Trip of Keilor No.1 220 kV busbar on 16 September 2014

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| An aemo power system operating incident report for the national electricty market |

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INCIDENT CLASSIFICATIONS

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| --- | --- |
| Time and date and of incident | 1518 Tuesday 16 September 2014 |
| Region of incident | Victoria |
| Affected regions | Victoria |
| Event type | Busbar Trip |
| Primary cause | Transmission Equipment Failure |
| Generation Impact | No Generation lost |
| Load Impact | No Customer load lost |
| Associated reports | Nil |

ABBREVIATIONS

|  |  |
| --- | --- |
| Abbreviation | Term |
| AEMO | Australian Energy Market Operator |
| AusNet | AusNet Services – Transmission Network Service Provider in Victoria |
| CB | Circuit Breaker |
| Keilor | Keilor Terminal Station |
| kV | Kilovolt |
| MW | Megawatt |
| NER | National Electricity Rules |
| No.1 Busbar | Keilor No.1 220 kV Busbar |

IMPORTANT NOTICE

Purpose

AEMO has prepared this document to provide information about this particular Power System Operating Incident.

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# Introduction

This report reviews a power system, operating incident that occurred on Tuesday 16 September 2014 at Keilor Terminal Station (Keilor) in Victoria. This incident involved the trip of a transmission busbar caused by a circuit breaker (CB) that did not operate correctly.

AEMO is required to assess power system security over the course of this incident as the incident is classified as a non-credible contingency that under the National Electricity Rules (NER). [[1]](#footnote-1) Specifically, AEMO is required to 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]](#footnote-2)

AEMO concluded that a faulty CB trip coil caused this incident and that power system security was maintained over the course of the incident.

This report is based upon information provided by AEMO and AusNet Services (AusNet).[[3]](#footnote-3) National Electricity Market Time (Australian Eastern Standard Time) is used in this report.

# The Incident

On Tuesday 16 September at 1518 hrs,Keilor No.1 220 kV busbar (No.1 Busbar) tripped as a result of a CB that failed to operate correctly. There was no loss of load or generation and the power system remained secure. The CB was isolated and the busbar was returned to service 65 minutes later.

The reason for investigating this incident is that a transmission busbar tripped. The probability of a busbar fault is very low and is considered by AEMO as an unexpected event, known in power system security terms as a non-credible contingency.[[4]](#footnote-4)

See Appendix 1 for a diagram illustrating the incident and a chronological log of the incident.

# Ausnet services Investigation

AusNet investigated this incident and found that a capacitor bank CB at Keilor failed to operate correctly when it was closed. As a result the CB fail protection operated and tripped the No.1 Busbar at Keilor.

Prior to the incident the capacitor bank and its associated CB had been out of service for planned maintenance. Before returning the CB to service the X protection trips for the CB had been disabled pending on-load tests. This meant that only Y protection was in service at the time of the incident. The incident occurred as the capacitor bank CB was being closed to return the capacitor bank to service.

When AusNet closed the CB normal current initially flowed, which indicated that all three phases had closed correctly. After 79ms the White Phase of the CB then opened for no identifiable reason. After a further 191ms the Red Phase of the CB opened correctly on phase discrepancy protection – due to the White Phase being open.

At this stage the Blue phase should also have opened (on phase discrepancy) but it failed to open. Subsequently after 208ms (from the discrepancy protection trip signal) the CB fail protection correctly operated which in turn tripped No.1 Busbar.

AusNet later found that the Blue Phase did not open because the CB Blue Phase Y trip coil was faulty. If this trip coil had operated correctly then No.1 Busbar would not have tripped. Likewise, if the X protection trips had been in service then the Blue Phase X protection CB trip coil would have operated, opened the Blue Phase, and No.1 Busbar would not have tripped. The CB Blue Phase Y trip coil was later replaced and the capacitor bank was returned to service at 1645 hrs on 18 September 2014.

AusNet expect to complete an investigation into why the White Phase of the CB opened by 30 September 2015.

# Power System Security

This section assesses how power system security was managed over the course of the incident.[[5]](#footnote-5)

1. Following the trip of the busbar AEMO determined that the power system was in a secure state and no immediate action was required.
2. AEMO issued Market Notice 46467 at 1540 hrs to notify the market of a non-credible contingency event.[[6]](#footnote-6)
3. AusNet isolated the CB and capacitor bank returned No.1 Busbar to service.
4. AEMO then assessed whether or not to reclassify the event as a credible contingency.[[7]](#footnote-7) For this incident AusNet had isolated the CB and capacitor bank. AEMO was therefore satisfied that the cause had been identified and isolated and that the incident was unlikely to reoccur.
5. AEMO issued Market Notice 46469 at 1646 hrs to notify the market that the incident would not be reclassified as a credible contingency.
6. AusNet replaced the faulty trip coil and returned the capacitor bank to service at two days later at 1645 hrs on 18 September 2014.

For this incident the power system remained secure over the course of the incident. AEMO issued appropriate notifications, correctly assessed the incident and did not reclassify the incident as a credible contingency.

# Conclusions

AEMO concluded that:

1. The No.1 Busbar tripped due to a faulty trip coil in the Blue Phase of a capacitor bank CB.
2. The provision and response of facilities and services were adequate to maintain the power system security over the course of the incident.
3. The AusNet investigation into why the CB White Phase opened in this incident remains ongoing.

# Pending Action

1. AusNet to investigate the reason why the White Phase of the capacitor bank CB opened and submit the investigation findings to AEMO by 30 September 2014.

# Appendix 1

**Diagram illustrating the power system at Keilor immediately after the incident.**



**Incident event log**

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| --- | --- |
| Time and Date | Event |
| 1518 hrs 16 Sept 2014 | Keilor No. 1 220kV Bus tripped during a planned outage of A4 500/220kV transformer. |
| 1540 hrs 16 Sept 2014 | AEMO issued Market Notice 46467: Notification of non-credible contingency. |
| 1623 hrs 16 Sept 2014 | Keilor Busbar returned to service. |
| 1646 hrs 16 Sept 2014 | AEMO issued Market Notice 46469: Notification that Keilor No.1 Busbar had been returned to service and that the event will not be reclassified as a credible contingency. |
| 1645 hrs 18 Sept 2014 | Capacitor circuit breaker and capacitor returned to service. |

1. NER 4.8.15(a)(1)(i), and AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents. [↑](#footnote-ref-1)
2. NER Clause 4.8.15 (b) [↑](#footnote-ref-2)
3. AusNet Services is the Transmission Network Service Provider in Victoria. Information provided by AusNet Services on a without prejudice basis and nothing in this report is intended to constitute, or may be taken by any person as constituting, an admission of fault, liability, wrongdoing, negligence, bad faith or the like on behalf of AusNet Services (or its respective associated companies, businesses, partners, directors, officers or employees). [↑](#footnote-ref-3)
4. NER Clause 4.2.3 - Credible and non-credible contingency events; *AEMO Power System Security Guidelines,* Section 10 - Definition of a non-credible contingency events [↑](#footnote-ref-4)
5. AEMO is responsible for power system security in the NEM and is required to operate the power system in a secure operating state (NER Clause 4.2.4 (a)). AEMO must ensure that the power system is maintained in, or returned to, a secure operating state following a contingency event. [↑](#footnote-ref-5)
6. This is within two hours of the event. 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. [↑](#footnote-ref-6)
7. AEMO is required to assess whether or not to reclassify a non credible contingency event as a credible contingency - NER Clause 4.2.3A (c)) - and to report how re-classification criteria were applied - NER Clause 4.8.15 (ca). AEMO has to determine if the condition that caused the non-credible contingency event has been resolved. [↑](#footnote-ref-7)