POWER SYSTEM NOT IN A SECURE OPERATING STATE IN SOUTH AUSTRALIA ON 13 NOVEMBER 2016

REVIEWABLE OPERATING INCIDENT REPORT UNDER THE NATIONAL ELECTRICITY RULES

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	1210 hrs – 1720 hrs Sunday 13 November 2016
Region of incident	South Australia
Affected regions	South Australia
Event type	Power system not secure
Generation Impact	No generator was disconnected or limited as a result of this incident
Customer Load Impact	No customer load was disconnected as a result of this incident
Associated reports	Secure operation of South Australia during periods of low fault levels

IMPORTANT NOTICE

Purpose

AEMO has prepared this report in accordance with clause 4.8.15(c) of the National Electricity Rules, using information available as at the date of publication, unless otherwise specified.

Disclaimer

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CONTENTS

1. OVERVIEW **4**

2. THE INCIDENT **5**

3. POWER SYSTEM SECURITY **6**

3.1 Post event analysis 6

4. CONCLUSIONS **7**

1. OVERVIEW

This report relates to a reviewable operating incident that occurred in South Australia on 13 November 2016.

From 1210 hrs to 1721 hrs on Sunday 13 November 2016, the South Australian (SA) power system was operated with only one synchronous generating unit in service. While AEMO took no action at the time, subsequent analysis has shown that the power system was not in a secure operating state during this period.

AEMO has concluded that:

- While the SA power system was in a satisfactory operating state[1] with a single synchronous generating unit on line it was not in a secure operating state[2].
- Studies conducted by AEMO have shown that a minimum of two TIPS B generating units (or equivalent) are required on line for SA power system to be in a secure operating state.
- AEMO has implemented new procedures to ensure the minimum number of synchronous generating units are on line.

As a reviewable operating incident, AEMO is required to assess power system security over the course of this incident, and assess the adequacy of the provision and response of facilities and services and the appropriateness of actions taken to restore or maintain power system security[3].

This report is prepared in accordance with clause 4.8.15(c) of the National Electricity Rules (NER). It is based on information provided by AEMO.

Australian Eastern Standard Time (AEST) is used in this report. Local time in SA in November is AEST plus 30 minutes.

[1] See NER clause 4.2.2
[2] See NER clause4.2.4
[3] See NER clause 4.8.15(b).

2. THE INCIDENT

On Sunday 13 November 2016, demand in SA was being supplied by wind generation and two thermal synchronous generating units, Torrens Island B units 1 and 2 (TIPS B1 & B2). Power flow across the Heywood interconnector was generally towards Victoria at varying levels. The Murraylink interconnector was out of service. Figure 1 shows the supply/demand pattern just before 1200 hrs on 13 November 2016.

At 1140 hrs on 13 November 2016, AGL re-bid TIPS B2 as unavailable from 1200 hrs to 2000 hrs on 13 November 2017. This resulted in SA power system being operated with only one synchronous generating unit on line.

While this was an uncommon situation, AEMO took no action at the time as:

- AEMO did not have a requirement for a minimum number of synchronous generating units online in SA.
- AEMO did not have sufficient information at the time to analyse and determine whether SA was in a secure operating state.
- None of AEMO's on line power system analysis tools indicated any power system security issues.

A number of re-bids were submitted during the day by AGL with respect to TIPS B2, with the unit returning to service at 1721 hrs on 13 November 2017.

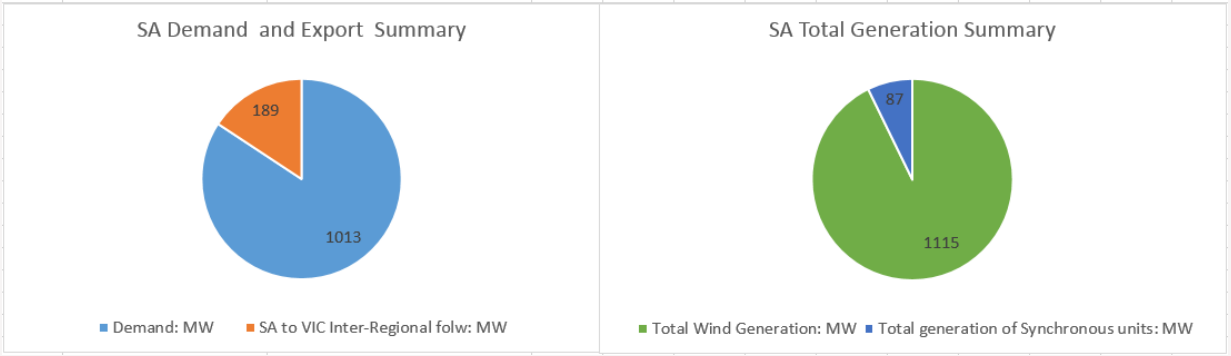

Figure 1 – SA Market Summary just prior to this incident

3. POWER SYSTEM SECURITY

AEMO is responsible for power system security in the National Electricity Market (NEM). This means AEMO is required to operate the power system in a secure operating state to the extent practicable and take all reasonable actions to return the power system to a secure state following a contingency event in accordance with the NER.[4]

3.1 Post event analysis

After this event, AEMO conducted studies to determine whether the power system in SA was in a secure operating state with only a single synchronous generating unit on line.

The analysis showed that:

- If no synchronous generating units were online, the power system would not be in a satisfactory operating state. The system strength (fault level) in SA would be at such a low level that:
  - Manufacturers' design limits would not be met on power electronic interfaced devices such as wind turbines and static VAr compensators. Operation of these devices outside their minimum design limits could give rise to generating system instability and consequent disconnection from the grid.
  - Protection systems relying on the measurement of current and voltage may not operate correctly. This means that protection systems may not operate correctly to clear a fault or may operate when there is no fault.
  - Variations in voltage could become excessive, especially during switching on of transmission equipment or reactive devices or during normal system changes due to market operation.

Fault levels in a power system are influenced by the amount of synchronous generation on line. Non-synchronous generation such as wind and solar generation contribute very little to the fault level.

As fault level is a characteristic of the local power system, it is not materially increased by interconnection to remote parts of the network.

3.1.1 Minimum operating requirement

AEMO has determined that, to ensure the SA power system remains in a satisfactory operating state, that is system strength would be adequate to ensure electronic interfaced devices will operate correctly, protection systems will operate correctly and voltage levels can be controlled, at least one large synchronous generating unit equivalent to a TIPS B generating unit needs to be online in SA.

As such, to ensure the power system is operating in a secure operating state, that is after a credible contingency such as the loss of a synchronous generating unit the power system remains in a satisfactory operating state a minimum of two large synchronous generating units (or equivalent) are required to be on-line at all times in SA.

On Friday 18 November, AEMO implemented new arrangements to manage system strength and maintain power system security in SA.[5] The new arrangements include:

- A minimum number of synchronous generating units equivalent to two TIPS B units connected to the 275 kV network are required to be on line at all times.
- Whenever there is an indication that the minimum requirement will not be met in the pre-dispatch timeframe, AEMO will take the following actions:
  - Constrain on any suitable generating unit that is bid available but not already on line.

[4] Refer to AEMO's functions in section 49 of the National Electricity Law and the power system security principles in clause 4.2.6 of the NER

[5] Further details on the new arrangements can be found on the AEMO website at: http://www.aemo.com.au/-/media/Files/Media_Centre/2016/SA-System-Strength.pdf

- If there are no suitable generating units bid available,
  - Issue a market notice to seek market response.
  - If a market response is not received, AEMO will issue a direction to suitable generating unit(s).

3.1.2 Further studies

AEMO will conduct further analysis to determine:

- The maximum allowable level of on-line non-synchronous generation as a function of the number of on-line synchronous generating units to maintain a secure operating state.
- The relative capability of various types of non-synchronous generating units to operate in a low system strength network as the number of on-line synchronous generating units declines.

This work is expected to begin in late March 2017 and be completed by December 2017.

4. CONCLUSIONS

AEMO has assessed this incident in accordance with clause 4.8.15(b) of the NER. In particular, AEMO has assessed the adequacy of the provision and response of facilities or services, and the appropriateness of actions taken to restore or maintain power system security.

AEMO has concluded that:

- While the SA power system was in a satisfactory operating state with a single synchronous generating unit on line it was not in a secure operating state.
- Studies conducted by AEMO have shown that a minimum of two TIPS B generating units (or equivalent) are required on line for SA power system to be in a secure operating state.
- AEMO has implemented new procedures to ensure the minimum number of synchronous generating units are on line.