AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Trip of 330 kV A Busbar at Capital Substation on 9 May 2018

November 2018

Reviewable Operating Incident Report under the National Electricity Rules

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	1017 hrs on 9 May 2018
Region of incident	New South Wales
Affected regions	New South Wales
Event type	BB – Busbar trip
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 either incident
Associated reports	Trip of Capital Wind Farm A and C 330 kV busbars on 27 May 2015 Trip of Capital Wind Farm A and C 330 kV busbars 3 May 2017 and 28 June 2017

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
CB	Circuit Breaker
kV	Kilovolt
MW	Megawatt
NER	National Electricity Rules

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.

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1. Overview

This report relates to a reviewable operating incident[1] that occurred on 9 May 2018 at Capital substation in New South Wales. The incidents involved the trip of the 330 kV 'A' busbar ('A' busbar) and was caused by incomplete isolation of secondary systems during planned maintenance.

No generation or customer load was lost as a result of the incident.

As this was a reviewable operating incident, AEMO is required to assess power system security over the course of each 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[2].

AEMO has concluded that:

1. The Capital substation 330 kV 'A' busbar was inadvertently tripped while performing planned maintenance on the Capital Wind Farm No.1 33 kV bus zone protection. The inadvertent trip was due to the incomplete isolation of secondary system equipment.
2. Infigen Energy has identified differences between the 'As Built' drawings and the actual secondary systems installed as the cause of the incomplete isolation. Infigen has commissioned an audit of the 'As Built' drawings to ensure they match the onsite equipment.
3. The power system remained in a secure operating state over the course of this incident.

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 Infigen Energy[3] and AEMO.

The reason for reviewing this incident is that this is the forth incident involving the inadvertent trip of Capital 'A' and/or 'C' busbars since May 2015[4]. The trip of Capital 'A' and 'C' busbars is credible for a trip of any of the transformers, due to the network configuration at Capital substation[5]. As each incident involved inadvertent protection operation causing the trip of the busbars, which was not expected in the circumstances, AEMO has reviewed and is reporting on these incidents.

National Electricity Market time (Australian Eastern Standard Time) is used in this report.

2. The incident

2.1 Pre-event conditions

Both Woodlawn and Capital Wind Farms were offline on 9 May 2018 for annual high voltage maintenance. The Capital 330 kV 'C' busbar was also out of service.

[1] See NER clause 4.8.15(a)(1)(i), as the event relates to a non-credible contingency event; and the AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

[2] See NER clause 4.8.15(b).

[3] Infigen Energy is the operator of Capital Wind Farm and Woodlawn Wind Farm.

[4] Reports on the previous incidents can be found on the AEMO website at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Market-notices-and-events/Power-System-Operating-Incident-Reports.

[5] At Capital substation, there are no circuit breakers (CBs) on the 330 kV side of the transformers via which the wind farms connect to the network. See Appendix A for a diagram of the configuration of the network.

2.2 The incident

On Wednesday 9 May 2018 at 1017 hrs, maintenance on the Capital Wind Farm 33 kV busbar protection resulted in the unintentional trip of the 330kV 'A' busbar at Capital substation. When 'A' busbar tripped Woodlawn Windfarm and Capital Wind Farm were both disconnected, removing a total of 184 MW generation capacity from the network. As maintenance was in progress the wind farms were not generating at the time.

No load was lost as a result of this incident.

See Appendix A1 for a diagram showing Capital substation immediately after the incident.

The 'A' busbar was returned to service at 1938 hrs on 9 May 2018.

2.3 Infigen Energy investigation

The following information is based on that provided by Infigen Energy.

At the time of this incident, bus zone protection testing was being undertaken on the Capital Wind Farm No. 1 33 kV busbar. All in service circuit breakers (CBs) should have been isolated from trip signals generated as part of the test. However, due to differences between the available drawings and the actual plant configuration not all links were identified and so not all trip circuits were isolated during testing.

During testing a trip signal to the No. 1 330/33 kV Transformer 33 kV CB 121 was initiated. As the trip circuits to this CB were correctly isolated it did not operate. As a consequence of CB 121 not operating, it correctly initiated a CB Fail (CBF) intertrip signal to trip the 'A' busbar. As the trip signals to the 'A; busbar had not been correctly isolated this resulted in the actual and unexpected trip of the busbar.

The investigation showed that while a secondary isolation sheet had been prepared prior to the work being undertaken, the isolation links for the CBF signals on the 330/33 kV transformers had not been identified. The CBF links from the 330/33 kV transformers do not route through the TransGrid marshalling strip[6] but are directly connected from the incomer panels. As there is no overarching document outlining the location of all links, they had not been identified and the 'As Built' protection drawings available differed from the actual link configuration in the panel.

There have been previous events in May 2015, May 2017, and June 2017, which resulted in inadvertent operation of the protection system. After each event, investigations were performed to identify the root cause and necessary corrective actions, including identifying the TransGrid links to be incorporated into the secondary isolations sheets and be isolated prior to testing being undertaken. While this was done, and the trip links were identified and isolated, due to the differences between the available drawings and the actual plant configuration not all links were identified resulting in incomplete protection isolation during testing.

In response to this latest incident, Infigen Energy has commissioned an audit to review the 'As Built' protection drawings compared with the actual onsite wiring. On completion of the audit, all secondary systems isolation sheets will be reviewed and updated as necessary to ensure all isolation points are correctly identified. Infigen Energy has advised AEMO that this work will be completed by 30 November 2018, prior to the next planned maintenance work.

2.4 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

[6] This is the marshalling or junction box at the interface of TransGrid and Infigen Energy operational areas. The majority of protection signalling is routed via this marshalling box.

reasonable actions to return the power system to a secure state following a contingency event in accordance with the NER[7].

For this incident, the power system remained in a secure operating state over the course of the incident and no action was required by AEMO.

2.4.1 Reclassification

AEMO assessed whether or not to reclassify this incident as a credible contingency[8].

At 1445 hrs, before the 'A' busbar was returned to service, TransGrid[9] advised AEMO the cause of the incident had been identified and remedial action taken to prevent a re-occurrence. Based on this information, AEMO was satisfied that the cause had been identified and the incident was unlikely to reoccur and therefore did not reclassify this incident as a credible contingency.

AEMO issued Market Notice 62770 at 1945 hrs on 9 May 2018 to notify the market that the incident would not be reclassified as a credible contingency.

For this incident the power system remained in a secure operating state over the course of the incident and AEMO correctly assessed the incident and did not reclassify the incident as a credible contingency event.

2.5 Market information

AEMO is required by the NER and operating procedures to inform the market about incidents as they progress. This section assesses how AEMO informed the market[10] over the course of this incident.

For this incident, AEMO informed the market on the following matters:

1. A non-credible contingency event – notify within two hours of the event[11].
   - AEMO issued Market Notice 62768 at 1037 hrs – 20 minutes after the event.
2. Updates to the non-credible contingency event – as information becomes available[12].
   - AEMO issued Market Notice 62770 at 1945 hrs with information that the cause of the non-credible contingency event had been identified and AEMO was satisfied that another occurrence of this event was unlikely under the current circumstances.

Over the course of this incident AEMO issued appropriate, timely, and sufficiently detailed market information.

[7] Refer to AEMO's functions in section 49 of the National Electricity Law, the power system security principles in clause 4.2.6 of the NER, .and AEMO's responsibility for power system security in clause 4.3.1 of the NER

[8] AEMO is required to assess whether or not to reclassify a non-credible contingency event as a credible contingency event – NER clause 4.2.3A(c) – and to report how the reclassification criteria were applied – NER clause 4.8.15(ca).

[9] As transmission network service provider (TNSP) for the area of this incident.

[10] AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see AEMO website at https://www.aemo.com.au/Market-Notices.

[11] AEMO is required to notify the Market of a non-credible contingency event within two hours of the event – AEMO, Power System Security Guidelines, Section 10.3.

[12] AEMO is required to notify the Market as it becomes aware of new and material information – NER Clause 4.2.3A(d).

3. 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:

1. The Capital substation 330 kV 'A' busbar was inadvertently tripped while performing planned maintenance on the Capital Wind Farm No. 1 33 kV bus zone protection. The inadvertent trip was due to the incomplete isolation of secondary system equipment
2. Infigen Energy has identified differences between the 'As Built' protection drawings and the actual secondary systems installed as the cause of the incomplete isolation. Infigen has commissioned an audit of the 'As Built' protection drawings to ensure they match the onsite equipment.
3. The power system remained in a secure operating state over the course of this incident.

4. Pending actions

By 30 November 2018, Infigen Energy is to complete an audit of the 'As Built' protection drawings compared with the actual on site secondary systems. Infigen Energy will advise AEMO when the audit is complete. No further action is required by AEMO.

A1. Power system diagram

The diagram below shows Capital substation immediately after the incident.