



Electricity

Transmission Licence Compliance Review - ElectraNet Pty Ltd

28 September 2016 state-wide power system outage

June 2017

Enquiries concerning this 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
Web: www.escosa.sa.gov.au

Table of contents

- Glossary of terms iii
- 1 Executive summary..... 1
 - 1.1 Findings and recommendations 1
 - 1.2 Other reviews..... 3
- 2 Scope of the review 4
 - 2.1 Licensing under the Electricity Act 1996 4
 - 2.2 Summary of the event 4
 - 2.3 Significant event reporting..... 5
 - 2.4 Licence conditions under review 6
 - 2.5 Process and scope..... 6
 - 2.6 Other reviews..... 7
- 3 Electricity Transmission Code 9
 - 3.1 Overview of the Electricity Transmission Code..... 9
 - 3.2 Reliability and equivalence terminology..... 10
 - 3.2.1 N reliability 11
 - 3.2.2 N-1 reliability 11
 - 3.2.3 Equivalence 11
- 4 Emergency provisions of the Code 12
 - 4.1 Obligation 12
 - 4.2 Was there an emergency? 12
 - 4.2.1 Evidence..... 12
 - 4.2.2 Analysis and findings 13
 - 4.3 Were the emergency provisions invoked? 14
 - 4.3.1 Evidence..... 15
 - 4.3.2 Analysis and findings 15
 - 4.4 Compliance with the requirements of clause 9.1.2(a) 15
 - 4.4.1 Evidence..... 15
 - 4.4.2 Analysis and findings 15
 - 4.5 Compliance with clause 9.1.2(b) 16
 - 4.5.1 Evidence..... 16
 - 4.5.2 Analysis and findings 18
- 5 Restoration of transmission services in other parts of the state 19
 - 5.1 Obligation 19
 - 5.1.1 Facts..... 19
 - 5.2 Evidence 21
 - 5.3 Analysis and findings..... 25

5.3.1	Clause 2.5 of the Code – Category 1 exit points	25
5.3.2	Clause 2.6 of the Code – Category 2 exit points	25
5.3.3	Clause 2.7 of the Code – Category 3 exit points	25
5.3.4	Clause 2.8 of the Code – Category 4 exit points	26
5.3.5	Clause 2.9 of the Code – Category 5 exit points	26
6	Restoration of Port Lincoln.....	27
6.1	Obligation	28
6.2	Facts	28
6.3	Evidence	30
6.3.1	Historical performance at Port Lincoln.....	30
6.3.2	Timeline of events.....	32
6.3.3	System restart	34
6.3.1	Restoration of the Yadnarie to Port Lincoln transmission line.....	35
6.3.2	Generator availability - 29 September 2016 to 8 October 2016	35
6.4	Analysis	36
6.4.1	Network support arrangement availability.....	36
6.5	Findings and recommendations	39
6.5.1	System restart	39
6.5.1	Restoration of the Yadnarie to Port Lincoln transmission line.....	40
6.5.2	Port Lincoln connection point reliability	40
7	ElectraNet’s risk management system	43
7.1	Obligation	43
7.2	Facts	44
7.3	Evidence	45
7.4	Analysis	45
7.5	Findings and recommendation.....	46
8	Next Steps.....	47

Glossary of terms

AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
Black system	The absence of voltage on all or a significant part of the transmission system or within a sub-network following a major supply disruption, affecting a significant number of customers.
Code	Electricity Transmission Code
Commission	Essential Services Commission, established under the Essential Services Commission Act 2002
CST	Central standard time
Electricity Act	Electricity Act 1996
ESC Act	Essential Services Commission Act 2002
EST	Eastern standard time
kV	Kilovolt
licence	Electricity Transmission licence
LMF	Arrium Ladle Metallurgical Furnace
Management Plan	Safety, Reliability, Maintenance and Technical Management Plan
MW	Megawatt
N	Means that the transmission system is able to supply the contracted amount of agreed maximum demand connected to the transmission system provided that all the network elements are in service (such that the loss of a single transmission element could cause supply interruption to some customers)
N-1	Means the ability of the transmission system to continue to supply the contracted amount of agreed maximum demand connected to the transmission system without interruption should any one element fail
NEM	National Electricity Market
NER	National Electricity Rules
Outage	The state-wide power outage which commenced at 15.48 (CST) on 29 September 2016
PV	Solar photovoltaic
RIT-T	Regulatory Investment Test - Transmission

SCADA	Supervisory Control and Data Acquisition
SESS	South East Substation
SRAS	System Restart Ancillary Services
Synergen	Synergen Power Pty Ltd
Technical Regulator	The Technical Regulator as appointed under section 7 of the Electricity Act 1996
UFLS	Under frequency load shedding

1 Executive summary

On Wednesday 28 September 2016, a state-wide power system outage (**outage**) occurred in South Australia that impacted on customers across the state. Following the loss of three transmission lines operated by ElectraNet Pty Ltd (**ElectraNet**) due to a severe thunderstorm and tornado outbreak, voltage disturbances resulted in a loss of 456 MW of generation. The sudden increase in electricity flow resulting from the loss of generation caused the automatic protection mechanism of the Heywood Interconnector to disconnect from the National Electricity Market (**NEM**), resulting in the state-wide outage.

Licensing of electricity transmission businesses in South Australia is one of the Essential Services Commission's (**Commission**) statutory functions. ElectraNet operates the main electricity transmission network in South Australia and holds an appropriate licence issued by the Commission pursuant to Part 3 of the Electricity Act 1996 (**Electricity Act**). It is a condition of ElectraNet's Electricity Transmission licence (**licence**) that it comply with the Electricity Transmission Code (**Code**) (including service standards) and an approved Safety, Reliability, Maintenance and Technical Management Plan (**Management Plan**).

As the licensing authority under the Act, and consistent with its general powers and functions under the Essential Services Commission Act 2002 (ESC Act), the Commission has compliance and enforcement powers in relation to the performance of licensees. The Commission determined that it was appropriate to review ElectraNet's regulatory compliance in relation to the outage.

The review focused on ElectraNet's systems, processes, controls and response in relation to the outage. It did not cover issues relating to the cause of the outage and associated technical, safety, maintenance and reliability considerations, as those fall within the remit of other regulatory bodies.

The Commission sought to understand the course of events, ElectraNet's response and actions and to identify opportunities for improvements in customer outcomes. Specifically, the Commission has assessed ElectraNet's response to the outage against conditions of its licence and the reliability provisions of the Code. In reviewing ElectraNet's compliance, the Commission has considered ElectraNet's performance against the service standards prescribed in the Code.

Due to the severity of the weather event that passed through the northern part of South Australia on 28 September 2016 and the damage and insecurity to the network caused by that weather, the Commission determined that the weather event gave rise to an emergency (as that term is defined in the Code). As a result, connection points located in the emergency area were not subject to specific reliability service standards in respect of the outage. Instead and in accordance the Code, the Commission assessed whether ElectraNet used its best endeavours to restore transmission services to connection points in the emergency area, once the emergency passed.

The Commission has also reviewed ElectraNet's compliance with its Management Plan, focusing its review on the adequacy of ElectraNet's Risk Management System. Specifically, the Commission wished to understand whether ElectraNet's system identified and appropriately managed risks inherent in its operations, including a revision of risk following the outage.

1.1 Findings and recommendations

It is evident that the severe weather event, outage and damage to transmission services were significant and resulted in substantial loss of electricity supply to residential customers and businesses. Notwithstanding the significant impact on customers, the information available suggests that overall, ElectraNet remained compliant with the conditions of its licence and the Code. However, the Commission has identified areas for improvement, to promote the long-term interests of consumers with regard to the price, reliability and quality of essential services.

In regard to the restoration of transmission services at Port Lincoln, the Commission's analysis has determined that ElectraNet has complied with the conditions of its licence. However, the outage caused by the severe weather event has highlighted additional risks in operating the Port Lincoln network support arrangement. As a result, there are opportunities for improvement in terms of restart procedures, clarification of Code requirements, maintenance and better transparency of network support arrangement availability.

- ▶ **Recommendation 1:** The Commission considers that ElectraNet and AEMO should review restart procedures to ensure that the Port Lincoln network support arrangement can begin operating as soon as possible in the event of a black system¹ condition.
- ▶ **Recommendation 2:** ElectraNet should coordinate with Synergen Pty Ltd (**Synergen**)² to ensure that an inspection of all bolts, gaskets and seals at the Port Lincoln Power Station is performed on a periodic basis.
- ▶ **Recommendation 3:** The Commission will review and consult on amendments to the Electricity Transmission Code with regard to the availability of network support arrangements.
- ▶ **Recommendation 4:** The Commission will review and consult on additional reporting requirements regarding the availability of network support arrangements.

ElectraNet has demonstrated that it has a Risk Management System in place as outlined in its Management Plan. Therefore, the Commission considers that ElectraNet complied with its licence obligation. However, based on the information provided by ElectraNet, the Commission was unable to confirm whether certain parts of the system were applied.

- ▶ **Recommendation 5:** ElectraNet must report to the Commission by 31 August 2017, on how its Risk Management System is applied at an operational level. ElectraNet should also ensure that its Asset Risk Management Framework integrates into its overall Risk Management System. Further, the Commission has flagged with ElectraNet that the risk management chapter of the Management Plan should be included in the annual compliance audit for 2017. The results of that audit are to be provided to the Commission following its completion.

The Commission will publish a follow up report if there is a material change to the facts or observations contained in this report.

¹ The absence of voltage on all or a significant part of the transmission system or within a sub-network following a major supply disruption, affecting a significant number of customers.

² Synergen Pty Ltd is owner and operator of the Port Lincoln power station.

1.2 Other reviews

The Australian Energy Regulator (**AER**), Australian Energy Market Operator (**AEMO**) and the Technical Regulator are conducting their own investigations into aspects of the event. The Commission has coordinated with these bodies, recognising that each has a defined area of responsibility.

The AER has commenced an assessment of entities' compliance with the National Electricity Rules (**NER**) during the outage and the subsequent period of market suspension. The outcome of the AER's investigation will be the subject of a public report.

On 28 March 2017, AEMO released its Black System South Australia 28 September 2016 Final Report. The full report and other relevant information can be accessed on AEMO's website.

The Technical Regulator is conducting a review into safety and technical compliance by electricity entities, including consideration of whether the condition and maintenance of network and generation infrastructure is consistent with good industry practice.

2 Scope of the review

2.1 Licensing under the Electricity Act 1996

Licensing of electricity transmission businesses in South Australia is one of the Commission's statutory functions. As the licensing authority under the Act, and consistent with its general powers and functions under the Essential Services Commission Act 2002 (**ESC Act**), the Commission has compliance and enforcement powers in relation to the performance of licensees.

ElectraNet operates the main electricity transmission network in South Australia and holds an appropriate licence³ issued by the Commission pursuant to Part 3 of the Electricity Act. It is a condition of ElectraNet's licence that it comply with the Code (including service standards) and an approved Management Plan.

2.2 Summary of the event

On Wednesday 28 September 2016, a state-wide power system outage occurred in South Australia. Following the loss of three transmission lines operated by ElectraNet due to a severe thunderstorm and tornado outbreak, voltage disturbances resulted in a loss of 456 MW of generation. The sudden increase in electricity flow resulting from the loss of generation caused the automatic protection mechanism of the Heywood Interconnector to disconnect from the National Electricity Market, resulting in the state-wide outage that impacted on residential and business customers across South Australia..

The following summary of the event and restoration is taken from AEMO's Black system South Australia 28 September 2016 final report. Please note, times in AEMO's report are shown in Eastern Standard Time (EST).

The event (page 32)

'Immediately prior to the event, Supervisory Control and Data Acquisition (SCADA) data showed that the 1,826 MW of electricity demand of SA's 850,000 electricity customers was being collectively supplied by:

- 883 MW of SA wind generation.
- 330 MW of SA gas generation.
- 613 MW of electricity imports via the two interconnections with Victoria (Heywood and Murraylink).

The total amount of domestic solar photovoltaic (PV) was estimated to be approximately 50 MW.

Extreme weather conditions resulted in five system faults on the SA transmission system in the 87 seconds between 16:16:46 and 16:18:13, with three transmission lines ultimately brought down.

Following these faults, and the resulting six voltage disturbances, there was a sustained reduction of 456 MW of wind generation to the north of Adelaide. Analysis of high speed monitoring data has shown a further 42 MW of transient wind power reduction. This transient response is the normal expected response of wind farms riding through the voltage disturbances.

Increased flows on the Heywood Interconnector counteracted this loss of local generation by increasing flows from Victoria to SA.'

³ Refer: <http://www.escosa.sa.gov.au/industry/electricity/licensing/licence-register>.

*'This reduction in generation, and immediate compensating increase of imports on the Heywood Interconnector, resulted in the activation of Heywood Interconnector's automatic loss of synchronism protection mechanism at South East Substation (**SESS**), leading to the 'tripping' (disconnection) of both of the transmission circuits of the Heywood Interconnector.*

As a result, approximately 900 MW of supply from Victoria over the Heywood Interconnector was immediately lost, and the remaining generation in SA was unable to meet the SA demand.

*This sudden and large deficit of supply caused the system frequency to collapse more quickly than the SA under frequency load shedding (**UFLS**) scheme was able to act. Without any significant load shedding, the large mismatch between the remaining generation and connected load led to the system frequency collapse, and consequent Black System.'*

Load restoration (pages 73-74)

'Load restoration commenced at approximately 1900 hrs on [28] September 2016.

Load restoration was initially achieved via the Heywood Interconnector, and supplemented by generation in SA as it became available.

Load restoration was halted temporarily at around 2040 hrs, because flow on the interconnector was around 100 MW above the interconnector limit of 300 MW. Load restoration began again at around 2115 hrs, as generation from the power stations on Torrens Island became available.

By 2030 hrs (four hours after the Black System), approximately 40% of the load that was available for restoration was restored. By midnight on 28 September 2016 (7.5 hours after the Black System), approximately 1,000 MW or 80–90% of load that could be restored had been restored.

Although AEMO gave clearance to restore all remaining load at 1829 hrs on Thursday 29 September, approximately 34% of forecast load (mainly in the northern part of the network) could not be restored due to damage to the transmission network. Load in this area was progressively restored over the next few days as repairs to the transmission network were completed.

All load in SA was restored by 11 October 2016.'

Page seven of AEMO's report notes that 'the time to restore the majority of the load was in line with restoration times experienced in other recent power system restorations in Australia and elsewhere around the world.'

2.3 Significant event reporting

While the Commission assesses some aspects of a licensee's performance on an annual basis against service standards and regulatory obligations, events may occur during the year that warrant special ad hoc reporting. For example, an event that may result in large numbers of customers being without electricity supply for an extended period, posing questions as to the licensee's ability to meet a service standard and whether the entity has used best endeavours in its efforts to restore supply. These are significant performance events.⁴

The Commission determined that special reporting was warranted as the outage met the criteria of being a significant performance event as:

- ▶ every South Australian consumer was affected by the disruption, some for a lengthy duration

⁴ Refer: <http://www.escosa.sa.gov.au/industry/electricity/reporting-compliance/significant-performance-event-reporting-framework>.

- ▶ the event may impact on ElectraNet’s ability to comply with its service standards
- ▶ it needed to undertake a review to be confident that ElectraNet has complied with its electricity licence obligations, and
- ▶ there is strong stakeholder interest in ElectraNet’s performance in responding to the outage.

It is important to reiterate that all significant events will be reviewed and reported in the annual Regulatory Performance Report⁵. The purpose of designating an event as significant is to determine when an immediate review and reporting on an event will occur.

2.4 Licence conditions under review

As a condition of its licence, ElectraNet is required to comply with the Code, an industry code made by the Commission pursuant to section 28 of the ESC Act. It is also a condition of ElectraNet’s licence that it must comply with matters relating to the safety, reliability, maintenance and technical capability of its transmission network (achieved through the preparation of a Management Plan).

The Commission has assessed ElectraNet’s compliance with the following licence conditions, which form part of its Electricity Transmission licence.

The licensee must:

- a) *comply with all applicable provisions of the Electricity Transmission Code (including any service standards);*
- b) *comply with all applicable provisions of any other industry code or rule made by the Commission from time to time; and*
- c) *notify the Commission if it commits a material breach of the Electricity Transmission Code or any other applicable industry code within 3 business days after becoming aware of that breach.*

The licensee must:

- a) *when required by the Commission, prepare a safety, reliability, maintenance and technical management plan dealing with matters prescribed by regulation and submit the plan to the Commission for approval;*
- b) *annually review, and if necessary update, the plan to ensure its efficient operation, and submit the updated plan to the Commission for approval;*
- c) *comply with the plan (as updated from time to time) as approved by the Commission;*
- d) *not amend the plan without the approval of the Commission; and*
- e) *undertake annual audits of its compliance with its obligations under the plan and report the results of those audits to the Technical Regulator, in a manner approved by the Technical Regulator.*

2.5 Process and scope

The Commission utilised its formal information gathering powers to collect the information and evidence necessary to determine ElectraNet’s compliance with its licence obligations. In summary, the Commission requested the following:

- ▶ ElectraNet’s view on whether it considered the events to be an emergency for the purposes of the Code and any subsequent actions undertaken
- ▶ information regarding the timeframes for returning each transmission exit point to N: or N-1 equivalent line capacity

⁵ Refer: <http://www.escosa.sa.gov.au/industry/electricity/reporting-compliance/regulatory-performance-reports>.

- ▶ detailed information, including relevant documents, regarding the restoration at Port Lincoln and overall reliability of the Port Lincoln generators, and
- ▶ copies of the policies, procedures, guidelines and risk registers forming ElectraNet's Risk Management System.

The initial information request was made on 8 December 2016, with ElectraNet providing a response on 3 February 2017. A subsequent information request was made on 3 March 2017, with ElectraNet providing a response on 17 March 2017.

The Commission also requested information directly from Synergen Power Pty Ltd (**Synergen**), owner and operator of the Port Lincoln generator (Synergen is jointly owned by ENGIE (72 percent) and Mitsui & Co Ltd (28 percent)).

The Commission's review has focused on ElectraNet's systems, processes, controls and response in relation to the outage. It did not cover issues relating to the cause of the outage and associated technical, safety, maintenance and reliability considerations, as those fall within the remit of other regulatory bodies.

The Commission sought to understand the course of events, ElectraNet's response and actions and to identify opportunities for improvements in customer outcomes. The Commission's review is in context of the current regulatory framework. Specifically, the Commission has assessed ElectraNet's response to the outage against the following conditions in its Electricity Transmission licence and reliability provisions of the Electricity Transmission Code.

Please note that times in this report are shown in central standard time (**CST**), unless otherwise specified.

2.6 Other reviews

The Commission is also considering the performance of electricity generators, prior to, during and after the outage in the context of the obligations contained in the licences they hold under the Electricity Act.

Investigations are currently being undertaken by various authorities into aspects of the event – including its causes, the process for the restoration of the power supply and the performance of all power system elements and entities. The Commission is coordinating with all of those bodies, recognising that each has a defined area of responsibility.

Australian Energy Regulator

- ▶ The AER is the national enforcement agency responsible for ensuring that registered participants, including AEMO, comply with the requirements of the NER. The AER commenced an assessment of compliance levels during the outage and the subsequent period of market suspension. Its review covers a range of issues including, but not limited to, plant compliance with performance requirements, participant compliance with AEMO directions and/or instructions and the overall management of the power system and market in line with the Electricity Rules. The outcome of the AER's investigation will be the subject of a public report.

Australian Energy Market Operator

- ▶ On March 28 2017, AEMO released its Black system South Australia 28 September 2016 Final Report. The full report can be accessed on AEMO's website. The report covers pre-event matters, the events resulting in the black system, restoration, System Restart Ancillary Services (**SRAS**), market suspension and subsequent operation, recommendations and next steps.

Technical Regulator

- ▶ The Technical Regulator (under the Electricity Act) is conducting a review into safety and technical compliance by electricity entities, including consideration on whether the condition and maintenance of network and generation infrastructure is consistent with good industry practice.

Other broader market and technical studies are also being undertaken, with respect to power system transition, by AEMO, Australian Energy Market Commission and Council of Australian Governments Energy Council.

Noting the scope of work being undertaken by the various authorities above, the Commission has undertaken a compliance review into those aspects of its framework that are independent of the NER. To the extent that compliance with licence conditions is a matter which itself is conditional on the findings of another organisation (for example, it is for the AER to determine whether or not obligations under the NER have been complied with) then the Commission will await the outcomes of that organisation's work.

Should the AER or Technical Regulator find that market participants did not act in accordance with the NER or Electricity Act, further compliance action may be warranted as this may give rise to a breach of licence. The Commission will consider this as a separate matter once the findings of the AER and the Technical Regulator are available.

The focus of this report is on compliance by ElectraNet with the conditions of its electricity transmission licence. The Commission will report separately on generation licensees' compliance with their licence obligations (as appropriate).

3 Electricity Transmission Code

The Electricity Transmission Code (**Code**) was first issued on 11 October 1999, at the time that the South Australian Government was preparing for the long-term lease of the Government owned electricity assets. It sets out the obligations that ElectraNet must comply with in relation to the provision of transmission services in South Australia, including exit point reliability standards.

Importantly, the Code only applies to the extent that ElectraNet provides services relating to the operation of a transmission network, transmitting electricity between electricity businesses (generators and distributors) and from electricity businesses to end-use customers (usually through the distribution network operator but, in limited cases, direct to end-use customers).

To the extent that ElectraNet also provides other services in the electricity supply industry (for example, ElectraNet also performs a system control role in this State), those functions are regulated outside of the scope of the transmission licence and the Code. This means that if, for example, ElectraNet wanted to operate a standalone electricity transmission network outside of the NEM, such as in a remote area of the State or in the case of a new development supplied by means other than the NEM, then a different regulatory scheme would apply to it for those operations.

In the context of the provision of transmission services, however, the Code forms part of a broader regulatory scheme for transmission in the NEM. The reason for regulation of the transmission system is that while, in one sense, it may be seen as merely the physical system which transports wholesale energy from generator connection points to market customers and retailers, in a more fundamental way it provides the means by which the NEM operates.

Regulation of the system occurs at two levels: the NER establish technical standards, dealing with matters such as frequency, system stability, voltage and fault clearance. Jurisdictional standards, such as those set under the Code, provide for security and reliability standards which align with, and complement, the NER technical standards.

The Commission's role is to develop and administer security and reliability standards under the Code. AEMO has responsibilities under the NER for technical matters. As noted above, the AER is responsible for regulation of the revenue that transmission businesses are permitted to earn, having regard to the standards set by the Commission and AEMO.

3.1 Overview of the Electricity Transmission Code

The Code sets out various requirements that ElectraNet must meet as a condition of holding an electricity transmission licence in South Australia. These requirements (which are additional to those imposed under the NER and the Electricity Act) include:

- ▶ service standards
- ▶ requirements relating to interruptions
- ▶ design requirements
- ▶ technical requirements
- ▶ general requirements
- ▶ access to sites requirements
- ▶ telecommunications access requirements, and
- ▶ emergency requirements.

A key element of the Code is the setting of exit point reliability standards that ElectraNet must comply with. The Code contains five reliability categories for exit points on ElectraNet’s transmission network. Each exit point category has specific reliability and supply restoration standards. The existing reliability categories are summarised in Table 1:⁶

Table 1: Summary of reliability categories

Reliability category	Reliability	Time to restore to n line equivalent capacity	Time to restore to n transformer equivalent capacity
1	N line and transformer	2 days	8 days
2	N line, N-1 transformer	2 days	8 days
3	N-1 non-firm line and transformer ⁷	1 hour	1 hour
4	N-1 line and transformer	4 hours (best endeavours) for grouped exit points and 12 hours (best endeavours) for all other exit points	4 hours (best endeavours) for grouped exit points and 12 hours (best endeavours) for all other exit points
5	N-1 line and transformer provided from independent and diverse transmission substations	At least 65 percent within 4 hours	At least 65 percent within 4 hours

Category 1 has the lowest reliability and supply restoration requirements and Category 5 has the highest. The categorisation of exit points is based on the Commission’s periodic assessments as to whether the costs of replacing or augmenting each exit point are outweighed by the value to customers of the differential in reliability that would result.

In effect, the standards require a level of security (also referred to as redundancy) to be built into ElectraNet’s transmission system so that it can, in most cases, maintain a continuous electricity supply. Further, when network elements fail, the standards require restoration within specified timeframes.

3.2 Reliability and equivalence terminology

Terminology such as N and N-1 is used in the Code (and throughout this report) to describe levels of redundancy and hence, reliability of ElectraNet’s transmission system. The terms are applied to transmission lines and to transformers. As explained below, different N requirements for those network elements are established across the network. Further, the Code does not mandate the use of physical lines or transformers. Instead, it requires the delivery of an outcome equivalent to the outcome that a physical line or transformer would deliver – including any N requirement.

⁶ Sourced from AEMO, *Review of the South Australian Electricity Transmission Code reliability standards*, May 2015, p.9.

⁷ ‘Non-firm’ means the required level of supply can be met after post-contingent operation (ie allows for interruption).

3.2.1 N reliability

A transmission system with N reliability means that it is able to supply the required demand, provided that all the network elements are in service. The loss of a single transmission element (a line, a transformer or other associated equipment) will interrupt supply to some customers.

3.2.2 N-1 reliability

A level of N-1 reliability provides a higher degree of reliability. Under this standard there would be no interruption to supply with one network element out of service. It is also possible to define N-1 reliability in terms of a percentage of time or for a percentage of maximum demand.

3.2.3 Equivalence

The current Code only specifies reliability standards of N or N-1 connection capacity as appropriate for each exit point category. These reliability standards, except for Category 1, may be delivered by any means, including transmission network capability, distribution network capability, and demand management or generation alternatives. The reliability standards are minimum standards; ElectraNet may choose to offer reliability performance in excess of the standards set out in the Code.

This flexibility and focus on outcomes was introduced by the Commission in 2006, by replacing the concepts of 'x line capacity' and 'x transformer capacity' with 'x **equivalent** line capacity' and 'x **equivalent** transformer capacity' in the Code. This focus has continued for each subsequent review of the Code.

The purpose of utilising an outcomes-focussed regime is to provide incentives to the regulated business (in this case, ElectraNet) to meet the relevant standard in the most efficient manner available, rather than the regulator specifying the use of particular inputs.

This means that, while the outcomes sought are expressed in terms of the capacity to be delivered by particular types of plant and equipment (lines and transformers), the Code does not specify the use of only that type of plant and equipment – any solution can be utilised, provided it delivers the same, or better outcomes.

For example, it may be more effective and efficient for ElectraNet to deliver a standard through a combination of lines, transformers, generators, demand side response or battery storage. The Code facilitates this, in the context of efficiency for consumers in relation to the price, quality and reliability of electricity services.

The only limitation on that principle, in terms of the Code's scope, is that the solution is to form part of the overall transmission network. Absent that criteria, the Code (and licence) would not apply to the operations (although other regulatory controls, such as a standalone licensing and code regime, might apply in the alternative).

4 Emergency provisions of the Code

Having regard to information obtained from ElectraNet, the Bureau of Meteorology and published by AEMO in respect of the severity of the weather event that passed through the northern part of South Australia on 28 September and the damage and insecurity to the network caused by that weather, the Commission is satisfied that the weather event gave rise to an emergency (as that term is defined in the Code).

The Commission is satisfied, based on the information available, that ElectraNet used its best endeavours to restore transmission services to all exit points within the emergency area. Therefore, the Commission considers that ElectraNet complied with its licence obligations.

4.1 Obligation

Clause 9 of the Code contains provisions that can be invoked in the case of an emergency. Clause 9.1.1 of the Transmission Code provides that:

'Notwithstanding any other clause in this industry code, a transmission entity may disconnect, interrupt or limit the provision of transmission services at one or more connection points in the case of an emergency.'

The Code defines an emergency to mean:

'...an emergency due to the actual or imminent occurrence of an event which in any way endangers or threatens to endanger the safety or health of any person, or the maintenance of power system security, in the state of South Australia or which destroys or damages, or threatens to destroy or damage, any property in the state of South Australia.'

Where a transmission entity exercises its rights under clause 9.1.1, clause 9.1.2 of the Code requires the transmission entity to:

- (a) *provide, by way of its 24 hour emergency service, information on the nature of the emergency and an estimate of the time when the transmission services will be available, and*
- (b) *use its best endeavours to restore transmission services to a transmission customer, distributor or generator once the emergency has passed.*

In an emergency situation, if the emergency provisions are invoked, the mandatory obligations associated with the reliability service standards set out in clauses 2.5 to 2.9 of the Code cease to apply to the exit points that are affected by the emergency event. Instead, as specified in clause 9.1.2(b) of the Code, ElectraNet is required to use its best endeavours to restore transmission services to those exit points (and therefore to impacted customers, distributors or generators) once the emergency has passed. Best endeavours is defined in the Code to mean to act in good faith and use all reasonable efforts, skill and resources. Any exit point not affected by the emergency event is to be treated in the normal way such that the clause 2 obligations associated with reliability standard applicable to that exit point continue to apply.

4.2 Was there an emergency?

4.2.1 Evidence

ElectraNet provided information to the Commission about the impact of the severe weather event on 28 September in terms of its infrastructure, public safety and network security. In summary, ElectraNet submitted that the weather event:

- ▶ caused damage to a number of ElectraNet’s transmission assets, such as its transmission towers and high voltage lines
- ▶ endangered the safety of the public (through reduced clearance of transmission lines or lines being on the ground) and prevented the safe inspection of other infrastructure by ground and aerial patrols, and
- ▶ significantly impacted the security of the power system.

The following is a summary from the severe thunderstorm and tornado outbreak South Australia 28 September 2016 report, available on the Bureau of Meteorology’s website.⁸

‘One of the most significant severe thunderstorm outbreaks in recent decades impacted central and eastern districts of South Australia during the afternoon and evening on 28 September 2016. Multiple supercell thunderstorms produced damaging to destructive wind gusts, including at least seven tornadoes, very large hailstones and locally intense rainfall. These supercell thunderstorms and tornadoes impacted the South Australian power network, contributing to a state-wide power outage.

The severity of the thunderstorms was aided by an intense and powerful mid-latitude cyclone (low pressure system), which intensified over the Great Australian Bight on 28 September and directly impacted the state on 29 September.

The severe thunderstorm and tornado outbreak described in this report was the initial phase in a week of severe weather in South Australia. This followed a tumultuous winter and spring where wetter and windier than average conditions had already stretched the State Emergency Service which had already turned out to more jobs than the previous year. Winds on 29 September reached storm force over coastal waters, generating damaging wave action and a significant storm surge in Spencer Gulf. Persistent heavy rain over the Mount Lofty and Flinders Ranges led to flooding impacts, including widespread riverine flooding which continued through to 2 October. A series of fronts associated with a second low pressure system brought further bursts of severe winds and moderate to heavy rain during 2-4 October, which led to renewed flooding.’

The information obtained from the Bureau of Meteorology confirms the severity and uniqueness of the thunderstorms and tornadoes which passed through the northern part of South Australia on 28 September. In addition, news reports and media releases of ElectraNet at the time (or just after) the weather event corroborate the information provided by ElectraNet in terms of infrastructure damage and safety concerns. The reports published by AEMO in relation to the outage also confirm the weather event was significant and severe.

4.2.2 Analysis and findings

Having regard to information obtained from ElectraNet, the Bureau of Meteorology and published by AEMO in respect of the severity of the weather event that passed through the northern part of South Australia on 28 September and the damage and insecurity to the network caused by that weather, the Commission is satisfied that the weather event gave rise to an emergency (as that term is defined in the Code). However, on the basis that the severe weather and the impacts of that weather in terms of damage to infrastructure and risk to public safety occurred in the northern part of the state, it follows that the emergency should also be confined to that area for the purposes of the emergency provisions.

Accordingly, the Commission has assessed each exit point in the State’s transmission network in terms of whether it fell within the emergency area or not. It has been guided by weather reports which indicate where severe winds and rain were recorded and where infrastructure damage was identified as a result

⁸ Refer: http://www.bom.gov.au/announcements/sevwx/sa/Severe_Thunderstorm_and_Tornado_Outbreak_28_September_2016.pdf

of that cyclonic activity. Table 2 identifies all exits point that the Commission has determined fall within the emergency area.

Table 2 – Exit points within the emergency area

Category	Connection point within emergency area
Category 1	Baroota
	Davenport
	Leigh Creek Coal
	Leigh Creek South
	Middleback (SAPN)
	Middleback (Arrium)
	Morgan/Whyalla 1
	Morgan/Whyalla 2
	Morgan/Whyalla 3
	Morgan/Whyalla 4
	Mt Gunson
	Neuroodla
	Pimba
	Stony Point - Whyalla Refiners (distribution)
	Stony Point
	Whyalla Terminal LMF
Woomera	
Category 2	Wudinna
	Yadnarie
Category 3	Port Lincoln
Category 4	Brinkworth
	Clare North
	Templers
	Hummocks
	Davenport West
	Waterloo
	Whyalla Central – Main Bus
	Bungama and Pt Pirie

Subject to the discussion below regarding whether the emergency provisions of the Code were invoked, the connection points identified in the above table are, prima facie, not subject to the requirements of clause 2 of the Code in respect of the outage. Instead, in accordance with clause 9.1.2(b) of the Code, the Commission is to determine whether ElectraNet used its best endeavours to restore transmission services to the relevant connection points supplying impacted customers, distributors or generators once the emergency passed.

4.3 Were the emergency provisions invoked?

The existence of an emergency, by itself, does not automatically result in the disapplication of the obligations set out in clauses 2.5 to 2.9 of the Code to restore transmission services. The Code

requirements set out in these clauses apply as normal unless ElectraNet exercises its right to disconnect, interrupt or limit the provision of transmission services at one or more connection points upon the commencement of the emergency. The Commission therefore asked ElectraNet to provide details of the actions taken after the emergency commenced, in particular, details on how it determined to disconnect, interrupt or limit the provision of transmission services at one or more connection points.

4.3.1 Evidence

ElectraNet submitted to the Commission that, following the outage caused by the ongoing severe weather event, it commenced a period of assessment and restoration and limitation of supply in accordance with directions from AEMO and in line with its Emergency Response Procedures. Copies of the procedures followed by ElectraNet were provided to the Commission and were reviewed to determine what actions are to be taken by ElectraNet following an emergency such as a state-wide outage. In addition to reviewing the Emergency Response Procedures of ElectraNet, the Commission was provided with AEMO's South Australian Restart Plan and a presentation on black system restarts.

4.3.2 Analysis and findings

The procedures and plan confirm that in the event of a state-wide outage ElectraNet is to undertake assessments of the state of key transmission assets, conduct the staged restoration of supply via the Heywood interconnector and various generation units and systematically limit supply to connection points to reduce the risk of further disturbances to the network.

While the Commission understands that, in these circumstances, ElectraNet is largely under the direction of AEMO, the actions to be taken are agreed between the parties. In addition, ElectraNet, as the entity with the crews on the ground, is responsible for relaying critical information to AEMO during emergency events so that decisions (and subsequent actions) as to the restoration and, in particular, limitation of transmission services can be made.

For these reasons, the Commission is satisfied that ElectraNet did exercise its rights under clause 9.1.1 of the Code so that the emergency provisions were invoked.

4.4 Compliance with the requirements of clause 9.1.2(a)

On the basis that the emergency provisions of the Code were invoked, the Commission assessed ElectraNet's compliance with clause 9.1.2 (a) and 9.1.2(b) of the Code (as set out above).

4.4.1 Evidence

Regarding the provision of a 24 hour emergency service, ElectraNet submitted to the Commission that, during the outage, its control room operated 24 hours a day communicating with generators, load customers and regulators in relation to the state of the network and estimated times for the restoration of transmission services. ElectraNet also advised that it maintained a 24 hour phone line to provide information by telephone and engaged a communication firm to assist its internal communication team provide information regarding restoration time updates to the media and general public.

The media releases made by ElectraNet at the time of and after the outage confirm that a 24 hour hotline was available to all members of the general public to report damaged or fallen powerlines or to receive information about restoration of supply.

4.4.2 Analysis and findings

In light of the above, the Commission is satisfied that ElectraNet complied with the requirements of clause 9.1.2(a) of the Code.

4.5 Compliance with clause 9.1.2(b)

As discussed above, the Commission has determined that the emergency provisions of the Code were invoked by ElectraNet. Therefore, in accordance with clause 9.1.2(b) of the Code, ElectraNet must use its best endeavours to restore transmission services to a transmission customer, distributor or generator once the emergency condition has passed.

4.5.1 Evidence

ElectraNet submitted to the Commission that it believes that it used best endeavours to restore transmission services to customers once the emergency had passed. It also provided for each exit point, information about restoration times and its understanding of the times that customers accepted supply.

To demonstrate its compliance, ElectraNet supplied detailed information regarding the timeframes to restore each of the exit points listed in the Code to N and N-1 equivalent line capacity. Further, ElectraNet also provided policies and procedures, which detail its approach to emergency situations.

The Commission notes that in some circumstances there were delays between the restoration times and when customers accepted supply within the emergency area. This is due to a variety of reasons including damage to the distributor or customer infrastructure or ElectraNet restricting supply to certain customers due to load limitations.

Further, ElectraNet submitted to the Commission that delay in re-energisation of the Whyalla Arrium Ladle Metallurgical Furnace (LMF) connection point was due to voltage control and power quality considerations while the Eyre Peninsula was supplied by a single 275kV Transmission line. There was concern that the nature of the LMF plant switching on and off continuously would cause power system security issues and result in unstable voltage fluctuations on the Eyre Peninsula. ElectraNet completed several network studies and supply was made available to the LMF plant after confidence in the stability of the network was reached.

This is further discussed on page 74 of AEMO's Black system South Australia 28 September 2016 final report.⁹ An extract of that information is shown below, detailing the delayed exit point restoration of exit points. Please note, times in AEMO's report are shown in Eastern Standard Time (EST).

Load restoration in the northern part of the state (page 74)

'Although AEMO gave clearance to restore all remaining load at 1829 hrs on Thursday 29 September, approximately 34% of forecast load (mainly in the northern part of the network) could not be restored due to damage to the transmission network. Load in this area was progressively restored over the next few days as repairs to the transmission network were completed.

Table 14 shows the restoration sequence of the major industrial loads fed from the Davenport substation. The timing of the restoration was based on two factors:

- ▶ *Initially no connection was available to Davenport substation from the south, due to actual or potential damage to all transmission lines. The first transmission line to Davenport (Davenport–Bungama 275 kV line) was returned to service at 1215 hrs on 29 September after completion of line patrols. This allowed partial restoration of the loads in the northern area of the state.*
- ▶ *After the Davenport–Bungama line was returned to service, the capability of supplying the load in the area was limited due to voltage control issues with only this single line in service.*

⁹ Refer: <http://aemo.com.au/Media-Centre/AEMO-publishes-final-report-into-the-South-Australian-state-wide-power-outage>.

Full load capability was restored after a second line to Davenport (Davenport–Belalie 275 kV line) was returned to service after repairs at 1340 hrs on 10 October 2016.

All load in SA was restored by 11 October 2016.

Table 14 Load restoration in the northern part of the state

Connection Point / Load	First energised	Maximum permissible load	Full load capability restored
<i>Whyalla Central (Arrium Steel Works & SA Power Network customers))</i>	1655 hrs on 29/09/2016	Initially 30 MW total pending further network studies by ElectraNet. Increased to 46 MW total (Arrium Steel 26 MW) at 1800 hrs on 4/10/2016	1700 hrs on 10/10/2016
<i>Middleback (Arrium Mine)</i>	1930 hrs on 29/09/2016	2 MW (pending further network studies by ElectraNet)	1800 hrs on 4/10/2016
<i>Olympic Dam 132 kV connection (this is a standby supply and not normally required if the 275 kV connection is available)</i>	1840 hrs on 30/09/2016	20 MW (as requested by BHP)	1700 hrs on 6/10/2016
<i>Whyalla Central (Arrium Ladle Metallurgical Furnace (LMF))</i>	ElectraNet advised Arrium connection point available to energise at 1930 hrs on 5/10/2016. Arrium commenced taking load 0520 hrs on 6/10/2016.	20 MW (normal full load)	0520 hrs on 6/10/2016
<i>Olympic Dam 275 kV connection</i>	ElectraNet were ready to energise the line at 1615 hrs on 10/10/2016 but BHP requested a delay until 0730 hrs on 11/10/2016	No limit	0730 hrs on 11/10/2016

In Section 3.5.1 [(of AEMO's report)], it was noted that the power system around Davenport would likely have been in a satisfactory operating state with only one line in service, but that ongoing voltage control would have been very difficult.

Because normal local voltage control capability was unavailable due to the remaining transmission circuit outages, a conservative approach to load restoration in this area was required, until at least a second line had been restored.'

4.5.2 Analysis and findings

In determining whether ElectraNet has met best endeavours to restore transmission services to those exit points the Commission has considered the information provided by ElectraNet and the Bureau of Meteorology and published by AEMO.

Taking into account this information regarding the severity of the storm, the damage to ElectraNet's transmission lines and ElectraNet having to wait for the storm and system black to end before it could assess line damage and restore transmission services, the Commission is satisfied that ElectraNet used best endeavours to restore transmission services to each exit point within the emergency area once the emergency passed.

The Commission has also investigated the Port Lincoln exit point due to a delay in network support arrangements being able to be provided and then a subsequent failure in to those arrangements, which is detailed in Chapter 6 below.

5 Restoration of transmission services in other parts of the state

The Commission is satisfied, based on the information available, that ElectraNet used its best endeavours to restore transmission services in other parts of the state. Restoration timeframes were impacted by the staged restoration of supply, including limiting supply to connection points to reduce the risk of further disturbances to the network. Therefore, the Commission considers that ElectraNet complied with its licence obligations.

5.1 Obligation

As a condition of its licence, ElectraNet is required to comply with the Code, an industry code made by the Commission pursuant to section 28 of the ESC Act. The Commission has assessed ElectraNet's compliance with the following licence condition, which forms part of its Electricity Transmission licence.

The licensee must:

- d) comply with all applicable provisions of the Electricity Transmission Code (including any service standards);*
- e) comply with all applicable provisions of any other industry code or rule made by the Commission from time to time; and*
- f) notify the Commission if it commits a material breach of the Electricity Transmission Code or any other applicable industry code within 3 business days after becoming aware of that breach.*

In reviewing ElectraNet's compliance with the Electricity Transmission Code, the Commission has considered ElectraNet's performance against the service standards prescribed in the Code.

As discussed in section 4.2, the Commission has determined that the emergency provisions of the Code were invoked by ElectraNet for exit points in Northern areas impacted by the severe weather. Therefore, restoration of transmission services to those exit points was assessed in accordance with clause 9.1.2(b) of the Code. For the remaining exit points not included within the emergency areas, ElectraNet must comply with the reliability service standards set out in clauses 2.5 to 2.9 of the Code.

5.1.1 Facts

The electricity transmission network in South Australia extends across some 200,000 square kilometres of diverse and rugged terrain, operating at voltages of 275, 132 and 66 kilovolts (275,000, 132,000 and 66,000 volts). The network includes 91 high-voltage substations with approximately 5,600 circuit kilometres of transmission lines.¹⁰

Generally, ElectraNet must plan and develop its transmission system such that each exit point, or group of exit points, meet the minimum reliability standards applicable to that category. The allocation of exit points to categories is set out in Table 3 below.

¹⁰ Source: <https://www.electranet.com.au/what-we-do/solutions/network-map/>

Table 3: Exit point categories

Category	Exit point [] = group of exit points	
Category 1	<ul style="list-style-type: none"> ▶ Baroota ▶ Back Callington * ▶ Davenport * ▶ Florieton SWER ▶ Kanmantoo ▶ Leigh Creek Coal * ▶ Leigh Creek South Mannum/Adelaide 1 * ▶ Mannum/Adelaide 2 * ▶ Mannum/Adelaide 3 * ▶ Middleback* ▶ Millbrook * ▶ Morgan/Whyalla 1 * ▶ Morgan/Whyalla 2 * ▶ Morgan/Whyalla 3 * ▶ Morgan/Whyalla 4 * ▶ Mt Gunson ▶ Murray/Hahndorf 1 * 	<ul style="list-style-type: none"> ▶ Murray/Hahndorf 1 * ▶ Murray/Hahndorf 2 * ▶ Murray/Hahndorf 3 * ▶ Neuroodla ▶ Pimba * ▶ Roseworthy* ▶ Stony Point (Whyalla Refiners) - distribution ▶ Stony Point* ▶ Whyalla Terminal LMF ▶ Woomera* ▶ ▶ * denotes a customer but does not include a distributor. Restoration standards set out in clause 2.5 only apply to equipment providing a prescribed transmission service. ▶
Category 2	<ul style="list-style-type: none"> ▶ Ardrossan West ▶ Dalrymple 	<ul style="list-style-type: none"> ▶ Kadina East ▶ Wudinna ▶ Yadnarie
Category 3	<ul style="list-style-type: none"> ▶ Port Lincoln 	<ul style="list-style-type: none"> ▶ Snuggery Rural
Category 4	<ul style="list-style-type: none"> ▶ Angas Creek ▶ [Berri/Monash] ▶ Blanche ▶ Brinkworth ▶ Clare North ▶ Dorrien ▶ Templers ▶ Hummocks ▶ Keith 	<ul style="list-style-type: none"> ▶ North West Bend ▶ Penola West ▶ Davenport West ▶ Snuggery Industrial ▶ Taillem Bend ▶ Waterloo ▶ Whyalla Central – Main Bus ▶ [Bungama and Pt Pirie]

Category	Exit point [] = group of exit points	
	<ul style="list-style-type: none"> ▶ Kincaig ▶ Mannum ▶ Mobilong ▶ [Mt Barker, Mt Barker South] ▶ Mt Gambier 	<ul style="list-style-type: none"> ▶ [Dry Creek (West), Kilburn, LeFevre, New Osborne and Torrens Island 66kV] ▶ [Happy Valley, Magill (South), Morphett Vale East and City West (South)] ▶ [Para, Munno Para and Parafield Gardens West] ▶ [Dry Creek (East), Magill (East) and Northfield]
Category 5	▶ Adelaide Central [East Tce, City West (ACR)]	

5.2 Evidence

ElectraNet submitted to the Commission that it believes that it used best endeavours to restore transmission services to customers. To demonstrate its compliance, ElectraNet supplied detailed information regarding the timeframes to restore each of the exit points listed in the Code to N and N-1 equivalent line capacity. Table 4 details the exit points that were outside the emergency area, and the restoration times for each of these points.

Table 4: Restoration times for exit points outside the emergency area

Category	Connection point	Supply interrupted (date and time)	Supply offered (or available) to customer(date and times)
Category 1	Back Callington *	28-09-16 15:48	29-09-16 1:06
	Florieton SWER	28-09-16 15:48	28-09-16 23:29
	Kanmantoo	28-09-16 15:48	28-09-16 19:35
	Mannum/Adelaide 1 *	28-09-16 15:48	28-09-16 21:19
	Mannum/Adelaide 2 *	28-09-16 15:48	28-09-16 21:19
	Mannum/Adelaide 3 *	28-09-16 15:48	28-09-16 21:19
	Millbrook *	28-09-16 15:48	28-09-16 21:38
	Murray/Hahndorf 1 *	28-09-16 15:48	28-09-16 19:34
	Murray/Hahndorf 2 *	28-09-16 15:48	28-09-16 19:34
	Murray/Hahndorf 3 *	28-09-16 15:48	28-09-16 19:34
	Roseworthy*	28-09-16 15:48	28-09-16 22:14
Category 2	Ardrossan West	28-09-16 15:48	28-09-16 23:39
	Dalrymple	planned outage	planned outage
	Kadina East	28-09-16 15:48	28-09-16 23:27
Category 3	Snuggery Rural	28-09-16 15:48	28-09-16 20:17
Category 4	Angas Creek	28-09-16 15:48	28-09-16 21:16
	[Berri/Monash]	28-09-16 15:48	28-09-16 22:54
	Blanche	28-09-16 15:48	28-09-16 22:09
	Dorrien	28-09-16 15:48	29-09-16 0:49

Category	Connection point	Supply interrupted (date and time)	Supply offered (or available) to customer(date and times)
	Hummocks	28-09-16 15:48	28-09-16 23:31
	Keith	28-09-16 15:48	28-09-16 20:51
	Kincraig	28-09-16 15:48	28-09-16 20:55
	Mannum	28-09-16 15:48	28-09-16 21:48
	Mobilong	28-09-16 15:48	28-09-16 19:35
	Mt Barker	28-09-16 15:48	28-09-16 21:11
	Mt Barker South	28-09-16 15:48	28-09-16 19:42
	Mt Gambier	28-09-16 15:48	28-09-16 18:32
	North West Bend	28-09-16 15:48	28-09-16 22:57
	Penola West	28-09-16 15:48	28-09-16 21:46
	Snuggery Industrial	28-09-16 15:48	28-09-16 20:17
	Tailem Bend	28-09-16 15:48	28-09-16 19:38
	Kilburn	28-09-16 15:48	28-09-16 20:15
	LeFevre	28-09-16 15:48	28-09-16 19:39
	New Osborne	28-09-16 15:48	28-09-16 19:44
	Torrens Island 66kV	28-09-16 15:48	28-09-16 18:15
	Dry Creek (West)	28-09-16 15:48	28-09-16 20:18
	Magill (South)	28-09-16 15:48	28-09-16 18:43
	Morphett Vale East	28-09-16 15:48	28-09-16 19:33
	City West (South)	planned outage	planned outage
	Happy Valley	28-09-16 15:48	28-09-16 18:44
	Munno Para	28-09-16 15:48	28-09-16 19:58
	Parafield Gardens West	28-09-16 15:48	28-09-16 19:50
	Para	28-09-16 15:48	28-09-16 17:40
	Dry Creek (East)	28-09-16 15:48	28-09-16 18:43
	Magill (East)	28-09-16 15:48	28-09-16 18:43
	Northfield	28-09-16 15:48	28-09-16 19:47
Category 5	City West (ACR)	planned outage	planned outage
	East Tce	28-09-16 15:48	28-09-16 19:10

ElectraNet submitted to the Commission that following the system black event, ElectraNet restored its network in direction of and in accordance with AEMO's system restart requirements and taking account the safety of the public and to property.

Further, ElectraNet also provided policies and procedures, which detail its approach to system restart. In addition the Commission was provided with AEMO's South Australian Restart Plan and a presentation on black system restarts. In accordance with these procedures and plan, ElectraNet conducts a staged restoration of supply via the Heywood interconnector and various generation units and systematically limit supply to connection points to reduce the risk of further disturbances to the network.

Restoration details are further discussed in appendix R on pages 183-4 of AEMO's Black system South Australia 28 September 2016 final report.¹¹ An extract of that information is shown below, detailing the delayed exit point restoration of exit points. Please note, times in AEMO's report are shown in Eastern Standard Time (EST).

APPENDIX R. RESTORATION DETAILS

Table 23 Restoration sequence of events – main SA network

<i>Time</i>	<i>Event</i>
<i>28 September</i>	<i>Initial actions</i>
<i>16:19 (T+44s)</i>	<i>Confirmed black system condition with ElectraNet.</i>
<i>16:24 (T+6min)</i>	<i>Declared black system condition for SA region.</i>
<i>16:25 (T+7min)</i>	<i>SA market suspension declared. System separation constraints invoked to ensure accurate inputs for the remainder of the NEM. AGC re-configured to stabilise frequency for the remainder of the network.</i>
<i>16:30 (T+12min)</i>	<i>Based on network conditions at this time, AEMO developed a restoration strategy in conjunction with ElectraNet and Generators with SRAS contracts. This included the following restoration plans to proceed in parallel:</i> <ul style="list-style-type: none"> <i>• To establish a corridor from Victoria and supply auxiliary supplies to SA power stations and high priority loads determined by ElectraNet.</i> <i>• To provide auxiliary supplies to power stations from QPS.</i>
<i>16:32 (T+14min)</i>	<i>Activated SRAS contract with QPS.</i>
	<i>Restart Sequence</i>
<i>16:37 (T+19min)</i>	<i>Requested QPS Unit 1 to come on at minimum load under SRAS.</i>
<i>17:10 (T+52min)</i>	<i>QPS start initiated and switching commenced.</i>
<i>17:13 (T+55min)</i>	<i>Torrens Island Power Station house load supplied from QPS unit.</i>
<i>18:43 (T+2h 25min)</i>	<i>Torrens Island house supplies were changed over to supplies from interconnector and QPS unit shutdown to allow connection to the interconnected system.</i>
	<i>Restart from Victoria</i>
<i>17:23 (T+1h 5min)</i>	<i>South East substation was energised from Victoria via the Heywood–South East No.2 275 kV transmission line. South East No.2 275 / 132 kV transformer energised.</i>
<i>17:33 (T+1h 15min)</i>	<i>Tailem Bend substation was energised via the South East–Tailem Bend No. 2 275 kV transmission line.</i>
<i>17:52 (T+1h 34 min)</i>	<i>South East SVCs energised.</i>
<i>18:06 (T+1h 48min)</i>	<i>Tungkillo substation was energised via Tailem Bend–Tungkillo 275 kV transmission line.</i>
<i>18:09 (T+1h 51 min)</i>	<i>Para substation was energised via Tungkillo–Para 275 kV transmission line.</i>
<i>18:18 (T+1h 59 min)</i>	<i>Para SVCs 1 and 2 were energised in service to provide voltage support.</i>
<i>18:21 (T+2h 3 min)</i>	<i>Para SVC 1 tripped. South East SVC 1 and 2 tripped.</i>
<i>18:28 (T+2h 10min)</i>	<i>Torrens Island East 275 kV busbar energised via Para–Torrens Island 275 kV transmission line.</i>
<i>18:32 (T+2h 14 min)</i>	<i>South East SVC 1 in service.</i>
<i>18:42 (T+2h 24min)</i>	<i>South East–Heywood No.1 transmission line in service.</i>
<i>18:52 (T+2h 34 min)</i>	<i>South East SVC 2 in service.</i>

¹¹ Refer: <http://aemo.com.au/Media-Centre/AEMO-publishes-final-report-into-the-South-Australian-state-wide-power-outage>.

18:59 (T+2h 41min)	South East–Tailern Bend No.2 275 kV transmission line in service.
19:00 (T+2h 42min)	Transmission corridor from Victoria was established through to the Adelaide and CBD area and load restoration commenced. It was decided not to attempt to rebuild the network north of Adelaide due to advice of major transmission network damage.
19:01 (T+2h 43min)	South East–Mt Gambier–Blanche 132 kV transmission lines in service.
19:06 (T+2h 48min)	Tailem Bend–Cherry Gardens–Torrens Island 275 kV transmission lines in service.
19:07 (T+2h 49min)	Para–Magill 275 kV transmission line in service.
19:09 (T+2h 51min)	Cherry Gardens–Happy Valley 275 kV transmission line in service.
19:16 (T+2h 58min)	Happy Valley–Magill transmission line in service. This completed a loop between Torrens Island and Para 275 kV.
19:18 (T+3h)	Magill–Burnside 66 kV line in service.
19:29 (T+3h 11min)	Happy Valley–Seacombe–Oakland No.1 and No.2 66 kV lines in service.
19:31 (T+3h 13min)	Para–Parafield Gardens West–Pelican Point–Le Fevre–Torrens Island B 275 kV transmission lines in service.
19:35 (T+3h 17min)	Happy Valley–Morphett Vale East–Cherry Gardens 275 kV transmission line in service.
19:46 (T+3h 28min)	Torrens Island A–Northfield 275 kV transmission line in service.
19:48 (T+3h 30min)	Torrens Island A–Magill 275 kV transmission line in service.
19:50 (T+3h 32min)	Pelican Point gas turbine transformer energised. Auxiliary supply restored to Pelican Point Power Station.
19:54 (T+3h 36min)	Tungkillo–Mt Barker–Cherry Gardens 275 kV transmission line in service.
19:55 (T+3h 37min)	QPS units 1–4 in service.
20:06 (T+3h 48min)	Tailem Bend–Mobilong–Murray Bridge / Hahndorf Pumps No.2 132 kV transmission line in service.
20:43 (T+4h 25min)	Magill–East Terrace 275 kV transmission line in service.
20:47 (T+4h 29min)	South East–Snuggery 132 kV transmission line in service.
20:58 (T+4h 40min)	Torrens Island Power Station A2 generating unit in service.
21:23 (T+5h 5min)	Tailem Bend–Keith–Kincaig 132 kV transmission line in service.
21:34 (T+5h 16min)	Northfield–Kilburn–Torrens Island A 275 kV transmission line in service.
22:02 (T+5h 44min)	Torrens Island Power Station A4 generating unit in service.
22:05 (T+5h 47min)	Pelican Point Power Station gas turbine generating unit 1 in service.
22:08 (T+5h 50min)	Snuggery Power Station in service.
23:10 (T+6h 52min)	Pelican Point Power Station steam generating unit in service.
23:11 (T+6h 53min)	Para–Robertstown 275 kV transmission line in service.
23:31 (T+7h 31min)	Torrens Island Power Station B1 generating unit in service.
23:52 (T+7h 34min)	Tungkillo–Robertstown 275 kV transmission line in service.
29 September	Conclusion of black system condition
02:40 (T+10h 22min)	Torrens Island Power Station B3 generating unit in service.
12:15 (T+19h 57min)	Davenport–Bungama 275 kV line was re-energised after line patrol. Allowing some electricity to be restored in the northern region.
18:25 (T+1d 2h 7min)	AEMO advised that that a black system condition in the SA region was no longer current. AEMO gave clearance to restore the last load block in SA. AEMO notified that the Spot Market would continue to be suspended.
10 October 2016 13:40 (T+11d 21h 22min)	Davenport–Belalie 275 kV line
12 October 2016 19:15 (T+13d 2h 57min)	Davenport–Mt Lock 275 kV line.
18 December 13:18 (T+ 81d)	Davenport–Brinkworth 275 kV line'

5.3 Analysis and findings

The Commission has assessed whether ElectraNet met its reliability service standards with reference to the system restart procedures and plans.

5.3.1 Clause 2.5 of the Code – Category 1 exit points

In accordance with clause 2.5.1(a) of the Code, for category 1 exit points ElectraNet must in the event of an interruption use best endeavours to:

- ▶ *restore “N” equivalent line capacity as soon as practicable, and*
- ▶ *restore “N” equivalent line capacity within 2 days of the commencement of the interruption.*

As ElectraNet restored services in accordance with AEMO’s direction and the system restart procedures, the Commission has determined that ElectraNet used best endeavours to restore transmission lines and services to exit points within category 1. Further, all category 1 exit points, outside the emergency area, were restored within 2 days of the commencement of the interruption.

5.3.2 Clause 2.6 of the Code – Category 2 exit points

In accordance with clause 2.6.1(a) of the Code, for category 2 exit points ElectraNet must in the event of an interruption use best endeavours to:

- ▶ *restore “N” equivalent line capacity as soon as practicable, and*
- ▶ *restore “N” equivalent line capacity within 2 days of the commencement of the interruption.*

As ElectraNet restored services in accordance with AEMO’s direction and the system restart procedures, the Commission has determined that ElectraNet used best endeavours to restore transmission lines and services to exit points within category 2. Further, all category 2 exit points, outside the emergency area, were restored within 2 days of the commencement of the interruption.

5.3.3 Clause 2.7 of the Code – Category 3 exit points

In accordance with clause 2.7.1(a) of the Code, for category 3 exit points ElectraNet must provide N-1 equivalent line capacity for at least 100 percent of contracted agreed maximum demand (including through the use of post-contingent operation) and:

- ▶ *in the event of a failure of any installed transmission line or network support arrangement, use its best endeavours to restore N-1 equivalent line capacity as soon as practicable*
- ▶ *in the event of an interruption arising from the failure of the installed transmission lines or network support arrangements:*
 - *restore at least N equivalent line capacity within one hour of the commencement of the interruption, and*
 - *use its best endeavours to restore N-1 equivalent line capacity as soon as practicable after the commencement of the interruption.*

There are two exit points which have been categorised as category 3 exit points: Port Lincoln and Snuggery Rural. The Port Lincoln Exit point was within the emergency area as described in section 4.2.

Snuggery Rural was restored within 4 hours and 29 minutes of the interruption which was outside the 1 hour requirement set out in clause 2.7.1(a)(ii)(A) of the Code. However, as detailed above, ElectraNet restored transmission services in accordance with AEMO’s direction and the system restart procedures and as such was not able to energise the Snuggery Rural exit point any earlier. Due to these reasons,

the Commission has assessed ElectraNet as complying with clause 2.7.1 of the Code for the Snuggery Rural exit point.

5.3.4 Clause 2.8 of the Code – Category 4 exit points

In accordance with clause 2.8.1(a) of the Code, for category 4 exit points ElectraNet must in the event of an interruption arising from a failure of installed transmission lines or network support arrangements:

- ▶ *for the grouped exit points connected to the Category 5 exit points, use its best endeavours to restore at least “N” equivalent line capacity within 4 hours of the commencement of the interruption*
- ▶ *for all other exit points, use its best endeavours to restore at least “N” equivalent line capacity within 12 hours of the commencement of the interruption, and*
- ▶ *use its best endeavours to restore “N-1” equivalent line capacity as soon as practicable after the commencement of the interruption.*

After the outage, ElectraNet was able to restore transmission services (“N” equivalent line capacity) to the majority of category 5 exit points within the timeframes set out above.

However, ElectraNet was unable to restore transmission services to the following five exit points within those timeframes:

- ▶ [Berri/Monash]
- ▶ Mt Barker
- ▶ Dry Creek (West)
- ▶ Munno Para, and
- ▶ Parafield Gardens West.

As ElectraNet restored these transmission services in accordance with AEMO’s direction and the system restart procedures the Commission has determined that ElectraNet used its best endeavours to restore the transmission services within the appropriate timeframe.

5.3.5 Clause 2.9 of the Code – Category 5 exit points

In accordance with clause 2.9.1(a) of the Code, for category 5 exit points ElectraNet must in the event of an interruption use best endeavours to:

- ▶ *restore at least 65% of “N” equivalent line capacity within 4 hours of the commencement of the interruption, and*
- ▶ *use its best endeavours to restore “N-1” equivalent line capacity as soon as practicable after the commencement of the interruption.*

ElectraNet restored transmission services to the East Terrace exit point, which was the only exit point in operation, within 3 hours and 30 minutes of the interruption. As such, ElectraNet complied with clause 2.9 of the Code.

6 Restoration of Port Lincoln

Overall, the Commission's analysis has determined that ElectraNet has complied with the conditions of its licence. However, the outage caused by the severe weather event has highlighted additional risk in operating the Port Lincoln network support arrangement. As a result, there are opportunities for improvement in terms of restart procedures, clarification of Code requirements, maintenance and better transparency of network support arrangement availability.

Recommendation 1: The Commission considers that ElectraNet and AEMO should review restart procedures to ensure that the network support arrangement can begin operating as soon as possible in the event of a black system condition.

Recommendation 2: ElectraNet should coordinate with Synergen to ensure that an inspection of all bolts, gaskets and seals at the Port Lincoln Power Station is performed on a periodic basis.

Recommendation 3: The Commission will review and consult on amendments to the Electricity Transmission Code with regard to the availability of network support arrangements.

Recommendation 4: The Commission will review and consult on additional reporting requirements regarding the availability of network support arrangements.

The Commission's findings and recommendations, relating to Port Lincoln, focus on the following key restoration events that occurred following the outage.

- ▶ Electricity supply was initially restored to Port Lincoln at 19:03 on 28 September 2016, approximately 3 hours after the outage commenced, utilising the generation network support arrangement. The generator supplied Port Lincoln for approximately five hours until 00:22 on 29 September 2016.
- ▶ The Yadnarie connection point, which supplies electricity to Port Lincoln via the Yadnarie to Port Lincoln transmission line, was restored at 16:53 on 29 September 2016 (approximately one day after the commencement of the outage). This followed the restoration of the Whyalla Central – Main Bus connection point at 16:24 and the Davenport West connection point at 11:46. These connection points are located in the emergency area, refer sections 4.2 and 4.3 of this report for further information.
- ▶ At 16:56 on 29 September 2016, ElectraNet attempted to restore supply to Port Lincoln via the Yadnarie to Port Lincoln transmission line. However, supply was unable to be restored as the attempted energisation revealed that the Yadnarie to Port Lincoln transmission line had sustained damage from the storm.
- ▶ At 17:19 on 29 September 2016, crews were dispatched to locate and repair the fault on the 130km Yadnarie to Port Lincoln transmission line. Around 3 hours later, patrols were halted as it was unsafe for patrols to continue in the continuing severe weather conditions.
- ▶ Patrols recommenced at 8:40 on 30 September 2016. At 11:16 on 30 September 2016, a helicopter patrol located a broken insulator on the Yadnarie to Port Lincoln transmission line. Ground crews were then dispatched to repair the broken insulator.
- ▶ At 20:30 on 30 September 2016, supply is restored to Port Lincoln via the Yadnarie to Port Lincoln transmission line (approximately one day after the Yadnarie connection point was restored and two days after the commencement of the outage).
- ▶ The network support arrangement remained unavailable to provide back-up generation until 8 October 2016.

6.1 Obligation

As a condition of its licence, ElectraNet is required to comply with the Code, an industry code made by the Commission pursuant to section 28 of the ESC Act. The Commission has assessed ElectraNet's compliance with the following licence condition, which forms part of its Electricity Transmission licence.

The licensee must:

- a) comply with all applicable provisions of the Electricity Transmission Code (including any service standards);*
- b) comply with all applicable provisions of any other industry code or rule made by the Commission from time to time; and*
- c) notify the Commission if it commits a material breach of the Electricity Transmission Code or any other applicable industry code within 3 business days after becoming aware of that breach.*

In reviewing ElectraNet's compliance with the Electricity Transmission Code, the Commission has considered ElectraNet's performance against the service standards prescribed in the Code. As discussed in section 4.1, the Commission has determined that the emergency provisions of the Code were invoked by ElectraNet. Therefore, in accordance with clause 9.1.2(b) of the Code, ElectraNet must use its best endeavours to restore transmission services to a transmission customer, distributor or generator once the emergency condition has passed.

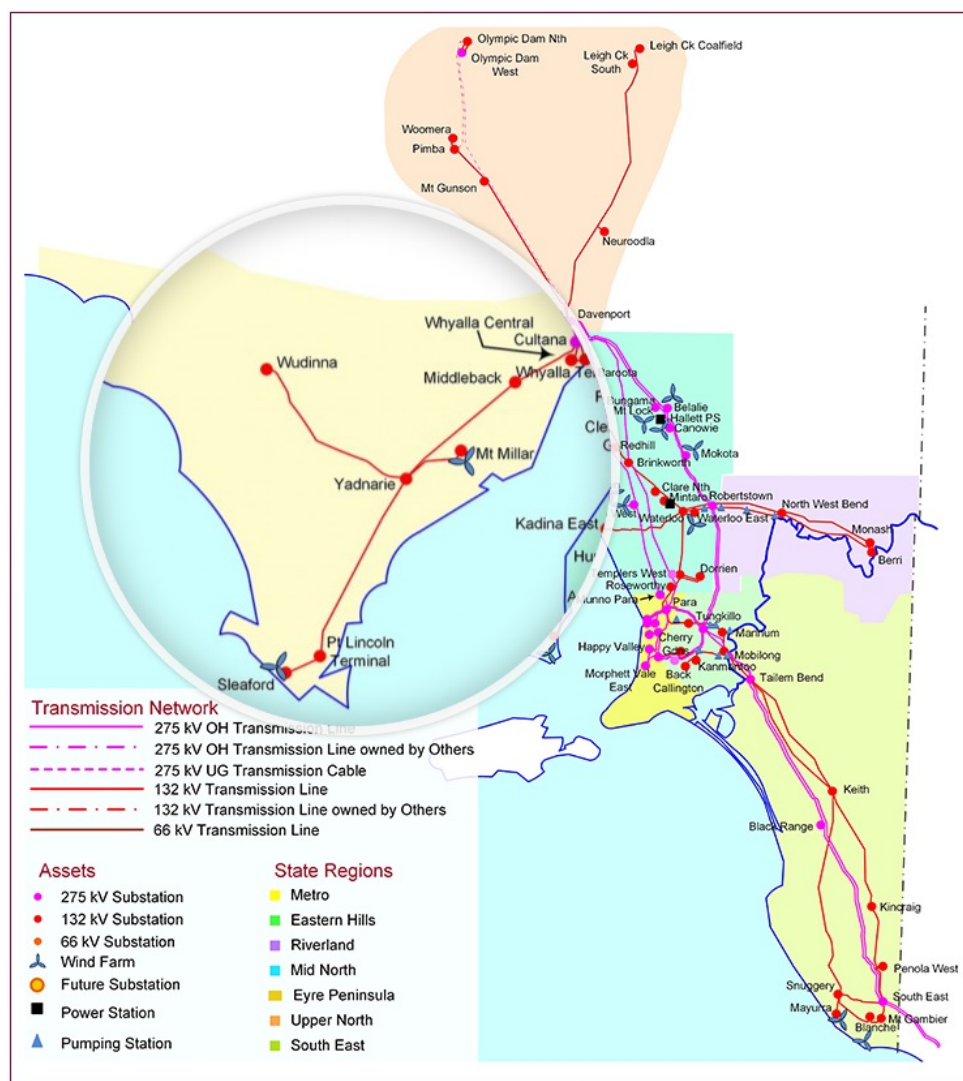
6.2 Facts

Port Lincoln is located on the lower Eyre Peninsula in South Australia. It is the largest city in the West Coast region with a population of around 16,000 and is located approximately 280 km from the city of Adelaide (646 km by road) on the shore of Boston Bay.

Port Lincoln electricity supply is provided by a single radial 132 kV transmission line connection from Whyalla to Port Lincoln, approximately 260 km in length. ElectraNet's Yadnarie intermediate 132 kV substation is located on this line near Cleve, approximate half way between Whyalla and Port Lincoln (Map 1). In this region the network does not contain redundancy in the form of a second transmission line. Therefore, an interruption occurring from the Whyalla substation onwards would result in a loss of supply to Port Lincoln, in absence of a network support arrangement.

ElectraNet's connection at Port Lincoln supplies a 33 kV network which is owned and operated by SA Power Networks. Customers take electricity supply in Port Lincoln for residential, commercial, agriculture, aquaculture and grazing purposes.

Map 1: Transmission Network Map¹²



The Port Lincoln exit point is a Category 3 exit point. In respect of Category 3 exit points, ElectraNet must (as defined in the Code):

provide N-1 equivalent line capacity for at least 100% of contracted agreed maximum demand (including through the use of post-contingent operation) and:

- i. in the event of a failure of any installed transmission line or network support arrangement, use its best endeavours to restore N-1 equivalent line capacity as soon as practicable*
- ii. in the event of an interruption arising from the failure of the installed transmission lines or network support arrangements:*
 - A. restore at least N equivalent line capacity within one hour of the commencement of the interruption, and*
 - B. use its best endeavours to restore N-1 equivalent line capacity as soon as practicable after the commencement of the interruption.*

¹² Source: <https://www.electranet.com.au/what-we-do/solutions/network-map/>

provide N-1 equivalent transformer capacity for at least 100% of contracted agreed maximum demand (including through the use of post-contingent operation) and:

- i. in the event of a failure of any installed transformer or network support arrangement, use its best endeavours to restore N-1 equivalent transformer capacity as soon as practicable*
- ii. in the event of an interruption arising from the failure of the installed transformers or network support arrangements:*
 - A. restore at least N equivalent transformer capacity within one hour of the commencement of the interruption, and*
 - B. use its best endeavours to restore N-1 equivalent transformer capacity as soon as practicable after the commencement of the interruption.*

In typical circumstances, when an interruption occurs these obligations require ElectraNet to restore supply as soon as possible and within one hour of the interruption occurring. Further, ElectraNet is required to use its 'best endeavours' to restore the additional redundancy as soon as practicable.

To meet these requirements, ElectraNet currently utilises a third party network support arrangement (three Frame 5 turbines – nominal 25 MW each). The turbines are provided under commercial contractual arrangements between ElectraNet and Synergen. This generation support is the least cost option to provide security of supply to Port Lincoln. The alternative option, being the installation of a second transmission line, is comparatively uneconomic.

The Port Lincoln generators are capable of running as an 'island' to supply local customers, separate from the remainder of the South Australian transmission network and NEM. When islanded from the main transmission network, the Eyre Peninsula wind farms (Mount Millar and Cathereral Rocks) do not have the ability to supply local customer demand independently.

6.3 Evidence

ElectraNet submitted to the Commission that it believes that it used best endeavours to restore transmission services to customers once the emergency had passed. It also provided for each exit point, information about restoration times and its understanding of the times that customers accepted supply.

To demonstrate its compliance, ElectraNet supplied detailed information regarding the timeframes to restore each of the exit points listed in the Code to N and N-1 equivalent line capacity. Further, ElectraNet also provided policies and procedures, which detail its approach to emergency situations and system restart.

ElectraNet also provided the following information regarding historical performance of the network support arrangement at Port Lincoln and the timeline of events following the outage. Synergen provided further information regarding generator availability from 29 September 2016 to 8 October 2016

6.3.1 Historical performance at Port Lincoln

In the five years up to December 2016, 10 unplanned outages have occurred which required the Port Lincoln network support arrangement to be utilised. Table 5 outlines the minutes taken to restore supply to Port Lincoln utilising the network support arrangement, minutes that the network support arrangement successfully operated to supply Port Lincoln, minutes taken to restore the transmission line and the cause of the unplanned interruption.

Table 5: Port Lincoln unplanned interruptions in the last five years

	Date	Minutes to restore supply	Minutes that the arrangement operated	Minutes to restore transmission line	Interruption cause
1	3/11/2012	16	136	152	Lightning
2	4/11/2012	14	163	177	Lightning
3	30/11/2012	13	175	188	Lightning
4	26/02/2013	18	193	211	Insulator failure
5	27/02/2013	40	492	532	Insulator failure
6	15/08/2013	21	32	53	Insulator failure
7	11/03/2014	23	122	145	Lightning
8	2/03/2016	97	54	151	Lightning
9	4/08/2016	16	304	320	Protection mal-operation
10	8/9/2016	59	1671 (~28 hrs)	1730	Insulator failure / storm

The network support arrangement operated to supply Port Lincoln following each unplanned interruption. On 2 March 2016, the generators failed to start due to a time out in receiving the required start signal through the SCADA system. However, the generator was started locally and supply was restored 97 minutes after the unplanned interruption.

The average time to restore supply utilising the network support arrangement was 31.7 minutes. The time that the network support arrangement was required to run ranged from 32 minutes to approximately 28 hours. In terms of availability, the generator was unavailable for 97 minutes between 3 November 2012 and 8 September 2016.

The Commission notes that most significant restoration time to the transmission line, on 8 September 2016, was impacted by weather. The following is an extract from the Bureau of Meteorology's Monthly Weather review for September 2016, available on its website:¹³

'A strong upper-level trough generated a rain band which moved over eastern South Australia during the 8th, which led to some significant daily totals in the Lower South East, including 71 mm at Kalangadoo, 67 mm at Nangwarry and 59 mm at Penola. The rain caused strong and fast flows in the drains and creeks and some minor local flooding.

Further west, a band of thunderstorms with heavy rain and gusty winds developed ahead of a low pressure trough during the afternoon of the 8th, initially over the North West Pastoral and Eyre Peninsula districts, before affecting the Yorke Peninsula during the late afternoon and Adelaide in the early evening. 20 to 30 minutes between about 6:30 pm and 7:30 pm in Adelaide and the eastern suburbs, resulting in flash flooding, with several main roads closed at Stepney, Trinity Gardens and Norwood and some damage to property, including the Burnside Hospital. At Burnside, 30 mm fell in 30 minutes from 6:35 pm. In the same period, 22 mm fell at Kent Town and 20 mm at Greenhill. Lightning caused scattered power outages, including some long-duration outages in western parts of the State.'

¹³ Refer: <http://www.bom.gov.au/climate/mwr/aus/mwr-aus-201609.pdf>

In addition to providing network support, regular testing of the Port Lincoln power station has occurred to ensure successful operation of the generating units. In the same period, 30 tests were performed on a periodic basis. The units successfully synchronised 28 out of the 30 times (93 percent of the time).

6.3.2 Timeline of events

The following timeline of events prior to, during and after the outage is based on information received from ElectraNet, Synergen and other publicly available information, including the AEMO report. The Commission notes that in some instances, the stated time is approximate based on the best available information. Times are stated in 24 hour Central Standard Time (CST).

27 September 2016

Time	Description
11:11	Test run of all Port Lincoln generating units as a precaution of extreme weather predicted.

28 September 2016

Time	Description
15:48	Supply interrupted at Yadnarie substation.
15:55	Black system condition declared by AEMO.
16:37	ElectraNet requested permission from AEMO to start the Port Lincoln generator to supply Port Lincoln as an islanded network (permission to start was not granted at this time).
18:18	As per its operating protocol with Synergen, ElectraNet requested permission to start the Port Lincoln generator.
18:21	Synergen gave permission and advised ElectraNet to start GT1 and GT2 first.
18:25	AEMO gave ElectraNet permission to start the Port Lincoln generator.
18:36	Generating unit one in service.
19:03	Generating unit two in service – N equivalent line capacity restored for approximately 5 hours
19:28	Generating unit three in service and used to manage the frequency of the islanded network.

29 September 2016

Time	Description
00:22	Generating units one and two tripped due to damage as a result of the extreme weather.
00:24	Synergen gave permission to ElectraNet to load generating unit three up to 20MW.
00:45	Generating unit three manually shut down by Synergen due to instability. Multiple restarts attempted with a failure to sync until 4.14am when Synergen onsite staff unable to continue work and advised to return to site later in the morning. Restart continue with GT3 only throughout the day with an inability to synchronise and hold load. In one particular case SAPN did not strip all load from PL-32 feeder leaving Marina substation connected and too much load was connected at once. SAPN disabled under frequency load shedding at Port Lincoln to minimise risk of GT3 tripping.

Time	Description
11:46	ElectraNet restores power to the Davenport West connection point.
15:39	Cultana – Yadnarie line patrol of road crossings and public areas completed.
16:10	Yadnarie – Port Lincoln line patrol of road crossings and public areas completed.
16:24	ElectraNet restores power to the Whyalla Central – Main Bus connection point.
16:53	ElectraNet restores power to the Yadnarie connection point.
16:56	ElectraNet attempts to restore power to Port Lincoln but tripped off due to single phase fault (single phase fault causing three phase lockout as expected for "reclose onto fault" condition).
17:12	Synergen advised ElectraNet that it was not able to get staff and equipment to site to resolve issues on 29 September 2016.
17:19	Crews dispatched to locate and repair fault on the 130km Yadnarie to Port Lincoln transmission linelocate, but crews are unable to locate the fault due to poor visibility as a result of the continuing severe weather conditions.
18:00	End of black system condition declared by AEMO.
20:13	Electranet attempts again to restore power to Port Lincoln but tripped off due to single phase fault (single phase fault causing three phase lockout as expected for "reclose onto fault" condition). Weather conditions considered unsafe for patrols to continue.

30 September 2016

Time	Description
08:40	Crews dispatched to undertake further line inspection based on advice to check structures 524 and 525, but unable to locate fault at location (plus and minus 10 structures) Based on fault information from relays. More accurate fault information not available because of open network arrangement in Port Lincoln.
09:25	Generating unit three in service but experiencing frequency control issues.
11:16	Helicopter patrol dispatched and locates broken insulator on structure 554. Ground crew dispatched to repair insulator.
14:36	Following several trips, generating unit three back in service.
19:14	Synergen advised generating unit one and two are still not available due to ongoing investigation and repair and generating unit three circuit breaker still under investigation.
20:20	Generating unit three shut down to allow reconnection to the main transmission network.
20:30	ElectraNet restores Port Lincoln to the transmission network, following energisation of the Port Lincoln to Yadnarie line - N equivalent line capacity restored

1 October 2016

Time	Description
16:06	Synergen complete testing of generating unit three and confirm that ElectraNet can restore generating unit three to load.

2 October 2016

Time	Description
08:43	Synergen complete testing of generating units one and two and confirm that ElectraNet can restore generating units one and two to minimal load.
11:45	Synergen advised ElectraNet that generating units one and two require further repairs but can generate at 5MW combined in an emergency circumstance. Synergen advised ElectraNet that generating unit three is available at full capacity.

8 October 2016

Time	Description
PM	Generating units one and two were made available for service on 8 October 2016. N-1 equivalent line capacity restored

Another summary of the event and restoration at Port Lincoln is also available on page 73 of AEMO's Black system South Australia 28 September 2016 final report.¹⁴

6.3.3 System restart

Following declaration of a black system event under the NER, AEMO maintains overall control of the system restart and restoration process. To ensure the overall system is restored as soon as possible, no generation, transmission or distribution equipment is permitted to be returned to service without approval from AEMO. Any generating unit must gain permission from AEMO prior to connecting to the power system.

ElectraNet requested permission from AEMO to start the Port Lincoln generators within one hour (16:37) of the outage (15:48). However, permission was not granted at that time. Permission to generate was granted by AEMO at 18:25, approximately 2.5 hours after the outage occurred.

Following the receipt of permission to start generating, ElectraNet then commenced the start-up procedures for the generating units. Generating unit one was available at 18:36 and provided 7MW of electricity (33 percent of the Port Lincoln demand). Generating unit two was available at 19:03 and provided the remaining 14MW of electricity (approximately 67 percent of the Port Lincoln demand). At this point supply was restored to Port Lincoln, 38 minutes after permission was received from AEMO, and supplied Port Lincoln for approximately five hours. Generating unit three was available at 19:28 and was used to manage the frequency of the islanded network.

Generating units one and two tripped shortly after midnight on 29 September 2016, due to damage as a result of the extreme weather. Generating unit three was then manually shut down by Synergen due to instability.

¹⁴ Refer: <http://aemo.com.au/Media-Centre/AEMO-publishes-final-report-into-the-South-Australian-state-wide-power-outage>.

6.3.1 Restoration of the Yadnarie to Port Lincoln transmission line

The restoration of the Yadnarie to Port Lincoln transmission line was hampered by the outage and poor working conditions due to the severe weather event.

Prior to energisation of a transmission line, ElectraNet completes a patrol of road crossing and public areas to ensure public safety. At 15:39 on 29 September 2016, ElectraNet completed its patrol of the Cultana to Yadnarie transmission line. At 16:10, ElectraNet completed its patrol of the Yadnarie to Port Lincoln transmission line.

Following the visual inspection, at 16:53 ElectraNet restored power to the Yadnarie connection point, approximately 24 hours after the commencement of the outage. The Yadnarie connection point is a category 2 connection point. Generally, ElectraNet must use its best endeavours to restore N equivalent line capacity as soon as practicable and in any event, restore N equivalent line capacity within two days of an interruption.

Three minutes later at 16:56 on 29 September 2016, ElectraNet attempted to restore power to Port Lincoln but the transmission line tripped due to a single phase fault, causing a three phase lockout as expected for 'reclose on to fault' condition.

ElectraNet dispatched crews to locate the fault at 17:19, 23 minutes after the fault was able to be identified. However, ElectraNet crews were unable to locate the fault as a result of poor visibility due to the ongoing storm. At 20:13, ElectraNet attempted to restore power again to Port Lincoln but the transmission line tripped off again due to the same fault. At this point it was deemed unsafe for patrols to continue due to the weather conditions.

At 8:40 on 30 September 2016, crews were dispatched to undertake further transmission line inspections. Based on fault information from relays, crews checked structures 524 and 525 (plus and minus 10 structures) but were unable to locate the fault in the vicinity. Due to the open network arrangement at Port Lincoln, more accurate fault information is not available.

At 11:16, helicopter patrols were dispatched and located a broken insulator on structure 554. Ground crews were then dispatched to the site. At 20:30 on 30 September 2016, following repair of the broken insulator, ElectraNet was able to restore Port Lincoln to the transmission network, following successful energisation of the Yadnarie to Port Lincoln transmission line.

6.3.2 Generator availability - 29 September 2016 to 8 October 2016

On 27 September 2016, in preparation for the forecast extreme weather event, the three generating units at the Port Lincoln Power Station were tested to ensure availability of the units. All three generating units successfully synchronised and no alarms, trips or failed starts occurred. Following the outage on 28 September 2016, all three generating units were started successfully and supplied power to the Port Lincoln area for approximately five hours.

At 00:22 on 29 September 2016, generating units one and two unexpectedly tripped. Synergen, owner and operator of the Port Lincoln power station, advised this was a result of generator stator earth fault protection. Generating unit three was taken offline at 00:45 on 29 September 2016, when frequency instability issues were experienced. These stability issues only occurred following the trip of generating units one and two.

Following the unexpected trip, Synergen arranged for technical experts from Loy Yang B power station in Victoria (a related company) to attend the site and troubleshoot the root-cause of the fault. Technicians arrived the next day on 30 September 2016 and remained onsite until 2 October 2016.

Based on the testing and inspections, it was identified that the location of the earth fault was in between the circuit breakers and low voltage winding of step-up transformer of generating unit one and two. Synergen's management requested a root-cause analysis be performed to identify the cause of the fault.

The analysis identified that the fault location was in the common cables and transformers shared by generator one and generator two. Two specialist teams from SA Power Networks were also engaged to assist in testing the high voltage cabling between generating unit one and two and the shared transformer.

On 5 October 2016, the transformer terminal box was opened to access the low voltage connection for further electrical testing. At that point it was discovered that water had entered the transformer terminal box. Water droplets were also found to be condensed on the cable connections. After drying out the water, electrical tests performed between 5 October 2016 and 8 October 2016 verified that the faults had been cleared on the cables and transformer. Generating unit one and two were made available for service on the afternoon of 8 October 2016.

Based on the root-cause analysis, Synergen concluded that during the significant weather event water must have entered through a gasket of the step-up transformer terminal box. It is thought this was due to water pooling against the lower gasket and being forced through the seal due to extreme wind.

To prevent reoccurrence, Synergen has increased the frequency of inspections for moisture ingress into the low voltage terminal box of generating units one and two, including ensuring that bolts and seals are working effectively.

6.4 Analysis

6.4.1 Network support arrangement availability

The requirement to meet the Port Lincoln exit point service standards (noted above in section 6.2) are contingent on the reliability of the network support arrangement, which provides back-up generation in the event of a transmission line failure. Clause 2.12.1 of the Code sets out certain requirements for the availability of network support, not only in relation to Port Lincoln, but to all exit points that are serviced using network support arrangements.

Where the contracted agreed maximum demand is less than 120 percent of the installed transformer or transmission line capacity (as is the case for Port Lincoln), the network support arrangement must have at least 95 percent availability for each year. Specifically:

Where a transmission entity has a network support arrangement in place and delivers transformer or transmission line capacity by means of an equivalent capacity, the transmission entity may contract for any amount of agreed maximum demand provided that:

- a) *If the level of contracted agreed maximum demand is less than 120% of the installed transformer or transmission line capacity, the network support arrangement must have at least 95% availability for the 12 months to 30 June each year.*

The basis for determining the 95 percent availability stems from advice given to the Commission by the Electricity Supply Industry Planning Council in October 2005, as part of the Commission's review of the Electricity Transmission Code at that time. The section of that advice relating to non-network solutions is reproduced below:

Non-Network Solutions

'The Transmission Code identifies that for existing categories 2 to 5, the required capacity in lines and transformers can be provided by whatever means including implementation of transmission

system capability, distribution system capability, generating unit capability or load interruptibility (or any combination thereof).

As transmission networks are fundamentally highly reliable, the reliability outcomes by non-transmission options may be far below the expected reliability.

At present, the Transmission Code does not quantify the reliability requirements for a non transmission option to meet the code capacity requirements.

Reasonably it could be expected that the options chosen would have broadly similar reliability, otherwise there would be a differential outcome for the customers and inappropriate cost/benefit assessments during the selection of options.

However, given the high reliability of the N portion of supply, the reliability of the N-1 portion need only be moderately reliable to deliver a very high overall reliability.

A relevant example is the case of the current Category 2 connection at Port Lincoln. A long radial 132kV transmission line ex Whyalla Terminal supplies this load. Reliability calculations indicate that the contribution to unreliability is predominantly from the line. Even with line maintenance being undertaken via live line techniques so that a line outage for maintenance is not required, the reliability is calculated to be about 99.8% resulting in an average annual outage hours of about 16.

As there is only one line, ElectraNet SA has entered into a network support contract with International Power to fulfil the N-1 > ⅓ MD requirement for the transmission line. The support is achieved through two gas turbine generators installed adjacent to Port Lincoln Terminal Station.

The following sensitivity analysis of overall Port Lincoln reliability for various levels of the reliability of the N-1 backup supply demonstrates the issue.

Reliability of the N-1 Element

Case	Reliability of parallel element %	Element Outage Hours pa of parallel element	Overall Reliability	Overall Outage Hours pa	Value of Customer Load Lost – Unserved Energy \$ pa
N (Base)	0%		99.82%	15.9hrs	\$5.07m
N-1	99.14%	75hrs	99.999%	0.14hrs	\$0.04m
N-1	98.29%	150hrs	99.997%	0.27hrs	\$0.09m
N-1	96.57%	300hrs	99.994%	0.54hrs	\$0.17m
N-1	95.00%	438hrs	99.99%	0.79hrs	\$0.25m
N-1	93.15%	600hrs	99.988%	1.09hrs	\$0.35m
N-1	89.73%	900hrs	99.981%	1.63hrs	\$0.52m
N-1	86.3%	1,200hrs	99.975%	2.17hrs	\$0.69m
N-1	82.88%	1,500hrs	99.969%	2.71hrs	\$0.87m

Even with an N-1 element reliability as low as 82.88% (1,500hrs pa outage), the overall system reliability is improved from 99.82% (15.9hrs pa outage) to 99.969% (2.71hrs pa outage).

Care must be exercised when the N-1 element outage hours per annum become high as, during any outage time, a failure of N at this time will result in customer supply loss.

A reasonable target for this case would be to require the N-1 element reliability to be no less than 95%, which still allows the backup supply to be out of service for 438 hrs each year. This target should be inclusive of any time delays inherent in the provision of the network support.

This would provide a target that could reasonably be met by network support alternatives such as generation, but would still result in very high overall reliability at the connection point.

Recommendations

- *Non-transmission network support options be required to meet a minimum reliability/availability target of 95%.*
- *Require the TNSP to report annually to ESCOSA, demonstrating the performance of network support facilities.*

The manner in which the TNSP chooses to demonstrate achievement of the 95% target will necessarily vary with the type of network support. For generation, regular testing may be required, whereas for an interruptible load, details of the physical and contractual arrangements for calling on the load may be sufficient.

In applying this recommendation, it will be important to recognise the extent of control that a TNSP may have over a third party provider. While the Transmission Code may, in effect, set a minimum contracting standard, breach of that standard by a third party should not necessarily result in an automatic Transmission Code breach by the TNSP.

In any event, the growing importance of reliability-based incentive payments will encourage rigour in the establishment of network support contracts.

Discussion point

The reliability of standby generation tends to be considerably lower than base load generation. The low reliability is typically due to failures in starting of standby plant. A strategy to improve this is to install multiple generating units of smaller size so that the probability of sufficient units starting when required is high.¹⁵

The advice and the Electricity Distribution Code quantify the availability requirement of the network support arrangement in terms of annual availability. The premise of the availability target is that an outage can occur at anytime during the year, meaning that a network support arrangement can be called on at any time. In terms of hours over a year, 100 percent availability equates to:

- ▶ 24 hours (one day) x 365 days = 8760 hours.

For a network support arrangement to provide a 95 percent availability, it must successfully run 95 percent of the time on an annual basis. In terms of hours over a year, 95 percent availability equates to:

- ▶ 8760 hours x 95 percent = 8322 hours (approximately 347 days).

Taking the inverse, this allows the network support arrangement to be unavailable five percent of the time. In terms of hours over a year, 5 percent availability equates to:

- ▶ 8760 hours x 5 percent = 438 hours (approximately 18 days).

¹⁵ The Commission notes that a third turbine has been installed at the power station since the advice received from the Electricity Supply Industry Planning Council in October 2005.

The advice states that this target should be inclusive of any time delays inherent in the provision of the network support. Therefore, to quantify the time that the network support arrangement is unavailable, it is necessary to measure from the time the generators were first unavailable (when called upon in an unplanned interruption or through testing) to the time the generator is again verified as available. Further, any time that the generator is offline for maintenance should also be included in the availability calculation.

If the generator fails while attempting to restore at least N equivalent line capacity within one hour of the commencement of the interruption, this does not trigger a non-compliance of this requirement. This is because the two obligations operate concurrently. However, the period of unavailability will count towards the annual 95 percent availability target.

It should be noted that unavailability of the network support arrangement should not result in a loss of supply for the same amount of time. In all cases, ElectraNet must use its best endeavours to restore the transmission line in a timely manner to minimise the duration of the interruption. Therefore, when considering the overall reliability of supply in Port Lincoln, it is necessary to consider the performance of the transmission line and network support arrangement together. As noted above in the advice received from the Electricity Supply Industry Planning Council, setting the availability of the network support arrangement at 95 percent should result in the Port Lincoln connection point, on average, producing overall reliability of 99.99 percent.

6.5 Findings and recommendations

Through the Commission's investigation, key questions have been raised regarding the restoration of the Port Lincoln exit point, following the outage, and the performance of the network support arrangement. In particular, stakeholders aimed to understand:

- ▶ why the network support arrangement was not started within one hour of the outage
- ▶ the factors impacting the restoration of the Yadnarie to Port Lincoln transmission line, and
- ▶ why the network support arrangement was unable to maintain supply for the duration of the outage.

6.5.1 System restart

The Code is one document in a suite of documents that govern electricity operations at a state and national level. This is recognised in clause 1.8.1 of the Code, which states:

'any obligations imposed under this industry code are in addition to those imposed under National Electricity Rules and the (Electricity) Act (and regulations).'

Following declaration of the black system condition by AEMO, ElectraNet was obligated to comply with system restart procedures. Those procedures require that ElectraNet must gain permission from AEMO prior to returning any equipment to service, including the network support arrangement at Port Lincoln.

AEMO did not give permission to start the generators at the time of the initial request. The Commission notes that the Port Lincoln generators are capable of running as an island to supply local customers, separate from the remainder of the South Australian transmission network. In that sense, starting the Port Lincoln generators would not hinder the overall system restart provided the correct network switching has occurred.

Following the receipt of permission from AEMO, ElectraNet utilised the network support arrangement to restore supply to Port Lincoln within the timeframes expected in the Code and met the best endeavours requirement. Therefore, The Commission considers that ElectraNet complied with its licence obligations.

Recommendation 1: The Commission considers that ElectraNet and AEMO should review restart procedures to ensure that the Port Lincoln network support arrangement can begin operating as soon as possible in the event of a black system condition.

6.5.1 Restoration of the Yadnarie to Port Lincoln transmission line

Port Lincoln is at the end of a single radial transmission line. Due to the configuration on the transmission network, supply is restored in segments. To restore supply to Port Lincoln customers via the transmission line following the outage, the following connection points had to be restored in sequential order:

- ▶ Davenport West
- ▶ Whyalla Central – Main Bus
- ▶ Yadnarie, and
- ▶ Port Lincoln.

These connection points are located in the emergency area, refer sections 4.2 and 4.3 of this report for further information. Similarly to the restoration of other connection points around the state, ElectraNet had to wait for the storm and system black event to pass before it could assess line damage and restore transmission services.

Davenport West connection point was restored at 11:46 on 29 September 2016. Whyalla Central – Main Bus connection point was restored at 16:24 on 29 September 2016. Yadnarie connection point was restored at 16:53 on 29 September 2016.

It was not until the Yadnarie connection point was restored, that ElectraNet could attempt to restore supply to the Port Lincoln connection point. Upon attempting this restoration at 16:56 on 29 September 2016, a further fault was identified that required discovery and repair.

Unsafe working conditions, due to the continuing severe weather, prevented ElectraNet from continuing patrols through the night to identify and troubleshoot the fault. Patrol commenced the following morning on 30 September 2016 and ElectraNet appeared to take appropriate steps (refer section 6.3.1) to identify and repair the fault, caused by a broken insulator on the 130km Yadnarie to Port Lincoln transmission line.

The Commission is satisfied, based on the information provided, that ElectraNet used its best endeavours to restore the transmission line to Port Lincoln as soon as possible. Therefore, the Commission considers that ElectraNet complied with its licence obligations.

6.5.2 Port Lincoln connection point reliability

When considering the overall reliability of supply in Port Lincoln, it is necessary to consider the performance of the transmission line and network support arrangement together. The combination of the transmission line and network support arrangement is the basis of calculating the overall reliability at the Port Lincoln connection point. As noted in section 6.4.1 in the advice received from the Electricity Supply Industry Planning Council, setting the availability of the network support arrangement at 95 percent should result in the Port Lincoln connection point, on average, receiving overall reliability of 99.99 percent.

The overall reliability forecast is calculated using average outage rates per kilometre of line and the number of hours that each connection point would, on average, be without power. The forecast does not consider overall reliability in context of emergency events. The Commission notes that this is the

first time that the emergency provisions of the Code have been invoked since the Code was first issued on 11 October 1999.

In the five years preceding the 28 September 2016 outage, Port Lincoln experienced a total of 5.3 hours of unplanned interruptions; over 11 separate events (refer section 6.3.1). These interruptions were primarily due to lightning, insulator failure and storms. During this period, customers experienced an interruption (on average) of approximately one hour per year.

Following the outage, Port Lincoln customers experienced around 40 hours of interruption from the time the network support arrangement ceased operating until the Yadnarie to Port Lincoln line was restored. The protracted nature of the severe weather and resulting emergency has influenced the overall reliability at the Port Lincoln connection point.

Based on ElectraNet's performance over the last five years, excluding the outage, the overall reliability at the Port Lincoln connection point is 99.99 percent. Including the outage, the overall reliability at the Port Lincoln connection point is 99.90 percent.

In regard to the performance of the network support arrangement, it is noted that the performance of the generators between 29 September 2016 and 8 October 2016 is not consistent with the historical performance of the generators over the last five years. On 8 September 2016 the generators operated for a period of 28 hours. This indicates that the generators have the inherent capability to operate for more than five hours, as occurred on 28 September 2016 following the outage. Further, prior to the outage, the longest period of unavailability during an unplanned interruption was 97 minutes on 2 March 2016.

The Commission's view is that in normal operating conditions, the network support arrangement has operated satisfactorily. However, the inclement weather has exposed a weakness in the equipment, which has not identified prior to the severe weather event. While the Commission recognises the severity of the storm contributed to the malfunction of the generator, a comprehensive inspection of all bolts, gaskets and seals at the Port Lincoln Power Station prior to the event may have prevented the inconvenience and difficulty that the customers of Port Lincoln and surrounding areas have experienced as a result of the extended interruption.

The Commission expects that a robust Safety, Reliability, Maintenance and Technical Management Plan should ensure that inspections and audits are conducted on a periodic basis to identify weaknesses that may give rise to safety or reliability concerns. Given the lower gasket was in a condition to allow water to enter step-up transformer terminal box, it would appear that an inspection had not occurred recently or that the inspection failed to identify that the gasket required replacement.

The presence of severe weather has highlighted additional risks in operating the network support arrangement, which do not appear to have been considered previously. In this context, the Commission considers that further actions are prudent to mitigate the recurrence of water ingress in any components of the network support arrangement at Port Lincoln. The Commission considers that a thorough inspection of all bolts, gaskets and seals is warranted on a periodic basis, to ensure the reliable ongoing operation of the network support arrangement, should further severe weather events occur.

Recommendation 2: ElectraNet should coordinate with Synergen to ensure that an inspection of all bolts, gaskets and seals at the Port Lincoln Power Station is performed on a periodic basis.

Based on the information available, Synergen took steps to troubleshoot and repair the fault. In addition, Synergen took remedial action to replace the gasket to prevent a recurrence of the same fault in future. Nevertheless, following the outage, the Port Lincoln generators were unavailable for 10 days (approximately 240 hours). Further, it took seven days to identify the cause of the fault.

The Commission considers that systems and processes should be in place to ensure that faults affecting the performance of the network support arrangement are identified, and resolved, in a timely manner. This is particularly important when severe weather events occur in the region; as such events are likely to affect the reliability of the associated transmission line. It would be appropriate for co-ordinated preparation and response to such events to occur as part of an integrated Emergency Response Framework, to ensure that unplanned interruptions to customers are minimised.

The Commission notes that the annual 5 per cent unavailability allowance, as contemplated in the advice given to the Commission by the Electricity Supply Industry Planning Council in October 2005, equates to 438 hours (approximately 18 days). The Commission also notes that industry practice to test generator availability may be determined with reference to the number of successful start-ups, rather than considering the minutes the generator was available (or unavailable). In any event, ElectraNet's compliance with this requirement is unable to be determined until the end of the financial year. The Commission will assess whether the network support arrangement at Port Lincoln provided 95 percent availability for the year as at 30 June.

Nevertheless, the events do give cause to consider whether the availability requirement of 95 percent is still the appropriate measure based on the historical performance of the network support arrangement. Through the payment of network tariffs, consumers have funded a network support arrangement, which has performed well. In fact, it would appear that Port Lincoln generally receives more than 95 percent of availability from the network support arrangement.

The Commission is of the view that the availability requirement could be set to more accurately reflect historical performance. This should not result in additional costs to consumers as consumers are already funding the level of reliability they are receiving. Events such as the failure of generating units one and two following the outage, should not ordinarily be considered part of the average service level. Therefore, a review of the availability provisions of the Code would ensure Port Lincoln consumers are receiving an appropriate level of service going forward.

Recommendation 3: The Commission will review and consult on amendments to the Electricity Transmission Code with regard to the availability of network support arrangements.

At present, ElectraNet assures the Commission of its compliance with availability and other Code requirements through annual compliance reporting in accordance with Energy Industry Guideline No 4 - Compliance Systems and Reporting.

The Commission notes that there is strong public interest in the performance of the network support arrangement at Port Lincoln. Therefore, consideration should be given to more transparency around the actual performance of the network support arrangement with reporting on a regular basis.

Therefore, the Commission considers that additional operational reporting on availability should be introduced in Electricity Industry Guideline No 3 - Transmission and System Control. For example, ElectraNet could report to the Commission on any delays in starting the network support arrangement, any instances where the generators fail to start and any periods where the generators are out for maintenance. The Commission would then make this information available to stakeholders as part of its Regulatory Performance Report.

Recommendation 4: The Commission will review and consult on additional reporting requirements regarding the availability of network support arrangements.

7 ElectraNet's risk management system

ElectraNet has demonstrated that it has a Risk Management System in place as outlined in its Management Plan. Therefore, the Commission considers that ElectraNet complied with its licence obligation. However, based on the information provided by ElectraNet, the Commission was unable to confirm whether certain parts of the system were applied.

Recommendation 5: ElectraNet must report to the Commission by 31 August 2017, on how its Risk Management System is applied at an operational level. ElectraNet should also ensure that its Asset Risk Management Framework integrates into its overall Risk Management System. Further, the Commission has flagged with ElectraNet that the risk management chapter of the Management Plan should be included in the annual compliance audit for 2017. The results of that audit are to be provided to the Commission following its completion.

7.1 Obligation

It is condition of ElectraNet's licence that it must comply with matters relating to the safety, reliability, maintenance and technical capability of its transmission network. This is achieved through the preparation of a Safety, Reliability, Maintenance and Technical Management Plan (Management Plan).

The Commission has assessed ElectraNet's compliance with the following licence condition, which forms part of its Electricity Transmission licence.

The licensee must:

- f) when required by the Commission, prepare a safety, reliability, maintenance and technical management plan dealing with matters prescribed by regulation and submit the plan to the Commission for approval;*
- g) annually review, and if necessary update, the plan to ensure its efficient operation, and submit the updated plan to the Commission for approval;*
- h) comply with the plan (as updated from time to time) as approved by the Commission;*
- i) not amend the plan without the approval of the Commission; and*
- j) undertake annual audits of its compliance with its obligations under the plan and report the results of those audits to the Technical Regulator, in a manner approved by the Technical Regulator.*

In terms of ElectraNet's Management Plan, the Commission has focused its review on the adequacy of ElectraNet's Risk Management System. Specifically, the Commission wished to understand whether ElectraNet's framework identified and appropriately managed risks inherent in its operations, including a revision of risk following the outage.

It is a condition of ElectraNet's licence that it must prepare, review and comply with a Management Plan. The Management Plan includes information in relation to ElectraNet's approach to Risk Management. ElectraNet's Management Plan outlines ElectraNet's approach to risk management. The Commission has reviewed ElectraNet's compliance with the following section of its Management Plan.

'ElectraNet has a Risk Management System (aligned to the requirements of the Risk Management Standard ISO 31000:2009) in place to assist the organisation to manage its activities and decisions regarding business objectives.

The Risk Management System provides a mechanism to identify, analyse, evaluate, control, monitor and review risks relevant to ElectraNet's business objectives and operations. The system is intended to apply to all business activities and development decisions involving large capital expenditure and high risk activities.

Responsibility for the management of risk resides with managers in all parts of the company and its projects. Those accountable for the management of risks are also accountable for ensuring that the necessary controls remain in place and are effective at all times. [The] Risk Assessment and Treatment Guideline describes the general approach to the assessment and treatment of risks used by ElectraNet.'

7.2 Facts

AS/NZS ISO 31000:2009 Risk management – Principles and guidelines (**Standard**)¹⁶ establishes a number of principles that need to be satisfied before risk management will be effective. The Standard recommends that organisations should have a framework that integrates the process for managing risk into the organisation's overall governance, strategy and planning, management, reporting processes, policies, values and culture.

When implemented and maintained in accordance with the Standard, the management of risk enables all organisations to, for example:

- ▶ increase the likelihood of achieving objectives
- ▶ encourage proactive management
- ▶ be aware of the need to identify and treat risk throughout the organisation
- ▶ improve the identification of opportunities and threats
- ▶ achieve compatible risk management practices between organisations and nations
- ▶ comply with relevant legal and regulatory requirements and international norms
- ▶ improve financial reporting
- ▶ improve governance
- ▶ improve stakeholder confidence and trust
- ▶ establish a reliable basis for decision making and planning
- ▶ improve controls
- ▶ effectively allocate and use resources for risk treatment
- ▶ improve operational effectiveness and efficiency
- ▶ enhance health and safety performance as well as environmental protection
- ▶ improve loss prevention and incident management
- ▶ minimise losses
- ▶ improve organisational learning, and
- ▶ improve organisational resilience.

¹⁶ Refer: <https://www.iso.org/standard/43170.html>.

7.3 Evidence

The Commission reviewed the following information provided by ElectraNet in response to the information requested on its Risk Management System. The documents included:

- ▶ Risk Management Policy (**Policy**)
- ▶ Risk Assessment and Treatment Guideline (**Guideline**)
- ▶ Asset Risk Management Framework
- ▶ Audit Reports and Compliance Statements, and
- ▶ general supporting extracts.

ElectraNet did not state whether it considered itself compliant with its licence obligation. However, ElectraNet did state that 'records indicate that there were no known maintenance issues or operational risks identified prior to the black system event which contributed to or which were risks that became realised during the black system event.'

7.4 Analysis

ElectraNet's approach to manage risk consists of a Risk Management System to manage its activities and decisions regarding business objectives and is designed to be consistent with the Risk Management Standard ISO 31000:2009.

The Risk Management System applies to ElectraNet's business activities and development decisions that involve large capital expenditure and high-risk activities. The responsibility for the management of risks rests with managers in all parts of the company and its projects.

The Policy and the Risk Assessment and Guideline are the main corporate documents in managing the operational risks and they are consistent with the Risk Management Standard ISO 31000:2009.

The compliance audit of the Management Plan is based on a risk-assessed 5-year rolling audit program approved by the Technical Regulator.

The extracts provided by ElectraNet indicate that the Board through its Audit and Compliance Committee has followed the Risk Management System as set out in the Policy and Guideline to develop and manage a Risk Register.

In early January 2017, post-outage, a Risk Management workshop was held in line with the Risk Management System to review the risk settings and ensure ElectraNet's risk profile and risk assessments were appropriate. The outcome of the workshop fed into the risk management processes, these included updates to the Risk Register and a report to the Audit and Compliance Committee.

7.5 Findings and recommendation

ElectraNet has demonstrated that it has a Risk Management System in place as outlined in its Management Plan. Therefore, the Commission considers that ElectraNet complied with its licence obligation.

ElectraNet has shown that it has actively followed the Policy and Guideline and has taken the appropriate actions for review following the outage which may have affected the risk profiles. However, based on the information provided, the Commission is unable to confirm that the Risk Management System is applied at the operational levels across ElectraNet. It should be noted that the Commission's findings are based on the processes undertaken and no evaluation has been made of the adequacy of the assessments.

In addition, ElectraNet provided an Asset Risk Management Framework (**Framework**) document. The document is a technical document which outlines the process for managing risks, which are directly related to the asset types held by ElectraNet, and the integration of the risk assessments into the systems used to manage them. The Framework is consistent with the Policy and Guideline. However, based on the information provided, the Commission was unable to confirm how the Framework integrates into the overall Risk Management System as this is not documented in the Framework.

The 2016 compliance audit did not include a review of Chapter 11 Safety and Technical Compliance which contained the risk management component.

Recommendation 5: ElectraNet must report to the Commission by 31 August 2017, on how its Risk Management System is applied at an operational level. ElectraNet should also ensure that its Asset Risk Management Framework integrates into its overall Risk Management System. Further, the Commission has flagged with ElectraNet that the risk management chapter of the Management Plan should be included in the annual compliance audit for 2017. The results of that audit are to be provided to the Commission following its completion.

8 Next Steps

The Commission will continue to liaise with ElectraNet on these matters and will require ElectraNet to provide further information on actions resulting from the Commission's recommendations listed above, by 31 August 2017.

The Commission will publish a follow up report if there is a material change to the facts or observations contained in this report. In all other cases, finalised observations and conclusions regarding the event will be addressed in the Commission's Regulatory Performance Report for ElectraNet, due to be released in late 2017.

Should the AER or Technical Regulator find that market participants did not act in accordance with the NER or Electricity Act, further compliance action may be warranted as this may give rise to a breach of licence. The Commission will consider this as a separate matter once the findings of the AER and the Technical Regulator are available.



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