



Implementation of the National Electricity Amendment (Mandatory Primary Frequency Response) Rule 2020

Status as at 15 Dec 2020

A report for the National Electricity Market

Important notice

PURPOSE

AEMO publishes this report to inform industry about AEMO's implementation of the National Electricity Amendment (Mandatory Primary Frequency Response) Rule 2020 (Mandatory PFR Rule).

This publication has been prepared by AEMO using information available at 15 December 2020. This information will be updated and superseded by future implementation reports until full implementation.

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1. Summary

This report provides information on the implementation of the National Electricity Amendment (Mandatory Primary Frequency Response) Rule 2020¹ (Mandatory PFR Rule). It will be updated periodically as implementation proceeds, at intervals of approximately two to three weeks.

The Mandatory PFR Rule affects *Scheduled Generators* and *Semi-Scheduled Generators* (Affected Generators), who are initially required to undertake a self-assessment of the ability of their *generating systems* (Affected GS) to provide *primary frequency response* (PFR) in accordance with the *primary frequency response parameters* (PFRP) specified in the interim *Primary Frequency Response Requirements* (IPFRR).

Implementation of the Mandatory PFR Rule will be carried out in three tranches, as specified in the IPFRR.

The results of the self-assessments (Results) for Tranche 1² Affected Generators were due on 28 August 2020 and AEMO's determination of PFR Settings for Tranche 1 Affected GSs is substantially complete. Implementation of setting changes for those Affected GSs commenced from late September 2020 and has now been completed for around 71% of Tranche 1 installed capacity.

Results for Affected GSs in Tranche 2 were due by 19 November 2020. As at the date of this report, 96 Results have been received for Tranche 2, with initial assessments for a majority of these now completed. The Results for generation in Tranche 3 are due by 17 February 2021.

Table 1 shows the number of Results, applications for variation and exemption received as at the date of this report.

Table 1 Results and Applications received

Number of Affected GS	Results	Applications for Variation	Applications for Exemption
Tranche 1	76	17	8
Tranche 2	96	16	9
Tranche 3	36	1	2

2. Self-Assessments

AEMO has received Results in respect of 208 Affected GSs across all three Tranches. AEMO has now agreed PFR settings for 173 of those, covering around 45,500 MW of installed capacity. Table 4 contains a register of Affected GSs with their PFR Settings.

¹ Available at <https://www.aemc.gov.au/rule-changes/mandatory-primary-frequency-response>.

² Tranche 1 Affected GS are those with a *Registered Capacity* above 200 MW. Tranche 2 Affected GS are between 80 and 200 MW. Tranche 3 are below 80 MW. All Registered Capacities are the level of the individual DUID.

3. Applications for Variation

Table 2 details the number of applications for variation received in respect of Affected GSs, those granted and those still under consideration as at the date of this report.

Table 2 Variations

Number of Affected GS	Applications for Variation	Variations Granted	Variations not Granted	Variations being Assessed
Tranche 1	17	17		
Tranche 2	16	12		4
Tranche 3	1			1

4. Applications for Exemption

Table 3 details the number of applications for exemption received in respect of Affected GSs, those granted and those still under consideration as at the date of this report.

Table 3 Exemptions

Number of Affected GS	Applications for Exemption	Exemptions Granted	Exemptions not Granted	Exemptions being Assessed
Tranche 1	8		8	
Tranche 2	9			9
Tranche 3	2			2

5. Implementation of PFR Settings

5.1 Tranche 1 Implementation

Implementation of PFR Settings for approximately 71% of installed generation capacity in Tranche 1 has now been achieved. Information on actual and expected timing of setting changes is shown in Table 4.

AEMO is continuing to work to achieve implementation of PFR Settings across the largest possible proportion of Tranche 1 Affected GSs in a timely manner.

Some Affected Generators indicated a preference to make staged changes to frequency response deadbands, in which case, more than one implementation date has been listed in Table 4. Other Affected Generators elected to alter settings in one step, and in these cases, a single implementation date is listed.

In some cases, expected implementation dates have changed from those reported previously. This has occurred for several reasons, including:

- Affected GS forced outages
- Delays in Affected GS returning from planned outages.
- Delays in provision of key information or advice from OEMs.
- Affected Generator resourcing constraints.
- Problems encountered when altering settings.

In all cases, the earliest reasonably achievable date, subject to these constraints, has been determined, or re-determined (as applicable) after consultation with the relevant Affected Generator.

5.2 Implementation for Tranche 2 and 3

As outlined in the IPFRR, Tranche 2 Generators were required to complete their self-assessments by 19 November 2020. Tranche 3 Generators will be required complete their self-assessments by 17 February 2021.

Power system reliability and security concerns suggest that requiring control system setting changes across many Affected GSs in the middle of Summer 2020/21 might not be prudent as this is, typically, the most challenging period of the year for power system operations.

Noting these competing demands, it is currently proposed that implementation of setting changes would be targeted for completion by the following dates, where this can be reasonably achieved:

- Tranche 2 (DUIDs 80 MW – 200 MW) – By 30 March 2021
- Tranche 3 (DUIDs below 80 MW) – By 30 June 2021

Details on agreed dates for settings changes for Tranche 2 and Tranche 3 Generators are shown in Table 4.

5.3 Flexibility in Implementation Dates

Some flexibility in implementation dates exists, particularly if an Affected Generator wishes to complete implementation of setting changes earlier than previously agreed. Affected Generators currently undertaking commissioning activities may wish to undertake the necessary work while specialist staff remain available and onsite.

Provided they consult with AEMO beforehand, Affected Generators may commence making setting changes earlier, or in an incremental manner, to achieve their PFR Settings by the specified implementation date.

Power system conditions, such as major network outages, could also require alterations to implementation dates, though this has not been necessary to date.

5.4 Generation providing PFR prior to Mandatory PFR Rule

Previous surveys of generator active power controls, and more recent engagement with Affected Generators indicate that no large Affected GSs were providing PFR that fully met the PFRP prior to the Mandatory PFR Rule.

AEMO is aware of a small number of, typically, smaller or low capacity factor Affected GSs that are operating in a way that could meet the PFRP (at least partially). These are identified in Table 4 following confirmation from the Affected Generator.

5.5 Implementation for Semi-Scheduled Generation

The Mandatory PFR Rule represents a material change to the operation of generation in the NEM, particularly for semi-scheduled generation, many of which have not previously operated in frequency response mode.

Experience to date with PFR implementation indicates that a staged approach will be required to ensure an effective rollout of PFR from semi-scheduled generation across. This will require working with OEMs in the determination and validation of an effective PFR implementation strategy for their plant.

Changes to PFR control system software will be trialled and validated at a small number of Affected GSs from each OEM, before moving to wider-scale implementation. AEMO intends to work closely with the relevant OEMs and a selection of Affected Generators to do this in the most prudent manner.

With around 20 OEMs in the NEM this might take some time, and AEMO will be prioritising those OEMs with the greatest installed capacity.

While, in many cases, AEMO will be able to agree in-principle settings an Affected GS, it will be unable to confirm implementation dates with each Affected Generator prior to having confirmed an effective PFR implementation strategy with each relevant OEM.

Hence, where PFR Settings have been agreed for an Affected GS, but an effective PFR implementation has not yet been confirmed with the relevant OEM and tested with appropriate Affected GSs, there will be no implementation dates reported for relevant Affected GSs in Table 4, just a “#” symbol.

Work on confirmation of an effective implementation strategy has commenced with several OEMs. Initial testing has commenced and will continue into January 2021 across several Affected GSs.

6. Register of Affected GS

Table 4 details, for each Affected GS, the planned or actual dates for completion of implementation of the PFR Settings notified by AEMO in accordance with the IPFRR, and whether AEMO has granted an exemption or variation from the PFRP. Where a variation has been granted, the table also indicates which PFRP has been varied.

A single implementation date under the ‘Stage 1’ column indicates that full implementation of the PFR Settings is to be, or has been, achieved by that date. The ‘Stage 2’ column will only be populated where the deadband is to be, or has been, tightened in two stages.

Tranche 2 (in blue font) and Tranche 3 (in green font) generation is being added to this table as AEMO completes their assessments.

At the time of writing, Affected GSs with an installed capacity of approximately 26,300 MW have either partially or fully implemented PFR Settings, or were already providing PFR that meets the PFRP.

This represents approximately 47% of the approximately 56,400 MW of NEM installed capacity across all three Tranches that is expected to ultimately be captured by the Mandatory PFR Rule.

Table 4 Register of Affected GS

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2 ³			
Ararat WF	ARWF1	241	#				
Bald Hills WF	BALDHW1	106	#				
Barker Inlet PS	BARKIPS1	211	Pre-existing		Yes	Response time ⁴	
Bango 973 WF	BANGOWF1	159	#				
Bayswater PS	BW01	660	29 Sep 20	14 Oct 20			
Bayswater PS	BW02	660	16 Oct 20				
Bayswater PS	BW03	660	3 Nov 20				
Bayswater PS	BW04	660	29 Sep 20	14 Oct 20			
Berrybank WF	BRYB1WF1	180	#				
Beryl SF	BERYLSF1	98	#				
Blowering PS	BLOWERNG	80	30 Apr 21				
Boco Rock WF	BOCORWF1	113	#				
Bodangora WF	BODWF1	113	#				
Bogong / Mackay PS	MCKAY1	300	22 Oct 20				
Braemar PS	BRAEMAR1	168	4 Mar 21	25 Mar 21			
Braemar PS	BRAEMAR2	168	4 Mar 21	25 Mar 21			
Braemar PS	BRAEMAR3	168	4 Mar 21	25 Mar 21			
Braemar 2 PS	BRAEMAR5	173	30 Mar 21	1 Jun 21			
Braemar 2 PS	BRAEMAR6	173	30 Mar 21	1 Jun 21			
Braemar 2 PS	BRAEMAR7	173	30 Mar 21	1 Jun 21			
Broken Hill SF	BROKENH1	53	#				
Callide B PS	CALL_B_1	350	8 Nov 20	18 Nov 20			

³ This column will be populated only when deadband adjustments will be made in two stages.

⁴ AEMO has granted a variation in respect of response time, where 12 sec is required to achieve a 5% change in output. This information is included with the consent of the Affected Generator.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2 ³			
Callide B PS	CALL_B_2	350	30 Sep 20	28 Oct 20			
Callide C PS	CPP_3	420	9 Nov 20	26 Nov 20		Yes	Response time
Callide C PS	CPP_4	420	10 Dec 20			Yes	Response time
Clare SF	CLARES1	110	#				
Coleambally SF	COLEAS1	180	#			Yes	Deadband ⁵
Colongra PS	CG1	181	30 Jun 21				
Colongra PS	CG2	181	30 Jun 21				
Colongra PS	CG3	181	30 Jun 21				
Colongra PS	CG4	181	30 Jun 21				
Condamine PS	CPSA	144	1 Jun 21				
Coopers Gap WF	COOPGWF1	452	#				
Corowa SF	CRWAS1	36	#				
Crookwell 2 WF	CROOK2WF	96	#				
Crowlands WF	CROWLWF1	79	#				
Crudine Ridge WF	CRURWF1	138	#				
Darling Downs PS	DDPS1	644	15 Jun 20				
Darling Downs SF	DDSF1	121	#				
Darlington Point SF	DARLSF1	324	#				
Dartmouth PS	DARTM1	185	30 Mar 21				
Daydream SF	DAYDSF1	167	#				
Dundonnell 1 WF	DUNDWF1	168	#				
Dundonnell 2 WF	DUNDWF1	46	#				
Dundonnell 3 WF	DUNDWF1	121	#				
Eildon PS	EILDON1	60	30 Mar 21				
Eildon PS	EILDON2	60	30 Mar 21				
Elaine WF	ELAINWF1	83	#				
Eraring PS	ER01	720	27 Oct 20			Yes	Response time
Eraring PS	ER02	720	16 Oct 20			Yes	Response time

⁵ The Affected GS will be operated with a deadband of ± 0.020 Hz due to the 2-digit precision of the frequency measurement used. This information is included with the consent of the Affected Generator.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2 ³			
Eraring PS	ER03	720	13 Oct 20			Yes	Response time
Eraring PS	ER04	720	20 Oct 20			Yes	Response time
Gangarri SF	GANGARR1	162	#				
Gladstone PS	GSTONE1	280					
Gladstone PS	GSTONE2	280					
Gladstone PS	GSTONE3	280					
Gladstone PS	GSTONE4	280					
Gladstone PS	GSTONE5	280					
Gladstone PS	GSTONE6	280					
Glenrowan West SF	GLRWNSF1	132	#				
Gordon PS	GORDON	432	Unit 1 – Late Dec 20 Unit 2 – 28 Sep 20 Unit 3 – 29 Sep 20				
Granville Harbour WF	GRANWF1	111	#				
Gunning WF	GUNNING1	47	#				
Guthega PS	GUTHEGA	60	31 Mar 21				
Hallett PS	AGLHAL	217	27 Oct 20 ⁶				
Hallett WF	HALLWF1	95	#				
Haughton SF	HAUGHT11	132	#				
Hornsedale Power Reserve	HPRG1	150	30 March 21				
Hornsedale 1 WF	HDWF1	112	#				
Hornsedale 3 WF	HDWF3	102	#				
Jeeralang PS	JLA01	51	16 Dec 20				
Jeeralang PS	JLA02	51	16 Dec 20				
Jeeralang PS	JLA03	51	16 Dec 20				
Jeeralang PS	JLA04	51	16 Dec 20				
Jeeralang PS	JLB01	76	16 Dec 20				
Jeeralang PS	JLB02	76	16 Dec 20				
Jeeralang PS	JLB03	76	16 Dec 20				

⁶ Applicable to one generating unit, remainder previously complied with the PFRP.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2 ³			
Jemalong SF	JEMALNG1	50	#				
Karadoc SF	KARSF1	104	#				
Kiamal SF	KIAMSF1	239	#				
Kogan Creek PS	KPP_1	744	19 Nov 20	26 Nov 20			
Liddell PS	LD01	500	26 Nov 20				
Liddell PS	LD02	500	After RTS in late Dec 20				
Liddell PS	LD03	500	26 Nov 20				
Liddell PS	LD04	500	26 Nov 20				
Lilyvale SF	LILYSF1	118	#				
Limondale 1 SF	LIMOSF11	275	#				
Lincoln Gap WF	LGAPWF1	212	#				
Loy Yang A PS	LYA1	560	14 Oct 20				
Loy Yang A PS	LYA2	530	14 Oct 20	11 Nov 20			
Loy Yang A PS	LYA3	560	17 Nov 20				
Loy Yang A PS	LYA4	560	15 Oct 20				
Loy Yang B PS	LOYYB1	500	16 Dec 20	23 Dec 20			
Loy Yang B PS	LOYYB2	500	30 Sep 20	28 Oct 20			
Macarthur WF	MACARTH1	420	#				
Mannum Adelaide Pipe PV2	MAPS2PV1	13	#				
Mannum Adelaide Pipe PV3	MAPS3PV1	12	#				
Millmerran PS	MPP_1	426	1 Oct 20	28 Oct 20		Yes	Response time
Millmerran PS	MPP_2	426	12 Nov 20			Yes	Response time
Mintaro PS	MINTARO	90	27 Nov 20				
Moorabool WF	MOORAWF1	312	#			Yes	Deadband ⁷
Morgan Whyalla Pump PV1	MWPS1PV1	6	#				
Morgan Whyalla Pump PV2	MWPS2PV1	6	#				
Morgan Whyalla Pump PV3	MWPS3PV1	8	#				

⁷ AEMO has granted a variation to the deadband at ± 100 mHz based on the currently known capabilities of the Affected GS for a period of 9 months. This information is included with the consent of the Affected Generator.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2 ³			
Morgan Whyalla Pump PV4	MWPS4PV1	6	#				
Mortlake PS	MORTLK11	283	30 Sep 20				
Mortlake PS	MORTLK12	283	6 Nov 20				
Mount Emerald WF	MEWF1	180	#				
Mt Gellibrand WF	MTGELWF1	138	#				
Mt Piper PS	MP1	700	After RTS in late Dec 20.				
Mt Piper PS	MP2	700	29 Sep 20	28 Oct 20			
Murra Warra WF	MUWAWF1	231	#				
Murray PS	MURRAY	1500	31 March 21 ⁸				
Nevertire SF	NEVERSF1	132	#				
Newport PS	NPS	500	28 Sep 20	19 Oct 20			
North Brown Hill WF	NBHWF1	132	#				
Numurkah SF	NUMURSF1	112	#		Yes	Deadband ⁹	
Nyngan SF	NYNGAN1	100	#				
Oakey PS	OAKEY1	144	30 Mar 21		Yes	Deadband	
Oakey PS	OAKEY2	144	30 Mar 21		Yes	Deadband	
Osborne PS	OSB-AG	180	Pre-existing				
Pelican Point PS	PPCCGT	478	30 Sep 20				
Poatina PS	POAT220	200	Pre-existing		Yes	Deadband, Response Time ¹⁰	
Poatina PS	POAT110	100	Pre-existing		Yes	Deadband, Response Time ¹¹	
Rugby Run SF	RUGBYR1	83	#				
SA Temp. Gen. Sth	SATGS1	123	1 Mar 21				
Sapphire WF	SAPHWF1	270	#				

⁸ One generating unit (out of 14) will have PFR Settings implemented in Oct 2021.

⁹ The Affected GS will be operated with a deadband of ± 0.020 Hz due to the 2-digit precision of the frequency measurement used. This information is included with the consent of the Affected Generator.

¹⁰ The variation to the deadband at ± 150 mHz is for 6 months only. The variations were granted due to the inherent capability and design of the Affected GS. This information is included with the consent of the Affected Generator.

¹¹ The variation to the deadband at ± 150 mHz is for 6 months only. The variations were granted due to the inherent capability and design of the Affected GS. This information is included with the consent of the Affected Generator.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2 ³			
Shoalhaven PS	SHGEN	240	Bendeela Unit 1 – 31 October 2022	Bendeela Unit 2 - 31 August 2021			
			Kangaroo Valley Unit 3 -30 November 2023	Kangaroo Valley Unit 4 -31 August 2021			
Silverton WF	STWF1	198	#				
Smithfield Energy Facility	SITHE01	161	Pre-existing				
Snowtown WF	SNOWTWN1	99	#				
Snowtown WF Stage 2	SNOWNTH1	144	#				
Snowtown Sth WF	SNOWSTH1	126	#				
Somerton PS	AGLSOM	170	30 Apr 21				
Stanwell PS	STAN-1	365	27 Oct 20				
Stanwell PS	STAN-2	365	27 Oct 20				
Stanwell PS	STAN-3	365	27 Oct 20				
Stanwell PS	STAN-4	365	29 Oct 20				
Stockyard Hill WF	STOCKYD1	531	#		Yes	Deadband ¹²	
Swanbank E PS	SWAN_E	385	8 Dec 20		Yes	Response Time	
Tallawarra PS	TALWA1	440	Upon RTS from outage in late Mar 2021				
Taralga WF	TARALGA1	106	#				
Tarong North PS	TNPS1	443	21 Oct 20		Yes	Droop, Response Time ¹³	
Tarong PS	TARONG#1	350	27 Oct 20				
Tarong PS	TARONG#2	350	3 Nov 20				

¹² AEMO has granted a variation to the deadband at ± 100 mHz based on the currently known capabilities of the Affected GS for a period of 9 months. This information is included with the consent of the Affected Generator.

¹³ The droop characteristics applied to the unit do not meet the requirement for a droop of 5% or less. This variation is granted for a period of 12 months only. An ongoing variation on response time has been granted. This information is included with the consent of the Affected Generator.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2 ³			
Tarong PS	TARONG#3	350	27 Oct 20				
Tarong PS	TARONG#4	350	27 Oct 20				
Torrens Island A PS	TORRA1	120	Pre-existing			Yes	Droop ¹⁴
Torrens Island A PS	TORRA3	120	Pre-existing			Yes	Droop ¹⁵
Torrens Island B PS	TORRB1	200	30 Mar 21			Yes	Droop ¹⁶
Torrens Island B PS	TORRB2	200	30 Mar 21			Yes	Droop ¹⁷
Torrens Island B PS	TORRB3	200	30 Mar 21			Yes	Droop ¹⁸
Torrens Island B PS	TORRB4	200	30 Mar 21			Yes	Droop ¹⁹
Townsville PS	YABULU	160	31 March 21				
Tumut 3 PS	TUMUT3	1500	1 Dec 20				
Tumut 1 & 2 PS	UPPTUMUT	616	18 Dec 20				
Uranquinty PS	URANQ11	166	30 Mar 21	30 Jun 21			
Uranquinty PS	URANQ12	166	30 Mar 21	30 Jun 21			
Uranquinty PS	URANQ13	166	30 Mar 21	30 Jun 21			
Uranquinty PS	URANQ14	166	30 Mar 21	30 Jun 21			
Vales Point B PS	VP5	660	30 Sep 20			Yes	Deadband ²⁰
Vales Point B PS	VP6	660	30 Sep 20			Yes	Deadband ²¹
Valley Power	VPGS1	50	28 Feb 21				
Valley Power	VPGS2	50	28 Feb 21				
Valley Power	VPGS3	50	28 Feb 21				
Valley Power	VPGS4	50	28 Feb 21				
Valley Power	VPGS5	50	28 Feb 21				
Valley Power	VPGS6	50	28 Feb 21				
Wellington SF	WELLSF1	216	#				

¹⁴ Droop varies with loading level, and may exceed 5% at high output. This information is included with the consent of the Affected Generator.

¹⁵ Droop varies with loading level, and may exceed 5% at high output. This information is included with the consent of the Affected Generator.

¹⁶ Droop varies with loading level, and may exceed 5% at high output. This information is included with the consent of the Affected Generator.

¹⁷ Droop varies with loading level, and may exceed 5% at high output. This information is included with the consent of the Affected Generator.

¹⁸ Droop varies with loading level, and may exceed 5% at high output. This information is included with the consent of the Affected Generator.

¹⁹ Droop varies with loading level, and may exceed 5% at high output. This information is included with the consent of the Affected Generator.

²⁰ AEMO has granted a variation to the deadband at ± 100 mHz based on the unique condition of the Affected GS for a period of 12 months. This information is included with the consent of the Affected Generator.

²¹ AEMO has granted a variation to the deadband at ± 100 mHz based on the unique condition of the Affected GS for a period of 12 months. This information is included with the consent of the Affected Generator.

Affected GS Name	DUID	Reg Cap (MW)	PFR Settings changes to be (or have been) implemented for ongoing operation by		Exemption	Variation	PFRP Varied
			Stage 1	Stage 2 ³			
Wemen SF	WEMENSF1	97	#				
Willogoleche WF	WGWF1	119	#				
Wivenhoe PS	W/HOE#1	285	26 Oct 20			Yes	Response Time
Wivenhoe PS	W/HOE#2	285	26 Oct 20			Yes	Response Time
Yallourn W PS	YWPS1	360	28 Oct 20				
Yallourn W PS	YWPS2	360	29 Sep 20	28 Oct 20			
Yallourn W PS	YWPS3	380	29 Sep 20	28 Oct 20			
Yallourn W PS	YWPS4	380	29 Sep 20	28 Oct 20			
Yatpool SF	YATSF1	94	#				
Yendon WF	YENDWF1	144	#				

7. Impact on Frequency Performance

AEMO provides detailed reporting on power system frequency performance in its Frequency and Time Error Monitoring reports²² published quarterly. The most recent report was published on 11 November 2020.

This report focuses on a sub-set of the matters raised in the quarterly report and provides some information focusing on relatively recent frequency performance to help capture impacts on power system frequency that are (at least in part) associated with the implementation of the Mandatory PFR Rule.

0 shows the monthly frequency distribution for the last six months (01 Apr 2020 to 13 Dec 2020).

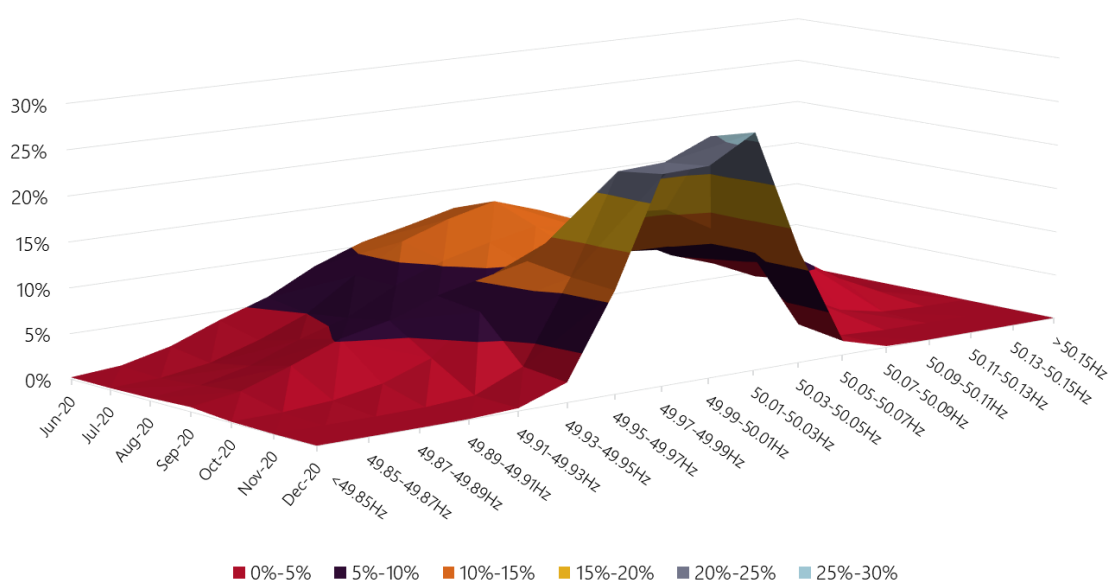
Figure 2 shows the day-by-day frequency distribution from early September 2020. It highlights the time Affected Generators began implementation of their PFR Settings at the end of September 2020.

These two figures show continued improvement in the closeness of the distribution of frequency around 50 Hz, particularly from the second half of October 2020, where many generators moved from interim to final PFR settings. This trend is expected to continue as additional Affected GSs implement PFR Settings during the following weeks and months.

Figure 3 shows a comparison of the daily frequency distribution, at monthly intervals from Jun 2020. It shows a relatively consistent distribution of frequency from June 2020 until immediately before implementation of PFR settings commenced in late September 2020.

Some improvement was seen following initial setting changes in late September, however from late October, when many generators moved from interim to final PFR settings, the improvement in the control of NEM frequency to near 50 Hz is significant. This change has remained relatively consistent throughout the month of November 2020 and into December 2020.

Figure 1 Monthly frequency distribution (six-month rolling, 01 Jun 2020 to 13 Dec 2020)



²² Available at <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/frequency-and-time-deviation-monitoring>.

Figure 2 Daily frequency distribution (data from 01 Sep 2020 to 13 Dec 2020)

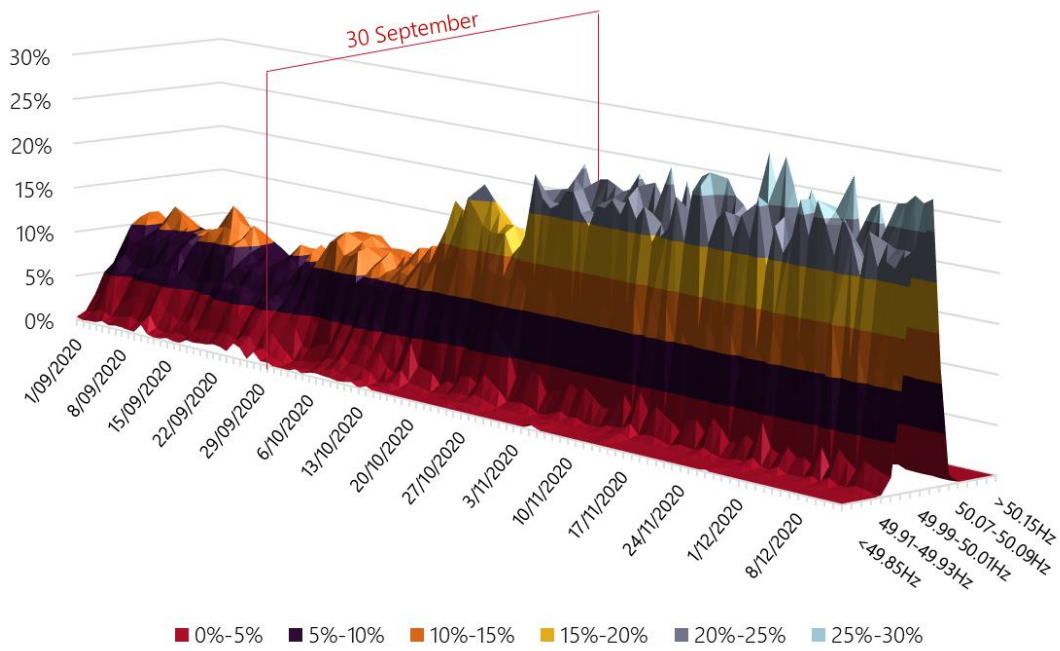
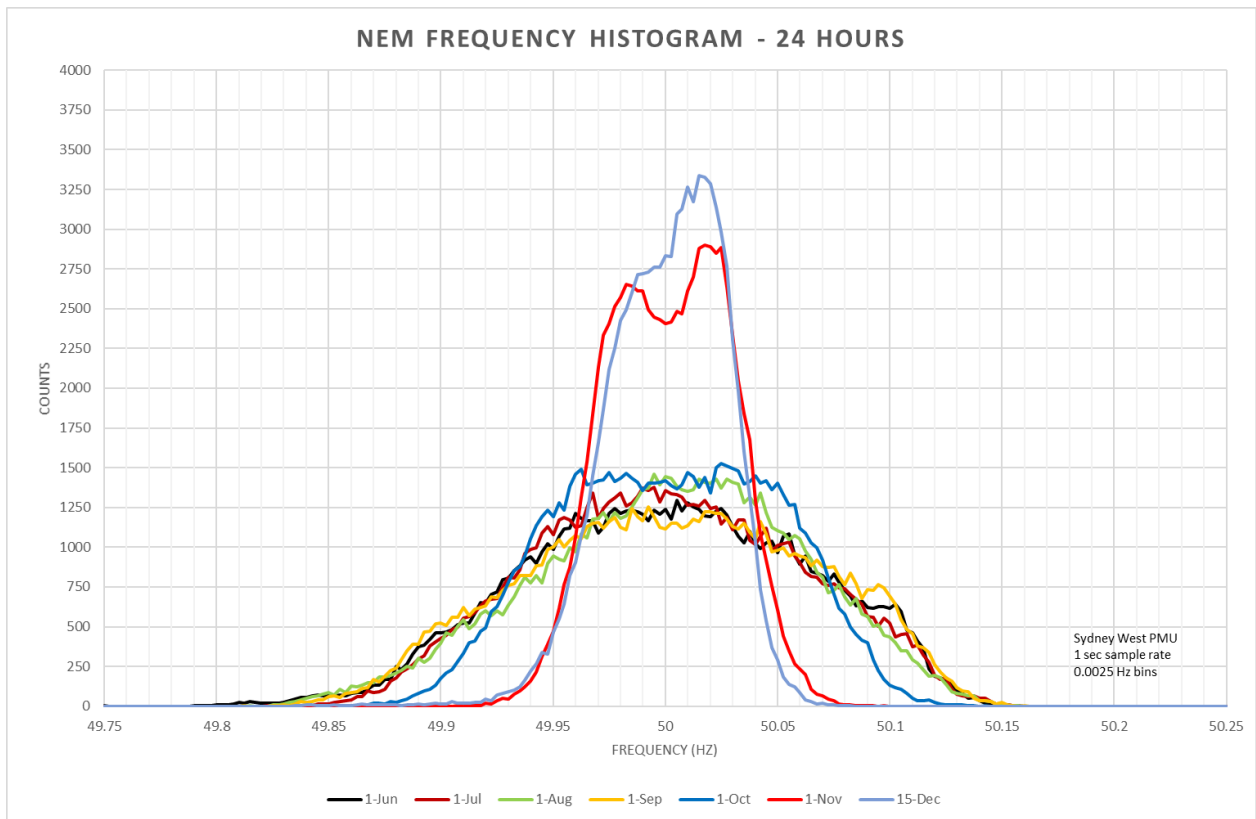


Figure 3 Daily frequency distribution at monthly intervals – June to Dec 2020



The total number of departures from the normal operating frequency band (NOFB) and the number of times frequency crossed the nominal 50 Hz is shown on a monthly basis in Figure 4 and on a day-by-day basis in Figure 5.

These figures show a significant reduction in the number of excursions outside the NOFB following the commencement of implementation of PFR setting changes from the end of September 2020. This trend is particularly evident since mid-October 2020, and has persisted since that time.

Figure 4 Monthly frequency crossings – under 49.85 Hz, across 50 Hz, beyond 50.15 Hz

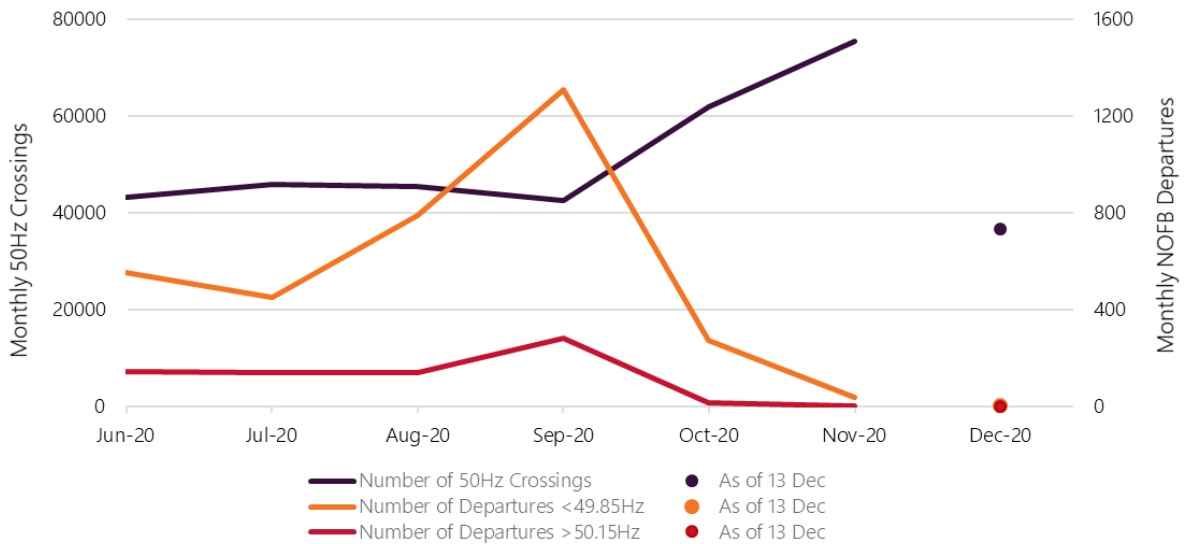
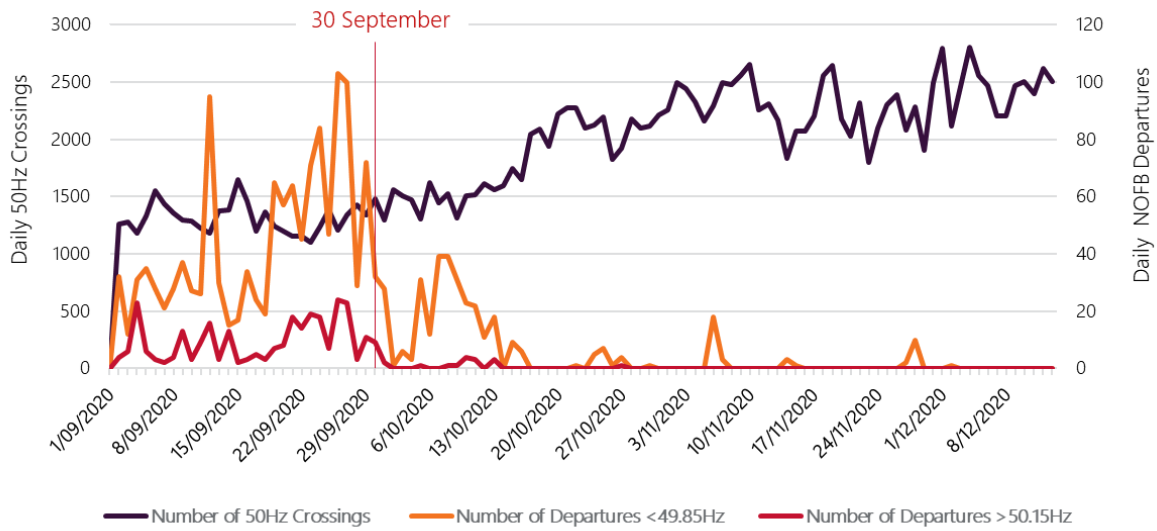


Figure 5 Daily frequency crossings – under 49.85 Hz, across 50 Hz, beyond 50.15 Hz



Glossary

This document uses many terms that have meanings defined in the National Electricity Rules (NER). The NER meanings are adopted unless otherwise specified.

Term	Definition
Affected Generator	As defined in the IPFRR.
Affected GS	As defined in the IPFRR.
CCGT	Combined Cycle Gas Turbine.
DUID	Dispatchable unit identification.
GT	Gas Turbine
HP	Hold Point. A point during commissioning of new <i>plant</i> determined by reference to <i>generation</i> output.
IPFRR	Interim Primary Frequency Response Requirements.
Mandatory PFR Rule	National Electricity Amendment (Mandatory Primary Frequency Response) Rule 2020.
NOFB	<i>normal operating frequency band.</i>
PFR	<i>primary frequency response.</i>
PFR Settings	The settings to achieve the provision of PFR in accordance with the IPFRR, as notified to an Affected Generator by AEMO.
PFRP	<i>primary frequency response parameters.</i>
PS	Power Station.
PV	Photovoltaic
Results	As defined in the IPFRR.
RTS	Return to service following an <i>outage</i> .
SF	Solar Farm.
Tranche 1	Affected GS with a <i>nameplate rating</i> of >200 MW.
Tranche 2	Affected GS with a <i>nameplate rating</i> between 80 MW and 200 MW.
Tranche 3	Affected GS with a <i>nameplate rating</i> of <80 MW.
WF	Wind Farm.