

Power System Operating Incident Report - Trip of Greenbank - Molendinar 275 kV Transmission Line at Greenbank End on 21 December 2013

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Version Release History

VERSION	DATE	BY	CHANGES	CHECKED BY	AUTHORISED BY
1	4 Feb 2014	P McEniery	FINAL	S Darnell	P Biddle

Incident Classifications

Time and date and of incident	0403 hrs Saturday 21 December 2013
Region of incident	QLD
Affected regions	QLD
Event type	OTH – Other
Primary cause	PTN & CTR – Protection and Control
Impact	Nil
Associated reports	Nil

Abbreviations

Abbreviation	Term
AEMO	Australian Energy Market Operator
EMMS	Electricity Market Management System
EMS	Energy Management System
kV	Kilovolt
NER	National Electricity Rules

1 Introduction

This report reviews a power system operating incident that occurred on Saturday 21 December 2013 in Queensland at Greenbank substation. AEMO is required to review this incident as it satisfies the requirements of a reviewable operating incident under the National Electricity Rules¹ (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 security².

This report is based upon information provided by Powerlink³. 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 Saturday 21 December 2013 at 0403 hrs the Greenbank – Molendinar No. 8825 275 kV transmission line (Greenbank - Molendinar Line) opened at the Greenbank substation end. No load or generation was disconnected as a result of this incident.

The primary reason for investigating this incident is that the Greenbank – Molendinar line tripped at one end. 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. 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.

3 Participant Investigation

Powerlink found that a faulty protection relay caused the incident; that is the faulty protection relay triggered 275 kV circuit breakers 5052 and 88252 at Greenbank substation to open.

The faulty protection relay was immediately replaced by Powerlink.

The transmission line was returned to service on Saturday 21 December 2013 at 1152 hrs.

4 System Diagrams

The status of the power system prior to the incident is shown in Figure 1 and after the incident in Figure 2. For clarity only equipment relevant to this incident has been included in the diagrams. Figure 1 shows the Greenbank – Molendinar Line in service. Figure 2 shows the Greenbank – Molendinar Line off-loaded and open at Greenbank.

5 Incident Event Log

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

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 Powerlink is the Transmission Network Service Provider in Queensland.

Figure 1 - Status of the power system prior to the incident

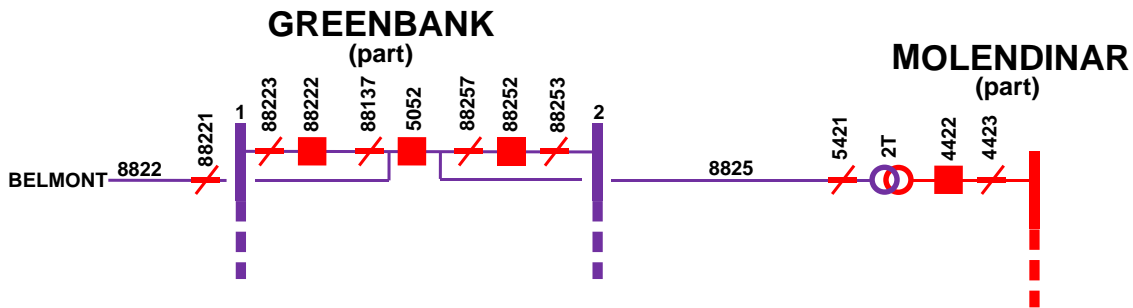


Figure 2 - Status of the power system immediately after the incident

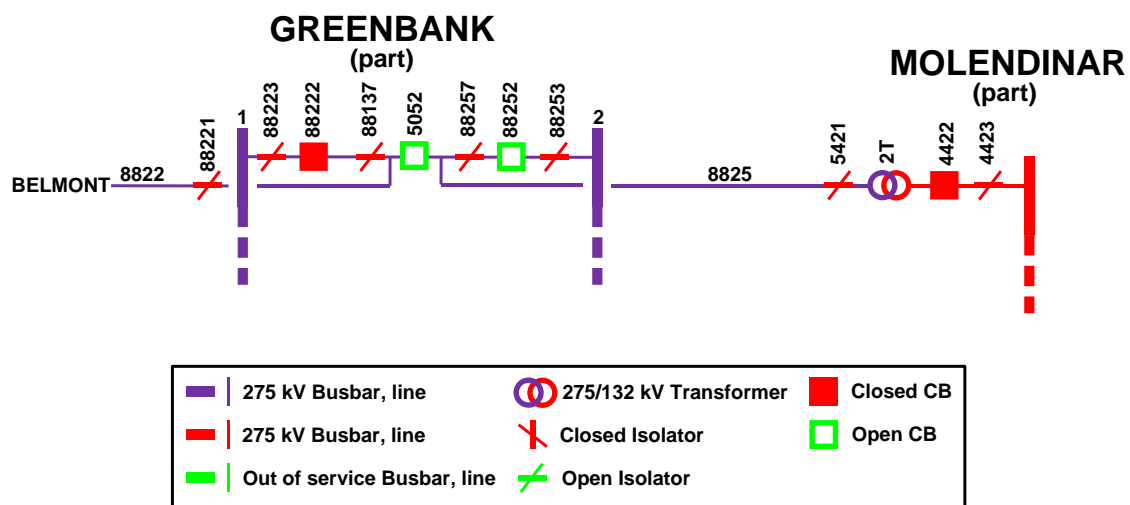


Table 1 – Event Log

Time and Date	Event
0403 hrs Sat 21 Dec 2013	Greenbank – Molendinar Line opened at the Greenbank substation end
0406 hrs Sat 21 Dec 2013	Greenbank – Molendinar Line manually opened at the Molendinar end by Powerlink
0410 hrs Sat 21 Dec 2013	Constraint set Q-GMBO_8824_8825 ⁴ invoked
0445 hrs Sat 21 Dec 2013	Powerlink advises AEMO of cause of trip
0451 hrs Sat 21 Dec 2013	Market Notice 44311 issued notifying the market that: <ul style="list-style-type: none"> • a non-credible contingency event had occurred • the cause of the non-credible contingency has been identified • the event will not be re-classified as a credible contingency • constraint set Q-GMBO_8824_8825 had been invoked
1152 hrs Sat 21 Dec 2013	Greenbank – Molendinar Line returned to service
1155 hrs Sat 21 Dec 2013	Constraint set Q-GMBO_8824_8825 revoked

⁴ This constraint set is invoked when either the No. 8824 or No.8825 Greenbank – Molendinar 275 kV transmission lines is out of service. When binding, this constraint set increases flow north on the Terranora interconnector to avoid voltage stability problems in the Gold Coast area for the outage of either of these two transmission lines.

6 Immediate Actions

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

1. Three minutes after the initial event, Powerlink isolated the Greenbank – Molendinar Line, so that the trip of the transmission line could be investigated.
2. AEMO invoked constraint set Q-GMBO_8824_8825 at 0410 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.⁵

7 Follow-up Actions

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

1. Powerlink identified that the cause of the transmission line opening was the unexpected operation of a protection relay at Greenbank. The protection relay issued a trip signal to circuit breakers 5052 and 88252 at Greenbank before failing completely, that is the relay powered down and would not power up. The trip signal was not expected for the failure of the protection relay.
2. AEMO issued Market Notice 44311 at 0451 hrs on Saturday 21 December 2013 to notify the market of the non-credible contingency event. AEMO issued this Market Notice approximately 48 minutes after the initial event. This is within two hours of the event in which AEMO is required to notify the market of a non-credible contingency event⁶.
3. Powerlink immediately replaced the faulty protection relay.
4. After the protection relay was replaced, the Greenbank – Molendinar Line was returned to service at 1152 hrs. Constraint set Q-GMBO_8824_8825 was revoked at 1155 hrs.

8 Power System Security

This section assesses how AEMO managed power system security over the course of the incident⁷.

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 voltages remained within power system limits. Therefore no action was required of AEMO or Powerlink to manage high voltages as a result of this incident.

Over the course of this incident power system security was maintained. AEMO invoked constraint set Q-GMBO_8824_8825 to manage power system dispatch whilst the Greenbank – Molendinar Line was out of service. AEMO correctly assessed the incident as a non-credible contingency.

9 Conclusions

1. A faulty protection relay caused the Greenbank – Molendinar Line to open at the Greenbank end. The protection relay was replaced and the transmission line was returned to service approximately eight hours later.
2. Power system security was maintained over the course of the event.

⁵ NER v60 Clause 4.2.6 (b)

⁶ AEMO, *Power System Security Guidelines*, v56 Section 10.3

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.

10 Recommendations

There are no recommendations arising from this incident.