INADVERTENT LOSS OF LOAD IN TASMANIA ON 13 NOVEMBER 2017

REVIEWABLE OPERATING INCIDENT REPORT UNDER THE NATIONAL ELECTRICITY RULES

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	0952 hrs on Monday 13 November 2017
Region of incident	Tasmania
Affected regions	Tasmania
Event type	Procedural error/lack of procedures
Generation impact	Generation reduction of 85 MW
Customer load impact	319 MW of customer load lost
Associated reports	Nil

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.

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CONTENTS

1. OVERVIEW

This report relates to a reviewable operating incident[1] that occurred on 13 November 2017 in Tasmania. This incident involved the loss of 319 megawatts (MW) of customer load as a result of the inadvertent operation of the Generator Contingency Scheme (GCS)[2].

A generating unit reduced output by 85 MW in response to market targets as a result of this incident.

As this was 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[3].

AEMO has concluded that:

- The root cause of the incident was the unexpected interaction between the GCS and the Adaptive Under Frequency Load Shed Scheme (AUFLS)[4] during testing of the latter by TasNetworks. Modifications have been made to the GCS to prevent a reoccurrence.
- The GCS tripped more load than expected, due to a design error associated with the feedback signal to the GCS provided from the load.
- AEMO did not correctly identify this as a non-credible contingency and consequently did not consider reclassification and did not advise the market of this incident.
- The power system remained in a secure operating state during this incident.

This report is prepared in accordance with clause 4.8.15(c) of the National Electricity Rules (NER). It is based on information provided by TasNetworks[5] and from AEMO Energy Management Systems.

National Electricity Market (NEM) time (Australian Eastern Standard Time) is used in this report.

2. THE INCIDENT

At 0952 hrs on 13 November 2017, three blocks of industrial customer load, totalling 319 MW, were shed during planned testing of the AUFLS. The AUFLS was disabled at the time and there was no low frequency event leading up to the incident.

AEMO gave permission to commence load restoration at 0956 hrs, and all load was restored by 1041 hrs on 13 November 2017.

Although no generation tripped as a result of this incident, the Tamar Valley Power Station (TVPS) received market targets to reduce output by 85 MW as a result of the GCS becoming unavailable.

In accordance with AEMO's Power System Security Guidelines[6], AEMO has determined this incident was a non-credible contingency and as such a reviewable operating incident. In accordance with clause 4.8.15 of the NER, AEMO is required to review and report on any reviewable operating incident.

[1] See NER clause 4.8.15, and the AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.
[2] Refer to Appendix 1 for a description of the GCS.
[3] See NER clause 4.8.15(b).
[4] Refer to Appendix 1 for a description of the AUFLS.
[5] TasNetworks is the transmission network service provider (TNSP) in the Tasmania region.
[6] Refer to section 10.2 of SO_OP 3715 – see AEMO website: http://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3715---Power-System-Security-Guidelines.pdf.

3. TASNETWORKS INVESTIGATION

The following is based on information provided by TasNetworks as transmission network service provider (TNSP) of the area in question.

TasNetworks is in the process of implementing a new AUFLS scheme, with a view to placing the scheme into service at the request of Hydro Tasmania.

On 13 November 2017, TasNetworks was making preparations to conduct timing tests on the scheme. The AUFLS was not in service and the load trip links at the remote site(s) were removed. Although the AUFLS and the GCS both use the same Loss of Generation (LoG) signal from the TVPS, the testing was not expected to influence this input signal. The testing did not involve the actual tripping of any loads via either the AUFLS or GCS.

When the input links to the AUFLS were closed at 0952 hrs on 13 November 2017, three blocks of industrial load were shed. This was not an expected outcome.

Investigations revealed that while the AUFLS scheme had not operated, the testing process on the AUFLS resulted in the LoG input to the AUFLS going high, which then fed back into the GCS.

The GCS was in service and armed with a single 117 MW block of industrial load available for tripping due to the high level of generation at TVPS. The AUFLS and GCS do not use the same load blocks. As a result of the LoG signal fed from the AUFLS, the GCS operated to trip the armed load block.

TasNetworks stopped all testing on the AUFLS immediately they became aware of the unexpected load tripping.

While all normal procedures had been followed during the planning phase for this work, the potential for interaction between the two schemes was not known or documented and was therefore an unexpected outcome. Subsequent to this event TasNetworks has implemented modifications to the GCS to ensure a similar incident does not occur in the future.

The design of the feedback signal from the load block to the GCS resulted in the GCS cycling and tripping all load blocks available to the scheme, instead of just the single load block that was armed. A total of 319 MW of load was tripped. As no load blocks were then available to the GCS, the GCS became unavailable, resulting in a reduction in generation from the TVPS. See Section 4 for details.

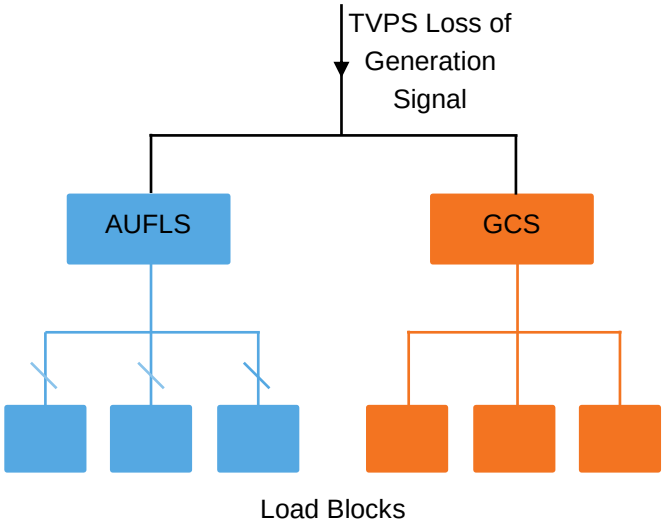
This issue with the GCS incorrectly tripping multiple load blocks had not been identified previously, because:

- A recent change was made to the GCS logic at the load site to ensure the GCS would arm the largest available load block first.
- The GCS had not been required to operate since this change was made.
- The false LoG signal generated during this incident was a permanent activation, as opposed to the transitory signal that would normally be received for a genuine activation.

Although the modifications made to the GCS by TasNetworks are intended prevent any further unintentional tripping of multiple load blocks, TasNetworks are also working with the load site to determine if changes at the load site are also required.

Figure 1 shows a simplified overview of the AUFLS and GCS

Figure 1 AUFLS/GCS overview



4. REDUCTION IN OUTPUT FROM TVPS

Prior to this incident, TVPS was generating 207 MW. As a result of GCS becoming unavailable (that is, there were no load blocks available to be armed), TVPS received market targets to reduce output to 122 MW, a reduction of 85 MW. This is an expected outcome when the GCS is unavailable.

5. 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 to the extent practicable, and take all reasonable actions to return the power system to a secure state following a contingency event, in accordance with the NER[7].

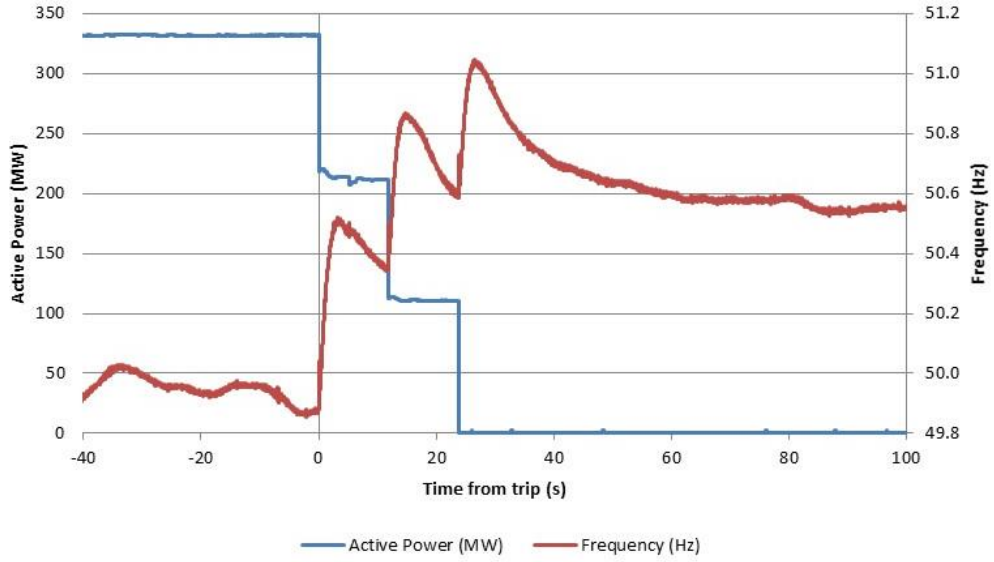
This section assesses how AEMO managed power system security over the course of this incident.

5.1 Frequency

As a result of the load tripping, the frequency in Tasmania increased to approximately 51.05 Hz after the trip of the third load block. Figure 2 shows the load tripping in three stages, and the resulting increase in Tasmania frequency.

[7] Refer to AEMO's functions in section 49 of the National Electricity Law and the power system security principles in clause 4.2.6 of the NER.

Figure 2 Load and frequency traces



Source: TasNetworks

5.2 Frequency standard

The frequency standard for Tasmania requires that, for a load event, the frequency should not exceed 52 Hz and should return to the normal frequency band of 49.85-50.15 Hz within 10 minutes. For this event, the maximum frequency reached was 51.05 Hz and the frequency returned to below 50.15 Hz within seven minutes. The frequency standard was met for this incident.

5.3 Frequency control ancillary services

As the frequency did not exceed the upper limit of 52 Hz, AEMO has not reviewed the delivery of the fast lower frequency control ancillary service (FCAS). AEMO has reviewed the delivery of the slow and delayed frequency control ancillary services that were enabled in Tasmania at the time of this incident. The results are shown in Table 1.

Table 1 FCAS response

Service	L60	L5
Enabled FCAS (MW)	130.9	120.7
FCAS delivery (MW)	171.3	0

The non-delivery of the L5 service is because the delivery of this service was based on a switching controller which was set to operate only if the frequency exceeds 51.0625 Hz. As the frequency did not reach this value, this service operated correctly.

Although not a provider of FCAS, Basslink is required to respond to frequency events. At the time of this incident, Basslink was importing into Tasmania. The response of Basslink to this frequency event was as expected.

The power system was in a secure operating state prior to and after this incident. AEMO was not required to take any action to restore or maintain power system security as a result of this incident.

5.4 Reclassification

Immediately after this incident AEMO did not consider the loss of the multiple loads as a non-credible contingency and consequently did not consider reclassification. AEMO's Power System Security

Guidelines[8] state that the trip of more than one block of load is a non-credible contingency event. While AEMO should have considered reclassification after this incident it would not have been necessary to reclassify the loss of multiple loads as a single credible contingency in this instance as TasNetworks had advised the load trips were associated with the testing work and that all testing had been stopped and therefore a reoccurrence was unlikely.

6. MARKET INFORMATION

This section assesses how AEMO informed the market[9] over the course of this incident.

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

- A non-credible contingency event – notify within two hours of the event[10].
  - At the time of this incident AEMO did not identify this incident as a non-credible contingency, (refer to Section 5.4) and therefore did not issue a market notice.

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 has concluded that:

- The root cause of the incident was the unexpected interaction between the GCS and the AUFLS during testing by TasNetworks. Modifications have been made to the GCS to prevent a reoccurrence.
- The GCS tripped more load than expected due to a design error associated with the feedback signal to the GCS provided from the load.
- AEMO did not correctly identify this as a non-credible contingency and consequently did not consider reclassification and did not advise the market of this incident.
- The power system remained in a secure operating state during this incident.

[8] Refer to SO_OP 3715 Power System Security Guidelines, section 10.2

[9] AEMO generally informs the market about operating incidents as they progress by issuing Market Notices – see AEMO website: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Market-notices-and-events.

[10] 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.

APPENDIX A. CONTROL SCHEME DESCRIPTIONS

A.1 Adaptive Under Frequency Load Shed Scheme

The AUFLS was implemented in January 2016, during the outage of Basslink. The scheme was implemented to reduce the amount of FCAS that was required to be enabled in Tasmania. The scheme was designed to disconnect customer load from TasNetworks' network under a contractual arrangement if a generation contingency resulted in frequency in Tasmania falling below a set value.

The AUFLS was disabled when Basslink returned to service in June 2016.

TasNetworks is currently modifying the AUFLS with a view to making the scheme available again.

A.2 Generator Contingency Scheme

The combination of the closed cycle gas turbine and associated steam turbine at TVPS represents a potential single contingency of approximately 200 MW. Normally, sufficient contingency FCAS would need to be dispatched to cover this contingency. The GCS was implemented to ensure the maximum contingency required to be covered by FCAS in Tasmania remains less than a maximum contingency size as determined by TasNetworks, with a maximum of 144 MW. This then reduces the amount of contingency FCAS required to be dispatched.

The GCS has been designed to disconnect customer load from TasNetworks' network under a contractual arrangement if a trip of the CCGT occurs when its output is above the specified maximum contingency size.

Operation of the scheme relies on a loss of generation signal being sent from the TVPS.

If the GCS is not available, the output of the TVPS is limited to the maximum contingency size, as previously set by TasNetworks.