Power System Operating Incident Report – Trip of Millmerran Power Station Generating Units 1 and 2 on 23 December 2013

PREPARED BY: AEMO Systems Capability

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STATUS: FINAL

Contents

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Version Release History

VERSION	DATE	BY	CHANGES	CHECKED BY	AUTHORISED BY
1	26 Mar 2014	S Darnell	FINAL	S Darnell	P Biddle

Incident Classifications

Time and date and of incident	0856 hrs Monday 23 December 2013
Region of incident	QLD
Affected regions	QLD
Event type	GG – Loss of multiple generating units
Primary cause	PS – Power Station Internal Issues
Impact	VS – Very significant
Associated reports	Power System Operating Incident Report - Simultaneous Trip of Millmerran Power Station Units 1 and 2 on 9 March 2013

Abbreviations

Abbreviation	Term
AEMO	Australian Energy Market Operator
EMMS	Electricity Market Management System
EMS	Energy Management System
kV	Kilovolt
MOC	Millmerran Operating Company
MW	Megawatt
NER	National Electricity Rules

1 Introduction

This report reviews a power system operating incident that occurred on Monday 23 December 2013 in the Queensland region at Millmerran Power Station (Millmerran PS). 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 Millmerran Operating Company (MOC)[3]. 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 Monday 23 December 2013 at 0856 hrs both generating units at Millmerran PS simultaneously tripped resulting in the loss of 870 MW of generation. The cause of the incident was an issue internal to the power station and there was no further impact on the power system.

The reason for investigating this incident is that two generating units tripped simultaneously. Generally, any one generating unit is required to operate independently and to remain connected to the power system while faults on other generating units, or the power system, are cleared.

3 Participant Investigation

MOC investigated the incident and found that the distributed control system (DCS) for the power station failed. The exact cause of the incident is unclear, however MOC believes an unidentified electrical disturbance damaged several components of the DCS. MOC suspect that the source of the electrical disturbance may have been a cabinet power supply unit, which itself was one of the components damaged. Other damaged components include a hard disc drive (HDD) and communications module.

The DCS at Millmerran is a dual communication loop that connects all of the distributed process control units (PCUs), the human machine interface (HMI) PCUs and the data historian PCUs for both generating units. The dual loop configuration allows for communications to continue if either loop fails. However if both communication loops fail the protection system software is configured to trip both generating units.

The reason both generating units tripped simultaneously is that both communication loops failed. This DCS communication failure was caused by a failed communication module in one of the data historian PCUs. The two communication loops come together in the communications module of each PCU connected to the communications loop.

The communication module in each PCU could therefore be considered a single point of failure for both generating units. However, PCU communication modules at Millmerran PS have previously failed without disabling both communication loops. This event is the first time since the power station was commissioned a communication module has disabled both communication loops.

In response to this incident MOC has implemented a real time monitoring technique that can identify a deteriorating communications module. This will assist MOC to proactively maintain the DCS communication loops. MOC is also reviewing the DCS configuration at Millmerran Power Station to better understand the

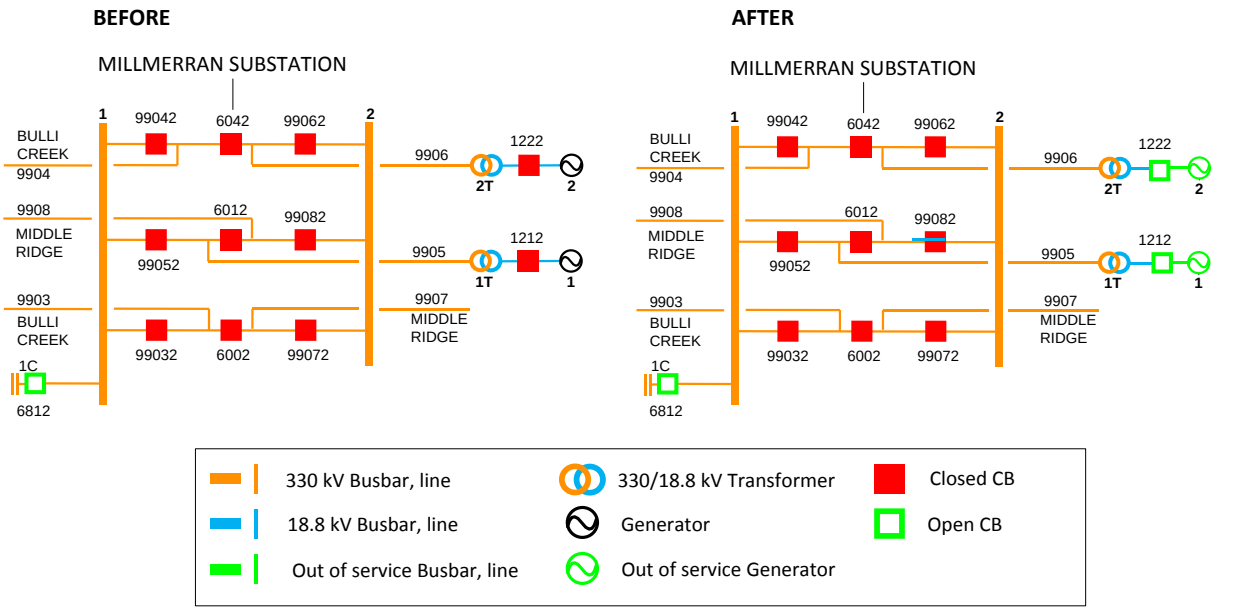
[1] NER v60 Clause 4.8.15(a)(1)(i) and AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.
[2] NER v60 Clause 4.8.15 (b)
[3] MOC is the operator of Millmerran Power Station

risks of current the arrangement versus alternative arrangements. MOC will submit its findings to AEMO for power system security assessment.

4 System Diagram

The status of the power system before and after the incident is shown in Figure 1. For clarity only equipment relevant to this incident has been included in the diagrams. The diagram shows the transmission system at Millmerran Substation unaffected by the generator unit trips.

Figure 1 - Status of the power system before and after the incident



5 Incident Event Log

The sequence of events comprising the incident are itemised in Table 1. The incident spanned approximately 17 hours from the initial trip of the generating units to both units being returned to service.

6 Immediate Actions

This section assesses the actions taken as the immediate response to the incident.

No immediate actions were required to ensure that the power system was in a secure operating state[4]. MOC promptly identified the cause of the incident and informed AEMO. No constraints were required for this type of event.

[4] AEMO is required to return the power system to a secure state within thirty minutes following a contingency event - NER v60 Clause 4.2.6 (b)

Table 1 – Event Log

Time and Date	Event
0856 hrs 23 Dec 2013	Millmerran Power Station Generating Units 1 and 2 tripped – DCS failure
0857 hrs 23 Dec 2013	HMI indications restored at Millmerran Power Station
0900 hrs 23 Dec 2013	DCS room at Millmerran Power Station inspected – failed equipment identified
0918 hrs 23 Dec 2013	Market Notice 44345 Issued notifying of a non-credible contingency event
0930-01600 hrs 23 Dec 2013	Failed power supply replaced DCS communication loops restored PCU containing failed communications card isolated
1438 hrs 23 Dec 2013	Market Notice 44348 issued notifying that the event would not be reclassified as a credible contingency – AEMO was satisfied that the event was unlikely to reoccur
2015 hrs 23 Dec 2013	Millmerran Unit 1 returned to service
0215 hrs 24 Dec 2013	Millmerran Unit 2 returned to service

7 Follow-up Actions

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

AEMO issued Market Notice 44345 at 0918 hrs approximately 20 minutes after the incident to notify the market of a non-credible contingency event. This was within two hours of the event in which AEMO is required to notify the market of a non-credible contingency event[5].

MOC promptly identified the problem, restored the DCS communication loops and isolated the PCU containing the damaged communications module.

AEMO then assessed whether or not to reclassify the event as a credible contingency[6]. For this incident AEMO was satisfied that the cause had been identified and that the incident was unlikely to reoccur. AEMO issued Market Notice 44348 at 1438 hrs to notify the market that the incident would not be reclassified as a credible contingency.

MOC returned the generating units to service without any further DCS issues.

8 Power System Security

This section assesses how AEMO managed power system security over the course of the incident[7].

For this incident the power system remained secure over the course of the incident. Power system frequency, and voltage remained within limits following the trip of the generating units. Based on the information available at the time of the incident AEMO correctly assessed the incident as unlikely to reoccur and did not reclassify the incident as a credible contingency.

The subsequent investigation by MOC identified the communications module of each PCU on the Millmerran DCS communication loop as a potential single point of failure for both generating units. MOC is

[5] AEMO, *Power System Security Guidelines,* v56 Section 10.3

[6] For a non credible contingency AEMO is required to assess whether or not to reclassify a non credible contingency 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.

[7] 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.

currently reviewing the DCS configuration at Millmerran Power Station and will submit its findings to AEMO for power system security assessment.

AEMO has not reclassified the trip of both Millmerran units as a single credible contingency because, based on current evidence, AEMO considers the risk of a reoccurrence as very low. Once MOC has submitted the findings of its current review AEMO will reconsider this assessment.

9 Recommendations

1. MOC to review the DCS system configuration at Millmerran Power Station and submit the findings to AEMO by 30 April 2014.