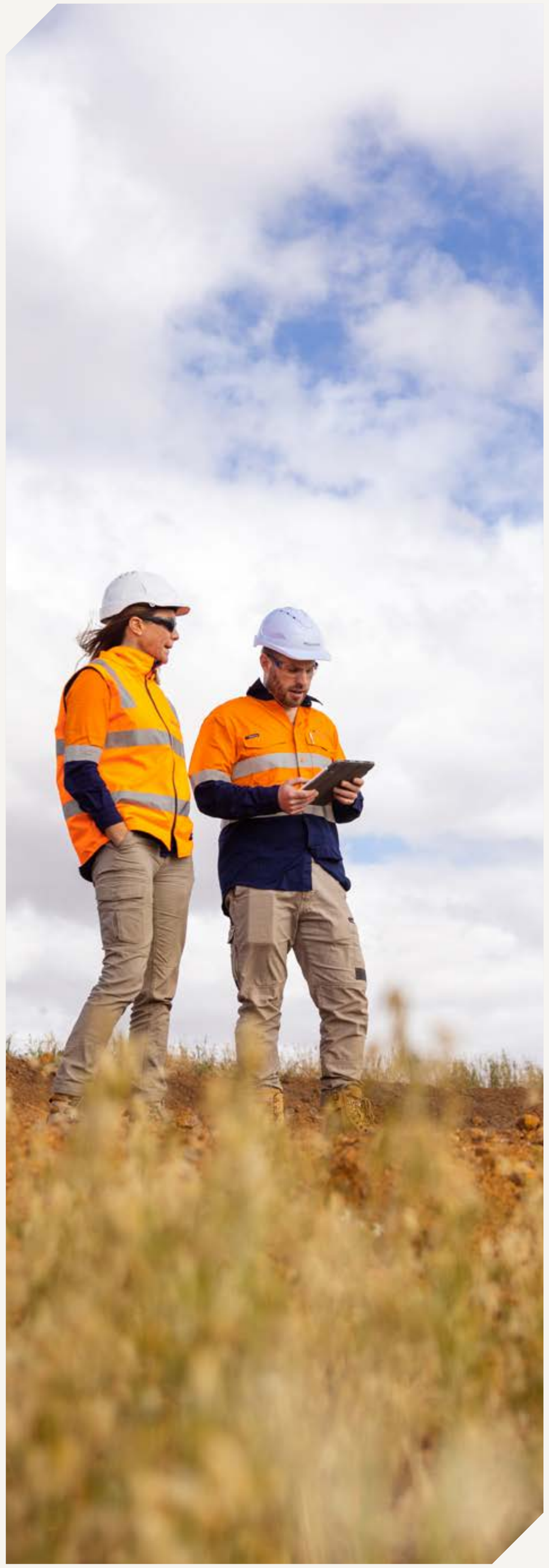
We prioritise the delivery of our capital program to ensure that the capital expenditure objectives are met as efficiently as possible. Our capital expenditure forecasts reflect the latest information on the timing of current projects, which is continually updated as projects proceed.

C.6 Further information on ElectraNet's asset management strategy and methodology

Further information can be obtained from:

consultation@electranet.com.au

Phone: +61 8 8404 7966



Appendix D
Compliance checklist

This appendix sets out a compliance checklist which demonstrates the compliance of ElectraNet's 2025 Transmission Annual Planning Report with the requirements of clause 5.12.2(c) of version 227 of the Rules (the latest version at time of writing).

Summary of Requirements		Section
The Transmission Annual Planning Report must be consistent with the TAPR Guidelines and set out:		
(1)	iv. The forecast *loads* submitted by a *Distribution Network Service Provider* in accordance with clause 5.11.1 or as modified in accordance with clause 5.11.1(d), including at least: v. A description of the forecasting methodology, sources of input information, and the assumptions applied in respect of the forecast *loads*; vi. A description of high, most likely and low growth scenarios in respect of the forecast *loads*; vii. An analysis and explanation of any aspects of forecast loads provided in the *Transmission Annual Planning Report* from the previous year which are significantly different from the actual outcome;	Chapter 2, and our Transmission Annual Planning Report web page[65]
(1A)	for all *network* asset retirements, and for all *network* asset de-ratings that would result in a *network constraint*, that are planned over the minimum planning period specified in clause 5.12.1(c), the following information in sufficient detail relative to the size or significance of the asset: i. A description of the *network* asset, including location; ii. The reasons, including methodologies and assumptions used by the *Transmission Network Service Provider* for deciding that it is necessary or prudent for the network asset to be retired or de-rated, taking into account factors such as the condition of the *network* asset; iii. The date from which the *Transmission Network Service Provider* proposes that the *network* asset will be retired or *de-rated*; and iv. If the date to retire or *de-rate* the *network* asset has changed since the previous *Transmission Annual Planning Report*, an explanation of why this has occurred;	Appendix F.5, and our Transmission Annual Planning Report web page[64]
(1B)	For the purposes of subparagraph (1A), where two or more *network* assets are: i. Of the same type; ii. To be retired or *de-rated* across more than one location; iii. To be retired or *de-rated* in the same calendar year; and iv. Each expected to have a replacement cost less than $200,000 (as varied by a cost *threshold determination*, Those assets can be reported together by setting out in the *Transmission Annual Planning Report*: v. A description of the *network* assets, including a summarized description of their locations; vi. The reasons, including methodologies and assumptions used by the *Transmission Network Service Provider*, for deciding that it is necessary or prudent for the *network* assets to be retired or *de-rated*, taking into account factors such as the condition of the *network* assets; vii. The date from which the *Transmission Network Service Provider* proposes that the *network* assets will be retired or *de-rated*; and viii. If the calendar year to retire or *de-rate* the *network* assets has changed since the previous *Transmission Annual Planning Report*, an explanation of why this has occurred;	Appendix E, and our Transmission Annual Planning Report web page[64]
(2)	Planning proposals for future *connection points*;	Section 3.8

[65] ElectraNet | Transmission Annual Planning Report

Summary of Requirements		Section
(3)	A forecast of constraints and inability to meet the *network* performance requirements set out in schedule 5.1 or relevant legislation or regulations of a *participating jurisdiction* over 1, 3 and 5 years, including at least: i. A description of the *constraints* and their causes; ii. The timing and likelihood of the *constraints*; iii. A brief discussion of the types of planned future projects that may address the *constraints* over the next 5 years, if such projects are required; and iv. Sufficient information to enable an understanding of the *constraints* and how such forecasts were developed;	Section 5.1
(4)	In respect of information required by subparagraph (3), where an estimated reduction in forecast *load* would defer a forecast *constraint* for a period of 12 months, include: i. The year and months in which a *constraint* is forecast to occur; ii. The relevant *connection points* at which the estimated reduction in forecast *load* may occur; iii. The estimated reduction in forecast *load* in MW needed; and iv. A statement of whether the *Transmission Network Service Provider* plans to issue a request for proposals for *augmentation*, replacement of *network* assets, or a *non-network* option identified by the annual planning review conducted under clause 5.12.1(b) and if so, the expected date the request will be issued;	Appendix F, and our Transmission Annual Planning Report web page[64]
(5)	For all proposed *augmentations* to the *network* and proposed replacements of *network* assets the following information, in sufficient detail relative to the size or significance of the project and the proposed operational date of the project: i. Project/asset name and the month and year in which it is proposed that the asset will become operational; ii. The reason for the actual or potential *constraint*, if any, or inability, if any, to meet the *network* performance requirements set out in schedule 5.1 or relevant legislation or regulations of a *participating jurisdiction*, including *load* forecasts and all assumptions used; iii. The proposed solution to the *constraint* or inability to meet the network performance requirements identified in subparagraph (ii), if any; iv. Total cost of the proposed solution; v. Whether the proposed solution will have a *material inter-network impact*. In assessing whether an *augmentation* to the *network* will have a *material inter-network* impact a *Transmission Network Service Provider* must have regard to the objective set of criteria *published* by *AEMO* in accordance with clause 5.21 (if any such criteria have been published by *AEMO*); and vi. Other reasonably *network options* and *non-network options* considered to address the actual or potential *constraint* or inability to meet the network performance requirements identified in subparagraph (ii), if any. Other reasonably *network* and *non-network* options include, but are not limited to, *interconnectors*, *generation* options, demand side options, *market network service* options and options involving other *transmission* and *distribution networks*;	Section 5, Appendix F, and our Transmission Annual Planning Report web page[64]
(6)	The manner in which the proposed augmentations and proposed replacements of *network assets* relate to the most recent *Integrated System Plan*;	Section 5
(6A)	for proposed new or modified *emergency frequency control schemes*; the manner in which the project relates to the most recent general *power system risk review*;	Section 6.3, Appendix H
(6B)	information about which parts of its *transmission network* are *designated network assets* and the identities of the owners of those *designated network assets*;	Appendix G

Summary of Requirements		Section
(7)	information on the *Transmission Network Service Provider's* asset management approach, including: i. A summary of any asset management strategy employed by the *Transmission Network Service Provider*; ii. A summary of any issues that may impact on the system *constraints* identified in the *Transmission Annual Planning Report* that has been identified through carrying out *asset management*; and iii. Information about where further information on the *asset management* strategy and methodology adopted by the *Transmission Network Service Provider* may be obtained.	Appendix C
(8)	Any information required to be included in a *Transmission Annual Planning Report* under: i. Clauses 5.16.3(c) and 5.16A.3 in relation to a *network* investment which is determined to be required to address an urgent and unforeseen *network* issue; or ii. Clauses 5.20B.4(h) and (i) and clauses 5.20C.3(f) and (g) in relation to *network* investment and other activities to: a. Provide *inertia network services* or *inertia support activities*; or b. Meet the standard in clause S5.1.14 in relation to a *system strength node*;	ElectraNet has not made any network investments that were determined to be required to address an urgent and unforeseen network issue Section 6.3
(9)	Emergency controls in place under clause S5.1.8, including the *Network Service Provider's* assessment of the need for new or altered emergency controls under that clause;	Appendix H
(9A)	the analysis of the operation of, and any known or potential interactions between: i. Any *emergency frequency control schemes*, or emergency controls in place under clause S5.1.8, on its *network*; and ii. *Protection systems* or *control systems* or *plant connected* to its *network* (including consideration of whether the settings of those systems are fit for purpose for the future operation of its *network*), Undertaken under clause 5.12.1(b)(7), including a description of proposed actions to be undertaken to revise those schemes, controls or systems, or to address any adverse interactions;	Section 6.4
(10)	Facilities in place under clause S5.1.10;	Appendix H
(11)	An analysis and explanation of any other aspects of the *Transmission Annual Planning Report* that have changed significantly from the preceding year's *Transmission Annual Planning Report*, including the reasons why the changes have occurred;	Appendix A
(12)	The results of joint planning (if any) undertaken with a *Transmission Network Service Provider* under clause 5.14.3 in the preceding year, including a summary of the process and methodology used by the *Transmission Network Service Providers* to undertake joint planning and the outcomes of that joint planning; and	Appendix B
(13)	The *system strength locational factor* for each *system strength connection point* for which it is the Network Service Provider and the corresponding *system strength node*.	Appendix I

Appendix E Connecting to the South Australian transmission system

E.1 Implications of South Australian system strength requirements for generators

ElectraNet installed synchronous condensers at Davenport and Robertstown in 2021, bolstering system reliability; and addressing a shortfall in system strength and inertia resulting from the network's high penetration of renewable generation.

Commissioning of the synchronous condensers has allowed the amount of non-synchronous generation that can be dispatched at times of minimum conventional generation in South Australia to be increased from 2,000 MW to 2,500 MW.

The total installed capacity of non-synchronous generation in South Australia now exceeds 2,500 MW, so the non- synchronous generation system constraint remains in place at this new increased level now that the four synchronous condensers have been installed.

Other constraints such as for thermal capacity, stability or voltage limitations, and interconnector transfer capacity are likely to bind at times so as to limit non-synchronous generation at levels below the non-synchronous generation system strength constraint.

The successful completion of a system strength Full Impact Assessment conducted for a proposed non-synchronous generator in accordance with clause 5.3.4B of the National Energy Rules is a pre-requisite for connection and inclusion in the non- synchronous generation system constraint.

ElectraNet and AEMO continue to utilise an agreed approach for how a generator can be excluded from the non-synchronous generation system constraint. The following conditions must be met:

- The generator performance standard compliance must be verified with validated R2 models
- The generator must propose mitigation measures which may include control system modifications or installation of additional plant that increases the non-synchronous generation system constraint limit by their rated capacity. An increase in the constraint by part of a non-synchronous generator's rated capacity would be considered but the removal of the generator from the constraint would then be on a pro-rata basis. This assessment will be performed as a Full Impact Assessment.

ElectraNet has assessed the anticipated impact that the full implementation of Project EnergyConnect will have on the amount of non-synchronous generation that can be dispatched at times of minimum conventional generation in South Australia. We have taken the results of that assessment into account as we prepared the PADR for our System Strength Requirements in South Australia RIT-T, which we published in April 2025.

E.2 Opportunities to connect to Project EnergyConnect

Project EnergyConnect, the transmission interlink with NSW and Victoria, comprises two stages:

- Stage 1 – construction of the first 700 km double circuit and release of 150 MW which was completed in late March 2025
- Stage 2 – release of 800 MW, scheduled to be completed in Q2 (May) 2027.

ElectraNet is aware of significant interest among potential renewable energy generation and storage proponents seeking to take advantage of increased interconnection that will be introduced by Project EnergyConnect.

We advise that a staged approach for progressing connections to Project EnergyConnect has been adopted, taking into account Project EnergyConnect's stated May 2026 timeframe for completion.

A Connections Framework which outlines pre-requisites for each connection project phase relative to Project EnergyConnect milestones is available on the Project EnergyConnect website.[66]

[66] Project EnergyConnect

For proponents interested in connecting to Project EnergyConnect, in many cases the connection process will be similar to the current process for connection to the transmission network.

However, proponents interested in connecting to certain sections of Project EnergyConnect in NSW will need to take into account access arrangements relating to the South-West Renewable Energy Zone.

The update provided in April 2024 confirms that Project EnergyConnect models have reached sufficient maturity to be used for planning purposes.

Project EnergyConnect models are now available to proponents via the AEMO Data Request process.[67]

Further details can be found the Project EnergyConnect website.[68]

New cut-in connections along Project EnergyConnect

While connection enquiries and connection applications for proposed connections directly to Project EnergyConnect (cut-ins) can be lodged and processed utilising available information, connections can only be physically facilitated once 500 MW of transfer capacity has been released across Project EnergyConnect.

This is anticipated to occur in 2027, following successful completion of hold point testing under the Inter-Network Test Plan.

ElectraNet encourages interested parties to submit connection enquiries and applications for proposed connections directly to Project EnergyConnect.

South Australian Interconnector Trip Remedial Action Scheme (SAIT RAS)

SAIT RAS is a special protection scheme developed by ElectraNet to cater for a non-credible trip of either the Project EnergyConnect interconnector or the Heywood interconnector under high power transfer conditions so as to prevent separation of South Australia from the National Energy Market (NEM).

It is the largest and most complex protection scheme in the NEM and aims to ensure that South Australia can continue to progress the energy transition at pace.

ElectraNet advises that any cut-in along Project EnergyConnect will likely require a significant amount of analysis and consequential redesign of the SAIT RAS.

NSW South-West Renewable Energy Zone Access Arrangements

Proponents seeking a connection to the Project EnergyConnect network infrastructure in NSW will need to consider access arrangements for the South-West REZ.

This may affect the proponent's ability to submit a connection enquiry, apply to connect, or receive an offer to connect to Project EnergyConnect network infrastructure both within and outside the South-West REZ.

ElectraNet advises that proponents seeking a connection should familiarise themselves with the regulatory and access arrangements for the South-West REZ.[69]

E.3 Impact of generation connection on power quality

To support the ongoing connection and integration of new generation technologies within the power system, ElectraNet performs complex power quality studies and assessments to ensure that customers will continue to experience satisfactory power quality.

As such, ElectraNet requires generators to submit a site-specific power quality model for use in the PowerFactory simulation tool per Section 4.6 of the AEMO Power System Model Guidelines; and a power quality design report that incorporates sufficient supporting studies and assessment results per the submission requirements under 5.3.4A(b2) of the National Electricity Rules.

[67] AEMO | Policy on provision of network data
[68] Project Energy Connect
[69] NSW Government EnergyCo | South West Renewable Energy Zone

Appendix F Projects

F.1 Interconnector and Smart Grid planning

ElectraNet is progressing projects and investigating opportunities to increase interconnector capacity between South Australia and the rest of the NEM, including the development of Project EnergyConnect and the deployment of "smart grid" technology such as wider area monitoring and protection schemes (Table 15 and Figure 2).

These projects have either been identified by AEMO in an ISP or GPSRR, or we will be working with AEMO to enable assessment of these projects in future ISPs or GPSRRs.

Table 15: Committed and proposed projects to strengthen interconnection, or improve transfer capability by the application of smart grid technology

Project Description	Region	Constraint driver and investment type	Asset in service
EC.14171 Project EnergyConnect: New interconnector between South Australia and New South Wales **Estimated cost: $440–500 million (South Australian component only)** **Status: Committed** Construct a new 330 kV, 800 MW interconnector from Robertstown in South Australia to Wagga Wagga in New South Wales, via Buronga and strengthen the link between Buronga and Red Cliffs (Victoria). This project will increase the full combined transfer limit across both the Heywood and Project EnergyConnect interconnectors to 1,300 MW import into South Australia and 1,450 MW export We envisage that this project will impact inter-regional transfer.	Main Grid	Market benefit Augmentation	Stage 1 (Robertstown to Buronga): 150 MW transfer capacity released in April 2025 Stage 2 (Buronga to Wagga Wagga): Full transfer capacity expected to be released in 2027

Table 15: Committed and proposed projects to strengthen interconnection, or improve transfer capability by the application of smart grid technology (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15272 Wide Area Monitoring Scheme 2023–2028 **Estimated cost: $15–18 million** **Status: Committed** Expand the existing WAMS by installing phasor measurement units (PMUs) as required by AEMO at candidate sites across the SA transmission network. The scope of works includes installing hardware and software to integrate new PMUs to existing systems and deploy associated software application analytical tools that will be used to analyse the data collected. The candidate sites cover a range of network locations listed below: • Main transmission network (incremental to existing PMU network) – will monitor the performance of the main transmission network and identify emerging power system challenges • Generator/BESS sites – will monitor the dynamic response of major generators and batteries • Regional Load sites at the periphery of the system – monitoring will help understanding of load dynamics for benchmarking power system models and identification of emerging challenges in the power system • Metro Loads incorporating significant CER Feed-in – monitoring will help understand the response of CER following-system disturbances for benchmarking power system models, network planning and accurate constraint development We do not envisage that this project will impact inter-regional transfer.	All	Stability Operational	AEMO data requirement was completed by August 2024 Remaining site data by June 2025
EC.15466 South East Interconnection **Estimated cost: To be determined** **Status: Being considered as an option for future development** Develop a new AC interconnector between the South East of South Australia and Heywood in Victoria This project option would increase transfer capability between South Australia and Victoria to unlock cheaper energy sources, enabling access for South East SA wind-powered generation to Victoria and the rest of the NEM. This project would impact inter-regional transfer.	Main Grid	Market benefit Augmentation	Subject to if or when shown to deliver benefit to customers
EC.15467 Mid North Interconnection **Estimated cost: To be determined** **Status: Being considered as an option for future development** Develop a new 500 kV AC interconnector between the Mid North of South Australia at New South Wales. This project option would increase transfer capability between South Australia and New South Wales to unlock cheaper energy sources, enabling access for South Australian wind- and solar-powered generation to New South Wales and the rest of the NEM. This project will impact inter-regional transfer.	Main Grid	Market benefit Augmentation	Subject to if or when shown to deliver benefit to customers

This project option would increase transfer capability between South Australia and Victoria to unlock cheaper energy sources, enabling access for South East SA wind-powered generation to Victoria and the rest of the NEM

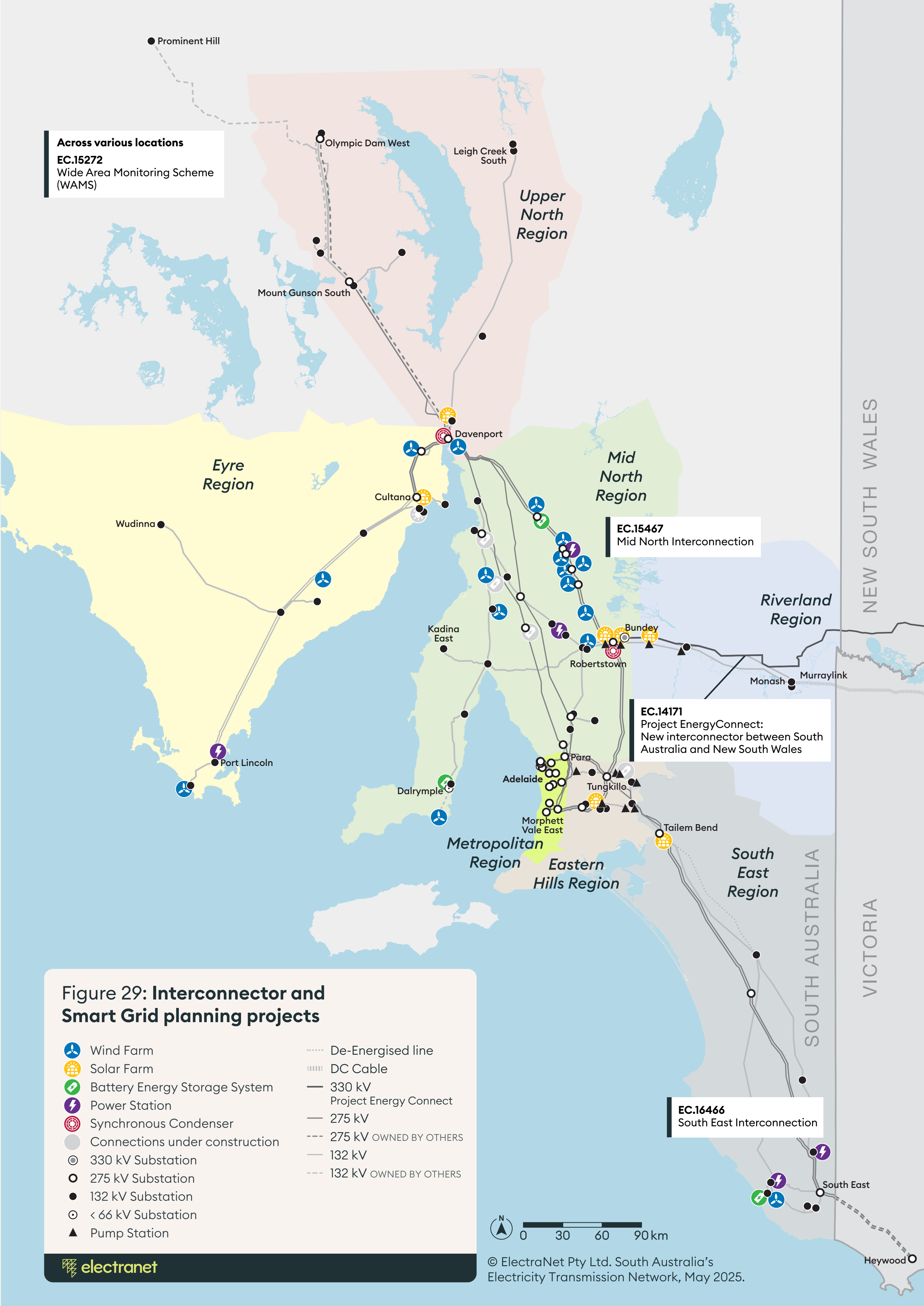


Figure 29: **Interconnector and Smart Grid planning projects**

© ElectraNet Pty Ltd. South Australia's Electricity Transmission Network, May 2025.

F.2 System security, power quality and fault levels

A secure power system needs adequate levels of system strength, inertia, and voltage control, which in the past have been provided by synchronous power generation. We have proposed several projects to continue to provide an adequacy supply of system strength, inertia, and voltage control on South Australia's transmission network (Table 16 and Figure 30).

Expected maximum and minimum fault levels at each connection point are available from the supporting data published on our Transmission Annual Planning Report web page.[70]

Table 16: Projects proposed to maintain or enhance system security or power quality

Project Description	Region	Constraint driver and investment type	Asset in service
EC.11645 Transmission Network Voltage Control **Estimated cost: $80–90 million** **Status: Committed** Install a total of three 60 Mvar 275 kV reactors around the Adelaide metropolitan region at Parafield Gardens West, Torrens Island and Magill, a total of two 50 Mvar 275 kV reactors around the Adelaide metropolitan region at Cherry Gardens and Torrens Island Power Station, and a single 50 Mvar 275 kV reactor at South East. The installations will include associated works for reactor connection and switching, monitoring and control, system protection, and site civil works. These and other reactive and voltage control devices on the main 275 kV transmission network will be upgraded to enable coordinated automatic switching of existing and planned reactive power devices. This will require the installation and modification of secondary plant items for monitoring, control and protection covering multiple substation sites including automating Onload Tap Changer operation at SA Power Networks connection points. The RIT-T for this project was completed in June 2024. ElectraNet does not envisage that this project will impact inter-regional transfer.	Main Grid	Reactive support Augmentation	Cherry Gardens reactor installed September 2023 Para reactor installed December 2024 Installation of remainder of 275 kV reactors by mid-2026 Automated switching by mid-2028
EC.15572 Network Power Quality Remediation **Estimated cost: $30–60 million** **Status: Contingent project in the 2024–2028 regulatory control period** Install relevant equipment to ensure maintain power quality is maintained for customers across the transmission network in relation to voltage harmonic requirements in line with accepted standards. ElectraNet does not envisage that this project will impact inter-regional transfer.	Various, depending on the outcome of monitoring	Compliance Augmentation	2024–2028 (if shown to be required)
EC.15149 Main Grid System Strength Support 2024–2028 **Estimated cost: About $5 million per clutch on each new generator** **Status: Planned** Procure prudent levels of additional system strength services to satisfy future system strength requirements at System Strength Nodes in South Australia. We published the PSCR in November 2023, and the PADR in April 2025. ElectraNet does not envisage that this project will impact inter-regional transfer.	Main Grid	Compliance Augmentation	2026–2029 (depending upon solution)

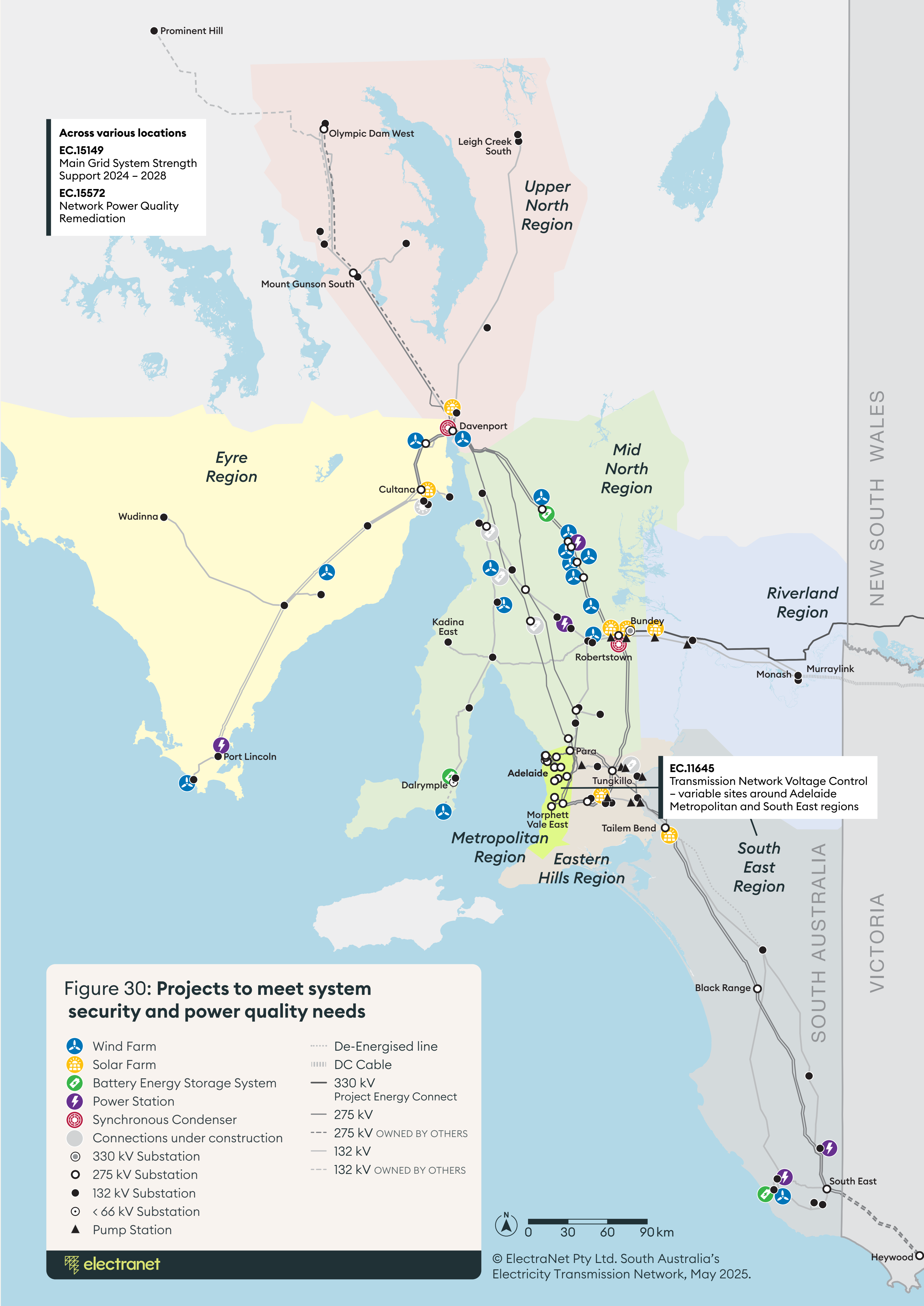


Figure 30: **Projects to meet system security and power quality needs**

[70] ElectraNet | Transmission Annual Planning Report

F.3 Capacity and Renewable Energy Zone development

We have identified potential projects to provide capability for future new customers and generators (Table 17 and Figure 31).

ElectraNet annually compares connection capability against forecast connection point demand, considering the redundancy requirements specified for each connection point in the South Australian Electricity Transmission Code (ETC, redundancy requirements summarised in Appendix C.2). This is coordinated through joint planning with SA Power Networks, in which connection point projects are considered, proposed, and planned (Appendix A.2).

We have also assessed the capability of the network to accommodate new generator connections. In doing so we consider the REZs that AEMO identifies for potential development in the ISP along with the results of our own analysis to identify potential projects to provide additional capacity.

In recent years, interest in large new load connections to the South Australian electricity transmission system has risen sharply, with proponents seeking to take advantage of South Australia's low-cost and low-emission electricity from renewable sources.

These potential new demand developments fundamentally change the outlook for the South Australia's transmission network. We are considering prioritised options for development that would unlock capacity for in S3 Mid North SA, S2 Riverland, S5 Northern SA, S9 Eastern Eyre Peninsula, and S1 South East SA REZs.

AEMO's 2024 ISP highlighted the Mid North South Australia REZ Expansion (South) as a newly actionable project, with required completion in 2029. The 2024 ISP initiated the RIT-T process for this identified need. We plan to publish a PADR by December 2025.

We monitor updates in forward and reverse power flow forecasts for all connection points. This enables us to consider options for augmentation or implement appropriate reverse power flow management by the time it is required at each connection point.

- There is a potential need for a new connection point at Kingsford in the 2030s if potential new residential developments connect to the distribution network in that area
- Tailem Bend and Baroota connection points will require upgrade in 2034, based on our analysis of current maximum demand forecasts.
- Several connection points are currently projected to required upgrades later in the 2030s or 2040s but could be required in 2034 or earlier if significant potential new industrial loads connect to the distribution network or load forecasts are increased by 10-15% in the future. These include the following connection points:
  - Mount Barker South
  - Davenport West
  - Mount Gambier
  - Southern Suburbs
  - Western Suburbs
  - Yadnarie
  - Blanche.

Table 17: Projects to meet capacity or REZ development needs

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15104 Eyre Peninsula Upgrade **Estimated cost: $160–750 million (depending upon solution)** **Status: Planned** Upgrade the operating voltage of the committed new Cultana to Yadnarie transmission lines from 132 kV to 275 kV if potential large loads connect on the Eyre Peninsula. If needed, construct additional double circuit 275 kV line between Davenport and Cultana. We have commenced the RIT-T and published the PSCR in December 2023. We published the PADR in March 2025. ElectraNet does not envisage that this project will impact inter-regional transfer.	Eyre Peninsula	Capacity Augmentation	2027–2030 (depending upon solution)
EC.11011 Upper South East Network Augmentation **Estimated cost: $35–40 million** **Status: Proposed** String the vacant third 275 kV circuit between Tailem Bend and Tungkillo and install static and dynamic reactive compensation if needed to increase transfer capability between the South East and the Adelaide metropolitan area, and between the Mid North and the Heywood interconnector. We are considering whether this project is best progressed as a stand-alone RIT-T, or whether it should be incorporated as part of the scope of the Northern Transmission Project. ElectraNet envisages that this project may impact inter-regional transfer.	Eastern Hills	Market benefits Augmentation	2029
EC.15424 Northern Transmission Project (NTx) **Estimated cost: $750–3,500 million** **Status: Planned** The project has been identified as an actionable project in AEMO 2024 ISP report. The project will explore the benefits of increased transfer capacity between Bundey and the Adelaide metropolitan load centre, and Bundey and the anticipated Cultana load centre. We have commenced the RIT-T process and are planning to publish the PADR by the end of 2025. Project options are included in chapter 4. We envisage that this project may impact inter-regional transfer.	Mid North	Market benefits Augmentation	2029 – 2033 (depending on solution)
EC.15473 Mid North Reinforcement **Estimated cost: to be determined** **Status: To be proposed for consideration as a future contingent project** Rebuild the Davenport – Brinkworth – Templers West – Para 275 kV line as a high-capacity double circuit line, with new connecting lines between Munno Para and Templers West and between Bungama and Brinkworth. Additional potential details are included in Chapter 4. This project will enable increased access for new low-cost renewable generation in the Mid North SA, North SA, and Eyre Peninsula REZs to Adelaide and the proposed Eyre Peninsula hydrogen hub major load centres. ElectraNet does not envisage that this project will impact inter-regional transfer.	Main Grid	Capacity and Market benefits Augmentation	2040s (subject to demonstrating benefits to customers)

Table 17: Projects to meet capacity or REZ development needs (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15112 Heywood Interconnector Dynamic Voltage Stability Increase **Estimated cost: $30–60 million** **Status: To be considered as a contingent project.** Install dynamic reactive support at Tailem Bend substation, to firm up import and export capability across Heywood interconnector, especially if needed to cater for early coal retirements in Victoria, if not addressed by other developments. ElectraNet envisages that this project will impact inter-regional transfer.	Main Grid	Market benefits Augmentation	2030s (subject to demonstrating benefits to customers)
EC.14085 Kingsford 275/66kV Connection Point **Estimated cost: $35–60 million** **Status: Proposed** Cut into the Para to Templers West 275 kV line and create a 66 kV connection point with 2x 275/66 kV transformers.	Mid North	Capacity Augmentation	2030s (depending on local load growth)
EC.15471 Eyre Peninsula Grid **Estimated cost: to be determined** **Status: An option for future development** This project would support development of REZs and release areas on the Eyre Peninsula to support large renewable generation projects near Whyalla, Port Bonython, and Cape Hardy, unlocking potential for increased connection of low-cost renewables to supply increasing demand. ElectraNet does not envisage that this project will impact inter-regional transfer.	Eyre Peninsula	Capacity and Market benefits Augmentation	2030s (depending on local load growth)
EC.15468 Tailem Bend upgrade **Estimated cost: $12–15 million** **Status: Proposed** Replace the two existing 25 MVA 132/33 kV transformers at Tailem Bend with two 60 MVA units. SA Power Networks' draft 2024 connection point report is forecasting the need for this project in 2034. We plan to commence the RIT-T process in 2028. ElectraNet does not envisage that this project will impact inter-regional transfer.	South East	Capacity Augmentation	2034 A 10% higher load forecast would require this project in 2028
EC.15772 Baroota upgrade **Estimated cost: $30–50 million** **Status: Proposed** Rebuild connection point with 2x25 MVA 132/33 kV transformers. ElectraNet does not envisage that this project will impact inter-regional transfer.	Mid North	Capacity Augmentation	2034
EC.15773 Mount Barker South reinforcement **Estimated cost: $10–20 million** **Status: Proposed** Install a second 225 MVA 275/66 kV transformer at Mount Barker South and retire ElectraNet assets at Mount Barker. ElectraNet does not envisage that this project will impact inter-regional transfer.	Eastern Hills	Capacity Augmentation	2035 A 10% higher load forecast would require this project in 2032 A 15% higher load forecast would require this project in 2030

Table 17: Projects to meet capacity or REZ development needs (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15774 Davenport West reinforcement **Estimated cost: $15–30 million** **Status: To be considered for proposal in a future revenue control period** Replace existing 2x60 MVA 132/33 kV transformers with 2x120 MVA 132/33 kV transformers. ElectraNet does not envisage that this project will impact inter-regional transfer.	Upper North	Capacity Augmentation	2040 A 10% higher load forecast would require this project in 2034 A 15% higher load forecast would require this project in 2031
EC.15708 Lower South East upgrade **Estimated cost: $35–50 million** **Status: To be considered for proposal as a contingent project in the 2028–29 to 2033–34 revenue control period** Options: • Replace the existing 1x25 MVA 132/33 kV transformer at Mount Gambier with a second 60 MVA 132/33 kV transformer and transfer load from Blanche to Mount Gambier – consider rebuilding Mount Gambier connection point at a nearby site • Replace the existing 132/33 kV transformers at Blanche connection point with 2x 120 MVA 132/33 kV transformers and transfer load from Mt Gambier to Blanche. ElectraNet does not envisage that this project will impact inter-regional transfer.	South East	Capacity Augmentation	2040 A 10% higher load forecast would require this project in 2035 A 15% higher load forecast would require this project in 2031 A 20 MW spot load increase would require this project from 2029
EC.15472 Metropolitan reinforcement **Estimated cost: to be determined** **Status: An option for future development** Establish a second 275 kV underground cable to provide a second transmission supply to City West and establish a new 275 kV underground cable from City West to the Southern Suburbs. This project will improve geographical diversification of transmission supply to the Southern Suburbs of Adelaide to increase supply security, which will become increasingly important as climate change increases bushfire risks to the transmission corridors in the Eastern Hills. In addition, it will increase supply capability to the Western Suburbs, Eastern Suburbs and Southern Suburbs to cater for potential increased electrification. ElectraNet does not envisage that this project will impact inter-regional transfer.	Metropolitan	Capacity Augmentation	2040s (depending on local load growth)
EC.15730 Southern Suburbs reinforcement **Estimated cost: $30–50 million** **Status: To be considered for proposal in a future revenue control period** Install a third 225 MVA 275/66 kV transformer at Morphett Vale East, or replace the existing 2x225 MVA 275/66 kV transformers at Morphett Vale East with 2x300 MVA 275/66 kV transformers. ElectraNet does not envisage that this project will impact inter-regional transfer.	Metropolitan	Capacity Augmentation	2041 A 10% higher load forecast would require this project in 2037 A 15% higher load forecast would require this project in 2034

Table 17: Projects to meet capacity or REZ development needs (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15729 Western Suburbs reinforcement **Estimated cost: $20–60 million, depending on option** **Status: Proposed** Options: • Replace the existing 2x150 MVA 275/66 kV transformers at Torrens Island with 2x225 MVA 275/66 kV transformers; • Install a second 225 MVA 275/66 kV transformer at Kilburn. ElectraNet does not envisage that this project will impact inter-regional transfer.	Metropolitan	Capacity Augmentation	2041 A 10% higher load forecast would require this project in 2037 A 15% higher load forecast would require this project in 2034
EC.15775 Yadnarie upgrade **Estimated cost: $20–35 million** **Status: To be considered for proposal in a future revenue control period** Rebuild Yadnarie connection point as a 2x60 MVA 132/66 kV transformer connection point at Yadnarie North. ElectraNet does not envisage that this project will impact inter-regional transfer.	Eyre Peninsula	Capacity Augmentation	A 10% higher load forecast would require this project in 2038 A 15% higher load forecast would require this project in 2033
EC.15776 Northern Suburbs reinforcement **Estimated cost: $15–100 million, depending on option** **Status: To be considered for proposal in a future revenue control period** Options: • Replace existing 180 MVA 275/66 kV transformer at Parafield Gardens West with a 225 MVA or 300 MVA 275/66 kV transformer; • Install second 225 MVA 275/66 kV transformer at Munno Para and rebuild the Para – Munno Para 275 kV line as double circuit. ElectraNet does not envisage that this project will impact inter-regional transfer.	Metropolitan	Capacity Augmentation	A 10% higher load forecast would require this project in 2042 A 15% higher load forecast would require this project in 2040 A 120 MW spot load increase would require this project from 2035
EC.15777 Whyalla Central upgrade **Estimated cost: to be determined** **Status: To be considered for proposal in a future revenue control period** Rebuild the Cultana to Whyalla 132 kV lines with larger conductor and apply cyclic ratings to Whyalla Central 132/33 kV transformers. ElectraNet does not envisage that this project will impact inter-regional transfer.	Eyre Peninsula	Capacity Augmentation	A 10% higher load forecast would require this project in 2043 A 15% higher load forecast would require this project in 2040
EC.15778 Mobilong upgrade **Estimated cost: to be determined** **Status: To be considered for proposal in a future revenue control period** Replace existing 2x60 MVA 132/33 kV transformers with 2x120 MVA 132/33 kV transformers. Consider rebuilding Mobilong connection point or building an additional connection point at a nearby site. ElectraNet does not envisage that this project will impact inter-regional transfer.	Eastern Hills	Capacity Augmentation	A 15% higher load forecast would require this project in 2038

Table 17: Projects to meet capacity or REZ development needs (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15771 Angas Creek upgrade **Estimated cost: to be determined** **Status: To be considered for proposal in a future revenue control period** Replace existing 2x25 MVA 132/33 kV transformers with 2x60 MVA 132/33 kV transformers and build a new 132 kV bus. ElectraNet does not envisage that this project will impact inter-regional transfer.	Eastern Hills	Capacity Augmentation	A 15% higher load forecast would require this project in 2042
EC.15779 Berri/Monash upgrade **Estimated cost: to be determined** **Status: To be considered for proposal in a future revenue control period** Install 2x120 MVA 132/66 kV transformers at Monash, and remove the existing 2x50 MVA 132/66 kV transformers at Berri and the 1x60 MVA 132/66 kV transformer at Monash. Convert the two Monash to Berri 132 kV lines to 66 kV operation. ElectraNet does not envisage that this project will impact inter-regional transfer.	Riverland	Capacity Augmentation	A 15% higher load forecast would require this project in 2042
EC.15780 Kanmantoo upgrade **Estimated cost: to be determined** **Status: To be considered for proposal in a future revenue control period** Transfer connection point from 11 kV tertiary winding to 33 kV secondary winding of existing 132/33/11 kV transformer. ElectraNet does not envisage that this project will impact inter-regional transfer.	Eastern Hills	Capacity Augmentation	A 15% higher load forecast would require this project in 2042
EC.15781 Mannum upgrade **Estimated cost: to be determined** **Status: To be considered for proposal in a future revenue control period** Replace existing 33 kV transformer cables and cyclically rate the existing 25 MVA 132/33 kV transformers. ElectraNet does not envisage that this project will impact inter-regional transfer.	Eastern Hills	Capacity Augmentation	A 15% higher load forecast would require this project in 2042
EC.15782 Kincraig upgrade **Estimated cost: to be determined** **Status: To be considered for proposal in a future revenue control period** Replace existing 2x25 MVA 132/33 kV transformers with 2x60 MVA 132/33 kV transformers. ElectraNet does not envisage that this project will impact inter-regional transfer.	South East	Capacity Augmentation	A 15% higher load forecast would require this project in 2044

Table 17: Projects to meet capacity or REZ development needs (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15783 Eastern Suburbs reinforcement **Estimated cost: to be determined** **Status: To be considered for proposal in a future revenue control period** Potential solution to be determined. ElectraNet does not envisage that this project will impact inter-regional transfer.	Metropolitan	Capacity Augmentation	A 15% higher load forecast would require this project in 2044
EC.15470 South East Expansion (Stage 2) **Estimated cost: to be determined** **Status: An option for future development** Construct new high capacity double-circuit twin conductor lines from the South East SA and South East SA Offshore REZs to Bundey, via a location near Kincraig. This project would provide strong connection for new low-cost renewable generation developments in the South East SA REZ and Offshore REZ to the South Australian transmission backbone. ElectraNet envisages that this project may impact inter-regional transfer.	Main Grid	Market benefits Augmentation	Subject to demonstrating benefits to customers

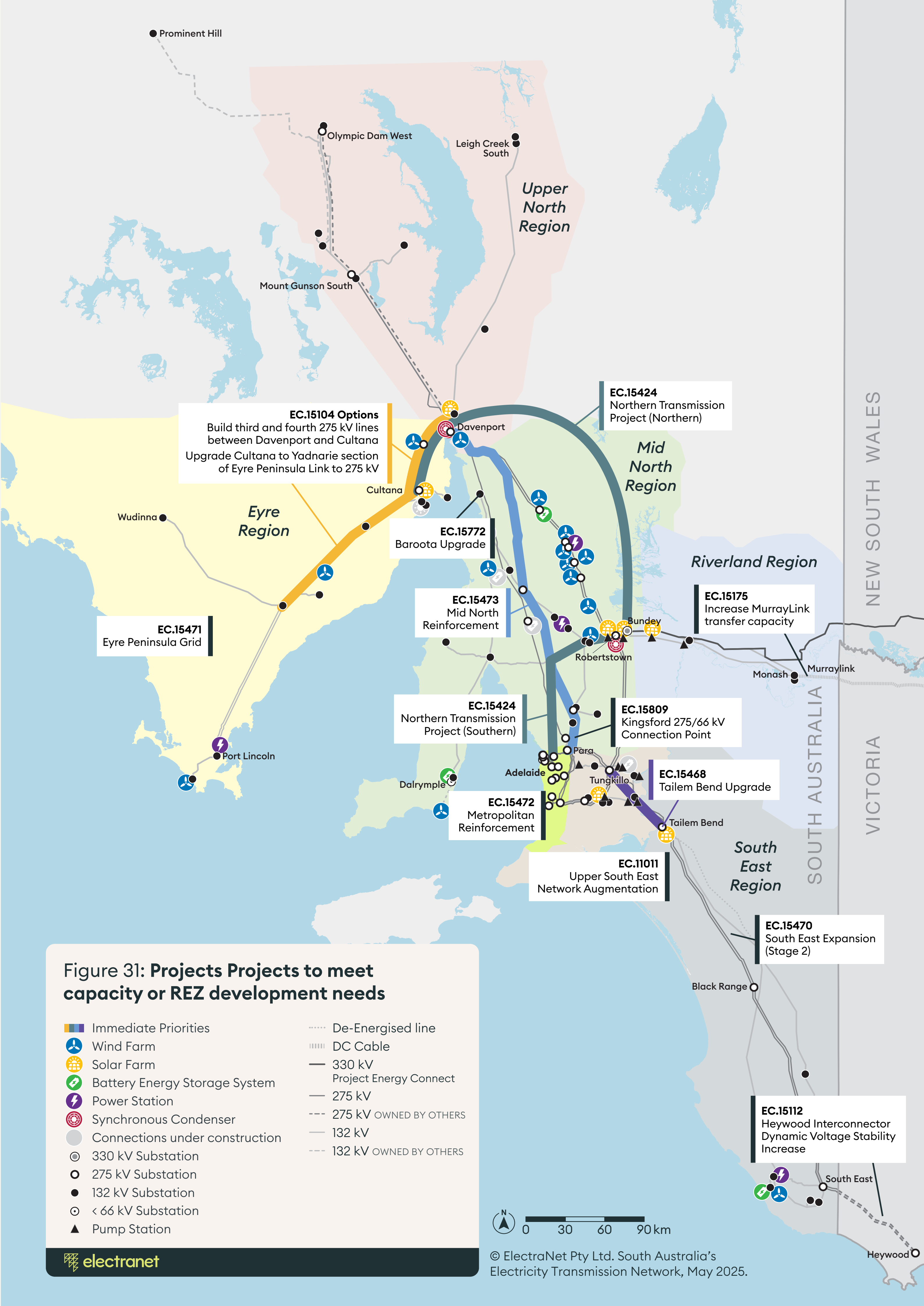


Figure 31: **Projects Projects to meet capacity or REZ development needs**

F.4 Market benefit opportunities

ElectraNet monitors congestion on the South Australian transmission system (Section 4.1). We also consider information regarding future probable generator and load connections, along with AEMO's ISP, to predict new constraints that may develop in future years.

Many of the projects discussed in preceding sections also provide net market benefits, for example by improving customer reliability or reducing congestion on the transmission system. In addition, we have included in our 2023–24 to 2027–28 Network Capability Incentive Parameter Action Plan (NCIPAP – Table 18 and Figure 32). We are currently considering a new project for inclusion in our 2023–24 to 2027–28 NCIPAP program, to establish a remedial action scheme that will reduce anticipated generation constraints under system normal conditions for generators and batteries in the Mid North.

Table 18: Projects to address market benefit opportunities

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15179 Robertstown to Tungkillo Line Uprating **Estimated cost: $1–2 million** **Status: Planned** **This project is included in our 2023–24 to 2027–28 NCIPAP** Alleviate forecast constraints between Robertstown and Para, and Robertstown to Tungkillo by uprating the lines from 100°C to 120°C design clearances. This will increase the average line ratings by 90 MVA. ElectraNet envisages that this project will impact intra-regional transfer, but not inter-regional transfer.	Mid North	Market benefits (NCIPAP) Augmentation	April 2025
EC.15171 NCIPAP Davenport to Cultana line uprating **Estimated cost: $1–2 million** **Status: Planned** **This project is included in our 2023–24 to 2027–28 NCIPAP** Alleviate forecast congestion between Cultana and Davenport by removing plant and equipment limitations at either end of the Cultana to Davenport 275 kV lines to release the full design capacity of the lines. ElectraNet envisages that this project will impact intra-regional transfer, but not inter-regional transfer.	Eyre Peninsula	Market benefits (NCIPAP) Augmentation	Mid 2025
EG.01011 / EC.15571 Transmission Line Rating Improvement **Estimated cost: $5–7 million** **Status: Planned** **This project is included in our 2023–24 to 2027–28 NCIPAP** Alleviate constraints across the South Australian electricity transmission system by delivering a package of works to replace the existing 3-band rating by 10-band rating. ElectraNet envisages that this project will impact intra-regional transfer and inter-regional transfer.	All	Market benefits (NCIPAP) Augmentation	Mid 2025
EC.15175 Increase Murraylink Transfer Capacity **Estimated cost: $4–6 million** **Status: Planned** **This project is included in our 2023–24 to 2027–28 NCIPAP** Alleviate forecast congestion on the Murraylink interconnector at times of high export by installing a 132 kV capacitor bank Monash and upgrade the existing runback control scheme to include bi-directionality and allow it to run forward if required ElectraNet envisages that this project will impact inter-regional transfer.	Riverland	Market benefits (NCIPAP) Augmentation	Mid 2026

Figure 32: **Projects to address market benefit opportunities**

F.5 Network asset retirements and retirements

Electranet carries out projects that address needs that arise from planned retirements or de-ratings of assets, for example due to condition (Table 19).

Table 19: Projects to address planned asset retirements

Project Description	Region	Constraint driver and investment type	Asset in service
EC.14081 Line Insulator Systems Refurbishment 2019–2023 **Estimated Cost: $60–65 million** **Status: Committed** Program to refurbish transmission line support systems and extend the life of 18 transmission lines by renewing line asset components. This program of work was committed prior to 30 January 2018.	Various	Asset condition and performance Asset renewal	April 2025
EC.14077 Mannum Transformer #1 and Secondary System Replacement **Estimated cost: $5–7 million** **Status: Planned** Replace transformer #1 and secondary systems at Mannum substation that has been assessed to be at the end of their technical lives with a corresponding high risk of failure, with a new 25 MVA 132/33 kV transformers (nearest ElectraNet standard size). Note that Mannum transformer #2 was replaced in 2021 when the transformer failed.	Eastern Hills	Asset condition and performance Asset renewal	May 2025
EC.14032 Instrument Transformer Unit Asset Replacement 2019–2023 **Estimated cost: $15–17 million** **Status: Committed** Replace 55 voltage transformers and 121 current transformers across the South Australian electricity transmission system that have reached the end of their technical or economic lives and have an increased likelihood of catastrophic explosion.	Various	Asset condition and performance Asset renewal	June 2025
EC.14031 Protection Systems Unit Asset Replacement 2019–2023 **Estimated cost: $45–50 million** **Status: Committed** Replace protection scheme relays across the South Australian electricity transmission system that have reached the end of their technical or economic lives. We concluded the RIT T for this program of work on 6 December 2019.	Various	Asset condition and performance Asset renewal	June 2025
EC.14034 Isolator Unit Asset Replacement 2019–2023 **Estimated cost: $12–15 million** **Status: Committed** Replace individual substation isolators that have been assessed to be at the end of their technical or economic lives or that no longer have manufacturer support, at 18 sites across South Australia where the asset won't be replaced as part of an augmentation or substation rebuild during the 2018–19 to 2022–23 regulatory period. We concluded the RIT T for this program of work on 18 November 2019.	Various	Asset condition and performance Asset renewal	June 2025

Table 19: Projects to address planned asset retirements (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.14176 Surge Arrestor Unit Asset Replacement 2018–2023 **Estimated cost: $8–10 million** **Status: Committed** Replace porcelain surge arrestors and arcing horns at 18 substations that are at the end of their technical and economic lives due to their increasing risk of failure and potential to cause injury to personnel and collateral damage to other plant within the substation as a result of an explosive failure.	Various	Asset condition and performance Asset renewal	June 2025
EC.15321 TIPS IMB300 CT Replacement **Estimated Cost: $14–16 million** **Status: Planned** Urgent removal and replacement of 38 sets of current transformers at TIPS A and B switchyards that have been identified as high risk of failure. We are currently applying the RIT-T for this project.	Metro	Asset condition and performance Asset renewal	November 2025
EC.14182 South East SVC Computer Control System Replacement **Estimated cost: $7–10 million** **Status: Planned** Replace the computer control system for the SVC 1 and SVC 2 at South East substation that has been assessed as being end of its life cycle, requiring replacement during the 2024–2028 regulatory control period. We published a PACR on 16 November 2023, concluding the RIT-T for this project.	South East	Asset condition and performance Asset renewal	December 2025
EC.15449 IMB300 CT Hazard Mitigation **Estimated cost: $13–15 million** **Status: Planned** Replace 56 sets of current transformers at six substations that have been identified as high risk of failure, based on failure of similar of current transformers that were of same make, model and age. We have completed the RIT-T for this project.[71]	Various	Asset condition and performance Asset renewal	December 2025
EC.14046 AC Board Replacement 2019 to 2023 **Estimated cost: $30–35 million** **Status: Committed** Program to replace and improve AC auxiliary supply equipment, switchboards and cabling at 17 substations across the South Australian electricity transmission system that have been assessed to be at the end of their technical and economic lives. We completed a RIT-T for this program of work by publishing a PACR on 14 January 2020.	Various	Asset condition and performance Asset renewal	January 2026

[71] ElectraNet | Managing the Risk of 275 kV Current Transformer Failures 2024–2028

Table 19: Projects to address planned asset retirements (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15568 Northfield Transformer #8, #9 and #10 Interface Connection Requirement **Estimated Cost: $45–55 million** **Status: Planned** SA Power Networks are planning to replace their aging/failing 66kV GIS switchgear at Northfield substation with a new AIS 66kV switchyard. To support this replacement, we will need to upgrade the 66 kV GIS to AIS connection points to transformers #8 and #9 and install new transformer #10 at Northfield substation. SA Power Networks published the final RIT-D document for Ensuring Reliable Supply for Adelaide's Eastern Suburbs in December 2022.	Metropolitan	Asset condition and performance Asset renewal	Connection of transformer #9 by November 2026 Connection of transformer #10 by November 2027 Connection of transformer #8 by August 2028
EC.15427 High Crossing Tower Climbing System Replacement **Estimated cost: $6–8 million** **Status: Proposed** Replace all tower climbing systems that includes fixed climbing ladders, climbing aids and platform refurbishment on 13 high crossing tower structures that have been identified as not effective in meeting current WHS Act and Regulations requirements.	Various	Asset condition and performance Asset renewal	December 2027
EC.15239 F1803 Hummocks – Ardrossan West 132kV Line Renewal **Estimated cost: $30–35 million** **Status: Planned** The line conductor, earthwire and insulator strings for the entire Hummocks to Ardrossan West 132 kV line has been assessed to be at end-of-life and requires replacement, during the 2024–2028 regulatory control period. We are currently applying the RIT-T for this project.[72] The option with the highest Net Present Value is to replace the line in its entirety.	Mid North	Asset condition and performance Asset renewal	June 2028
EC.15060 Circuit Breakers Unit Asset Replacement 2024–2028 **Estimated cost: $14–16 million** **Status: Planned** Replace and improve 26 circuit breakers at 11 substations across the South Australian electricity transmission system that have been assessed to be at the end of their technical and economic lives during the 2024-2028 regulatory control period. We have completed the RIT-T for this project.[73]	Various	Asset condition and performance Asset renewal	June 2028

[72] ElectraNet | Managing the Risk of Hummocks to Ardrossan West 132 kV Line Failure Line Failure
[73] ElectraNet | Managing the Risk of Circuit Breaker Failures 2024–2028

Table 19: Projects to address planned asset retirements (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15120 Instrument Transformer Unit Asset Replacement 2024–2028 **Estimated cost: $20–22 million** **Status: Planned** Replace 26 voltage transformers and 72 current transformers at 12 substations across the South Australian electricity transmission system that have been assessed to be end-of-life during the 2024–2028 regulatory control period to address the increased risk of unsafe operation and poor. We have completed the RIT-T for this project.[74]	Various	Asset condition and performance Asset renewal	June 2028
EC.15189 Protection Relay Unit Asset Replacement 2024–2028 **Estimated cost: $16–18 million** **Status: Planned** Replace protection relays and associated components at six substations across the South Australian electricity transmission system that have been assessed to be end-of-life during the 2024–2028 regulatory control period. We have completed the RIT-T for this project.[75]	Various	Asset condition and performance Asset renewal	June 2028
EC.15237 Surge Arrestor Unit Asset Replacement 2024–2028 **Estimated cost: $5–7 million** **Status: Planned** Replace 63 porcelain surge arrestors located in 9 substations that are at the end of their technical and economic lives due to their increasing risk of failure and potential to cause injury to personnel and collateral damage to other plant within the substation as a result of an explosive failure.	Various	Asset condition and performance Asset renewal	June 2028
EC.15397 Isolator Unit Asset Replacement 2024–2028 **Estimated cost: $23–25 million** **Status: Planned** Replace or refurbish approximately 50 individual substation isolators at nine substations across the South Australian electricity transmission system that have been assessed to be at end-of-life during the 2024–2028 regulatory control period. We have completed the RIT-T for this project.[76]	Various	Asset condition and performance Asset renewal	June 2028
EC.15279 Emergency Unit Asset Replacement 2024–2028 **Estimated cost: $8–12 million** **Status: Committed** Emergency replacement of individual assets is undertaken for assets that fail unexpectedly, to meet reliability standards.	Various	Asset condition and performance Asset renewal	June 2028

[74] ElectraNet | Managing the Risk of Instrument Transformer Failure 2024–2028
[75] ElectraNet | Managing the of Protection Relay Failure 2024–2028
[76] ElectraNet | Managing the Risk of Isolator Failure 2024–2028

Table 19: Projects to address planned asset retirements (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15233 Transmission Line Insulation System Replacement 2024–2028 **Estimated cost: $34–38 million** **Status: Planned** Implement a program to replace about 2775 insulator strings on 779 structures with equivalent insulation and associated hardware on 14 transmission lines across the network that have been assessed to be at end-of-life during the 2024–2028 regulatory control period, to renew line asset components and extend line life. We have completed the RIT-T for this project.[77]	Various	Asset condition and performance Asset renewal	June 2028
EC.15242 Transformer Bushing Unit Asset Replacement 2024–2028 **Estimated cost: $12–14 million** **Status: Planned** Replace individual transformer bushings on 15 high voltage transformers at 13 substations across the South Australian electricity transmission system that have been assessed to be at end-of-life during the 2024–2028 regulatory control period. We have completed the RIT-T for this project.[78]	Various	Asset condition and performance Asset renewal	June 2028
EC.15394 Invensys C50 RTU Upgrades **Estimated cost: $6-8 million** **Status: Proposed** Replace the main hardware components for all 56 Foxboro Gateway RTUs units and 30 Bay RTU modules at regulated 18 sites with the latest equivalent during the 2024-2028 period.	Various	Asset condition and performance Asset renewal	June 2029
EC.15432 F1802 Bungama – Port Pirie 132kV Line Refurbishment **Estimated cost: $5–10 million** **Status: Proposed** Decommission the existing Port Pirie to Bungama 132 kV line, which has been assessed to be at end-of-life during the 2029–2033 regulatory control period, and replace with a new 132 kV line alongside the existing easement. We plan to initiate a RIT-T prior to commitment.	Mid North	Asset condition and performance Asset renewal	2029–2033
EC.14090 Mount Gambier Transformer 1 Replacement **Estimated cost: $4–6m** **Status: Proposed** Replace the existing 50 MVA 132/33 kV transformer, assessed to be at the end of its technical life with a corresponding high risk of failure, with a new 25 MVA transformer. A size of 25 MVA has been selected to match the other 132/33 kV transformer at Mount Gambier, and provides capacity to meet the forecast demand at Mount Gambier connection point. We plan to initiate a RIT-T prior to commitment.	South East	Asset condition and performance Asset renewal	2029–2033

[77] ElectraNet | Managing the Risk of Line Insulation System Failure 2024–2028

[78] ElectraNet | Managing the Risk of Transformer Bushing Failures 2024–2028

Table 19: Projects to address planned asset retirements (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15069 Circuit Breakers Unit Asset Replacement 2029–2033 **Estimated cost: $6–10 million** **Status: Proposed** Replace and improve circuit breakers across the South Australian electricity transmission system that will be assessed to be at the end of their technical and economic lives during the 2029–2033 regulatory control period. We plan to initiate a RIT-T prior to commitment.	Various	Asset condition and performance Asset renewal	2029–2033
EC.15042 AC Board Unit Asset Replacement 2029–2033 **Estimated cost: $18–24 million** **Status: Proposed** Replace and improve AC auxiliary supply equipment, switch boards and cabling at 23 substations across the South Australian electricity transmission system that will be assessed to be at the end of their technical and economic lives during the 2029–2033 regulatory control period. We plan to initiate a RIT-T prior to commitment.	Various	Asset condition and performance Asset renewal	2029–2033
EC.15123 Instrument Transformer Unit Asset Replacement 2029–2033 **Estimated cost: $50–60 million** **Status: Proposed** Replace voltage transformers and current transformers across the South Australian electricity transmission system that have reached the end of their technical or economic lives and have an increased likelihood of catastrophic explosion. This project will include the replacement of assets which will be determined based on asset needs. We plan to initiate a RIT-T prior to commitment.	Various	Asset condition and performance Asset renewal	2029–2033
EC.15244 Transformer Bushing Unit Asset Replacement 2029–2033 **Estimated cost: $5–10 million** **Status: Proposed** Replace individual transformer bushings that will be assessed to be at the end of their technical or economic lives during the 2029–2033 regulatory control period. This project will include the replacement of assets which will be determined based on asset needs. We plan to initiate a RIT-T prior to commitment.	Various	Asset condition and performance Asset renewal	2029–2033
EC.15211 Protection Relays Unit Asset Replacement 2029–2033 **Estimated cost: $8–15 million** **Status: Proposed** Replace protection relays and control schemes across the South Australian electricity transmission system that will be assessed to be at the end of their technical and economic lives during the 2029–2033 regulatory control period. We plan to initiate a RIT-T prior to commitment.	Various	Asset condition and performance Asset renewal	2029–2033

Table 19: Projects to address planned asset retirements (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15214 Protection Signal Equipment Replacement Stage 1 **Estimated cost: $6–8 million** **Status: Proposed** Replace protection signalling equipment that will be assessed to be at the end of their technical and economic lives during the 2029–2033 regulatory control period. We plan to initiate a RIT-T prior to commitment.	Various	Asset condition and performance Asset renewal	2029–2033
EC.15251 Transmission Line Insulation Unit Asset Replacement 2029–2033 **Estimated cost: $12–20 million** **Status: Proposed** Refurbish transmission line insulator systems across the network that will be assessed to be at end-of-life during the 2029–2033 regulatory control period, to renew line asset components and extend line life. We plan to initiate a RIT-T prior to commitment.	Various	Asset condition and performance Asset renewal	2029–2033
EC.15253 Transmission Line Conductor Unit Asset Replacement 2029–2033 **Estimated cost: $12–20 million** **Status: Proposed** Replace transmission line conductor and earthwire components that will be assessed to be at end-of-life during the 2029–2033 regulatory control period, to renew line asset components and extend line life. We plan to initiate a RIT-T prior to commitment.	Various	Asset condition and performance Asset renewal	2029–2033
EC.15295 Emergency Unit Asset Replacement 2029–2033 **Estimated cost: $8–12 million** **Status: Proposed** Emergency replacement of individual assets is undertaken for assets that fail unexpectedly, to meet reliability standards. The average annual value of emergency replacement is about $2 million.	Various	Asset condition and performance Asset renewal	2029–2033
EC.15564 Oil Containment System Improvement 2029–2033 **Estimated cost: $30–40 million** **Status: Proposed** Addresses environmental hazards with existing oil containment systems at various ElectraNet substations in 2029–2033 period. By replacing lining of low integrity transformer bunds, upgrading/replacing underground tank oil water separator systems that are not performing to EPA standards and the installation of monitoring systems for water tables for pollutants. Plus the installation of additional oil containment systems for sites with large containment requirements. We plan to initiate a RIT-T prior to commitment.	Various	Asset condition and performance Asset renewal	2029–2033

F.6 Security and compliance

There are a range of committed and planned projects that relate to the maintenance of our security and compliance for which planned expenditure exceeds $8 million (Table 20).

Table 20: Projects to maintain security and compliance

Project Description	Region	Constraint driver and investment type	Asset in service
EC.14131 Motorised Isolator LOPA Improvement **Estimated cost: $18–22 million** **Status: Committed** Modify 876 isolators and replace 33 isolators to provide satisfactory mechanical and electrical isolation lock-off points on all motorised air insulated isolators identified as safety hazards by a Layer of Protection Analysis (LOPA).	Various	Safety Asset renewal	June 2025
EC.15401 Happy Valley Site Drainage Replacement **Estimated cost: $6–10 million** **Status: Proposed** Replace the existing drainage system at Happy Valley substation with a new drainage system to improve site drainage, stability of footings, and trafficability on site roadways and reduce erosion issues.	Metropolitan	Safety Asset Renewal	December 2025
EC.15399 Substation Technology System Cybersecurity Uplift 2024–2028 **Estimated cost: $14–18 million** **Status: Planned** Replace and upgrade substation technology assets identified as being susceptible to cyber-attack breaches by replacing relevant equipment as well and uplifting cyber security of network and intelligent devices. This work will be carried out progressively during the 2024–2028 regulatory period across 57 high risk substations.	Various	Security Asset Renewal	June 2026
EC.11828 Substation Perimeter Intrusion and Motion Detection Security System **Estimated cost: $12–14 million** **Status: Planned** Upgrade substation security systems across 35 ElectraNet substations by installing external motion detection and CCTV systems with built-in analytics reporting back to a networked video management system. These external motion detection and CCTV systems will supplement the "deter and delay" primary control measures such as fences and signage with a proactive and responsive secondary system, responding to potential unauthorised presence inside the security fence.	Various	Safety Operational	March 2030
EC.15220 Substation Security Fencing Replacement 2024–2028 **Estimated cost: $8–10 million** **Status: Planned** Replace high voltage security fencing and gates located at eleven substations that have been assessed to be at the end of their technical and/or economic lives and require replacement to prevent unauthorised access.	Various	Safety Asset renewal	April 2030

Table 20: Projects to maintain security and compliance (cont.)

Project Description	Region	Constraint driver and investment type	Asset in service
EC.15235 Transmission Line Anti-Climb Installation 2024–2028 **Estimated cost: $20–25 million** **Status: Planned** Install climbing deterrent devices and warning signage on 2100 transmission towers located on 59 high voltage transmission lines that have been assessed as highly vulnerable to unauthorised access.	Various	Safety Asset renewal	June 2030
EC.15496 Substation LAN Replacement and Cybersecurity Uplift 2028–2033 **Estimated cost: $8–12 million** **Status: Proposed** Replace and upgrade substation technology assets identified as being susceptible to cyber-attack breaches by replacing relevant equipment as well and uplifting cyber security of network and intelligent devices at 19 substations. This cyber-security uplift continues the work undertaken in 2024–2028 period.	Various	Security Asset Renewal	2029–2033
EC.15231 – Transmission Line Anti-Climb 2029–2033 **Estimated cost: $30–40 million** **Status: Proposed** Replace or install climbing deterrent devices and warning signage on all identified line tower assets to meet and maintain requirements to prevent unauthorised access to electricity infrastructure.	Various	Safety Asset renewal	2029–2033
EC.15275 - Earth Leakage Protection Replacement 2029–2033 **Estimated cost: $14–18 million** **Status: Proposed** Upgrade the earth frame leakage protection to ensure all assets are protected with a high-speed duplicated protection system. The replacement and upgrade of the earth frame leakage system may require additional primary plant and substation infrastructure works.	Various	Safety Asset renewal	2029–2033

F.7 Contingent projects

Table 21: Contingent projects for the 2024–2028 revenue control period

Project	Trigger[79]	Current status	Reference
Eyre Peninsula Upgrade Upgrade of the 132 kV Eyre Peninsula Link between Cultana and Yadnarie to 275 kV and/or augmentation of power transfer capacity between Davenport and Cultana and/or Cultana and Whyalla and/or Cultana and Stony Point	Commitment for additional load from one or more customers to connect to the transmission network with aggregate load sufficient to cause the: a. Cultana 275/132 kV transformers to exceed their thermal limit of 200 MVA; or b. Whyalla Central 132/33 kV transformers to exceed their thermal limit of 120 MVA; or c. Whyalla Central to Cultana 132 kV lines to exceed their thermal limit of 117 MVA; or d. Cultana to Stony Point 132 kV line to exceed its thermal limit of 144 MVA; or e. Davenport to Cultana 275 kV lines to exceed their thermal limit of 597 MVA causing a need for the upgrade of the 132 kV Eyre Peninsula Link between Cultana and Yadnarie to 275 kV and/or augmentation of power transfer capacity between Davenport and Cultana and/or Cultana and Stony Point. Successful completion of a RIT-T, including an assessment of credible options, showing the upgrade of the 132 kV Eyre Peninsula Link between Cultana and Yadnarie to 275 kV and/or augmentation of power transfer capacity between Davenport and Cultana and/or between Cultana and Whyalla and/or between Cultana and Stony Point is the preferred option: a. Demonstrating positive net market benefits; and/or b. Addressing a reliability corrective action.	We published a PADR for this project in March 2025 We are planning to publish a PACR by March 2026	Appendix F.3
Network Power Quality Remediation Installation of harmonic filters, reactors or STATCOMs as required	ElectraNet obtains measurements that demonstrate the voltage harmonics at any one or more of the sites listed below exceed those specified by their planning levels under Rules cl. S5.1a.6 in accordance with electromagnetic compatibility standard AS/NZS IEC 61000.3.6:2012: 1. South East 2. Tailem Bend 3. North West Bend 4. Monash 5. Mount Gunson 6. Pimba. ElectraNet demonstrates that the voltage harmonic distortion causing the planning levels under Rules cl. S5.1a.6 to be breached can be attributed to the extent practicable to the transmission network rather than to one or more Network Users or to a Distribution Network Service Provider. Successful completion of a RIT-T that demonstrates that the proposed network investment is the most efficient option to ensure that voltage waveform distortion planning levels at the sites at which voltage harmonics exceeded specifications as referred to above are not exceeded.	Not yet triggered	Appendix F.2

79 In addition, the following trigger condition applies to each of the projects listed: *ElectraNet Board commitment to proceed with the project subject to the AER amending the revenue determination pursuant to the Rules.*

Appendix G
Designated Network Assets

Designated network assets are defined in the Rules. They are apparatus, equipment, plant, and buildings that are used from a "boundary point" to convey electricity for an identified user group and are owned by a member or members of that identified user group. They do not provide prescribed transmission services, form part of a network loop, form part of a transmission system for which a Market Network Service Provider is registered under Chapter 2 of the Rules, or form part of a declared transmission system of an adoptive jurisdiction.

There is one designated network asset in South Australia, as shown in the following table.

Designated network asset	Connection point to shared transmission network	Owner
Clements Gap DNA	Redhill 132 kV	ElectraNet

Appendix H
Emergency control schemes

H.1 Proposed new control schemes and modifications

South Australian Interconnector Trip Remedial Action Scheme (SAIT RAS)

ElectraNet is developing the SAIT RAS to detect the non-credible loss of either Heywood Interconnector or Project EnergyConnect and will take remedial action to prevent the tripping of the remaining interconnector due to power system stability.

Further details were provided in Section 6.3.3.

Mid North (West) Remedial Action Scheme

Mid North (West) Remedial Action Scheme will be designed to:

- Prevent an overload of the 66kV at Munno Para following a trip of Para – Munno Para line (F1956).
- Prevent the islanded operation of Snowtown 2 Windfarm and Blyth West BESS.
- Prevent some of the pre-contingency constraints or disconnections of Snowtown 2 Windfarm and Blyth West BESS to manage voltage instability and thermal overloading under prior outage conditions.
- Future-proof the design to allow for additional generation connections in the 275kV Mid North Region and make staged improvements
- Improve operability of the scheme (i.e. does not require operator intervention)
- Remove dependability of the scheme on the relevant line protection relays.

The scheme will replace the Blyth West Control Scheme (Table 22).

Murraylink Runback and Sever Scheme

The current Murraylink Runback Scheme operates only in the Murraylink transfers from South Australia to Victoria direction. ElectraNet is considering modifying the Murraylink Runback Scheme for bi-directional operation and to reduce applicable thermal constraints. The work is planned to be carried out under EC.15175 - NCIPAP Increase Murraylink Transfer Capability 1.

We are considering upgrading the Murraylink Runback Scheme to a fully redundant scheme, given its increased criticality if new connection projects proceed in the 132 kV corridor between Robertstown and Monash.

Intra-Area Separation Prevention Scheme

The non-credible loss of Tungkillo – Robertstown 275 kV or Robertstown – Davenport 275 kV double circuits under high wind generation conditions could overload the 275 kV and 132 kV network and cause transient stability issues between Para and Davenport. Transient instability issues could lead to the separation of the upper north region and metro regions within the South Australian network, leading to major supply disruptions. At present, this risk is managed via reclassification of non-credible loss of Tungkillo – Robertstown or Robertstown – Davenport double circuits as credible under destructive wind conditions and constrain the mid-north generation.

The analysis also indicated similar issues when South Australia imports via Project EnergyConnect.

A new control scheme is being considered to mitigate the risk.

ElectraNet is also considering new transmission lines between Bundey and Cultana and Bundey and Adelaide as part of the NTx project. Construction of these additional circuits could also mitigate the identified risk.

Dorrien Anti-Islanding Scheme

A new anti-islanding scheme is proposed to prevent an unintended islanding between the Dorrien distribution connection point and Templers BESS for credible contingency during a prior outage condition.

Extended Eyre Peninsula Anti-Islanding Scheme

Extending the current Eyre Peninsula Anti-Islanding Scheme is being considered to cover the loss of both Davenport – Cultana lines or Cultana 275/132 kV transformers (due to loss of a transmission element during a prior outage of the parallel transmission element).

Replacement of Waterloo Runback Scheme

The current Waterloo Runback Scheme pre-contingently manage the generation of Waterloo wind farm to avoid the thermal loading of the transmission network (Waterloo – Templers 132 kV line, Waterloo East – Robertstown 132 kV line, Robertstown 275/132 kV transformers). The scheme provides the allowable generation limit to the Waterloo wind farm, so that the generation output can be maintained within the limit. In the event of asset overloading due to the wind farm not responding to limits sent by the scheme, the wind farm will be tripped.

There is an increasing risk of the scheme tripping for reasons other than Waterloo Wind Farm not responding to its dispatch limits. They may include:

- Fast frequency response provided by BESS
- Non-credible contingencies in parallel transmission lines
- Other generators not following NEMDE targets sent to those generators.

The scheme will be when asset replacement of the Waterloo Scheme is required, to minimise unintended operation.

H.2 Potential new control schemes or modifications

Future Upgrade to South Australian Interconnector Trip Remedial Action Scheme

Due to the significant generation and load connections with South Australia and planned major network augmentations within South Australia and interstate (such as Humelink and VNI West), it is expected that SAIT RAS will need a significant revision to the design around 2030.

Other Remedial Action Schemes

Issues similar to those that will be managed by the Mid North (West) Remedial Action Scheme may arise in other parts of the network, depending on where new generators or BESSs connect. Such new RASs may be required to manage thermal loadings on transmission lines, transient or voltage stability, and aggregate responses of generators and BESSs to frequency disturbances elsewhere in the NEM.

Based on current connection interest, potential areas where ElectraNet considers such a new RAS may be required include the following:

- The Davenport – Brinkworth – Templers West – Para 275 kV lines
- The 275 kV lines between Davenport and Robertstown
- The Robertstown – Tungkillo 275 kV lines
- The Tungkillo – Tailem Bend 275 kV lines
- The Tailem Bend – South East 275 kV lines.

H.3 List of existing control schemes

There are a wide range of control schemes that are used to enhance the capability, security and resilience of the South Australian transmission system (Table 22).

Table 22: Existing control schemes

Scheme Name	Scheme Type	Functionality
Wide Area Protection Scheme	Transient Stability	Rapidly identify conditions that could otherwise result in a loss of synchronism between South Australia and Victoria and correct those conditions by rapidly injecting power or shedding load in South Australia to avoid this loss of synchronism
PEC Stage 1 Inter-trip Scheme	Transient Stability	Trip South Australia – New South Wales Interconnector in the event of trip of Heywood Interconnector
South East Loss of Synchronism Protection	Transient Stability	Trip the Heywood interconnector for loss of synchronism between South Australia and Victoria
Tailem Bend 132 kV Tripping Scheme	Transient Stability and Thermal Loading	Trip the underlying 132 kV network in the event of a 275 kV double circuit outage between South East and Tailem Bend or Tailem Bend and Tungkillo.
Murraylink Automated Control Scheme	Anti – Islanding/ Thermal Loading	Reduce Murraylink flow to prevent overload of transmission elements (Robertstown – Northwest Bend lines 1 and 2, Northwest Bend -Monash 1 &2, Robertstown 275/132 kV transformers) If Murraylink is connected to an islanded section of SA, trip the circuit breakers CB 6152, 6153, 6154 at Monash, isolating the Murraylink from South Australia
Hallett Power Station Islanding Scheme	Anti-islanding	Armed when Canowie is radially fed to trip Hallett Power Station and Hallett 2 WF on next contingency to prevent islanded generation
Wattle point Tripping Scheme	Voltage Stability	Prevent voltage instability caused by the trip of Hummocks-Waterloo or Hummocks-Snowtown-Bungama lines when Wattle point wind generation is above 60 MW, by tripping the Wattle Point wind farm
Waterloo Runback Scheme	Thermal Loading	Runback or trip to Waterloo wind farm on overloading of following transmission lines or transformers. Waterloo East – MWP4 132 kV line MWP4 – Robertstown 132 kV line Waterloo – Templers 132 kV line Robertstown 275/132kV transformer 1 & 2
AMCOR runback Scheme	Thermal Loading	Runback or trip AMCOR load following the loss of Para – Roseworthy line
South East Control Scheme	Thermal Loading	Runback or trip to Lake Bonney wind farm generation on overload of Southeast transformers or the Southeast – Snuggery / Mayurra 132kV line
Black Range Fixed Series Capacitors Bypass Control Scheme	Asset Protection	Detect Sub-synchronous Oscillation / Sub-synchronous Control Interaction and bypass the Black Range Fixed Series Capacitor
Bungala solar farm Runback and Sever Scheme	Thermal Loading/ Anti-Islanding	Runback or trip Bungala Solar Farm on overload of Davenport 275/132 kV transformers Prevent islanding of Bungala Solar Farm with 132 kV load for trip of both 275/132 kV transformers at Davenport, by tripping the solar farms.
Hornsdale Wind Farm 3 Inter-trip Scheme	System Strength	For loss of Mount Lock - Canowie, Mount Lock - Davenport, or Canowie – Robertstown lines, trip turbines in Hornsdale Wind Farm Stage 3 to manage system strength

Table 22: Existing control schemes (cont.)

Scheme Name	Scheme Type	Functionality
Blyth West Control Scheme	Thermal loading, System Strength	Trip Blyth West -Snowtown 2 line following a loss of one of the line sections of the Para – Munno Para – Blyth West – Bungama – Davenport 275kV line
Upper North Voltage Management Emergency Control Scheme	Voltage Stability	Prevent voltage collapse and/or unacceptable voltages at Davenport and Prominent Hill following multiple contingency events
Dalrymple BESS Islanding Detection Scheme	Islanding	This system detects if Dalrymple Substation has been islanded due to an upstream event. With the IDS in AUTO and if it detects an islanding condition, the BESS & IDS will island Dalrymple Substation, Dalrymple Nth and SAPN load onto a micro-grid
Under Voltage Load Shedding schemes	Voltage Stability	Prevent voltage collapse and or line overloading at high system loads during a contingency. UVLS is installed in following sites: • Mannum Adelaide Pump Station 1, 2 and 3 • Murray Bridge Pump Station 1, 2 and 3 • Keith
Eyre Peninsula Anti Islanding Scheme	Anti-islanding	Inter-trip Eyre Peninsula generators when an island is formed in Eyre Peninsula (due to the loss of double circuits/ loss of single circuit during a planned outage of the other circuit between Cultana and Port Lincoln)
TIPS66 - TINS Islanding Sever Trip Scheme	Anti-islanding	Intertrip Quarantine Power Station Generator Circuit Breakers if TIPS - TINS 66 kV line breakers are opened at TIPS and Quarantine Power Station generators are islanded
Lake Bonney Inter-trip Scheme	System Strength	Intertrip Lake Bonney Wind Farm Stage 1, 2 and 3 for loss of double circuits between Moorabool – South East

Appendix I
System strength locational factors

System strength locational factors quantify how a connection point's location affects its impact on the overall stability and strength of the electrical grid.

It is calculated by AEMO based on the electrical distance between the connection point and the nearest system strength node; and is used to determine the relative impact on system strength at different locations within the transmission network.

The greater the electrical distance (or impedance) of a connecting generator from a node, the greater its impacts on system strength.

For each proposed connection or alteration to a generating system, integrated resource system or other connected plant on the South Australian transmission system, ElectraNet determines a SSLF. We do this in our role as the System Strength Service Provider for South Australia, in accordance with AEMO's system strength impact assessment guidelines.

Each proponent has the option to either provide their own required level of system strength or elect to pay a system strength charge for ElectraNet to continue to provide a satisfactory level of system strength services in South Australia.

We publish system strength locational factors for committed or connected facilities where the proponent has elected to pay the system strength charge where applicable (Table 23).

Table 23: System strength locational factors

System Strength Connection Point	Status	System Strength Node	System Strength Locational Factor
Summerfield BESS 1	Has a TCA	Para	1.0149
Summerfield BESS 2	Has a TCA	Para	1.0149
Tailem Bend 3 BESS	Has a TCA	Para	1.0223

Abbreviations

Abbreviation	Definition
°C	Degrees Celsius
AC	Alternating Current
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AI	Artificial Intelligence
AIS	Gas Insulated Switchgear
AMD	Agreed maximum demand
BESS	Battery energy storage system
CBD	Central business district
CCGT	Closed-Cycle Gas Turbine
CER	Consumer Energy Resources
CIS	Capacity Investment Scheme
cm	A unit of distance, equivalent to one hundredth of a metre
CO2-e	Carbon dioxide equivalent
DNSP	Distribution Network Service Provider
DRI	Direct Reduced Iron
EDC	Event-driven component, one of the three components of the SAIT RAS
ESCOSA	Essential Services Commission of South Australia
ESG	Environmental, social and governance
ESOO	Electricity Statement of Opportunities, published by AEMO
ETC	Electricity Transmission Code, published by ESCOSA
EV	Electric Vehicle
FAPR	Fast active power response
FCAS	Frequency control ancillary services
FERM	Firm Energy Reliability Mechanism, proposed by the Government of South Australia
GIS	Gas Insulated Switchgear
GPSRR	General Power System Risk Review, published by AEMO
GW	Giga-Watt, a unit of active power equivalent to 1,000 MW
GWh	Giga-Watt-hours, a unit of energy equivalent to 1,000,000 Watt-hours
HRE Act	South Australian Hydrogen and Renewable Energy Act
Hz	Herz, a unit of frequency
IASR	Inputs, Assumptions and Scenarios Report, published by AEMO
IBR	Inverter based resources
ISP	Integrated System Plan, published by AEMO
km	Kilometres
kV	kilo-Volts, a unit of electrical potential equivalent to 1,000 Volts
LOPA	Layer of protection analysis
ML	Mega-litres, a unit of volume equivalent to 1,000,000 litres
Mt	Mega-tonnes, a unit of mass equivalent to 1,000 tonnes

Abbreviations (cont.)

Abbreviation	Definition
MVA	Mega-Volt-Ampere, a unit of apparent power
Mvar	Mega-var, a unit of reactive power
MW	Mega-Watt, a unit of active power equivalent to 1,000 Watts
NCIPAP	Network Capability Incentive Parameter Action Plan
NEM	National Electricity Market
NOTE	Network Operational Technology Enhancements program
NSCAS	Network Support and Control Ancillary Services report, published by AEMO
NSP	Network Service Provider
NTx	Northern Transmission Project
OCGT	Open-Cycle Gas Turbine
OFGS	Over frequency generator shedding
OTR	Office of the Technical Regulator
PACR	Project Assessment Conclusions Report, the final report in the RIT-T process
PADR	Project Assessment Draft Report, the second report (if required) in the RIT-T process
PMU	Phasor measurement unit
PSCR	Project Specification Consultation Report, the first report in the RIT-T process
PV	Photovoltaic
RAS	Remedial action scheme
RCC	Resource controller component, one of the three components of the SAIT RAS
RDC	Response-driven component, one of the three components of the SAIT RAS
RETA	Renewable Energy Transformation Agreement
REZ	Renewable Energy Zone
RIT-T	Regulatory Investment Test for Transmission
RoCoF	Rate of change of frequency
Rules	National Electricity Rules
SAIT RAS	South Australian Interconnector Trip Remedial Action Scheme
SRMTMP	Safety, Reliability, Maintenance and Technical Management Plan
STATCOM	Static Compensator
SVC	Static Var Compensator
TAPR	Transmission Annual Planning Report
TCA	Transmission Connection Agreement
TNSP	Transmission Network Service Provider
TUoS	Transmission Use of Service
TWh	Tera-Watt-hours, a unit of energy equivalent to 1,000 GWh
UFLS	Under frequency load shedding
VCR	Value of customer reliability
VNR	Value of network resilience

Glossary

Term	Description
10% PoE	10% probability of exceedance. This is used to indicate a forecast value that is expected to be exceeded once in every 10 years, on average.
90% PoE	90% probability of exceedance. This is used to indicate a forecast value that is ex-pected to be exceeded nine times in every 10 years, on average.
Constraint	A limitation on the capability of a network, load or a generating unit that prevents it from either transferring, consuming or generating the level of electrical power which would otherwise be available if the limitation was removed.
Eastern Hills	One of ElectraNet's seven regional networks in South Australia.
Eyre Peninsula	One of ElectraNet's seven regional networks in South Australia.
Frequency control ancillary service	Contingency FCAS helps to stabilize system frequency from the first few seconds after a frequency disturbance, while regulation FCAS rase and lower services help AEMO control system frequency over the longer term.
Jurisdictional Planning Body	ElectraNet is the Jurisdictional Planning Body for South Australia under clause 11.28.2 of the Rules. This means that ElectraNet has specific obligations with regard to network connection, network planning and establishing or modifying a connection point.
Main Grid	ElectraNet's Main Grid is a meshed 275 kV network that is connected to three interconnectors and seven regional networks in South Australia.
Maximum demand	The highest amount of electricity drawn from the network within a given time period.
Metropolitan	One of ElectraNet's seven regional networks in South Australia.
Mid North	One of ElectraNet's seven regional networks in South Australia.
N	System normal network, will all network elements in-service.
N-1	One network element out of service, with all other network elements in-service.
National Electricity Rules	The Rules prescribe the obligations of national electricity market participants, including a TNSP's obligations regarding network connection, network planning, network pricing and establishing or making modifications to connection points.
Non-network options	Options which address a network that don't include regulated network infrastructure, such as generation, market network services and demand-side management initiatives.
Over frequency generator shedding	A scheme that trips generators based on a pre-determined schedule when the system frequency increases due to supply exceeding demand.
Registered participants	As defined in the Rules.
Riverland	One of ElectraNet's seven regional networks in South Australia.
STATCOM	A power electronic device based on IGBT technology that can rapidly adjust its level of reactive power contribution.
SVC	A power electronic device based on thyristor technology that can rapidly adjust its level of reactive power contribution.
South East	One of ElectraNet's seven regional networks in South Australia.
Thermal ratings	The maximum amount of electrical power that a piece of equipment can accommodate without overheating.
Transfer limit	The maximum feasible power transfer through a transmission or distribution limit.
Under frequency load shedding	A scheme that trips loads based on a pre-determined schedule when the system frequency decreases due to demand exceeding supply.
Upper North	A scheme that trips generators based on a pre-determined schedule when the system frequency increases due to supply exceeding demand.

electranet