TRIP OF THE No.1 500/220KV TRANSFORMER AND No.1 STATIC VAR COMPENSATOR AT ROWVILLE ON 28 APRIL 2016

AN AEMO POWER SYSTEM OPERATING INCIDENT REPORT FOR THE NATIONAL ELECTRICITY MARKET

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	1405 hrs Thursday 28 April 2016
Region of incident	Victoria
Affected regions	Victoria
Event type	Operator error
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	Nil

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
kV	Kilovolt
NER	National Electricity Rules
No.1 500/200 kV transformer	A1 Transformer
No.1 Static Var Compensator	No.1 SVC
Rowville Terminal Station	ROTS

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

AEMO has made every effort to ensure the quality of the information in this report but cannot guarantee its accuracy or completeness. Any views expressed in this report are those of AEMO unless otherwise stated, and may be based on information given to AEMO by other persons.

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1. OVERVIEW

This report relates to a reviewable operating incident[1] that occurred on 28 April 2016 at Rowville Terminal Station (ROTS) in Victoria. This incident involved the simultaneous trip of the No.1 500/220 kV transformer (A1 Transformer) and the No.1 Static Var Compensator (No.1 SVC). There was no loss of generation or customer load as a result of this incident.

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.[2]

AEMO has concluded that:

1. The No.1 SVC tripped due to a manual switching sequence error.
2. The A1 Transformer tripped due to an incorrect default protection setting.
3. Power system security was maintained over the course of the incident.

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

2. THE INCIDENT

On Thursday 28 April 2016 at 1405 hrs, the ROTS A1 Transformer and the No.1 SVC unexpectedly tripped during switching to return the ROTS No.1 220 kV bus to service after a planned outage.

The No.1 SVC was returned to service at 1918 hrs the same day. The ROTS A1 Transformer was returned to service on Thursday 12 May 2016 at 1617 hrs, two weeks after the incident.

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

The reason for investigating this incident is that the simultaneous trip of ROTS A1 Transformer and No.1 SVC is a non-credible contingency event[4]. See Appendix A for a power system diagram illustrating the incident and Appendix B for a chronological log of the incident.

3. AUSNET SERVICES INVESTIGATION

AusNet Services investigated this incident and found that the No.1 SVC tripped due a switching error that resulted in an earth being applied to live switchgear while AusNet staff were restoring the No.1 220 kV bus. Before the restoration, the No.1 SVC was in operation and connected to No.4 220 kV bus. The switching error placed a fault between the No.1 SVC and the No.1 SVC No.1 bus 220kV circuit breaker. The No.1 SVC X and Y[5] protections detected a single phase to earth fault and tripped the No.1 SVC. This is an expected outcome for a fault at this location.

The A1 Transformer also tripped on tertiary winding overcurrent protection operation. This was an unexpected outcome and was due to an incorrect default protection setting. AusNet Services, in consultation with the original designer of the facility has updated the protection settings. AusNet

[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] Information provided by AusNet Services has been provided 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).
[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.
[5] Protection schemes on transmission systems are usually replicated (two systems operating in parallel). Generally where two schemes are used they are notionally referred to as X and Y.

Services conducted tests on the transformer and the updated protection settings before returning it to service.

AusNet has reviewed the switching sequence and has determined the switching error was the result of human error. The switching operators failed to identify the correct switchgear prior to operation.

4. POWER SYSTEM SECURITY

AEMO is responsible for power system security in the NEM. This means AEMO is required to operate the power system in a secure operating state and return the power system to a secure state following a contingency event. This section assesses how AEMO managed power system security over the course of this incident[6].

AEMO invoked constraint sets V-ROTX_R[7] at 1420 hrs and V-2RP[8] at 1425 hrs, an acceptable 15 minutes after the incident. This action ensured that the power system was restored to and maintained in a secure operating state. AEMO is required to return the power system to a secure state within thirty minutes following a contingency event.[9]

Constraint set V-2RP was revoked at 1920 hrs on 28 April 2016 after the No. 1 SVC was returned to service.

Constraint set V-ROTX_R was revoked at 1620 hrs on 12 May 2016 after the A1 Transformer was returned to service.

4.1 Reclassification

On the return to service of the A1 transformer, AEMO assessed whether or not to reclassify the event as a credible contingency[10]. For this incident AEMO was satisfied that the cause had been identified and that the incident was unlikely to reoccur, so a reclassification was not required to maintain power system security.

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[11] over the course of this incident.

For this incident, AEMO was required to inform the market on the following matters:

1. Occurrence of a non-credible contingency event - notify within two hours of the event.[12]

   AEMO issued Market Notice 52896 at 1444 hrs – 39 minutes after the event.

2. Constraints invoked with interconnector terms on the LHS.[13]

   AEMO issued Market Notice 52904 at 1456 hrs – 51 minutes after the event.

[6] 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 thereby ensure that the power system is maintained in, or returned to, a secure operating state following a contingency event.
[7] Constraint set required when one of the Rowville 500/200 kV transformers is out of service.
[8] Constraint set required when two of the SVCs at either Rowville Terminal Station or South East Substation are out of service. The second SVC at Rowville was on a planned outage since 30 March 2016 when the SVC No.1 tripped.
[9] Refer NER Clause 4.2.6 (b)
[10] 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.
[11] AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see AEMO website
[12] 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
[13] For short term outages AEMO is required to notify the Market of variances to interconnector transfer limits AEMO, *Power System Security Guidelines,* Section 22

3. Reclassification, details, and cancelation of a non-credible contingency – notify as soon as practical.[14]

   AEMO issued Market Notice 53143 at 1706 hrs on 12 May 2016 to notify the market:

   - The A1 Transformer was returned to service at 1625 hrs.
   - That the cause of the trip had been identified and the event was unlikely to reoccur.

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

6. CONCLUSIONS

AEMO has concluded that:

1. The No.1 SVC tripped due to human error during a manual switching sequence to restore the No.1 220 kV bus to service after a planned outage.
2. The A1 Transformer tripped due to an incorrect default protection setting. The protection relay setting has since been rectified.
3. The provision and response of facilities and services were appropriate and power system security was maintained over the course of the incident.

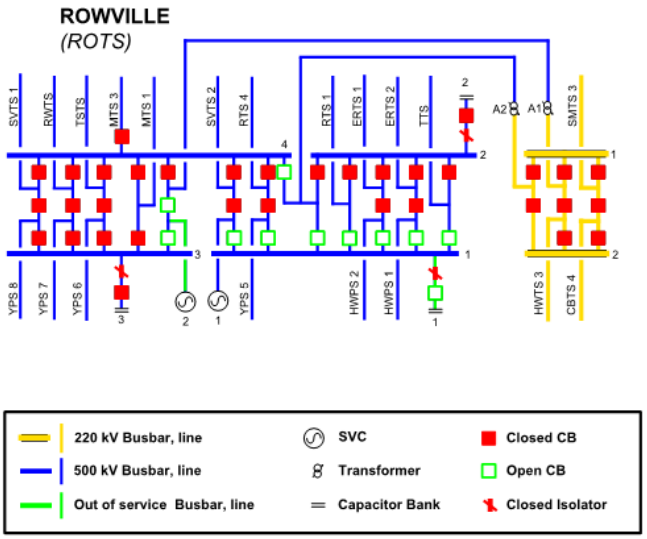
There are no outstanding issues to resolve as a result of this incident.

[14] AEMO is required to notify the market of a reclassification NER clause 4.2.3(g), details of the reclassification 4.2.3(c) and when AEMO cancels the reclassification 4.2.3(h)

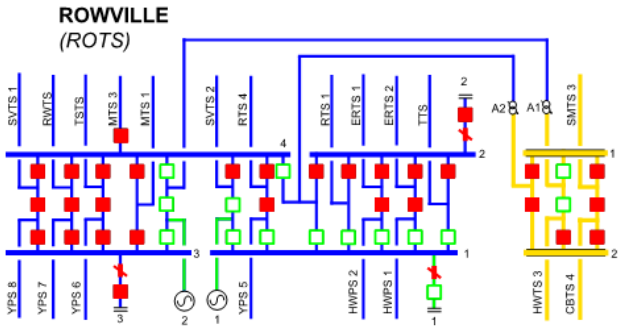
APPENDIX A. – POWER SYSTEM DIAGRAM

The power system immediately before and after the incident.

Before:



After:



APPENDIX B. – INCIDENT EVENT LOG

Chronological Log of Incident

Time and Date	Event
1405 hrs Thu 28 Apr 2016	ROTS A1 Transformer and No.1 SVC tripped
1420 hrs Thu 28 Apr 2016	V-ROTX_R constraint set invoked
1425 hrs Thu 28 Apr 2016	V-2RP constraint set invoked
1444 hrs Thu 28 Apr 2016	Market Notice 52896 issued to inform the market of the non-credible contingency event
1456 hrs Thu 28 Apr 2016	Market Notice 52904 issued to inform the market of the constraints invoked
1608 hrs Thu 28 Apr 2016	AusNet Services returned the No.1 220 kV bus to service
1918 hrs Thu 28 Apr 2016	AusNet Services returned No.1 SVC to service
1625 hrs Thu 12 May 2016	AusNet Services returned A1 Transformer to service
1706 hrs Thu 12 May 2016	Market Notice 53143 issued to inform the market the return of service of A1 Transformer