AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Comparison of ElectraNet's 2018 TAPR projects and the AER's revenue determination

August 2018

South Australian Advisory Functions

Important notice

PURPOSE

This document compares the projects proposed in ElectraNet's 2018 Transmission Annual Planning Report (TAPR) with the plan accepted by the Australian Energy Regulator (AER) for the current regulatory period of 2018-23. The purpose of this document is to provide the Australian Energy Market Operator's (AEMO's) view on the alignment of these plans.

AEMO's comparison and assessment focuses on transmission network projects that fall into the project categories reported in ElectraNet's 2018 TAPR: augmentation, connection, security/compliance, and replacement.

AEMO publishes this document as part of its South Australian Advisory Functions (SAAF) in accordance with section 50B of the National Electricity Law.

This publication has been prepared by AEMO using information available at 30 June 2018.

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ACKNOWLEDGEMENT

AEMO acknowledges the support, co-operation and contribution of all participants in providing data and information used in this publication.

VERSION CONTROL

Version	Release date	Changes
1	31 August 2018	Initial release

Executive summary

AEMO has undertaken this report as part of its advisory role for the South Australian jurisdiction. It compares the projects ElectraNet proposed in its 2018 Transmission Annual Planning Report (TAPR) against capital expenditure plans in the Australian Energy Regulator (AER) revenue determination for the current regulatory period (1 July 2018 to 30 June 2023).

In April 2018, the AER published the final decision on ElectraNet's revenue proposal for the regulatory period 2018-23. ElectraNet's 2018 TAPR reported an augmentation project, a connection project, 22 security and compliance projects, and 30 asset replacement projects as committed or proposed for the period of 2018-23. These projects are consistent with the AER's revenue determination for the period 2018-23, except for one project under the category of security and compliance. This project is for safety improvement in substations, with an estimated cost of less than $5 million.

The AER's revenue determination included seven projects under the network capability incentive parameter action plan (NCIPAP). In March 2017, AEMO reviewed and endorsed all these NCIPAP projects. ElectraNet's 2018 TAPR listed six NCIPAP projects. The project not listed in the TAPR is improvement to constraint formulation, and ElectraNet advised that this project is planned for commencement in 2021.

ElectraNet's 2018 TAPR also reported two augmentation projects, four security and compliance projects, four asset renewal projects, and one NCIPAP project that were committed and continued from the previous regulatory period of 2013-18. These projects were included in the AER's revenue determination for the regulatory period of 2013-18.

ElectraNet's 2018 TAPR reported five large projects as contingent projects for the regulatory period of 2018-23. The AER's final decision included all these five projects as contingent projects in the regulatory period of 2018-23. The projects were:

1. Eyre Peninsula supply reinforcement ($200 million).
2. South Australian Energy Transformation ($200-500 million).
3. Upper North-East transmission line reinforcement ($60 million).
4. Upper North-West transmission line reinforcement ($110 million).
5. Main Grid System Strength Support ($60-80 million).

The AER stated that each of the first four projects must satisfy successful completion of the Regulatory Investment Test for Transmission (RIT-T) and the identification of a preferred option that maximises positive net economic benefits and/or addresses a reliability corrective action. These projects can proceed following the AER's determination that the proposed investment satisfies the RIT-T. ElectraNet is currently undertaking RIT-Ts for Eyre Peninsula supply reinforcement and South Australian Energy Transformation projects.

The fifth project is to address insufficient system strength in the South Australian transmission network. In October 2017, AEMO, in its update to the 2016 *National Transmission Network Development Plan* (NTNDP), declared a gap in system strength in South Australia. ElectraNet, in consultation with AEMO, is currently in the process of identifying a preferred technical solution to address insufficient system strength. The AER stated that this project must satisfy successful completion of the RIT-T (or equivalent economic evaluation) including an assessment of credible options showing a transmission investment is justified, and determination by the AER that the proposed investment satisfies the RIT-T or equivalent economic evaluation.

AEMO's review identified that augmentation, security and compliance, and asset renewal projects reported in ElectraNet's 2018 TAPR have a close correlation with the AER's revenue determination. This TAPR and recent RIT-Ts show evidence that ElectraNet has undertaken detailed planning review.

Contents

Tables

1. Background

This chapter provides background on the capital expenditure (capex) revenue proposal and the Transmission Annual Planning Reports (TAPRs) prepared by ElectraNet. In particular:

- Section 1.1 describes the background to ElectraNet's revenue determination.
- Section 1.2 provides background information on ElectraNet's TAPR.
- Section 1.3 outlines the impact of any differences between the Australian Energy Regulators (AER's) regulatory determinations and ElectraNet's 2018 TAPR[1].
- Section 1.4 describes the extent to which AEMO and ElectraNet collaborate on transmission network planning.

1.1 ElectraNet's revenue determination

The regulatory framework established by the National Electricity Rules (NER) is an ex-ante framework, meaning that the revenue a Transmission Network Service Provider (TNSP) earns is based on expected future costs rather than historical costs.

The AER undertakes a detailed review of the TNSP's forecast expenditure to form a view of the economic efficiency of the proposed capital works program over the five-year regulatory period. On this basis, it determines a capital expenditure allowance, forming the basis of the maximum allowed revenue the TNSP can recover over the regulatory period.

The TNSP does have discretion to deviate, as circumstances may require, from the capital expenditure allowance determined by the AER when augmenting and maintaining their network. If this occurs, consumers:

- Do not pay for overspends the AER determines to have been inefficient in an ex-post review.
- Pay a portion of overspends determined to be efficient.
- Share in the benefits when a network business is able to spend less than its forecast capex allowance.

The business retains 30% of an underspend (or overspend), while the remaining 70% is passed through to (or recovered from) consumers[2].

Plan accepted by the AER for the current regulatory period

In April 2018, the AER made its final determination for ElectraNet's revenue allowance for the current regulatory period, 1 July 2018 to 30 June 2023.

Table 1 provides a timeline of the AER's regulatory determination process for this allowance.

[1] ElectraNet. South Australian Transmission Annual Planning Report. June 2017. Available at: https://www.electranet.com.au/wp-content/uploads/2017/06/2017-Transmission-Annual-Planning-Report.pdf.

[2] AER: Expenditure incentives guideline 2013. December 2012. Available at: https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/expenditure-incentives-guideline-2013.

Table 1 Timeline of ElectraNet's 2018-23 regulatory determination

Date	Action	Document and link
28 March 2017	ElectraNet submits revenue proposal	ElectraNet. Transmission Network Revenue Proposal (2018-23). Available at: https://www.aer.gov.au/system/files/ElectraNet%20%E2%80%93%20ENET002%20%E2%80%93%20ElectraNet%20%E2%80%93%20Revenue%20Proposal%20Overview%20%E2%80%93%20March%202017.pdf
26 October 2017	AER releases draft decision	AER. Draft Decision – ElectraNet Transmission determination 2018-23. Available at: https://www.aer.gov.au/system/files/AER%20-%20Draft%20Decision%20-%20Overview%20-%2026%20October%202017%20%28amended%203%20Nov%202017%29.pdf
22 December 2017	ElectraNet submits revised revenue proposal	ElectraNet. Transmission Network Revised Revenue Proposal (2018-19 to 2022-23). Available at: https://www.aer.gov.au/system/files/ElectraNet%20-%20Revised%20revenue%20proposal%20-%20December%202017%20-%20version2.pdf
30 April 2018	AER releases final decision	AER. Final Decision, ElectraNet, Transmission Determination, 2018-19 to 2022-23. Available at: https://www.aer.gov.au/system/files/D18-32266%20AER%20-%20Final%20decision%20ElectraNet%202018-23%20transmission%20determination%20-%20Determination%20-%20April%202018.pdf

The AER's final decision accepted the following capex categories in ElectraNet's revised capital expenditure (capex) proposal:

- Network capex:
  - Augmentation.
  - Connection.
  - Security/compliance.
  - Inventory and spares.
  - Replacement and refurbishment projects.
- Non-network capex:
  - Business information technologies (IT).
  - Buildings and facilities.

AEMO has reviewed ElectraNet's 2018 TAPR and compared it with network capex in the latest revenue determination (see Chapter 2). In summary:

- The following projects were committed and approved by the AER in ElectraNet's revenue allowance for the regulatory period 2013-18:
  - Two augmentation projects.
  - One NCIPAP project.
  - Four security and compliance projects.
  - Four asset renewal projects.
- The following projects were approved by the AER in the revenue determination for the regulatory period of 2018-23.
  - One augmentation project.
  - Seven NCIPAP projects.
  - One connection project.
  - 21 security and compliance projects.
  - 30 asset renewal projects.

1.2 ElectraNet's TAPR

The transmission planning regime established under Chapter 5 of the National Electricity Rules (NER) requires TNSPs to publish a TAPR by 30 June each year.

Role of the TAPR

The TAPR is an outcome of annual planning review which analyses the expected operation of each transmission network over an appropriate planning period, considering the relevant forecast loads, any future generation, market network service, demand side, and transmission developments, and any other relevant data.

TNSPs are not constrained to act in accordance with their TAPRs in making investment decisions or submitting regulatory proposals to the AER.

Scope of the TAPR

The requirements for a TAPR are defined in the NER under clauses 5.12.1 and 5.12.2. Clause 5.12.2(c) describes matters that the report must set out. The NER do not require the TAPR to comprehensively address all aspects of a TNSP's capex program.

Table 2 lists the capex categories included in and excluded from ElectraNet's 2018 TAPR. All these categories are considered as part of the AER's revenue determination process.

Table 2 Capex categories reported in ElectraNet's 2018 TAPR

Included in the TAPR[A] and the revenue determination	Included in the revenue determination but not in the TAPR
• Augmentation (including market benefit project proposals) • Connection • Security/compliance • Replacement/Refurbishment	• Inventory and spares • Land and easement • Business information technologies (IT) • Buildings and facilities

A. ElectraNet's 2018 TAPR does not report on all the projects proposed in the plan accepted by the AER, even those which fall into the categories reported in the 2018 TAPR, as this is not required by the NER.

This report focuses on the capex categories included in the TAPR (see Section 2.1).

2018 TAPR and connection point forecasts

ElectraNet published its 2018 TAPR[3] and South Australian Connection Point Demand Forecasts[4] on 29 June 2018. These cover a 10-year planning period, and describe the current network, demand projections, emerging network limitations or constraints, and information on completed, committed, pending, and proposed transmission network developments in South Australia.

ElectraNet annually receives 10-year connection point demand forecasts from SA Power Networks, and collaborates with AEMO to receive forecasts from direct connect customers. Also, ElectraNet has taken into consideration of AEMO's connection point forecasts for South Australia, published in September 2017. ElectraNet compared its connection point forecasts against AEMO's forecasts and reported that there are some differences between the two forecasts, but neither forecast has consistently higher or lower than the other. Further, the 2018 TAPR reported these differences have no impact on network limitations or development plans within the next ten years. The development plans presented in the 2018 TAPR are based

[3] ElectraNet. 2018 Transmission Annual Planning Report. June 2018. Available at: https://www.electranet.com.au/wp-content/uploads/2018/06/SA-Transmission-Annual-Planning-Report-2018.pdf

[4] ElectraNet. 2018 South Australian Connection Point Forecast. Available at: https://www.electranet.com.au/wp-content/uploads/2018/06/2018-SA-Connection-Point-Forecast.pdf

on the connection point demand forecasts that are summarised in ElectraNet's 2018 South Australian Connection Point Forecasts Report[5] and 2018 TAPR.

Additionally, ElectraNet has used the forecast provided in AEMO's March 2018 update to the *2017 Electricity Forecasting Insights* (EFI)[6] to determine future needs for improved voltage control on the Main Grid[7] at times of maximum and minimum demand in South Australia.

1.3 TAPR comparison with revenue proposals

In accordance with AEMO's South Australian Advisory Function (SAAF) requirements, AEMO undertook a high-level review of ElectraNet's 2018 TAPR.

Assessment methodology

The review incorporated a comparison of the augmentation plan proposed in the TAPR against:

- The AER revenue allowance for the previous regulatory period, from 1 July 2013 to 30 June 2018.
- The AER revenue allowance for the current regulatory period, from 1 July 2018 to 30 June 2023.

AEMO used the demand forecasts from its March 2018 EFI Update[8] for the comparison at a regional level, and the 2017 *Transmission Connection Point Forecasting Report for South Australia*[9] for the comparison at the connection point level. The assessment included, but was not limited to:

- A review of the need for each project, the project timing, and its scope. This considered power system and forecast changes, particularly changes in forecast demand that occurred since AER's revenue determination or ElectraNet's revenue proposal.
- A review of the reasonableness of adjustments (such as changes or cancellations) made to projects in relation to the AER's determination or revenue proposal.
- Consultation with ElectraNet regarding any mismatch in cost estimates between the TAPR and regulatory proposals. AEMO assessed the reasonableness of the clarifications obtained.

The assessments did not consider:

- Project cost assessments.
- Market modelling to assess the market benefits delivered by individual projects.
- Asset condition – for any asset condition-based replacement project, AEMO's assessment was limited to the capacity requirement.

Interpretation of differences between the revenue determination and TAPR

Differences between ElectraNet's TAPR and the capex forecasts submitted by ElectraNet as part of the AER's revenue determination may arise for any of the following reasons:

- The capex forecasts have different reporting coverage.
- ElectraNet responds to the incentives created by the regulatory framework.
- Other changed circumstances.

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[5] ElectraNet. *South Australian Connection Point Demand Forecast* 2018. Available at: https://www.electranet.com.au/wp-content/uploads/2018/06/2018-SA-Connection-Point-Forecast.pdf.

[6] AEMO. 2017*Electricity Forecasting Insights.* Available at: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Electricity-Forecasting-Insights.

[7] As stated in ElectraNet's 2018 TAPR, the Main Grid is a meshed 275 kV network that is connected to two interconnectors and seven regional networks in South Australia.

[8] AEMO. 2018 *Electricity Forecasting Insights*. Available at http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Electricity-Forecasting-Insights/2018-Electricity-Forecasting-Insights

[9] AEMO. *Transmission Connection Point Forecasting*. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting/South-Australia.

Although TNSPs are not obliged to follow either their TAPR capex plan or the AER revenue determination capex plan, there is value in monitoring how the capex forecasts compare. Significant and consistent discrepancies between the TAPR and the capex forecasts set out in TNSPs' regulatory proposals may signal a need for improved planning processes or business practices.

1.4 South Australian transmission network planning

1.4.1 Collaboration between AEMO and ElectraNet on transmission network planning

This section describes the extent to which AEMO and ElectraNet collaborate on transmission network planning.

AEMO and ElectraNet joint planning studies

When the need arises, AEMO and ElectraNet carry out joint planning studies to identify the preferred solution to relieve limitations that may impact network planning in both South Australia and Victoria. Recently completed joint planning studies include:

- Heywood Interconnector Upgrade project.
- Special protection scheme – see "Implementation of recommendations from South Australia Black System report" in Section 1.4.2 for more details.
- Review of Regulatory Investment Test for Transmission (RIT-T) documents – see "AEMO review of ElectraNet's draft Regulatory Investment Test-Transmission documents" below for more details.

AEMO and ElectraNet joint planning meetings

AEMO and ElectraNet hold regular joint planning meetings on network planning-related issues. Regular meeting agenda items include updates and discussions on:

- Load and generator connections in South Australia and Victoria.
- South Australian and Victorian TAPRs.
- South Australia Energy Transformation RIT-T (South Australia to Eastern States interconnector).
- South Australian and Victorian intra-regional RIT-Ts.
- Identification of Renewable Energy Zones (REZs) in South Australia.
- The *Integrated System Plan* (ISP) and previous year's *National Transmission Network Development Plan* (NTNDP).
- Demand forecasts.
- Options to address the system strength gap in South Australia.
- Power system frequency risk review.
- Coordination of operational management of South Australian distributed energy resources.
- Power system security.
- Other planning topics.

AEMO review of ElectraNet's draft TAPR

As part of its normal planning procedures, ElectraNet gives AEMO the opportunity to review and comment on the draft TAPR before publication. While AEMO conducts a high-level review and provides feedback for consideration, ElectraNet remains the sole author and owner of the document.

AEMO review of ElectraNet's draft RIT-T documents

As part of its normal planning procedures, ElectraNet gives AEMO the opportunity to review and comment on draft RIT-T documents before their publication. AEMO's review is focused on augmentation RIT-Ts and not replacement RIT-Ts. While AEMO reviews the draft documents and provides comments, ElectraNet remains the sole author and owner.

Recently, AEMO reviewed the following RIT-T documents:

- South Australia Energy Transformation (SAET) RIT-T – in November 2016, ElectraNet commenced the RIT-T process for this project by publishing a Project Specification Consultation Report (PSCR)[10]. AEMO formally submitted to the PSCR consultation (see Appendix B). AEMO and ElectraNet met regularly to discuss the technical and economic benefit assessment of network and non-network options. ElectraNet consulted AEMO before publishing a Project Assessment Draft Report (PADR) on 29 June 2018[11].
- Eyre Peninsula Electricity Supply Options RIT-T – in April 2017, ElectraNet commenced the RIT-T process for this project by publishing a PSCR[12]. ElectraNet consulted AEMO before publishing a PADR in November 2017[13]. ElectraNet is currently in the process of finalising a Project Assessment Conclusions Report (PACR), and has consulted AEMO on the draft PACR.

Joint working groups

The following joint working groups, which seek to facilitate constructive discussion on matters relating to gas and electricity forecasting, market modelling, and strategic network planning, were in place in 2017 and 2018:

- Executive Joint Planning Committee (EJPC) – forum with executive members of planning of AEMO and TNSPs.
- Joint Planning Committee (JPC) – forum with AEMO's and TNSPs' planning specialists.
- Market Modelling Working Group (MMWG) – forum with AEMO's and TNSPs' market modelling specialists.

ElectraNet regularly attends all these meetings.

As the national transmission planner, AEMO is required to review and publish advice on the development of the transmission grid across the NEM, to provide a national strategic perspective for transmission planning and coordination, and to publish an annual 20-year outlook for NEM transmission planning (the NTNDP). In June 2018, AEMO published an ISP, which, with associated material, met AEMO's responsibilities and fulfilled the requirements of the NTNDP.

The consultations that informed the ISP were initiated in January 2017. Discussion on the progress of the ISP is a standing agenda item at EJPC, JPC, and MWWG meetings.

AEMO worked closely with ElectraNet in developing the ISP, through these working group meetings, and formal and informal consultation. The ISP incorporates ElectraNet's current network and its committed development plans. It includes discussion on the key transmission network projects proposed in ElectraNet's TAPR and the impact of these projects on relevant transmission flow paths. Before publishing the ISP, AEMO consulted with ElectraNet on its findings of generation and transmission outlooks and modelling results.

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[10] ElectraNet. South Australian Energy Transformation RIT-T: Project Specification Consultation Report. Available at: https://www.electranet.com.au/wp-content/uploads/resource/2016/11/20161107-Report-SouthAustralianEnergyTransformationPSCR-1.pdf.

[11] ElectraNet. South Australian Energy Transformation RIT-T: Project Assessment Draft Report. Available at: https://www.electranet.com.au/wp-content/uploads/projects/2016/11/2018-07-06-SAET-PADR-Final.pdf.

[12] ElectraNet. Eyre Peninsula Electricity Supply Options. RIT-T Project Specification Consultation Report. Available at: https://www.electranet.com.au/wp-content/uploads/2017/04/20170428-Report-EyrePeninsulaElectricitySupplyOptionsPSCR.pdf.

[13] ElectraNet. Eyre Peninsula Electricity Supply Options. RIT-T Project Assessment Draft Report. Available at: https://www.electranet.com.au/wp-content/uploads/projects/2017/04/PADR-Eyre-Peninsula-Electricity-Supply-Options-Final-16-Nov-2017.pdf.

In accordance with NER requirements, ElectraNet considers the strategic plan outlined in the previous NTNDP in its TAPRs. In their development of the 2018 TAPR, ElectraNet also considered information from the inaugural Integrated System Plan[14].

AEMO review of ElectraNet's Network Capability Incentive Parameter Action Plan (NCIPAP)

In December 2012, the AER introduced a network capability component in the Service Target Performance Incentive Scheme (STPIS) for transmission network service providers. It is designed to encourage efficient network capability from existing assets when and where most needed to improve customer or wholesale market outcomes. The STPIS requires TNSPs to submit a NCIPAP as part of its revenue proposal to the AER.

As part of the process, TNSPs are required to consult with AEMO, prior to submitting the NCIPAP, about their reviews of transmission circuits and injection points in their networks, and the potential priority projects which have been identified[15]. This includes consultation with AEMO regarding:

- The potential for co-ordinated projects with other TNSPs.
- Whether achieving the proposed priority project improvement targets will result in the proposed priority project having a material benefit.
- The classification of priority projects, based on likely benefit to consumers or wholesale market outcomes.
- The ranking of the priority projects.

As part of the NCIPAP process, AEMO collaborated with ElectraNet in 2017 to identify options and quantify market benefits of potential NCIPAP projects for implementation within ElectraNet's regulatory period (2018-23). AEMO conducted independent analysis of network limitations, considering historical congestion, future network flows, and reliability and security implications. This has led to prioritising NCIPAP projects to deliver the best value for money for customers.

In 2017, the AER accepted AEMO's review of ElectraNet's NCIPAP projects and the project ranking for the regulatory period 2018-23 and in April 2018 AER included NCIPAP projects in their final determination[16]. These NCIPAP projects are listed in Table 3.

Table 3 ElectraNet's NCIPAP augmentation projects for the current regulatory period (in order of priority)

NCIPAP Project	Regulatory period	AEMO comments
South East dynamic line ratings: Tailem Bend – Mobilong 132 kV, Tailem Bend – Tungkillo 275 kV, Tailem Bend – Cherry Gardens 275 kV, South East – Tailem Bend 275 kV No. 1 and No. 2 lines.	2018-23	Project included in 2018 TAPR with committed status and a timing of June 2019.
Uprating of limiting plants on Robertstown to Davenport 275 kV lines: Robertstown–Mokota–Belalie–Davenport 275 kV, Robertstown – Canowie – Mt Lock – Davenport 275 kV lines.	2018-23	Project included in 2018 TAPR with planned status and a timing of June 2019
Robertstown transformer management relay DR-E3 uprating program.	2018-23	Project included in 2018 TAPR with planned status and a timing of June 2022.
Constraint formulation investigation: Improve SA network transient and voltage stability limits by improving constraints formulation.	2018-23	Not in 2018 TAPR. ElectraNet advised that this project is planned for commencement in 2021.

[14] AEMO. Integrated System Plan. Available at: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Integrated-System-Plan.

[15] AER. https://www.aer.gov.au/system/files/AER%20-%20STPIS%20version%205%20%28corrected%29%20-%2030%20September%202015.pdf. Viewed 19 July 2017.

[16] AER. https://www.aer.gov.au/system/files/D18-32266%20AER%20-%20Final%20decision%20ElectraNet%202018-23%20transmission%20determination%20-%20Determination%20-%20April%202018.pdf.

NCIPAP Project	Regulatory period	AEMO comments
South East 275 kV capacitor bank: Install an additional 100 MVAr capacitor bank at South East substation.	2018-23	Project included in 2018 TAPR with planned status and a timing of June 2020.
Smart Wires Powerline Guardian trial (Waterloo–Templers): Waterloo–Templers 132 kV, Robertstown–Tungkillo 275 kV, Robertstown–Para 275 kV lines.	2018-23	Project included in 2018 TAPR with planned status and timing of December 2019.
Tailem Bend to Cherry Gardens tie in: One additional diameter at Tungkillo by tying in the Tailem Bend – Cherry Gardens 275 kV line.	2018-23	Project included in 2018 TAPR with planned status and a timing of June 2021.

1.4.2 Other South Australian initiatives that may impact on transmission planning

Implementation of recommendations from South Australia Black System report

In March 2017, AEMO published its final report on the South Australian black system event of 28 September 2016[17]. This report outlined 19 recommendations to be implemented in South Australia to:

- Reduce the risk of islanding of the region.
- Increase the likelihood that, in the event of islanding, a stable electrical island can be sustained at least in part of South Australia.
- Improve the performance of the system restart process.
- Improve market and system operation processes required during periods of market suspension.

A number of projects listed in the 2018 TAPR address the recommendations of this report. Where there is potential relevance, AEMO has noted this in Appendix A.

Demand side management initiative with ARENA

In October 2017, the Australian Renewable Energy Agency (ARENA) and AEMO jointly announced 10 pilot projects had been awarded funding under a demand response initiative to help manage electricity supply during extreme peaks. Demand response involves paying an incentive for energy users to reduce their power consumption, switch to backup generation, or dispatch their energy storage, for short periods when electricity reserves reach critically low levels. Over three years, the pilot projects are being trialled in Victoria, South Australia, and New South Wales to free up temporary supply during extreme weather (such as prolonged summer heatwaves) and unplanned outages[18].

Meeting system strength gap

In October 2017, AEMO, in its update to the 2016 NTNDP, declared a gap in system strength in South Australia. To maintain and manage the security of the power system, the system strength that has been supplied by traditional synchronous generation sources now needs to be provided by other means. ElectraNet's 2018 TAPR reported that they have been investigating options to address this gap as a fault level shortfall, to ensure ElectraNet can provide customers with a reliable and secure power system, while also keeping costs down. Options included entering into contracts with existing conventional generators or installing synchronous condensers. ElectraNet has determined installation of synchronous condensers on the

[17] AEMO. Black System South Australia 28 September 2016. Available at: http://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/Integrated-Final-Report-SA-Black-System-28-September-2016.pdf.

[18] ARENA and AEMO pilot demand response program. Available at: https://www.aemo.com.au/Media-Centre/AEMO-and-ARENA-demand-response-trial-to-provide-200MW-of-emergency-reserves-for-extreme-peaks

network be the most efficient and least-cost option. As part of this project, ElectraNet is undertaking detailed technical analysis in consultation with AEMO.

Power system frequency risk review (PSFRR)

A Power System Frequency Risk Review (PSFRR) is an integrated, periodic review of power system frequency risks associated with non-credible contingency events in the National Electricity Market (NEM). In September 2017, AEMO published the outcomes of a PSFRR for South Australia[19] that specifically considered the loss of multiple generating units in the South Australian region when South Australia is importing energy from Victoria.

This PSFRR recommended an interim emergency frequency control scheme (EFCS) as the most efficient way to manage the risk of multiple generator contingencies within South Australia leading to a loss of the Heywood Interconnector, islanding of South Australia, cascading loss of remaining South Australian generation, and a black system. In response to this recommendation, the system integrity protection scheme (SIPS) was commissioned by ElectraNet in December 2017.

In June 2018, AEMO published the outcomes of a PSFRR assessing frequency risks in each NEM region, which was undertaken during 2017-18 in collaboration with Network Service Providers (NSPs)[20]. Key insights for South Australia were:

- AEMO, in consultation with ElectraNet, recommended an upgrade to the recently commissioned SIPS, to further reduce the likelihood that a loss of multiple generators in South Australia will lead to separation and a black system.
- AEMO, in consultation with ElectraNet, recommended the creation of a new protected event to manage risks relating to transmission line failure causing generation disconnection and subsequent islanding and black system during destructive wind conditions in South Australia. AEMO will submit a request to the Reliability Panel for the declaration of this protected event.

Other AEMO reports published under South Australian Advisory Function

AEMO has also recently published the following reports that relate to South Australian transmission system:

- *South Australian Demand Forecasts*[21].
- *South Australian Fuel and Technology Report*[22].
- *South Australian Renewable Energy Report*[23].
- *South Australian Electricity Report*[24].
- Independent Planning Review – ElectraNet Capital Expenditure Projects[25].
- *South Australian Historical Market Information Report*[26].
- *South Australian Generation Forecast Report*[27].

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[19] AEMO. 2017 Power System Frequency Risk Review – Multiple Generator Trips in South Australia. Available at: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Power-System-Frequency-Risk-Review.

[20] AEMO. 2018 Power System Frequency Risk Review. Available at: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Power-System-Frequency-Risk-Review.

[21] AEMO. *2017 South Australian Demand Forecasts*. Available at: https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2017/2017-South-Australia-Demand-Forecasts.pdf.

[22] AEMO. *2017 South Australian Fuel and Technology Report*. Available at: http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2017/2017_SAFTR.pdf.

[23] AEMO. *2017 South Australian Renewable Energy Report*. Available at: http://aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2017/South-Australian-Renewable-Energy-Report-2017.pdf.

[24] AEMO. *2017 South Australian Electricity Report*. Available at: http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2017/South-Australian-Electricity-Report-2017.pdf.

[25] AEMO. 2017 Independent Planning Review - ElectraNet Capital Expenditure Projects. Available at: https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2017/Independent_Planning_Review-ElectraNet_Capital_Expenditure_Projects.pdf.

[26] AEMO. *2017 South Australian Historical Market Information Report*. Available at: http://aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2017/South-Australian-Historical-Market-Information-Report-2017.pdf.

[27] AEMO. *2017 South Australian Generation Forecast Report*. Available at: http://aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2017/2017-South-Australian-Generation-Forecast.pdf.

2. Transmission network comparison and assessment

This chapter compares the projects listed in ElectraNet's 2018 TAPR with AER's revenue determination for the previous regulatory period of 2013-18 and current regulatory period of 2018-23, and provides AEMO's view on any differences. It also considers differences between ElectraNet's 2018, 2017, and 2016 TAPRs.

2.1 Scope and assumptions

AEMO's comparison and assessment focuses on the transmission network projects that fall into the project categories reported in ElectraNet's 2018 TAPR (augmentation, security/compliance, and replacement). Details of the assessment methodology are summarised in Section 1.3.

As noted in Section 1.2, the TAPRs only include a subset of the TNSPs' overall capex. This report does not include the capex project categories that are not reported in ElectraNet's 2018 TAPR (land and easement, inventory and spares, business information technologies (IT), and buildings and facilities).

The comparison takes into account:

- ElectraNet's 2016, 2017, and 2018 TAPRs.
- The AER's Final Decision on ElectraNet Transmission Determination for the regulatory period 2013-18, published in 2013[28].
- The AER's Final Decision on ElectraNet Transmission Determination for the regulatory period 2018-23, published in April 2018[29].

ElectraNet advises in the 2018 TAPR that:

- Committed projects are projects where a RIT-T has been completed (where required), and approval has been given by the ElectraNet Board.
- ElectraNet does not currently have any pending projects (projects which have passed the RIT-T but are not yet fully committed).

Appendix A provides detailed comments for each augmentation, connection, security and compliance, and replacement project included in ElectraNet's 2018 TAPR.

2.2 Augmentation projects

A comparison of augmentation projects with a direct impact on transmission network performance is provided in Table 4 of Appendix A. The table also contains comments where relevant.

There are three augmentation projects which are reported as committed and continued from the previous regulatory period of 2013-18:

[28] AER. Final Decision on ElectraNet Transmission Determination from 2013-14 to 2017-18. Available at: https://www.aer.gov.au/system/files/AER%20-%20final%20decision%20for%20ElectraNet%27s%202013–18%20regulatory%20control%20period%20-%2030%20April%202013_0.pdf.

[29] AER. Final Decision on ElectraNet Transmission Determination from 2018-23. Available at: https://www.aer.gov.au/system/files/D18-32266%20AER%20-%20Final%20decision%20ElectraNet%202018-23%20transmission%20determination%20-%20Determination%20-%20April%202018.pdf.

- A NCIPAP project involving uprating the Robertstown – North West Bend No. 2 and North West Bend – Monash No. 2 circuits.
- Implementation of a control scheme to bypass the series capacitors under certain operating conditions.
- A grid-connected utility-scale battery energy storage system at Dalrymple, involving regulated service of supply of fast frequency response to reduce constraints on the Heywood Interconnector and reduction of expected unserved energy in Yorke Peninsula.

The AER accepted:

- The regulatory component of the Dalrymple battery energy storage project and ElectraNet's proposal of advancing the timing of this project in the regulatory period of 2013-2018.
- The deferral of minor project works with a total value equivalent to the forecast capex of the Dalrymple energy storage project into the 2018-23 regulatory period.

Seven projects are reported as proposed augmentation projects, and these were included in AER's revenue determination for the current regulatory period of 2018-23:

- Six projects are NCIPAP projects, and AEMO reviewed all these NCIPAP projects in March 2017 and agreed with ElectraNet's assessment on improvement of transfer capability. AEMO confirms the need for these projects still exist.
- One project is to install a coordinated control scheme to better utilise voltage control facilities to minimise system constraints.

One of an accepted NCIPAP is not listed in the 2018 TAPR. This project is for improvement to constraint formulation, and ElectraNet advised that this project is planned for commencement in 2021.

There are four augmentation projects reported as contingent in the current regulatory period of 2018-23:

- A project to reinforce the Eyre Peninsula transmission supply. This involves constructing a new double circuit line from Cultana to Yadnarie to Port Lincoln. This project will also address expiry of the existing contract for network support at Port Lincoln (a RIT-T in progress).
- A new high capacity interconnector between South Australia and the eastern states, or a range of network solutions (a RIT-T in progress)
- Rebuild the Davenport – Pimba 132 kV line and establish associated network assets to reinforce the Upper Northern Region western 132 kV line.
- Uprating of the Davenport – Leigh Creek 132 kV line and establish associated network assets to reinforce the Upper Northern Region eastern 132 kV line.

These projects will be subject to the RIT-T process. ElectraNet is undertaking RIT-Ts for the first two projects. The eastern and western transmission lines of Upper Northern region were assessed in March 2017 by AEMO, and it was agreed to include these projects as contingent for the regulatory period of 2018-23. These projects will also be subject to the RIT-T process, and ElectraNet's 2018 TAPR reported that the timing and scope of these projects are uncertain at this time.

2.3 Connection projects

A comparison of transmission connection projects is provided in Table 5 of Appendix A. Of five connection projects, four projects are for connection of wind farms and mine load. These do not come under ElectraNet's prescribed services. A connection project to create a 132/11 kV substation at Gawler East to supply SA Power Networks' load has been reported with a timing of November 2023. ElectraNet's 2018 TAPR reported that SA Power Networks plans to work with ElectraNet to commence a Regulatory Investment Test for Distribution (RIT-D). The preferred option is to be determined by the outcome of the RIT-D.

2.4 Security and compliance projects

A comparison of security and compliance projects with a direct impact on transmission network performance is provided in Table 6 of Appendix A. The table also contains comments where relevant.

There are four security and compliance projects which are reported as committed and continued from previous regulatory period of 2013-18:

- Implement Over-Frequency Generation Shedding (OFGS) scheme for South Australian wind farms, including a backup scheme on the network side of the wind farm connections.
- Refurbish transformer oil containment systems at various sites.
- Complete Tailem Bend 275 kV substation upgrade to minimise the impact of Victoria – South Australia interconnector constraints.
- Install automated regional voltage control schemes for Eyre Peninsula and Upper North regions.

There are eight security and compliance projects are reported as committed in the regulatory period 2018-23, and AER's revenue determination for the regulatory period 2018-23 includes these projects.

Of 14 proposed security and compliance projects for the period 2018-23, 13 projects were included in the AER's revenue determination for regulatory period 2018-23. The project not included in the revenue determination is implementation of a program of safety improvement activities in substations, with an estimated cost of less than $5 million. ElectraNet advised that this project was not included in their revenue proposal and subsequently they identified a need to improve safety of personnel accessing ElectraNet's high voltage facilities. AEMO cannot comment on this project because ElectraNet, as the asset owner, is in the best position to address safety-related matters.

2.5 Replacement and refurbishment projects

A comparison of replacement and refurbishment projects with a direct impact on transmission network performance is provided in Table 7 in Appendix A. The table also contains comments where relevant.

There are four asset replacement projects which are reported as committed and continued from the previous regulatory period of 2013-18:

- Asset condition online monitoring equipment replacement.
- Para – Brinkworth – Davenport hazard mitigation.
- Program of unit asset replacements.
- Magi – East Terrace cable joint monitoring.

There are 10 asset replacement and refurbishment projects committed and 20 asset replacement and refurbishment projects proposed in the regulatory period of 2018-23, and AER's revenue determination includes all these projects. AEMO noted that the timing of some projects reported in the 2018 TAPR is different from the proposed timing in the revenue determination. AEMO cannot comment on this because these projects are asset condition-based replacement projects, and ElectraNet, as the asset owner, is in the best position to adjust the project timing as necessary.

2.6 Key differences between the 2017 and 2018 TAPRs

ElectraNet annually receives 10-year demand forecasts from SA Power Networks, and collaborates with AEMO to receive forecasts from direct connect customers. ElectraNet's development plans presented in the 2018 TAPR are based on the connection point demand forecasts that were provided to ElectraNet by SA Power Networks in December 2017, and detailed in ElectraNet's 2018 *South Australian Connection Point Forecasts*

Report[30] and AEMO's March 2018 EFI update[31]. The maximum demand forecasts used to prepare 2018 TAPR have generally changed little or remained consistent since the publication of 2017 TAPR.

On 24 August 2018, AEMO updated its maximum demand forecast for South Australia[32]. This latest forecast has an increased maximum demand outlook for South Australia compared to the March 2018 EFI update, and was not available when ElectraNet was developing their 2018 TAPR. AEMO expects that ElectraNet's future network planning work will incorporate AEMO's latest available maximum demand forecasts.

[30] ElectraNet. *South Australian Connection Point Demand Forecast* 2017. Available at: https://www.electranet.com.au/wp-content/uploads/2017/05/2017-SA-Connection-Point-Forecast.pdf.

[31] AEMO. *2018 Electricity Forecasting Insights – March 2018 Update. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Electricity-Forecasting-Insights/2018-Electricity-Forecasting-Insights/Summary-Forecasts*

[32] AEMO. Forecasting Data Portal. Available at: http://forecasting.aemo.com.au/.

Appendix A. Project comparison and assessment details

Table 4 Augmentation projects in the 2018 TAPR

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost** ($ million)	Regulatory Period	Timing*	Cost** ($ million)	
Committed projects						
Robertstown – North West Bend No.2 and the North West Bend – Monash No.2 132 kV line uprating Type: Augmentation Scope: Uprate the Robertstown – North West Bend No.2 and the North West Bend – Monash No.2 132 kV lines to 100 ˚C line clearances.	August 2018 [June 2017] (June 2017)	<5 [<5] (<5)	2013-18	AER approved as a NCIPAP project for period 1 July 2015-30 June 2018.	4.4	• Upgrading of the supply capacity of the 132 kV lines between Robertstown and North West Bend will result in supply reliability in the Riverland region meeting ETC requirements in the medium term, and increases the availability of Murraylink transfers from South Australia to Victoria. • AEMO agreed with this project as a NCIPAP project in March 2015.
Heywood interconnector upgrade Type: Augmentation Scope: Minor works outstanding, including implementation of control scheme to bypass the capacitors under certain conditions.	2018 [July 2016] (July 2016)	35-40 [35-45] (35-45)	2013-18	• This project was a contingent project proposal in 2013-2018 regulatory period. • This project passed through RIT-T in 2014. AER's decision in 2014 excluded decommissioning of the Keith – Tailem Bend No.1 132 kV line and the Snuggery–Keith 132 kV line from the scope of the Heywood interconnector upgrade project.		The ElectraNet 2018 TAPR reports implementation of control scheme is to be completed in 2018. This would improve system stability and thermal limits and allow full capability of VIC-SA Heywood interconnector transfer levels for a wide operating condition.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost** ($ million)	Regulatory Period	Timing*	Cost** ($ million)	
Grid-connected battery at Dalrymple (ESCRI-SA) Type: Augmentation Scope: Construct a 30 MW, 8 MWh large-scale battery energy storage system at Dalrymple.	July 2018 [Summer 2017-18] (Not in 2016 TAPR)	<6 (Cost of regulated component) [5-8 (ElectraNet cost only)] (NA)	2013-18	2018	6	• The Dalrymple energy storage project relates to the regulated component of a project to install a utility scale (30 MW) battery at Dalrymple as a 'proof of concept' to demonstrate the application of fast frequency response to address system security risks and local supply during an islanded operation. • The AER accepted the regulatory component of this project and ElectraNet's proposal of advancing the timing of this project in the regulatory period of 2013-2018. The AER accepted the deferral of minor project works with a total value equivalent to the forecast capex of the Dalrymple energy storage project into the 2018-23 regulatory period.
Proposed projects						
Waterloo – Templers 132 kV power flow control Type: Augmentation Scope: Install modular power flow control elements on the Waterloo–Templers 132 kV line. Uprate the Robertstown–Tungkillo and Robertstown–Para 275 kV lines and Templers–Roseworthy 132 kV line.	December 2019 [2020] (Not in 2016 TAPR)	3-6 [3-6] (NA)	2018-23 NCIPAP	2019-20	5.9	• In March 2017, AEMO reviewed and agreed with ElectraNet's NCIPAP proposal. • The AER accepted this proposed project as a NCIPAP project for the 2018-23 regulatory period.
Dynamic ratings to transmission lines between South East and Tungkillo Type: Augmentation Scope: Apply dynamic ratings to the Tailem Bend to Tungkillo, Tailem Bend to Cherry Gardens, South East to Tailem Bend No. 1, and South East to Tailem Bend No. 2 275 kV lines and to the Tailem Bend to Mobilong 132 kV line.	June 2019 [June 2019] (Within 10 years, 2018-23 period)	<5 [<5] (<5)	2018-23 NCIPAP	2018-19	0.1	• In March 2017, AEMO reviewed and agreed with ElectraNet's NCIPAP proposal. • The AER accepted this proposed project as a NCIPAP project for the 2018-23 regulatory period.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost** ($ million)	Regulatory Period	Timing*	Cost** ($ million)	
Robertstown – Davenport 275 kV line – upgrade of limiting substation plants Type: Augmentation Scope: Replace plant that are rated lower than the design capability of the conductors on the 275 kV lines between Robertstown and Davenport with high ratings.	June 2019 [June 2019] (Within 10 years)	<5 [<5] (<5)	2018-23 NCIPAP	2018-19	1.3	• In March 2017, AEMO reviewed and agreed with ElectraNet's NCIPAP proposal. • The AER accepted this proposed project as a NCIPAP project for the 2018-23 regulatory period.
Tailem Bend to Cherry Gardens tie in Type: Augmentation Scope: Add one additional diameter at Tungkillo 275 kV substation to connect the Tailem Bend – Cherry Gardens 275 kV line at Tungkillo substation.	June 2021 [2020] (Not in 2016 TAPR)	3-6 [4-8] (NA)	2018-23 NCIPAP	2019-20	5.3	• In March 2017, AEMO reviewed and agreed with ElectraNet's NCIPAP proposal. This project will increase the availability of full capability of Heywood interconnector. • The AER accepted this proposed project as a NCIPAP project for the 2018-23 regulatory period.
Reactive Plant Control Systems Type: Augmentation Scope: Install a coordinated control scheme to better use existing reactive plant and voltage control facilities to minimise system constraints, while managing system voltage levels.	2020 [2018] (2018)	3-6 [<5] (<5)	2018-23	2020	1.5	This project is to address the difficulty in effectively controlling the increasing number of reactive plant and voltage control facilities across the main grid in SA.
South East 275 kV capacitor bank Type: Augmentation Scope: Install an additional 100 MVAr capacitor bank at South East substation.	June 2020 [2021] (Not in 2016 TAPR)	<5 [<5] (NA)	2018-23 NCIPAP	2020-21	3.6	• In March 2017, AEMO reviewed and agreed with ElectraNet's NCIPAP proposal. This project will increase the availability of full capability of Heywood interconnector. • The AER accepted this proposed project as a NCIPAP project for the 2018-23 regulatory period.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost** ($ million)	Regulatory Period	Timing*	Cost** ($ million)	
Increase short-term rating of transformers at Robertstown Type: Augmentation Scope: Install transformer management relays and bushing monitoring equipment to enable the application of short term ratings to the Robertstown 275/132 kV transformers	June 2022 [June 2022] (When or if needed: potentially within 10 years)	<5 [<5] (<5)	2018-23 NCIPAP	2021-22	0.5	• In March 2017, AEMO reviewed and agreed with ElectraNet's NCIPAP proposal. • The AER accepted this proposed project as a NCIPAP project for the 2018-23 regulatory period.
Davenport – Robertstown 275 kV line uprating Type: Augmentation Scope: Uprate selected spans to achieve 120°C rating, uprate protection and metering systems, and implement calculation of real-time ratings.	2024-28 [2024-28] (Not in 2016 TAPR)	<5 [<5] (NA)	Beyond Regulatory period of 2018-23			
Tie in Robertstown – Para 275 kV line at Tungkillo substation Type: Augmentation Scope: Add one additional diameter at Tungkillo 275 kV substation to connect the Robertstown–Para 275 kV line at Tungkillo substation.	2024-28 [2024-28] (Not in 2016 TAPR)	4-8 [4-8] (NA)	Beyond Regulatory period of 2018-24			
Contingent projects						
Eyre Peninsula transmission supply reinforcement Type: Augmentation Scope: Reconductor sections of the Cultana to Yadnarie and Yadnarie to Port Lincoln 132 kV lines, or replace the lines with new 132 kV or 275 kV lines.	December 2021 [About 2022] (Within 10 years)	80-560 based on the range of options being considered [200-550] (150-300)	2018-23	Subject to successful completion of RIT-T	Contingent project 200	This project is driven by the asset condition of the existing transmission line from Cultana to Yadnarie to Port Lincoln. This project is subject to successful completion of a RIT-T justifying the investment option. The AER accepted this project as a contingent project in the regulatory period of 2018-23. ElectraNet is currently undertaking a RIT-T.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost** ($ million)	Regulatory Period	Timing*	Cost** ($ million)	
South Australian Energy Transformation Type: Augmentation Scope: Construct a new 330 kV, 800 MW interconnector from Robertstown in SA to Wagga Wagga in NSW via Buronga.	Between 2022 and 2024 [1-2 years RIT-T, 3-5 years delivery] (1-2 years RIT-T, 3-5 years delivery)	200-500 (SA component only) [250 - 500] (300-700)	2018-23	Subject to successful completion of RIT-T	Contingent project 200-500	This project is driven by net market benefits by lowering generation dispatch costs and enhancing security and reliability. The AER accepted this project as a contingent project in the regulatory period of 2018-23. ElectraNet is currently undertaking a RIT-T.
Upper North-West 132kV line reinforcement Type: Augmentation Scope: Rebuild the Davenport to Pimba 132 kV line and establish associated substation assets (including reactive support).	Timing subject to customer commitment to connect new additional load along the Davenport–Pimba 132 kV line [As above]	110 [110]	2018-23	Subject to successful completion of RIT-T	Contingent project 110	• This project is subject to successful completion of a RIT-T justifying the investment option. The AER accepted this project as a contingent project in the regulatory period of 2018-23. • ElectraNet is progressing to install a new 275 kV line from Davenport to Mt Gunson as a "negotiated asset" with a reconfiguration of 132 kV line from Davenport to Mt Gunson to Pimpa. AEMO suggests, ElectraNet to consider timing of augmentation of Davenport – Pimba 132 kV line with the proposed 132 kV reconfiguration.
Upper North-East 132kV line reinforcement Type: Augmentation Scope: Uprate or rebuild the Davenport to Leigh Creek 132 kV line and establish associated substation assets (including reactive support).	Timing subject to customer commitment to connect new additional load along the Davenport – Leigh Creek 132 kV line [As above]	60 [60]	2018-23	Subject to successful completion of RIT-T	Contingent project 60	• AEMO's agrees that the existing Davenport – Leigh Creek 132 kV line needed to be augmented if there was a step load increase causing the line to exceed its thermal limit of 10 MVA. • This project is subject to successful completion of a RIT-T justifying the investment option. The AER agreed this project as a contingent project in the regulatory period of 2018-23.

Table 5 Connection projects in the 2018 TAPR

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Proposed projects						
Corraberra Hill connection point Type: Connection Scope: Turn one of the Davenport to Cultana 275 kV lines in/out at Corraberra Hill and establish a 275 kV bus for connection of Lincoln Gap wind farm.	2018 [Not in 2017 TAPR] (Not in 2016 TAPR)	Not specified. [Not in 2017 TAPR] (Not in 2016 TAPR)	Connection project is not part of regulatory proposal.			
Mount Gunson South Connection Stage 1 Type: Connection Scope: Turn in the Davenport to Mt Gunson 132 kV line at Mt Gunson South to establish a 132 kV bus for connection of Carrapateena mine.	2018 [Not in 2017 TAPR] (Not in 2016 TAPR)	Not specified. [Not in 2017 TAPR] (Not in 2016 TAPR)	Connection project is not part of regulatory proposal.			
Mount Gunson South Connection Stage 2 Type: Connection Scope: Construct a new Saltbush Hill to Mt Gunson South 275kV line and upgrade to a 275/132 kV connection point at Mt Gunson South for connection of Prominent Hill mine.	2020 [Not in 2017 TAPR] (Not in 2016 TAPR)	Not specified [Not in 2017 TAPR] (Not in 2016 TAPR)	Connection project is not part of regulatory proposal.			
Saltbush Hill connection Type: Connection Scope: Turn one of the Davenport to Cultana 275 kV lines in/out at Saltbush Hill and establish a 275 kV bus. Construct a new 275 kV line from Saltbush Hill to provide a 275 kV connection to Mount Gunson South connection point	2020 [Not in 2017 TAPR] (Not in 2016 TAPR)	Not specified [Not in 2017 TAPR] (Not in 2016 TAPR)	Connection project is not part of regulatory proposal.			
Gawler East connection point Type: Connection Scope: Cut into the Para to Roseworthy 132 kV line and create a 132 kV connection point for a new 132/66/11 1x25 MVA transformer substation.	November 2023 [Nov 2022] (Nov 2019)	<5 [3-6]	2018-23		6.3	This project is to provide a 132 kV connection point for SA Power Networks to establish a 132/11 kV substation at Gawler East. Preferred option and timing for a new Gawler East connection point is subjected to outcome of a RIT-D assessment.

Table 6 Security and Compliance projects in the 2018 TAPR

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Committed projects						
Automatic over-frequency generator shedding (OFGS) scheme Type: Security and compliance Scope: Implement OFGS scheme for SA windfarms including a backup scheme on the network side of the wind farm connections.	2018 [2017] (Not in 2016 TAPR)	<5 [<5] (NA)	2013-18	2018	0.58	• This project is required for compliance with the new regulatory requirements – Emergency frequency control schemes rule March 2017 and managing rate of change of power system frequency rule September 2017. • Cost included for the regulatory period of 2013-18.
Refurbish transformer oil containment systems Type: Security and compliance Scope: Install, upgrade or replace transformer oil containment systems and associated equipment at various sites where assessment indicates a clear need.	2018 [2017] (2017)	8-10 [8-10] (8-10)	2013-18	2018	Not available	• ElectraNet 2018 TAPR reported transformer oil containment system need refurbishing in accordance with environment protection regulations. • ElectraNet advised this project completed in 2018.
Tailem Bend Substation Upgrade Type: Security and compliance Scope: Extend the Tailem Bend substation to accommodate an additional 275 kV diameter with two circuit breakers, associated plant and secondary systems, and rearrange 275 kV line exits.	August 2018 [November 2017] (June 2017)	9-10 [9-10] (9-10)	2013-18	2018	9	This project will minimise the impact of VIC-SA interconnector constraints and improve reliability and security. ElectraNet 2018 TAPR reported this project was committed and construction in progress.
Upper North Voltage Control Scheme Type: Security and compliance Scope: Install automated regional voltage control schemes for Eyre Peninsula and Upper North regions.	2020 [2018] (2017)	<5 [<5] (<5)	2013-18	2018	1.2	The ElectraNet 2018 TAPR reported this project to prevent potential violations of voltage limits in Eyre Peninsula and Upper North region with changing generation pattern.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Back up control and data centre Type: Security and compliance Scope: Construct a new Backup Control and Data Centre to meet current physical and electronic security requirements.	October 2018 [2018] (2018)	7-9 [4-8] (4-8)	2018-23	Sep-18	5.9	The ElectraNet 2018 TAPR reported existing backups for ElectraNet's control centre and data centre requirements require improvement to address emerging security threats.
Install a 50 MVAr 275 kV switched reactor at Templers West Type: Security and compliance Scope: Install a 50 MVAr 275 kV switched reactor at Templers West.	August 2018 [November 2018]	4-6 [<5]	2018-23	2019	4.8	The proposed reactor at Templers West will assist to control over voltages. ElectraNet 2018 TAPR reported this project is committed with a service date of August 2018.
Transmission line access track upgrade Type: Security and compliance Scope: Upgrade transmission line access tracks at vulnerable locations across the network	2018 [2019] (Not in 2016 TAPR)	<5 [<5] (NA)	2018-23	2019	3.7	The ElectraNet 2018 TAPR reported inadequate access tracks in difficult terrain hinder inspection and restoration of transmission lines following a fault.
High voltage switching training facility Type: Security and compliance Scope: Create a high voltage switching training facility to improve training standards across all aspects of high voltage switching.	2019 [2018] (2018)	8-10 [4-8] (4-8)	2018-23	2019	3.3	
Maintain required minimum levels of South Australian system strength Type: Security and compliance Scope: Upgrade existing protection devices and install up to six synchronous condensers at selected locations across the 275 kV transmission network.	2020 [AEMO provision of system strength NSCAS gap details. Successful completion of the RIT-T justifying the investment option.] (Not in 2016 TAPR)	80-140 [60-80] (NA)	2018-23	Contingent project	60-80	• In October 2017, AEMO declared a gap in the system strength in South Australia. ElectraNet has evaluated the potential options and in the process of developing a detailed specification and design of synchronous condensers in consultation with AEMO and manufactures. • The AER accepted this project as a contingent project in the regulatory period of 2018-23.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Tailem Bend spare, second transformer Type: Security and compliance Scope: Install, connect and commission the spare 160 MVA 275/132 kV transformer as a second transformer on hot standby at Tailem Bend substation.	2020 [2018] (Not in 2016 TAPR)	<5 [<5] (NA)	2018-23	2018	0.25	ElectraNet reported that the second transformer would remove the Heywood interconnector constrain during an outage of the single 275/132 kV Tailem Bend transformer.
Special protection and wide area monitoring schemes Type: Security and compliance Scope: Implement a Special Protection Scheme (SPS) and Wide Area Monitoring Scheme (WAMS) utilising transmission-level load tripping and phasor measurement capabilities.	2020	4-8	2018-23	2020	5.4	In AEMO's final report into South Australia's black system event on 28 September 2016, AEMO recommended the development of a special protection scheme to prevent electrical separation of South Australia. ElectraNet completed SIPS and is working with AEMO to upgrade the SIPS to implement Wide Area Protection Scheme.
Motorised Isolator Improvement Type: Security and compliance Scope: Replace or refurbish mechanical and electrical isolation lock-off points on all motorised air insulated isolators.	March 2021 [2019] (Not in 2016 TAPR)	10-15 [10-15] (NA)	2018-23	2019	12.8	The ElectraNet 2018 TAPR reported this project addresses safety hazards and is a committed project.
Proposed projects						
Status indication on isolators and earth switches Type: Security and compliance Scope: Install status indication on isolators and earth switches where there currently is none.	2019 [2018] (2019)	<5 [<5] (NA)	2018-23	2019	0.92	The ElectraNet 2018 TAPR reported high voltage hazard due to lack of remote visibility of manually operated isolator and earth switch status.
East Terrace, Northfield and Kilburn emergency GIS equipment Type: Security and compliance Scope: Design and procure plant and equipment required to support the rapid restoration of a failed GIS-connected 225 MVA 275/66 kV transformer at East Terrace, Northfield and Kilburn.	2020 [2019] (Not in 2016 TAPR)	<5 [<5] (NA)	2018-23	2019	2.5	The ElectraNet 2018 TAPR reported unavailability of Gas Insulated Switchgear (GIS) connection spares hinders restoration of supply following a 225 MVA 275/66 kV transformer failure at East Terrace, Northfield or Kilburn substation.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Transformer geomagnetic induced current monitoring Type: Security and compliance Scope: Install protective monitoring and alarming to enable affected transformers to be tripped prior to serious damage occurring.	2020 [2019]	<5 [<5]	2018-23	2019	0.4	The ElectraNet 2018 TAPR reported geomagnetic induced currents resulting from enhanced solar activity may induce DC currents on transmission lines and possible transformer damage or failure.
Alternative diesel generator supply for critical substations Type: Security and compliance Scope: Provide alternative diesel generator supplies to critical substations, connection points for mobile generators to non-critical substations, and related AC and DC supply improvements.	2020 [2019] (Not in 2016 TAPR)	5-10 [5-10] (NA)	2018-23	2020	7.8	The ElectraNet 2018 TAPR reported loss of AC auxiliary supplies hinders restoration of supply during black start or other abnormal operating conditions.
Spencer Gulf Crossing Bypass Type: Security and compliance Scope: Undertake preparatory site works and procure spares to support a rapid restoration.	2020 [2018] (Not in 2016 TAPR)	<5 [<5] (NA)	2018-23	2018	3.4	The ElectraNet 2018 TAPR reported Spencer Gulf high tower crossings for the Davenport – Cultana 275 kV transmission lines, supplying the entire Eyre Peninsula region, would prove difficult or impossible to restore to in a timely manner following an asset failure.
Kilburn 275 kV emergency bypass Type: Security and compliance Scope: Design, procure and have on standby the necessary line components to bypass Kilburn substation.	2020 [2019] (Not in 2016 TAPR)	<5 [<5] (NA)	2018-23	2019	0.14	Failure of Gas Insulated Switchgear (GIS) plant at Kilburn substation places significant load at risk from the next single contingency. In March 2017, AEMO reviewed this project and agreed.
Robertstown circuit breaker arrangement upgrade Type: Security and compliance Scope: Install a single 275 kV circuit breaker and associated equipment between the 275 kV buses at the Robertstown substation.	June 2020 [2019] (Not in 2016 TAPR)	5-8 [5-8] (NA)	2018-23	2020	7.2	As part of SA-NSW interconnector upgrade (Riverlink) option, Robertstown 275 kV likely to be augmented. ElectraNet reported this project will be reviewed following completion of the South Australian Energy Transformation RIT-T.
Canowie circuit breaker arrangement upgrade Type: Security and compliance Scope: Install a 275 kV circuit breaker and associated equipment on the Robertstown exit at Canowie substation.	2021 [2021] (Not in 2016 TAPR)	<5 [<5] (NA)	2018-23	2021	1.7	Generator disconnection at Canowie during an unplanned outage of the Canowie to Robertstown 275 kV transmission line. In March 2017, AEMO reviewed this project and agreed.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Safety improvement activities Type: Security and compliance Scope: Implement a program of safety improvement activities for infrastructure associated with high voltage plant areas, such as fencing, earthing, entry locking and surface treatment.	2018-21	<5	Not included in 2018-23 revenue proposal or allowance			ElectraNet advised this project is required to improve the safety of personnel in the access of ElectraNet's enclosed high voltage areas for substation 'low height high voltage equipment', including capacitor banks, low level bus and VT infrastructure, located at multiple substations. It will also improve the prevention of unauthorised entry to such enclosed high voltage areas and will reduce the maintenance costs of these enclosed high voltage areas.
Neutral earthing resistors and reactors Type: Security and compliance Scope: Install a monitoring and protection scheme for the neutral earthing reactor and resistor installations across the network.	2022 [2023]	<5 [<5]	2018-23	2023	0.96	ElectraNet identified this project to manage risk of thermal damage to neutral earthing reactors and resistors, and consequent unsafe operating conditions and risk of damage to larger plant.
Motorised Isolator Improvement at Templers Substation Type: Security and compliance Scope: Replace mechanical and electrical isolation lock-off points on all motorised air insulated isolators at Templers substation.	2023 [Not in 2017 TAPR] (Not in 2016 TAPR)	<5 [NA] (NA)	2018-23	2019	0.027	ElectraNet advised project scope and timing have been adjusted since the revenue proposal/allowance for the 2018-23 regulatory period, with target completion set to 2023. This line entry relates to the security compliance aspects of the project.
Torrens Island North substation tie bus Type: Security and compliance Scope: Install a 66 kV circuit breaker and associated equipment to tie the two Torrens Island North lines in the Torrens Island North 66 kV switchyard	2023 [2023]	<5 [<5]	2018-23	2023	1.6	This project will address the current operational difficulty to start the Quarantine generator unit No.5 (QPS5) during system black start conditions. Quick start of QPS5 is essential for a speedy restoration of other big generators in SA.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Install a switched 50 MVAr 275 kV reactor at Blyth West Type: Security and compliance Scope: Install a switched 50 MVAr 275 kV reactor at Blyth West	2025 [2021]	<5 [<5]	2018-23	2021	4.7	ElectraNet is in the process of installing synchronous condensers to manage system strength in South Australia. This project would influence timing of additional reactors, including at Blyth, to control over voltages in South Australia.
Install a switched 50 MVAr 275 kV reactor at Para Type: Security and compliance Scope: Install a switched 50 MVAr 275 kV reactor at Para	Not reported [2021]	NA [<5]	2018-23	2023	4.9	ElectraNet is in the process of installing synchronous condensers to manage system strength in South Australia. This project would influence timing of and may reduce need for additional reactors, including at Para, to control over voltages in South Australia.
Blanche circuit breaker arrangement upgrade Type: Security and compliance Scope: Install an additional 132 kV circuit breaker and associated equipment at Blanche substation.	2024-2028 [2024-2028] (Not in 2016 TAPR)	<5 [<5] (NA)	Beyond next regulatory period of 2018-23			
Full single pole reclosing capability on the 132 kV circuits in the Mid North region Type: Security and compliance Scope: Implement full single pole reclosing capability on the 132 kV circuits in the Mid North region.	2024-28 [2024-28] (2018-23)	<5 [<5] (<5)	Beyond next regulatory period of 2018-23			ElectraNet is considering this project under NCIPAP with the timing of 2024-28. The 2018 TAPR reported that Mintaro and Angaston generators are constrained off during 132 kV outages that result in these generators being radialised.
Full single pole reclosing capability on the 132 kV circuits in the South East region Type: Security and compliance Scope: Implement full single pole reclosing capability on the 132 kV circuits in the South East region.	2024-28 [2024-28] (2018-23)	<5 [<5] (<5)	Beyond next regulatory period of 2018-23			ElectraNet is considering this project NCIPAP with the timing of 2024-28. The 2018 TAPR reported that Ladbroke Grove and Snuggery generators are constrained off during 132 kV outages that result in these generators being radialised.

Table 7 Asset replacement projects in the 2018 TAPR

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Committed projects						
Asset Condition Online Monitoring Equipment Replacement Type: Replacement Scope: Replace or upgrade the majority of primary plant online condition monitoring equipment, which is at the end of its usable life and experiencing high failure rates.	August 2018 [2018] (2018)	7-10 [8-12] (8-12)	2013-18	2018	7.5	ElectraNet reported that many items of online condition monitoring equipment are now nearing the end of their usable lives and are exhibiting high failure rates. Ongoing need for this equipment needs to be assessed on a case-by-case basis.
Para – Brinkworth – Davenport Hazard Mitigation Type: Replacement Scope: Replace load-releasing cross arms and all porcelain disc insulators on Para–Brinkworth–Davenport 275 kV line to achieve a 15-year life extension.	December 2018 [2018] (September 2017)	50-60 [55-65] (46-60)	2013-18	2018	48.5	
Program of unit asset replacements Type: Replacement Scope: Program of unit asset replacements at multiple substations to address high failure rates and safety risks.	2014-2019 [2013-18] (2013-18)	40-50 [40-50] (45-55)	2013-18	2019	43	ElectraNet advised this project is in progress with target completion in 2019.
Magill/East Terrace cable joint monitoring Type: Replacement Scope: Replace degraded underground fluid instrumentation and associated telecommunications and infrastructure.	2019 [2019]	<4-6 [<5]	2013-18	2019	1.7	
Battery charger unit replacements Type: Replacement Scope: Implement a planned replacement program to remove battery chargers from service and replace with modern, fit-for-purpose equipment.	2018 [2017] (2018)	<5 [<5] (<5)	2018-23	2018	0.8	The ElectraNet 2018 TAPR reports a number of substation battery charger units have reached the end of their practical life and that the spare parts are not available.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Baroota substation refurbishment Type: Replacement Scope: Replace assets that are at end of life at Baroota substation and implement flood mitigation measures. Retain only the existing single 10 MVA 132/33 kV transformer.	June 2018 [2017] (2017)	5-8 [5-8] (5-10 ElectraNet's cost only)	2018-23	2018	6.3	The ElectraNet 2018 TAPR reports that most of the primary equipment at Baroota is at end of its technical life and requires replacement. This project is a committed project.
Substation lighting and infrastructure replacement Type: Replacement Scope: Replace substation lighting and associated infrastructure at sites where the safety hazards that exist because of poor lighting.	October 2018 [2019]	10-12 [4-8]	2018-23	2018	9.9	
Davenport to Pimba 132 kV line low span uprating Type: Replacement Scope: Treat low spans to achieve the designed nominal 65°C design temperature rating for the Davenport to Mount Gunson section of the Davenport to Pimba 132 kV line.	December 2018 [2018] (Not in 2016 TAPR)	12-15 [4-8] (NA)	2018-23	2022	11.2	ElectraNet is in the process of building a new 275 kV line to Mt Gunson and reconfigure Mt Gunson and Pimba 132 kV network connections. This could reduce loading on Davenport to Pimba 132 kV line. With this information, AEMO suggests ElectraNet review timing of asset replacement project between Davenport and Mt Gunson.
East Terrace gas monitoring system replacement Type: Replacement Scope: Replace existing combined phases gas monitoring system with isolated per phase systems.	2019 [2018] (Not in 2016 TAPR)	<5 [<5] (NA)	2018-23	2018	1	ElectraNet advised this project is in progress with target completion in 2019.
AC Board Replacement 2013-18 Type: Replacement Scope: Replace and improve AC auxiliary supply equipment, switchboards and cabling at 11 substations.	April 2019 [2018] (2018)	12-14 [8-12] (<5)	2018-23	2019	11.3	ElectraNet advised this project is in progress with target completion in 2019.
Monash and Berri relay replacement Type: Replacement Scope: Replace protection relays and a communications gateway at Monash and Berri substations to enable remote control and monitoring, to improve network reliability, maintainability and response following system events.	August 2019 [2018]	<5 [<5]	2018-23	2018	1.4	ElectraNet advised this project is in progress with target completion in 2019.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Murraylink runback control scheme Type Replacement Scope: Redesign and replace the Murraylink runback control scheme.	2019 [2018] (2018)	<5 [<5] (<5)	2018-23	2018	0.9	ElectraNet advised Murraylink runback control scheme is to prevent overloading of ElectraNet's assets. If an overload is detected on any one of the Riverland 132 kV lines or any one of the Robertstown 275/132 kV transformers, runback control scheme would reduce Murraylink flow from South Australia to Victoria. This control scheme allows to increase the utilisation of transmission network.
Line support systems refurbishment 2018-23 Type: Refurbishment Scope: Refurbish transmission line support systems to achieve an overall life extension of the Snuggery – Blanche and Blanche – Mt Gambier 132 kV lines by replacing every fastener on every transmission tower on these two transmission lines.	July 2023 December 2019 [2019-23]	9-10 [8-10]	2018-23	2023	9.5	There is an ongoing need for Snuggery – Blanche – Mt Gambier 132 kV circuit to connect local generation and substations.
Line Insulator Systems Refurbishment 2018-23 program Type: Refurbishment Scope: Program to refurbish transmission line support systems and extend the life of 18 transmission lines by renewing line asset components.	June 2023 [2024-28]	45-60 [10-15]	2018-2023	2023	63.9	The ElectraNet 2018 TAPR reports this is a committed project with refurbishing work to be progressively completed from 2019 to 2023.
Proposed projects						
Magill substation fire suppression system Type: Replacement Scope: Investigate, design and install refurbished or replacement fire suppression systems.	2019 [2019]	<5 [<5]	2018-23	2019	1.7	
Transformer bushing replacements Type: Replacement Scope: Implement a program to replace transformer bushings at various substations.	2020	6-8	2018-23	2021	8.7	

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Instrument transformer replacements Type: Replacement Scope: Implement a program to replace selected instrument transformers at various substations.	2021	<4-6	2018-23	2023	5.3	
Leigh Creek South transformer replacement Type: Replacement Scope: Replace the existing two 5 MVA transformers with a single new 5 MVA 132/11 kV transformer and associated plant at Leigh Creek South substation.	2021 [2019] (2016)	<5 [<5] (<5)	2018-23	2020	3	• In March 2017, AEMO considered the demand at Leigh Creek South to be uncertain and suggested consideration of deferring the replacement (if the condition of the asset permits) and replacing with a smaller transformer or non-network options to mitigate the risk of the new transformer becoming stranded. • In the 2018 TAPR, ElectraNet advises the Leigh Creek South transformers 1 and 2 have been assessed to be at the end of their technical lives and at high risk of failure, necessitating the replacement.
Surge arrestor replacements Type: Replacement Scope: Implement a program to replace selected porcelain surge arrestor units at various substations.	2021	<5	2018-23	2023	2.9	
Battery charger unit replacements Type: Replacement Scope: Implement a planned replacement program to remove battery chargers from service and replace with modern, fit-for-purpose equipment.	2022	<5	2018-23	2022	1.2	
AC board unit asset replacement Type: Replacement Scope: Replace AC auxiliary supply equipment, switchboards and cabling at 17 substations.	2022	8-12	2018-23	2021	10.3	

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Substation local control system replacements Type: Replacement Scope: Implement a program to replace selected substation PC-based local control systems at various substations.	2022	<5	2018-23	2021	3.2	
South East SVC computer control system replacement Type: Replacement Scope: Replace the existing SVC computer control system at South East substation with a new fully supported system.	2022 [2022]	4-6 [4-8]	2018-23	2022	5	
Mount Gambier 132/33 kV transformer No. 1 (50 MVA) replacement Type: Replacement Scope: Replace the existing 50 MVA transformer with a new 25 MVA 132/33/11 kV at Mount Gambier substation.	2023 [2021] (2018-23)	<5 [<5] (3-5)	2018-23	2021	2.3	In March 2017, AEMO assessed that an ongoing need exists for maintaining the supply capacity in Mount Gambier substation. ElectraNet advised that the existing 50 MVA transformer is in poor condition and the poor asset condition needs to be addressed in the next regulatory period. ElectraNet proposed replacing the existing 50 MVA transformer in poor condition with a new 25 MVA transformer. AEMO considers ElectraNet's proposal reasonable.
Mannum Transformer 1 and 2 Replacement Type: Replacement Scope: Replace the existing 20 MVA transformers with two new 25 MVA 132/33 kV transformers (nearest ElectraNet standard transformer size) at Mannum substation.	2023 [2022] (2018-23)	<5 [<5] (<5)	2018-23	2022	3	AEMO's assessment in March 2017 agreed the proposal is reasonable, however replacing the existing transformers with two 15 MVA transformers should be investigated in detail prior to committing to an investment.
Circuit breaker replacements Type: Replacement Scope: Implement a program to replace selected circuit breaker units at various substations.	2023	4-6	2018-23	2023	5.4	
Substation fencing replacements Type: Replacement Scope: Implement a program to replace substation fences at selected substations.	2023	4-6	2018-23	2021	4.3	

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Templers substation equipment replacement Type: Replacement Scope: Replace 8 isolators and the 132 kV busbar at Templers substation which have been identified as end of economic life.	2023	<5	2018-23	2018	27	
Transmission line conductor and earth wire refurbishment Type: Refurbishment Scope: Implement a program of transmission line conductor and earth wire refurbishment to renew line asset components and extend line life.	2019-2022 [2019-2023]	15-20 [10-20]	2018-23	2023	19.3	
Cultana–Yadnarie conductor and earth wire refurbish Type: Refurbishment Scope: Refurbish conductor and earth wire and extend the life of the Cultana to Yadnarie 132 kV transmission line.	2019-2023 [2019-2023]	30-45 [30-45]	2018-23	2022	38.2	ElectraNet advised if the Eyre Peninsula Electricity Supply Options RIT-T shows that another solution is preferred, then these projects will not proceed. The cost of these projects would then be offset against the contingent project application.
Yadnarie-Port Lincoln line refurbishment Type: Refurbishment Scope: Refurbish conductor and earth wire and extend the life of the Yadnarie to Port Lincoln 132 kV transmission line.	2019-2023	30-45 [30-45]	2018-23	2023	41.6	
Substation isolator replacements Type: Replacement Scope: Implement a program to replace individual substation isolators.	2019-23	8-12	2018-23	2023	12.3	
Replace protection scheme relay assets Type: Replacement Scope: Implement a program of unit protection relay and control system replacement projects at various substations.	2018-23 [2019-23] (2018-23)	25-35 [25-35] (30-40)	2018-23	2023	32.1	
Asset Condition Online Monitoring Equipment Replacement Type: Replacement Scope: Replace or upgrade most of primary plant online condition monitoring equipment, which is at the end of its usable life and experiencing high failure rates.	2019-23 [2019-23]	4-6 [4-8]	2018-23	2021	4.9	ElectraNet reported that many items of online condition monitoring equipment are now nearing the end of their usable lives and are exhibiting high failure rates. Ongoing need for this equipment needs to be assessed on a case-by-case basis.

Project description	2018 TAPR [2017 TAPR] (2016 TAPR)		Capex proposal or contingent project proposal			AEMO's comments
	Timing*	Cost**	Regulatory Period	Timing*	Cost**	
Transmission line support system refurbishment Type: Refurbishment Scope: Implement a program of transmission line support system refurbishment to renew line asset components and extend line life.	2024-2028 [2024-2028]	10-15 [10-15]	Beyond next regulatory period of 2018-23			TAPR project timing beyond next regulatory period of 2018-23.
Transmission line insulator refurbishment Scope: Implement a program of transmission line insulator system refurbishment to renew line asset components and extend line life.	2024-2028 [2024-2028]	50-80 [50-80]	Beyond next regulatory period of 2018-23			TAPR project timing beyond next regulatory period of 2018-23.
Transmission line conductor and earth wire refurbishment Type: Refurbishment Scope: Scope: Implement a program of transmission line conductor and earth wire refurbishment to renew line asset components and extend line life.	2024-2028 [2024-2028]	70-100 [70-100]	Beyond next regulatory period of 2018-23			TAPR project timing beyond next regulatory period of 2018-23.
Program of unit asset replacements Type: Replacement Scope: Implement a program of unit protection relay and control system replacement projects at various substations.	2024-2028 [2024-2028]	50-80 [50-80]	Beyond next regulatory period of 2018-23			TAPR project timing beyond next regulatory period of 2018-23.
Replace protection scheme relay assets Type: Replacement Scope: Implement a program of unit protection relay and control system replacement projects at various substations.	2024-2028 [2024-2028]	30-50 [30-50]	Beyond next regulatory period of 2018-23			TAPR project timing beyond next regulatory period of 2018-23.
Transformer and infrastructure replacements Type: Refurbishment Scope: Implement a program of transformer and infrastructure replacement projects at various substations.	2024-2028 [2024-2028]	10-20	Beyond next regulatory period of 2018-23			TAPR project timing beyond next regulatory period of 2018-23.

*Expected date of commissioning.
**Total Nominal 2017-23 Cost as submitted to The AER in ElectraNet's final proposal for non-contingent projects. Indicative cost from the Revenue Proposal Overview for contingent projects

Appendix B. AEMO submission to SAET RIT-T

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27 February 2017

ElectraNet

PO Box 7096
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Adelaide SA 5000

Attention: Hugo Klingenberg

Dear Hugo,

SUBMISSION TO SOUTH AUSTRALIAN ENERGY TRANSFORMATION (SAET) PROJECT SPECIFICATION CONSULTATION REPORT (PSCR)

Thank you for the opportunity to submit on ElectraNet's consultation for the South Australian Energy Transformation PSCR. The market modelling and supplementary information papers published by ElectraNet are a positive initiative in providing transparency for those interested in participating in this Regulatory Investment Test for Transmission (RIT-T) process.

AEMO has a number of roles relevant to this consultation:

- National Electricity Transmission Planner
- National Electricity Market (NEM) system and market operator
- Victorian Transmission Network Service Provider (TNSP)

In the 2015 and 2016 National Transmission Network Development Plans (NTNDPs), AEMO highlighted the emerging system resilience challenges relating to South Australia's changing energy mix. AEMO therefore supports ElectraNet's RIT-T process, and considers it to be an appropriate response to these challenges. AEMO is also actively supporting the AEMC's System Security Market Frameworks Review and the Essential Services Commission of South Australia's review of technical standards for inverter-connected generators, which will both complement the optimal outcome of this RIT-T.

Supplementing interconnector options to address system strength

The identified need includes a requirement to provide system resilience, including system strength, as South Australia transitions to a low carbon future. AEMO agrees this is a priority, and its 2016 NTNDP identified an 'NSCAS gap' in South Australia relating to system strength. The proposed interconnector options present solutions to increase transfer capacity, but will not specifically address system strength. AEMO suggests that the proposed interconnector options should be supplemented with distributed services (e.g. synchronous condensers) so that the identified emerging system strength challenges can be addressed effectively.

Wholesale pricing in the identified need

The National Electricity Rules (NER) requires that a RIT-T should identify the solution for an identified need that "maximises the present value of net economic benefits to all those who produce, consume and transport electricity in the market". ElectraNet's identified need includes an outcome of lower wholesale electricity prices in South Australia, which could result in a preferred option that is potentially inconsistent with the RIT-T objective. By making regional wholesale pricing a specific element of the identified need, there is a risk that other

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cost elements (including network costs) might not be equally weighted. This in turn risks excluding a range of potentially cheaper non-network solutions. AEMO therefore suggests that the specific wholesale pricing driver be removed from the identified need.

Evaluating system resilience

AEMO supports ElectraNet's use of a combination of market and system resilience benefits (called "system security benefits"). AEMO suggests that the SAET should address the following important considerations:

- Whether any proposed interconnector option can deliver system resilience without operating below capacity or relying on control schemes and distributed services, and the resultant impact on potential market benefits.
- Ensuring that system resilience benefits are not double-counted with other market benefits (i.e. fuel cost savings).
- Describing and proportioning system resilience benefits against the components that deliver those benefits.

Additionally, AEMO suggests that ElectraNet's Project Assessment Draft Report (PADR) should provide a technical assessment to demonstrate the effectiveness of the preferred solution in withstanding various contingencies[1].

ElectraNet's SAET reports discuss the benefits of increasing resilience to survive a loss of the Heywood interconnector at its planned capacity of 650 MW. The Heywood interconnector has historically tripped at near 900 MW following the sudden loss of multiple generators in South Australia. AEMO suggests that the loss of multiple generators within the South Australia region should also be considered when assessing a system resilience benefit.

As a part of our Future Power System Security program, AEMO intends to publish information on generator Rate of Change of Frequency (RoCoF) withstand capability by mid-2017. AEMO suggests that this information should be considered in ElectraNet's system resilience assessment.

Should you have any questions in relation to this submission, please contact Mr Elijah Pack on (07) 3347 3995.

Yours sincerely

Christian Schaefer
Manager Network Planning

[1] Historically relevant non-credible contingencies include loss of the Heywood interconnector and loss of 500 MW of South Australian generation.

Measures and abbreviations

Units of measure

Abbreviation	Unit of measure
kV	Kilovolt
MW	Megawatts
MVAR	Megavolt Amperes Reactive
MVA	Megavolt Amperes

Abbreviations

Abbreviation	Expanded name
AC	Alternate Current
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
capex	Capital Expenditure
ETC	South Australian Electricity Transmission Code
ICT	Information Communication Technologies
ESCOSA	Essential Services Commission of South Australia
NCIPAP	Network Capability Incentive Parameter Action Plan
NEFR	National Electricity Forecasting Report
NER	National Electricity Rules
NTNDP	National Transmission Network Development Plan
POE	Probability of Exceedance
RIT-T	Regulatory Investment Test for Transmission
RIT-D	Regulatory Investment Test for Distribution
SACPFR	South Australian Connection Point Forecasts Report
SAAF	South Australian Advisory Functions
STPIS	Service Target Performance Incentive Scheme
SVC	Static VAR Compensator
TAPR	Transmission Annual Planning Report
TNSP	Transmission Network Service Provider

Glossary

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

Term	Definition
annual planning report	An annual report providing forecasts of gas or electricity (or both) supply, network capacity and demand, and other planning information.
black system	The absence of voltage on all or a significant part of the transmission system or within a region during a major supply disruption affecting a significant number of customers.
category 1/2/3/4 connection point	Refer to Essential Services Commission of South Australia's (ESCOSA) Electricity Transmission Code, available at http://www.escosa.sa.gov.au/ArticleDocuments/1020/20160922-Electricity-TransmissionCode-TC09.pdf.aspx?Embed=Y.
committed projects	Generation that is considered to be proceeding under AEMO's commitment criteria.
constraint	A limitation on the capability of a network, load, or generating unit such that it is unacceptable to either transfer, consume, or generate the level of electrical power that would occur if the limitation was removed.
limitation (electricity)	Any limitations on the operation of the transmission system that could give rise to unserved energy or to generation re-dispatch costs.
maximum demand	The highest amount of electrical power delivered, or forecast to be delivered, over a defined period (day, week, month, season, or year) either at a connection point, or simultaneously at a defined set of connection points.
minimum demand	The lowest amount of electrical power delivered, or forecast to be delivered, over a defined period (day, week, month, season, or year) either at a connection point, or simultaneously at a defined set of connection points.
reactive power	Reactive power, which is different to active power, is a necessary component of alternating current electricity. It is predominantly consumed in the creation of magnetic fields in motors and transformers. Management of reactive power is necessary to ensure network voltage levels remain within required limits, which is in turn essential for maintaining power system security and reliability.
unserved energy	The amount of energy that cannot be supplied because there is insufficient generation or network capacity to meet demand.