AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Wholesale Demand Response

June 2022

Annual Report

A report on the operation of the arrangements for the provision of wholesale demand response

Important notice

Purpose

AEMO publishes the Wholesale Demand Response Annual Report under clause 3.10.6 (a) of the National Electricity Rules.

This publication has been prepared by AEMO using information available at 12 June 2022. Information made available after this date may have been included in this publication where practical.

Disclaimer

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Version control

Version	Release date	Changes
1	29/06/2022	

Executive summary

This report provides information on the first year of wholesale demand response (WDR) operations, including on baseline methodologies, WDR performance and WDR trends, as required under the National Electricity Rules (NER) clause 3.10.6 (a) for the period of 24 October 2021 to 12 June 2022.

The report finds that overall, the four available baselines methodologies and the eligibility assessment, compliance testing and non-conformance processes are all functioning as expected. AEMO is not currently developing any new baseline methodologies outside of the existing CAISO 10 of 10 framework, and believes that the baseline accuracy and bias thresholds remain appropriate.

In terms of WDR operations, there has been a slow build of WDR capacity registered since the start of the mechanism. After a summer with few WDR events, there have been an increasing number of WDR events over the winter period. The key operational statistics of WDR over the past year are shown in Table 1.

Table 1 WDR operation – key statistics over reporting timeframe

Key statistic	Value
Baseline methodologies available	4
Baseline methodologies used by participants	2
DRSP registered	1
WDRUs registered	12
NMIs registered	25
Regions in which NMIs are registered	NSW, VIC, SA
Capacity registered	61.6 MW
Number of NMIs not passing compliance testing	3
WDR event days	16 days
Region of WDR events	NSW, VIC
WDR dispatched	319 MWh
Average price for WDR dispatch for bulk of WDR events ($/MWh)	500 - 2000 $/MWh
Non-conformance frequency	6 out of 1403 trading intervals
Non-conformance extent	20.3 MW

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1 Background

The WDR mechanism started on 24 October 2021, implementing the AEMC's WDR Mechanism rule[1] of June 2020. The WDR mechanism allows demand side (or consumer) participation in the wholesale electricity market. 'Demand Response Service Providers' (DRSP) classify and aggregate the demand response capability of large market loads for dispatch through the NEM's standard bidding and scheduling processes. The DRSP receive payment for the dispatched response, against a baseline estimate, at the electricity spot price.

1.1 Rules requirements

Under NER clause 3.10.6 (a), within six months after the end of each calendar year, AEMO is required to publish an annual report including the following information on DRSP-led wholesale demand response (without disclosing any confidential information):

- the number of registered DRSPs
- the number and capacity of loads classified as wholesale demand response units
- the amount of demand response dispatched in the wholesale market under the wholesale demand response mechanism, as well as the frequency of dispatch
- analysis of the spot price levels at which wholesale demand response was dispatched
- analysis of the impact of wholesale demand response on the procurement and use of market ancillary services
- relevant trends, including year-on-year changes over time

1.2 Procedural requirements

Under clause 2.8 of AEMO's WDRM Baseline Eligibility, Metrics and Compliance Policy[2], AEMO has committed to undertake an annual review of the suitability of the eligibility and compliance methodology as well as the metrics thresholds (See Section 2.7 of the Report).

[1] https://www.aemc.gov.au/rule-changes/wholesale-demand-response-mechanism

[2] https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2020/wdrm-becm-policy/first-round/baselines-eligibility-compliance-and-metrics-policy.pdf?la=en

2 Baseline methodologies reporting

Under NER 3.10.6 (b) AEMO is required to report on outcomes relating to the use and accuracy of baseline methodologies, including on the following:

- Baseline methodologies available
- Baseline methodology use
- Proposals for new baseline methodologies
- Baseline methodology assessment
- Baseline non-compliance
- Improvements to WDR provision
- Timing of any improvements

2.1 Baseline methodologies available

The four baseline methodologies (and their associated key settings) available for use currently under the wholesale demand response guidelines are shown in Table 2. They are outlined in the Baseline Methodologies Register[3].

Table 2 Baseline methodologies – key settings summary table

	All Days (BM1)	Business Days (BM2)	Non-Business Days (BM3)	Business + Non-Business Days Composite (BM4)
BM ID	BM1	BM2	BM3	BM4
Framework	CAISO 10 of 10	CAISO 10 of 10	CAISO 4 of 4	CAISO 10 of 10 CAISO 4 of 4
Day type	All days.	Business days only.	Non-business days only.	Business days and non-business days.
Baseline window	50 days	50 days	50 days	50 days
Selected days	Most recent 10 days (minimum 5).	Most recent 10 business days (minimum 5).	Most recent 4 non-business days (minimum 4).	Most recent 10 business days (minimum 5). Most recent 4 non-business days (minimum 4).

[3] https://aemo.com.au/initiatives/trials-and-initiatives/wholesale-demand-response-mechanism/wdr-participant-toolbox/wdr-baseline-methodology-register

	All Days (BM1)	Business Days (BM2)	Non-Business Days (BM3)	Business + Non-Business Days Composite (BM4)
Unadjusted baseline energy for TI	Average metered energy for TI for selected days.	Average metered energy for TI for selected days.	Average metered energy for TI for selected days.	Average metered energy for TI for selected days.
Baseline adjustment	Multiplicative adjustment with ±20% cap.	Multiplicative adjustment with ±20% cap.	Multiplicative adjustment with ±20% cap.	Multiplicative adjustment with ±20% cap.
Baseline adjustment window (settlement)	3 hrs ending 1 hr prior to the first TI of WDR.	3 hrs ending 1 hr prior to the first TI of WDR.	3 hrs ending 1 hr prior to the first TI of WDR.	3 hrs ending 1 hr prior to the first TI of WDR.
Baseline adjustment window (PoL)	3 hrs ending 1 hr prior to TI.	3 hrs ending 1 hr prior to TI.	3 hrs ending 1 hr prior to TI.	3 hrs ending 1 hr prior to TI.
Required number of eligibility days	50	50	20	50
Eligibility TIs window	3pm to 8pm (market time)	3pm to 8pm (market time)	3pm to 8pm (market time)	3pm to 8pm (market time)
Required number of compliance days	50	50	20	50
Compliance TIs window	3pm to 8pm (market time)	3pm to 8pm (market time)	3pm to 8pm (market time)	3pm to 8pm (market time)

2.2 Baseline methodology use

The extent to which each of the four the baseline methodologies are being used is shown in Table 3. Most of the registered NMIs are using baseline methodology 4 (Business + Non-Business Days Composite). Table 4 shows that correspondingly most of the WDR capacity is also registered under BM4.

Table 3 Number of NMIs per baseline methodology

	All Days (BM1)	Business Days (BM2)	Non-Business Days (BM3)	Business + Non-Business Days Composite (BM4)	Total number of NMIs
June 2022	-	2	-	23	25

Table 4 Total capacity (MW) per baseline methodology

	All Days (BM1)	Business Days (BM2)	Non-Business Days (BM3)	Business + Non-Business Days Composite (BM4)	Total Capacity
June 2022	-	1.00	-	60.60	61.6

The trend over the reporting timeframe, both in terms of total capacity (MW) and total number of NMIs is shown in Figure 1 and Figure 2, with a breakdown of capacity by region in Figure 3. As show, there has been a steady build-up of capacity over the reporting timeframe. In terms of registered WDR capacity, it is split between NSW and Victoria, with a small amount of capacity in SA.

Figure 1 Number of NMIs per BM over time

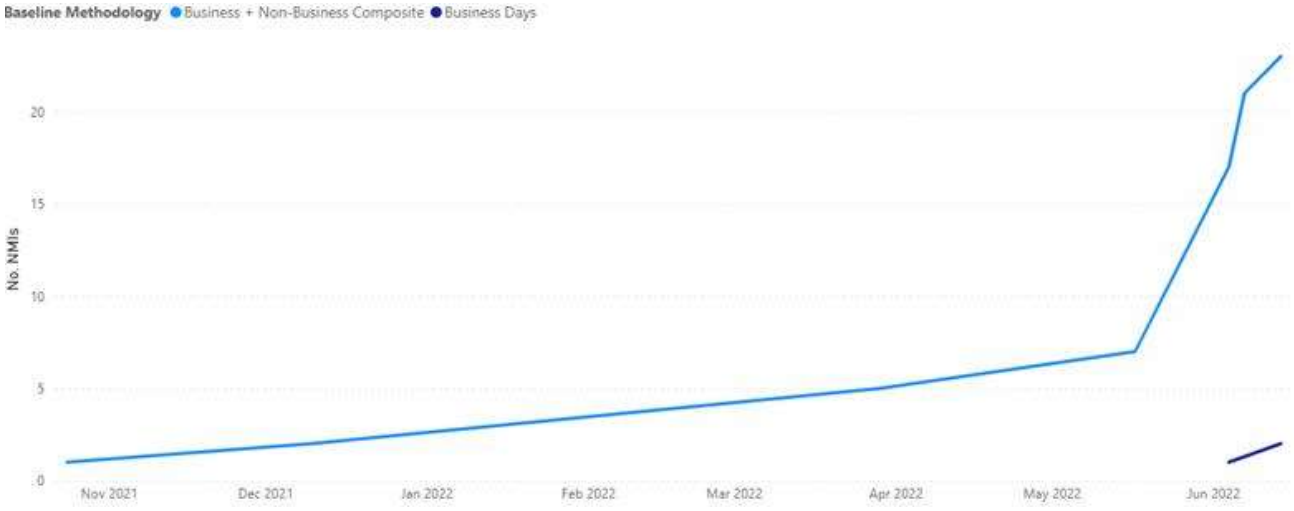


Figure 2 Total capacity per BM over time (MW)

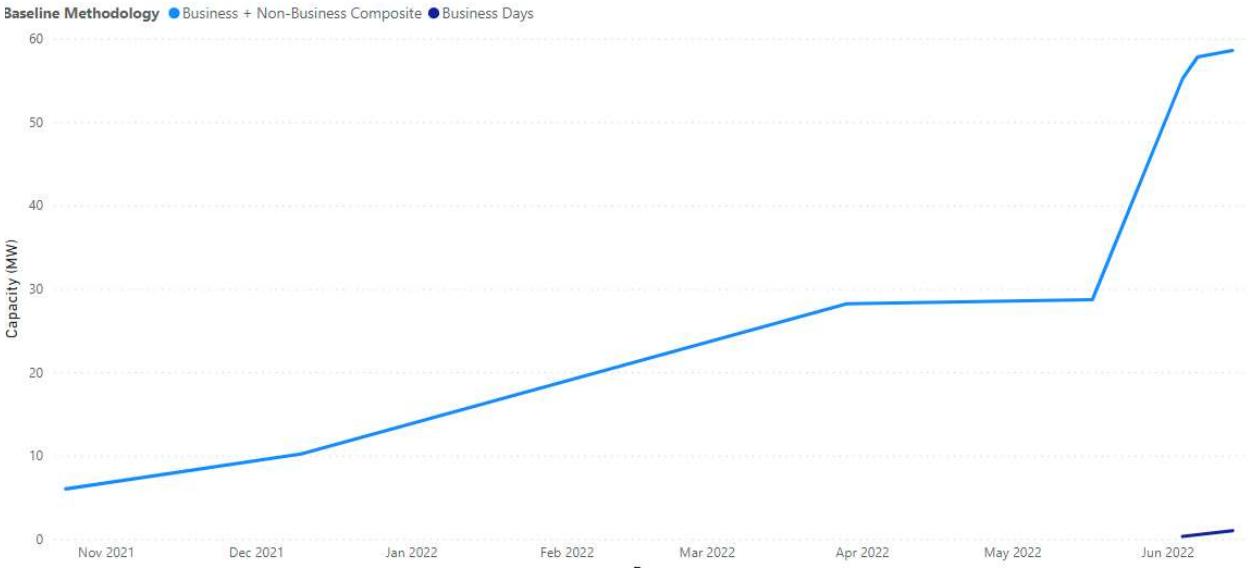
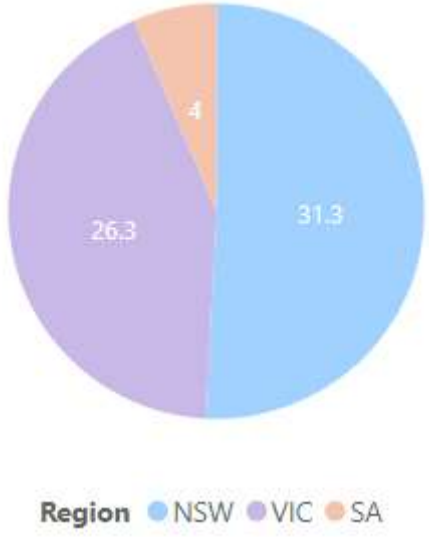


Figure 3 Capacity by region (MW)



2.3 Proposals for new baseline methodologies

Under NER clause 3.10.6 (b) (1) ((ii) AEMO is required to outline any proposals for new baseline methodologies received by AEMO and new baseline methodologies being developed.

AEMO has had discussions with market participants and other interested parties regarding potential new baseline methodologies. However, AEMO did not receive any detailed official submissions for new baseline methodologies from any market participant during the reporting period.

AEMO is looking at potentially implementing a new baseline methodology and associated processes that would utilise the current baseline methodology framework (i.e. CAISO 10 of 10) but give DRSPs greater flexibility over the days of the week included in the baseline calculation. This would lead to DRSPs being able to use a bespoke number of days of the week most suited to their load (i.e. Monday to Thursday only, Friday to Sunday only etc).

The utility of this methodology is currently being trialled though the expanded use of 'exclusion days'. It is likely to be implemented in AEMO's systems as a new baseline methodology (BM5) if there is enough market participant interest. In general, any new baseline methodology that is a variation on the current framework is easier, quicker and more cost effective to implement than one that requires different data sets and/or new logic, algorithms, calculations and system build.

2.4 Baseline methodology assessment

NER clause 3.10.6 (b) (2) outlines that for each baseline methodology, an assessment against the baseline methodology metrics as measured during the WDRU classification process and baseline compliance testing must be completed for this Report.

To participate in WDR, the DRSP must demonstrate that the baseline methodology, when applied to the load and using the proposed baseline settings and historical metering data for the load produces a baseline that satisfies

the baseline methodology metrics. The two baseline methodology metrics used to assess a baseline's eligibility for WDR (baseline eligibility assessment) and continued compliance (baseline compliance testing) are accuracy and bias.

- Accuracy is the measure of deviation between the actual load and its baseline.
- Bias is the systematic tendency of a baseline method to over- or under-predict actual loads.

Table 5 and Table 6 below tables outline the minimum, maximum and average accuracy and bias scores for the baseline methodologies currently in use (BM2 and BM 4), both under baseline eligibility assessment and baseline compliance testing. Baseline compliance testing was conducted as out outlined in the WDRM Baseline Eligibility, Metrics and Compliance Policy on the 1st to 2nd of June 2022.

As BM2 has only two associated NMIs, it's hard to draw any solid conclusions from the accuracy and bias scores. As shown in Table 5, both under the eligibility assessment and compliance testing the average accuracy score was well below the 20% accuracy threshold. There was also little difference between the eligibility and compliance accuracy scores. The average bias score at eligibility assessment was closer to threshold at 3% but was significantly lower under compliance testing at 0.9%. There were no NMIs under BM2 that failed compliance testing.

Table 5 BM 2 – Eligibility assessment and compliance testing results

	Eligibility Assessment		Compliance Testing	
	Accuracy	**Bias[4]**	**Accuracy**	**Bias**
Threshold	*20%*	*±4%*	*20%*	*±4%*
Minimum	10.8%	2.6%	11.8%	0.1%
Maximum	18.6%	3.4%	17.5%	1.6%
Average	14.7%	3.0%	14.7%	0.9%

As shown in Table 6, for BM4 (used by most NMIs in WDR currently) the average accuracy score was well below the 20% accuracy threshold at under 9%, for both eligibility assessment and compliance testing. There is also a wide range of accuracy scores across eligibility/compliance testing, ranging from as low as 0.8% to nearly hitting the threshold at 19.9%. This suggests that there are many different types of loads participating in WDR with different load profiles and resultant accuracy scores.

The average bias scores were also significantly lower than the 4% threshold for both eligibility and compliance testing, at under 0.4%. There was also a wide range of bias scores from 0% to 2.7%.

There were three NMIs under BM4 that failed compliance testing. All three failed to meet the accuracy threshold and one NMI also failed to meet the bias threshold. These NMIs were excluded from the compliance testing statistics.

[4] Minimum, maximum and average values calculated from absolute bias scores.

Table 6 BM 4 – Eligibility assessment and compliance testing results

	Eligibility Assessment		Compliance Testing[5]	
	Accuracy	**Bias[6]**	**Accuracy**	**Bias**
Threshold	*20%*	*±4%*	*20%*	*±4%*
Minimum	2.2%	0.0%	0.8%	0.0%
Maximum	19.6%	1.5%	19.9%	2.7%
Average	8.8%	0.4%	8.9%	0.3%

2.4.1 Trends in accuracy and bias

Trend analysis of accuracy and bias scores over time will be provided in subsequent reports once multiple years of data is available.

2.5 Baseline non-compliance

When AEMO conducted baseline complained testing, a small number of NMIs (see Table 7) failed to pass the baseline compliance test. This means that the NMI baselines did not meet the required accuracy and/or bias thresholds. This can occur for a number of reasons, such as a significant change in plant operations, change in business model or a seasonal characteristic of the particular load. Such NMIs are set as 'non-compliant' in AEMO's systems and are unable to partake in WDR until they pass baseline compliance testing at a future date. A DRSP may also re-submit an amended application for compliance testing if appropriate, using 'exclusion days' to remove any abnormal loads from the baseline compliance testing calculation.

All NMIs that were found to be baseline non-compliant have provided an available capacity of zero for the WDRU. There have been no periods in which a baseline non-compliant WDRU has bid in, or was dispatched.

Table 7 NMI compliance testing - June 2022

	All Days (BM1)	Business Days (BM2)	Non-Business Days (BM3)	Business + Non-Business Days Composite (BM4)	Total
Total number of NMIs	-	2	-	23	25
Number of NMIs that failed compliance testing	-	-	-	3	3
% of NMIs failing compliance testing	-	0%	-	14%	14%

[5] Only NMIs that passed the compliance test were included in the accuracy and bias statistics.

[6] Minimum, maximum and average values calculated from absolute bias scores.

2.6 Improvements to WDR provision

Under NER clause 3.10.6 (b) (4) any potential improvements to the provision of WDR under the Rules, together with the associated timing and process for making any improvements (NER 3.10.6 (b) (5)) needs to be included in this Report.

AEMO is currently working on improvements to the functionality of the Portfolio Management System (PMS) used by DRSPs. AEMO aims to have these improvements implemented by the end of 2022. As mentioned under Section 2.3 of this Report, AEMO is going to be trialling a new baseline methodology that would give DRSPs greater flexibility over the days of the week included in the baseline calculation. If there is enough market participant interest this new baseline methodology (BM5) could be implemented in AEMO's systems over the next year.

2.7 Suitability of eligibility and compliance methodology

Under clause 2.8 of AEMO's WDRM Baseline Eligibility, Metrics and Compliance Policy[7], AEMO committed to undertaking an annual review of the suitability of the eligibility and compliance methodology as well as the metrics thresholds.

2.7.1 Eligibility assessment

With 25 NMIs registered and 16 event days of WDR to date, it is difficult to draw firm conclusions regarding the long term efficacy of eligibility and compliance methodology or the accuracy and bias thresholds. However, as shown in Section 2.4, the NMIs registered for WDR, when tested for eligibility, have a wide variety of accuracy and bias characteristics, with an average accuracy and bias values well below the 20% and ±4% thresholds respectively. This suggests that WDR and baseline methodologies employed, together with the eligibility assent methodology is suitable for a variety of load types.

AEMO has not encountered a large number of NMIs bought forward by market participants that have failed to pass eligibility assessments, or encountered loads which should be suitable for WDR but have been excluded due to the eligibility assessment criteria or the thresholds. There has been a steady stream of NMIs being registered and passing eligibility assessment. There is no indication that the supply of NMIs suitable to participate in WDR have been exhausted, particularly in regions other than VIC and NSW, or that further participation in WDR is limited by the eligibility assessment methodology or the accuracy and bias thresholds.

2.7.2 Compliance testing

With regards to the compliance testing methodology, the first bi-annual compliance test for all NMIs undertaken in early June 2022 ran smoothly and did not encounter any issues. Most NMIs tested had very similar accuracy and bias statistics in the compliance test as see in the eligibility assessment, suggesting that their loads are largely predictable in a way suitable to participate in WDR.

As discussed in Section 2.5, small number of NMIs did not pass the compliance test due the exceeding the accuracy and/or bias thresholds. The reason for not passing the compliance test was not due to any issues with

[7] https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2020/wdrm-becm-policy/first-round/baselines-eligibility-compliance-and-metrics-policy.pdf?la=en

the methodology, but simply a result of changing load patterns or seasonality of the load. Some/all of the non-compliant NMIs may again become baseline compliant, due to changing circumstances and/or seasonality changes in the future.

2.7.3 Accuracy and bias thresholds

Based on the data to date, AEMO believes that the baseline eligibility and compliance methodologies, together with the accuracy and bias metrics result in loads that have accurate and unbiased baselines participating in WDR and that the demand response provided under the WDRM is real and additional.

A such, AEMO currently sees no evidence for changing the eligibility assessment or compliance testing methodologies or raise or lower the accuracy and bias thresholds.

2.7.4 Baseline adjustment cap

The baseline adjustment cap is a multiplicative adjustment, set at ±20% for all baseline methodologies. That is, the adjustment applied to the baseline using meter data to reflect conditions on the day, may be positive or negative and is capped at 20%.[8] The same cap applies to baseline calculations for WDR settlement as well as eligibility assessment and compliance testing.

AEMO is aware that some load types may not pass the eligibility assessment due to the cap on adjustments. However, AEMO believes that the baseline adjustment cap serves its purpose of ensuring baselines are accurate and unbiased and the demand response provided under the WDRM is real and additional and a such do not need to be changed.

2.7.5 Eligibility and compliance trading intervals window

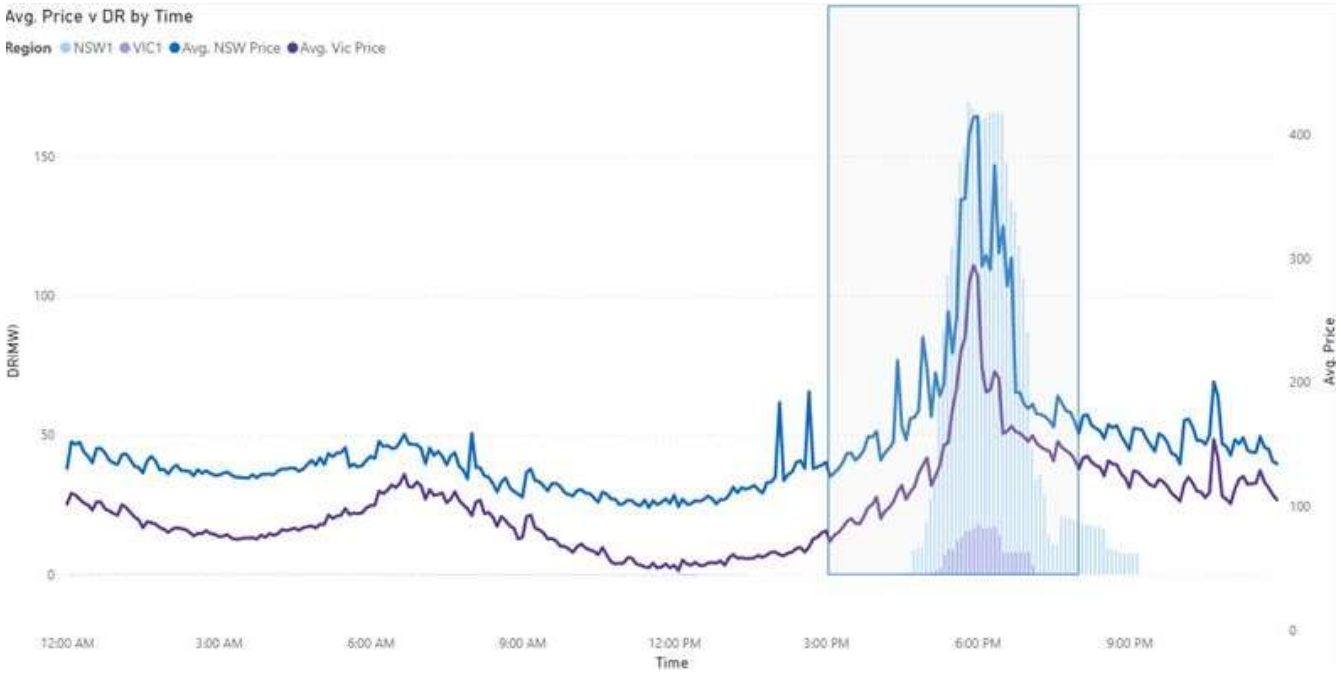
The eligibility TIs window and compliance TIs window refers to the TIs from which meter data is taken for the load for the purpose of conducting baseline eligibility assessment and compliance testing. The eligibility TIs window and compliance TIs window are both set at 3pm to 8pm (market time).[9] These windows were set to ensure that eligibility assessment and compliance testing were conducted on TIs that were most likely to have WDR dispatched.

Figure 4 shows average regional prices by time of day (the line chart corresponding with y-axis 2) overlayed by actual wholesale demand response (the bar chart corresponding with y-axis 1). The shaded area represents the eligibility and compliance TIs window of 3pm to 8pm. As shown, the TIs widow lines up well with the actual demand response dispatched, which aligns with higher afternoon peak prices. This shows that at least for the WDR events seen to date, the baseline assessment for eligibility/compliance was conducted on the TIs that coincide with the TIs that WDR was dispatched at. This ensures that the baselines are accurate and unbiased, particularly in the 3pm to 8pm period, and the demand response provided under the WDRM is real and additional. As such, AEMO believes that the eligibility TIs window and compliance TIs window should both remain set at 3pm to 8pm (market time).

[8] Refer to the WDRM – Baseline Methodology Register for capping methodology at https://aemo.com.au/initiatives/trials-and-initiatives/wholesale-demand-response-mechanism/wdr-participant-toolbox/wdr-baseline-methodology-register

[9] Refer to the Baseline Eligibility, Metrics and Compliance Policy at https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2020/wdrm-becm-policy/first-round/baselines-eligibility-compliance-and-metrics-policy.pdf?la=en

Figure 4 Average regional price and demand response by time of day



2.7.6 Other settings

AEMO believes that all other baseline settings relevant to the eligibility and compliance methodology, including the selected days, baseline window, baseline adjustment window, required number of eligibility days and required number of compliance days are working as intended and require no adjustment at this time.

3 WDR performance

Under NER clause 3.10.6 (c), the Report must include, for the period under review the following:

- the number of registered DRSPs and the number and WDRUs
- the amount of dispatched WDR, the frequency of dispatch and the spot market price levels at which wholesale demand response was dispatched
- the frequency and extent of WDRU declared to be non-conforming
- analysis of the impact of dispatched WDR on the procurement and use of each market ancillary service
- analysis of trends, including year-on-year changes

3.1 DRSPs and WDRUs

The number of registered DRSPs and the number and capacity of WDRUs is shown in Table 8 below.

Table 8 DRSPs, WDRUs and total capacity

Date	Registered DRSPs	WDRUs	Total WDRU capacity
June 2022	1	12	61.6MW

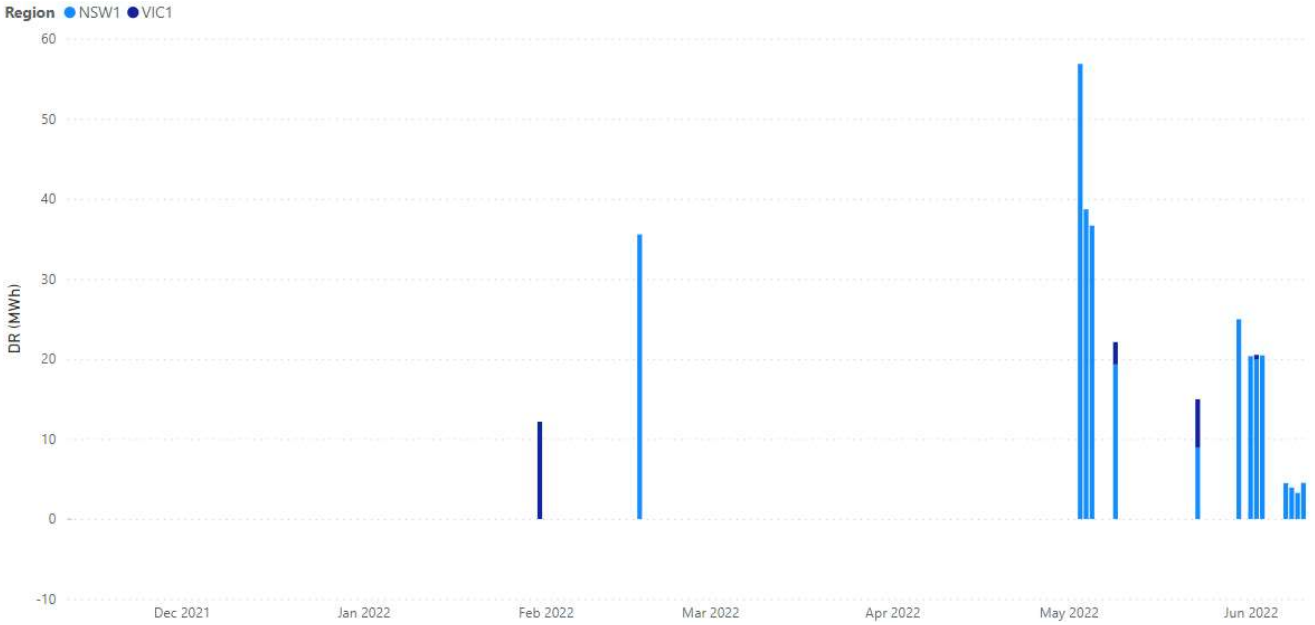
3.2 Wholesale demand response dispatch and pricing

To 12 June 2022, there has been a total of 319[10] MWh of WDR dispatched since the start of the mechanism in October 2021. The WDR dispatch occurred in the NSW and VIC regions.

The amount of WDR dispatched over time is shown in Figure 5 below. There were relatively few events over the summer period, a result of only a few NMIs being registered, together with relatively low prices. WDR dispatch activity has increased significantly since May, with the bulk of WDR events happening in the May-June timeframe. This is likely the result of more NMIs and capacity being registered for WDR, together with an environment of sustained higher prices, which has increased the opportunity for WDR dispatch.

[10] WDR calculated from metered energy minus baseline energy

Figure 5 WDR dispatched over time (MWh)



The average volume weighted price for WDR per region is shown in Table 9, and sit around $2000.

Table 9 Average Volume Weighted Price for WDR per region (Oct 21 - June 22)

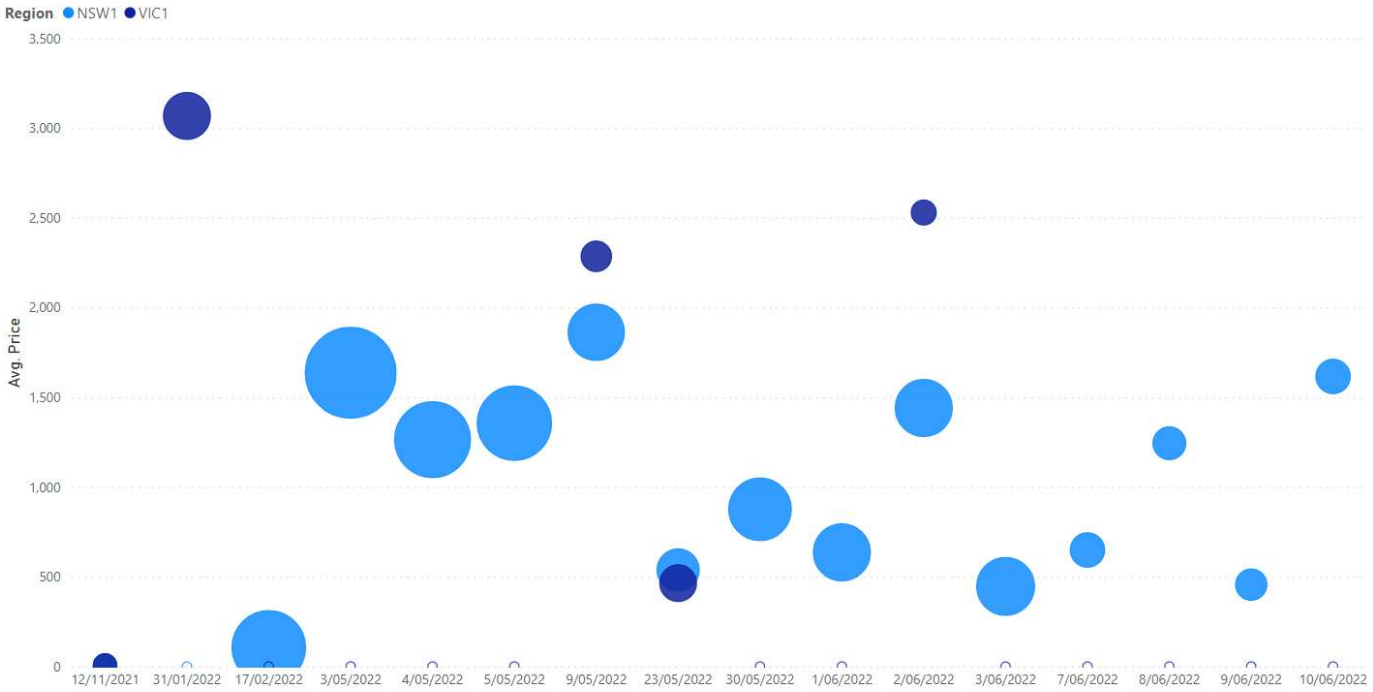
Date	Average Volume Weighted Price ($/MWh)
NSW	$2,200
VIC	$2,002

The average price levels at which WDR was dispatched at are shown in Figure 6. The size of the circles represents the relative size of the dispatch (in MWh) on that day for a region. As shown, to date, most WDR dispatch events happened at an average price above 500 $/MWh. Most dispatch events fell between an average price of $500-$2000 per MWh, with a few events in the $2000 to $3000 average price range. There was one[11] WDR event at the lower price end occurring at just above 100 $/MWh.

In regional terms, while most of the WDR dispatch occurred in NSW, the highest prices WDR dispatches all occurred in VIC. This probably reflects the type and characteristic of the load dispatched and the price point at which WDR is cost effective for those particular loads.

[11] The event of 11/12/21 was the result of a market participant error and was unintentional.

Figure 6 Average price ($/MWh) vs total WDR dispatch (MWh)



3.3 Non-conformance

The frequency and extent of WDRUs declared to be non-conforming under NER clause 3.8.23(a) is shown in Table 10 below.

Dispatch conformance is assessed at an interval (MW) and settlement day (MWh) level as outlined in Section 3 of the Post-Event Dispatch Conformance Policy[12]. Due to the small size of most WDRUs (i.e. 19 out of 25 being under 6MW in size) and the interval MW error non-conformance threshold being 6MW, the interval assessment shows that only 6 out of 1403 intervals have been deemed as non-conforming (i.e. demand response is not within 6MW of the dispatch target). From a settlement day perspective, 6 out of 51 dispatch events have been deemed non-confirming (per Dispatchable Unit Identifier (DUID) Settlement Day). The extent of the non-conformance was also small. At the trading interval level, total non-conformance for the reporting period was 20.3 MW with an average of 3.4MW.

At the Settlement Day level, while there was a total of 38MWh of non-conformance for the reporting period, this value was skewed by one event, resulting from an auto-bidding error, that was responsible for 32MWh of that total non-conformance. All other events combined resulted in non-conformance of under 6MWh (out of 319MWh) for the reporting period.

While there have been a small number of non-conformance occurrences, there have not been any repeated instances of non-conformance requiring AEMO intervention over the reporting period.

[12] https://aemo.com.au/-/media/files/initiatives/wdr/2021/post-event-dispatch-conformance-policy.pdf?la=en

Table 10 Non-conformance over time

Non-conformance measure	Value
Non-conformance frequency (Trading Intervals)	6 out of 1403 trading intervals
Extent of non-conformance – Interval (MW)	Total non-conformance - 20.3 MW Average non-conformance - 3.4 MW
Non-conformance frequency (Settlement Day)	6 out of 51 DUID Settlement Days
Extent of non-conformance- Settlement Day (MWh)	Total non-conformance - 37.6 MWh Non-conformance due to auto bidding error (single instance) - 32 MWh Total from all other non-conformance events - 5.5 MWh

3.4 WDR effect on market ancillary services

Due the WDR Mechanism only starting in October 2021, and the relatively low volume/size of WDR dispatch to date, there is no perceivable effect of WDR in the procurement and use of market ancillary services.

3.5 Trend analysis

Analysis of WDR performance trends, including year-on-year changes as required under NER clause 3.10.6 (c) (7) will be completed in subsequent reports, once more data is available.

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
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator Limited
AER	Australian Energy Regulator
BM	Baseline Methodology
DRSP	Demand Response Service Provider
DUID	Dispatchable Unit Identifier
WDRU	Wholesale Demand Response Unit
NER	National Electricity Rules
WDR	Wholesale Demand Response
WDRM	Wholesale Demand Response Mechanism
NMI	National Metering Identifier