



NSW Demand Response

ARENA Knowledge
Sharing Report

September 2018



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This report describes AGL's progress against the objectives of the ARENA Demand Response Trial in NSW and is submitted in partial fulfilment of AGL's knowledge sharing obligations to the project's funding partner, ARENA. AGL also wishes to acknowledge the NSW State Government funding contribution to this program.



1 Context

As Australia's energy markets continue to evolve, the nature of the supply and demand relationship is changing. Customers are playing an increasingly important role, driving a shift away from the traditional linear electricity supply chain to a more decentralised and bi-directional market.

The ten pilot projects funded by the Australian Renewable Energy Agency (ARENA) and the Australian Energy Market Operator (AEMO) under the Demand Response Initiative demonstrate one way in which Australia's future energy markets could empower customers to participate in the ongoing management of Australia's electricity system whilst supporting the distribution network and wholesale electricity market.

Australia's National Electricity Market (NEM) was established on the basis of thermal capacity and, in most cases, assumes that demand is relatively inelastic and that dispatchable thermal generation is able to meet demand. The increased penetration of renewable energy is now revealing the limitations of the NEM's thermal-centric design. As the generation mix changes to incorporate a growing amount of renewable energy, demand for energy services and supplementary markets will become increasingly important to ensure security, reliability and system resilience.

In the future, the grid could facilitate a range of service markets for customers rather than simply enabling the consumption of electricity delivered from centralised plant. As one such service, demand response could play an increasing role in balancing supply and demand.

In the national energy policy debate, policymakers are continuing to assess how best to facilitate demand response in the wholesale market. While policymakers need to carefully balance the role of demand response in managing exposure to peak demand against the costs of procuring these resources in advance of high demand events, it is likely that demand response will play an enduring role in Australia's future energy markets.

The development of a mature demand response market is also fundamentally about enhancing customers' energy experience and ensuring that customers can realise the value of customer-owned distributed energy resources. AGL considers that innovation and competition in technology and business models will be a primary means of aligning the interests of energy services providers with those of the customers they serve. The effectiveness of any demand response programs therefore depends upon the extent to which these service offerings can harness and respond to customer behaviour to incentivise participation.

In October 2017, AGL was awarded funding under the Demand Response Initiative to deliver 20MW of demand response in NSW by 2020. This report is the first Knowledge Sharing Report as part of the three year project. The project has already revealed a range of insights in residential and commercial and industrial demand response that could be built upon to enhance the effectiveness of demand response programs in the future.

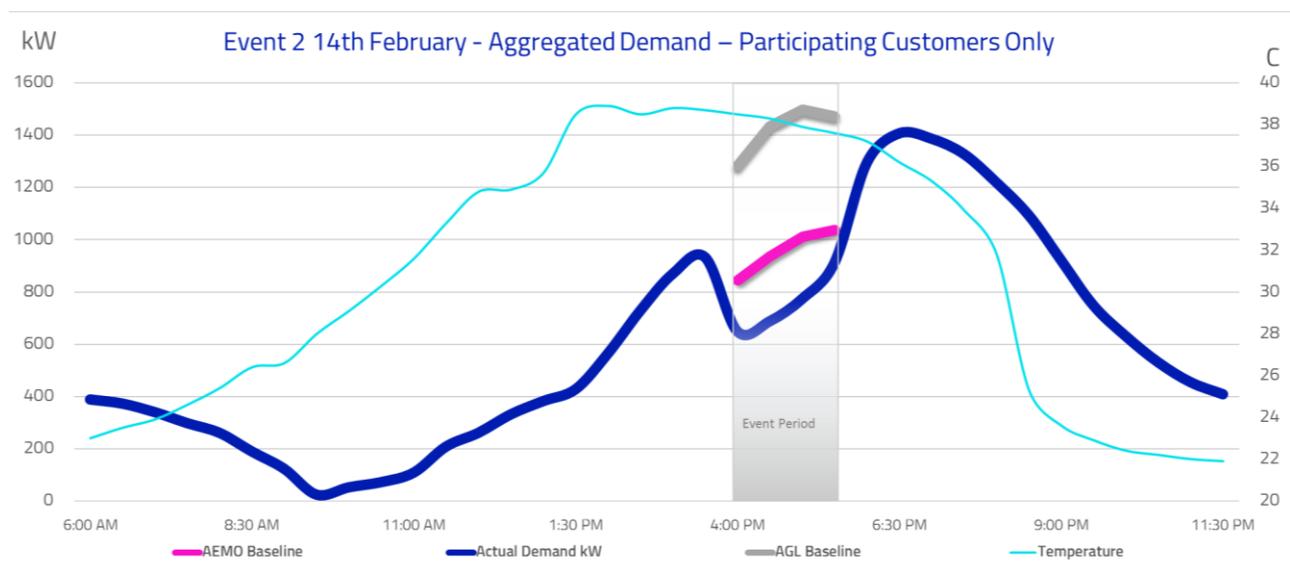
2 Executive Summary

2.1 Residential Demand Response

AGL's [Peak Energy Rewards](#) program was launched in November 2017. 750 customers were recruited, and the program went live on 2 January 2018 with a New Year SMS message welcoming participants.

Although customers were formally participating as part of the AEMO SN RERT program, AGL elected to trigger its own 'Peak Events' to maintain customer engagement and start collecting program insights. AGL executed four Peak Events, one per month from January to April 2018, in which customers were asked to reduce consumption over a two-hour period. The selected Peak Event days were business days with forecast high temperatures in order to mimic the most likely conditions during a potential RERT event.

The graph below shows the largest aggregated response achieved, which was during an event held on a day when the Sydney CBD temperature reached 39°C. Participating customers reduced an average of 1.35 kW per customer across the 4:00pm to 6:00pm period (NEM time). The average aggregate demand response achieved was 0.67 MW¹.



¹ According to AGL's baseline calculation methodology. For further information refer to Section 3.1.9.

While it is too early in the program to draw conclusions on the firmness of behavioural demand response, indications are that such programs can make a meaningful contribution, particularly on extreme temperature days.

Key insights developed across the four Peak Events were that:

- Roughly one third of customers reduced consumption a lot, one third reduced a little and one third exhibited no change from their expected load profile.
- The top 10% of performers were responsible for between 50% and 57% of the total energy reduction of all participating customers.
- The aggregate MW reduction from an event on a 39°C day was almost double that achieved on the other three event days when the temperature was 32 – 33°C, with very similar participation rates.

Following the launch of *Peak Energy Rewards*, AGL launched a subsequent program – *Peak Energy Rewards Managed For You* – giving customers the option of having their own device, such as an air conditioner, remotely triggered during a demand response event. In exchange for allowing AGL to control these devices, customers are paid a financial incentive.

The *Managed For You* program was initially launched in February 2018 with air conditioner control, involving retro-fitting air conditioners with a Demand Response Enabling Device (DRED). The program was expanded to electric vehicles in March 2018 using smart charging stations.

Despite offering more substantial financial rewards compared to the behavioural demand response program, AGL found that recruiting customers to the *Managed For You* program more challenging as the customer was required to cede control of their device.

AGL has found the recruitment of existing residential air conditioners and the retro-fitting of DREDs under current Australian Standards a complex technical challenge. The installation phase took longer than anticipated and AGL was not able to run any Peak Events for this trial cohort before the end of summer 2017-18. However, these customers are contracted in the program until the end of March 2019, allowing Peak Events over the coming summer.

The EV customer trial group participated in one successful event in June 2018. Key insights were:

- EV home charging is a potentially significant and highly deferrable load
- EV owners are supportive of efforts to manage the impacts of their charging on the grid
- Deferring charging until the end of the DR event has the potential to create a new peak that is larger than the one replaced.

2.2 Commercial and Industrial Demand Response

After signing ARENA and AEMO agreements in Oct 2017, AGL contracted commercial and industrial customers to provide 10 MW of demand response from 1 December 2017, increasing to 17 MW in January 2018.

Over the course of the reporting period, the portfolio has been tested three times as summarised below:

Date	NEM Time	Event Trigger	Result (MW)
23 Feb 2018	14:30 – 15:30	AGL test	17.13
28 March 2018	13:00 – 15:00	AEMO SN RERT test	15.39
26 June 2018	16:30 – 18:30	AEMO SN RERT test	17.74

The program has so far demonstrated processes for the rapid recruitment of participants and successful execution of participant communications for DR responses in test events. Several barriers have been identified in the implementation of DR technology on customer sites, however this has not impacted the effectiveness of the program to date.

The program has also identified shortfalls in the current AEMO baseline calculation methodology that disadvantages temperature sensitive loads and fluctuating or intermittent loads, and has identified challenges in maintaining an effective year-round DR portfolio.

3 Residential Demand Response

3.1 'Peak Energy Rewards' Behavioural Demand Response

AGL launched *Peak Energy Rewards*² in November 2017. The program has revealed a number of key customer insights on customer motivation, recruitment, churn, communication and segmentation.

3.1.1 Customer Motivations

AGL's internal research and surveys have highlighted the following motivations driving customers to participate in demand response:

- Reducing overall spend on energy (primary motivation)
- Helping to ensure the community is never without power (secondary motivation)
- Reducing energy consumption and helping support the transition to renewable energy (secondary motivation).

Our research has illustrated that customers who participate in demand response have an awareness of energy use and are proactively looking for ways to reduce their bills.

3.1.2 Customer Recruitment

AGL's demand response program drew upon AGL's broad customer base in New South Wales including metropolitan and regional areas, pensioners and healthcare card holders. Customers were required to have an existing smart meter. Customers flagged for life support or bad debt were excluded from the recruitment campaign.

Customers were recruited using a digital-only approach until the target of 700 customers (+5%) was achieved. The recruitment campaign consisted of a targeted email linked to a registration form on the campaign landing page. Eligibility checks ensured customers were based in NSW with a smart meter before eligibility was confirmed and customers were onboarded to the program with a welcome email and welcome pack outlining program details and expectations. Customers were offered an incentive structure comprising a one-off \$50 to sign up, and an event reward of \$2 for each kWh reduced calculated from the customers baseline energy use.

AGL had a strong response to the recruitment. Given the upfront reward of \$50, the conversion was higher than average for new energy pilots.

Customers were asked to participate in four two-hour events on 19 January, 14 February, 19 March and 13 April 2018. In the absence of AEMO triggered events, these events were initiated by AGL to maintain customer engagement with the program. Participation in the events was positive with more than 60% of customers reducing their energy usage.

² See further <https://aglsolar.com.au/peakenergyrewards/>. This landing page has transitioned from a recruitment page to a participation page over the course of the program.

Between 11% and 15% of customers responded to the post-event survey. From this cohort, more than 90% said they were either likely, or very likely, to participate in a future event.

3.1.3 Churn

From the original 756 customers in the program on 2 January 2018, three customers opted out of the program, and 27 customers churned away from AGL as their energy retailer and consequently left the program. Initial indications suggest slightly lower than the average AGL churn rate in this program cohort, potentially demonstrating a higher level of customer retention than normal over the program period. Quantification of retention benefits (if any) will require further analysis and time in market.

3.1.4 Communication

Previous research has shown that customers prefer to communicate using digital channels and, as such, we have used email and SMS extensively through the program.

For information sharing such as recruitment, on-boarding and performance summaries, customers have been happy with email, particularly for the post event summaries showing their performance during the event and their reward. This has been evidenced through the engagement in post-event surveys and customer interactions by email.

Event alerts were delivered via SMS, which proved successful for advising the timing of events. A restriction identified with SMSs was that the program participant, account owner and SMS recipient were not always the same person. This was identified as an opportunity for improvement in future years.

3.1.5 Customer Segments

Over time it became apparent that the trial cohort was skewed towards more progressive and engaged energy users, with many customers already motivated to use less energy.

Approximately 50% of the summer 17/18 cohort already had a solar system installed. Since only smart meter customers were eligible for the program, this cohort is naturally skewed towards solar system owners who must have a smart meter to access feed-in tariffs.

3.1.6 Events and Results

AGL triggered four Peak Events from January to April 2018 on business days when the forecast temperature was above 30°C. While it is too early in the program to draw conclusions on the firmness of behavioural demand response, early indications are that such programs can make a meaningful contribution to grid security, especially in high temperatures.

The communication process for summer 17/18 Peak Events was:

- A SMS message 24 hours before the event
- A reminder SMS message 15 – 30 minutes before the event start, with a link to AGL website for energy reduction tips
- A final SMS message immediately after the event, thanking the customer and with a link for a quick post event survey (which asks about participation, actions and comfort)

- An email 2 – 7 days after the event with the performance outcome (calculated using AGL's baseline methodology), confirmation of the reward for the event and accumulated rewards for all events to-date.

Peak event confirmed for Peak Energy Rewards program. Voluntarily reduce energy usage: Wednesday from 5pm to 7pm. Prioritise your health.



Customers may opt-in or opt-out of events by their actions and don't need to inform AGL of their decision (although they may self-report in the after-event survey).

The table on the next page shows the aggregated response from the customers in the program. The aggregate demand graphs for each event can be found in the Appendix.

	19-Jan	14-Feb	19-Mar	13-Apr
Day of Week	Fri	Wed	Mon	Fri
Event Time Period	4-6 pm	5-7 pm	5-7 pm	4-6 pm
Sydney CBD Maximum Temperature (degC)	33	39	33	32
No. of active customers in the program	750	742	732	729
Percentage of customers with measured energy reduction (according to AGL baseline)	61.7%	65.0%	59.7%	56.4%
Total portfolio reduction, including customers with measured reduction only (kW)	365	665	378	255
Per customer average reduction, including customers with measured reduction only (kW)	0.77	1.35	0.86	0.62
Survey responses stating no loss of comfort	96.7%	79.0%	90.7%	89.3%

Insights from the four events suggest³:

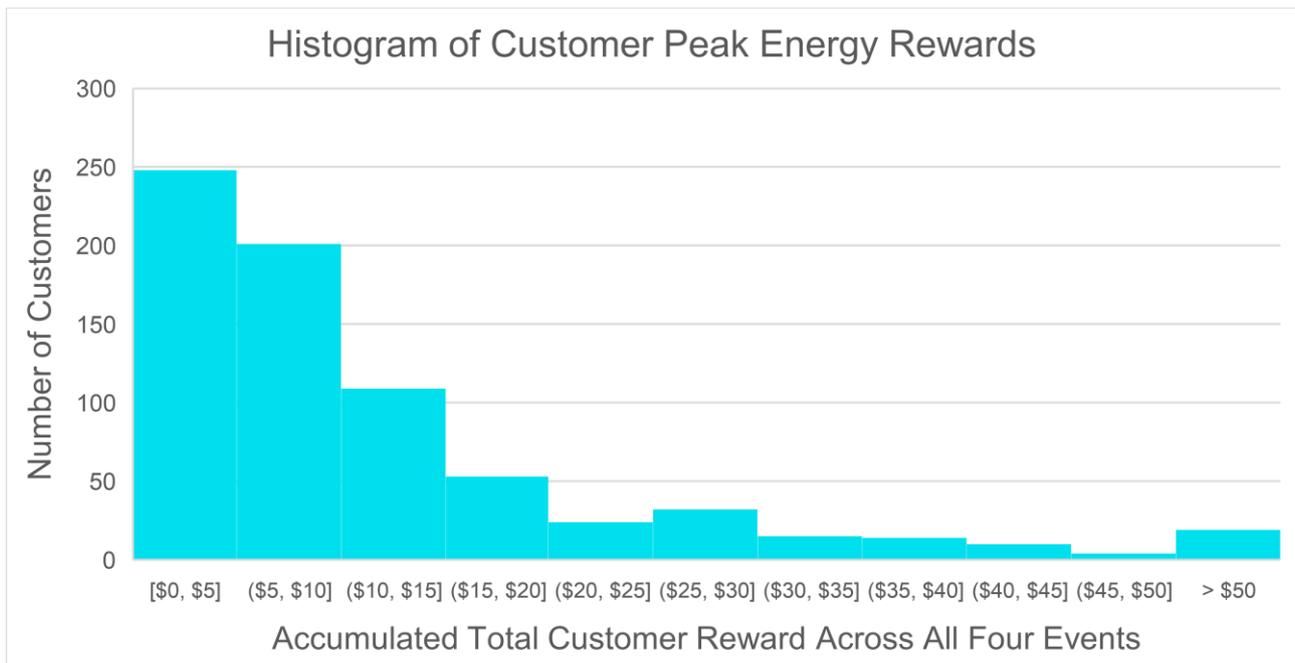
- Roughly a third of customers reduced consumption a lot, a third reduced it a little and a third did not depart noticeably from their expected usage.
- The top 10% of performers were responsible for between 50-57% of the total energy reduction of participating customers.
- The result from the event on a 39°C day was almost double the result from the other event days which were 6° – 7° cooler.
- There was a slight drop in participation from Event 1 to Event 4, suggesting that the ‘novelty factor’ may have worn off towards the end of summer.
- For a similar temperature day, Event 3 in the 5pm – 7pm period appears have improved performance over Events 1 and 4 in the 4pm – 6pm period.

3.1.7 Incentives

The average customer incentive across the four events was \$12 (customer incentives were rounded up to the nearest dollar). The highest performing customer received \$93 across the four events and the top 10% of customers received an average of \$43 across the four events. The bottom 10% of customers received \$2 across the four events, typically demonstrating a small measured energy reduction in only one of the four events.

³ Note: All results are expressed relative to AGL’s baseline methodology. See Section 3.1.9 for further information on baseline calculations.

The figure below shows the distribution of rewards for the 729 program customers that remained in the program for its full duration.



Program feedback suggested that many customers consider the monetary value of their rewards to be insignificant but explained that this wasn't their primary motivation for participating. Others explained that 'every little bit counts' and even small rewards were valued.

3.1.8 Overall Impressions

Participants expressed overall very high levels of satisfaction with the program. Approximately 40% of the total program cohort responded to the end-of-summer survey, with the headline results being:

- Would recommend the program to others (90% agree)
- Satisfied with the overall program (85% agree)
- Fairness of incentives according to effort (80% agree)
- Understood the incentive calculation (70% agree).

Many reported that the program was simple and easy to participate in, and would like to continue in the program after the end of the trial. Many saw it as having a low impact on their life, from both a behavioural change and reward perspective, but were motivated to continue because of the potentially larger impact across the total group of participants.

3.1.9 Residential Baseline

A key challenge of any demand response program is the estimation of how much energy would have been consumed by a customer if they had not taken any reduction measures. This estimate is called the baseline.

Under the SN RERT program, AEMO supplies the baseline formula against which the aggregate demand response is measured, however it is up to the aggregator to determine how each individual customer should be incentivised to meet the overall portfolio objectives. For AGL's residential portfolio, we used an in-house baseline methodology to calculate the result for individual customers, developed from a previous demand response trial conducted in Carrum Downs, Victoria.

The AGL baseline averages the usage at a particular time of the day for days of a similar temperature over the last five weeks (differentiating usage on a week day or weekend) and anchors it to the actual consumption before and after the event. It is calculated using the following steps:

- Generation of a site level forecast based on regression of the previous five weeks net load (load – solar) excluding any controlled load channels against temperature, time of day and workday/non-workday
- De-biasing by comparing the previous seven days forecasts against the actuals for the same time of day as the event period and adjusting the event period baseline forecast
- Anchoring the predicted consumption outside the event period to the actual consumption on that day, based on smoothed consumption either side of the event period.

While AGL's baseline performed very well across the four events, some discrepancies were detected. False positives occurred when the baseline methodology detected a reduction for customers who did not actively change their behaviour, and false negatives occurred when the baseline methodology did not detect a reduction for customers who genuinely changed their behaviour, including customers who actively left the house earlier in the day to avoid being home during the event.

A key challenge of a variable baseline methodology is that under different temperature and household energy use scenarios different results will be achieved, ie the same behaviour change or action may produce a different monetary reward from event to event. As seen in the results, energy reduction is highly temperature dependant. This represents an interesting challenge for demand response programs – while variable incentives are designed to reward customers more on hot days to compensate for the potential impact to comfort, they can also introduce confusion and disengagement if customers do not understand the complexities behind them.

A key benefit of the AGL baseline, however, is that it appears to perform equally well for both solar and non-solar households.

3.1.10 Event Participation

There was a discrepancy noted between the customer's perceptions of event participation and the actual results. 40% of end-of-summer survey participants had a measured energy reduction for all four events according to the AGL baseline, however 62% self-reported as 'participating' in all four events.

There may be several reasons for this discrepancy. Some customer's perception of 'participating' may involve actions that do not have a measurable impact, for example turning off a few lights. In some situations, the baseline methodology may not have detected genuine attempts at energy reductions, or some customers may not have accurately remembered the number of events they participated in by the time the end-of-summer survey was conducted.

3.2 'Managed For You' Load Control Program

The *Managed For You* program allows customers to nominate their own device, such as an air conditioner, to be remotely triggered in a demand response event. In exchange for allowing AGL some level of control of these devices during Peak Events, customers are paid a financial incentive.

The *Managed For You* program first launched with air conditioner load control in February 2018⁴, involving retro-fitting air conditioners with a Demand Response Enabling Device (DRED). The program was expanded to electric vehicles in March 2018⁵, deploying smart charging stations to electric vehicle owners in NSW. These two initial trial cohorts were both incentivised via a \$300 trial participation reward and a \$30 flat incentive for participation during a Peak Event.

AGL recognises that global technology trends are creating potentially low-cost, high-value opportunities to intelligently manage behind-the-meter distributed energy resources (DER) and is exploring how these might translate to the Australian energy market. In particular, electric vehicle charging is a large, deferrable load which could be shaped if incentivised and intelligently managed. However, at this stage, AGL has found that complex customer and technology challenges exist in the deployment of DER orchestration.

Despite offering more substantial financial rewards than the behavioural demand response program, AGL has found that successfully recruiting customers into a program requiring the customer to give up some level of control has a number of challenges. One of these has been the willingness of customers to be at home during business hours to meet the installation contractor.

3.2.1 Participant Recruitment – Air Conditioner Program

In addition to the base program eligibility criteria of AGL NSW customers with a smart meter and not flagged for life support or hardship issues, customers were targeted for the air conditioner program if they had higher than average energy consumption, high energy use on hot days and were located in the Sydney metropolitan area. The recruitment campaign consisted of a targeted email linking to a registration form on the campaign web page.

There was a positive response to the recruitment, however, despite offering an upfront incentive of \$300, the response rate was significantly less than the Peak Energy Rewards (behavioural) program which had an upfront incentive of \$50. While AGL initially had 123 enrolments in the Managed For You – AC program, only 58 were subsequently confirmed and 45 successfully proceeded to final installation. The primary reason for this reduction was the air conditioner not being compatible with Australian Standard AS 4755, rendering customers' assets incompatible with DREDS and therefore not possible to remotely control in this manner.

⁴ <https://agsolar.com.au/managedforyou/> (Note the landing pages for both air conditioners and electric vehicles have transitioned from a recruitment to participation pages over the course of the program.)

⁵ <https://agsolar.com.au/managedforyou-ev/>

3.2.2 Participant Recruitment – Electric Vehicle Program

The electric vehicle trial participants were similarly recruited via a targeted email campaign to selected NSW AGL customers on an existing Electric Car Plan. 24 registrations were received with 14 customers proceeding through to installation of a smart charging station.

Key insights gained through the electric vehicle recruitment process were as follows:

- EV owners are highly engaged and connected to their peers, with conversion from email to registration of 40% and 16% of recipients forwarding the recruitment email to a friend.
- Despite initial interest, many applicants did not proceed and 25% of registrations did not reply or commit to the formal participant agreement.

Once eligibility was confirmed, customers were onboarded through a welcome email and welcome pack that outlined the program details and expectations. Once customers were sent the welcome pack they were considered part of the program.



3.2.3 Event Results

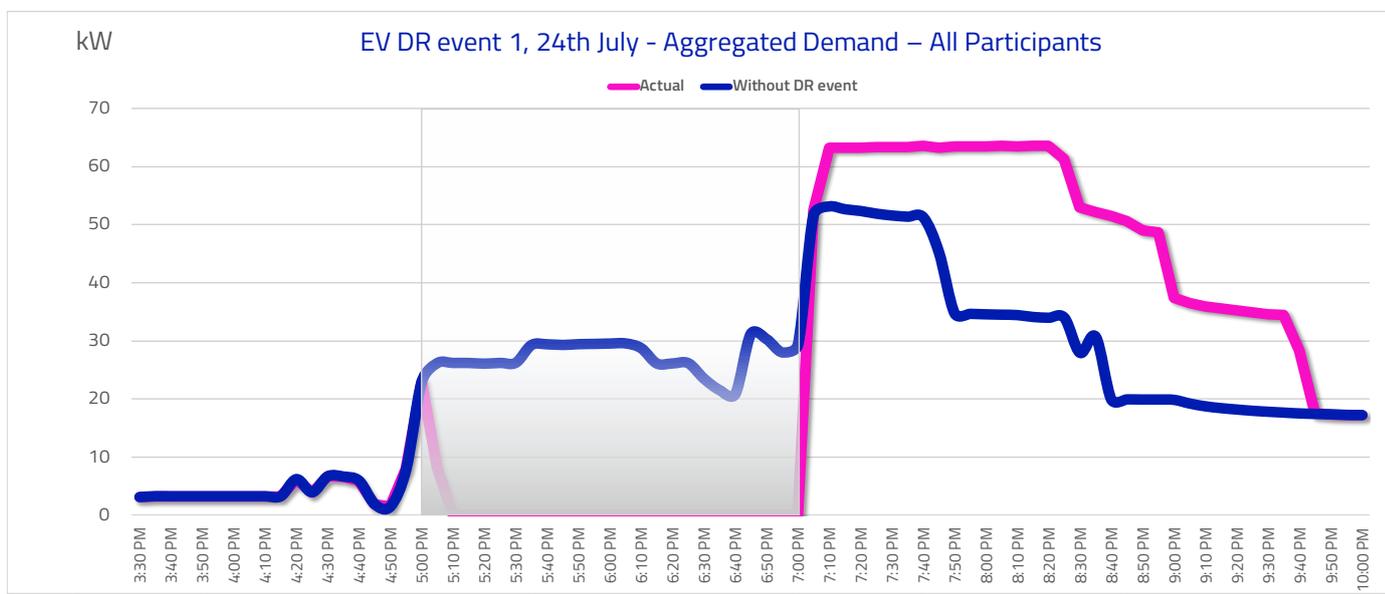
No events have been run for the air conditioner program to date.

For the *Managed For You – Electric Vehicle* program, one Peak Event was staged between 5:00pm to 7:00pm on Tuesday 24 July 2018. Any vehicles plugged in and charging at the time had their charging activity remotely curtailed at the outset of the DR event and recommenced at the end of the event. Any vehicles returning home during the event had their charging deferred until the end of the event.

Participant communications were:

- An SMS alert delivered 24 hours before the start of the event, including an opt-out via email
- A Chargefox app notification at the start of the event, including an opt-out via a button in the app
- A Chargefox app notification at the end of the event
- An SMS message with a survey link five minutes after the end of the event.

The remote charge management solution was successfully demonstrated. For the 14 participants in the EV group, the charging activities of seven (50%) were deferred to the end of the event, translating to a 30kW load reduction.



Survey responses were received from six participants, a 43% response rate. These indicated:

- The primary reason for participating in the program was to help manage EV charging impacts on the grid. (83%)
- High levels of awareness of the event, primarily via the SMS notification. (100%)
- Generally high levels of confidence and understanding of what happened during the event and what could be done in response (67%). (Note: There were some issues with operation of the app that contributed to a lack of confidence/understanding in some cases.)
- High levels of comfort having car charging managed. (100%)
- High levels of support for the program and a willingness to recommend participation to others. (100%)

Key insights from the first EV DR event were:

- EV home charging is a potentially significant and highly deferrable load.
- EV owners are supportive of efforts to manage the impacts of their charging on the grid.

- Deferring charging to the end of the DR event has the potential to create a coincident peak where all of the charging is initiated at the same time.

AGL has commenced discussions with distribution network service providers around the preferred approach to managing charging at the end of a DR event.

3.2.4 Technology

AGL deployed the following technology for the *Managed For You - Air Conditioner* program:

- Wattwatchers DRED for remote AC control using DRM commands as per Australian Standard AS4755. AGL polls the DRED API every minute to see the current state of the device and dispatches event controls remotely via an event schedule.
- Wattwatchers Auditor 6W for disaggregated circuit current measurements. The Auditor provides a near-real-time data feed to monitor each site. For each device, AGL polls the Wattwatchers API every five minutes.
- MClimate 'Melissa' Smart A/C controller provides eligible split-system air conditioning customers with remote control of the air conditioner via a smartphone app. Importantly, this allows customers the ability to pre-cool their house, even if they are not home. AGL receives the temperature and humidity data.
- Zen Thermostat provides eligible ducted air conditioning customers an opportunity to remotely control their air conditioner with a smartphone app. This also allows customers to pre-cool their house even if they are not home. AGL receives the temperature and humidity data.
- AGL has developed inhouse software for near-real-time monitoring of individual sites and the overall portfolio, and to initiate demand response commands. The Auditors allow AGL to monitor in real time during an event.

For the *Managed For You – Electric Vehicle* program, AGL has deployed the following technology:

- Schneider EV Link Smart Charging station
- ChargeFox app, including DR functionality developed for the AGL project. This allows AGL to schedule Peak Events and for customers to remotely opt out of events if they desire.

3.2.5 Technology Issues in the Air Conditioner Program

AGL anticipated some AS4755 compatibility issues prior to customer recruitment and therefore restricted eligibility for the program to customers with:

- air-conditioners less than five years old
- makes and models of air-conditioner that AGL could cross-check for compatibility with AS4755 prior to visiting the site.

In practice it was very difficult for many customers to find the model number of their air-conditioner. Often the required information was on the nameplate on the outdoor unit which may not be safely accessible. AGL had to email and/or call customers repeated times to obtain the relevant air-conditioner make/model information, which created a significant workload in the onboarding customers to the program. A further 10% of customer registrations were abandoned because customers gave up trying to find the information or could not be contacted by AGL.

Approximately 40% of customers that signed up had an air-conditioner that was not compatible with AS4755, so these customers were excluded from the program.

For those customers found to have an eligible air-conditioner make and model, site visits were arranged to install the equipment, however AGL encountered further complexities on site including:

- Compliance with AS4755 is not 'plug and play'. In many cases, an additional adapter from the OEM was required to interface between the DRED and the air-conditioner. There is no standardisation of adapter parts across brands, and many variants of adapters exist even across air-conditioners of the same brand.
- Many of the OEM parts did not have clear installation instructions.
- Some OEMs did not fully implement DRM as defined in AS4755 or the necessary translation of commands, requiring a bespoke approach to DRED installation.

In summary, the retro-fitting of DREDs to existing residential air conditioners uncovered many issues with compatibility, reliability, feasibility and cost. Due to the complexity of DRED installation, the time spent at customer sites was significantly more than planned, not only increasing costs but also proving an additional impost on customer's time.

From this experience, deployment of DREDs at scale is more likely to be achieved by integration of the functionality in new appliances rather than by retrofitting.

4 Commercial & Industrial

4.1 Recruitment

After signing ARENA and AEMO agreements in Oct 2017, AGL contracted commercial and industrial customers to support 10 MW of DR from 1 Dec 2017, increasing to 17 MW in January 2018. This demonstrated that Commercial and Industrial (C&I) loads can be rapidly contracted to deliver demand response.

AGL employed a direct marketing approach, contacting end-users in NSW who had either:

- a high peak demand
- previously participated in DR programs
- registered an interest with AGL to participate in DR programs.

There was no requirement for the customers approached, or ultimately contracted, to be AGL retail customers.

After the initial customer engagement, analysis of customer data was undertaken to estimate the customer's likely curtailment capability under the program. AGL has several inhouse algorithms capable of identifying prospective RERT providers based on load profile and capacity.

Most customers contacted had not previously participated in a demand response program. AGL found that almost all organisations contacted were aware of DR and had a general interest in participating, however it is still a relatively new concept and continued education and awareness programs are necessary to help source providers for future programs.

For most providers the financial incentive was the main motivator in joining the program, however some providers cited that being part of an ARENA program was a key motivator, and some of the State and local government owned bodies have participated largely because of the community benefit.

Sizeable curtailable C&I loads that can sustain a four-hour continuous outage have been challenging to enlist. AGL has also had difficulty identifying specifically commercial curtailable loads of an attractive size without the use of generators. Consequently, in the commercial area, AGL has focused on seeking smaller DR sources.

4.2 Current Status

From 1 January 2018 to the time of writing, AGL has had 17 MW of commercial and industrial load declared available to AEMO in the NSW SN RERT scheme.

4.3 Incentive Structures

For the ARENA SN RERT program, AGL approached C&I customers offering both an availability fee and a dispatch fee.

The availability fee is attractive to participants who need to prepare before DR events. It is also useful to remind DR providers that they are in a DR program. This is particularly important as our agreement with these providers is dependent on their participation and the only penalty for poor performance is a reduction or loss of payments.

The availability fee is paid monthly and reset after each test or dispatch to reflect the capacity provided from each NMI at that time.

4.4 Customer Feedback

Feedback from DR providers has indicated the main reasons for joining AGL's program are that AGL offers:

- At least one hour's notice
- An agreement whereby providers can opt in or out, either partly (nominating specific NMIs) or entirely, without penalty
- No mandatory requirement for remote activation
- No up-front hardware cost (any hardware cost is covered by AGL/ARENA).

4.5 Customer Types & Location

AGL's C&I DR portfolio in NSW currently comprises 34 sites across the following industry sectors:

- Data centres (1 site)
- Telecommunications (3 sites)
- Shopping centres (11 sites)
- Manufacturing and recycling plants (4 sites)
- Water utility pumping stations and treatment plants (15 sites)
- A university campus (1 site).

Most of these sites are in metropolitan Sydney, with ten water utility sites and two shopping centres in country NSW.

4.6 Technology

AGL is in the early stages of implementing demand response hardware and software. We have selected a software platform together with DR hardware to be deployed at each site, providing real time monitoring and potential automation of loads. To obtain metering data, the hardware is connected to the site revenue meter or alternatively the site's building management/control system.

In practice AGL has encountered several barriers to the deployment of the DR hardware in the field, including:

- 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 operations – many metering points across a geographically dispersed area – makes it impractical to install hardware at every site
- The cost of the hardware and installation is not economic for many smaller sites (ie the cost is higher than the benefit that the site delivers to the program).

Under the current commercial arrangements, there is no direct financial benefit for customers if they consent to the installation of DR technology at their site. Indirect customer benefits may flow from the provision of real-

time meter data, however many sites have their own control systems and/or energy management systems so additional demand response technology provides little benefit. AGL is working to address these barriers and provide a technology solution that makes it easier for C&I customers to participate in DR programs.

For sites where installation of DR hardware has not been possible, AGL has employed various monitoring methods including:

- Direct login to customer energy management systems to access real-time data
- Daily csv files via FTP (file transfer protocol) from the site metering provider
- Screenshots from the site SCADA system
- Day-behind meter data from the AGL database (for AGL retail customers)
- Manual collection of meter data files from customers and/or their metering providers (for non-AGL retail customers).

Whilst these solutions have worked adequately in to date, we continue to explore options to improve communications and access to data.

4.7 Event Communications

Communication with participants before, during and after an event (or test) is primarily achieved through email and SMS, with the message content pre-formatted and sent from a common system. One exception to this is a participant who has requested a custom format of email message to match their internal processes; this is currently dealt with manually.

Participants are requested to confirm their participation in the event to an AGL DR email address, and most do this. Some also respond via SMS, which is also acceptable although it requires more effort by the dispatcher to identify the respondent.

Participants also have the phone number of the AGL dispatcher and can call if necessary. In the case of large participants with multiple sites and/or plant items to coordinate, the AGL dispatcher will often call the participant directly to discuss details of the dispatch and ensure that the process is running smoothly.

From the SMS/email system, there are two main messages that a participant will receive:

- 1) A “pre-notice” message, indicating that a DR event may occur at a particular date/time. This instructs the participant to be prepared for the event, but not to activate the DR until further instructed.
- 2) An activation message sent one hour before the event start time, instructing the participant to activate the DR at the nominated start time.

These are supplemented by some secondary messages which are sent when necessary:

- 1) A cancellation message that is used if an event is cancelled either before or during the event.
- 2) An updated pre-notice message may be sent if the proposed event time changes during the pre-notice period.
- 3) An “event finished” message, which is not part of our formal process but is sent more as a courtesy and thank you.

4.8 Test Results

Other than communications test and tests of individual customers, there have been three full tests of the AGL C&I portfolio in the reporting period. The results are summarised below:

Date	NEM Time	Event Trigger	Result (MW)
23 Feb 2018	14:30 – 15:30	AGL test	17.13
28 March 2018	13:00 – 15:00	AEMO SN RERT test	15.39
26 June 2018	16:30 – 18:30	AEMO SN RERT test	17.74

4.8.1 AGL Test – 23 February 2018

An AGL initiated load-drop test of the NSW C&I portfolio was conducted on Friday 23 February 2018 at 14:30 NEM time (3:30pm AEDT) for one hour. Sydney weather on the test day was 27°C and partly sunny, with 32°C recorded at Penrith.

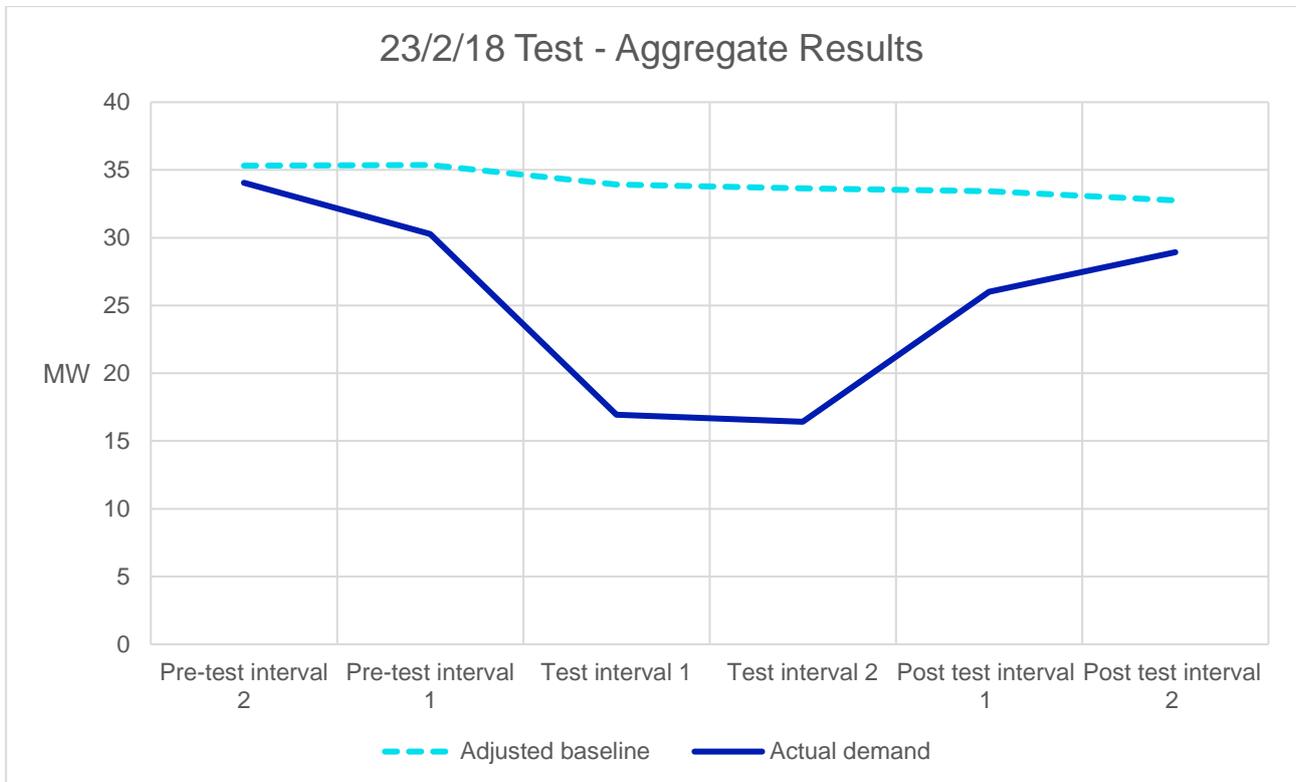
The test used the normal communications process for a real event, comprising:

- A pre-notice sent at 4:00pm the previous day indicating that a DR event was possible the following day.
- An activation notice sent one hour before the start of the event.

All entities in the portfolio at the time participated in the event, except for:

- a) One site for whom we already had solid test data that confirmed the expected load curtailment, and for whom the activation process had already been well tested. This capability was also confirmed in the later AEMO tests on 28 March and 26 June when this site performed slightly above target.
- b) One participant for which the hours of operation of the loads were outside the test time. This entity participated on the basis of a comms test only.
- c) One site that had a shortage of personnel on the day due to illness and withdrew at the one-hour activation notice.

To emulate a real AEMO event, the data from the test was analysed using the AEMO benchmark formula. Including the load from (a) above but excluding the loads from (b) and (c), the test achieved an average curtailment across the two intervals of 17.13 MW, confirming the availability listed with AEMO.



In general, the load curtailment of the individual participants was as expected. Some notable individual performances were:

- One water utility overperformed by about 30%
- Two water utilities underperformed by about 30%
- One industrial site overperformed by 25%.

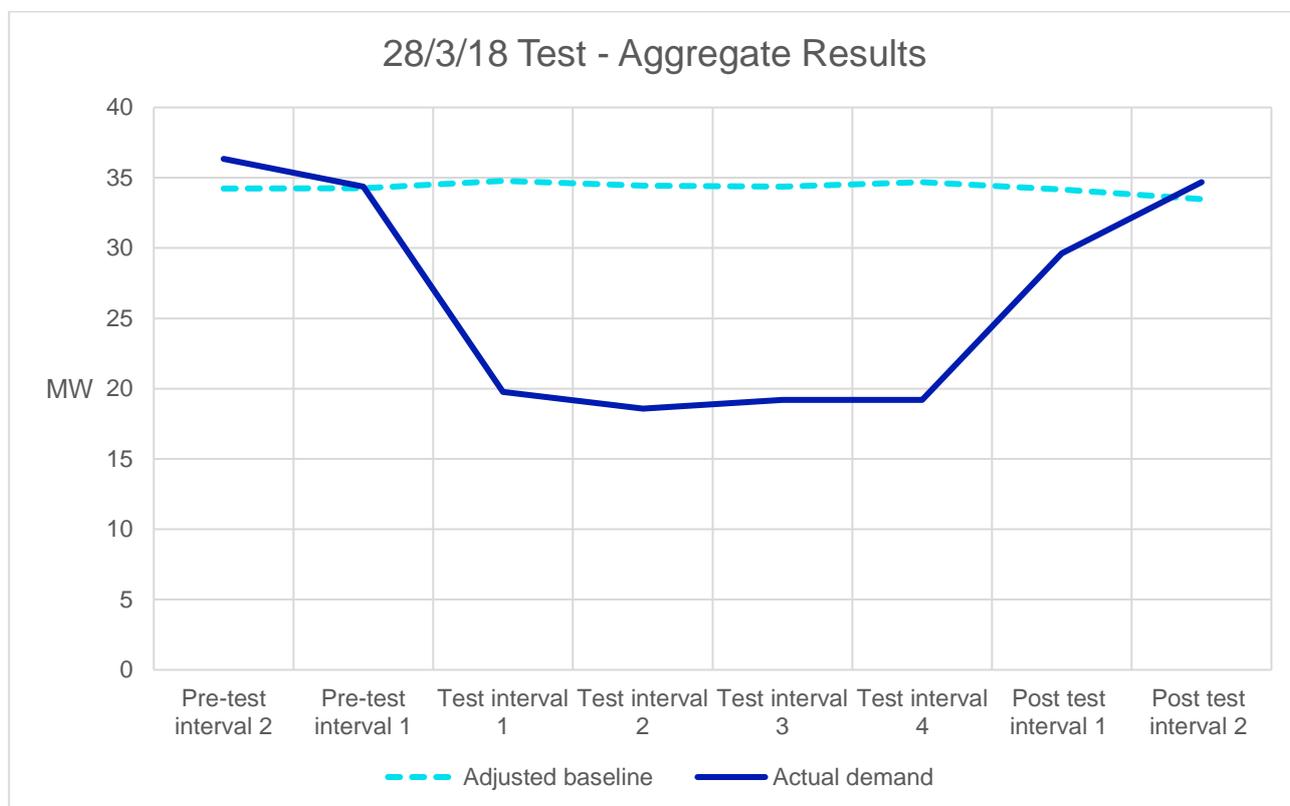
Water utilities have previously indicated that their performance may vary depending upon which processes are running on the day, so in that respect the +/- 30% from those participants was not unexpected.

The industrial site that overperformed has a somewhat intermittent load, so its expected performance was marked down as its baseline is generally lowered due to the intermittency. It was encouraging that it exceeded expectations on this occasion. The effect of intermittency on baseline calculation is discussed further in Section 4.9.

Shopping centre loads performed at the expected level and were not adversely affected by the benchmarking issues encountered in earlier dispatches under the Victoria LN RERT program, and described in Section 4.9, due to the reasonably mild weather and the timing of the test.

4.8.2 AEMO Test – 28 March 2018

An AEMO initiated test for the NSW SN RERT portfolio was executed by AGL on Wednesday 28 March at 13:00 NEM time (2:00pm AEDT) for two hours. Sydney weather on the test day was 27°C and sunny, with 30°C recorded at Penrith.



AEMO reported an average reduction 15.39 MW vs declared availability of 17 MW. Despite the weather being similar to that of the previous test, the aggregate load reduction was about 2MW lower and did not meet the target of 17MW.

Analysis of the data identified the major variations from the previous test as:

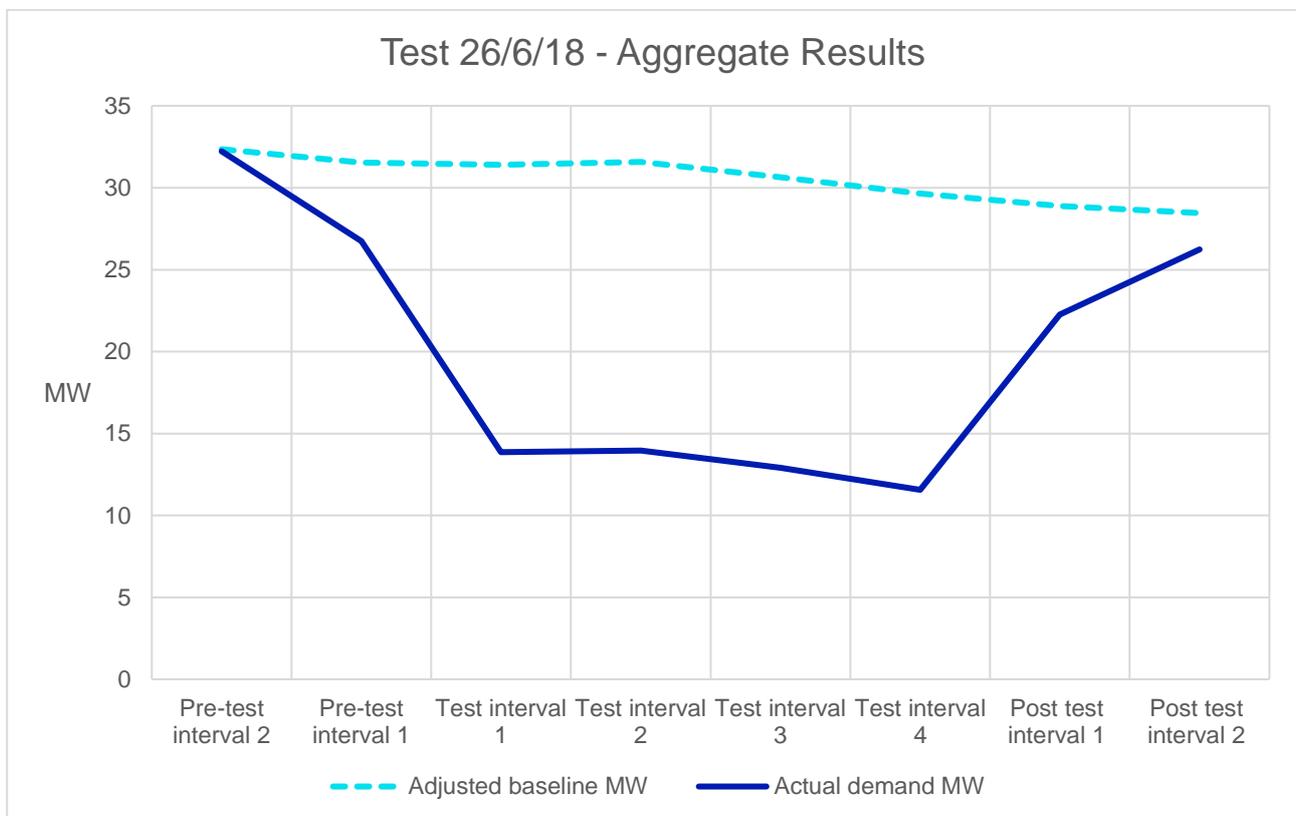
- The water utility that over-performed versus its nominal DR target in the previous test underperformed this time, resulting in a reduction of 2MW versus the previous test.
- One industrial site withdrew from this test at the pre-notice due to a requirement to complete a backlog of orders prior to the end of the month.
- A site that did not participate last time due to staff illness did participate this time, however its contribution was cancelled out by the shortfall from the industrial site above.

There were two main lessons from this result:

- 1) The fact that a water utility over-performed in the first test was not necessarily indicative of its future performance. As previously indicated, water utilities have flagged that their performance can vary by as much as +/- 30% depending upon which processes are running on the event day, and this is the variation observed between the two tests.
- 2) Industrial sites that participate through the mechanism of suspending production have a higher degree of uncertainty. For many industrial businesses, the cost of not producing for the duration of an event is significantly larger than the dispatch payments for the event. While increasing dispatch payments may partly overcome this, the cost to reputation and potential loss of customers due to non-delivery of product are generally much larger factors to a business. This may reduce the desire of businesses to participate in some DR events.

4.8.3 AEMO Test – 26 June 2018

An AEMO initiated test for the NSW SN RERT portfolio was executed by AGL on Tuesday 26 June at 16:30 NEM time (4:30pm AEDT) for two hours. Sydney weather on the test day was 19°C and partly sunny, with 18°C recorded at Penrith. This was considerably cooler than the previous two tests.



AEMO reported an average load reduction of 17.74MW as against the declared availability of 17MW, slightly above target.

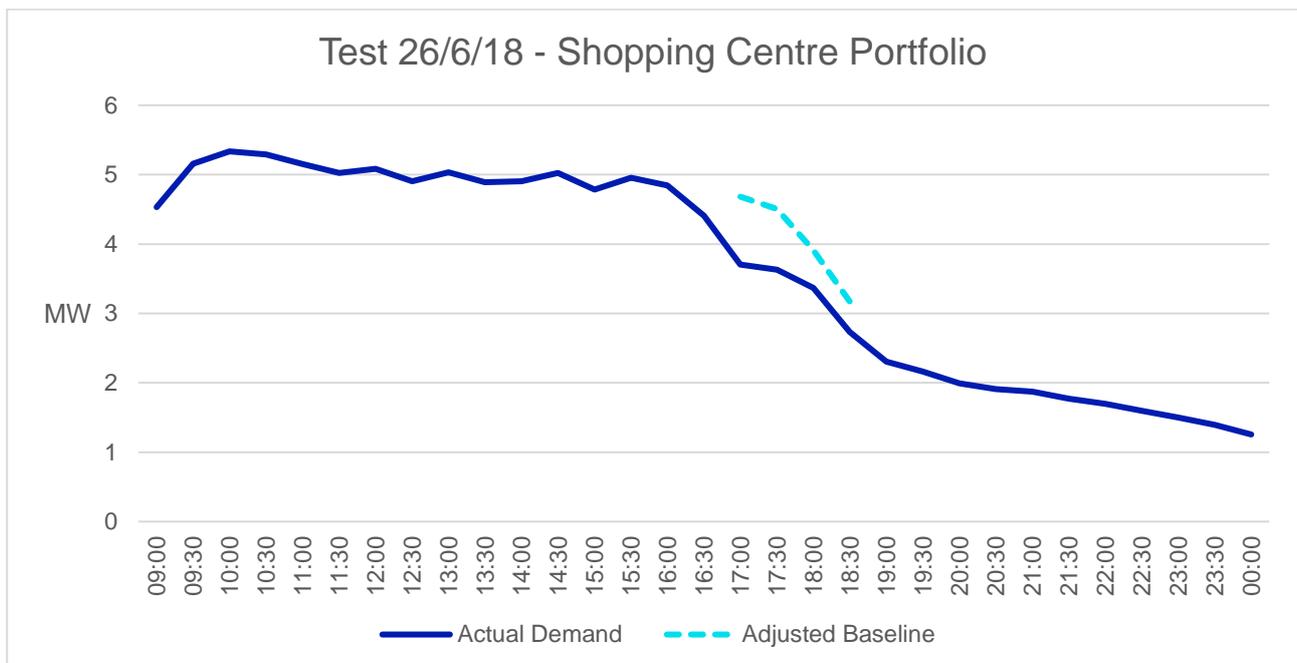
The main variations to the previous test were:

- A reduction by a factor of four in the average load curtailment of the shopping centre portfolio, and a marked diminution in that curtailment across the period of the test. This was due to the comparatively low temperature on the test day, together with the timing of the test during the period that the centres were winding down their HVAC systems in preparation for closing (closing time is typically 5:30pm or 6:00pm on Tuesday).
- The addition of a new industrial customer in the portfolio that contributed just under 2MW of load reduction.
- The return of the industrial customer that did not participate last time, adding 0.5MW.

Other participants, including the water utilities, achieved similar results to the previous test.

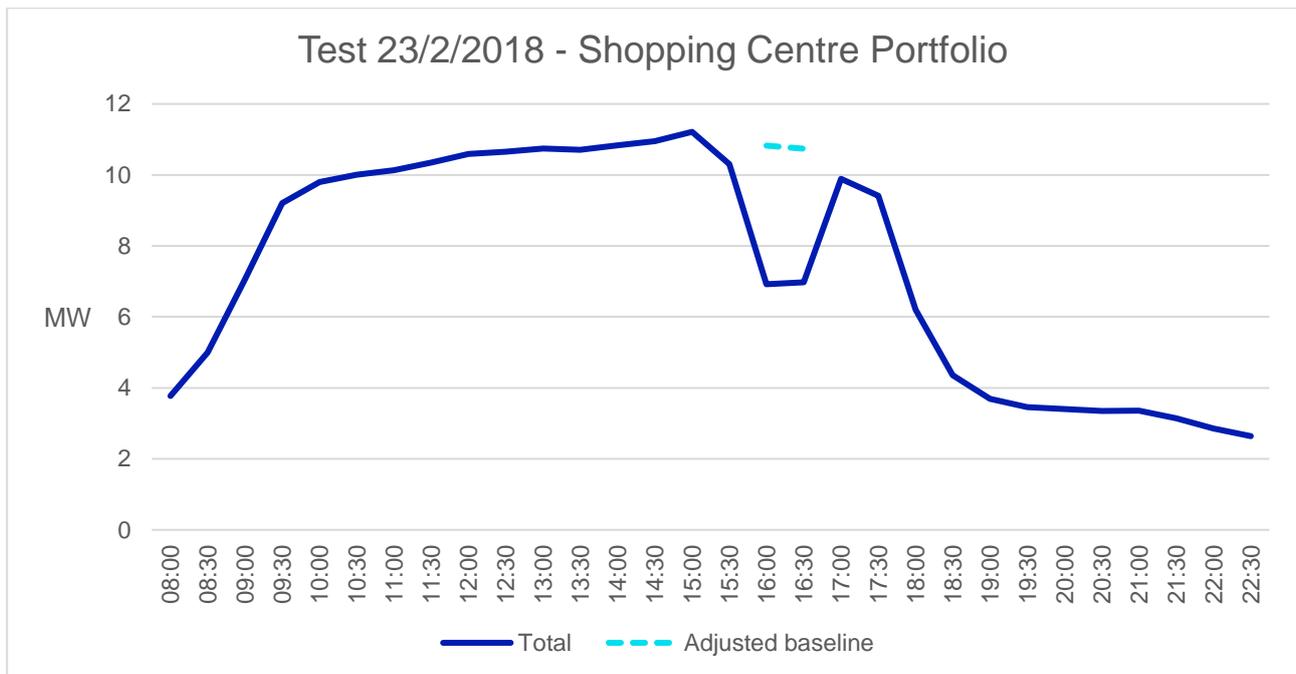
Discounting the movement of participants in and out of the portfolio, the main lesson from this test is the marked reduction in DR achieved by the shopping centres. There are two factors at play here:

- 1) Most of the curtailable load in shopping centres is from air-conditioning systems. The cooler weather means that these are not running at capacity and therefore there is less load to shed.
- 2) The test occurred between 4:30pm and 6:30pm. The shopping centres in the portfolio generally close to customers at either 5:30pm or 6:00pm on Tuesday and begin to reduce their HVAC load from around 4:30pm. The effect of this can be seen in the gap between the adjusted baseline actual demand curves for the aggregate shopping centre load, which reduces significantly across the four half-hour intervals from the beginning of the test to the end. This reduces the average load curtailment recorded by AEMO.



Contrast this with the result for the test on the same portfolio on 23 February, held during hot weather on a Friday (later shopping hours) and held an hour earlier in the day, where there is a much larger reduction in

demand. In this case the reduction was for one hour, but could have been sustained for two hours with little diminution:



The 26 June test illustrates the significant seasonal variation in that can occur with some loads in a DR portfolio. Testing at one point in time may not reflect the load available six months later. The example here is for a shopping centre portfolio, however the same result will occur with other commercial loads where the curtailment is predominantly air-conditioning. It may also occur for pumping loads with a seasonal component.

Maintaining a DR program over winter is challenging with these loads. A 20MW summer portfolio may be totally different to a winter portfolio, leaving the aggregator with significant work to do to adjust the portfolio throughout the year.

4.9 Data Collection & Analysis

Post-event data collection and analysis is an area that needs considerable streamlining in order to manage larger DR programs.

AGL does not currently have monitoring hardware installed in many sites for the reasons outlined in Section 4.6. Data for non-AGL customers comes in a wide variety of different formats from different meter data providers or from the customers directly. AGL has developed tools that work very well for collating and analysing the metering data already held for AGL retail customers, however merging this with the different data formats from non-AGL customers is currently a manual exercise.

In all cases AGL holds signed authorities from the customers giving permission for us to obtain their data from MDPs, however in many cases actually acquiring the data has been a problem requiring significant time and resources to resolve. Some MDPs do not provide data for DR programs at all and it has been necessary to

obtain the data from the local network business. It should be said that the customer service from a couple of meter data providers has been extremely good; conversely the performance of some others has been extremely poor.

In this respect it is encouraging that the COAG Energy Council is addressing this issue of accessibility and provision of meter data in the energy sector through the application of the Consumer Energy Data right.

4.10 Baseline Issues

Whilst the current baseline calculation method used by AEMO works well for some DR participants, it does not work well for others. AGL's experience with DR dispatches in the Vic/SA LN RERT program during summer 2017/18, and confirmed with testing in the NSW SN RERT program, demonstrated that the baseline is appropriate for flat and constant loads but discounts the DR provided from temperature sensitive loads and intermittent or fluctuating loads, despite these loads being valuable contributors in a DR event.

AGL has discussed this with AEMO and provided research and supporting data to ARENA for the purposes of a broader baseline methodology review.

4.11 Other C&I Demand Response Activity

Other than the ARENA/AEMO SN RERT program in NSW, AGL has been involved in several other DR activities during the reporting period:

- AGL participated in the AEMO LN RERT program in Victoria and South Australia from 1 November 2017 to 31 March 2018.
- AGL has pre-existing commercial relationships with large C&I customers for either mandatory or voluntary load curtailment. For clarity, AGL does not have any customers who participate in both SN RERT and an AGL market curtailment contract.

5 Appendix

