# Power System Operating Incident Report – Trip of Brinkworth-Davenport 275 kV Transmission Line at Brinkworth End on 14 October 2013

PREPARED BY: AEMO Systems Capability

DATE: 6 January 2014

STATUS: FINAL

**Contents**



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| 1 | 6 Jan 2014 | S Darnell | FINAL | P Biddle | P Biddle |

## Incident Classifications

| | |
|---|---|
| Time and date and of incident | 0225 hrs Monday 14 October 2014 |
| Region of incident | SA |
| Affected regions | SA |
| Event type | OTH - Other |
| Primary cause | PTN & CTR – Protection and Control |
| Impact | Nil |
| Associated reports | Nil |

## Abbreviations

| Abbreviation | Term |
|---|---|
| AEMO | Australian Energy Market Operator |
| CB | Circuit Breaker |
| EMMS | Electricity Market Management System |
| EMS | Energy Management System |
| kV | Kilovolt |
| NER | National Electricity Rules |
| TNSP | Transmission Network Service Provider |

# 1 Introduction

This report reviews a power system operating incident that occurred on Monday 14 October 2013 in South Australia. AEMO is required to review this incident as it is classified as a non-credible contingency that satisfies the requirements of a reviewable operating incident under the National Electricity Rules[1] (NER).

The purpose of this incident review is to assess power system security over the course of the incident. The NER requires AEMO 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].

This report is based upon information provided by ElectraNet[3]. Data from AEMO's Energy Management System (EMS) and Electricity Market Management System (EMMS) has also been used in analysing the incident.

All references to time in this report are to National Electricity Market time (Australian Eastern Standard Time).

# 2 The Incident

On Monday 14 October at 0225 hrs the Brinkworth - Davenport 275 kV transmission line opened at the Brinkworth Substation end. The line remained open at Brinkworth Substation until Thursday 17 October 2013 (approximately 3 days) when the line was returned to service. No load or generation was disconnected as a result of this incident.

The primary reasons for this investigating this incident are to determine why the transmission line opened at one end only, and understand the subsequent impact on power system security. The opening of a transmission line at one end is an unexpected event and is identified in power system security terms as a non-credible contingency. Generally transmission lines open at both ends under fault conditions. This is an expected outcome known in power system security terms as a credible contingency.

# 3 TNSP Investigation

ElectraNet investigated the incident and found that faulty protection signalling (communication) equipment caused the opening of the transmission line. The faulty protection signalling equipment triggered 275 kV Circuit Breakers 6527 and 6530 at Brinkworth Substation to open. A manual reclose[4] was attempted shortly afterwards at 0230 hrs, however the transmission line once again tripped at the Brinkworth end.

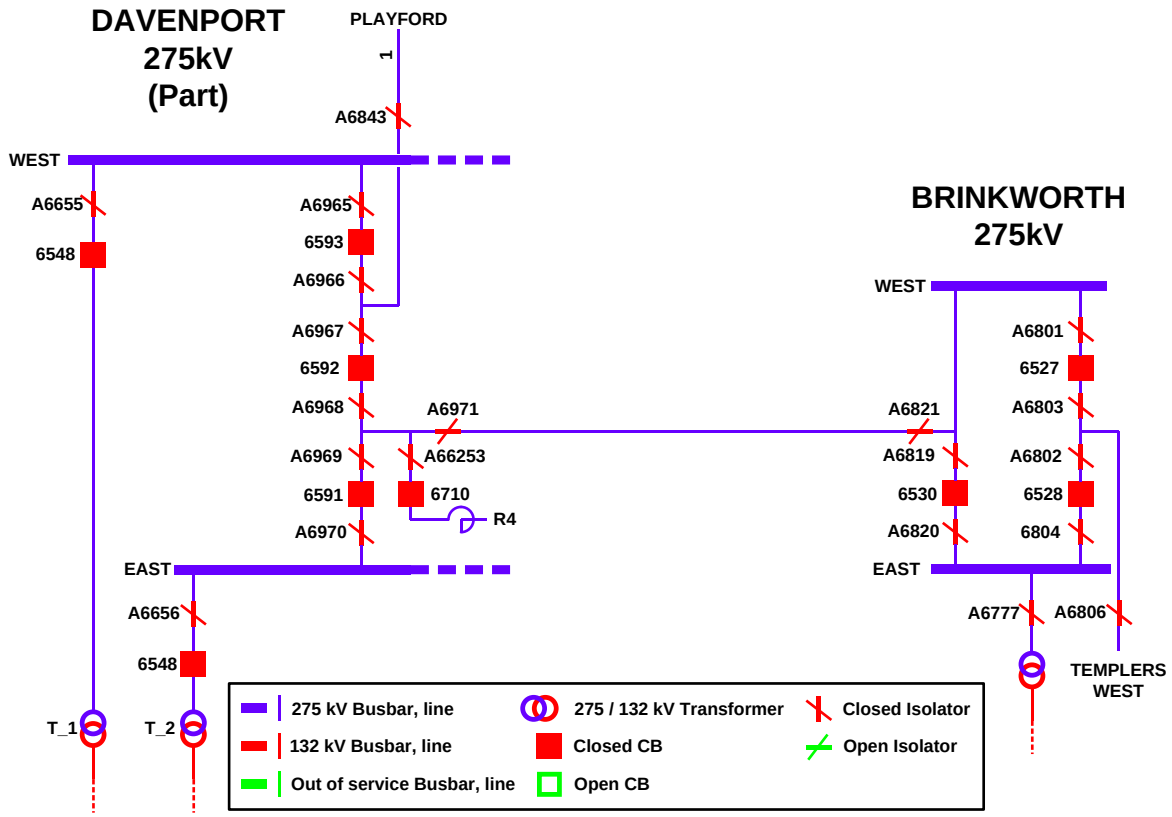
The faulty protection signalling equipment was later identified and replaced. The transmission line was returned to service on Thursday 17 October at 1046 hrs.

# 4 System Diagram

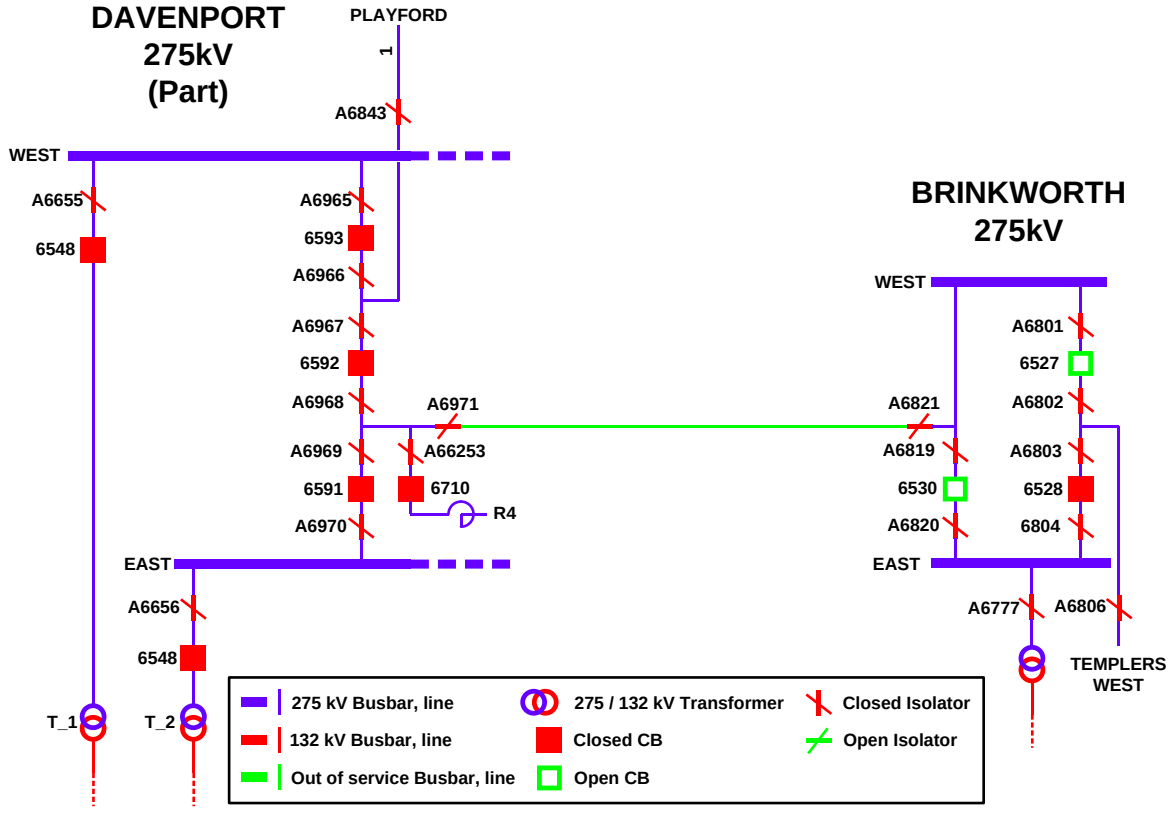
The status of the power system before the incident is shown in Figure 1 and following the incident in Figure 2. For clarity only sections of substations relevant to this incident have been included in the diagram. The diagram shows Brinkworth-Davenport 275 kV Transmission Line in service in Figure 1 and off-loaded and open at the Brinkworth end in Figure 2.

[1] *NER* v60 Clause 4.8.15(a)(1)(i) and AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.
[2] *NER* v60 Clause 4.8.15 (b)
[3] ElectraNet is the Transmission Network Service Provider in South Australia
[4] A manual reclose means a reclose that is not automatic (an operator action is required)

## Figure 1 - Status of the power system before the incident




## Figure 2 - Status of the power system after the incident



# 5 Incident Event Log

The sequence of events comprising the incident are itemised in Table 1. The incident spanned approximately three days from the initial opening of the transmission line to the line being returned to service.

**Table 1 – Event Log**

| Time and Date | Event |
|---|---|
| 0225 hrs Mon 14 Oct 2013 | Brinkworth - Davenport 275 kV Transmission Line opened at the Brinkworth Substation end |
| 0230 hrs Mon 14 Oct 2013 | Manual reclose attempted - the line again opened at the Brinkworth end |
| 0658 hrs Mon 14 Oct 2013 | Market Notice 43595 issued notifying the market that:<br>• the incident is non-credible contingency event<br>• the cause of the non-credible contingency not identified<br>• the incident to be reclassified as a credible contingency<br>• constraint set S-BRDV invoked |
| 0937 hrs Tues 15 Oct 2013 | Market Notice 43612 issued notifying the market that:<br>• the cause of the non-credible contingency has been identified<br>• the reclassification as a credible contingency has been cancelled |
| 1046 hrs Thur 17 Oct 2013 | Brinkworth - Davenport 275 kV Transmission Line returned to service |
| 1100 hrs Thur 17 Oct 2013 | Constraint set S-BRDV revoked |

# 6 Immediate Actions

This section assesses the immediate responses to the incident.

1. Five minutes after the initial event, at 0230 hrs, ElectraNet attempted to manually close the opened circuit breakers at Brinkworth substation. The manual reclose however failed with the same circuit breakers again opening.
2. AEMO then invoked constraint set S-BRDV[5] at 0240 hrs. This action ensured that the power system was in a secure operating state. AEMO is required to return the power system to a secure state within thirty minutes following a contingency event.[6]

# 7 Follow-up Actions

This section assesses the follow-up actions taken to resolve the incident.

1. AEMO issued Market Notice 43595 at 0658 hrs on Monday 15 October to notify the market of the non-credible contingency event. AEMO issued this Market Notice approximately three hours and thirty minutes after the initial event. This is not within two hours of the event in which AEMO is required to notify the market of a non-credible contingency event[7].

[5] This constraint set is invoked when the Brinkworth – Davenport 275 kV line is out of service. The constraint set limits the power flow on the Mintaro - Waterloo 132 kV transmission line so that this line does not overload in the event of a trip on the Brinkworth – Temple West 275 kV line.
[6] NER v60 Clause 4.2.6 (b)
[7] AEMO, *Power System Security Guidelines,* v54 Section 10.3

2. AEMO assessed whether or not to reclassify the event as a credible contingency[8]. For this event AEMO reclassified the opening of the Brinkworth - Davenport 275 kV transmission line at the Brinkworth Substation end as a credible contingency. AEMO considered that the cause of the event remained unresolved and could thereby reoccur (once the line was returned to service).
3. On Tuesday 15 October ElectraNet notified AEMO that cause of the event, faulty protection signalling equipment, had been identified and isolated. AEMO then issued Market Notice 43612 to cancel the reclassification of the event.
4. On Thursday 17 October ElectraNet replaced the faulty equipment and returned the Brinkworth - Davenport 275 kV transmission line to service. AEMO then revoked constraint set S-BRDV.

## 8 Power System Security

This section assesses how AEMO managed power system security over the course of this incident[9].

When a transmission line opens at one end, there is a risk that the voltage at the open end may exceed power system limits. In this case however the voltage at Davenport remained below voltage limits. No action was therefore required of AEMO or ElectraNet to manage high voltages as a result of this incident.

Over the course of this incident power system security was maintained. AEMO invoked constraint S-BRDV to manage powers system dispatch whilst the Brinkworth - Davenport 275 kV transmission line service was out of service. AEMO correctly reclassified the incident as a credible contingency until the cause of the event had been identified and resolved.

## 9 Conclusions

1. Faulty protection signalling equipment caused the Brinkworth - Davenport 275 kV transmission line to open at the Brinkworth Substation end. The equipment was replaced and the line was returned to service three days later.
2. AEMO failed to notify the market within two hours of the non-credible contingency event.
3. Power system security was maintained over the course of the incident.

## 10 Recommendations

There are no recommendations arising as a result of this investigation.

[8] For a non credible contingency AEMO is required to assess whether or not to reclassify the event as a credible contingency (NER v60 Clause 4.2.3A (c)) and to report how re-classification criteria were applied (NER v60 Clause 4.8.15 (ca)). AEMO has to determine if the condition that caused the non-credible contingency event has been resolved.

[9] AEMO is responsible for power system security in the NEM and is required to operate the power system in a secure operating state (NER v60 Clause 4.2.4 (a)). AEMO must thereby ensure that the power system is maintained in, or returned to, a secure operating state following a contingency event.