Inquiry into the reliability and quality of electricity supply on the Eyre Peninsula

Final Report

October 2017

Issued by the Essential Services Commission on 6 October 2017

Enquiries concerning this final report should be addressed to:

Essential Services Commission
GPO Box 2605
ADELAIDE SA 5001

Telephone: (08) 8463 4444
Freecall: 1800 633 592 (SA and mobiles only)
E-mail: escosa@escosa.sa.gov.au
Website: www.escosa.sa.gov.au

Contact Officer: Nathan Petrus, Director Consumer Protection and Pricing.

Table of contents

Glossary of terms

AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
COAG	Council of Australian Governments
Commission	Essential Services Commission, established under the Essential Services Commission Act 2002
DER	Distributed energy resources
Enlighten	Enlighten Power Systems Pacific
ESCRI	Energy Storage for Commercial Renewable Integration South Australia study
ESSAWP	Energy Security for South Australia Working Party
EWOSA	Energy and Water Ombudsman of South Australia
GWh	GigaWatt hour,
IEEE	Institute of Electrical and Electronics Engineers
kV	Kilovolt
LNG	Liquefied Natural Gas
MEDs	Major Event Days, a measure used to remove the impacts of severe weather events from reliability performance data
MW	MegaWatt
MWh	MegaWatt hour
NER	National Electricity Rules
NSA	Network Support Agreement
PV	Photo-voltaic
Powership	Enlighten's proposed floating combined cycle generator
RIT-D	Regulatory Investment Test – Distribution
RIT-T	Regulatory Investment Test – Transmission
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index

SCADA	Supervisory control and data acquisition
SS	Substation
SWER	Single wire earth return
USAIDI	Unplanned System Average Interruption Duration Index
USAIFI	Unplanned System Average Interruption Frequency Index
VCR	Value of customer reliability

1 Executive Summary

The Essential Services Commission (**Commission**) has undertaken an inquiry into the reliability and quality of electricity supply on the Eyre Peninsula (**Inquiry**).

The Inquiry has identified various technical options that could be implemented in the short, medium and long term that would improve the reliability of supply on the Eyre Peninsula. The Inquiry has also considered technical options for the Eyre Peninsula that are not primarily aimed at delivering reliability benefits but may provide for other benefits to the region. While outside the scope of this Inquiry, those non-reliability driven options are also discussed in this report, as it is important that any future system planning for the Eyre Peninsula consider all community benefits, not just reliability benefits.

The Inquiry has identified opportunities to improve the regulatory framework to provide better processes for system planning and coordination of network and non-network activities. This is likely to lead to better outcomes for customers on the Eyre Peninsula, where a mix of technologies may be the best solution for addressing reliability problems at the lowest cost. This is a matter that has recently been taken up by the Council of Australian Governments (**COAG**) Energy Council, as a response to the Independent Review into the Future Security of the National Electricity Market – Blueprint for the Future. The Commission supports a national approach to pursuing greater coordination of system planning and has identified areas where greater transparency of information around joint planning could be achieved until such time as a national response is implemented.

1.1 Options for improving reliability of supply

The most cost effective options for improving reliability of supply on the Eyre Peninsula in the short term (within the next 2 years) include installing diesel generators near Yadnarie, Ceduna and Streaky Bay. Generation near those towns would improve reliability on the west coast of the Eyre Peninsula, where outages are generally more common. Supplementing those generators with distributed solar PV and batteries is likely to produce greater reliability benefits, although these would be outweighed by their additional cost above diesel generation.

Cost effective medium-term options for improving reliability of supply include targeted network hardening (re-insulating feeders prone to lightning strikes), which could be implemented over the next 3 to 5 years. Network hardening would be complementary to the short-term generation options.

The best long-term options for improving reliability will depend on future electricity demand on the Eyre Peninsula, which will be heavily dependent on whether or not the Iron Road magnetite project proceeds. If it proceeds, the electricity infrastructure will need to be augmented to support the higher demand, which would largely be funded by Iron Road as the primary cause for the change in demand. If it does not proceed, ElectraNet will at least have to replace the existing Cultana to Port Lincoln transmission line, which is at the end of its useful life. The most appropriate technical solution in this case is currently being considered by ElectraNet through a regulatory investment test process under the National Electricity Rules (**NER**). The short and medium term options are complementary to these long-term options.

1.2 Reliability and quality of supply performance on the Eyre Peninsula

The Inquiry has proposed short, medium and long-term options having regard to historical reliability and quality of supply on the Eyre Peninsula.

Reliability of electricity supply on the Eyre Peninsula was generally consistent between 2006-07 and 2015-16. There was a significant increase in the average duration of outages during 2016-17, due to the severe weather events on 8 September 2016, 28 September 2016 and 23 December 2016.

Regions supplied by long, radial distribution feeders (remote from the transmission network) typically receive the greatest total minutes off supply, and include regions near Elliston, Penong and Cowell.

Data on historical reliability performance on the Eyre Peninsula confirms that there are two different reliability problems that could be addressed:

- There are ongoing reliability problems at the distribution feeder level, which are driven mainly by lightning strikes on radial distribution lines affecting local supplies.
- More recent reliability problems are driven by severe weather events that mainly impacted transmission services affecting large parts of the Peninsula.

Survey evidence suggests that customers on the Eyre Peninsula are used to experiencing reliability problems and some have become conditioned to power outages. Among customers that are dependent on a reliable power supply (for example, supermarkets), some have installed their own backup generators. Representations from customers suggest that, during the 28 September 2016 state-wide outage, the greatest concern of customers was the loss of telecommunications services, which are dependent on electricity.

The Inquiry has received representations suggesting poor quality of supply (voltage variations) in parts of the Eyre Peninsula, although complaints data suggests there are few problems. SA Power Networks has reported that, during the 2006-07 to 2016-17 period, there were 209 quality of supply enquiries and nine quality of supply complaints. SA Power Networks conducted 12 load and voltage tests over the 10 year period, with nine requiring rectification at the distribution transformer level. The Energy and Water Industry Ombudsman SA (EWOSA) reported that it received 20 enquiries/complaints from 8 March 2014 to 8 March 2017 relating to quality of supply on the Eyre Peninsula.

To determine whether there are quality of supply problems, the Commission has requested that SA Power Networks install voltage testing equipment at particular locations on the Eyre Peninsula. That equipment was installed in July 2017 at six sites and data on voltage outcomes will be reported over the coming months. The Technical Regulator is providing independent oversight of that process.

1.3 Improving the incentives for prudent and efficient levels of reliability and quality of supply

The Commission has also considered if there are any impediments in the NER or the Commission's regulatory framework to promoting appropriate levels of reliability and quality of supply to customers on the Eyre Peninsula. In relation to those matters, the Commission's findings are:

- The current feeder-type reliability standards in the Electricity Distribution Code do not provide strong and clear incentives to SA Power Networks to maintain reliability on the Eyre Peninsula. The reliability standards are set on a feeder-type basis rather than a locational basis and reliability performance in certain regions has the potential to be 'hidden' in aggregated performance data, although a decline in regional performance has not been evident based on data reported to date. This is a matter that will be considered by the Commission in its current review of SA Power Networks' reliability standards to apply from 1 July 2020. In the meantime, the Commission will report reliability performance on a regional basis, through its quarterly reports on SA Power Networks' operational performance.

- While the NER requires transmission and distribution businesses to undertake joint planning, the split responsibilities along the electricity supply chain may not always align to deliver the best possible outcomes for customers, in comparison to a single overall responsibility. Under the NER, joint planning is the responsibility of transmission and distribution businesses and there is a commercial incentive for those businesses to pursue investments in their own networks ahead of other solutions. In addition, the transparency of information to enable non-network solution providers to engage in regulatory investment tests could be improved. The Commission recommends greater disclosure of information by the network businesses to facilitate more effective joint planning. Recent changes to the NER imposing greater reporting requirements on distribution businesses to facilitate non-network solutions may assist in this area.

1.4 Background to the Inquiry

The Inquiry was initiated following concerns raised by Eyre Peninsula community members about the customer impacts arising from the level of reliability and quality of supply in the region. The Inquiry was referred to the Commission by the South Australian Treasurer on 9 March 2017, pursuant to Part 7 of the Essential Services Commission Act 2002.

The Commission has undertaken a consultative and transparent approach in conducting this Inquiry. It has liaised directly with key stakeholders, including an Inquiry reference group consisting of Eyre Peninsula council representatives. It thanks members of the reference group, and all stakeholders that have participated in this Inquiry.

This Final Report contains the Inquiry's final findings and recommendations for the Treasurer's consideration.

2 Reliability and quality of supply on the Eyre Peninsula

Findings

2.1 Reliability of electricity supply on the Eyre Peninsula was relatively stable between 2006-07 and 2015-16. However, the average duration of outages increased significantly in 2016-17, due to severe weather events on 8 September 2016, 28 September 2016 and 23 December 2016. Advice from the Bureau of Meteorology suggested that those events resulted from a weather system that occurs every four to seven years and the intensity of the events in 2016 were particularly unusual.

2.2 Over the 10 years to 2015-16, regions on the Eyre Peninsula supplied by long, radial distribution feeders (remote from the transmission network) had the greatest total minutes off supply. They included regions near Elliston, Penong and Cowell.

2.3 Customers on the Eyre Peninsula and the Inquiry reference group indicated the electricity voltage delivered to customers in some areas may be outside regulatory requirements and is affecting the operation of customers' equipment. However, SA Power Networks and the Energy and Water Ombudsman of SA (**EWOSA**) have received few formal complaints relating to quality of supply on the Eyre Peninsula. Further evidence is required to determine any quality of supply problems on the Eyre Peninsula. That evidence is being obtained through voltage testing by SA Power Networks.

Recommendations

2.1 The Commission recommends SA Power Networks continues to monitor and report on a monthly basis to the Technical Regulator voltage outcomes at six sites on the Eyre Peninsula until 31 March 2018.

2.2 The Technical Regulator should review the voltage data provided by SA Power Networks (starting in October 2017), to determine if voltage at each site meets the requirements of the relevant Australian Standards. If voltage is found to be outside the Australian Standards, SA Power Networks should take corrective action as required under the Electricity Act 1996.

2.3 The Commission, in conjunction with the Technical Regulator, will report back to the Treasurer on the outcomes of the voltage monitoring program and will advise the Treasurer if any material voltage problems are discovered during testing, with a summary to be provided by 31 May 2018.

2.1 Reliability outcomes on the Eyre Peninsula

SA Power Networks' data shows that the reliability of electricity supply on the Eyre Peninsula deteriorated significantly in the first half of 2016-17 (when severe weather events caused power interruptions), relative to the previous 10 years.

Figure 2.1 shows historical supply reliability, as measured by the Unplanned System Average Interruption Duration Index (USAIDI). The USAIDI captures the average annual duration of unplanned interruptions experienced by customers. It is broken down into interruptions caused by generation and transmission outages, distribution outages caused by severe weather events (major event days, or MEDs),[1] and distribution outages that exclude the impact of MEDs. According to SA Power Networks

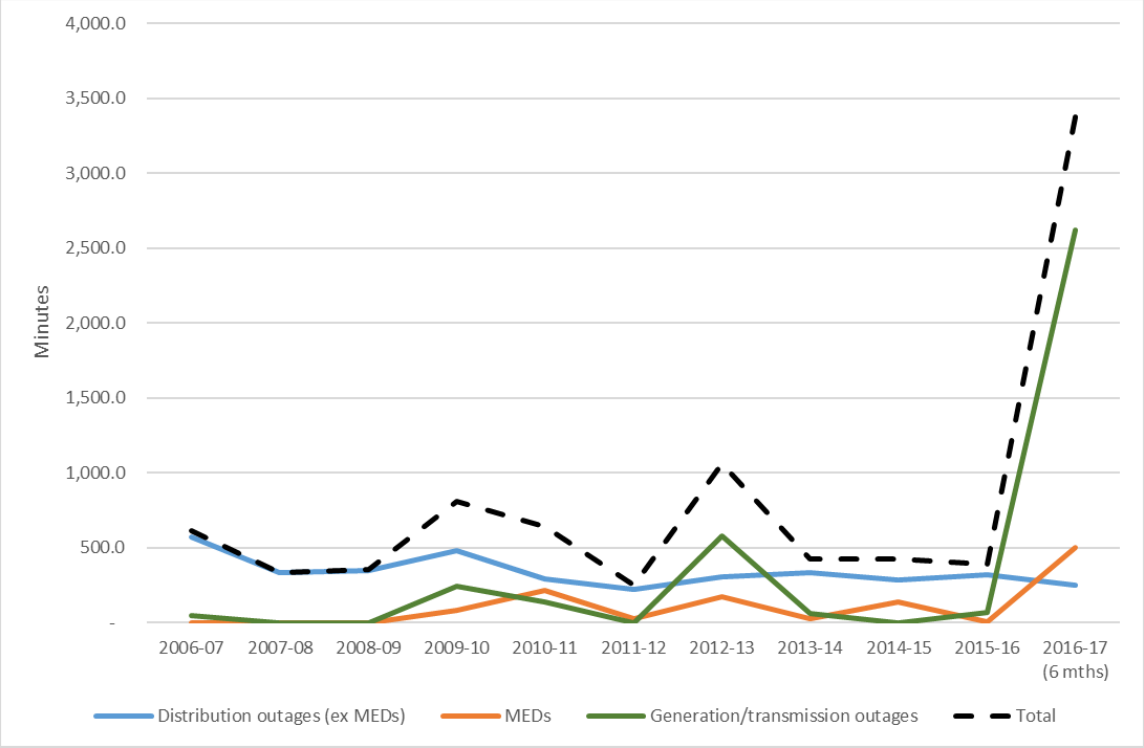
[1] The Commission uses MEDs to set distribution reliability standards under the Electricity Distribution Code, and to measure normalised distribution network performance. MEDs are defined under the Institute of Electrical and Electronics Engineers (IEEE) Standard 1366-2012

data, lightning strikes are the most common cause of distribution network outages on the Eyre Peninsula.

Between 1 July 2016 and 31 December 2016, USAIDI was nearly 3,400 minutes, of which generation/transmission outages comprised slightly more than 2,600 minutes. Average USAIDI over the previous 10 years was around 530 minutes per year, with an average of 400 minutes per year over the past three years.

As part of its investigation into the outages that arose from the 28 September and 27-28 December 2016 severe weather events, the Commission requested advice from the Bureau of Meteorology on those events. The Bureau of Meteorology has advised that the events resulted from a weather system that occurs every four to seven years and the intensity of the events in 2016 were particularly unusual.[2]

Figure 2.1: Eyre Peninsula USAIDI 2006-07 to 2016-17

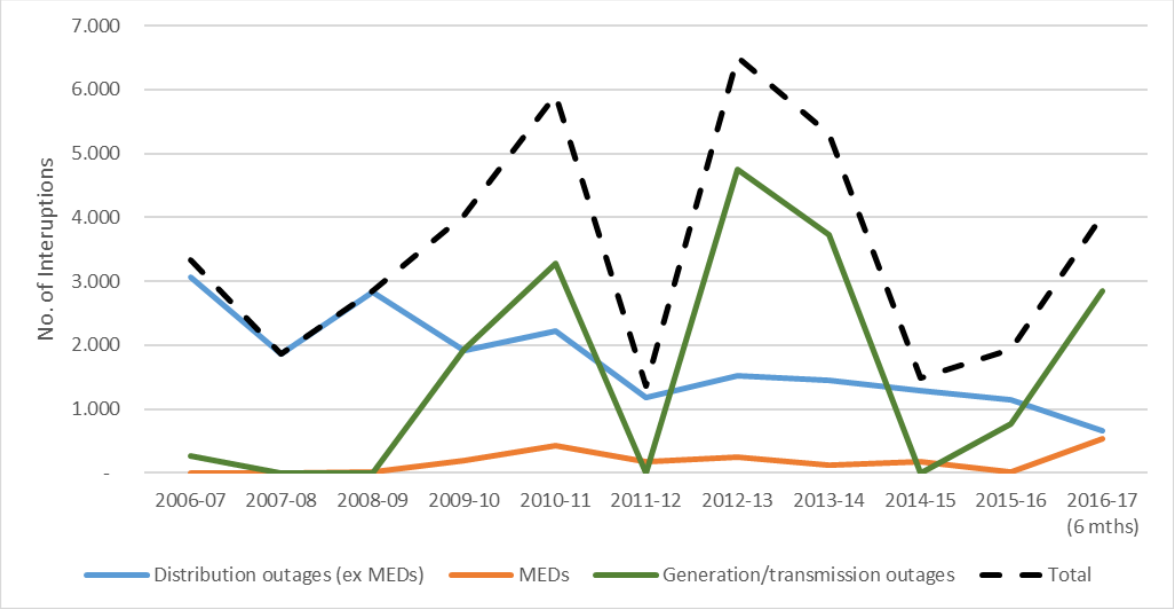


Source: SA Power Networks

The frequency of unplanned interruptions on the Eyre Peninsula is measured by the Unplanned System Average Interruption Frequency Index (USAIFI). Figure 2.2 shows USAIFI in the region ranged between around 1.5 and 6.5 interruptions per year, with an average of approximately 3.5 interruptions per customer per year. The severe weather events in the first half of 2016-17 did not affect USAIFI, whereas the length of the interruptions significantly impacted USAIDI. As shown in Figure 2.2, the frequency of interruptions was greater in 2012-13 relative to 2016-17.

[2] Bureau of Meteorology, *South Australia in 2016: Climate analysis for the Essential Services Commission of South Australia*, (available at http://www.escosa.sa.gov.au/ArticleDocuments/1054/20170623-Electricity-StatewideOutage28Sep2016-BOMClimateAnalysis.pdf.aspx?Embed=Y).

Figure 2.2: Eyre Peninsula USAIFI 2006-07 to 2016-17



Source: SA Power Networks

Figure 2.1 and Figure 2.2 show the frequency and duration of distribution outages (excluding MEDs) trended down over the past 10 years, indicating the underlying performance of the distribution network has improved. However, this improvement did not reflect the experience of customers that had power interruptions caused by severe weather events.

2.1.1 Distribution network reliability compared to regulatory standards

The Commission's distribution network reliability standards are not region specific and there is no current regulatory standard for the Eyre Peninsula to compare recent reliability outcomes. Prior to 1 July 2015, regional reliability standards did exist, including for the Upper North and Eyre Peninsula region, and reliability performance was generally poorer in that region than the regulatory target, as shown in Table 2.1.[3] The regulatory targets from 2005-06 to 2014-15 include the impacts of MEDs and reliability performance during that period was driven primarily by the impacts of severe weather events. The Commission found that SA Power Networks used its best endeavours to achieve the reliability target in each year.

Table 2.1: Upper North and Eyre Peninsula distribution USAIDI compared to regulatory target: 2005-06 to 2014-15 (includes MEDs)[4]

Period	Average annual USAIDI performance (minutes)	Annual USAIDI target (minutes)
2005-06 to 2009-10	449	370
2010-11 to 2014-15	488[5]	425

[3] As discussed in Section 4.3, the Commission moved from setting reliability standards on a regional basis to a feeder-type basis from 2015-16, in part to align with the AER's Service Target Performance Incentive Scheme.

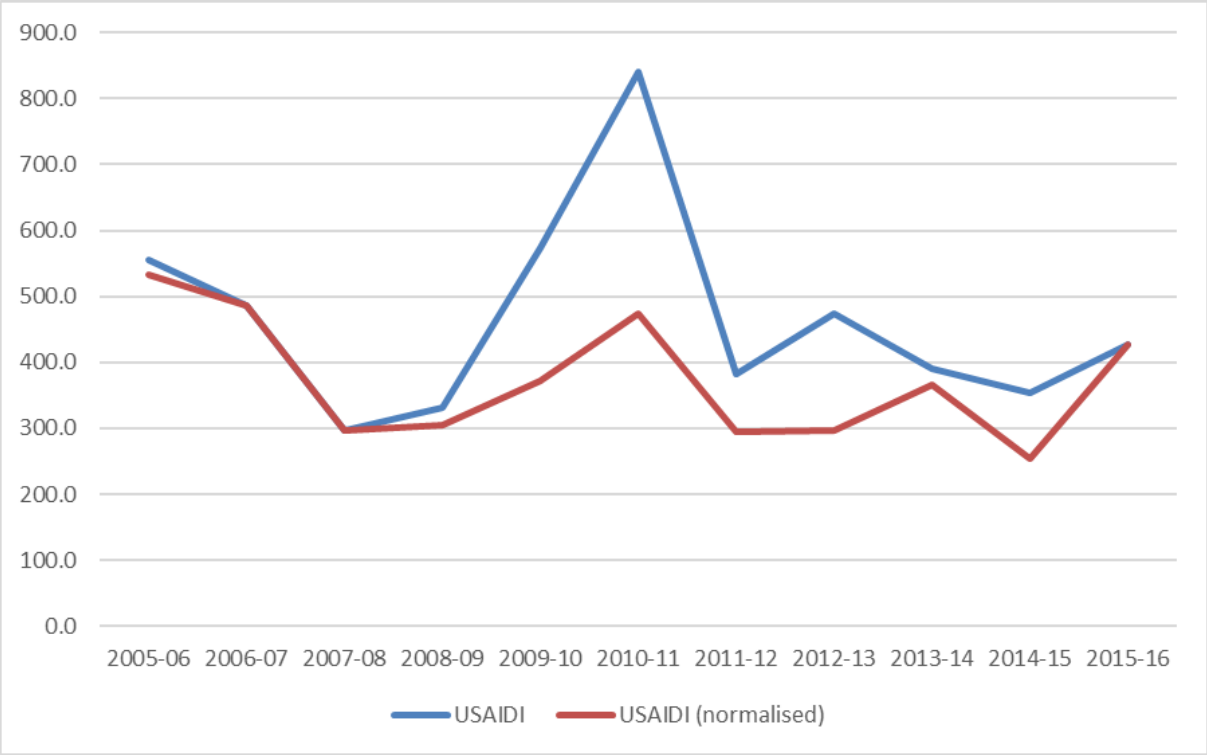
[4] Some feeders within the Upper North and Eyre Peninsula region (at Port Lincoln and Port Augusta) sit within the Major Metropolitan Areas region.

[5] If 2010-11 is excluded from this five-year figure, average annual USAIDI decreases to 406 minutes, which is within the annual USAIDI target.

While the Upper North and Eyre Peninsula region is larger in size than the Eyre Peninsula alone, the reliability results are weighted heavily towards performance on the Eyre Peninsula due to the greater number of customers on the Eyre Peninsula relative to the Upper North.

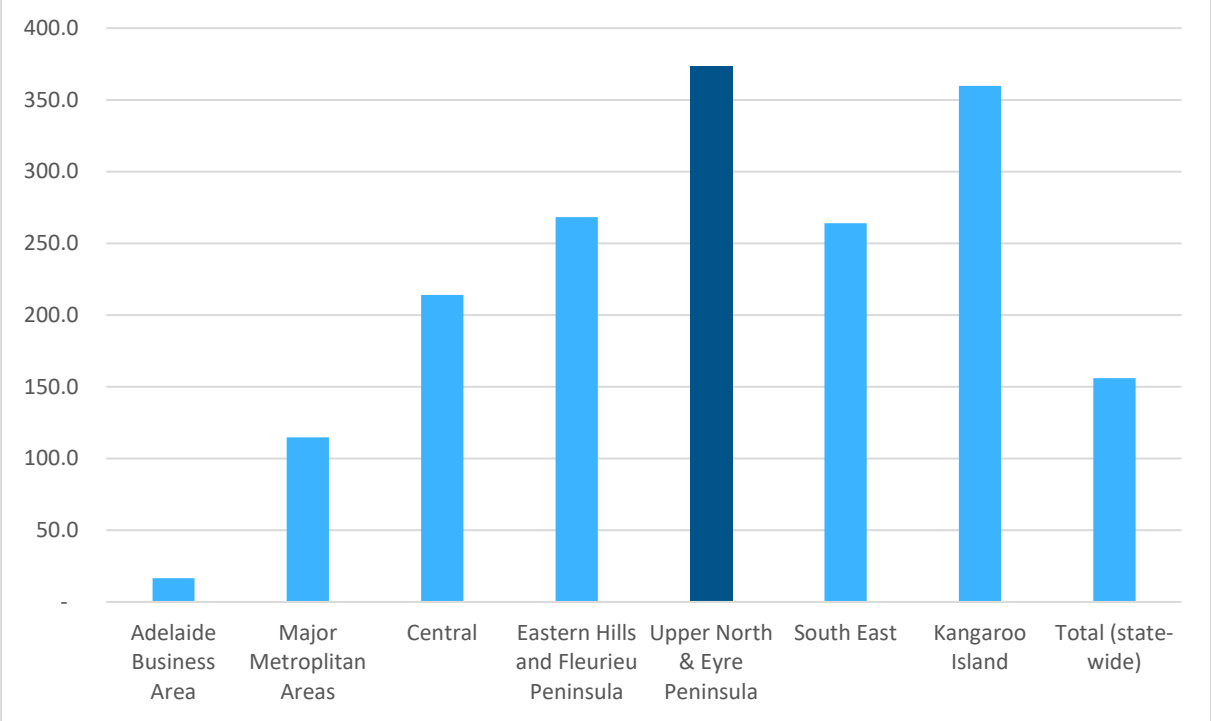
Figure 2.3 shows the annual USAIDI outcomes for the Upper North and Eyre Peninsula between 2005-06 and 2015-16. The increasing trend in USAIDI over the period is compared to the relatively flat trend in normalised USAIDI (which excludes MEDs). This supports the data presented earlier; underlying network performance, excluding the impact of severe weather events, was generally stable over the past 10 years. The increase in non-normalised USAIDI in 2010-11 is related to outages that occurred in the Upper North during that year.

Figure 2.3: Upper North and Eyre Peninsula USAIDI 2005-06 to 2015-16 (minutes)



The Commission monitors distribution network reliability across various regions of South Australia. Over the past 11 years, the Eyre Peninsula and Upper North region has, on average, experienced the highest USAIDI compared to the other regions in the State. Figure 2.4 shows the 11-year average USAIDI across regions, which excludes the impacts of MEDs, transmission outages and generation outages.

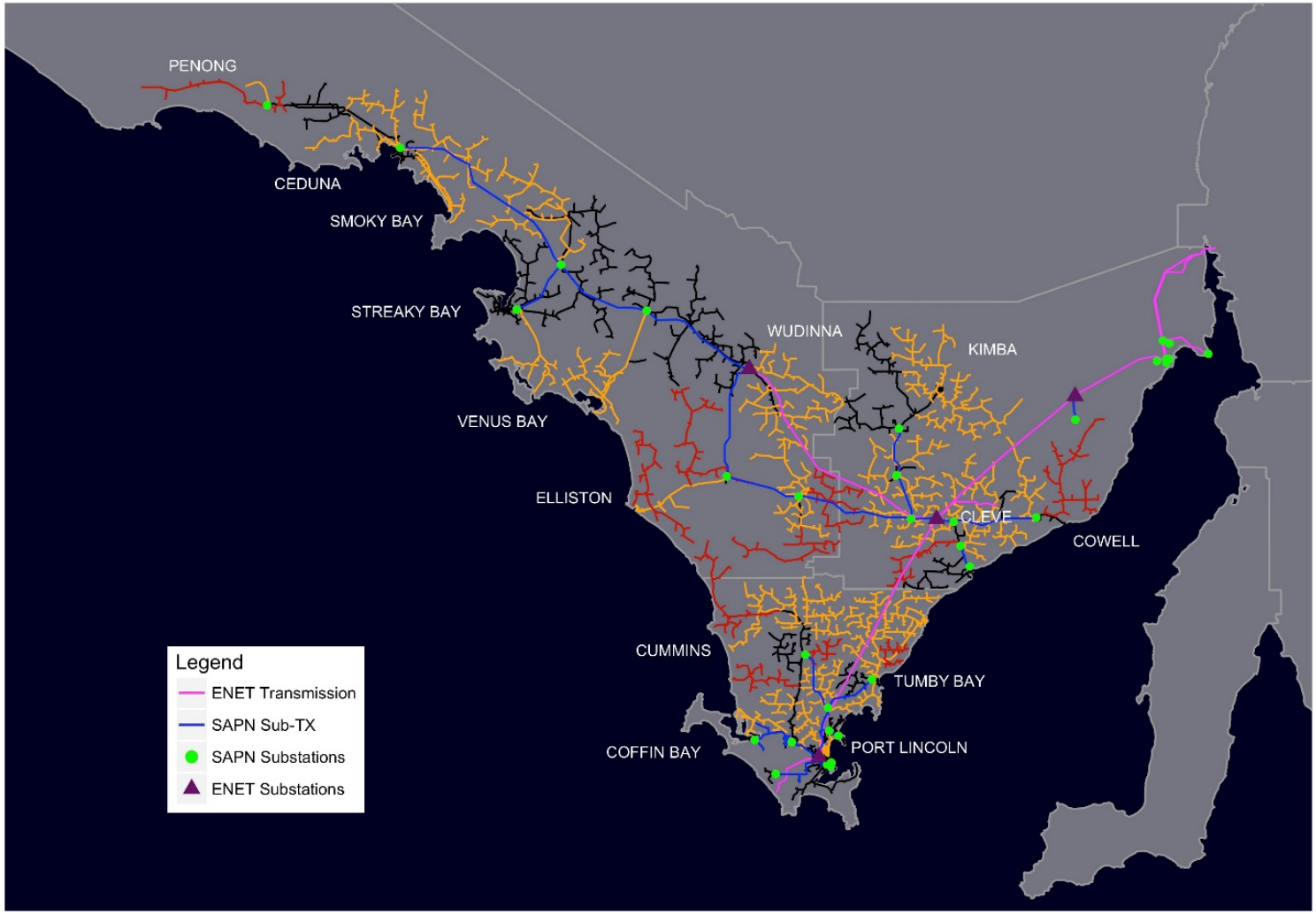
Figure 2.4: USAIDI by region averaged over 2005-06 to 2015-16 (excl. MEDs, transmission and generation outages)



2.1.2 Distribution network reliability varies across the Eyre Peninsula

Figure 2.5 shows the differences in USAIDI across different areas of the Eyre Peninsula over the past 10 years. The performance includes the impact of Major Event Days (MEDs) and the impact of generation and transmission interruptions. The black feeders experienced reliability performance better or near the region average. The orange feeders experienced mixed performance over the period, and the red feeders experienced relatively poor performance relative to the rest of the region.

Figure 2.5: Distribution feeder reliability performance 2006-07 to 2015-16 (USAIDI outcomes, including MEDs and transmission outages)



Source: SA Power Networks

Figure 2.5 reflects feeder reliability performance, and the data is not weighted by customer numbers on each feeder. Table 2.3 shows the proportion of customers on each feeder category; notably, red feeders supply only four per cent of customers on the Eyre Peninsula.

Table 2.2: Proportion of customers on feeders classified by reliability

	Black (%)	Orange (%)	Red (%)
Customers	74	22	4
HV feeder (by length)	32	53	15

Figure 2.5 shows feeders that are close to the transmission and sub-transmission networks generally had better reliability outcomes than had the long, radial distribution feeders that are remote from the transmission network. Regions that experience the greatest average minutes off supply include those near Elliston, Penong and Cowell.

Chapter 3 discusses potential technical options for addressing the reliability of supply problems.

2.2 Concerns raised by customers

The Commission consulted with the Inquiry reference group, to understand Eyre Peninsula customers' experiences of supply reliability and quality. The reference group stated electricity supply outages had become a part of life for many customers on the Eyre Peninsula, and customers had become conditioned to them.

An Eyre Peninsula customer survey—conducted by Regional Development Australia (Whyalla and Eyre Peninsula) following the 28 September 2016 state-wide outage—confirmed the reference group's impression. Of the 320 surveyed customers, 85 per cent had experienced a power outage (additional to the 28 September 2016 outage) in the previous 12 months. Many business customers were preparing for regular power outages, with 35 per cent of business respondents stating they owned/maintained back-up power generators.

Both the customer survey and the reference group found customers' greatest frustration during the 28 September 2016 outage was the lack of telecommunications access, which was caused by the power outage and failures of back up supplies. The reference group also stated some customers were concerned with quality of supply problems, which were blamed for damage to customers' equipment. Yet, despite anecdotal evidence of poor quality of supply (voltage variations) in parts of the Eyre Peninsula, complaints data suggests there are few problems. SA Power Networks reported 209 quality of supply enquiries and nine complaints in the 10 years to 2016-17. Further, it ran 12 proactive load and voltage tests over that period, of which nine required rectification at the distribution transformer level. EWOSA reported 20 enquiries/complaints (from 8 March 2014 to 8 March 2017) relating to quality of supply on the Eyre Peninsula.[6]

To determine the extent of any quality of supply problem on the Eyre Peninsula, the Commission asked SA Power Networks to install voltage testing equipment at particular locations on the peninsula. That equipment was installed in July 2017 at six sites and data on voltage outcomes will be reported over the coming months. The Technical Regulator is providing independent oversight of that process. Should the tests show that voltage is outside the relevant Australian Standards, SA Power Networks should take corrective action as required under section 46 of the Electricity (General) Regulations 2012. The Commission, in conjunction with the Technical Regulator, will report back to the Treasurer on the

[6] EWOSA has advised that its categorisation of quality of supply complaints may not correlate with SA Power Networks' definition of a quality of supply complaint, which may partly explain the difference in the number of complaints reported by both organisations.

outcomes of the voltage monitoring program and will advise the Treasurer if any material voltage problems are discovered during testing, with a summary to be provided by 31 May 2018.

3 Options for improving reliability of supply

Findings

3.1 The Commission's network reliability standards are a major driver of any option that would improve reliability of supply on the Eyre Peninsula. Notwithstanding that the current reliability of supply is within the regulated standards, options for improving reliability of supply on the Eyre Peninsula in the short term (within the next 2 years) should focus on localised supply. Local options such as installing diesel generators near Yadnarie, Ceduna and Streaky Bay will be the most cost effective short-term measures. Supplementing those generators with distributed solar PV and batteries is likely to produce greater reliability benefits over time but these would be outweighed by their additional cost above diesel generation.

3.2 Cost effective medium-term options for improving reliability of supply within the current framework include targeted network hardening (re-insulating feeders prone to lightning strikes), which could be implemented over the next 3 to 5 years. Network hardening would be complementary to the short-term generation options.

3.3 The best long-term options for improving reliability will depend on future electricity demand on the Eyre Peninsula, which in turn will be heavily dependent on whether or not the Iron Road magnetite project proceeds. If it proceeds, the electricity infrastructure will need to be augmented and/or duplicated to support the higher demand. As the primary cause for the change in demand, any network augmentation would largely be funded by Iron Road. The underlying level of reliability to the Eyre Peninsula will increase from this development.

3.4 If the mine does not proceed, ElectraNet will at least need to replace the existing Cultana to Port Lincoln transmission line due to the age of the asset and risk of failure. The most appropriate technical solution is currently being considered by ElectraNet through a regulatory investment test process. The medium-term options are complementary to these long-term options.

3.5 The options identified in this review are focussed purely on improving reliability; other options exist that may bring broader benefits to the Eyre Peninsula and facilitate broader infrastructure development, such as facilitating connection of large-scale renewable generation (e.g. Green Grid). While consideration of those non-reliability driven options is outside the scope of this Inquiry, it is important for the Government to consider them given its broader economic, environmental and social objectives. The Inquiry also notes that the RIT-T and RIT-D are focussed on electricity customer benefits (and costs), not on the broader community.

Recommendations

3.1 The Commission will consider those options that produce cost effective reliability improvements in its upcoming review of the reliability standards under the Electricity Distribution Code. As the costs of any distribution reliability improvement to the Eyre Peninsula would be borne by all South Australian distribution customers, the Commission will take into account customers' willingness to contribute towards the cost of those improvements before changing any standards.

Based on the analysis of network reliability discussed in the previous chapter, there are two distinct aspects of performance that could be addressed through technical solutions.

1. There are ongoing reliability issues at the distribution level, driven mainly by lightning strikes on radial distribution lines affecting local supplies. Technical solutions that provide an alternative source of supply to a feeder, or can improve the ability of an existing feeder to withstand lightning strikes, may address that problem. Customer-owned backup generation can also address that problem, as evidenced by the significant proportion of business customers with on-site generation.

2. More recent reliability problems have been driven by severe weather events that mainly impacted transmission services affecting large parts of the peninsula. Greater diversity of supply sources (geographically) may address that problem.

The Commission has sought to identify possible network and non-network solutions, to provide a range of options for consideration in the short, medium and long term. Those options range from large, centralised solutions (large-scale generation and transmission options) to small, decentralised solutions (small-scale solar and battery options). A summary of the options, including the potential improvements in reliability and annualised cost of each option, can be found at Table 3.5 in this chapter.

Where information is available, the costs and reliability benefits of each option have been separately assessed by the Commission.[7] It has also assessed the costs and reliability benefits of certain options that could be implemented in combination. The Commission has not attempted to conduct a detailed review of the efficiency of each option, due to the timeframes available. Nor has it attempted to quantify any non-reliability benefits that might arise from each option, although it has noted those benefits where possible.

There is a separate regulatory process for determining the efficiency of network and network support projects and identifying all market benefits. In that process, the AER can review all forecast capital and operating costs as part of a network business' five-year revenue determination or through a Regulatory Investment Test for distribution or transmission expenditure. Those are the proper mechanisms for reviewing the market costs and benefits of network and network support projects discussed in this Final Report, should they be proposed.

Some of the generation projects discussed in this Final Report may also be pursued on a commercial basis, using revenues available from the wholesale electricity and ancillary services markets.

To assess the costs and reliability benefits of the options, the Commission has developed a base case, which reflects the current electricity supply arrangements on the Eyre Peninsula. The continued availability of the Synergen-operated generators at Port Lincoln is part of that base case.

The analysis assumes zero load growth on the Eyre Peninsula. The Inquiry notes that the Iron Road magnetite project may, however, have a significant impact on the future electricity supply requirements for the Eyre Peninsula. If it proceeds, the project is expected to add 350MW to the existing 120MW of demand on the Eyre Peninsula (which includes demand in the Whyalla region). The project is not yet confirmed, and any long-term supply options for the Eyre Peninsula should only be pursued when there is certainty about the mine's future.

Likewise, any unconfirmed new supply sources (for example, potential expansion of the existing co-generation plant at the Whyalla steelworks), has not been reflected in the analysis.

The following sections present the options, before comparing the relative costs and reliability benefits.

[7] The methodology for calculating reliability benefits and costs is described in Appendix B.

3.1 Generation options submitted by SA Power Networks

SA Power Networks has identified three generation options for the Eyre Peninsula. Those options are described in Table 3.1.

Table 3.1: SA Power Networks' generation options

Option	Overview
Option 1 – Upgrade SA Power Networks' sub-transmission network to enable supply of the far west coast of Eyre Peninsula from Port Lincoln power station in circumstances when the transmission network north of Yadnarie is interrupted.	This is a network option, which will enable the Port Lincoln power station to supply the central and western Eyre Peninsula via the Yadnarie substation in addition to southern Eyre Peninsula, which should be supplied under ElectraNet's existing Network Support Agreement (NSA) at Port Lincoln. The option would also involve upgrade of the sub-transmission network's protection and communication systems in support of control and operation of this new network functionality, including installing SCADA to relevant sites (remote monitoring and control/switching to Rudall, Lock and Polda substations). This option would also require ElectraNet commitment to amend/renegotiate its current NSA at Port Lincoln power station, to allow for the supply of energy (per the ElectraNet NSA to customers via the upgraded network). In the event of an outage of the Cultana-Yadnarie 132kV line, all customers on the Eyre Peninsula (excluding Whyalla, which can be supplied via the Davenport to Cultana transmission line) could be supplied from the Port Lincoln power station under all demand conditions. Total maximum demand on the Eyre Peninsula (excluding the Whyalla region) is around 50MW, which could be met by two of the Port Lincoln generators. For an outage of both the Cultana-Yadnarie 132kV and the Yadnarie-Wudinna 132kV transmission lines, customers in the western Eyre Peninsula could be supplied under non-peak demand conditions (ie not under peak load conditions for the western Eyre Peninsula) via the 66kV sub-transmission network between Yadnarie and Wudinna. This options improves security of supply for these scenarios (mitigates the risk of loss of transmission line(s) or upstream generation). Annual SAIDI benefit to central and western Eyre Peninsula customers (8,780 customers) of around 370 minutes (based on proxy operating conditions experienced over last five years).
Option 2 – Install Generation at Wudinna substation (SS) and upgrade 66kV sub-transmission network	This is a network support option involving installation of a standby power station at/near Wudinna 132/66kV substation to supply the central and western Eyre Peninsula (ie excludes any supply to or from southern Eyre Peninsula). This would include an upgrade of the Wudinna SS to enable the injection of the generations output into the 66kV sub-transmission network. The option would also involve upgrade of the 66kV sub-transmission network's protection and communication systems in support of control and operation of this new network functionality including installation of SCADA (ie monitoring and control/switching) to Rudall, Lock, Polda, substations. Note: Supply should be maintained to southern Eyre Peninsula as a result of ElectraNet's NSA at Port Lincoln. In the event of an outage of the three (Cultana-Yadnarie, Yadnarie-Port Lincoln and Yadnarie-Wudinna) 132kV

Option	Overview
	transmission lines, then there would be constrained supply to central Eyre Peninsula via the Wudinna-Yadnarie 66kV sub-transmission line. Further studies can quantify the extent of work required to remove the constraint. This option improves security of supply where there is loss of transmission line(s) or upstream generation. Annual SAIDI benefit to central and western Eyre Peninsula customers (ie 8,780 customers) of around 370 minutes (based on proxy operating conditions experienced over last five years).
Option 3 – Install generation at Yadnarie, Ceduna and Streaky Bay substations and upgrade 66kV sub-transmission network as required	This is a network support option involving installation of standby power stations at/near Yadnarie 132/66kV, Ceduna 66/11kV and Streaky Bay 66/11kV substations to supply the central and western Eyre Peninsula (ie excludes any supply to or from southern Eyre Peninsula). This would include an upgrade of the Yadnarie, Ceduna and Streaky Bay substations to enable the injection of the generation output into the 66kV sub-transmission network. The option would also involve upgrade of the 66kV sub-transmission network's protection and communication systems in support of control and operation of this new network functionality, including installation of SCADA (ie monitoring and control/switching) to Rudall, Lock, Polda, Ceduna and Streaky Bay substations. Note: Supply should be maintained to southern Eyre Peninsula as a result of ElectraNet's NSA at Port Lincoln. Supply would be maintained to customers in western and central Eyre Peninsula under all demand conditions for an outage of the: ▶ Cultana-Yadnarie 132kV transmission line or ▶ Yadnarie-Wudinna 132kV transmission line. In addition, this option will maintain supply to customers supplied from the Streaky Bay and Ceduna substations (a total of 3,870 customers) for outages of the 66kV sub-transmission network between Wudinna, Ceduna and Streaky Bay. Improves security of supply for these scenarios (ie mitigates the risk of loss of transmission line(s), sub transmission line(s) or upstream generation). Annual SAIDI benefit to western and central Eyre Peninsula customers (ie 8,780 customers) of around 420 minutes (based on proxy operating conditions experienced over last five years).

All three of the options submitted by SA Power Networks deliver significant reliability benefits to customers. However, as shown in section 3.7 below, generation option 1 has the lowest capital and operating cost (as it utilises the existing Port Lincoln generators and only involves network protection and communication systems upgrades). There is, however, uncertainty as to whether or not the benefits of that option would be realised over the long term as it depends on ElectraNet continuing the NSA at Port Lincoln. Generation options 2 and 3 are not contingent on the NSA, and it may be more prudent to pursue either of those options until the long-term future of the NSA is assured. However, as shown in Table 3.6, the reliability benefits from the generation options would reduce if ElectraNet proceeded with its proposal to upgrade or duplicate the Cultana to Port Lincoln transmission line.

3.1.1 Decentralised generation options

The Commission has also considered the possibility of using a decentralised local generation solution for the worst served townships as a means of backup supply should a network line fail. Based on current technologies, a purely decentralised option is not viable as it is unable to provide appropriate system security.

The Commission analysed the possibility of using a PV and battery mix as back up from a line fault. SA Power Networks is trialling a similar system at Salisbury.[8] The Commission has consulted with SA Power Networks to see if such a solution could work on the Eyre Peninsula.

For a decentralised solution to work, there are some technical and practical issues that need to be overcome. In particular, for residential PV to be used as a form of decentralisation, the PV inverters need a point of reference to synchronise to the correct frequency. Inverter technology is currently unavailable to set this point of reference. Some form of constant high-powered generation is needed to set that reference. A large-scale generator (or possibly a large-scale battery) is needed to provide this reference.

In addition, grid support from PV generation would not be available if an outage occurs during night time or in a storm, unless small-scale batteries were installed alongside the PV units. By doing so, in high PV generation periods the batteries will charge and at times of low PV generation, the batteries can be discharged.

If batteries are used, there is a limit on how long they can discharge. Typically, power to energy for small-scale batteries are between 2-4 hours (depending on a customers' energy usage behaviour).

Considering the need to have a point of reference for frequency synchronisation, a pure decentralised option is not currently possible, although technological changes may address that problem in the future.

3.1.2 A hybrid option

To overcome those technical problems, a hybrid option (involving distributed generation and large-scale generation) could be implemented, although it would be less cost effective than large-scale (synchronous) generation alone. The Inquiry has considered this option through a combination of the diesel generators under options 2 and 3 above, with solar PV and batteries installed at customers' premises.

The installed size and operating time of the diesel generators could potentially be reduced if combined with distributed PV and batteries. For example, the size of the diesel generators at Ceduna could be reduced by 1MW if approximately 200 customers were encouraged to take-up PV/battery systems (likely at a subsidised rate). The saving in diesel cost (approximately $1.5 million) could provide a subsidy of up to $7,500 to each customer installing the PV/battery system, with no net cost increase.

The hybrid option has the advantage of directly benefitting those customers that receive the PV/battery system, by enabling them to avoid paying retail electricity charges at times of solar energy production.

In addition to customers becoming more self-sufficient, the PV/battery systems increase reliability of supply to those customers, as they provide an independent source of supply. SA Power Networks has suggested that, based on their experience, a subsidy of $5,000 to $7,500 per system would attract significant take-up.

[8] Information about the trial is available on SA Power Networks' website at https://www.sapowernetworks.com.au/public/download.jsp?id=54883.

3.2 Distribution network hardening options submitted by SA Power Networks

SA Power Networks has submitted three network hardening options, as set out in Table 3.2. The options involve the same technical solution (reinsulation of distribution feeders), but implemented at different scales.

Table 3.2: SA Power Networks' network hardening options

Option	Overview
Option 1 – Harden distribution network against lightning (95 percent of feeders)	Network option to improve reliability to customers on 95 percent of the high voltage distribution feeders on Eyre Peninsula. Reinsulate about 38,000 poles with lightning resistant insulators.
Option 2 – Harden distribution network against lightning (about 48 percent of feeders)	Network option to improve reliability to customers on about 48 percent of the distribution feeders on Eyre Peninsula. Reinsulate about 19,000 poles with lightning resistant insulators. Feeders will be targeted for reinsulating based on greatest benefit to customers (ie reinsulated feeders that will result in the greatest reduction in annual SAIDI, as some feeders have worse reliability and as such a greater contribution to annual SAIDI than other feeders).
Option 3 – Harden distribution network against lightning (about 25 percent of feeders)	Network option to improve reliability to customers on about 25 percent of the distribution feeders on Eyre Peninsula. Reinsulate about 10,000 poles with lightning resistant insulators.

The net benefit of the hardening options reduces as the scale of the roll-out increases. This is because a smaller roll-out would target those feeders with the lowest reliability levels. As the scale of implementation increases, the marginal benefit of additional reinsulation diminishes.

During 2016-17, SA Power Networks reinsulated the worst impacted feeder sections on the Eyre Peninsula, targeting 575 poles and 1,335 insulators. It has stated that this targeted replacement is producing reliability benefits to the relevant feeders.

3.2.1 SCADA options submitted by SA Power Networks

SA Power Networks has presented three SCADA options involving the upgrading of remote monitoring and control of switches on its high voltage feeders. The options differ only in the scale of implementation. The options are described in Table 3.3.

Table 3.3: SA Power Networks' SCADA options

Option	Overview
Option 1 – Enable remote monitoring and control on all high voltage feeders on Eyre Peninsula	This is a distribution network option. Upgrade all reclosers and mid-line sectionalisers and install remote monitoring and control to these devices. Install/upgrade switches (ie reclosers and sectionalisers) on existing non-SCADA source and mid-line reclosers and SWER sectionalisers to SCADA controlled "fuse saver" devices. Any interruption affecting these devices will be immediately reported via SCADA (ie customers will not need to contact SA Power Networks to report outages of whole or part feeders). Also, reduces need for restoration crews to physically check switch status and travel to manually operate switches. The installation

Option	Overview
	of these devices will enable quicker response times to customers who experience outages and reduce outage times by up to 60 minutes (eg do not have to travel to manually operate a switch, as it will be operated remotely). Annual SAIDI benefit to Eyre Peninsula Customers (ie 23,870 customers) is 23 minutes (modelled estimate).
Option 2 – Enable remote monitoring and control of switches on selected high voltage feeders on Eyre Peninsula (235 switches)	This is a distribution network option. Upgrade targeted reclosers and mid-line sectionalisers and install remote monitoring and control to these devices. Install/upgrade switches (ie reclosers and sectionalisers) on existing non-SCADA source and mid-line reclosers and SWER sectionalisers to SCADA controlled "fuse saver" devices. Feeders will be selected on greatest benefit to customers. Any interruption affecting these devices will be immediately reported (ie customers will not need to contact SA Power Networks to report outages of whole or part feeders). Also, reduces need for restoration crews to physically check switch status and travel to manually operate switches. The installation of these devices will enable quicker response times to customers who experience outages and reduce outage times by up to 60 minutes (eg do not have to travel to manually operate a switch, as it will be operated remotely). Annual SAIDI benefit to Eyre Peninsula Customers (ie 23,870 customers) is 21 minutes (modelled estimate).
Option 3 – Enable remote monitoring and control of switches on selected high voltage feeders on Eyre Peninsula (121 switches)	This is a distribution network option. Upgrade targeted reclosers and mid-line sectionalisers and install remote monitoring and control to these devices. Install/upgrade switches (ie reclosers and sectionalisers) on existing non-SCADA source and mid-line reclosers and SWER sectionalisers to SCADA controlled "fuse saver" devices. Feeders will be selected on greatest benefit. Any interruption affecting these devices will be immediately reported (ie customers won't need to contact SA Power Networks to report outages of whole or part feeders). Also, reduces need for restoration crews to physically check switch status and travel to manually operate switches. The installation of these devices will enable quicker response times to customers who experience outages and reduce outage times by up to 60 minutes (eg do not have to travel to manually operate a switch, as it will be able to be operated remotely). Annual SAIDI benefit to Eyre Peninsula Customers (ie 23,870 customers) is 16 minutes (modelled estimate).

While none of the SCADA options produce significant reliability benefits to customers, the small-scale roll-out of SCADA involves the lowest cost to customers. Similar to the network hardening options, the more targeted approaches deliver greater reliability benefits per dollar spent than the wide-scale approaches.

3.3 Transmission network options submitted by ElectraNet

ElectraNet has provided the Commission with five transmission network reliability improvement options. Those options are currently going through a separate public consultation process, as part of a RIT-T under the NER.[9]

ElectraNet has identified the need for capital expenditure on the Eyre Peninsula transmission network, due to deterioration of the conductor on the 132kV Cultana to Port Lincoln line. It is also reviewing options for providing N-1 reliability to Port Lincoln as required in the Electricity Transmission Code, as the existing NSA with Synergen for the stand-by generators at Port Lincoln is due to expire in December 2018.

The options identified by ElectraNet are all aimed at achieving the reliability standards set out in the Electricity Transmission Code. ElectraNet has indicated that some of the options may deliver reliability of supply at certain connection points that is better than that required under the Electricity Transmission Code.

The options identified by ElectraNet are set out in Table 3.4.

Table 3.4: ElectraNet's transmission reliability options

Option	Overview	Potential reliability benefits
Option 1 – Continue network support at Port Lincoln and component replacement works on the existing 132 kV single-circuit transmission line	Continue NSA for services combined with 132 kV line replacement works	• Shore up reliability
Option 2 – Double circuit 132 kV line	Construction of a new double circuit 132 kV transmission line following a Cultana to Yadnarie and Yadnarie to Port Lincoln route	• Replace existing line • Eliminate reliance on backup generators
Option 3 – Two single circuit 132 kV lines	Construction of two single circuit 132 kV transmission lines following separated routes between Cultana and Port Lincoln	• Building separate lines makes the network more reliable and would require a new easement • Eliminate reliance on backup generators
Option 4 – Double circuit 275 kV line	Construction of a double circuit 275 kV transmission line following a Cultana to Yadnarie and Yadnarie to Port Lincoln route	• Eliminate reliance on backup generators • Initially operated at 132kV but capable of upgrade to 275kv when needed
Option 5 – two single circuit 275 kV lines	Construction of two single circuit 275 kV transmission lines following separated routes between Cultana and Port Lincoln	• Separate lines make the network more reliable • Eliminate reliance on backup generators

[9] ElectraNet, *Eyre Peninsula Electricity Supply Options, RIT-T Project Specification Consultation Report*, April 2017 (available at https://www.electranet.com.au/wp-content/uploads/2017/04/20170428-Report-EyrePeninsulaElectricitySupplyOptionsPSCR.pdf).

Option	Overview	Potential reliability benefits
		• Initially operated at 132kV but capable of upgrade to 275kv when needed

Source: ElectraNet

ElectraNet has stated that non-reliability benefits may arise from the options, including benefits expected to arise from relieving the current output constraints on existing Eyre Peninsula wind farms, as well as option benefits through facilitating additional wind generation and the connection of new mining loads.

The submission from the Energy Security for South Australia Working Party (ESSAWP) to the Inquiry expressed concerns with ElectraNet's options.[10] It suggested that the existing generators at Port Lincoln are unreliable and ElectraNet's option 1 was not credible. It presented information to the Commission in support of that claim. It also considered options 2 to 5 to be inadequate, as they provide minimal opportunities for the connection of large-scale renewable generation.

Evaluation of the market benefits of ElectraNet's options, including non-reliability benefits, is beyond the scope of this Inquiry and are to be addressed in the RIT-T process that ElectraNet has recently commenced.

In relation to ESSAWP's concern about the reliability of the Port Lincoln generators, the Commission has requested that ElectraNet respond to the claims and information provided by ESSAWP. It will consider that response in light of the compliance investigation that the Commission has already undertaken in relation to the performance of the generators following the 28 September 2016 state-wide outage.[11] That investigation found no evidence of ElectraNet breaching its regulatory obligations. The Commission also notes that ElectraNet is currently looking at a range of network support options at Port Lincoln and its proposed option 1 does not assume continuation of the current service provider.

3.4 Options submitted by Eye Energy Systems

Eye Energy Systems submitted two options for improving reliability to customers on the Eyre Peninsula. Both of the options are currently being developed by Eye Energy Systems and its partners on a commercial basis.

3.4.1 Eyre Peninsula Solar PV - Cleve and Wudinna

Eye Energy Systems, in conjunction with Sunpact, is proposing to install large-scale embedded solar PV generation within the existing Eyre Peninsula electricity network, with the potential for co-location of battery storage. There are two sites under development - Cleve (10MW solar PV plant) and Wudinna (15MW solar PV plant), which it states will generate around 120GWh of total electricity per annum.

Eye Energy Systems has stated that the installation of embedded generation would reduce reliance on the transmission network to import electricity from more distant generation. It also stated that it will improve power quality in the local network.

---

[10] Energy Security for South Australia Working Party, *Submission to the Inquiry into the reliability and quality of electricity supply on the Eyre Peninsula*, May 2017, pages 4-5 of unnumbered. (available at http://www.escosa.sa.gov.au/ArticleDocuments/1085/20170831-Inquiry-ReliabilityQualityElectricitySupplyEyrePeninsula-DraftReportSubmission-ESSAWP.pdf.aspx?Embed=Y)

[11] The Commission's report on that compliance investigation is available at http://www.escosa.sa.gov.au/ArticleDocuments/1054/20170623-Electricity-StatewideOutage28Sep2016-TransmissionLicenceComplianceReview-ElectraNet.pdf.aspx?Embed=Y.

The projects are privately funded, with revenue streams to be earned through wholesale electricity and ancillary services markets. Therefore, the commercial risks of the projects would not be borne by customers, who would only pay for the market services provided by those options as they are delivered.

3.4.2 Port Lincoln Tuna industry Solar PV - Smart Mini Grid/Virtual Net Metering

Eye Energy Systems is working with Flextronics to install 2MW of distributed solar PV generation within an existing section of the Port Lincoln electricity network (an industrial precinct with several tuna businesses), with the potential for colocation of battery storage. The virtual net metering arrangement would allow users to share energy, where solar exports from one user could be credited against the consumption of another user. It may free up network capacity for other customers on the Eyre Peninsula. This project would also be privately funded.

3.5 Option submitted by Enlighten Power Systems Pacific

The submission from Enlighten Power Systems Pacific (Enlighten) submitted a floating combined cycle generator (Powership), which it suggested could be located in various places around the Eyre Peninsula, ideally located near Whyalla or Port Augusta. It suggested that the Powership could be in place within 120 days and provide up to 500MW of synchronous generating capacity. It could use heavy fuel oil, distillate, natural gas or imported liquefied natural gas (LNG).[12]

There may be system security benefits from a Powership, if it were to be located near Whyalla or Port Augusta. However, supply to customers on the Eyre Peninsula would still rely on the existing transmission and distribution networks and the network reliability problems discussed in Chapter 2 would remain. Locating the Powership in other locations (eg on the west coast of the Peninsula) may produce reliability benefits for those customers closer to the generation source, although network augmentation may be required in order to connect the generator.

This highlights the challenges of relying on any large-scale generation source to address reliability problems on the Eyre Peninsula: it requires connection to reliable high voltage transmission lines whereas many of the reliability issues are near sub-transmission and distribution lines, remote from the transmission network.

While Enlighten has not provided the Inquiry with information on the costs and reliability benefits of the Powership proposal, there is an opportunity for the proponent to earn revenues from the wholesale electricity and ancillary services markets and operate the plant on a commercial basis if there are sufficient market benefits.

3.6 Options submitted by Energy Security for South Australian Working Party

The ESSAWP submission suggested a short-term and long-term option for the Eyre Peninsula.

The ESSAWP short-term solution is a grid scale (30MW, 30MWh) battery system at Port Lincoln, together with two smaller battery systems at Streaky Bay and Ceduna. It described this option as:

> *[enabling] the existing Port Lincoln Power Station to come on line after an upstream supply failure to Port Lincoln without loss of supply to customers and provide longer term generation in the event of a long outage on the transmission system. This no break system would also [allow] the grid connected solar systems to remain on line and not increase the demand.*[13]

---

[12] Enlighten Power Systems Pacific, *Prudent and efficient options for improving the reliability and quality of electricity supply to electricity customers on the Eyre Peninsula: Submission to Inquiry*, 31 May 2017, page 4.

[13] Energy Security for South Australia Working Party, *Submission to the Inquiry into the reliability and quality of electricity supply on the Eyre Peninsula*, May 2017, page 14 of unnumbered. (available at

The submission suggested that the additional systems at Streaky Bay and Ceduna would be required in the event of a loss of the transmission or sub transmission line from Yadnarie to the west coast of the Eyre Peninsula.

The cost of the Port Lincoln system was estimated by ESSAWP to be around $30m, with the smaller systems in Streaky Bay and Ceduna costing around $20m in total. It did not provide estimates of the reliability benefits of the systems.

The proposal for Port Lincoln appears to be similar to the 30MW battery that has been announced for the Yorke Peninsula, following the Energy Storage for Commercial Renewable Integration South Australia (ESCRI) study.[14] That study found Port Lincoln to be a suitable site for such a battery system, supporting ESSAWP's proposal. While the Inquiry is unable to compare this option to other short-term options, any future system planning for the region should take this option into account.

The long-term option favoured by ESSAWP is a 500kV transmission network which would replace the current transmission network and run a line up the west coast.

This network redesign allows for the connection of possible new solar and wind-powered generation, particularly along the west coast, to export to the National Electricity Market. It suggested that it would also accommodate future large loads, such as the Iron Road development and any large-scale storage systems, such as pumped hydro systems.

ESSAWP provided an indicative cost of $1.2 billion for the redesigned Eyre Peninsula transmission network. It did not provide an estimate of the reliability benefits.

3.7 Examining the reliability benefits of each project

A summary of the reliability benefits (measured as minutes off supply saved) and costs of each option is presented in Table 3.5 below. As discussed previously, not all proposals have contained information to enable those benefits and costs to be calculated and those proposals are therefore not included in the analysis below. The costs and reliability benefits were calculated based on data provided by SA Power Networks and ElectraNet. That data has been estimated and the results of the Commission's analysis is therefore indicative only.

The table highlights that the reliability benefits (minutes saved per annum) are likely to be significant for the generation options identified by SA Power Networks. The Commission reiterates that there may be other market benefits that arise from each option, in addition to reliability benefits. Those benefits would need to be taken into account in a full cost-benefit analysis.

The costs of each project are annualised costs, not total costs, and are derived from capital and operating cost estimates. Table 3.5 shows the approximate impacts of those costs on customers' annual electricity bills. The costs of each project would be borne by the approximately 860,000 South Australian NEM-connected customers, through regulated network charges. Annual bill impacts were approximated by dividing the annual cost of an option by total South Australian customers. The actual bill impacts of any option, if implemented, would depend on the manner in which the costs were apportioned to network tariffs (through the different customer and tariff types).

http://www.escosa.sa.gov.au/ArticleDocuments/1085/20170831-Inquiry-ReliabilityQualityElectricitySupplyEyrePeninsula-DraftReportSubmission-ESSAWP.pdf.aspx?Embed=Y)

[14] Information about the ESCRI study is available at https://arena.gov.au/projects/energy-storage-for-commercial-renewable-integration.

Table 3.5: Summary of annual reliability improvement (minutes saved) of each option and cost[15]

Submitted by	Option	Minutes saved (p.a.)	Indicative Cost (p.a.)	Indicative bill impact (p.a.)	Approximate time to complete[16]
SA Power Networks	95 percent Hardening Option 1	122	$5,300,430	$6.20	10 years
SA Power Networks	48 percent Hardening Option 2	98	$2,357,500	$2.70	5 years
SA Power Networks	25 percent Hardening Option 3	76	$1,351,500	$1.60	3 years
SA Power Networks	Generation Option 1 - Port Lincoln	370	$398,700[17]	$0.50	1 year
SA Power Networks	Generation Option 2 - Wudinna	370	$4,063,500	$4.70	2 years
SA Power Networks	Generation Option 3 - Ceduna, Yadnarie, Streaky Bay	420	$5,194,900	$6.00	2 years
SA Power Networks	Feeder SCADA (all) Option 1	23	$1,136,000	$1.30	5 years
SA Power Networks	Feeder SCADA (partial) Option 2	21	$757,000	$0.90	4 years
SA Power Networks	Feeder SCADA (worst offenders) Option 3	16	$379,000	$0.40	2 years
ElectraNet[18]	Replace components of 132kV line	0	$8,592,000	$10.00	3 years
ElectraNet	Double circuit 132kV line	60	$15,108,000	$17.60	3 years
ElectraNet	Two single circuit 132kV line	60	$17,519,000	$20.40	4 years
ElectraNet	Double circuit 275kV line (include lines to Davenport upgrade)	60	$22,822,000	$26.50	6 years
ElectraNet	Two single circuit 275kV lines (include lines to Davenport)	60	$36,805,000	$42.80	6 years

Source: Commission analysis based on data provided by SA Power Networks and ElectraNet

15 The scope of this Inquiry does not include all potential costs and benefits of each option and, therefore, this table does not present a net benefit calculation for each option.

16 Timeframes for the ElectraNet options are based on completion dates provided by ElectraNet.

17 Costs estimated to be incurred by SA Power Networks. ElectraNet has also advised that this option is likely to require expenditure on its transmission network, although the amount is uncertain.

18 ElectraNet has not included any reliability benefits arising purely from replacing the existing transmission line with a new line/s. There is likely to be some reliability improvement arising from the replacement of an old asset with a new asset, but that improvement has not been factored into the Commission's analysis. The reliability benefits identified arise from the avoided start-up time of the Port Lincoln generators (approximately 60 minutes).

As previously discussed, ElectraNet expects its proposed options to deliver non-reliability benefits. Those potential benefits include:

- network support cost reduction
- maintenance cost reduction
- risk cost reduction (based on avoiding the escalating risks associated with defective conductor on the existing lines)
- wind farm constraint reduction
- transmission loss reduction
- future option value for connection of new renewable generation, and
- other market benefits, e.g. facilitation of increased market competition by the ability to connect additional low-cost generation on the Eyre Peninsula.

Those benefits should be considered as part of the current RIT-T process.

3.8 Reliability benefits and costs of combined options

The Commission has examined the combined reliability benefits and costs of implementing the ElectraNet options and SA Power Networks' generation options together. Those options interact with each other and it is important to recognise those interactions in analysing the various reliability benefits and costs. The network hardening and SCADA options do not impact the transmission network options.

Any transmission solution that leads to greater transmission network reliability would be expected to reduce the potential benefit from having generation providing network support. Therefore, should ElectraNet proceed with a reliability-enhancing transmission solution, the potential benefits of SA Power Networks' generation options would diminish. Table 3.6 shows those interactions.

Table 3.6: Interactions between ElectraNet's options and SA Power Networks' generation options

	SA Power Networks generation option 1 (Port Lincoln)	SA Power Networks generation option 2 (Wudinna)	SA Power Networks generation option 3 (Ceduna, Streaky Bay, Yadnarie)
ElectraNet option 1	If ElectraNet option 1 proceeded, the improvement in reliability arising from generation option 1 would reduce from 370 minutes saved to 90 minutes saved.	If ElectraNet option 1 proceeded, the improvement in reliability arising from generation option 2 would reduce from 370 minutes to 270 minutes.	If ElectraNet option 1 proceeded, the improvement in reliability arising from generation option 3 would reduce from 420 minutes to 300 minutes.
ElectraNet option 2-5	If any of the ElectraNet options were to go ahead, ElectraNet would cease contracting the Port Lincoln generators. SA	If any of the ElectraNet options were to go ahead, the reliability benefit of generation option 2 would reduce	If any of the ElectraNet options were to go ahead, any reliability benefits from generator at Yadnarie

	Power Networks' option 1 largely relies on the presence of those generators. The benefits of generation option 1 would reduce from 370 minutes to 35 minutes.	from 370 minutes to 140 minutes. Additionally, a separate line route provided by ElectraNet to Wudinna would further reduce the benefit of the generator (the line would provide the same reliability benefits).	would become minimal. The reliability benefits from the Ceduna and Streaky Bay generators would also decrease to approximately 140 minutes.

Source: Information provided by SA Power Networks and ElectraNet

4 Incentives to improve network reliability

Findings

4.1 The current feeder-type reliability standards in the Electricity Distribution Code do not provide strong and clear incentives to SA Power Networks to maintain reliability on the Eyre Peninsula. Reliability performance in certain areas may be 'hidden' in aggregated performance data, although a decline in regional performance has not been evident based on data reported to date.

4.2 The NER provides insufficient incentives for distribution and transmission businesses to undertake effective joint planning, which may not be delivering the most efficient network reliability solutions.

Recommendations

4.1 The Commission will publish quarterly regional network performance information, in addition to its current reporting, commencing December 2017.

4.2 In its current review of the Electricity Distribution Code, the Commission will consider and consult on:

a. Whether to continue reporting on the seven regions presently used, or to redefine regions to be more useful for planning and tracking historical performance

b. Changing the distribution reliability standards to impose regional standards or targets,

c. Changing the distribution reliability standards to better reflect customer preferences and desired long-term outcomes

4.3 The Commission recommends greater disclosure of information by the network businesses to facilitate more effective joint planning. It recommends that ElectraNet and SA Power Networks consult with industry participants to better understand the information gaps that may be preventing effective participation by third parties in regulatory investment test and network planning processes. Recent changes to the NER imposing greater reporting requirements on distribution businesses to facilitate non-network solutions may assist in this area.

4.4 The Commission recommends the State Government prioritise a review of the provisions for joint planning within the NER, having regard to barriers preventing economically and socially efficient outcomes.

The Inquiry terms of reference require the Commission to consider options for improving the incentives that SA Power Networks and ElectraNet have to upgrade current network infrastructure and restore supply following an outage.

Network reliability standards that apply to SA Power Networks and ElectraNet are contained in the Electricity Distribution Code and Electricity Transmission Code respectively. The Commission is responsible for issuing those Codes and enforcing compliance with them. The Commission's role in regulating reliability standards is complemented by the AER's role as economic regulator of SA Power Networks and ElectraNet.

4.1 Regulation of distribution services

The service standard framework that applies under the Electricity Distribution Code consists of:[19]

- average reliability and customer service standards and targets, and
- a Guaranteed Service Level Scheme that provides for payments to customers receiving service levels below pre-determined threshold levels within any single year.

In addition, the AER has implemented a financial incentive scheme that provides rewards/penalties to SA Power Networks for achievement against reliability and customer service targets.

The efficiency of any forecast expenditure necessary to meet reliability standards is reviewed by the AER as part of SA Power Networks' five-year revenue determination.

In addition, prior to undertaking any major investments, including reliability investments, SA Power Networks must apply to the AER under the RIT-D. The purpose of the RIT-D is to ensure distributors consider all credible options (which may include both network and non-network options) when choosing how to address identified network needs. The preferred option is that which maximises the economic benefit to all those who produce, consume and transport electricity in the National Electricity Market.

In identifying a need for network or non-network solutions, the NER requires ElectraNet and SA Power Networks to undertake joint planning, to ensure that the most efficient option is pursued.

4.2 Regulation of transmission services

The Commission's Electricity Transmission Code sets out the transmission network exit point reliability standards that apply to ElectraNet.[20] The Code contains five reliability categories for exit points on ElectraNet's transmission network and each category has specific reliability and supply restoration standards.

Similar to distribution services, the AER has established a transmission services performance incentive scheme and process for RIT-T.

4.3 Are there potential areas for improvement to the network reliability standards?

The distribution network reliability standards, set by the Commission under the Electricity Distribution Code, require SA Power Networks to use best endeavours to achieve specified USAIDI and USAIFI targets, set for each feeder category (CBD, urban, long rural and short rural). The USAIDI and USAIFI targets for 2015-16 to 2019-20 were set to maintain the average historical levels of service provided by SA Power Networks.[21] The Commission changed from geographic-based standards to feeder-type standards in 2014 because it considered the characteristic of the feeder to be a greater driver of network performance than physical location and to align with the AER's classification system for its Service Target Performance Incentive Scheme.

While the intent of the Commission's distribution network reliability standards is to maintain historical reliability levels, it is possible that some customers may receive improved reliability over time, while

---

19 Further information about the Electricity Distribution Code is available on the Commission's website at http://www.escosa.sa.gov.au/projects-and-publications/projects/electricity/sa-power-networks-service.

20 Further information about the Electricity Transmission Code is available on the Commission's website at http://www.escosa.sa.gov.au/projects-and-publications/projects/electricity/electricity-transmission-code-review-2018-2023-regulatory-period/electricity-transmission-code-review-2018-2023-regulatory-period.

21 Further information about the current distribution network reliability standards is available on the Commission's website at http://www.escosa.sa.gov.au/projects-and-publications/projects/electricity/sa-power-networks-service.

others receive deteriorating reliability. That possibility arises because reliability performance is measured on average across each relevant type of feeder. However, a decline in regional performance has not been evident based on data reported to date.

The current feeder-type reliability standards do not provide strong and clear incentives to SA Power Networks to maintain reliability on the Eyre Peninsula. Reliability performance in certain regions may be 'hidden' in aggregated performance data. While there is no specific reliability standard for the Eyre Peninsula, the Commission publishes annual reports on reliability performance in the Eyre Peninsula and Upper North.

The submission from Business SA to the Inquiry supported the region-based reliability standards, stating that:

> *…the recent spate of unreliability has highlighted the need to ensure that reliability in specific rural and regional areas is appropriately regulated for.*[22]

The Commission is currently considering the arguments for setting reliability standards on a regional basis, as part of its review of SA Power Networks' reliability standards to apply from 1 July 2020. That review is being conducted in 2017-18 and the Commission will be publicly consulting on its proposals in late 2017. In particular, the Commission will consider and consult on:

- Whether to continue reporting on the seven regions presently used, or to redefine regions to be more useful for planning and tracking historical performance
- Changing the distribution reliability standards to impose regional standards or targets, and
- Changing the distribution reliability standards to better reflect customer preferences and desired long-term outcomes.

The Commission does not plan to change distribution reliability standards in advance of that review, as it is important to test customers' service preferences across the entire State. The Commission must also take into account any cost implications for changing reliability standards for a particular region under the current Statewide pricing regime, where distribution prices are the same across the State.

In the meantime, to provide increased transparency of network performance across regions, the Commission intends to publish quarterly regional distribution network reliability outcomes, in addition to its annual reporting. The December 2017 quarterly report and all subsequent reports will include that information.

In relation to transmission reliability standards, the Commission has recently reviewed the transmission network exit point standards to apply from 1 July 2018.[23] The reliability standards that will apply from that date are based on an analysis of the costs and benefits of increasing or decreasing reliability at each exit point, using the 2014 AEMO study into the value of customer reliability.[24] The Commission does not propose to the change those exit point standards given that recent review. To the extent that ElectraNet can identify economic benefits of improving transmission network reliability above the minimum standards set by the Commission, it should make that business case to the AER through its current Eyre Peninsula RIT-T process.

---

22 Business SA, *Submission to the draft report for the Inquiry into the reliability and quality of electricity supply on the Eyre Peninsula*, page 2 of unnumbered. (available at http://www.escosa.sa.gov.au/ArticleDocuments/1085/20170831-Inquiry-ReliabilityQualityElectricitySupplyEyrePeninsula-DraftReportSubmission-BusinessSA.pdf.aspx?Embed=Y)

23 Essential Services Commission, *Electricity Transmission Code Review, Final Decision*, September 2016 (available at http://www.escosa.sa.gov.au/ArticleDocuments/1020/20160922-Electricity-TransmissionCodeReview-FinalDecision.pdf.aspx?Embed=Y).

24 AEMO, *Value of customer reliability: Final report*, September 2014 (available at https://www.aemo.com.au/-/media/Files/PDF/VCR-final-report--PDF-update-27-Nov-14.pdf).

4.4 The need for effective joint planning

In considering the various network and non-network options for improving reliability of supply on the Eyre Peninsula, the Commission has found that the process for ensuring effective joint planning of generation, transmission, distribution and demand is critical for integrating new technologies into the national market.

Under clause 5.14 of the NER, transmission and distribution network businesses must plan jointly. The submissions to the Inquiry from SA Power Networks and ElectraNet suggest that both organisations meet that requirement. For example, SA Power Networks stated that it undertakes joint capacity planning with ElectraNet on an annual basis, as required by the NER.[25]

The Commission is concerned, however, that there may be insufficient incentives to ensure that non-network solutions are able to be considered as part of an overall joint plan for a region. In particular, joint planning is intended to deliver a more efficient investment than that proposed by any one party, to the overall benefit of consumers. Network businesses may receive a lower return on investments through effective joint planning, which is not in their commercial interests.

While the NER requires network businesses to consider non-network solutions before proposing any new regulatory investment, the commercial incentives for any network business to pursue non-network solutions may not be strong. ElectraNet agreed with that view, stating in its submission that:

> *Currently there is no commercial upside and considerable potential downside (through cost recovery risk, cash flow risk, and contractual risk and compliance risk) associated with procuring non-network solutions, which are subject to cost pass through under the current regulatory framework.*[26]

The ElectraNet submission indicates that network businesses, acting commercially, would be biased towards network investments. If that is the case, there is a need for effective regulation to ensure that all viable solutions can be considered on their merits, and that a joint plan can be developed at the lowest cost to customers.

The Inquiry has received submissions suggesting that the regulatory framework creates barriers for non-network solutions, which may not be producing the best outcomes for customers. Submissions from ESSAWP, Business SA and GreenSync supported strengthening regulatory requirements for joint planning and information disclosure. The submission from Greensync stated that, as a provider of distributed energy solutions, it does not have access to sufficient information held by network businesses, to enable it to effectively participate in regulatory investment tests. It submitted that:

> *While there have been good strides made towards improving information transparency at the lower voltage levels, such as through the Distribution Annual Planning Report template, further information is required on the following network challenges:*
>
> *• Voltage;*
>
> *• Frequency;*
>
> *• Harmonics;*
>
> *• Flicker; and*

[25] SA Power Networks, Submission to the draft report for the Inquiry into the reliability and quality of electricity supply on the Eyre Peninsula, page 2. (available at http://www.escosa.sa.gov.au/ArticleDocuments/1085/20170831-Inquiry-ReliabilityQualityElectricitySupplyEyrePeninsula-DraftReportSubmission-SAPN.pdf.aspx?Embed=Y)

[26] ElectraNet, Submission to the draft report for the Inquiry into the reliability and quality of electricity supply on the Eyre Peninsula, page 5 (available at http://www.escosa.sa.gov.au/ArticleDocuments/1085/20170831-Inquiry-ReliabilityQualityElectricitySupplyEyrePeninsula-DraftReportSubmission-ElectraNet.pdf.aspx?Embed=Y). .

• *Power factors.*

Recent changes to the NER imposing greater reporting requirements on distribution businesses to facilitate non-network solutions may lead to greater transparency of information in these areas. In particular, distribution businesses will be required to publish each year a "system limitation report", which is intended to offer consistent and accessible information that will enable embedded generators and other providers of non-network solutions to better use existing mechanisms in the NER.[27]

The Independent Review into the Future Security of the National Electricity Market – Blueprint for the Future, prepared by Dr. Alan Finkel, has also found that there are deficiencies under the NER in relation to system planning and has put forward recommendations to address it. Those recommendations may result in improved joint planning for the Eyre Peninsula. The recommendations include requesting AEMO, supported by transmission network service providers and relevant stakeholders, to develop an integrated grid plan to facilitate the efficient development and connection of renewable energy zones across the National Electricity Market. The Eyre Peninsula may be declared as one of those zones.

Those recommendations have been endorsed by COAG and the COAG Energy Council will develop proposed changes to the NER as a consequence. These changes may lead to improved system planning and improved ability for new technologies to be integrated into the national market. However, those changes are likely to take time to implement.

The Commission recommends the State Government prioritise a review of the provisions for joint planning within the NER, having regard to barriers preventing economically and socially efficient outcomes. That review could feed into the COAG Energy Council's proposed rule changes.

The Commission also recommends SA Power Networks and ElectraNet disclose information on the inputs to their joint planning. It encourages SA Power Networks and ElectraNet to consult closely with other industry participants to better understand their information requirements and current information gaps that are preventing effective participation by third parties in regulatory investment test and network planning processes.

[27] Further information about the rule change is available on the AEMC's website at http://www.aemc.gov.au/Rule-Changes/Local-Generation-Network-Credits#.

Appendix A: Background to the Inquiry

On 9 March 2017, the South Australian Treasurer referred to the Essential Services Commission (**Commission**) an Inquiry into the reliability and quality of electricity supply on Eyre Peninsula (**Inquiry**). The Inquiry was referred to the Commission pursuant to Part 7 of the Essential Services Commission Act 2002.

The Treasurer's letter of referral, reproduced at the end of this Appendix, outlines the terms of reference of the Inquiry.

Electricity supply on the Eyre Peninsula

The Eyre Peninsula has an area of approximately 233,000 square kilometres with a population of around 56,000.[28] It has around 24,000 electricity customers, with over 10,000 of those customers located at Port Lincoln. Whyalla and Port Lincoln are the major load centres, accounting for around 85 percent of the total maximum demand on the Eyre Peninsula. Electricity supply is important for the regional economy, which is driven mainly by the agriculture, manufacturing, fishing, tourism and mining industries.

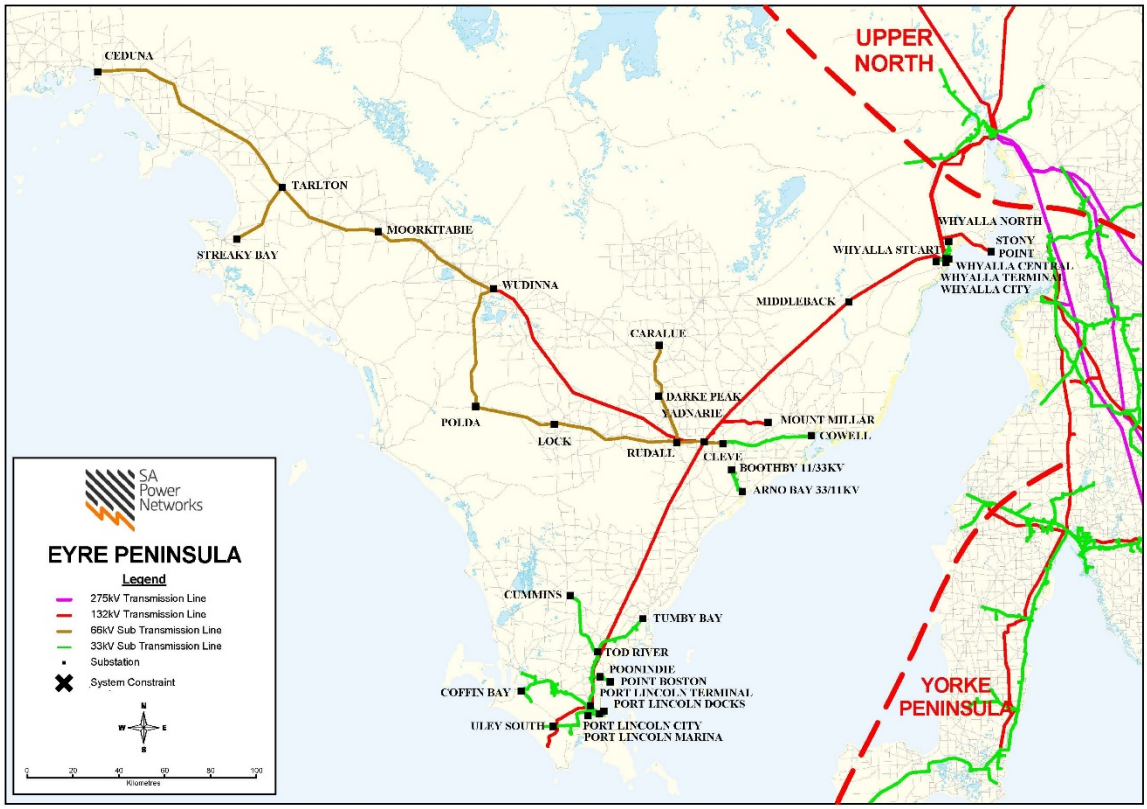
The region is supplied electricity via 275k/132kV substations at Davenport and Cultana. ElectraNet operates the 132kV transmission lines from Cultana to Port Lincoln, intersected by another 132kV transmission line from Yadnarie to Wudinna. ElectraNet has a network support arrangement in place with Synergen Power Pty Ltd, who operates three backup generators at Port Lincoln capable of supplying 73MW in total. That Network Support Agreement (**NSA**) is due to expire in December 2018.

SA Power Networks operates the 66kV and 33kV sub-transmission networks and 11kV primary distribution feeders. Some customers are also supplied via 19kV single wire earth return (**SWER**) systems. The networks operated by SA Power Networks cover the region south of Whyalla and west to Ceduna.

The transmission and distribution networks on the Eyre Peninsula are shown in Figure A.1.

[28] Regional Development Australia, *Regional Profile 2014-2016 – RDA Whyalla and Eyre Peninsula*, September 2014, page 6, available at http://www.rdawep.org.au/wp-content/uploads/2016/02/RDAWEP-REGIONAL-PROFILE-2014-16-September-2014.pdf.

Figure A.1: Transmission and distribution networks on the Eyre Peninsula



Source: SA Power Networks

There is also significant wind-powered generation capacity on the Eyre Peninsula, including the 66MW Cathedral Rocks wind farm south of Port Lincoln (operational since 2005) and the 70MW wind farm at Mt Millar near Cowell (operational since 2006). The commencement of construction of large-scale solar and wind farms near Port Augusta in 2017 will further diversify the sources of electricity supply to the region.[29]

The closure of the Northern Power Station near Port Augusta in May 2016 has reduced the stability of the power system on the Eyre Peninsula.

The loss of synchronous generation and increase in non-synchronous generation in South Australia is a matter that the Commission has recently considered through its inquiry into licensing arrangements for generators in South Australia.[30] Following that Inquiry, the Commission has introduced licence conditions to apply to all new licensed generators, which will require them to provide various technical services that can contribute to power system stability. Any new generation on the Eyre Peninsula would be required to meet those licence conditions, including any new grid-scale batteries. This will help to maintain system stability in the region.

29 Further information about the project is available at http://dpenergy.info/parep/.

30 Essential Services Commission, *Inquiry into the licensing arrangements for generators in South Australia: Final Report*, August 2017, available at http://www.escosa.sa.gov.au/ArticleDocuments/1050/20170817-Inquiry-LicensingArrangementsforGgneratorsSA-FinalReport.pdf.aspx?Embed=Y.

Inquiry process

In accordance with the Inquiry's terms of reference, the Commission has consulted with a reference group consisting of representatives of Eyre Peninsula councils. The reference group has provided advice to the Commission during the course of the Inquiry, and the Commission thanks all reference group members for their contributions.

The Commission has also consulted with staff of the Australian Energy Regulator (AER) and the Technical Regulator on regulatory and technical matters and has worked closely with industry participants to ensure that it has a clear understanding of electricity supply concerns on the Eyre Peninsula and options for addressing them. In particular, the Commission would like to thank SA Power Networks, ElectraNet, Eye Energy Systems and the Energy Security for South Australia Working Party for the extensive information that they have contributed to this Inquiry.

The Commission conducted public consultation on an Inquiry draft report, released on 6 July 2017. Consultation on that report closed on 18 August 2017 and nine submissions were received. The Commission also conducted a stakeholder forum in Port Lincoln on 14 September 2017, where each of the options presented to the Inquiry were discussed. A record of that forum has been published on the Commission's website.

The issues raised by stakeholders were carefully considered in preparing this Final Report. Where relevant, certain arguments and submissions have been mentioned in the text of this Final Report, either by direct quotation or by reference to themes or arguments, to assist stakeholders to understand the proposed positions that have been reached. A failure to reference an argument or submission does not mean that it has not been considered by the Commission in arriving at its conclusions.

The Hon Tom Koutsantonis MP
Member for West Torrens

Government of South Australia

Treasurer
Minister for Finance
Minister for State Development
Minister for Mineral Resources and Energy
Level 8
State Administration Centre
200 Victoria Square
Adelaide SA 5000
GPO Box 2264
Adelaide SA 5001
DX 56203 Victoria Square
Tel 08 8226 1866
Fax 08 8226 1896
minister.koutsantonis@sa.gov.au

MMRE17D00369

Mr Adam Wilson
Chief Executive Officer
Essential Services Commission of South Australia
GPO Box 2605
ADELAIDE SA 5001

Adam,

Dear Mr Wilson

I am writing to formally refer an Inquiry into the reliability and quality of electricity supply on the Eyre Peninsula to the Essential Services Commission of South Australia (ESCOSA). Set out in this written notice are my referral, terms of reference and requirements for the Inquiry.

As you are aware, electricity customers on the Eyre Peninsula have recently been affected by a number of prolonged power outages, and have expressed concern about the reliability and quality of their electricity supply. I share their concern and look forward to the results of your Inquiry.

Referral

I, Tom Koutsantonis, Minster for Mineral Resources and Energy, refer to the Commission the matter described in paragraph (a) of the Terms of Reference, including consideration of those matters in paragraph (b) of the Terms of Reference, and subject to the Requirements set out in this Notice.

Terms of Reference

The following are the Terms of Reference for the Inquiry:

a) The Commission is to inquire into prudent and efficient options for improving the reliability and quality of electricity supply to electricity customers on the Eyre Peninsula.
b) The Commission is to consider, in particular, the following matters:
    i. Electricity reliability and quality of supply outcomes to customers on the Eyre Peninsula during the period 1 January 2007 to 31 December 2016.
    ii. Prudent and efficient options for improving the incentives to ElectraNet and SA Power Networks, to upgrade current network infrastructure and restore supply following an outage.
    iii. Possible technical solutions for improving reliability and quality of electricity supply on the Eyre Peninsula and potential costs to consumers of implementing those solutions.

SOUTH AUSTRALIA

iv. Any other matters that the Commission considers relevant to the Inquiry.

Requirements for the Inquiry

In undertaking the Inquiry, the Commission must:

a) Establish and have regard to advice from an Inquiry reference group, consisting of representatives of Eyre Peninsula councils and other representatives as considered appropriate by the Commission.
b) Have regard to advice from the Technical Regulator on matters relating to the quality of electricity supply to customers on the Eyre Peninsula.
c) Conduct public consultation, in a manner considered appropriate by the Commission.
d) Submit a draft report on the Inquiry to me by 31 May 2017.
e) Submit a final report on the Inquiry to me by 6 October 2017.

I look forward to the results of your Inquiry into the reliability and quality of electricity supply on the Eyre Peninsula.

Yours sincerely

Hon Tom Koutsantonis MP
Minister for Mineral Resources and Energy

9 March 2017

Appendix B: Reliability cost-benefit analysis methodology

The Commission has calculated net reliability benefits on an annual basis, based on total annual reliability benefits less the total annual cost of the options that would deliver those benefits.

$$Net\ Reliability\ Benefit_{annual} = Reliability\ Benefit_{annual} - Cost_{annual}$$

Reliability benefit[31]

Reliability benefits are calculated using an estimated connection point value of customer reliability (CP VCR), customer minutes saved (Min_s), an estimated annual load factor (LF_{annual}) and an averaged annual forecast megawatt demand ($Demand_{MW}$):

$$Reliability\ Benefit_{annual} = (CP\ VCR) \times (\frac{Min_s}{60}) \times LF_{annual} \times Demand_{MW}$$

Where:

CP VCR is the connection point value of customer reliability

Min_s is the expected minutes saved, in SAIDI terms, to customers for undertaking that particular option to improve reliability on the Eyre Peninsula.

LF_{annual} is estimated load factor for the Eyre Peninsula provided by the network operators.

$Demand_{MW}$ is the maximum peak demand in Megawatts.

Costs

The cost has been calculated based on annual repayments of the capital expenditure over the expected life of the asset, and any annual operating expenditure (this could be as additional expenditure or savings).

$$Cost_{annual} = Capex_{annualrepayment} + Opex_{annual}$$

Where:

$$Capex_{annualrepayment} = \left(\frac{r}{1-(1+r)^{-n}}\right) Capex_{total}$$

Where:

r is the assumed interest rate (discount rate for this exercise).

n is the expected life cycle of the proposed capital expenditure.

$Capex_{total}$ is the total capital expenditure.

[31] This methodology is consistent with that used by the Commission and AEMO to assess economic benefits of changes in exit point reliability standards under the Electricity Transmission Code.

Data

- *CP VCR* data is estimated using AEMO VCR estimates for the Transmission network. This has been calculated using AEMO connection point data. A simple average was taken of the sector weightings of all the Eyre Peninsula connection points[32]. South Australian VCR values are then multiplied using the estimated Eyre Peninsula weightings. This was then converted into $/MWh. The table below demonstrated the connection points used to determine the Eyre Peninsula weightings and the VCR calculation.

Connection Point	% Residential Demand	% Agricultural Demand	% Commercial Demand	% Industrial Demand	CP VCR ($/Mwh)
Port Lincoln	41.86%	3.79%	36.28%	18.07%	$37,245
Wundinna	47.74%	6.60%	36.94%	8.72%	$36,341
Yadnarie	54.36%	5.96%	32.34%	7.34%	$35,149
SA VCR ($Kwh)	$26.88	$47.67	$44.72	$44.06	
Eyre Peninsula Demand %	47.98%	5.45%	35.19%	11.38%	
Eyre Peninsula VCR	$12.90	$2.60	$15.74	$5.01	$36,245

- Min_S is provided by SAPN for its options. A proxy estimate is used for ElectraNet's options. This is converted into hours.
- SAPN and ElectraNet provided Capex. Where a range was provided, the mid-point is used.
- Opex was provided by SA Power Networks. For all other options, it is assumed Opex is approximately 2% of Capex plus/minus any known Opex as a result of a particular option being adopted (whether or not the Port Lincoln generators were being contracted)
- Life cycle has been provided by the network providers.
- The discount rate used is 7.50%
- LF_{annual} is provided by the network providers. If the option does not provide support to all of Eyre Peninsula, the load factors of the affected connection points are used.
- $Demand_{MW}$ is provided by SA Power Networks. If an option does not provide support to all of Eyre Peninsula, the demands of the affected connection points is used (this is the case for the generation options provided by SA Power Networks).

[32] Direct transmission connections have been excluded

The Essential Services Commission
Level 1, 151 Pirie Street Adelaide SA 5000
GPO Box 2605 Adelaide SA 5001
T 08 8463 4444
E escosa@escosa.sa.gov.au | W www.escosa.sa.gov.au