DEMAND RESPONSE SHORT NOTICE RERT TRIAL YEAR 3 REPORT

OCTOBER 2021

Australian Government
Australian Renewable Energy Agency

ARENA

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TERMINOLOGY

AEMO	Australian Energy Market Operator	ITT	Invitations to Tender
API	Application Programming Interface	LN	Long notice
ARENA	Australian Renewable Energy Agency	MW	Megawatt
BDR	Behavioural Demand Response	NEM	National Electricity Market
C&I	Commercial and industrial	NMIs	National Metering Identifiers
DER	Distributed energy resources	PV	Photovoltaic
DR	Demand response	RERT	Reliability and Emergency Reserve Trader
DVMS	Dynamic Voltage Management System	SMEs	Small and medium-sized enterprises
EV	Electric vehicle	SN	Short notice
FCAS	Frequency Control Ancillary Services	VPPs	Virtual power plants
IR	Infrared	WDRM	Wholesale demand response mechanism

PROJECT PAGE LINKS

PROJECT PARTICIPANT	PROJECT PAGE LINK
AGL	https://arena.gov.au/projects/agl-demand-response/
EnergyAustralia	https://arena.gov.au/projects/energyaustralia-demand-response-program/
Enel X	https://arena.gov.au/projects/enel-x-demand-response-project/
Flow Power	https://arena.gov.au/projects/flow-power-energy-under-control-demand-response/
Intercast & Forge	https://arena.gov.au/projects/intercast-and-forge-demand-response/
Powershop	https://arena.gov.au/projects/powershop-australia-demand-response-program/
United Energy	https://arena.gov.au/projects/united-energy-distribution-demand-response/
Zeno Ecosystems	https://arena.gov.au/projects/zen-ecosystems-demand-response/

1.0

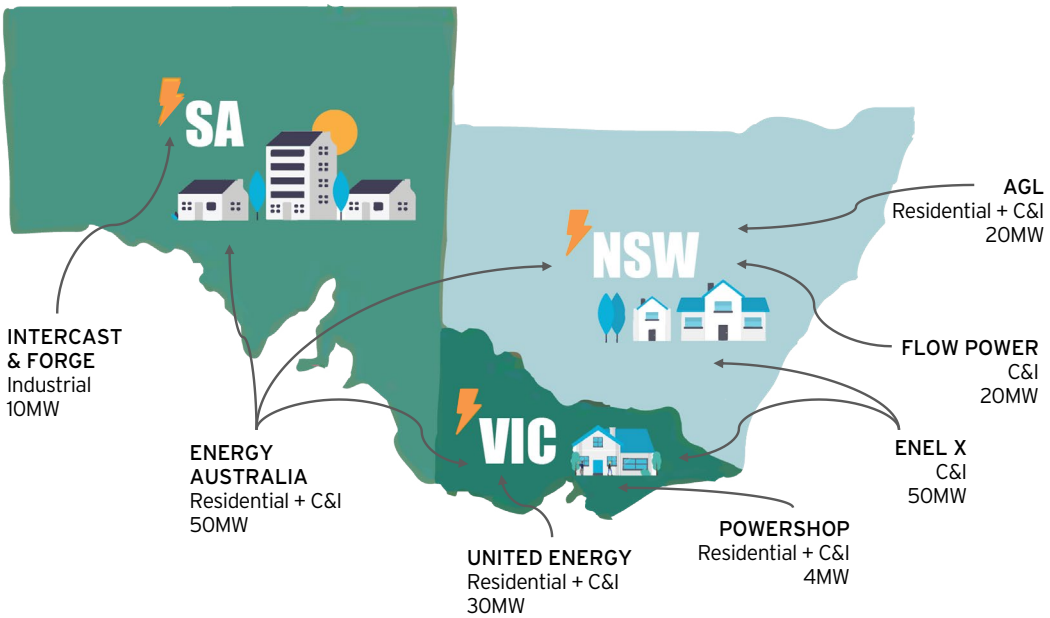
THE DR SN RERT TRIAL

1.1 ABOUT THE DEMAND RESPONSE SHORT NOTICE RERT TRIAL

In 2017, the Australian Renewable Energy Agency (ARENA) and the Australian Energy Market Operator (AEMO) entered a Memorandum of Understanding to jointly develop a series of 'proof of concept' projects supporting a secure and reliable renewable energy integration into the energy market. As part of this initiative, a three-year Demand Response Short Notice Reliability and Emergency Reserve Trader (DR SN RERT) Trial was established to explore innovative ways of managing the grid through demand response (DR). Each year of the three-year trial across 2017 to 2020 was separated into two periods – December to May and June to November[1]. Prior to each of these two periods, participants underwent a testing schedule, during which they were required to demonstrate their ability to deliver their contracted amount of DR capacity.

The DR SN RERT Trial was a $35.7 million program, spanning from 2017 to 2020. With funding of $28.55 million coming from ARENA and $7.18 million from the NSW Government, eight[2] organisations from NSW, SA and VIC participated in trialling 10[3] creative DR projects across both residential and commercial-industrial customer classes.

DR CONTRACTED FOR YEAR 3



1 See Table A in Appendix for the annual operating schedule.

2 Zen Ecosystems left the program at the end of Year 1.

3 Powershop offered a combined program across its residential and C&I customers.

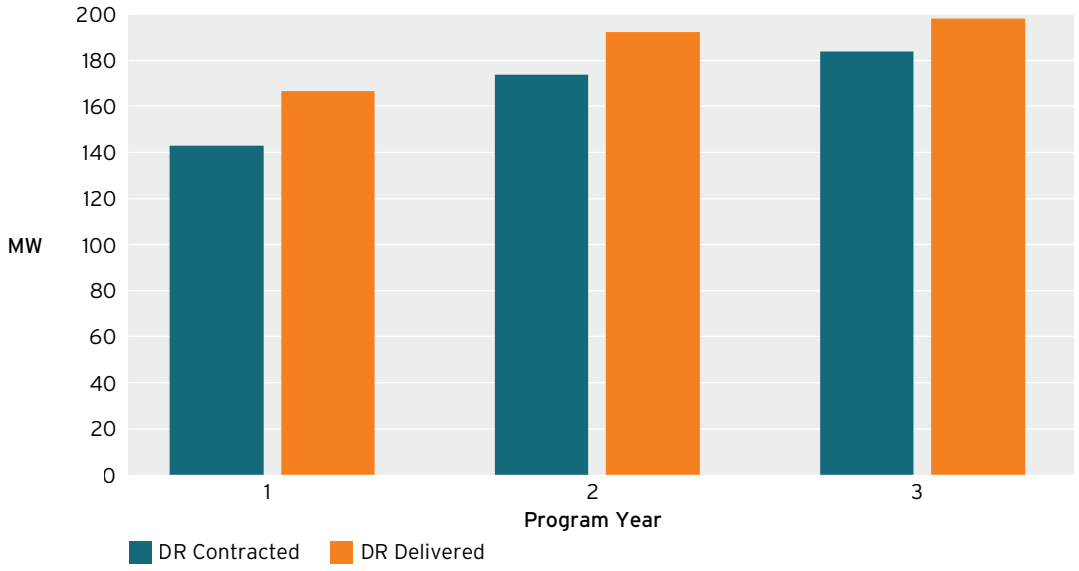
1.2 KEY OUTCOMES FROM THE DR SN RERT TRIAL

This report explores the key results and lessons learnt throughout the trial, including in the final Year 3, details of which will be discussed in the following chapters. Here, we present a summary of the trial's pivotal outcomes.

MORE DR DELIVERED THAN CONTRACTED

Figure 1 below shows the performance of the trial across the three years, in terms of the amount of DR capacity that was contracted and the amount of DR capacity that was delivered during the testing periods. As can be seen, the trial delivered more DR capacity in each successive year, and in each year the amount of DR delivered exceeded the amount that had been contracted.

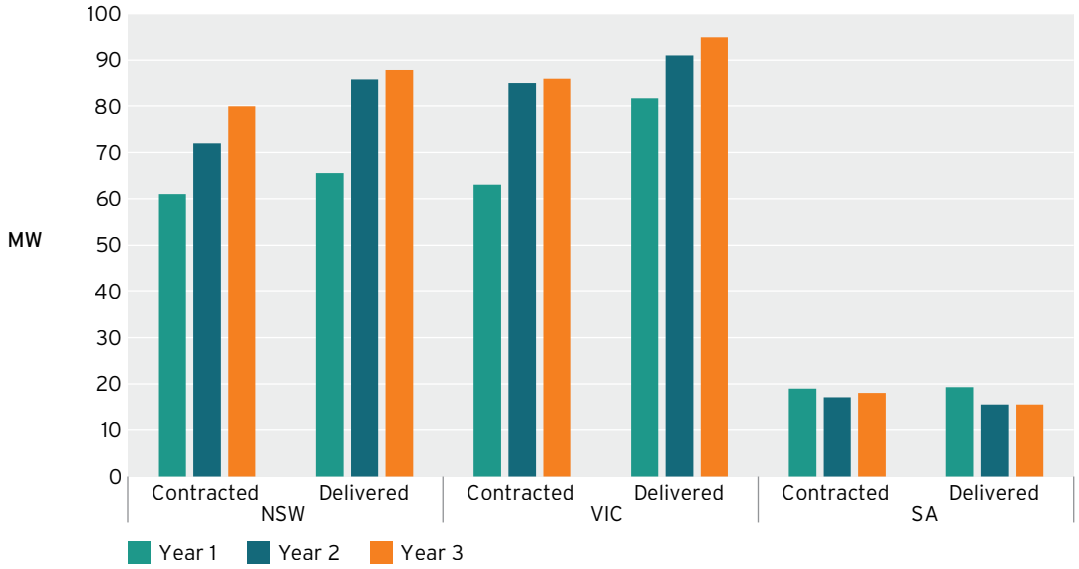
FIGURE 1: DR CAPACITY CONTRACTED VS DELIVERED IN EACH PROGRAM YEAR (MW)



See Table B in Appendix for the MW values behind Figure 1.

Figure 2 below shows that this pattern of over-delivery of DR capacity, as compared to the amount contracted, was also experienced at a state-level in both New South Wales and Victoria. Slightly different outcomes were observed in South Australia during Years 2 and 3, in which delivered DR capacity lagged the contracted volume. However, it should be noted that activity in South Australia was limited to two participants, and the shortfall was relatively small.

FIGURE 2: DR CAPACITY CONTRACTED VS DELIVERED BY STATE IN EACH PROGRAM YEAR (MW)



See Table B in Appendix for the MW values behind Figure 2.

Other key outcomes from the three-year program are summarised in the box below. For more details, please refer to Sections 4.0, 5.0 and 6.0.

KEY OUTCOMES AT A GLANCE: DR SN RERT TRIAL (2017-2020)

MORE DR DELIVERED THAN CONTRACTED

The trial delivered more DR capacity than had been contracted in each testing period in each year of the program.

RESIDENTIAL CUSTOMERS: BEHAVIOURAL DEMAND RESPONSE (BDR) HIGHLY POPULAR

All three of the participants that offered BDR programs in the residential sector significantly expanded these programs in Year 3 of the trial and plan to continue them, though possibly for use in the wholesale market rather than RERT. (Several participants also extended the BDR model to small business customers, but some technical issues still need to be refined before it can be implemented.)

RESIDENTIAL CUSTOMERS: DIRECT LOAD CONTROL LESS POPULAR

Despite high incentives (in some cases in the $200 to $300 range), very few customers expressed interest in participating in these programs. Customers were not particularly willing to cede control of their end-use equipment. More work is needed to better understand customer perceptions of external interference of their purchased service, such as in their use of air conditioning and vehicle battery charging.

COMMERCIAL-INDUSTRIAL CUSTOMERS: AUTOMATED TECHNOLOGIES YIELDED BETTER DR DELIVERY

Where automated technologies have been accepted by commercial and industrial (C&I) customers (as compared to the use of manual curtailment), there has been a significant improvement in the delivery of contracted DR and a high level of customer satisfaction. However, while automated DR delivers a higher percentage of contracted DR, it was not always applicable to all C&I customers. It was also the case that C&I portfolios without automation still almost always managed to meet or exceed their contracted volumes.

COMMERCIAL-INDUSTRIAL CUSTOMERS: POTENTIAL FOR DR TO CONTRIBUTE TO NATIONAL ELECTRICITY MARKET (NEM) OPERATIONS

Participants indicated that the trial had given them and their end-customers valuable experience with DR, and provided the opportunity for the participants to improve their processes and to identify more fit-for-purpose DR technology solutions.

COMMERCIAL-INDUSTRIAL CUSTOMERS: FROM PERIPHERAL ACTIVITY TO BUSINESS AS USUAL

Lessons learned in the trial have influenced participants to move DR from a peripheral activity to business as usual. For instance, interest has been expressed in exploring the potential for DR to shift loads and encourage new loads that address minimum operational demand conditions in the generation market, as well a localised over-voltage conditions in the distribution network.

2.0

DR PERFORMANCE IN YEAR 3 TESTS AND RERT EVENTS

2.1 OVERALL TEST PERFORMANCE

Two significant challenges affected the program in Year 3:

- The bushfires in the early part of Year 3 affected all three of the states in which the program had operating projects. This significantly impacted the ability of certain types of customers to provide the level of DR capacity they had contracted. These customers included those that had critical roles to play in combating the bushfires, such as water authorities and telecommunications providers, as well as those whose operations were disrupted as a result of the bushfires.
- The COVID-19 pandemic limited participants' efforts to recruit customers into their portfolios. The pandemic also reduced the participants' existing DR capacity when commercial and industrial (C&I) customer operations were shut down and stay-at-home orders reduced the flexibility of residential customers to respond to DR tests.

Despite these challenges, the DR projects of Year 3 managed to perform successfully. The lessons learned in earlier years were implemented to improve the performance of existing approaches and to expand participation to new customer segments.

Specifically, Year 3 continued the successful delivery of DR capacity that has characterised the program throughout its life. As in other years, Year 3 also saw the trial participants delivering more DR capacity than they were contracted for.

- Testing Period 5: Participants delivered 198.1 MW (110.1 per cent of the contracted capacity of 180 MW).
- Testing Period 6: Participants delivered 189.8 MW (103.2 per cent of the contracted capacity of 184 MW).

While there was a degree of variation in DR delivery against the contracted DR amount across the participants' portfolios[4], the number of participant portfolios that delivered more DR than their contracted capacity exceeded the number that failed to do so (6 to 3 in Period 5, and 7 to 3 in Period 6). The results are particularly noteworthy given the impact of the bushfires in New South Wales and Victoria in late 2019 and early 2020, and the pandemic which affected these states particularly heavily in calendar quarters 2 and 3 of 2020.

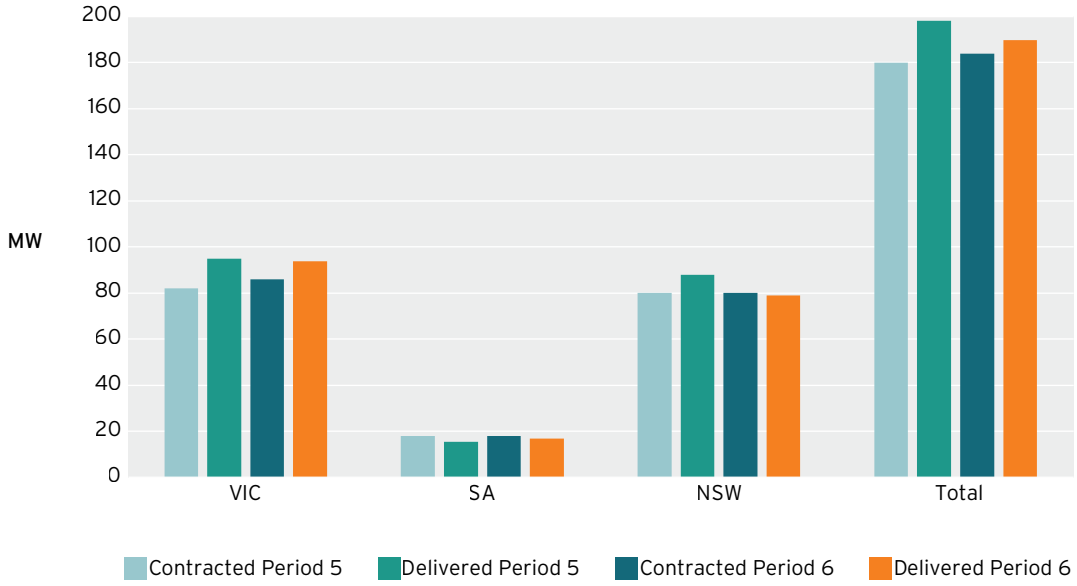
2.2 RESULTS BY STATE

Figure 3 below compares the contracted DR amount and test results for each of the Year 3 test periods by state.

As can be seen in the figure, in Victoria, the DR delivered in tests exceeded the contracted DR volume in both test periods. By contrast, test results fell short of the contracted volume in both periods in South Australia. However, the contracted volume in South Australia was already quite small, and the shortfall, particularly in Test Results Period 6, was quite modest (only 6 per cent, just over 1 MW). On the other hand, in New South Wales, test results over-delivered in Period 5 but fell short by a small margin (1.2 per cent, 1 MW) in Period 2.

4 See Table D in Appendix for DR delivery variation.

FIGURE 3: DR CAPACITY CONTRACTED VS DELIVERED BY STATE FOR PERIODS 5 AND 6 OF YEAR 3 (MW)



See Table C in Appendix for the MW values behind Figure 3.

2.3 RESULTS BY CUSTOMER CLASS

As AEMO does not have access to information on the customer class associated with individual National Metering Identifiers (NMIs), and is principally interested in DR at the portfolio level, test results at the customer class level are only available where:

- a portfolio consists of a single class of customers, or
- the participant provides information on test results by customer class within their portfolio.

The following analysis of customer-class performance is the result of re-aggregating participant test result data:

- Performance of portfolios with only C&I customers – Enel X (formerly EnerNOC), Flow Power, and Intercast & Forge – are reported on a combined C&I basis as it was not possible to separate test result data within those portfolios between commercial and industrial customers.
- Test results for the remaining participants' portfolios – AGL, EnergyAustralia, Powershop, and United Energy – were able to be separated into the residential and combined C&I customer classes.

Key findings of the analysis of customer class performance were:

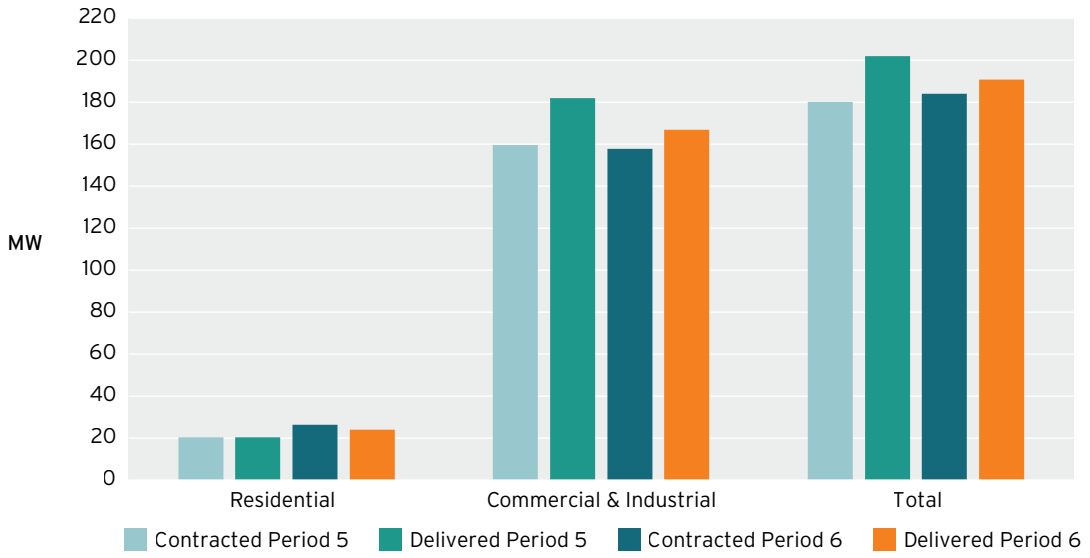
- As in the previous trial years, the majority of the DR capacity contracted and delivered in Year 3 came from C&I customers (see Figure 4).
- Over-delivery of contracted DR capacity in both testing periods arose primarily from the C&I portions of the participants' portfolios.
- Unlike previous years, delivered DR in the residential programs was only very marginally below the amount contracted[5].
- Overall, the Year 3 trial delivered more DR capacity than contracted for in both tests.

Evidence suggests that the baseline method used to calculate the amount of DR delivered is not well-suited to weather-sensitive loads and those loads that are materially impacted by the use of rooftop PV systems[6]. This, along with the comparatively small proportion of residential recruitment in MW terms, would have potentially affected the residential portfolios to a greater extent than the C&I portfolios.

5 Contracted volumes for residential programs were only explicitly reported by Powershop. Residential program contracted volumes were estimated for EnergyAustralia and United Energy, as they formed part of the capacity included in the participants' contracted volumes. By contrast, AGL did not include its residential portfolios in its contracted volumes and in the NMIs it included for testing by AEMO.

6 For more information on the challenges of developing baselines for rooftop PV systems, see Section 4.6 of Baselining the ARENA-AEMO Demand Response RERT Trial (September 2019).

FIGURE 4: DR CAPACITY CONTRACTED VS DELIVERED BY CUSTOMER CLASS IN PERIODS 5 AND 6 OF YEAR 3 (MW)



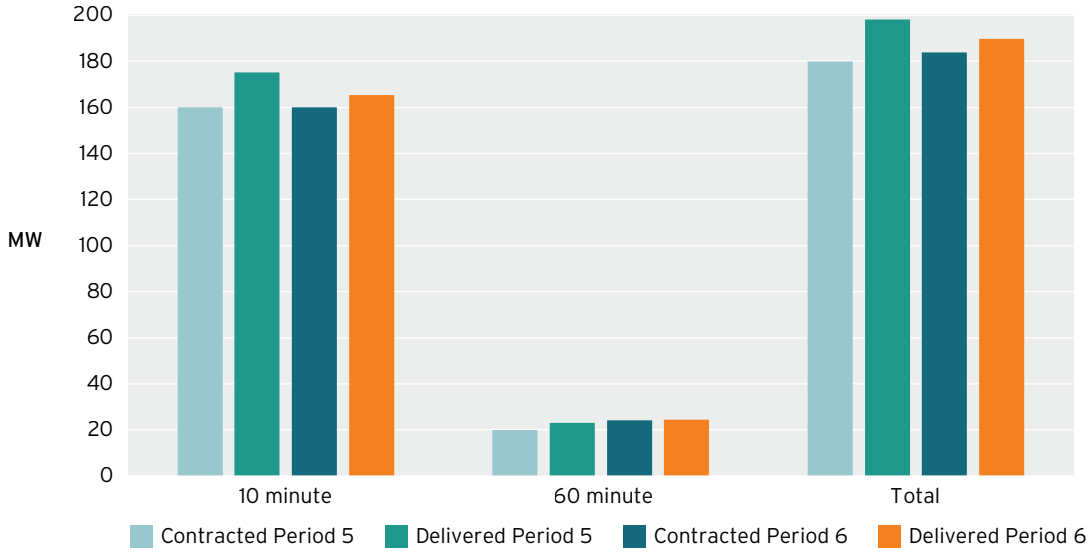
See Table E in Appendix for the MW values behind Figure 4.

2.4 RESULTS BY NOTIFICATION PERIOD

The results presented in Figure 5 show that the portfolios using a 10-minute notification period exceeded their aggregate contracted DR volume in both Testing Periods 5 and 6. This was also the case in Years 1 and 2.

Significantly, in Year 3, the portfolios using a 60-minute notification period met their aggregate contracted DR volume in both test periods. This was the first time this occurred over the course of the trial.

FIGURE 5: DR CAPACITY CONTRACTED VS DELIVERED BY NOTIFICATION PERIOD IN PERIODS 5 AND 6 OF YEAR 3 (MW)



See Table F in Appendix for the MW values behind Figure 5.

2.5 RERT ACTIVATIONS

During Year 3, AEMO activated RERT resources on five separate dates[7].

Four ARENA participants received Invitations to Tender (ITT) on one or more of these occasions, but only two (AGL and Powershop) were dispatched, as shown in the table below.

TABLE 1: RERT ITTS AND DISPATCHES OF ARENA PARTICIPANTS IN YEAR 3

RERT ACTIVATION DATE	STATE	PARTICIPANTS THAT RECEIVED ITTS	PARTICIPANTS DISPATCHED
30 December 2019	VIC	EnergyAustralia Enel X	None
04 January 2020	NSW	None	None
23 January 2020	NSW	AGL EnergyAustralia Enel X	AGL
31 January 2020	NSW	AGL Enel X	AGL
30 January 2020	SA	Intercast & Forge	None
30 January 2020	VIC	Enel X United Energy	None
31 January 2020	VIC	Enel X Powershop United Energy	Powershop

2.5.1 CASE STUDY: IMPACT OF BUSHFIRES ON AGL ACTIVATIONS

AGL was one of two participants that were dispatched by AEMO during Year 3 and, because of the bushfires in Victoria and New South Wales, AGL found that the available DR capacity was only about half of what it was contracted to deliver.

The 23 January 2020 activation occurred during the height of the bushfires in Victoria and New South Wales. AGL found that several its DR customers – particularly water utilities and telecom companies – were operating in emergency response mode and could not reduce their loads. Other customers were experiencing similar extenuating circumstances, such as a shopping centre that declined to participate due to air quality issues caused by bushfire smoke. Furthermore, the event took place on a Thursday at which time the shopping centres were open for later trading hours, which impeded their ability to reduce HVAC loads. This posed problems in performance measurement as the '10 of 10' baseline methodology[8] does not account for businesses having variable operating schedules.

7 On one other occasion, AEMO contracted but did not activate RERT resources. That was for both Victoria and South Australia on 30 January 2020.

8 The '10 of 10' methodology uses the consumption of the 10 most recent qualifying days to construct a 'baseline' that represents what the customer's consumption would have been expected to be if the customer had not provided DR. Qualifying days are days on which DR was not provided, and are weekdays in the case that the DR being assessed occurred on a weekday, or weekend days in the case where the DR being assessed occurred on a weekday. Public holidays are not included. For more information about Baselining the ARENA-AEMO Demand Response RERT Trial, visit https://arena.gov.au/knowledge-bank/baselining-the-arena-aemo-demand-response-rert-trial/

3.0

DEVELOPMENTS IN DR BUSINESS MODELS

3.1 OVERVIEW OF BUSINESS MODELS

In Year 3, participants continued to adapt, with alterations, expansions, and discontinuations more commonly occurring in the residential programs as compared to the C&I programs.

In the residential sector, program participation became highly skewed towards behavioural demand response (BDR) program designs. Participants undertook significant changes in their BDR programs, including in their recruitment approaches, incentive arrangements and information provision to customers. Significantly, each of these participants made decisions to continue to offer BDR programs after the trial ends, though not necessarily in the RERT.

The preference for BDR program designs, as noted in the Year 2 report, reflects the fact that BDR programs:

- allow almost all customers to participate
- do not require the customer to install any special technology (other than an interval meter), and
- allow the customer to retain complete control over their energy use and participation.

In contrast, the C&I sector experienced less change in the design and features of its programs. As in previous years, the most common type of program offered was based on load curtailment. However, Year 3 saw an increased level of customer acceptance of automated load control, as well as a diversification of the customer base. Similar to the residential sector, each of the participants in the C&I sector stated their intention to continue to offer demand response as part of their business.

3.2 RESIDENTIAL BDR PROGRAMS

AGL, EnergyAustralia and Powershop significantly expanded their BDR programs in Year 3. All three plan to continue their programs after the end of the three-year trial, having found value in them beyond their potential use in the RERT.

3.2.1 AGL

Year 3 saw an expansion of **AGL's Peak Energy Rewards BDR program** to slightly over 8,000 participants – more than doubling its 3,500 participants in Year 2 and increasing by a factor of 10 from its first group of 750.

The program experienced several significant changes, including:

- An earlier start and a more prolonged and tailored recruitment campaign resulting in 80 per cent of Year 2 participants re-signing for Year 3.
- A return to Year 1's use of a sign-on bonus ($10), coupled with three levels of reward for demand reduction (an initial level of $5, and two additional payments of $5 each for reaching two further load reduction targets). All payments for load reduction achievements were paid in the form of bill credits.
- Partial discontinuation of the in-event monitoring and feedback of customer demand reduction against the target. Access to this information was continued for Year 2 customers, but it was not made available to customers who were new to the program in Year 3. This change was based on Year 2 experience that, among other things, showed poor customer engagement with the in-event portal per event and a relatively poor expected financial returns given the value streams available under the RERT or anticipated to be available to DR in other applications (e.g., wholesale demand response, FCAS, flexibility services).
- Discontinuation of Year 2's deep learning method used to forecast customers' load, due to its high computation and time requirements. A simplified, three-tier target setting approach was adopted – Tier 1 for any level of reduction as compared to the baseline, and Tiers 2 and 3 set at 20 per cent and 40 per cent reductions respectively against the customer's baseline.

As in previous years, customers participating in AGL's BDR program showed a significant level of interest in participating in events, with a 70 per cent participation rate in AGL's first Year 3 event. Also, as in previous years, the results of the test events undertaken by AGL revealed that 20 per cent of its residential customers deliver 80 per cent of the demand reduction. Surveys undertaken with participating customers

were very positive — 96 per cent were highly satisfied with the program; 97 per cent said they would sign up for next year's program; and 90 per cent said the program made them more likely to stay with AGL.

Based on its experience in the program, AGL decided to expand its BDR program. When it opened the program in Victoria for the 2019-20 summer, 11,000 residential customers signed up. For the 2020-21 summer, the program had 50,000 participants across New South Wales, Victoria, South Australia and Queensland.

3.2.2 ENERGYAUSTRALIA

Year 3 saw a vast increase in the number of customers involved in EnergyAustralia's **PowerResponse BDR program** without an active marketing campaign. A decision to make eligibility in the PowerResponse program a standard feature of being an EnergyAustralia retail customer — along with their ability to opt out of specific events or unsubscribe from the program as a whole — contributed to much of this growth. Also contributing to the growth was a partnership that combined PowerResponse with the Power Changers BDR program that has been offered for the past several years in Victoria by the electricity distribution business Jemena. The combined program, which was called the Energy Saving Reward Program, was launched in December 2019 and provided the capability to observe the use of residential BDR to reduce peak demand

The above arrangements have resulted in there being 380,000 customers in the PowerResponse as at the end of December 2020. The first time the opt-out choice was offered to PowerResponse customers (in November 2020), only about 6 per cent of customers notified of the event chose to opt out.

Like AGL, EnergyAustralia changed the incentive levels it offered in Year 3 as the previous incentive levels were found to be financially unsustainable. All participating customers were rewarded $1 for any level of energy reduced in an event, as documented against the customer's baseline; and an additional $2 for each kWh of reduction.

EnergyAustralia noted that having a single incentive structure across all participating customers simplified the administration of the program, as well as made it financially more sustainable[9]. However, it also noted that it remains to be seen what impact, if any, this arrangement will have over the longer-term.

Nonetheless, EnergyAustralia found that customers who said they were aware of the availability of a financial incentive had a notably more favourable view of the program than those who were not aware of the incentive. However, the absence of a reward for participation did not necessarily lead to a negative perception. EnergyAustralia felt that this reflects the fact that customers understand and are motivated by the community benefits of the program.

As was the case with AGL's BDR customers, participants in EnergyAustralia's PowerResponse program registered a high level of interest in continuing with the program: 94 per cent said they would participate in future events. Presumably, the high level of customer satisfaction, the ability to simplify the administration of the program, and reduce its costs, all contributed to EnergyAustralia's decision to continue its residential BDR program. The company sees the best use of the program as being in relation to high wholesale electricity prices. It also decided to trial a similar program design for small business customers (see Section 3.4.2 for further information).

3.2.3 POWERSHOP

Powershop's **Curb Your Power (CYP) BDR program** was essentially unchanged in Year 3. CYP is an entirely voluntary opt-in BDR program that is open to all of the company's residential customers in Victoria who have a smart meter (except certain vulnerable customers, such as those with life support equipment). The program includes customers who have formally signed up to participate in the program, but also sends notices of all events to other eligible customers.

Customers who choose to participate in an event receive a $10 credit toward the purchase of electricity if they hit their 'curb target', which is defined as a 10 per cent reduction against their baseline, or a reduction of 1 kWh in every hour of the event.

Powershop notified 23,700 customers of a RERT event on 31 January 2020, approximately half of whom had formally signed up for the program. Just over 57 per cent of all those notified of the event participated and provided a total of 6.25 MW of demand reduction over the 3.5-hour event, exceeding the 4 MW that AEMO had requested. This represented an average reduction of 0.46 kW per participating customer. The participation rate and average demand reduction of the customers who had formally signed up for the program were both lower than those observed in the 'surprise' (on-event notification) group, but this may have been the result of the different time periods at which the two groups were dispatched. The fact that the second group was dispatched at a later time (17:00 to 19:00, as compared to 15:30 and 17:30 for the first group) may have meant that more of them were at home and were able to take action to reduce consumption.

By contrast in a test event on 29 October 2020, in which both groups were dispatched at the same time for

9 Incentives in Year 2 have been substantially higher: $10 for a reduction of 20 per cent to 49 per cent as compared to the baseline, and $20 if the reduction was 50 per cent or more. Customers could get another $5 for completing a survey at the end of the event.

2 hours, the group that had formally signed up to participate in CYP exhibited a slightly higher participation rate and average demand reduction than the group that was simply notified of the event and asked to respond in exchange for the program financial incentive.

Based on these results, Powershop concluded that both approaches – formal program registration and simple on-event notification – are both effective means for delivering BDR. The company also reported that the CYP program provided both additional customer engagement benefits and an effective means for educating customers about the challenges facing the electricity market.

3.3 RESIDENTIAL CONTROLLED LOAD PROGRAMS

In Year 3, AGL, EnergyAustralia and Powershop continued to build on their experiences from Year 2 and began trialling new direct load technologies such as internet-connected infrared (IR) blasters to manage air conditioners and smart isolation switches, as well as continuing the use of behind-the-meter battery storage systems as virtual power plants (VPPs) and remote control of electric vehicle (EV) charging.

3.3.1 AGL

AGL adapted the lessons learnt in Year 2 from the **Managed for You program** and began trialling new approaches to controlled load:

- **Direct control of air conditioning:** As noted in the Year 2 Report, AGL discontinued its original direct load control program due to a relative lack of interest from customers and significant problems with the load control technology itself, including incompatibility of the control technology with many brands and models of air conditioners, the high costs of rectifying these problems, and performance shortfalls even where the controllers were able to be installed. However, in Year 3, AGL embarked on a trial of internet-connected infrared (IR) blasters to control air conditioners via the infrared connection used by the remote control. AGL noted that, while this approach is not free from issues, the IR blasters can be self-installed by the customer, which avoids many of the problems experienced during the earlier air conditioning load control program. It is also a relatively low-cost option.
- **Control of EV charging:** In Year 3, AGL demonstrated that the home charging of privately-owned vehicles could be successfully controlled to avoid system peaks. Based on this experience, AGL successfully applied for ARENA funding for a much larger and more comprehensive trial of EV charging orchestration[10]. This trial was announced in November 2020 and at the time of writing was currently in the recruitment and installation phase.

3.3.2 ENERGYAUSTRALIA

EnergyAustralia deployed several controlled-load programs over the course of the trial:

- **Smart Isolation Switch Trial:** EnergyAustralia developed a smart isolation switch that could be installed and used to control customers' water heaters, pool pumps, or air conditioners. The switches were installed at no cost to the customer and could be used by EnergyAustralia, via communications, to coordinate the load of these devices. For the purpose of the RERT trial, it meant that these devices could be controlled during RERT activation periods. However, very few customers signed up to the program and this lack of interest (and associated lack of useful data to be provided from this program) led to it being abandoned by EnergyAustralia.
- **Controlled Load Circuit Program:** This program was started in 2018 but, as reported in the Year 2 report, suffered from low levels of customer interest, and installation costs that did not meet expectations. Ultimately, EnergyAustralia determined that those costs could never be recouped from the benefits available from the program and therefore discontinued it.
- **VPPs:** EnergyAustralia offered two VPP programs. The Bring Your Own Battery program was for customers who had already installed batteries on their own, and EnergyAustralia paid the customer to be allowed to dispatch the battery for up to four hours on up to 20 occasions in the year. Under the Solar Plus Plan, which was launched in June 2020, the customer takes a seven-year energy contract with EnergyAustralia in exchange for free installation of a 5.6 photovoltaic (PV) system and battery. EnergyAustralia owns and manages the battery for the contract period and the customer pays a single flat rate of $0.265/kWh for any electricity consumed. At the end of the seven-year period, ownership of the PV and battery is transferred to the customer.

3.3.3 POWERSHOP

Powershop reported that there were no changes in its recruitment and use of its VPP capabilities. However, Powershop noted that homes with batteries orchestrated through a VPP can provide "significant reserve" and that "the design of the offer and the systems used to encourage membership in a VPP [are] important to DR"[11].

10 AGL Electric Vehicle Orchestration Trial https://arena.gov.au/projects/agl-electric-vehicle-orchestration-trial/

11 Powershop, Powershop Demand Response Program, Final Report 2021, p 9. No further detail was provided on these points.

3.4 COMMERCIAL-INDUSTRIAL SECTOR PROGRAMS

Lessons learned in the trial provided participants with the opportunity to improve their production processes and identify more fit-for-purpose DR technology solutions. This has allowed several of the participants to convert their respective DR programs into to business as usual.

3.4.1 AGL

Over the course of the trial, AGL doubled its contracted capacity with C&I customers from an initial 10 MW in Year 1 to 20 MW by the start of Year 3, while the C&I portfolio itself remained relatively stable over the course of the trial[12]. The program was open to all C&I businesses in New South Wales and there was no requirement for customers participating in the program to be an AGL retail customer. As in previous years, AGL's Year 3 C&I DR customers included water and telecommunications utilities, shopping centres, manufacturing and recycling plants, data centres, and a university campus.

A direct marketing approach was used for recruitment, and financial incentives included both an availability fee and a dispatch fee based on the amount of DR delivered during a dispatch event. Poor performance from customers resulted in a reduced dispatch payment and resetting the customer's availability payment to reflect the actual amount of DR delivered. However, AGL noted that the monthly availability payments proved very useful in providing a regular reminder to customers of their participation in the program.

AGL's operating model for its C&I program remained relatively stable for the full period of the trial. One significant change in Year 3 was the use of an Application Programming Interface provided by participating meter data providers rather than a hardware system to provide near real-time meter data that allowed both the participating customer and AGL to monitor DR performance. AGL found that this 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"[13].

Favourable feedback about the program from AGL's participating customers included the fact that AGL provided at least one hour's notice of dispatch events, allowed these customers to opt in or out, without penalty, did not require remote activation of participating loads, and provided any required hardware for free (as part of the ARENA program funding).

Based on its experience in the ARENA program, AGL has undertaken additional DR activities, several of which are ongoing, including involvement in Transgrid's 'Powering Sydney's Future' demand response project from the summer of 2018-19 the 2021-22 summer, and an increased use of aggregated C&I demand response for its own wholesale portfolio management during the 2020-21 summer.

3.4.2 ENERGYAUSTRALIA

Year 3 saw EnergyAustralia grow its RERT C&I portfolio from 50 MW to more than 60 MW, despite the challenges COVID-19 had posed to recruitment activities. Much of the increase according to EnergyAustralia came from smaller C&I customers who were motivated to join the program to offset RERT costs that were being passed through to their bills via market fees. EnergyAustralia's C&I DR portfolio includes companies spanning production, primary industry, manufacturing, and fisheries/agriculture. Nineteen of these customer sites across New South Wales, Victoria and South Australia participated in the two test events undertaken in Year 3, and many of these customers also participated in the other four events that were conducted by EnergyAustralia in Year 3. More generally, EnergyAustralia noted that, through the ARENA trial, they have built a successful and valuable C&I DR portfolio. Unlike several other trial participants, this has been accomplished with essentially no automated control of customers' loads or DR. EnergyAustralia also noted that the monitoring solution it had put in place and used with its customers in previous years was discontinued in Year 3. However, EnergyAustralia is actively investigating new monitoring opportunities for the future.

Behavioural demand response product for small business customers: In the last six months of the program, EnergyAustralia successfully launched a trial of a behavioural demand response product for its small business customers, based on its PowerResponse residential product. While the program is still in the early days of testing, EnergyAustralia reported that the uptake and initial trial results have been positive, demonstrating that customers across all segments are willing and able to contribute to demand response.

Business PowerResponse program: Launched in May 2020 to small to medium sized C&I customers (SMEs), should follow this and not after C&I customers to earn $2 per kWh for electricity consumption reductions during a Business PowerResponse event[14].

12 See Table G in Appendix for the customer numbers and capacity in AGL's C&I portfolio.

13 AGL, AGL NSW Demand Response, Final ARENA Knowledge Sharing Report, May 2021, p. 49.

14 As measured by comparison to a baseline calculated in a consistent manner to that used in the company's residential PowerResponse program. Baseline calculation changed on 24th August 2020 to only include positive adjustments. Further information on the baseline can be found at https://www.energyaustralia.com.au/business/help-and-support/faqs/business-powerresponse

EnergyAustralia undertook three test events with participants in the Business PowerResponse program – in August 2020 with a single multi-site customer, in early November 2020 with 55 customers across 16 industries; and in December 2020 with 102 customers. Among other things, EnergyAustralia's analysis of the November and December events indicated that:

- 43 per cent of the sites curtailed load in both tests,
- six of the ten sites that had subscribed to EnergyAustralia's special offer and had performed in the November event repeated their participation and performed in the December test despite the removal of the $50 bonus bill credit reward, and
- only one customer left the Business PowerResponse program, and this was due to a change in the retailer serving this customer.

EnergyAustralia plans to continue to use and study its Business PowerResponse program. While EnergyAustralia noted that they have not fully exhausted the DR recruitment potential within their C&I customer base, their view – based on the feedback they have received during the program – is that most C&I customers would be better suited to other types of DR offers. In line with this, EnergyAustralia has developed an opt-in and fixed-rate DR product where customers get a surety of a financial return for participation, without any obligation to participate (i.e. a no-obligation availability payment). EnergyAustralia believes this product will have more appeal and garner more support from small to medium-sized C&I customers than participation in either a RERT or a wholesale market DR program offer in which the incentive is a share in the gross pool savings produced by their load reduction.

EnergyAustralia has also committed to participate in the RERT program beyond the ARENA trial program, offering to contract almost 70 MW of DR to the RERT for the 2020-21 summer.

3.4.3 ENEL X (FORMERLY ENERNOC)

As in Year 2, Enel was contracted to provide a total of 50 MW of capacity for the RERT – 20 MW in New South Wales and 30 MW in Victoria. This capacity was to be provided within 10 minutes of Enel X sending dispatch instructions informing its customers within the portfolio that a DR event is to commence. Although Enel X's C&I portfolio is made up of about equal numbers of commercial and industrial customers[15], the DR capacity of the portfolio is about 70 per cent from its industrial customers and about 30 per cent from its commercial customers.

Enel X provided its participating customers with two types of payment, namely:

- availability payments (structured as $/MW/year, and based on the customer's daily availability for responding to a DR event), and
- energy payments (structured as $/MWh for load reductions delivered per interval during a DR event as compared to the customer's baseline).

Enel X installed its own metering technology at each customer site to monitor the facility's demand and facilitate effective demand response. Performance information was provided in terms of the facility's instantaneous and average load reduction (as compared to its adjusted baseline), as well as the facility's 'reduction target'.

Also, several Enel X's C&I DR sites were equipped with control equipment that allowed Enel X to remotely initiate a load reduction. Significantly, the sites where DR was automatically dispatched by Enel X consistently showed better performance than those that relied on manual activation of their DR capacity. Table 2 below summarises the performance of Enel X's manually and automatically dispatched DR sites in Victoria and New South Wales, in terms of the percentage of contracted DR capacity delivered.

TABLE 2: DELIVERY OF DR CAPACITY AS A PERCENTAGE OF CONTRACTED VOLUME FOR MANUAL AND AUTOMATED DISPATCH IN ENEL X'S C/I PORTFOLIO

	MANUAL	AUTOMATED
VIC	81%	103%
NSW	84%	110%

These figures represent the average of the results of seven events in Victoria and six events in NSW. It is worth noting that the automatically dispatched sites outperformed the manually dispatched ones in every one of those 13 events. Enel X noted that, in their view, the outperformance of automated sites was due to the customers of these sites trusting the Enel X technology solution and taking fewer actions from their end. By contrast, Enel X noted that customers that relied on manual dispatch of their DR often faced several challenges, including:

- competing operational priorities,
- having suitably qualified people available on-site on the day of events, and
- personnel turnover resulting in loss of knowledge of the DR program and the need to train new staff.

15 See Table H in Appendix for more information on the customer types that make up the Enel X C&I DR portfolio.

3.4.4 FLOW POWER

Flow Power's program approach has remained quite stable over the course of the three-year ARENA trial. Features include:

- the provision of two types of payments – availability payment (based on the amount of DR capacity provided during tests or activations), and activation payment (based on the volume of load shed during events),
- the installation of proprietary technology – the kWatch® Intelligent Controller – at each customer site to facilitate ten-minute response to AEMO activation signals,
- an annual customer fee payment,
- notification of events via alerts, and
- an ability for customers to participate on either an opt-in or an opt-out basis (most customers participated on the opt-in basis).

Additionally, Flow Power's DR portfolio has grown significantly over the life of the program[16], with Year 1 concentrated on the initial set-up of the program and recruitment of customers; Year 2 focused on building, maintenance, and expansion; and Year 3 being a transition phase focussed on integrating participating customers into Flow Power's broader DR ecosystem.

3.4.5 POWERSHOP

Powershop operated two programs for its non-residential customers. One was the use of Monash University's 1 MW gas cogeneration facility which was commissioned to provide additional 'firm' capacity to that in the company's residential BDR program. However, due to ongoing maintenance and system failure, the cogeneration facility was not available for use in Year 3.

The other program was the inclusion of small business customers in its CYP BDR program. The small business portion of the CYP BDR program was operated using the same procedures and in combination with the residential portion of the program. However, the small business portion of the program used a different incentive structure, as shown in Table 3 below. All rewards to the small business customers were provided in the form of credit toward the purchase of electricity.

TABLE 3: INCENTIVE STRUCTURE FOR SMALL BUSINESS CUSTOMERS IN POWERSHOP'S CYP BDR PROGRAM.

DR (KWH REDUCED IN EACH HOUR OF THE EVENT)	REWARD
10% or 1kWh compared to baseline	$10
2 to 5 kWh	$20
5 to 10 kWh	$50
10 to 20 kWh	$100
20+ kWh	$200

The number of customers, contracted capacity, and results in the January 2020 RERT event and October 2020 activation test for the small business portion of the CYP BDR program is unavailable as it was not reported separately in the program.

3.5 OTHER PARTICIPANTS

Intercast & Forge and United Energy are discussed separately below from the other participants as their programs differ in fundamental ways from the programs discussed above. Most importantly, neither Intercast & Forge nor United Energy need to recruit customers to provide their contracted DR, and neither have to allocate their program revenue to individual customers.

3.5.1 INTERCAST & FORGE

Intercast & Forge is a foundry located in South Australia that provides DR from its own operations by shutting down its furnaces and other operational equipment. As such, it has not needed to recruit customers, nor does it have to deal with the other concerns faced by an aggregator. However, it has had to set up communication processes, both internally and with AEMO, for the purpose of responding to tests and activations.

In Year 3, Intercast & Forge continued to exceed their contracted capacity when called upon, and reported that in order to deliver their contracted DR capacity they have developed an internal procedure (including an extensive email personnel base) to quickly and safely reduce their electricity consumption during load curtailment; put in place a written standard operating procedure for plant personnel to ensure the business can comply with AEMO's request in a timely manner; and installed an electricity monitoring system to assist in delivering their ability to curtail load.

16 See Tables I and J in Appendix for more information on how Flow Power's portfolio have increased during the program.

3.5.2 UNITED ENERGY

United Energy is an electricity distribution business that serves approximately 600,000 customers in the south-eastern suburbs of Melbourne and the Mornington Peninsula. It provides DR by reducing the voltage supplied to customers served by all but one of the company's zone substations, while ensuring that delivered voltages remain above the minimum level specified by regulation. As United Energy is required to maintain delivered voltages within a specified range, there is no need for them to inform customers of that regulation or to recruit them to participate in the DR program.

The company committed to provide 30 MW of DR in Year 3 of the program[17] and demonstrated their ability to consistently deliver this amount. United Energy also developed a variation of the '10 of 10' baseline methodology that AEMO has accepted. The most significant change from the standard '10 of 10' method in the United Energy method is the use of days that are similar in temperature to the event day in the selection of the 10 days from which the baseline consumption profile is calculated[18].

In addition to their participation in testing periods and RERT events, United Energy has conducted considerable research as part of their involvement in the ARENA program, including on voltage reduction and its interaction with distribution network operation and equipment maintenance. Among other things, United Energy has stated that the ARENA program has allowed it to demonstrate the combined ability of its Dynamic Voltage Management System (DVMS) and smart meter technology to "deliver demand response services for RERT using voltage reduction" and to "deliver step-change improvements in steady-state voltage compliance by dynamically adjusting voltages at zone substations"[19].

These capabilities are likely to be of increasing interest as the use of smart meters grows throughout Australia. Increased deployment of rooftop PV and other distributed energy resources (DER) has led to the growing importance of managing voltage, and this DR can be provided automatically by distribution businesses, while still delivering electricity within required service levels to their consumers.

United Energy plans to continue to participate in RERT beyond the ARENA-funded project using its DVMS to increase supply-demand reserve levels in the NEM and to help avoid load shedding. To this end, the company has been working with AEMO to provide similar RERT services for the 2020/21 summer.

17 It also contracted 30 MW in Year 2 after growing to that level from its Year 1 commitment of 12 MW.

18 See United Energy's Final Project Performance Report for more information on baseline accuracy assessment and review.

19 United Energy, United Energy Demand Response – Final Project Performance Report, 21 December 2020, p. 52.

4.0

KEY LESSONS LEARNED

4.1 OVERVIEW

This section of the report provides a summary of the trial's key results, including progress made over the course of the three years.

4.2 AGGREGATED DR FEASIBLE FOR RERT

The ARENA DR RERT Trial has demonstrated that aggregated DR can work for the RERT. The program delivered the amount of DR that participants had contracted with ARENA to provide to the RERT[20].

4.3 BDR PROGRAMS HIGHLY POPULAR

A very high level of interest was demonstrated in the BDR programs on the part of both participants and residential customers.

All three of the participants that offered BDR programs in the residential sector significantly expanded them in Year 3 of the program, and plan to continue them after the end of the ARENA program. The primary selling points to customers of these programs are that they:

- allow almost all customers to participate, and no specialised knowledge of technology or the energy sector is required,
- do not require any significant financial outlay from the customer – BDR programs do not require the customer to install any special technology (other than a smart meter[21]),
- allow customers to retain complete control over their energy use and participation,
- provide financial and other incentives to customers, and
- appeal to customers' desire to provide community service by being part of the solution to the problems in the electricity grid.

From the participants' perspective, these programs were found to be valuable for customer retention. Also, the participants found that the mechanics and resources required to develop a residential BDR program can be put in place relatively rapidly. The program also provided enough time for refinements to be developed in both the mechanics and design of these programs.

The ability to simplify program design and reach a greater number of customers motivated all three participants to broaden the base of their residential BDR program offerings, making it available to virtually all residential customers on an opt-out basis. Two of the participants have extended the BDR program design to small business customers as well.

One drawback of the program was that significant levels of both false negatives and false positives were reported regarding the measurement of the load reductions of BDR customers. A number of reasons were identified for these mismatches between activity and results, including:

- difficulties with the '10 of 10' baseline methodology, particularly where boundary meter consumption varies significantly due to variations in household occupancy, ambient temperature or the presence of a rooftop PV system, and
- participating customers' lack of understanding regarding the behaviour change that is needed to achieve a material reduction in electricity consumption.

20 See Table B in Appendix for more information of the DR capacity contracted vs. delivered in each program year.

21 Where the deployment of smart metering is low, this can pose an additional cost. Also, where the adoption of an interval meter also requires the customer to be put on a different network tariff, the change in the customer's bill can be larger and negate the financial benefits of participating in the BDR program. Participants noted that this possibility needs to be understood in explaining the program.

In response, participants have experimented with alternative baseline designs. This remains an area that needs further work to devise approaches that are suitably accurate for use in the RERT[22].

4.4 DIRECT LOAD CONTROL LESS POPULAR

Direct load control programs proved significantly less popular among residential customers and in some cases have encountered non-trivial technology issues

The biggest finding regarding the offering of direct load program designs in the residential sector was the significant lack of interest on the part of residential customers in allowing their electricity retailer to control their end-use appliances — particularly their air-conditioning.

Participants also reported issues with control technologies. One participant cited the complexity, high costs and erratic outcomes of using the mechanism specified in Australian Standard AS4755 as the reason for discontinuation of its load control program.

Some of the participants working with residential customers were also offered controlled load programs based on EV charging and VPPs. Although the number of customers involved in these types of programs was very small, the participants noted that both have the potential to be substantial sources of load that can be shaped and managed without adversely affecting customer amenity.

4.5 POTENTIAL FOR DR TO CONTRIBUTE TO NEM OPERATIONS

Participants felt that the trial has materially aided the potential for DR to contribute to the overall operations of the NEM. They indicated that the program has given them and end-customers valuable experience with DR. Several noted that it provided financial incentives (including availability payments for C&I customers) that were effective in motivating customers to participate in the DR RERT Trial program. Customers have been willing to continue participating in DR programs and the trial participants intend to continue (and in some cases expand) their DR programs.

Importantly, the program also provided the opportunity for participants to improve their program processes, to identify (and in some cases develop) more fit for purpose DR technology solutions. As noted, several of the proponents are continuing to assess additional technologies to increase the amount of DR they can offer.

4.6 SPARK IN INTEREST IN DR CAPABILITIES OF SMALL COMMERCIAL SECTOR

The trial has sparked interest in the DR capabilities of the small commercial sector. As noted, several of the participants have initiated DR programs for small commercial customers — a sector that has only very rarely been included in DR program design and implementation efforts. These efforts are in their early days and have primarily involved BDR designs, which, as noted above, have posed some material measurement issues in the residential sector that will need to be investigated further in this sector as well.

4.7 SIGNIFICANT IMPROVEMENT IN CONTROL AND MONITORING TECHNOLOGIES FOR C&I SECTOR

While DR had already been practiced with some level of maturity in the large C&I sector, participants noted the impact that this trial has had on the ability to further develop technology, most importantly, for:

- sending control signals directly to C&I customer equipment and control programs rather than having to place total reliance on manual initiation of DR actions, and
- monitoring DR performance during events.

Participants also noted that, while the financial incentive has always been and continues to be the main motivation for C&I customers to participate in DR, the availability of these technologies and the social benefit of assisting to maintain reliability of supply also played a role in motivating the participation of customers.

However, there are lessons to be learned:

- C&I customers often reduce their operations around extended holiday periods (particularly, but not only, Christmas and Easter) and this can have a large impact on the volume of DR capacity within a participants' portfolio. Similarly, the DR capability of C&I customers can vary materially by season. It may be useful for AEMO to request information on the DR capability of portfolios seasonally.

22 It should be noted that where a participant employs BDR (or any other form of DR) to reduce its exposure to the spot market, the result will depend entirely on metered quantities on the day – no baseline is involved. Therefore, the retailer will pay for the amount of electricity consumed in aggregate by its customers. The settlement of that consumption does not affect the market. By contrast, DR provided to the RERT is paid for through market fees, meaning that measurement inaccuracies are borne by all electricity users.

- Some types of facilities come under special operating conditions in emergency situations. Industries with high levels of regulatory and environmental compliance requirements, such as telecommunications, water utilities and wastewater services, may also face difficulties in being able to provide DR during periods of drought, bushfire or other emergencies.
- The need to over-recruit DR capacity as compared to the level of DR contracted remains a practical and financial consideration for participants. Over-recruitment in the range of 20 per cent is generally considered prudent, but the over-recruitment must necessarily cover the largest amount of DR provided by any single customer in the portfolio otherwise the aggregator risks failing to deliver its aggregate contracted volume.
- While automation appears to provide a firmer base for the provision of DR and makes participation easier for the customer, automated control is not applicable to all DR capacity and even where it is, it may not be the preferred approach by the customer.
- The ability to offer availability payments was a significant motivator of participation in the Trial. However, as these payments are not officially available under AEMO's standard Short Notice RERT arrangements (as compared to other markets such as Long Notice (LN) RERT, Frequency Control Ancillary Services (FCAS) and WDRM, participants' and customers' preferences for continued participation may change.

4.8 INDEPENDENT EVALUATION

At the completion of the trial, CutlerMerz was engaged to undertake an independent evaluation and determined that overall the "ARENA funding of its portfolio of DR projects was appropriate, effective and efficient"[23].

The trial was found to have accelerated the commercial readiness of the DR technologies, helping to establish a functioning and competitive market for DR services, particularly C&I services in NSW, SA and Victoria.

The evaluation also found that the trial provided critical lessons to the industry regarding the applicability of residential DR programs. CutlerMerz concluded that ARENA's portfolio of DR projects was effective in delivering and exceeding the trial's objective of 200MW of tested DR capacity for the RERT.

4.9 FUTURE CONSIDERATIONS

The primary area in which participants identified that further work needed to be continued is in the area of baselining. Specific issues mentioned include:

- the need to develop a methodology that provides baselines for customers with variable operating schedules (perhaps using a similar-day approach),
- the need for the baseline to be applicable to sites with temperature-sensitive loads and/or behind the meter distributed energy resources — participants suggested that the methodology could employ an adjustment of load based on these variables or by using similar-day approaches[24], or simply increasing the adjustment factor used in the methodology from 20 per cent to 40 per cent (or leaving it uncapped altogether).

A further area needing attention is the amount of time available for prospecting, given AEMO's timeframe for contracting and empanelling RERT. One participant was of the view that a timeframe of six months would provide significantly better outcomes.

23 See CutlerMerz's Evaluation of ARENA's 2017-2020 Demand Response Portfolio Final Report June 2021 for more information on the evaluation process and findings.

24 As discussed above, United Energy proposed and AEMO accepted the use of similar temperature days in the construction of the baseline to be applied in the distribution business' voltage reduction DR program.

5.0

WHERE TO FROM HERE FOR DR: IMPLICATIONS OF THE DR SN RERT TRIAL

5.1 OVERVIEW

Overall, participants found that the trial has substantially increased market interest and capability in delivering DR, and all indicated that they intend to continue to offer DR programs to their existing and prospective customers. In this section, we discuss the implications of the insight gained in the trial for implementing DR in future RERT and other applications.

5.2 DR IN THE RERT

The removal of the availability payments and widely generous incentives that the trial made possible is likely to result in other applications of DR (in Long Notice Reliability and Emergency Reserve Trader, Frequency Control Ancillary Services – assuming the available DR can meet its specifications – and the Wholesale demand response mechanism) being seen as more attractive than the SN RERT.

5.3 WDRM

The WDRM may be more attractive to participants and their customers than the SN RERT, given that it:

- will provide AEMO with more visibility of DR,
- will increase the amount of DR available to the market when price is high, and therefore may reduce the number of times RERT is needed, and
- would substitute an on-market mechanism for an off-market one.

However, it is also possible that the WDRM may increase participants' interest in in-portfolio DR. One potential drawback of this outcome, should it occur, is that it will not increase AEMO's visibility of DR to the same extent as the exercise of DR through the WDRM would.

It is also the case that the WDRM as currently codified specifically precludes loads that are participating in the RERT being offered in the WDRM. It is worth noting that, while loads in the LN RERT are specifically contracted and paid throughout the RERT season whether they are dispatched or not, under the SN RERT, loads are empanelled but are not contracted until an ITT is issued and accepted. Given this, it may be the case that SN RERT DR loads can be offered into the WDRM until an ITT is issued. This can result in some sub-optimal outcomes as were experienced in one instance in Year 2.

5.4 FCAS

The use of DR capacity in the FCAS market can be attractive since it offers availability payments and requires only short durations of dispatch when actually called. It is worth noting that Enel X successfully took DR capacity out of availability for FCAS on days when a RERT event was possible. This was acceptable to AEMO during the trial, but remains to be seen whether that will continue to be the case once the trial has ended. If it is acceptable, it could provide justification for a similar DR arrangement in the SN RERT and WDRM markets.

5.5 NETWORK INVOLVEMENT IN RERT

United Energy's program has demonstrated that voltage control (that continues to provide electricity supply within the regulated voltage range) can be a valuable source of dispatchable DR for RERT. There may be a case to be made that distribution businesses that are capable of providing a similar service safely could be directed by AEMO to do so during RERT events.

5.6 EMERGING APPLICATIONS

There is also the potential for DR be used in emerging applications, including:

- new Essential System Services, and
- the provision of load increases to manage voltage in the network and/or to increase system stability at times of very low operational demand (these mechanisms are being described as 'negative WDRM' and 'negative RERT' are currently being considered).

APPENDIX

SUPPLEMENTARY TABLES

TABLE A (APPENDIX): TRIAL ANNUAL OPERATING SCHEDULE

YEAR	PERIOD	TESTING PERIOD	PERIOD
1	1	Late Oct - early Dec 2017	1 Dec 2017 - 30 May 2018
1	2	Late April - early Jun 2018	1 Jun - 30 Nov 2018
2	3	Late Oct - early Dec 2018	1 Dec 2018 - 30 May 2019
2	4	Late April - early Jun 2019	1 Jun 2019 - 30 Nov 2019
3	5	Late Oct - early Dec 2019	1 Dec 2019 - 30 May 2020
3	6	Late April - early Jun 2020	1 Jun 2020 - 30 Nov 2020

TABLE B (APPENDIX): DR CAPACITY CONTRACTED VS. DELIVERED IN EACH PROGRAM YEAR (MW)

PROGRAM YEAR	NSW		VIC		SA		TOTAL	
	CONTRACTED (MW)	DELIVERED (MW)	CONTRACTED (MW)	DELIVERED (MW)	CONTRACTED (MW)	DELIVERED (MW)	CONTRACTED (MW)	DELIVERED (MW)
Year 1	61.0	65.6	63.0	81.7	19.0	19.3	143.0	166.6
Year 2	72.0	85.8	85.0	90.9	17.0	15.5	174.0	192.2
Year 3	80.0	87.8	86.0	94.9	18.0	15.4	184.0	198.1

TABLE C (APPENDIX): DR CAPACITY CONTRACTED VS DELIVERED BY STATE IN PERIODS 5 AND 6 OF YEAR 3 (MW)

STATE	PERIOD 5		PERIOD 6	
	CONTRACTED (MW)	DELIVERED (MW)	CONTRACTED (MW)	DELIVERED (MW)
VIC	82.0	94.9	86.0	93.9
SA	18.0	15.4	18.0	16.9
NSW	80.0	87.8	80.0	79.0
Total	**180.0**	**198.1**	**184.0**	**189.8**

TABLE D (APPENDIX): NUMBER OF PARTICIPANTS WITH DR CAPACITY DELIVERED AS A PERCENT OF THE CONTRACTED AMOUNT FOR PERIODS 5 AND 6 OF YEAR 3

TESTING PERIOD	LESS THAN 50%	50% TO 74%	75% TO 99%	100% TO 124%	125% TO 150%	MORE THAN 150%
Period 5	0	1	2	4	2	0
Period 6	0	1	2	5	1	1

TABLE E (APPENDIX): DR CAPACITY CONTRACTED VS DELIVERED BY CUSTOMER CLASS IN PERIODS 5 AND 6 OF YEAR 3 (MW)

CUSTOMER CLASS	PERIOD 5		PERIOD 6	
	CONTRACTED (MW)	DELIVERED (MW)	CONTRACTED (MW)	DELIVERED (MW)
Residential	20.4	20.2	26.3	23.9
Commercial & Industrial	159.6	181.8	157.7	166.9
Total	**180.0**	**202.0**	**184.0**	**190.8**

TABLE F (APPENDIX): DR CAPACITY CONTRACTED VS DELIVERED BY NOTIFICATION PERIOD IN PERIODS 5 AND 6 OF YEAR 3 (MW)

NOTIFICATION PERIOD	PERIOD 5		PERIOD 6	
	CONTRACTED (MW)	DELIVERED (MW)	CONTRACTED (MW)	DELIVERED (MW)
10-minute	160.0	175.2	160.0	165.3
60-minute	20.0	22.95	24.0	24.5
Total	**180.0**	**198.1**	**184.0**	**189.8**

TABLE G (APPENDIX): NUMBER OF C&I CUSTOMERS AND SITES IN AGL'S C&I PROGRAM PORTFOLIO BY TRIAL YEAR

YEAR	NUMBER OF C&I CUSTOMERS	NO SITES	MW
1	9	35	10
2	10	34	17
3	12	37	20

TABLE H (APPENDIX): CUSTOMER TYPES IN ENEL X'S C&I DR PORTFOLIO

COMMERCIAL	INDUSTRIAL
Agricultural Product Wholesaling	Basic Chemical Manufacturing
Building Structure Services	Basic Metal Manufacturing
Fruit and Tree Nut Growing	Fruit and Vegetable Processing
Other Goods Wholesaling	Grain Mill and Cereal Product Manufacturing
Tertiary Education	Meat and Meat Product Manufacturing
Warehousing and Storage Services	Waste Treatment, Disposal & Remediation Services
Retail	Wood Product Manufacturing
	Paper Product Manufacturing

TABLE I (APPENDIX): GROWTH OF FLOW POWER PORTFOLIO

YEAR/PERIOD	DR CONTRACTED (MW)	DR RECRUITED (MW)	DR DELIVERED (MW)	NO. OF CUSTOMERS
Year 1 Period 1 Summer	5	7	1.52	4
Year 1 Period 2 Winter	5	39.3	27.9	6
Year 2 Period 3 Summer	15	39.57	21.8	7
Year 2 Period 4 Winter	15	39.57	23.1	7
Year 3 Period 5 Summer	20	39.57	19.16	7
Year 3 Period 6 Winter	20	39.57	16.72	7

Note: The test for Year 3 Period 6 Winter was postponed to October 2019.

TABLE J (APPENDIX): COMPOSITION OF FLOW POWER PORTFOLIO BY BUSINESS TYPE

INDUSTRY	INDUSTRY TYPE	RESERVE (MW)	LOCATION
Agri-businesses	Orchards/Irrigators	1.47	NSW and VIC border
Warehouse/Storage	Refrigeration	1.16	Sydney
Councils	Water Management	1.3	Throughout NSW
Food Processing	Packaging/Manufacturing	1.7	Throughout NSW
Forestry	Timber Mill	0.5	Northeastern NSW
Manufacturing	Building Supplies	3.7	Western Sydney region
Manufacturing	Steel Production	20	Newcastle region

Further information is available at
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