



# SIMULTANEOUS TRIP OF GORDON– CHAPEL STREET No.2 AND LIAPOOTAH-WAYATINAH-CATAGUNYA 220kV TRANSMISSION LINES

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

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## VERSION RELEASE HISTORY

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## INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	1325 hours on 9 February 2016
Region of incident	Tasmania
Affected regions	Tasmania
Event type	Loss of Transmission elements
Generation Impact	33MW of generation was disconnected
Customer Load Impact	No customer load was disconnected as a result of this incident
Associated reports	Nil



# IMPORTANT NOTICE

## Purpose

AEMO has prepared this document to provide information about this particular Power System Operating Incident.

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## 1. OVERVIEW

This report reviews a power system operating incident that occurred in Tasmania on 9 February 2016, involving the simultaneous trip of the Gordon – Chapel Street No. 2, Liapootah – Wayatinah and Wayatinah – Catagunya 220kV transmission lines. There was no loss of customer load as a result of this incident.

The power system is operated such that it will remain in a satisfactory operating state<sup>1</sup> for the loss of single elements in the transmission network, defined as credible contingency<sup>2</sup> events. AEMO considers the occurrence of these events to be reasonably possible and will ensure contingency plans are in place to minimise the impact on the power system following a credible contingency event. A non-credible contingency event is a contingency event other than a credible contingency event and usually involves multiple elements.

Under the National Electricity Rules (NER) this incident was a non-credible contingency event that impacted critical transmission elements<sup>3</sup> and AEMO is required to assess power system security over the course of the incident. Specifically, AEMO is required 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.<sup>4</sup>

AEMO concluded that:

1. The trip of the Gordon - Chapel Street No 2 220kV transmission line was a correct outcome likely caused by lightning.
2. The trip of the Liapootah – Wayatinah and Wayatinah – Catagunya 220kV transmission lines was the result of a protection mal-operation.
3. The power system was restored to a secure operating state within 30 minutes

This report is based on information provided by Hydro Tasmania, TasNetworks<sup>5</sup> and AEMO. National Electricity Market time (Australian Eastern Standard Time) is used in this report.

## 2. THE INCIDENT

At 1325 hours on Tuesday 9 February 2016 one phase of the Gordon – Chapel Street No. 2 220kV transmission line tripped due to a single phase to ground fault. This line phase then reclosed automatically as expected. On re-closure, the transmission line then tripped on all three phases and remained out of service.

At the same time, the Liapootah – Wayatinah and Wayatinah – Catagunya 220kV transmission lines also tripped, resulting in the loss of 33 MW of generation.

There was no loss of customer load as a result of this incident.

The Gordon – Chapel Street No.2 transmission line was returned to service at 1340 hours. The Liapootah – Wayatinah and Wayatinah – Catagunya transmission lines were returned to service at 1616 hours after a faulty protection relay at Wayatinah was isolated.

Appendix A provides a chronological sequence of events. Appendix B provides an overview of the transmission network impacted immediately after the event.

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<sup>1</sup> Refer to NER clause 4.2.2

<sup>2</sup> Refer to NER clause 4.2.3

<sup>3</sup> Refer to NER Clause 4.8.15(a)(1)(i) and AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

<sup>4</sup> NER clause 4.8.15 (b)

<sup>5</sup> *Hydro Tasmania is a generator in the Tasmania region. TasNetworks is the Transmission Network Service Provider in the Tasmania region.*



### 3. TASNETWORKS INVESTIGATION

TasNetworks investigated the trip of the Gordon – Chapel Street No. 2 220kV transmission line and provided the following information.

A single phase of the Gordon – Chapel Street No 2 transmission line tripped on line differential protection due to a phase to ground fault. The transmission line automatically reclosed after the dead time of 700ms and then tripped all three phases on a phase/phase/ground fault and remained out of service. Both faults were cleared in less than the required timeframes<sup>6</sup>. The transmission line was returned to service at 1340 hours on 9 February 2016.

A line patrol could not find a cause for the fault. Lightning was reported in the area at the time of the fault.

At 1351 hours an attempt was made to restore the Liapootah – Wayatinah – Catagunya transmission line. The attempt was not successful. The issue was investigated by Hydro Tasmania.

### 4. HYDRO TASMANIA INVESTIGATION

Hydro Tasmania investigated the trip of the Liapootah – Wayatinah and Wayatinah – Catagunya transmission lines and provided the following information.

The restricted earth fault protection scheme on transformer T5 at Wayatinah operated, tripped the T5 transformer at Wayatinah and sent an intertrip to trip Liapootah to trip circuit breaker E152. This is an expected outcome for the operation of this protection, however this protection should not have operated for a fault on the Gordon – Chapel Street transmission line.

At 1351 hours TasNetworks attempted to restore the Liapootah – Wayatinah transmission line. The restricted earth fault protection scheme on transformer T5 at Wayatinah operated again to trip the line.

Hydro Tasmania isolated the restricted earth fault protection scheme on transformer T5 at Wayatinah, and the Liapootah – Wayatinah – Catagunya transmission lines were returned to service at 1616 hours on 9 February 2016.

The protection was returned to service on 19 April 2016 after a loose wiring connection was repaired.

### 5. POWER SYSTEM SECURITY

AEMO is responsible for power system security in the National Electricity Market (NEM). This means AEMO is required to operate the power system in a secure operating state and return the power system to a secure operating state following a contingency event. This section assesses how AEMO managed power system security over the course of this incident<sup>7</sup>.

In response to the outages, AEMO invoked constraint sets T-CSGO<sup>8</sup> and F-T-CSGO<sup>9</sup> at 1335 hours, and T-LIWY<sup>10</sup>, T-CAWY<sup>11</sup>, at 1340 hours on 9 February 2016.

A number of the constraint equations associated with the F-T-CSGO constraint set violated for up to two dispatch intervals as shown in Table 1. With only a single Gordon – Chapel Street transmission line in service all of the Gordon generation would be lost if the remaining transmission line should trip. As

<sup>6</sup> As per NER S5.1a 8

<sup>7</sup> 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.

<sup>8</sup> Manage voltage stability with one Gordon – Chapel Street line out of service.

<sup>9</sup> FCAS requirements with one Gordon – Chapel Street line out of service.

<sup>10</sup> Sets Wayatinah generation to zero due line outage

<sup>11</sup> Sets Catagunya generation to zero due line outage

such, additional frequency control ancillary service (FCAS) was required but was not immediately available. The power system in Tasmania was not in a secure operating state at this time due to the lack of some FCAS.

**Table 1 – Constraint violations**

Constraint equation	Violation degree (MW)	
	DI 1340	DI 1345
F_T+CSGO_TG_R5	29.68	0
F_T+CSGO_TG_R6_1	148.58	143.38
F_T+CSGO_TG_R6_2	192.59	165.52
F_T+CSGO_TG_R6_3	188.48	141.66
F_T+CSGO_TG_R6_4	154.35	82.34
F_T+RREG_0050	13.2	0

The Gordon – Chapel Street No.2 transmission line was returned to service at 1340 hours, 15 minutes after the outage, which returned the power system in Tasmania to a secure operating state. While the power system was not in a secure operating state, it was returned to a secure operating state within 30 minutes as required by the NER<sup>12</sup>.

## 5.1 Reclassification

On the return to service of the Liapootah – Wayatinah – Catagunya transmission lines AEMO was unable to obtain sufficient information to determine if the non-credible contingency event was no longer reasonably possible. In accordance with its procedures<sup>13</sup> AEMO reclassified that event as a credible contingency event at 1616 hours on 9 February 2016. No constraint sets were required to be invoked in relation to this reclassification.

On receipt of further information from Hydro Tasmania and TasNetworks, AEMO was satisfied the cause of the trips had been identified and that the trips were unlikely to reoccur. The reclassification was cancelled at 1102 hours on 17 February 2016.

## 6. MARKET INFORMATION

AEMO is required by the NER and its operating procedures to inform the market about incidents as they occur. This section assesses how AEMO informed the market<sup>14</sup> 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.<sup>15</sup>
  - AEMO issued Market Notice 51898 at 1423 hours on 9 February 2016, 58 minutes after the event. This MN also provided details of the constraint sets invoked and the return to service of the Gordon – Chapel Street transmission line.

<sup>12</sup> AEMO is required to return the power system to a secure state within thirty minutes following a contingency event - NER Clause 4.2.6 (b)

<sup>13</sup> SO\_OP 3715 – Power System Security Guidelines

<sup>14</sup> AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see AEMO website

<sup>15</sup> 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



2. Reclassification, details, and cancellation of a non-credible contingency event– notify as soon as practical.<sup>16</sup>
  - AEMO issued Market Notice 51899 at 1638 hours on 9 February 2016 to advise of the return to service of the Liapootah – Wayatinah – Catagunya transmission lines and reclassification of the event as a credible contingency.
  - AEMO issued Market Notice 51931 at 1102 hours on 17 February 2016 to advise cancellation of the reclassification.

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

## 7. CONCLUSIONS

AEMO has assessed this incident in accordance with clause 4.8.15(b) of the NER. In particular, AEMO has assessed the adequacy of the provision and response of facilities or services, and the appropriateness of actions taken to restore or maintain power system security.

AEMO concluded that:

1. The trip of the Gordon - Chapel Street No 2 220kV transmission line was a correct outcome probably caused by lightning.
2. The trip of the Liapootah – Wayatinah and Wayatinah – Catagunya 220kV transmission lines should not have occurred and was the result of a protection mal-operation.
3. The power system was not in a secure operating state immediately after the event but was restored to a secure operating state within 30 minutes.

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<sup>16</sup> AEMO is required to notify the market of a reclassification NER clause 4.2.3A(g), details of the reclassification 4.2.3A(c) and when AEMO cancels the reclassification 4.2.3A(h)



## APPENDIX A. – INCIDENT EVENT LOG

### Chronological Log of Incident

Time hh:mm	Events/Comments
09/02/16 13:25	Gordon – Chapel Street No.2 220kV line tripped
13:25	Liapootah – Wayatinah 220kV line tripped
13:25	Wayatinah – Catagunya 220kV line tripped
13:35	Constraint sets invoked <ul style="list-style-type: none"> <li>• F-T-CSGO</li> <li>• T-CSGO</li> </ul>
13:40	Constraint sets invoked <ul style="list-style-type: none"> <li>• T-CAWY</li> <li>• T-LIWY</li> </ul>
13:40	Gordon - Chapel St No.2 220 kV Line was returned to service
13:45	Constraint sets revoked <ul style="list-style-type: none"> <li>• F-T-CSGO</li> <li>• T-CSGO</li> </ul>
13:51	Unsuccessful reclose attempt on Liapootah – Wayatinah line
14:23	Non-Credible Contingency Event Market Notice 51898 issued
16:16	Liapootah - Wayatinah 220 kV Line and the Wayatinah - Catagunya 220 kV Line were returned to service.
16:35	Constraint sets revoked <ul style="list-style-type: none"> <li>• T-CAWY</li> <li>• T-LIWY</li> </ul>
16:38	Reclassification of a Non-Credible Contingency Event Market Notice 51899 issued.
17/02/16 11:02	Reclassification cancelled. Market Notice 51931 issued.



## APPENDIX B. – NETWORK OVERVIEW

The diagram below provides an overview of part of the Tasmania network immediately after the event.

