

NSW Demand Response

ARENA Knowledge Sharing
Report

November 2020

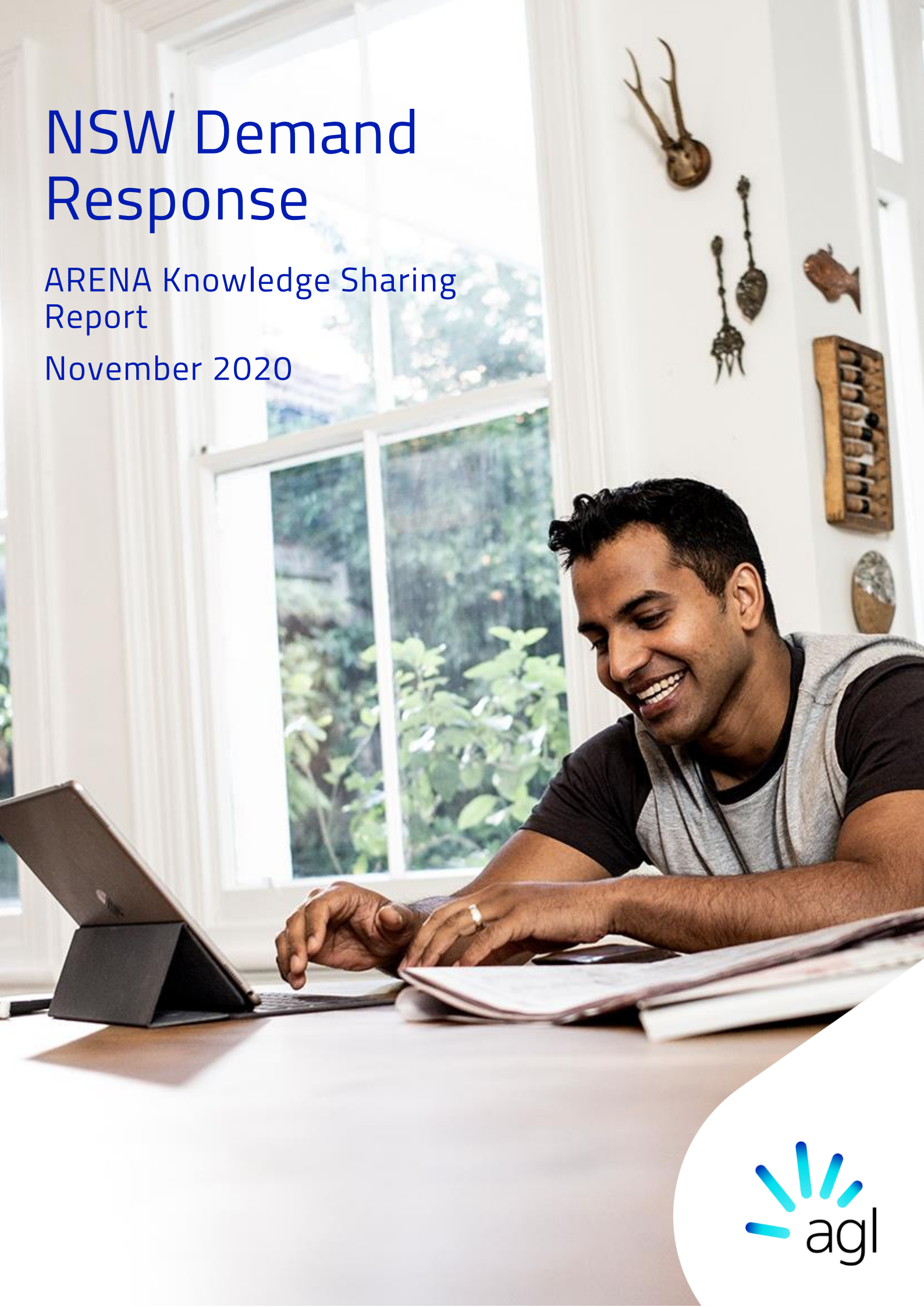




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1. Executive Summary

This is the third knowledge sharing report for the NSW Demand Response Project being conducted by AGL. This activity received funding from ARENA as part of ARENA's Advancing Renewables Programme – Demand Response, and from the NSW Government.

The first year of the project was detailed in AGL's ARENA Knowledge Sharing Report September 2018, and the second year in AGL's ARENA Knowledge Sharing Report October 2019, both published by ARENA at <https://arena.gov.au/projects/agl-demand-response/>.

This knowledge sharing report covers the period June 2019 to May 2020 and covers the performance of the Commercial and Industrial (C&I) portfolio over that period.

Details of the third year of the residential demand response component of the project will be covered in the final Knowledge Sharing Report to be published by AGL in 2021. The final report will also summarise the full three years of the project and draw conclusions from the experience gained.

During the period covered by this report there were two tests of the C&I portfolio and two event dispatches.

Both tests successfully demonstrated over 20MW of demand response.

The event dispatches occurred in January 2020 during the NSW bushfire crisis. At the time, several of the portfolio participants were involved in emergency response activities related to the bushfires and were not available for demand response. AGL's declared availability to AEMO for this period was correspondingly reduced. Even so, the demand response provided in the first event was lower than the declared amount. This experience highlighted the potential risk of underperformance during emergency conditions in demand response portfolios that contain a significant percentage of critical infrastructure loads such as water utilities and telecommunications providers.

This Project received funding from ARENA as part of ARENA's Advancing Renewables Programme - Demand Response and from the New South Wales Government.

The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.

2. Commercial and Industrial DR

2.1. 2019-20 Program Overview

Details of the 2017-18 and 2018-19 years of the C&I demand response program were covered in AGL's first and second Knowledge Sharing reports to be found at <https://arena.gov.au/projects/agl-demand-response/>.

The process used in the 2019-20 summer period was unchanged from the first and second year. Broadly speaking, the process is:

- A database is maintained of participant contacts – as many contacts as each participant wants to have informed of DR events.
- A “pre-notice” SMS and email is sent to the participants contacts either the afternoon before or the morning of a possible event. The pre-notice gives the likely start time and duration of the event but is not an instruction to activate.
- An “activation” SMS and email is sent to the participant contacts one hour before an event is to start. The activation message gives the confirmed start time and duration of the event.
- An “end of event” SMS and email is sent at the conclusion of the event.
- A “cancellation” SMS and email may be sent if an event is cancelled at any stage.

At the time of writing this report, there were exactly 100 contacts in our database for the ARENA NSW RERT project across 11 participant companies and 44 sites.

The messaging system used by AGL requires some manual work to execute an event. Although it can send both SMSs and emails simultaneously, event communications must be sent by an operator in real time and cannot be pre-organised.

That said, the system has generally worked well throughout the program and it takes only a few minutes to execute the messaging part of an event from any AGL laptop, either in the office or from a remote location. (The current system was not designed to allow event execution from a mobile device.) It is also true to say that demand response event execution is unlikely to ever be a fully automatic process, as telephone conversations with event participants are common and quite necessary in some cases to ensure an adequate flow of information about the event and deal with any problems as they arise.

2.2. Portfolio

The category of companies and sites participating in the third year of the program were:

Data centres – 2 companies, 2 sites

Telecommunications – 1 company, 5 sites

Shopping centres – 1 company, 10 sites

Manufacturing plants – 2 companies, 3 sites

Recycling plants – 1 company, 2 sites

Water utility pumping stations and treatment plants – 4 companies, 13 sites

University campus – 1 site

The portfolio has stayed relatively stable over the reporting period. One company with two manufacturing sites was added to the portfolio in June 2019. One water utility ceased participating in the program in December 2019 as it churned to a different retailer (and is not included in the above figures). The net result of these two changes on the MW capacity of the portfolio was approximately zero.

2.3. Technology

In our previous knowledge sharing reports, AGL detailed the issues encountered in installing DR-specific site monitoring equipment for the purpose of monitoring load in near-real time on DR sites. These issues included:

- Customer resistance to hardware installation or SCADA integration due to a perceived cybersecurity risk.
- Customer reluctance to provide site technical resources to assist with solution implementation (generally perceived as a distraction to normal operations).
- The distributed nature of some sites – many metering points across a geographically dispersed area – made it uneconomic to install hardware.
- The cost of hardware and installation being not economic for many smaller sites (ie the cost is higher than the DR benefit that the site delivers to the program).

By the time of our October 2019 report, AGL had ceased rolling out the hardware-based monitoring solution. Since then, the supplier of that system has made it obsolete. The small number of DR monitoring boxes that AGL had installed in the field have now been de-commissioned, and removed where it was practical to do so.

At the time of the last report, AGL had begun trialling the use of near real-time meter data delivered via an API from Meter Data Providers as an alternative to using separate bespoke DR monitoring solutions. The meter data API solution has the potential to greatly simplify the installation of site monitoring and significantly reduce the cost, as it uses equipment and comms channels that already exist for market metering purposes. Although, in some cases, a meter change may be required if the existing meter is an older model, the cost to do this is relatively low, Meter Providers have an established workforce able to do this across the NEM, and there is no need for any work to take place on site beyond the meter panel – something we have found to be a significant barrier to the successful completion of installation work on many sites due to site complexity and the necessity for the detailed involvement of site technical resources.

To date AGL has had detailed discussions with three Meter Data Providers who have the capability to provide five-minute near real-time data via an API. We have successfully connected to two of them using basic API tools, transferred data, and created a demonstration platform to visualise the data.

The graph in Figure 1 is a screenshot of five-minute meter data from our software platform that was obtained using this method; in this case the data is from a water utility site.

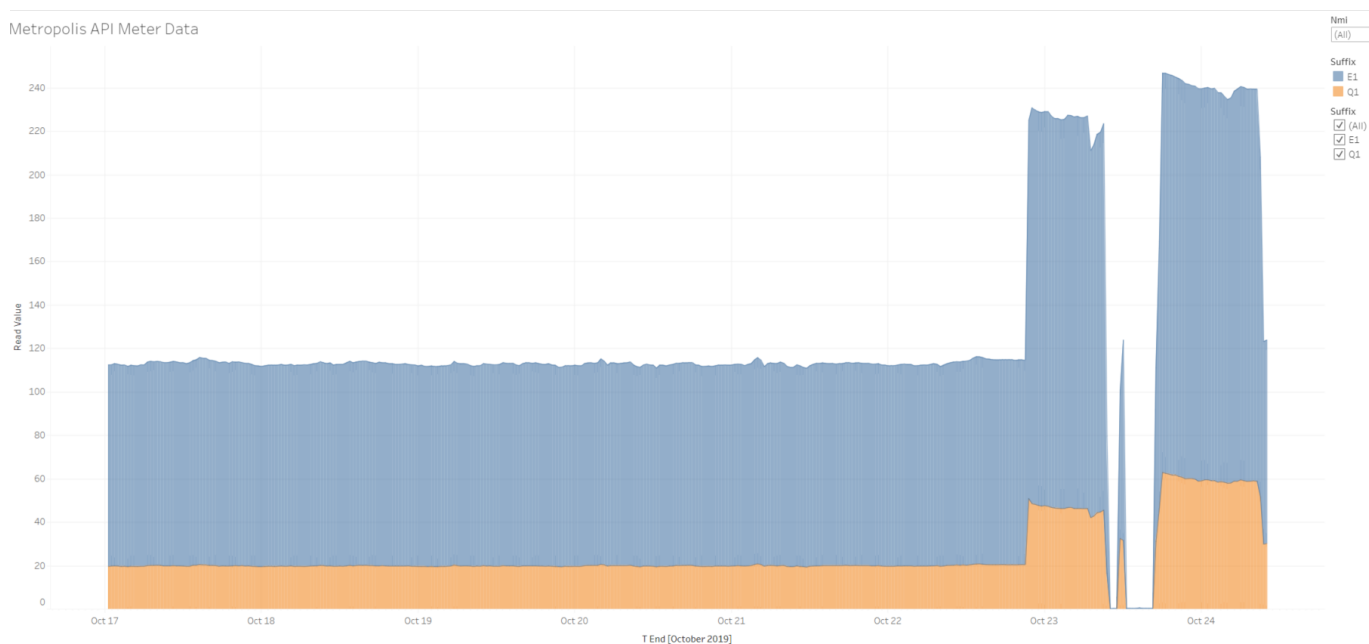


Figure 1 – Example five-minute near real-time meter data obtained via API

Indicative costs from Meter Data Providers suggest that the cost of site monitoring using this method will be significantly lower than the costs we have experienced installing and maintaining specific DR monitoring hardware.

Not all Meter Data Providers offer this service for C&I customers, and some of them have legacy back-office systems that are unable to provide it at present. However, discussions AGL has had with a wide range of MDPs suggest that they all know the potential value of this service and, in most cases, have it on their roadmap for development over the next couple of years.

2.4. Tests

During the period covered by this report there were two AEMO initiated tests of the portfolio, on 30 May 2019 and 4 December 2019.

30 May 2019

AEMO called a test of the portfolio on 30 May 2019 for the period 14:00 to 16:00 NEM time. Availability was declared at 17MW for this test in the AEMO markets portal.

The Sydney maximum temperature was a mild 21 degrees, with a similar temperature at Penrith.

Results for the test are shown in Figure 2.

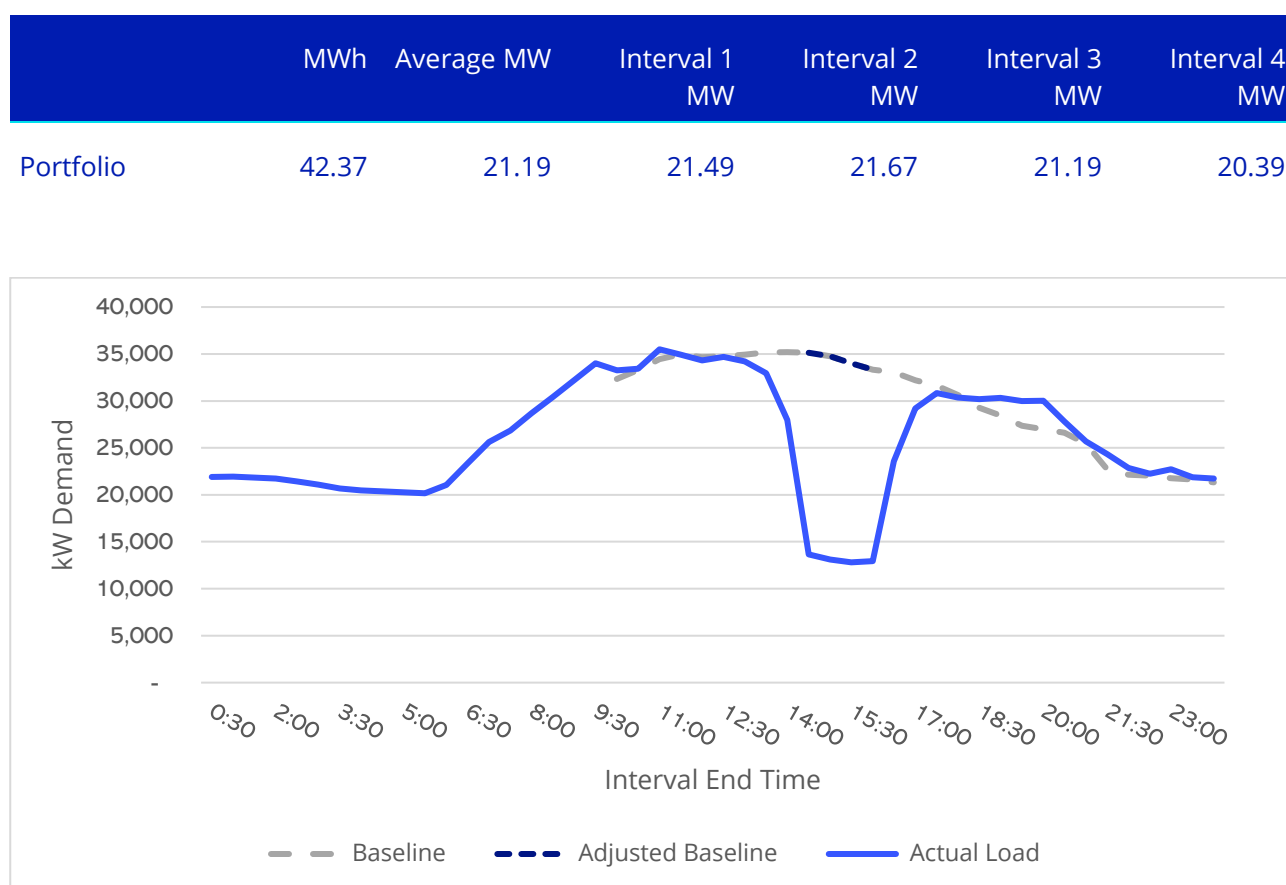


Figure 2 - Results of AEMO test 30 May 2019

This was a successful test with around 21 MW delivered, and there were no notable deviations from expected performance in the portfolio.

4 December 2019

AEMO called a test of the portfolio on 4 December 2019 for the period 14:00 to 16:00 NEM time. Availability was declared at 20MW in the AEMO portal at the time of this test.

The Sydney maximum temperature on the day was 30.9 degrees, with 34.1 degrees in Penrith.

Results for this test are shown in Figure 3.

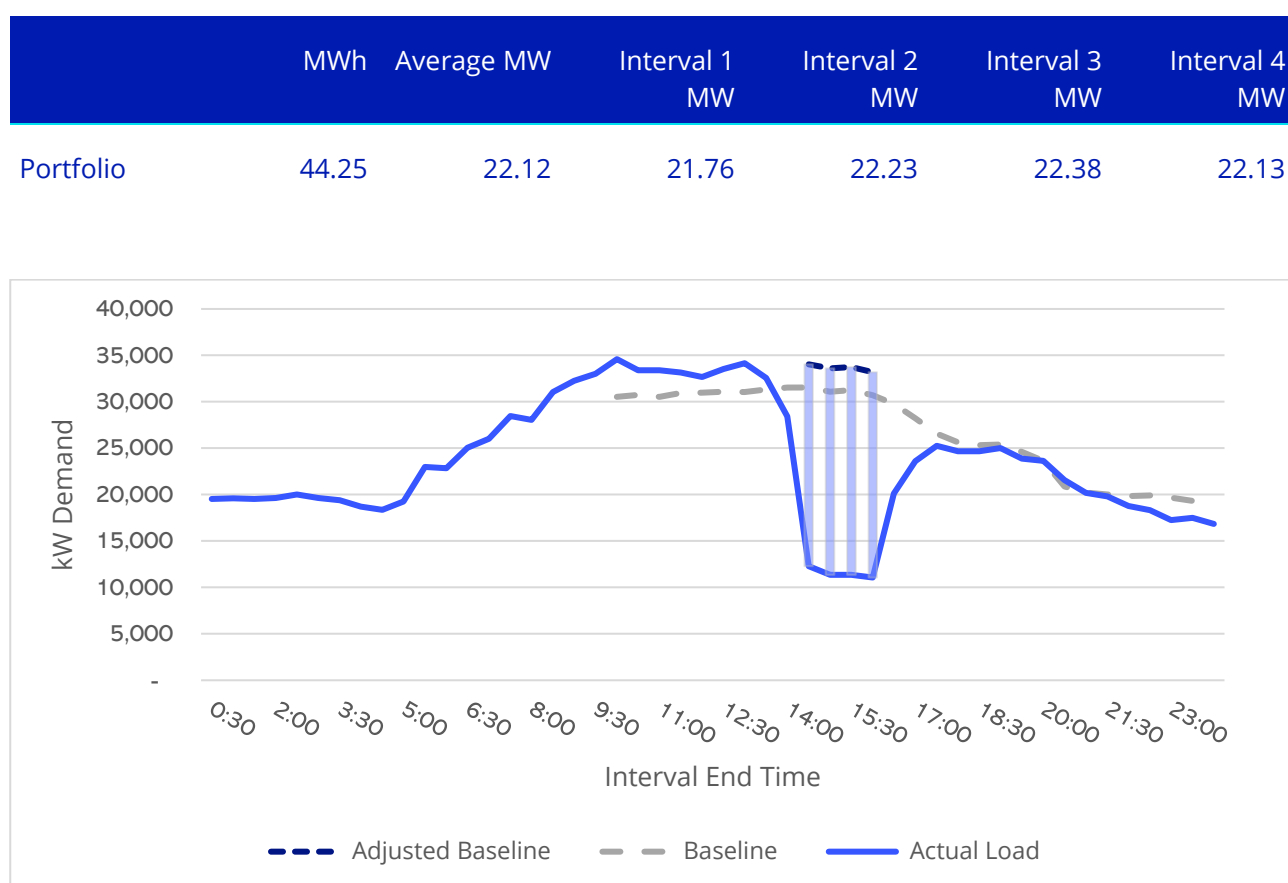


Figure 3 – Results of AEMO test 4 December 2019

This was again a successful test with around 22MW delivered and no notable variances from expectation in terms of participant performance.

2.5. Dispatch Events

There were two activations of the AGL NSW RERT portfolio by AEMO during the reporting period, on 23 January 2020 and 31 January 2020.

23 January 2020

This activation occurred during the height of the 2019-20 bushfire crisis in NSW and Victoria. To provide some context, on this particular day:

- There were 70 fires burning in NSW, with 44 not contained
- A Hercules C-130 air tanker crashed near Cooma while fighting the fires, killing three crew members
- Homes were lost at Moruya and Bermagui on the NSW South Coast
- There was a severe weather warning for damaging winds in parts of eastern NSW, including the ACT
- Canberra airport was closed due to a fire in the Pialligo Forest
- Melbourne was blanketed in brown rain, with play deferred at the Australian Open tennis.¹

In Sydney, the maximum temperature reached a very hot 41.2 degrees, with 42.4 degrees in Penrith.

In this situation, many of our DR participants were already operating in emergency response mode before the declaration of the DR event. Examples of this included:

- Water utilities having to pump water to reservoirs for firefighting purposes
- Telecommunications companies needing to restore critical communications in bushfire impacted regions
- Water utilities with lower pump loads due to ongoing water restrictions.

Given this environment, and after detailed discussions with participants about which DR assets could still be used if an event were called, AGL's NSW RERT availability in the AEMO markets portal was revised downwards on 22 January from 20MW to 12MW.

AEMO issued an Invitation to Tender for short-notice RERT at 12:35pm AEDT, followed by an activation message at 3:30pm AEDT. The requested activation was 10MW for two hours from 15:30 NEM time to 17:30 NEM time. Ten to fifteen minutes before this event was due to finish, AEMO requested AGL to extend the activation by a further hour to 18:30 NEM time. There were some technical issues with AEMO's issuance of the extension message due to a configuration problem in their platform, and the message was not initially received by AGL. This was overcome by phone conversations on the day, however.

¹ Source – Guardian Australia <https://www.theguardian.com/australia-news/live/2020/jan/23/nsw-fires-live-updates-victoria-bushfires-south-australia-fire-sa-australian-bushfire-near-me-cfa-rfs-latest-news-today-thursday>

When the initial activation message was issued to participants, there were a several negative replies due to the emergency response environment already active on the day. These included:

- A telecommunications company that had received an instruction from NSW Emergency Services prohibiting the use of backup diesel generators except in cases where grid power was down. This prohibition covered both urban and rural sites and prevented backup generators being used for RERT.
- A water utility that had just been given permission to pump water from local catchments to townships that were in crisis due to water restrictions and had to take advantage of that pumping time.
- A water utility that had already curtailed load as it had received an earlier instruction to do so directly from the NSW Government, bypassing AEMO. AEMO was unaware that this instruction had been issued.
- Some shopping centres declined to participate due to air quality issues from bushfire smoke.

Analysis of the event afterwards showed the expected underperformance from these loads. In the case of the shopping centres, this was also exacerbated by the long three-hour event in heat-wave conditions, and the fact that the event occurred on a Thursday evening, with a previously identified baseline problem emerging whereby shopping centres are penalised due to different closing times on different days of the week. There were also questions about whether the event messaging SMSs had been received at all the sites, possibly because of issues in the SMS network caused by the bushfire emergency. The shopping centre portfolio actually contributed a significant negative DR result during this event, which worsened as the event went on.

As has been previously identified, a shopping centre that closes around 5:30pm on Monday, Tuesday and Wednesday will baseline poorly under the AEMO RERT baseline for an event on Thursday evening when it closes much later, despite clearly shedding load during the event. Likewise, on a one-off extremely hot day, the significantly increased underlying load from the shopping centre air conditioners later in the day may not be reflected correctly in the same-day adjustment in the baseline calculation, causing an under-measurement of demand response. These adverse baseline effects have been described in more detail in AGL's earlier NSW Demand Response Knowledge Sharing reports.

Results for the event are shown in Figure 4.

	MWh	Average MW	Interval 1 MW	Interval 2 MW	Interval 3 MW	Interval 4 MW	Interval 5 MW	Interval 6 MW
Portfolio	13.14	4.38	8.99	6.41	4.94	3.41	1.72	0.82

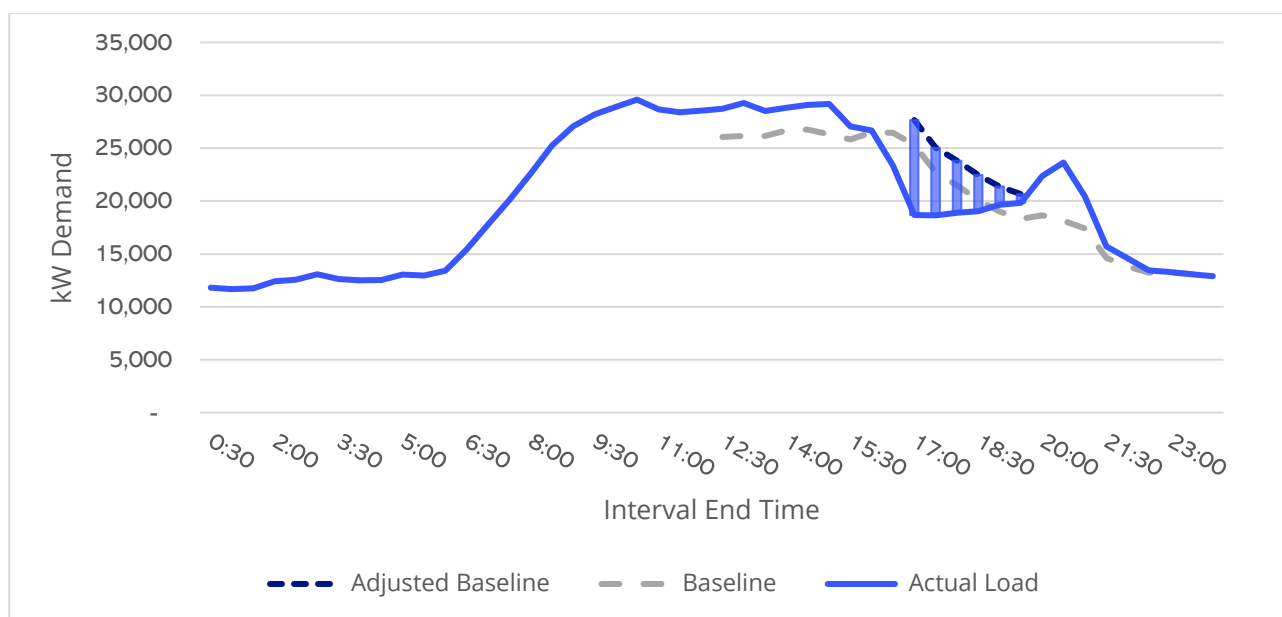


Figure 4 – Results of dispatch event 23 January 2020

Whilst the results show what was no doubt a useful demand reduction on the day, it was well below the expected performance of this portfolio under non-emergency conditions and it fades significantly towards the end of the event, mostly because of the shopping centres.

The result for the shopping centre component of the portfolio is shown in Figure 5. Other than the first interval, the contributed DR was negative throughout the event, worsening to a maximum of -5.5MW as the event continued.

	MWh	Average MW	Interval 1 MW	Interval 2 MW	Interval 3 MW	Interval 4 MW	Interval 5 MW	Interval 6 MW
Shopping Centres	-9.57	-3.19	0.66	-1.61	-3.07	-4.27	-5.33	-5.53

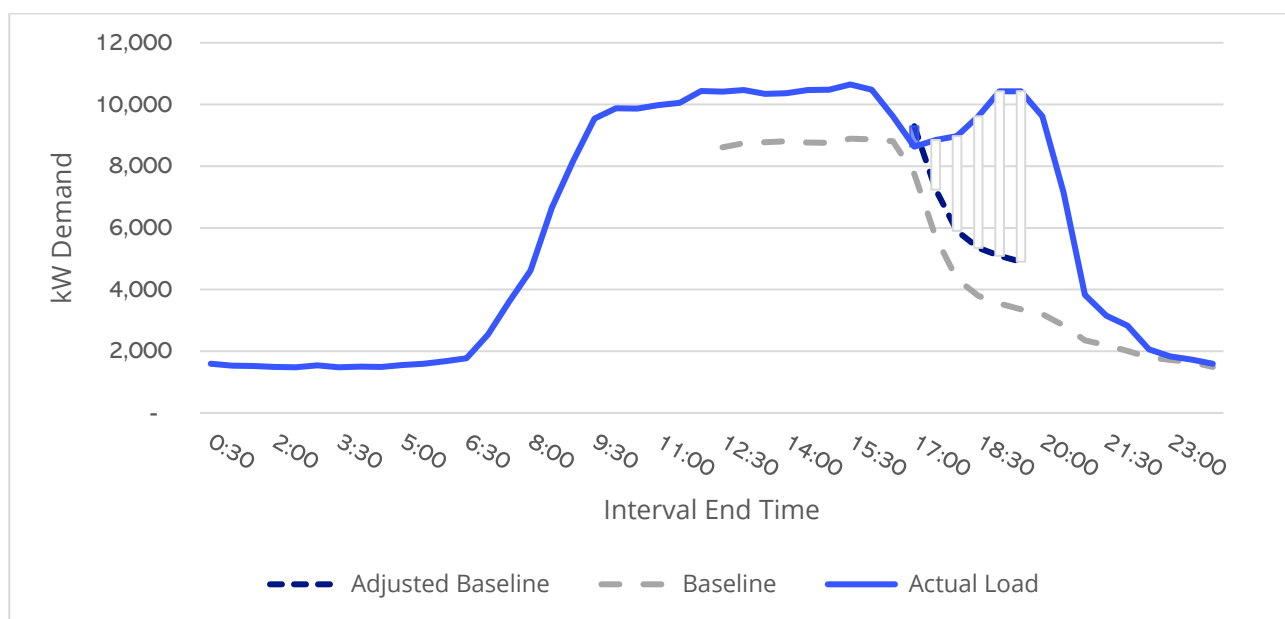


Figure 5 – Negative result for shopping centre portfolio 23 January 2020

Following this event, and after analysing the results and speaking further with participants, AGL further adjusted its NSW RERT availability to 10MW in the AEMO portal.

31 January 2020

On 31 January 2020, destructive winds destroyed or severely damaged seven transmission towers on the Victoria – South Australia interconnector, separating the Victorian and South Australian power networks, islanding the Mortlake Power Station and Macarthur Wind Farm, and tripping the Portland Smelter. This resulted in a LOR2 lack-of-reserve condition in Victoria from 15:00 to 18:00 NEM time, plus frequency stability issues and other consequent problems across the NEM.²

² AEMO Final Report – Victoria and South Australia Separation Event on 31 January 2020
https://aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2020/final-report-vic-sa-separation-31-jan--2020.pdf?la=en

In moving to stabilise the Victoria/NSW/Qld part of the grid following this incident, AEMO issued an ITT for AGL's NSW RERT portfolio at 4:16pm AEDT, followed by an activation notice at 4:59pm AEDT. This notice was for 10MW of load reduction for the period 17:00 to 21:00 NEM time. At 8:29pm AEDT the event was shortened to finish at 19:30 NEM time, as AEMO judged that the reserve was no longer necessary.

Sydney weather on 31 January was hot with a maximum of 32.4 degrees, with 41.2 degrees in Penrith.

The same emergency conditions that had been there for the 23 January event were still in place for this event, including the constraints on pumping and backup generator operation, leaving the declared 10MW as the maximum possible demand response available from the portfolio. However, bushfire conditions had abated slightly (54 fires burning with 28 not contained)³ and the weather was marginally cooler along the coast. Accordingly, the result for this event was better and very close to the declared availability of 10MW.

Results for this test are shown in Figure 6.

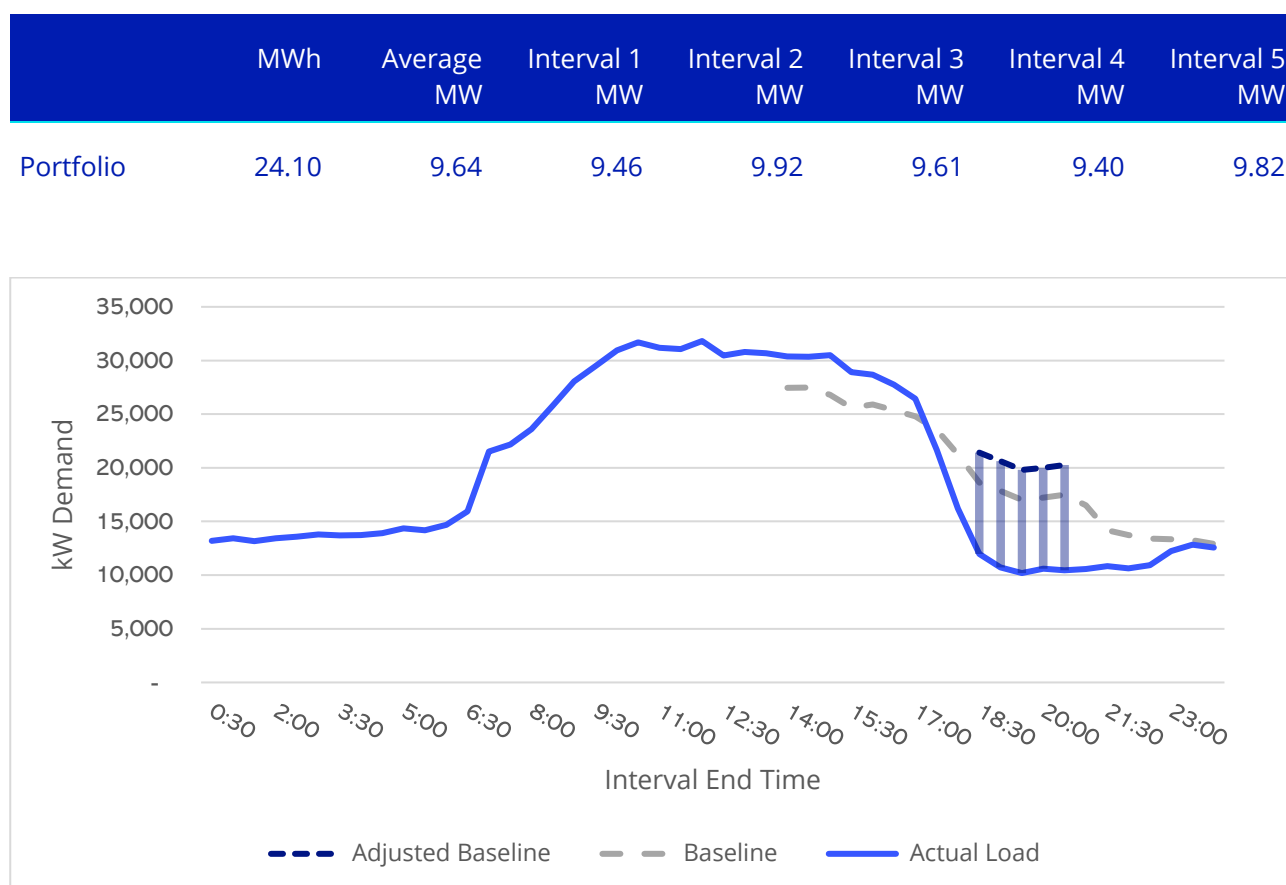


Figure 6 – Results of dispatch event 31 January 2020

³ Source – Guardian Australia <https://www.theguardian.com/australia-news/live/2020/jan/31/canberra-fires-live-updates-act-bushfires-nsw-australia-fire-near-me-heatwave-weather-forecast-latest-news>

On 17 February 2020, after an easing of bushfire conditions and further analysis and discussion with portfolio participants regarding asset availability, the availability of AGL's NSW RERT portfolio was returned to 20MW in the AEMO portal.