

The Black System Event Compliance Report:

Investigation into the pre-event, system restoration, and market suspension aspects surrounding the 28 September 2016 event

Report overview

On the afternoon of 28 September 2016, South Australia experienced a state-wide blackout. *The Black System Event Compliance Report* is a review of compliance by various National Electricity Market (NEM) participants against the National Electricity Rules (the Rules) regarding the operation of the South Australia region of the NEM in the period surrounding the blackout. Specifically, the report looks at the pre-event period, system restoration and market suspension.

The South Australia Black System Event – the facts

On 28 September 2016 a severe storm damaged transmission and distribution electricity assets in the lower Eyre Peninsula and mid-north region of South Australia, triggering a chain of events leading to a state-wide power outage. Three major 275 kV transmission lines were damaged in the mid-north of the State. The sequence of events was:

Pre-event and forecast conditions

On 27 and 28 September 2016, the Bureau of Meteorology (BOM) warned of a severe storm heading towards South Australia. On 28 September, the BOM issued a number of severe weather warnings, including predictions of damaging winds and thunderstorms. For most of the morning, the forecast was for damaging wind gusts with maximum wind gusts forecast between 90-120 km/h. From 12:56 hrs onwards, the forecast was upgraded to destructive wind gusts with maximum wind gusts forecast to be around 140 km/h. Both the Australian Energy Market Operator (AEMO) and ElectraNet were reviewing conditions and the potential effect on the power system during the pre-event period prior to the state going black.

South Australia going black

At approximately 16:18 hrs, multiple power system faults occurred in quick succession due to the storm activity and damage to transmission lines. The faults created significant

voltage disturbances, which then rapidly caused several of the wind farms operating at the time to shut down. This resulted in a sustained reduction of wind generation of 456 MW. This was a significant loss as approximately 48 per cent of South Australia's electricity supply overall was from wind farms. Under these circumstances, with high levels of power flowing into South Australia from Victoria, and only four thermal generators operating,¹ power system inertia in the state was low. Higher inertia ensures the grid can better withstand frequency deviations caused by electricity supply-demand imbalances.

The shutting down of wind generation resulted in a rapid increase of power flow into South Australia from Victoria over the Heywood Interconnector, to a peak of around 890 MW,² within a very short period. This led to a large shock to the power system and, in turn, activated the automatic loss of synchronism protection system on the Heywood Interconnector, causing the interconnector to be shut down. The loss of the Heywood Interconnector separated South Australia from the rest of the NEM and substantially reduced the available supply to meet state demand. This saw power system frequency in South Australia fall rapidly, due to the imbalance in electricity supply and demand and low inertia, resulting in the remaining online generators tripping off and the state going black.

¹ Two Torrens Island units and two Ladbroke Grove units.

² Noting the nominal capacity of the Heywood Interconnector is 650 MW.

System restoration

After the state went black, AEMO in conjunction with ElectraNet determined a system restoration strategy at around 16:30 hrs. The strategy consisted of using System Restart Ancillary Services (SRAS) from Quarantine Power Station (QPS) to provide contracted auxiliary supplies to the Torrens Island power station, in combination with the Heywood Interconnector to provide power to the auxiliary plant of other South Australian power stations and high priority loads. However, due to technical issues, QPS was not able to provide this service. The other SRAS provider, Mintaro Power Station (which is owned by Synergen Power), was also unavailable due to a technical fault.³

Given these circumstances, AEMO then proceeded with the planned restart of the system using the Heywood Interconnector. The first customers had power restored by 19:00 hrs on 28 September 2016. AEMO reported that 40 per cent of the load in South Australia capable of being restored had been restored by 20:30 hrs, with 80 to 90 per cent restored by midnight.⁴

Market suspension

AEMO suspended operation of the spot market in South Australia immediately after the collapse of the power system into a black system and invoked the market suspension pricing schedule as required by the Rules. On Thursday, 29 September 2016, AEMO was directed to keep the market in South Australia suspended via a Ministerial direction made under the *Essential Services Act 1981* (SA). The direction was extended on 6 October 2016, and revoked on 11 October 2016.

Key findings

Overall, the investigation found a high level of compliance by market participants with their obligations. However there were instances in which obligations were not complied with. The AER considers the breaches found did not contribute to the state going black, and that all core obligations were met.

AEMO

There was non-compliance with five clauses of the Rules in relation to actions during the pre-event and market suspension periods. The AER finds no specific incidents of non-compliance with respect to system restoration. The AER also finds that AEMO has not breached any of its core obligations around operating the market or managing power system security.

The specific breaches identified with **pre-event** compliance are:

1. Abnormal conditions (NER clause 4.2.3A(b)): Failure to take all reasonable steps to keep itself informed of abnormal conditions. While AEMO took several steps to keep itself promptly informed about the abnormal conditions on the day, we consider an additional reasonable step could have been taken.
2. Notification to market participants (NER clause 4.2.3A(c)): Failure to provide formal notification to market participants that the loss of multiple generating units or transmission elements, which would not be a credible risk in normal operating circumstances, was more likely to occur because of the abnormal weather conditions on the day. Although the evidence indicates AEMO considered this and communicated with some market participants about it, it failed to provide the appropriate notification as required by the NER.
3. Review of criteria for reclassifying contingency events (NER clause 4.2.3B): Failure to conduct formal reviews of the reclassification criteria in the manner required by the Rules in the three years prior to the Black System Event. The specific consultation documents we have reviewed are limited in scope to bushfires and lightning, and do not invite relevant stakeholders to comment on other criteria in the Power System Security Guidelines or criteria that could potentially be included.

The specific breaches identified with **market suspension** compliance are:

4. Publication of notices (NER clause 4.8.5A): Failure on several occasions to issue market notices when there were foreseeable circumstances that may have required AEMO to intervene in the market. There was also an occasion when AEMO did issue a market notice, but we assessed that it was not sufficiently immediate.
5. Operating procedures (NER clause 4.8.9(b)): Failure to adequately develop procedures for the issuance of directions in line with the legislated principles as required.

The non-compliance resulted in confusion among generators as to whether they were being formally directed, reducing their ability to make informed decisions. Our recommendations therefore relate to transparency through the publication of timely market notices as well as clarity of verbal communications.

³ We note that AEMO advised that Mintaro was not, and would not have been, called upon to provide SRAS on the day.

⁴ Load restoration continued on Thursday 29 September 2016 as transmission supply was restored to some areas in the north. Source: AEMO, *Black System South Australia 28 September 2016 – Final Report*, published March 2017, p. 75.

ElectraNet

We reviewed ElectraNet's compliance with numerous obligations in relation to the pre-event and system restoration periods and have determined that ElectraNet met the applicable obligations under the Rules.

Overall, we consider that ElectraNet communicated in a manner consistent with its established communication practices. ElectraNet had no concrete evidence of likely damage to specific assets, which would, based on past practice, normally form the basis of discussions regarding reclassification. ElectraNet communicated to AEMO its intention to recall planned outages and have standby crews available.

On the information before us, ElectraNet met its obligations during the SRAS procurement process. We also consider that on balance, ElectraNet used reasonable endeavours in respect of its broad obligations to cooperate and assist AEMO in relation to system restoration. At the same time, we consider that there were possible steps ElectraNet could have taken, namely, to have consulted with AEMO and Origin on the system restart switching program. The development of more detailed communication protocols with AEMO may have facilitated such consultation.

Origin Energy, Synergen Power and other generators

Origin (QPS 5) and Synergen Power (Mintaro Power Station) were the contracted SRAS providers for South Australia. While Quarantine was not successful in delivering restart services, we consider Origin met its obligations during the restoration by following directions from AEMO and complying with the provisions under its SRAS Agreement and the local black system procedures (LBSPs) it was required to develop. AER also assessed Synergen Power's LBSP as compliant.

Regarding the market suspension period, we assessed that AGL and ENGIE complied with obligations around AEMO's issuance of directions to them. Overall, the AER acknowledges that this period was challenging for generators, many of whom have advised they were incurring losses due to the low market suspension pricing schedule that was in operation.

Summary and next steps

We found non-compliance with five clauses of the NER and made recommendations about each of these. These predominantly relate to clarity of communication and transparency. We also found that AEMO and all South Australian market participants were committed to working together to restore power to customers and ensure the smooth operation of the market in the days after the event.

We have also identified areas where changes should be considered to improve the overall effectiveness of the regulatory framework. These include providing greater clarity and transparency about roles and responsibilities. The importance of AEMO complying with obligations around communication and transparency is growing given the introduction of new types of participants and increasing numbers of participants.

Actions proposed by the AER include:

- implementing more rigorous weather monitoring processes
- standardising notifications for market participants during abnormal weather conditions
- more broadly reviewing the criteria under which weather events are classified
- improving AEMO operator training, and
- clarifying roles and responsibilities of the market operator and network providers regarding system restoration.

We acknowledge some of these actions have commenced.

The AER's report will also be a key input into the policy review of the regulatory framework to be undertaken by the Australian Energy Market Commission (AEMC) in coming months.

We will continue to work with the industry to ensure the lessons learned from this event are effectively implemented not only in South Australia but broadly across the NEM. We will report on the implementation of our recommendations later next year, and undertake follow-up compliance reviews.

The information in this publication is general guidance only. It does not constitute legal or other professional advice, and should not be relied on as a statement of the law in any jurisdiction. Because it is intended only as a general guide, it may contain generalisations. You should obtain professional advice if you have any specific concern. The AER has made every reasonable effort to provide current and accurate information, but it does not make any guarantees regarding the accuracy, currency or completeness of that information.