

FREQUENCY AND TIME ERROR MONITORING – 4TH QUARTER 2013

PREPARED BY: AEMO Systems Capability

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2 Introduction

AEMO must use reasonable endeavours to maintain the power system frequency and time error within the limits specified in the Frequency Operating Standards determined for the Mainland and the Tasmania Region by the Reliability Panel. This document reports on the frequency and time error performance observed during October 2013, November 2013 and December 2013 in all regions of the NEM. Queensland, New South Wales, Victoria and South Australia are referred to as the Mainland regions throughout the report.

The Frequency Operating Standards for the Mainland regions and the Tasmania region are available on the AEMC web site¹.

The “Power System Frequency and Time Deviation Monitoring Report – Reference Guide²” outlines the calculation processes used by AEMO in the preparation of the monthly Power System Frequency and Time Deviation Monitoring reports.

The analysis of the delivery of Slow Raise service, Slow Lower service, Delayed Raise service and Delayed Lower service presented in this report are based on 4-second sampled data. Unless otherwise noted, frequency data for Mainland regions is sourced from 4-second measurements in New South Wales and frequency data for Tasmania region is sourced from 4-second measurements in Tasmania. The analysis of Fast Raise service and Fast Lower service delivered is based on high-speed (50 millisecond sampling or less) data from Market Participants and is only presented in this report for events where the appropriate data is available.

3 Operation within the Normal Operating Frequency Band

The Mainland frequency was within the Normal Operating Frequency Band (49.85 Hz – 50.15 Hz) more than 99% of the time, as required by the Frequency Operating Standards.

The Tasmanian frequency was within the Normal Operating Frequency Band more than 99% of the time, as required by the Frequency Operating Standards.

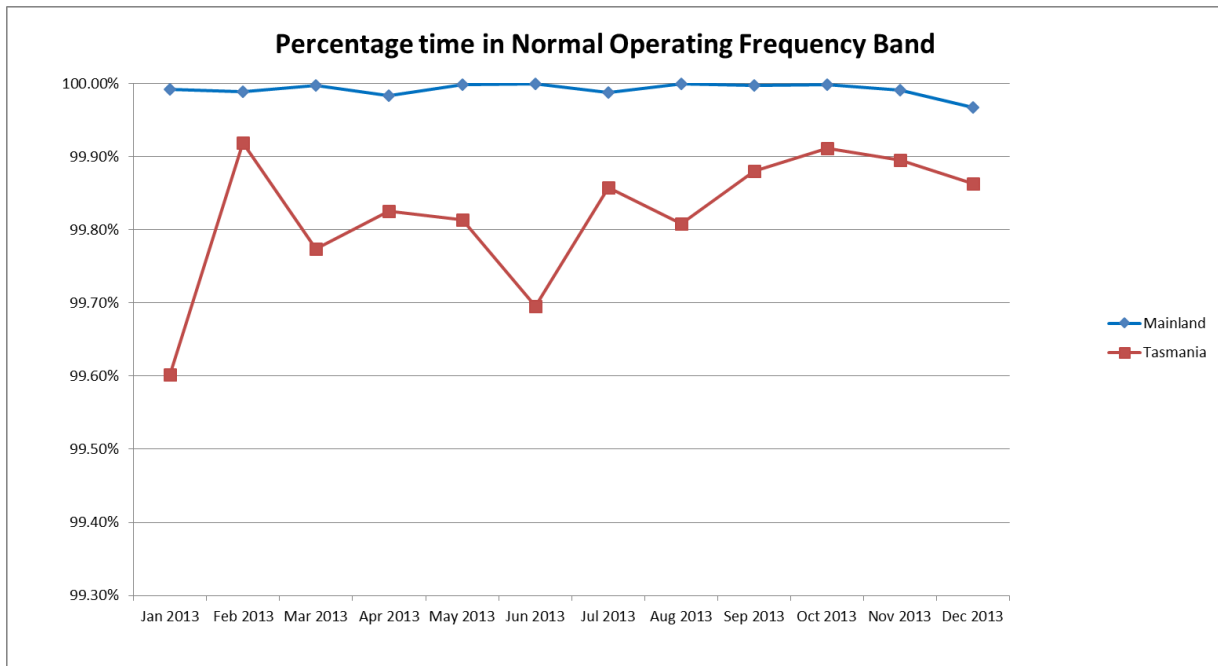
One Mainland frequency event within the Normal Operating Frequency Excursion Band (49.75 Hz – 50.25 Hz) did not return to the Normal Operating Frequency Band within the times prescribed in the Frequency Operating Standards. This event is discussed in Section 6.

The percentage time of operation in the Normal Operating Frequency Band over the last 12 months is shown in Figure 1.

¹ The Frequency Operating Standards for the Mainland and Tasmania regions are available from <http://www.aemc.gov.au/Panels-and-Committees/Reliability-Panel/Guidelines-and-standards.html>

² The Power System Frequency and Time Deviation Monitoring Report – Reference Guide is available from <http://aemo.com.au/Electricity/Resources/Reports-and-Documents/Frequency-and-Time-Error-Monitoring>

Figure 1: Percentage time in Normal Operating Frequency Band, last 12 months



4 Operation outside the Normal Operating Frequency Excursion Band

Table 1 summarises events in the Mainland and Tasmanian regions with frequency excursions outside the Normal Operating Frequency Excursion Band.

All Mainland events in Table 1 returned to the Normal Operating Frequency Band within the times in the Mainland Frequency Operating Standard.

Two Tasmania events in Table 1 did not return to the Normal Operating Frequency Band within the times in the Frequency Operating Standards. These events are discussed in Section 6.

5 Events outside Normal Operating Frequency Excursion Band

Table 1: Events in the Mainland and Tasmanian regions with frequency excursions outside the Normal Operating Frequency Excursion Band.

EVENT	LOW/HIGH FREQUENCY EVENT	NUMBER OF EVENTS	
		MAINLAND	TASMANIA
No contingency or load event/Normal event	LOW	0	0
	HIGH	0	1
Load Event	LOW	0	30
	HIGH	0	62
Generation Event	LOW	1	4
	HIGH	0	0
Network Event	LOW	0	0
	HIGH	0	1
Separation Event	LOW	0	0
	HIGH	0	0
Multiple Contingency Event	LOW	1	1
	HIGH	0	0

6 Events that did not meet the Frequency Operating Standards

In this section, details are provided of those events identified as not meeting the Frequency Operating Standard applicable to each event.

6.1 Events in Mainland regions

There was one low frequency event recorded in the Mainland region that did not meet the Mainland Frequency Operating Standard. This event is listed in Table 2.

Table 2: Frequency events in the Tasmania region during which frequency exceeded the Tasmania Frequency Operating Standard.

DATE	EVENT	MIN/MAX FREQUENCY (HZ)	TIME OUTSIDE NORMAL OPERATING FREQUENCY BAND (49.85 HZ - 50.15 HZ)(SECONDS)
1805 hrs 22/12/2013	Generation Event	49.78	476

6.1.1 Low frequency event: 1805 hrs 22/12/2013.

At 1805 hrs 22/12/2013, the generating unit Vales Point 6 tripped from 553 MW. The Mainland frequency reached a minimum of 49.78 Hz during the event, remaining outside the Normal Operating Frequency Band for 478 seconds³. This event is shown in Figure 2.

Basslink increased power export from Tasmania by approximately 50 MW during the event. The stabilisation and recovery of the Mainland frequency was impeded by the under-delivery of Slow Raise and Delayed Raise services, refer to Figure 3.

AEMO will seek high speed data from these generating units enabled for the Slow Raise and Delayed Raise services, and will prepare a report on the under-delivery of these services. This will be completed by the end of March 2014.

³ The Frequency Operating Standards require that the Mainland frequency recovers in 300 seconds for a Generation Event.

Figure 2: Mainland event, 1805 hrs 22/12/2013

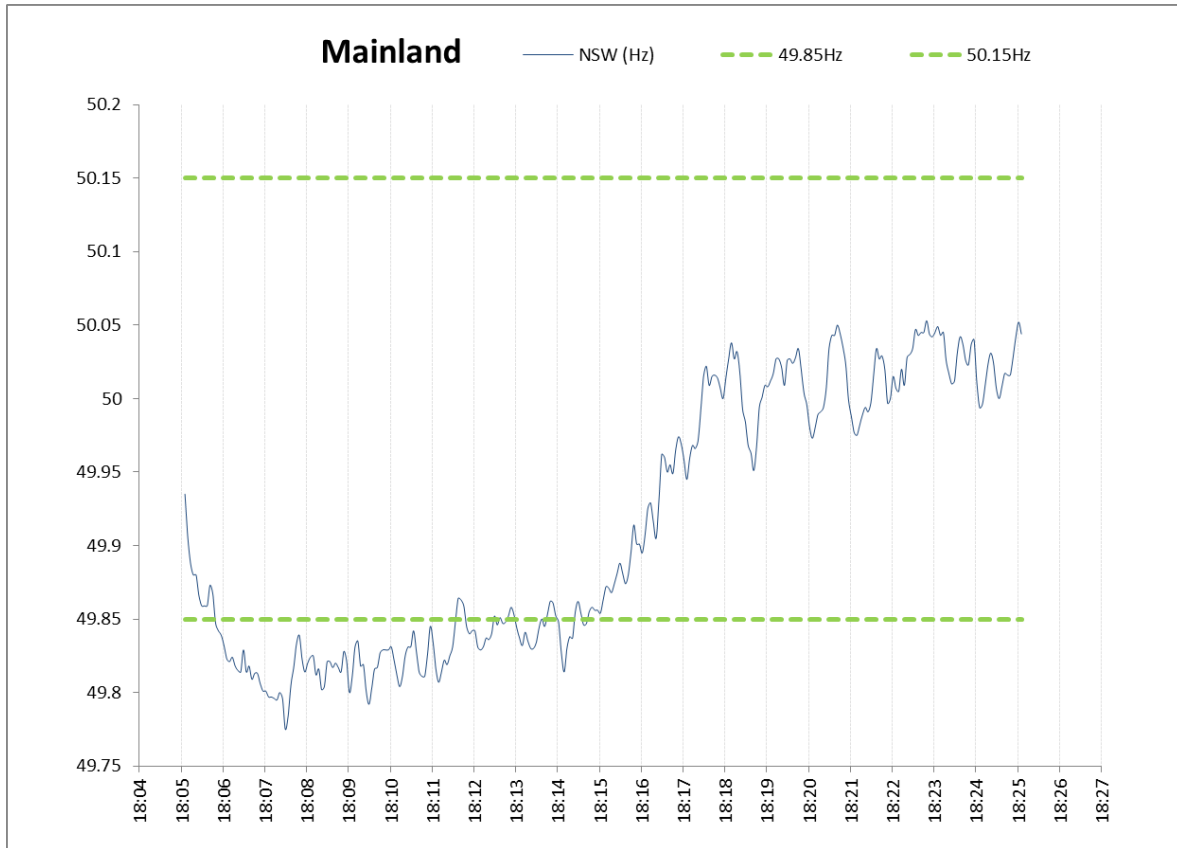
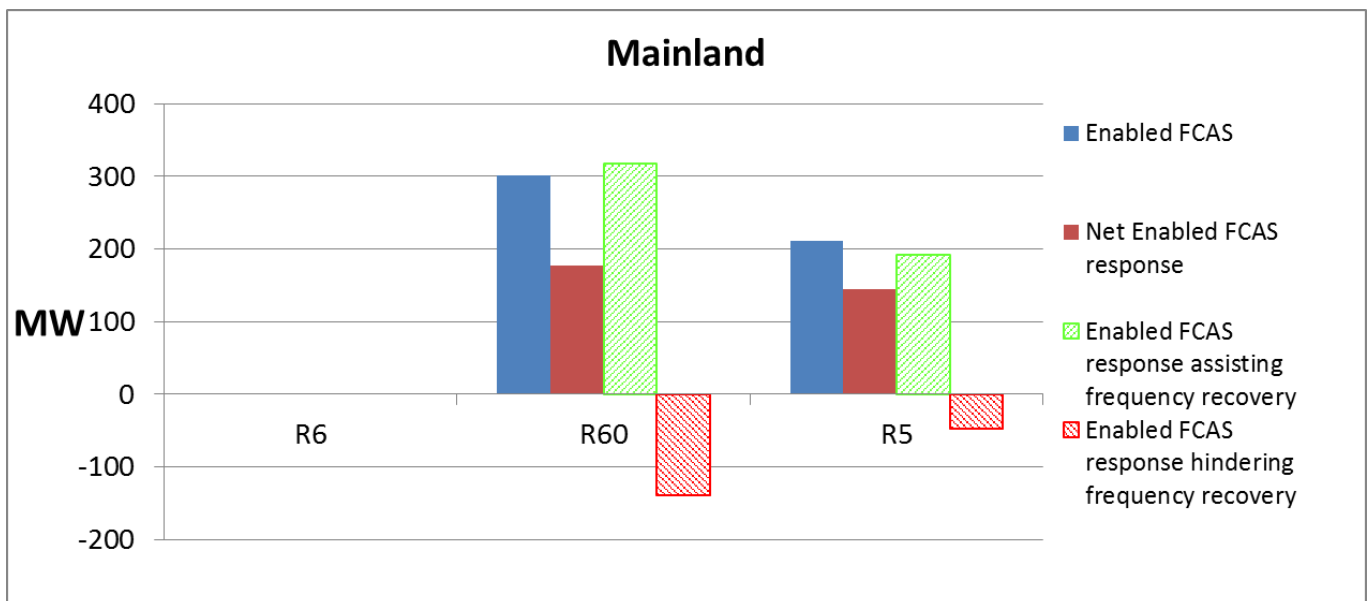


Figure 3: FCAS response during Mainland frequency event at 1805 hrs 22 December 2013.



6.2 Events in the Tasmania region

There were two frequency events recorded in the Tasmania region that did not meet the Tasmania Frequency Operating Standard. These events are listed in Table 3.

Table 3: Frequency events in the Tasmania region where the Frequency Operating Standards were not met.

DATE	EVENT	MIN/MAX FREQUENCY (HZ)	TIME OUTSIDE NORMAL OPERATING FREQUENCY BAND (49.85 HZ - 50.15 HZ)(SECONDS)
1441 hrs 5/12/2013	No contingency causing the event could be identified.	50.26	12
2015 hrs 19/12/2013	Network Event	50.38	944

6.2.1 High frequency event: 1441 hrs 5/12/2013

No contingency could be identified as the cause of the event in Tasmania at 1441 hrs 5/12/2013. Musselroe Wind Farm had increased output approximately 30 MW over its dispatch target, which contributed to the high frequency excursion. The Tasmania frequency reached a maximum of 50.26 Hz during the event, remaining outside the Normal Operating Frequency Band for 12 seconds. This event is shown in Figure 4.

Basslink was importing power to Tasmania at its minimum limit during the event, and was therefore unable to reduce power any further to assist in controlling the Tasmania frequency.

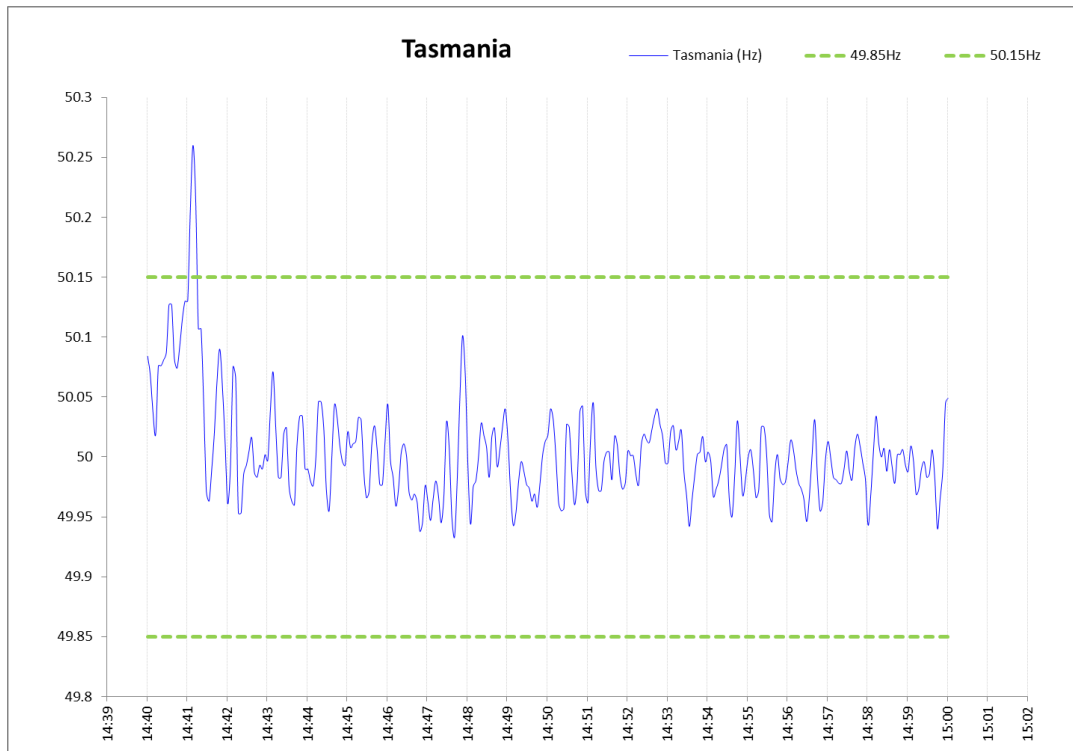
Lower Regulation services are expected to respond to such generating unit non-conformances such that:

- a. The frequency remains within the Normal Operating Frequency Excursion Band, and
- b. The frequency returns to the Normal Operating Frequency Band within 300 seconds.

A review of the performance of Lower Regulation services enabled in Tasmania during this event shows that one service had deviated from its Automatic Generation Control (AGC) target by 10-15 MW. Had the Lower Regulation service closely followed its AGC target, the frequency would likely have remained in the Normal Operating Frequency Excursion Band.

The frequency excursion was not of sufficient duration to evaluate the performance of Fast Lower, Slow Lower or Delayed Lower services.

Figure 4: High frequency event that occurred in Tasmania 1441 hrs 5/12/2013



6.2.2 High frequency event: 2016 hrs 19/12/2013

At 2016 hrs 19 December 2013 Basslink reduced export to the Mainland from 570 MW to 480 MW. The reduction was caused by the triggering of temperature protection for an internal Basslink transformer, which automatically limited Basslink current flow. The frequency excursion lasted 944 seconds⁴, reaching a maximum of 50.38 Hz. This event is shown in Figure 5.

The response of Fast Lower services were not verified as high speed data was not requested for this event.

The response of Slow Lower services is shown in Figure 6. The Slow Lower service response appears to have been insubstantial relative to the amount of Slow Lower services enabled.

The frequency excursion during this event was not of sufficient magnitude to trigger switched controllers for the delivery of Delayed Lower services during this event.

⁴ The Frequency Operating Standards require that the Tasmania frequency recovers in 600 seconds for a Network Event.

Figure 5: High frequency event that occurred in Tasmania 2016 hrs 19/12/2013

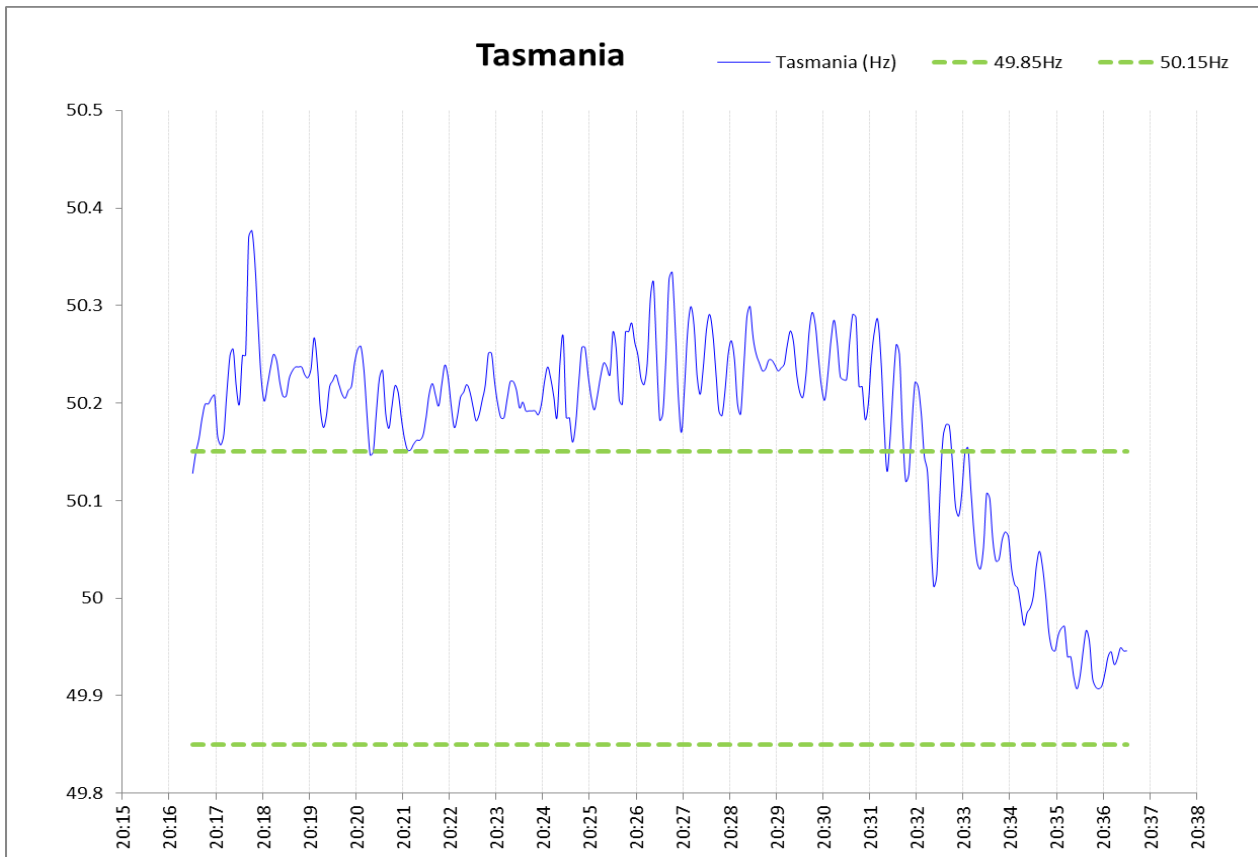
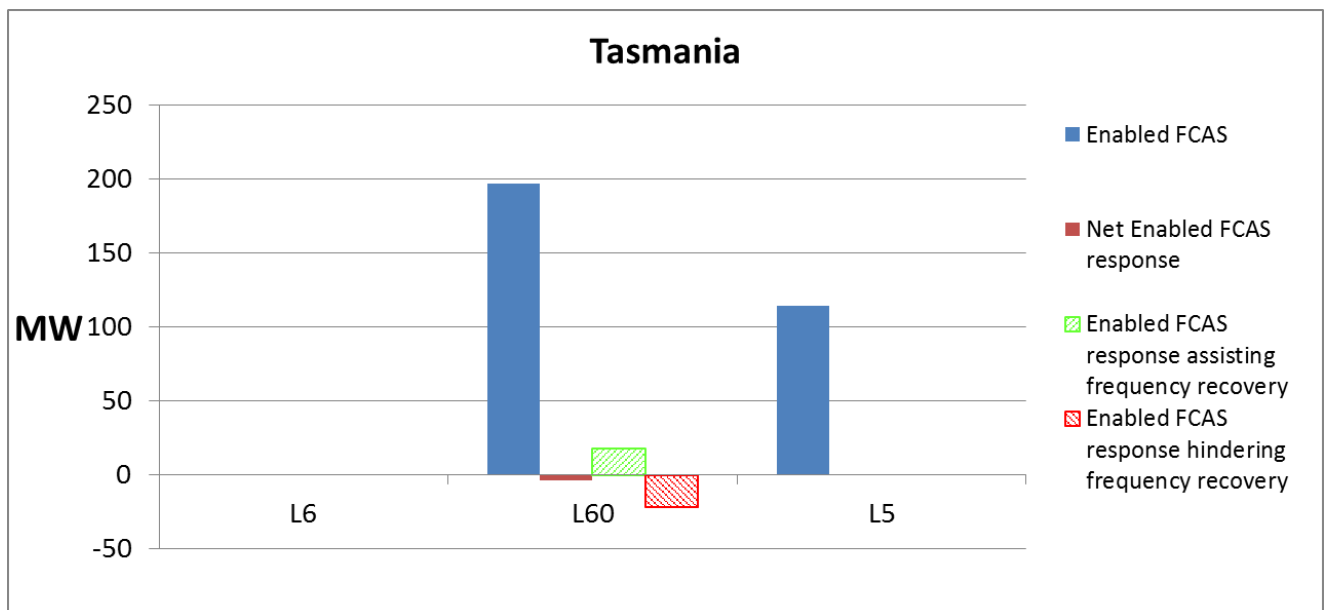


Figure 6: FCAS response during high frequency event that occurred in Tasmania 2016 hrs 19/12/2013



7 Accumulated time error

The Frequency Operating Standards require that the accumulated time error be maintained within the range ± 5 seconds in Mainland regions and ± 15 seconds in Tasmania. Constraints used to control Mainland accumulated time error, by varying the amount of Regulation FCAS enabled, are based upon measurements taken in Queensland and New South Wales. The ranges of accumulated time error recorded for measurements in Queensland, New South Wales and Tasmania are provided in Table 4.

Table 4: Maximum and minimum time error measurements, Queensland, New South Wales and Tasmania

VALUE	QLD	NSW	TAS
Highest positive time error (seconds)	2.95	2.98	6.11
Lowest negative time error (seconds)	-3.13	-2.78	-8.45