Power System Operating Incident Report – Trip of Rowville-Thomastown 220 kV Transmission Line and Multiple Wind Farms on 13 October 2013

PREPARED BY: AEMO Systems Capability

DATE: 14 January 2014

STATUS FINAL

Contents

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Version Release History

VERSION	DATE	BY	CHANGES	CHECKED BY	AUTHORISED BY
1	14/01/2014	J Duque	FINAL	S Darnell	P Biddle

Incident Classification

Time and date and of incident	1511 hrs Sunday 13 October 2013
Region of incident	Victoria
Affected regions	Victoria and Tasmania
Event type	TG – Loss of transmission element(s) and generating unit(s)
Primary cause	TE - Transmission equipment failure
Impact	Significant
Associated reports	Power System Operating Incident Report – Trip of Ringwood-Rowville 220 kV Transmission Line and Multiple Generator Units on 29 Sept 2013

Abbreviations and Symbols

Abbreviation	Term
AEMO	Australian Energy Market Operator
CB	Circuit Breaker
EMMS	Electricity Market Management System
EMS	Energy Management System
GPS	Generator Performance Standards
kV	Kilovolt
MW	Megawatt
NER	National Electricity Rules
ROTS	Rowville Terminal Station

1 Introduction

This report reviews a power system operating incident that occurred on 13 October 2013 in Victoria. 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 AEMO[3],SP AusNet[4], Powercor[5], AGL[6], Hydro Tasmania[7] and Goldwind Australia[8]. Data from AEMO's Energy Management System (EMS) and Electricity Market Management System (EMMS) has also been used in analysing the incident.

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

2 The Incident

On Sunday 13 October 2013, at 1511 hrs, the Rowville - Thomastown 220 kV Transmission Line tripped due to a lightning strike. Simultaneously, Oaklands Hill Wind Farm tripped from 54 MW, Mortons Lane Wind Farm tripped from 19 MW and Musselroe Wind Farm reduced generation by 17 MW. The transmission line was then returned to service via an auto reclose at the Thomastown end and a manual close at the Rowville end.

The primary reason for investigating this incident is that several generating units tripped as a result of a power system fault[9]. Generally, for a power system fault, generating units are required to remain connected to the power system whilst network protection systems react and clear the fault.

3 Incident Investigations

The incident was investigated by the entities affected by the transmission fault and the resulting power system disturbance. This section summarises the findings of these investigations.

3.1 SP AusNet – Transmission Network Service Provider

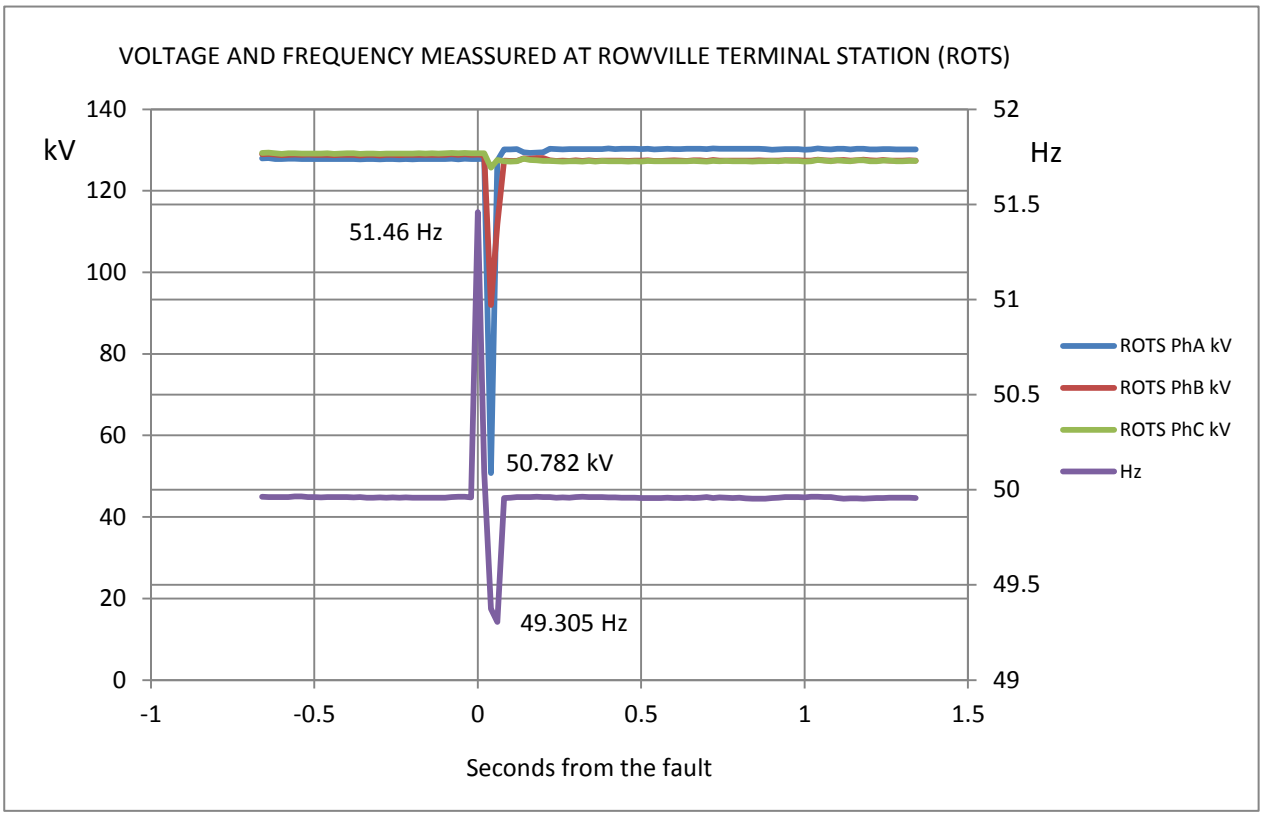
SP AusNet found that a lightning strike on the top of a wooden pole caused the Rowville – Thomastown 220 kV transmission line to trip. The fault was a single phase to earth which was cleared in 78 ms. Heavy rain was reported in the area at the time of this event.

The pole was cracked, but remained in a serviceable condition. Minor damage was also found on a neighbouring pole. The two affected wooden poles were repaired by 17 October 2013 (4 days later).

[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] In Victoria AEMO is both the National Electricity Market operator and the Victorian Transmission Network Service Provider.
[4] Information provided by SP AusNet 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 SP AusNet (or its respective associated companies, businesses, partners, directors, officers or employees).
[5] Powercor is the distribution network service provider for Oakland Hill and Mortons Lane Wind Farms
[6] AGL Hydro Partnership is the Registered Participant of Oaklands Hill Wind Farm.
[7] Hydro Tasmania is the operator of Musselroe Wind Farm
[8] Goldwind Australia is the operator of Mortons Lane Wind Farm
[9] A similar event occurred on 29 September 2013, when the Ringwood – Rowville 220 kV Transmission Line, Yallourn Unit 1 and Oaklands Hill Wind Farm tripped, and Macarthur and Musselroe Wind Farms reduced generation. The Power System Operating Incident Report for this incident is available on the AEMO website.

Figure 1 shows the frequency and phase voltages at Rowville Terminal Station (ROTS) during the event.

Figure 1 – Frequency and Voltage at Rowville Terminal Station



3.2 AGL, Goldwind Australia and Powercor

Oaklands Hill Wind Farm and Mortons Lane Wind Farm tripped from 54 MW and 19 MW respectively at the same time as the transmission line event.

AGL, Goldwind Australia and Powercor suspect that the cause of the wind farms trips was a transient overvoltage similar to a previous event on 29 September 2013. Powercor have been unable to identify the source of the overvoltage on the distribution network. The overvoltage triggered the operation of a Powercor overvoltage protection relay at Nareeb Switching Station which in turn tripped Oaklands Hill and Mortons Lane Wind Farms.

Static compensator equipment (STATCOM[10]) at both wind farms did not respond to the overvoltage. AGL, Goldwind Australia and Powercor investigated the response of the STATCOM equipment at both wind farms during this event[11]. The parties agreed to extend the time delay before Powercor overvoltage protection relays operate at Nareeb Switching Station, Mortons Lane Wind Farm and Oaklands Hill Wind Farm. The intent of the modification is to allow the STATCOM sufficient (more) time to respond to an overvoltage. The time delay was implemented in early January 2014.

Oaklands Hill Wind Farm did not need to submit a Generator Performance Standard (GPS) Non-Compliance for this event. A GPS Non-Compliance was already in place from the event on 29 September 2013 in which Oakland Hill wind Farm tripped for the same reason. This non-compliance was closed on 10 January 2013.

Mortons Lane Wind Farm did not have to provide a non-compliance notification for this event due to conditions stipulated in its generator performance standards.

[10] A static compensator is a voltage control device
[11] As also stated in the Power System Operating Incident Report for the incident on 29 September 2013

3.3 Hydro Tasmania – Musselroe Wind Farm

At Musselroe Wind Farm in Tasmania nine wind turbines tripped as result of the transmission disturbance in Victoria. The turbine trips were not expected for the type of fault that triggered this incident. The turbines were returned to service at approximately one hour after the event at 1516 hrs on 13 October.

Those nine turbines are part of a group of eleven turbines that had faults initially identified during testing in September 2013. The faults are related to hardware, software and inappropriate protection settings.

On 16 October 2013, after further investigations of similar events, Hydro Tasmania declared eleven turbines at Musselroe Wind Farm non-compliant with their GPS. Issues with five of those turbines were rectified and the turbines remained in service. The remaining six turbines were removed from service on 31 October 2013 as requested by AEMO and Transend. Following corrective action the turbines were incrementally returned to service. AEMO subsequently closed the GPS non-compliance on 05 November 2013.

On 03 December 2013, Hydro Tasmania informed AEMO that some of the affected turbines continued to exhibit similar problems. AEMO then reopened the non-compliance of wind turbines at Musselroe Wind Farm. Hydro Tasmania rectified the problems at Musselroe Wind Farm and the non-compliance was closed on 11 December 2013.

4 Power System Diagrams

The status of the power system before the incident is shown in Figure 2 and after the incident in Figure 3. For clarity only equipment relevant to this incident has been included in the diagrams. The diagrams shows how the affected generators are linked via the Victoria and Tasmania networks, and the generating units affected by the event.

Figure 2 - Status of the power system before the incident

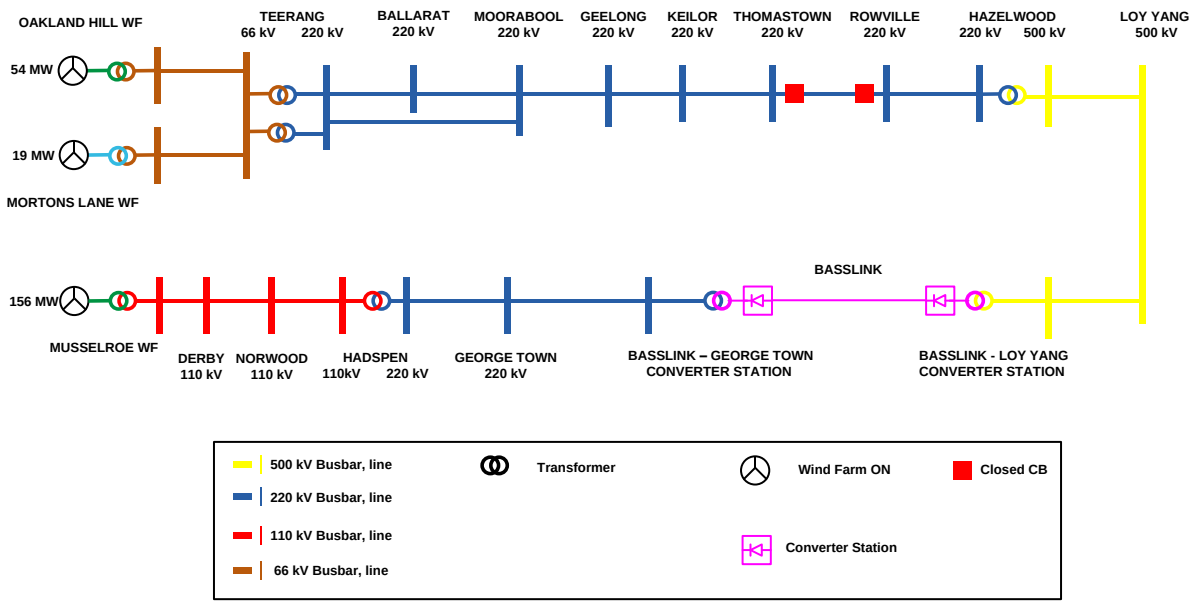
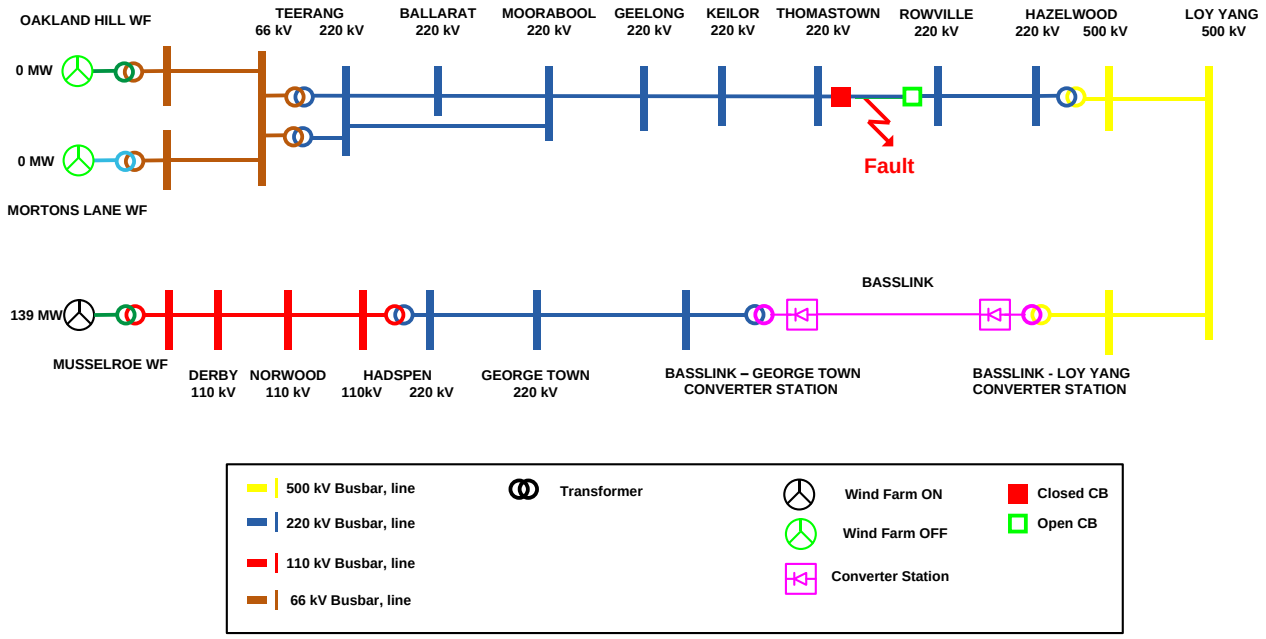


Figure 3 - Status of the power system immediately after the incident



5 Incident Event Log

The sequence of events comprising the incident are itemised in Table 1.

Table 1 – Event Log

Time and Date	Event
15:11 13 Oct 2013	Rowville – Thomastown 220 kV Transmission Line tripped and auto reclosed at Thomastown end.
	Oaklands Hill Wind Farm tripped from 54 MW
	Mortons Lane Wind Farm tripped from 19 MW
	Musselroe Wind Farm reduced generation by 17 MW.
15:14 13 Oct 2013	Rowville – Thomastown 220 kV Transmission Line reclosed at Rowville end.
15:46 13 Oct 2013	Mortons Lane Wind Farm returned to service
15:56 13 Oct 2013	Market Notice 43589 issued informing the market of non-credible contingency event
16:09 13 Oct 2013	Market Notice 43590 issued reclassifying the event as credible contingency event
17:00 13 Oct 2013	Oaklands Hill Wind Farm returned to service

6 Immediate Actions

This section assesses the immediate responses to the incident.

The Rowville – Thomastown 220 kV Transmission Line reclosed automatically at the Thomastown end as per design, and three minutes later was manually reclosed at the Rowville end.

Musselroe Wind Farm recovered to pre-incident generation output approximately five minutes after the event.

AEMO issued Market Notice 43589 approximately 45 minutes after the initial event to notify the market of the non-credible contingency event. This was within the two hour period in which AEMO is required to notify the market of a non-credible contingency event.[12]

All immediate responses to the incident were appropriate and correct

7 Follow-up Actions

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

Mortons Lane Wind Farm and Oaklands Hill Wind Farm returned to service on the same day at 1546 hrs and 1700 hrs respectively.

AEMO reclassified the trip of the Rowville – Thomastown 220 kV Transmission Line, Oaklands Hill and Mortons Lane Wind Farms, and the reduction on generation at Musselroe Wind Farm as credible contingency event. AEMO issued Market Notice 43590 at 1609 hrs on 13 October 2013 to notify the market of this reclassified credible contingency.

On 6 December 2013 AEMO then modified the reclassified credible contingency to any 220 kV credible contingency in Victoria together with the loss of Oaklands Hill, Mortons Lane, Macarthur and Musselroe Wind Farms and Yallourn Units 1 and 2. This reclassification followed further consideration of the generators affected by the events on both 29 September and 13 October 2013. Market Notice 44142 was issued at 1630 hrs on 6 December to notify the market of this modification to the previous reclassification.

This reclassified credible contingency was again modified on:

- 13 December to remove Yallourn units and Musselroe Wind Farm following remedial work (Market Notice 44204)
- 5 January 2014 to include reduction of generation at Waubra Wind farm after event on that date (Market Notice 44412), and
- 10 January to remove Oaklands Hill and Mortons Lane Wind Farms following remedial actions (Market Notice 44460)

As of 14 January 2014 the reclassification includes any 220 kV fault in Victoria and a reduction in generation at Macarthur Wind Farm and Waubra[13] Wind Farm.

8 Power System Security

The section assesses how power system security was managed over the course of the incident.

1. The fault on the Rowville - Thomastown 220 kV Transmission Line was correctly cleared as required by the NER.

[12] AEMO, Power System Security Guidelines, v54 Section 10.3

[13] Waubra Wind Farm has been included in this credible contingency due an event on 5 January 2014. AEMO is preparing a Power System Operating Incident Report for this event.

2. Oaklands Hill and Musselroe Wind Farms failed to comply with generator performance standards. AGL and Hydro Tasmania notified AEMO of the GPS Non-Compliances in accordance with NER 4.15. The GPS Non-Compliances affecting Oaklands Hill and Musselroe Wind Farms have since been rectified.
3. Power system voltage and frequency remained within the NER limits over the course of this event.
4. The power system remained secure for the duration of this event.

9 Conclusions

1. A lightning strike tripped the Rowville - Thomastown 220 kV Transmission Line. The fault was correctly cleared by protection systems and the line was returned to service within three minutes.
2. Oaklands Hill and Mortons Lane Wind Farms tripped due to the operation of a Powercor overvoltage protection system at Nareeb switching station. Remedial action has been taken to prevent this type of event reoccurring.
3. Nine turbines at Musselroe Wind Farm in Tasmania tripped due faults related to hardware, software and inappropriate protection settings. Actions have been taken to fix those issues.
4. Power system security was maintained for the duration of the incident.

10 Recommendations

There are no recommendations arising from this report.