

NEM EVENT – DIRECTION TO BASSLINK - 11 APRIL 2013

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1 Summary

At 1040 hrs on 11 April 2013, AEMO issued a direction to Basslink Pty Ltd to turn off the Basslink frequency controller in order to maintain power system security in the NEM. The direction was cancelled at 1638 hrs that day.

On 9 May 2013, AEMO advised the direction was for 'Other Service' and that no compensation is payable.

The purpose of this report¹ is to:

- describe the underlying issue, how it was identified and why a direction was required;
- estimate the market impact of the direction;
- assess AEMO's compliance with the market notification and intervention processes²; and
- identify potential improvements to the above processes, or the market design in general.

2 Background

The Basslink frequency controller comprises two frequency controller functions at the Victorian (Loy Yang) and Tasmanian (George Town) converter stations, with the controller at the sending end normally active (on) and the other end inactive (off). The frequency controller can rapidly control direct current (DC) power to prevent excessive frequency swings during generation or load loss. The frequency controller monitors the difference in frequency at each end of the DC link and, after exceeding a dead band of +/-0.01 Hz, modifies the Basslink power flow target to help reduce that frequency difference.

Basslink is not a provider of frequency control ancillary service (FCAS), but facilitates its transfer between Tasmania and the mainland using the frequency controller. This is a service that Basslink voluntarily provides to the market, and which typically remains available when Basslink is in service.

AEMO monitors the status of the frequency controllers at each end to determine whether to automatically invoke local FCAS requirement constraint equations for Tasmania and the mainland.

Basslink cannot transfer FCAS during a 5-minute dispatch interval if:

- the relevant frequency controller is turned off;
- Basslink flow is within, or will transition through, the "no-go" zone of +/- 50 MW;
- Basslink flow is at a transfer limit, affecting only the relevant raise or lower services; or
- the relevant frequency controller does not receive frequency data for both Tasmania and Victoria

Under the final scenario, if Tasmania is exporting³ and the Victorian frequency signal is not available at the Tasmanian end, the frequency controller remains in service and assumes a

¹ AEMO is required to publish a report as soon as reasonably practical after issuing the direction for the purposes described in clause 3.13.6A (a) of the National Electricity Rules (NER).

² As defined under NER 4.8

³ Hence the active frequency controller is at the Tasmanian end

Victorian frequency of 50 Hz whilst controlling the Tasmanian frequency to 50 Hz⁴. Tasmanian FCAS requirements can still be met from mainland FCAS because the frequency controller will respond to Tasmanian frequency disturbances and change the Basslink flow. However, mainland FCAS requirements cannot be met from Tasmanian FCAS, as the frequency controller cannot see any variation in the Victorian frequency following a mainland disturbance. In this case, AEMO receives a status indicating the relevant frequency controller remains turned on, and a second status indicating it is now operating in “Tasmania-only” control mode, so that mainland FCAS requirements are automatically invoked.

Conversely, if Tasmania is importing⁵ and the Tasmanian frequency signal is not available at the Victorian end, the relevant frequency controller automatically turns off, preventing FCAS transfers over Basslink in either direction⁶, with Tasmanian and mainland FCAS requirements being locally met. In this case, AEMO receives statuses indicating the relevant frequency controller is turned off, so that both Tasmanian and mainland FCAS requirements are automatically invoked.

3 Event Details

At 0745 hrs on 11 April 2013, Basslink informed AEMO that the Basslink frequency controller was not operating correctly, and Basslink could not transfer FCAS but only follow energy targets. After further discussions Basslink agreed to turn off the Basslink frequency controller.

At 0752 hrs AEMO manually replaced the Basslink frequency controller status to OFF⁷ to ensure local Tasmanian and mainland FCAS requirements were automatically invoked for dispatch interval ending (DI) 0800 hrs onward. At 0757 hrs Basslink turned off the Basslink frequency controller and AEMO removed its manual status override at 0806 hrs.

Basslink did not follow energy target on a number of occasions when the frequency controller was turned off⁸, apparently to control George Town voltage. This behaviour and the apparent lack of response from enabled regulation FCAS, resulted in a number of frequency excursions in Tasmania and the mainland although frequency remained within the operating standard.

At 1000 hrs, Basslink turned on the Basslink frequency controller, automatically revoking the local FCAS requirements from DI 1010 hrs onward. A further period then followed where Basslink did not follow energy target, again to control George Town voltage.

Basslink advised AEMO that the root cause of the issue was the loss of Victorian frequency data to the frequency controller at the Tasmanian converter station⁹ due to an inter-site communications failure. In this situation the relevant frequency controller remained on but entered the “Tasmania-only” control mode¹⁰. This was the first time the Basslink frequency controller had operated in this mode since commissioning of Basslink in 2006.

⁴ This design assumes that changes in Basslink flow to control the Tasmanian frequency to 50 Hz will not materially impact the mainland frequency

⁵ Hence the active frequency controller is at the Victorian end

⁶ This design assumes that, absent the Tasmanian frequency reference, the frequency controller would cause significant frequency deviations in the inherently weaker Tasmanian power system

⁷ AEMO did not realise there was a delay in Basslink turning off the Basslink frequency controller, and assumed the telemetered ‘ON’ status was incorrect

⁸ For DI 0815, and DIs 0825 to 0845 hrs

⁹ This controller was active as Basslink was exporting from Tasmania

¹⁰ It appears the failure occurred at around 2055 hrs the previous day (10 April), with AEMO’s logs indicating the Basslink frequency controller entered the “Tasmania-only” control mode at that time

Based on this advice, AEMO determined that there was potentially insufficient FCAS enabled to meet the mainland FCAS requirements¹¹, resulting in an insecure operating state until the Basslink frequency controller was turned off and local FCAS requirements were automatically invoked.

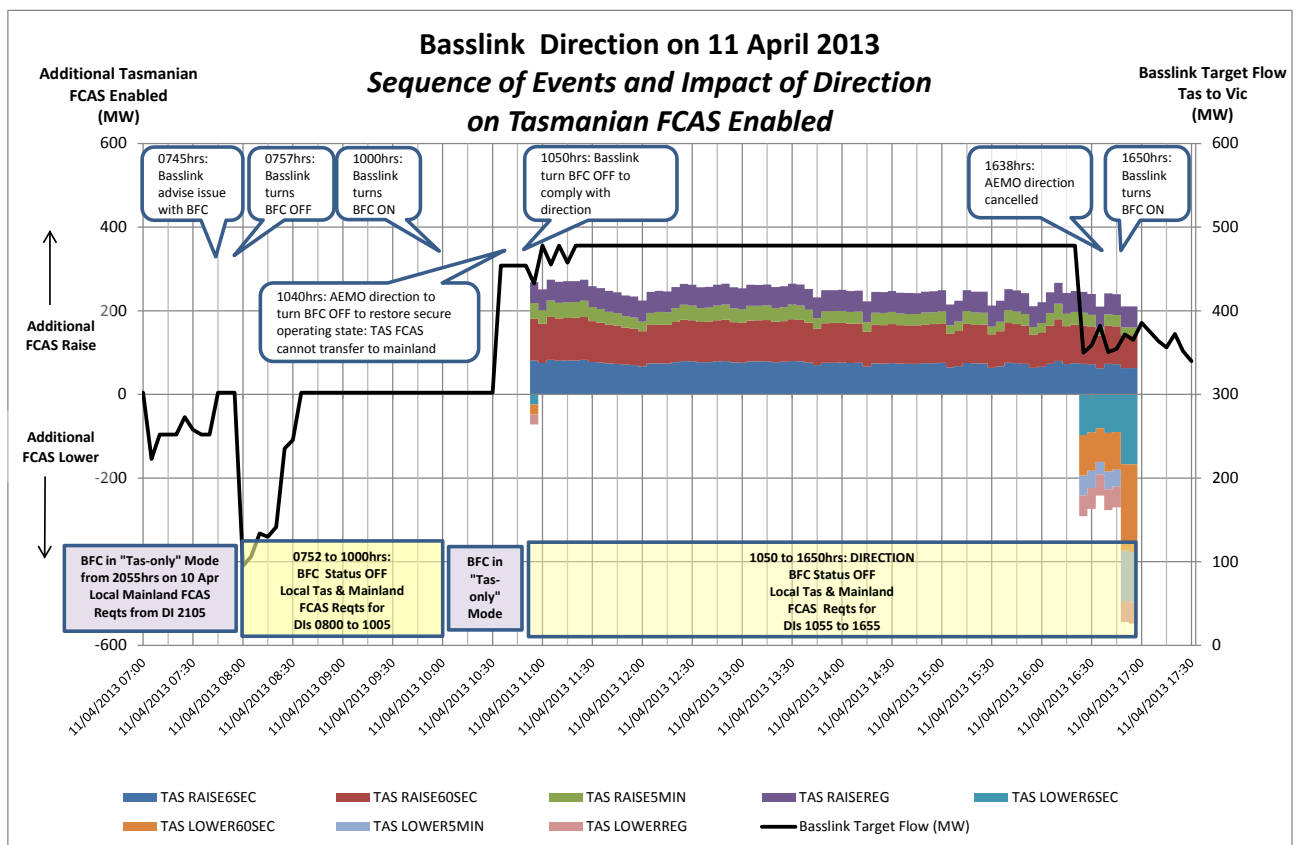
At 1040 hrs, AEMO issued a direction to Basslink to turn off the Basslink frequency controller in order to maintain power system security in the NEM¹² and issued Market Notice No. 42133 and Participant Notice No. 42134. Basslink turned off the Basslink frequency controller at 1050 hrs, resulting in local Tasmanian and mainland FCAS requirements for DI 1055 hrs onward.

At 1638 hrs, Basslink advised that the communications issue had been resolved and that Basslink was able to transfer FCAS in both directions. AEMO gave clearance to return the Basslink frequency controller, and cancelled the direction at 1638 hrs, issuing Market Notice No. 42138 and Participant Notice No. 42139.

Basslink turned on the Basslink frequency controller at 1650 hrs, automatically revoking the local FCAS requirements from DI 1700 hrs onward.

Figure 1 shows the sequence of events prior to, during and after the direction, including the period where local FCAS requirement constraints applied when the Basslink frequency controller was turned off and the impact of the direction on enabling additional Tasmanian FCAS.

Figure 1: Basslink direction – Sequence of Events and Impact of Direction



4 Review of Compliance with National Electricity Rules

Under NER clause 3.13.6A, AEMO must assess and report on its compliance with the processes for:

¹¹ Although no FCAS requirement constraint equations were violated over the period concerned, no enabled Tasmanian FCAS could be transferred over Basslink in response to a mainland contingency event
¹² As permitted under NER clause 4.8.2(a), and more broadly 4.8.9(a)

- calling for a market response in accordance with NER clauses 4.8.5A and 4.8.5B, to address the identified need prior to intervention
- intervening in the market through issuing a direction under NER clause 4.8.9, and
- determining whether to apply intervention pricing under NER clause 3.9.3(b)

Appendix 1 provides an extract of the above rules.

Circumstances giving rise to the need for the direction

This is covered in section 3 “Event Details”.

AEMO’s determination of the latest time for issuing the direction

AEMO did not seek to determine the latest time for issuing the direction, because there was an immediate need for action to address the insecure operating state and no viable alternatives were available.

AEMO’s determination that market response would not have avoided the direction

A market response would not have avoided the need for the direction, because AEMO determined that it did not have the appropriate FCAS requirement constraints available that, if invoked, would ensure that sufficient mainland FCAS was enabled to allow the Basslink frequency controller to continue operating in its “Tasmania-only” mode.

Changes to dispatch outcomes due to the direction

This is covered in section 5 “Market Impact”.

Processes implemented to issue the direction

During the direction, AEMO followed the relevant system operating procedure¹³ for the management of directions and interventions.

Reasons for not complying with processes under rule 4.8 prior to the direction

Reasons are provided above.

Determination of whether to apply intervention pricing under clause 3.9.3(b)

Intervention pricing was not applied, as the need to restore power system security could not be met by directing plant located at the regional reference node in accordance with NER clauses 3.9.3(b) and (d).

Effectiveness of responses to AEMO inquiries under clause 4.8.5A(d)

AEMO did not request information with respect to the latest time for intervention, because there was an immediate need for action to address the insecure operating state and no viable technical alternatives were available.

¹³ SO_OP 3707- Intervention, Direction and Clause 4.8.9 Instructions, located at: http://www.aemo.com.au/Electricity/Policies-and-Procedures/System-Operating-Procedures/Intervention-Direction-and-Clause-Instructions-SO_OP3707

Notice from Registered Participants of inability to comply with the direction

No information was received from Basslink under clause 4.8.9(d) that they would not be able to comply with the direction.

5 Market Impact

With the Basslink frequency controller turned off, Basslink is unable to transfer FCAS between Tasmania and the mainland, and FCAS requirements must be locally met to maintain power system security.

Prior to the direction, the Basslink frequency controller was in service in “Tasmania-only” control mode, and AEMO determined that the NEM was in an insecure operating state as there was potentially insufficient mainland FCAS enabled.

Subsequent investigations revealed this was not the case, with mainland FCAS requirements automatically invoked based on the Basslink frequency controller status information received by AEMO.

Hence the market impact of the direction was to enable more Tasmanian FCAS than was required between DI 1055 hrs and 1655 hrs, as shown in Figure 1 and summarised as follows:

- Over the whole period (73 DIs), an average increase in R6, R60, R5 and RReg FCAS of 74 MW, 93 MW, 30 MW and 50 MW, respectively
- For DI 1055 hrs, and from DI 1625 hrs to 1655 hrs (8 DIs), an average increase in L6, L60, L5 and LReg FCAS of 101 MW, 111 MW, 63 MW and 47 MW, respectively.

The additional Tasmanian lower FCAS was enabled by increasing energy dispatch of the marginal FCAS providers, causing Tasmanian export to be 26 MW higher on average than would otherwise have occurred absent the direction.

6 Compensation

On 9 May 2013, AEMO issued AEMO Communication No.1391 to advise Registered Participants that:

- the Basslink direction was a direction for ‘Other Service’ in accordance with NER clause 3.15.7A(a1), and
- no compensation is payable under NER clauses 3.15.7A or 3.15.7B

Although there is no methodology in place to determine a fair payment price for compensation under NER 3.15.7A, it is reasonable to conclude in this case that an independent expert would determine no compensation because:

- Basslink energy targets were not affected by the direction, and
- Basslink does not participate in FCAS and suffered no loss this way

7 Conclusions and Further Actions

AEMO has reviewed the Basslink direction on 11 April 2013 and the circumstances surrounding that direction.

As required by NER clause 3.13.6A, AEMO assessed its compliance with the processes for market notification and intervention, and is satisfied those requirements were met.

However, the event highlights some issues with the initial identification of the Basslink frequency controller failure, and with the lack of understanding of how the automated market systems were designed to address such a failure.

Based on the limited information available at the time, AEMO determined that a direction was required to maintain power system security.

In hindsight, however, better alerting of this type of failure and improved documentation of the procedures for addressing such failures might have avoided the need for the direction.

AEMO will undertake the following improvements to address those issues:

- AEMO will review alarms relating to changes in the operational status of Basslink frequency controller to improve its situational awareness
- AEMO will update its procedures to clarify the operation of the Basslink frequency controller where there is a failure of inter-site communications, how the automated market systems address such failures, and any required actions to be taken.

Abbreviations and Symbols

Abbreviation	Term
DC	direct current
DI	dispatch interval ending
FCAS	frequency control ancillary service
L6, L60, L5, LReg	Lower 6 second (fast), 60 second (slow), 5 minute (delayed), regulation FCAS
R6, R60, R5, RReg	Raise 6 second (fast), 60 second (slow), 5 minute (delayed), regulation FCAS

APPENDIX 1

National Electricity Rules

3.13.6A Report by AEMO

- (a) *AEMO* must, as soon as reasonably practical after issuing a *direction*, *publish* a report outlining:
- (1) the circumstances giving rise to the need for the *direction*;
 - (2) the basis on which it determined the latest time for that *direction* and on what basis that it determined that a *market* response would not have avoided the need for the *direction*;
 - (2) details of the changes in *dispatch* outcomes due to the *direction*;
 - (3) the processes implemented by *AEMO* to issue the *direction*;
 - (4) if applicable, the basis upon which *AEMO* did not follow any or all of the processes set out in rule 4.8 either in whole or in part prior to the issuance of the *direction*;
 - (5) if applicable, the basis upon which *AEMO* considered it impractical to set *spot prices* and *ancillary service prices* in accordance with clause 3.9.3(b);
 - (6) details of the adequacy and effectiveness of responses to inquiries made by *AEMO* under clause 4.8.5A(d); and
 - (7) information regarding any notification by a Registered Participant that it will not be able to comply with a *direction* under clause 4.8.9(d).
- (b) As soon as reasonably practical after *AEMO* has, in accordance with clause 3.15.10C, included the amount arising from a *direction* in a settlement statement provided under clause 3.15.15, *AEMO* must publish details of:
- (1) the compensation recovery amount arising from the *direction* as calculated under clause 3.15.8(a) for the period of the *direction*;
 - (2) details of the calculation of the regional benefit determined under clause 3.15.8(b1); and
 - (3) a breakdown of the compensation recovery amount by each category of Registered Participant, as determined by *AEMO*, in each region.

4.8.5A Determination of the latest time for AEMO intervention

- (a) *AEMO* must immediately *publish* a notice of any foreseeable circumstances that may require *AEMO* to implement a *AEMO intervention event*.
- (b) A notice referred to in paragraph (a) must include the forecast circumstances creating the need for the *AEMO intervention event*.
- (c) *AEMO* must, as soon as reasonably practicable after the *publication* of a notice in accordance with paragraph (a), estimate and *publish* the latest time at which it would need to intervene through a *AEMO intervention event* should the response from the *market* not be such as to obviate the need for the *AEMO intervention event*.
- (d) In order to estimate the time referred to in paragraph (c), *AEMO* may request information from a *Scheduled Network Service Provider*, *Scheduled Generator*, *Semi-Scheduled Generator* or *Market Customer* and may specify the time within which that information is to be provided.
- (e) The information that *AEMO* may request in accordance with paragraph (d) may include, but is not limited to:
 - (1) *plant* status;
 - (2) any expected or planned *plant outages* and the MW capacity affected by the *outage*, proposed start date and time and expected end date and time associated with the *outage* and an indication of the possibility of deferring the *outage*; and
 - (3) estimates of the relevant costs to be incurred by the *Scheduled Network Service Provider*, *Scheduled Generator* or *Market Customer* should it be the subject of a *direction*, but only if *AEMO* considers it reasonably likely that such *Scheduled Network Service Provider*, *Scheduled Generator* or *Market Customer* will be subject to a *direction*.
- (f) A *Scheduled Network Service Provider*, *Scheduled Generator* or *Semi-Scheduled Generator* or *Market Customer* must use reasonable endeavours:
 - (1) to comply with a request for information under paragraph (d); and
 - (2) to provide *AEMO* with the information required in the time specified by *AEMO*.
- (g) *AEMO* must regularly review its estimate of the latest time at which it would need to intervene through a *AEMO intervention event*, and *publish* any revisions to the estimate.
- (h) *AEMO* must treat any information provided in response to a request under paragraph (d) as *confidential information* and use it for the sole purpose of assessing to which *Scheduled Network Service Provider*, *Market Customer* or *Scheduled Generator* it should issue *directions*.

4.8.5B Notifications of last time of AEMO intervention

If the latest practicable time for a *AEMO intervention event*, as estimated by *AEMO* under clause 4.8.5A, is reached and, taking into account *relevant AEMO intervention events*, the circumstances described under clause 4.8.5A(a) have not been alleviated, *AEMO* must to the extent reasonably practicable immediately:

- (1) *publish* a notice that *AEMO*:

- (i) considers the time for the negotiation of further reserve contracts in accordance with rule 3.20 has elapsed; and
 - (ii) intends to implement a *AEMO intervention event*; and
- (2) amend the *pre-dispatch schedule* to ensure that it is a physically realisable schedule for all periods in which *AEMO* intends to implement a *AEMO intervention event*.