

Demand Response RERT Trial Year 1 Report

MARCH 2019



Developed with Oakley Greenwood in its role
as knowledge sharing partner for the DR trial.



Australian Government
**Australian Renewable
Energy Agency**

ARENA

INTRODUCTION

Renewable energy resources are playing an increasing role in Australia's electricity sector. By the end of January 2019, just over two million rooftop PV systems had been installed with a rated output of just over 8.1 GW¹. In the 2016-17 financial year large-scale solar and wind plants accounted for 5.1 per cent of all electricity entering the National Electricity Market's (NEM's) transmission system². Those plants accounted for an even larger percentage of the installed capacity in the NEM (excluding rooftop PV).

As the mix of electricity generation changes to a higher level of renewables, Australia's electricity system will need to continue to provide secure, reliable electricity with more diverse and distributed energy sources.

A flexible and responsive set of demand side resources, combined with appropriate storage, will be an integral element in managing an energy system increasingly powered by renewable energy. Demand response (DR) can play a role in this regard.

DR is a way of enhancing energy reserves by curbing energy use. This can be done through avenues such as behavioural change, manual and remote control of load and on-site generation curtailment. There are four roles DR can play in the power market:

- wholesale demand response
- emergency demand response
- ancillary services
- network demand response.

In critical peak demand situations, the Australian Energy Market Operator (AEMO) can invoke the Reliability and Emergency Reserve Trader (RERT) arrangements available under the Rules³. When activated, emergency DR can provide a quick response, especially when generation resources cannot meet the demand.

In 2017, ARENA and AEMO entered into a Memorandum of Understanding to jointly develop 'proof of concept' projects that support the integration of renewable energy into the energy market, while maintaining system reliability and security. As part of this initiative, a three year DR Short Notice RERT Trial was developed to:

- Demonstrate that DR is an effective source of reserve capacity for maintaining reliability of the electricity grid during Contingency Events and that DR resources can be rapidly developed for deployment from summer 2017/18.
- Provide an evidence base to inform the merits and design of a new market or other mechanism, for DR to assist with grid reliability and security, allowing for greater uptake of renewable energy.
- Improve the commercial and technical readiness of DR providers and technologies, in particular to help demonstrate and commercialise the use of DR for grid security and reliability.

Following a competitive funding round, 10 projects were funded in Victoria (VIC), South Australia (SA) and New South Wales (NSW), with the NSW Government also providing funding to projects in NSW. One year into the trial, this report provides a summary of the outcomes and learnings experienced to date. It outlines contracted and recruited capacity, test outcomes, program models and lessons learned.

Overall, ARENA considers Year 1 to be a successful start to the trial, with proponents able to recruit and mobilise their programs in a short time-frame with positive outcomes. Although performance varied between individual proponents, overall, the portfolio exceeded the combined contracted capacity for Year 1 of 143 MW. This varied performance has provided important insights and lessons that have been taken into consideration for Year 2. Consistent with the trial objectives, Year 1 provided evidence to support the reinstatement of the long-notice RERT scheme and is informing the AEMC's consideration of a wholesale DR mechanism.

1 Clean Energy Regulator

2 Department of the Environment and Energy, Australian Energy Statistics, Table O, August 2018

3 National Electricity Rules, Version 119, Section 3.20.

1. OVERVIEW OF THE DR RERT TRIAL

The DR RERT Trial is a \$35.7 million program, with ARENA providing \$28.55 million and the NSW Government providing \$7.18 million to proponents selected in NSW. Ten projects from eight organisations were selected to trial innovative approaches to delivering emergency demand response within either 10 or 60 minutes of a request by AEMO across residential, commercial and industrial portfolios. As reflected in the table below, the successful proponents included retailers, DR aggregators, an industrial company and an electricity distributor.

Table 1: Overview of projects funded as part of the Demand Response Trial

State ¹	Proponent	Type	3-yr Funding (\$m) ¹	Customer classes involved ³	Notification period (minutes)	MW contracted	
						Yr 1	Yr 3
VIC	EnergyAustralia ²	Electricity retailer	\$3.81	R, C & I	10	11	16
	Enel X	DR aggregator	\$5.40	C & I	10	30	30
	Powershop	Electricity retailer	\$1.00	R & C	60	5	5
	United Energy	Electricity distributor	\$5.76	R, C & I	10	12	30
	Zen Ecosystems ²	DR aggregator	\$1.18	R & C	60	5	5
VIC subtotal			\$17.15			63	86
SA	EnergyAustralia ²	Electricity retailer	\$3.12	R, C & I	10	9	15
	InterCast & Forge	Industrial customer	\$0.32	I	10	10	10
	Zen Ecosystems ²	DR aggregator	\$0.78	R & C	60	0	10
SA subtotal			\$4.22			19	30
NSW	AGL	Electricity retailer	\$5.25	R, C & I	60	18	20
	EnergyAustralia	Electricity retailer	\$2.87	R, C & I	10	18	18
	Enel X	DR aggregator	\$3.60	C & I	10	20	20
	Flow Power	Electricity retailer	\$2.64	C & I	10	5	20
NSW subtotal			\$14.36			61	78
Total			\$35.73			143	199

Source: ARENA

Notes:

1. This reflects the total funds by ARENA. In the case of projects in NSW, 50 per cent of the funding was given by the NSW government.
2. Costs of the EA and Zen projects in VIC and SA have been allocated to each of the states based on MW contracted from each proponent within each state.
3. R = Residential, C = Commercial and I = Industrial

The program is scheduled to run for three years, from 1 December 2017 to 30 November 2020. Each year of the program is organised into two periods (see Table 2). Period 1 runs from 1 December through 30 May, and Period 2 runs from 1 June through 30 November. Each proponent is required to deliver the amount of DR they are contracted for in a testing period prior to the commencement of each Period of the program. The testing period is an opportunity to build capacity and demonstrate that the proponents can reliably respond to a real RERT activation.

Table 2: DR 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 Apr - early Jun 2018	1 Jun - 30 Nov 2018
2 / 3	Late Oct - early Dec 2018	1 Dec 2018 - 30 May 2019
2 / 4	Late Apr - early Jun 2019	1 Jun - 30 Nov 2019
3 / 5	Late Oct - early Dec 2019	1 Dec 2019 - 30 May 2020
3 / 6	Late Apr - early Jun 2020	1 Jun - 30 Nov 2020

Source: ARENA

2. DR RECRUITMENT

2.1 DR CONTRACTED AND RECRUITED

Table 3 shows the amount of DR (in MW of capacity) that was contracted for and recruited in Year 1 of the program by state. This level of over-recruitment (as compared to the amount of DR capacity the proponents were contracted to deliver) is consistent with usual industry practice⁴.

Table 3 also shows that:

- Victoria and New South Wales represented 86.7 per cent of the DR capacity contracted for and recruited in Year 1.
- Recruitment exceeded contracted amounts in all states.
- This trend was highest in New South Wales and lowest in Victoria.

Table 3: DR contracted for and recruited by state in Year 1 (MW)

State	MW Contracted	MW Recruited	% Recruited / Contracted
Victoria	63.0	68.3	108.4%
South Australia	19.0	22.1	116.2%
New South Wales	61.0	73.2	120.0%
Total	143.0	163.6	114.4%

Table 4 shows contracted and recruited capacities by customer class, which include residential, commercial and industrial loads.

Table 4: DR capacity (MW) contracted for and recruited in Year 1, by customer class

Customer class	MW Contracted	MW Recruited	% Recruited / Contracted
Residential	18.3	14.3	78.1%
Commercial	34.1	43.8	128.4%
Industrial	90.5	105.4	116.4%
Total	143.0	163.6	114.4%

⁴ DR aggregators typically over-recruit DR capacity as a means of insuring against the inability of members of their portfolio to respond to all events or to their intended level in each event.

As shown in Table 4:

- In terms of MWs, just under two-thirds of the capacity contracted for and recruited in the first year (63.3 per cent and 64.4 per cent respectively) came from the industrial sector.
- About another quarter came from the commercial sector (23.8 per cent and 26.8 per cent respectively).
- Only a relatively small amount of the DR capacity that was contracted and recruited (12.8 per cent and 8.7 per cent respectively) came from the residential sector in Year 1, though residential customers comprised over 90 per cent of all end users⁵ within the portfolios.
- Over-recruitment in the commercial and industrial sectors approximated usual DR industry practice. The notable exception was the residential sector where recruitment did not achieve the level that was expected to be contracted. These results are reflective of the short timeframe proponents had to contract their first-year portfolios, in addition to the greater familiarity that large customers have with DR and the level of engagement a number of the proponents already had with industrial and commercial customers.

Figure 1 and Figure 2 show the breakdown of contracted and recruited DR capacity respectively by customer class in Year 1 of the program.

Figure 1: Total DR contracted in Year 1 (143 MW)

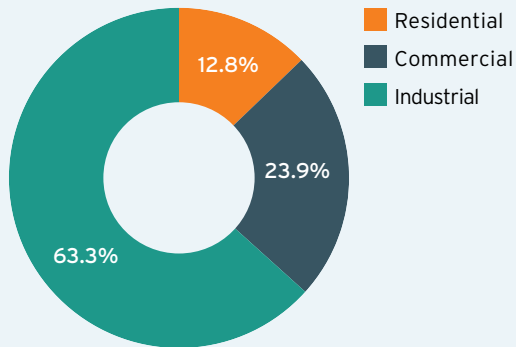


Figure 2: Total DR recruited in Year 1 (163.6 MW)

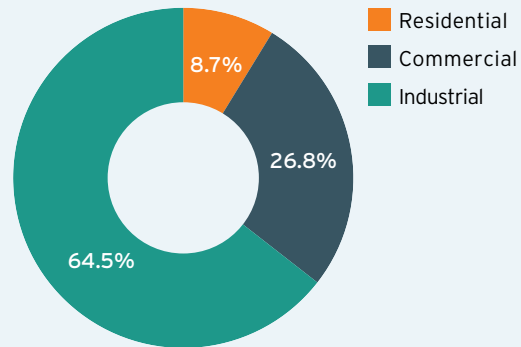


Figure 3 to Figure 8 below provides comparisons of the DR capacity contracted and recruited at the state level. As can be seen, while recruitment exceeded contracted capacity volumes in each of the states, the specifics of over- and under-recruitment by customer class varied⁶.

Figure 3: VIC contracted DR (63 MW)

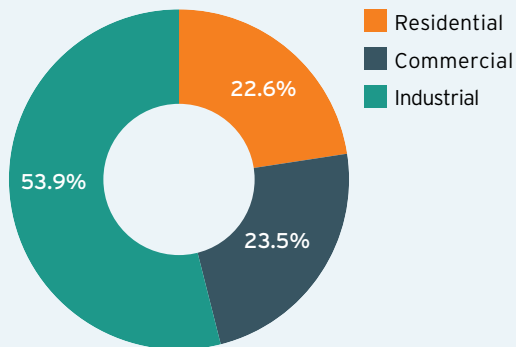
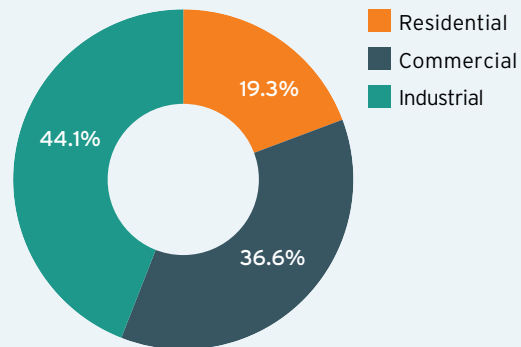


Figure 4: VIC recruited DR (68.3 MW)



⁵ Residential customers comprised just under 98 per cent of all end users involved in the proponents' portfolios. However, one portfolio, United Energy, accounted for just under 98 per cent of all end users and all residential end users. Leaving out United Energy, residential end users still accounted for over 91 per cent of the all end users in these portfolios.

⁶ One proponent did not report separately the number of customers or MW of DR it had recruited in Victoria and South Australia. Disaggregated numbers were estimated based on the amount of DR capacity this proponent had contracted for in each of the two states.

Figure 5: SA contracted DR (19 MW)

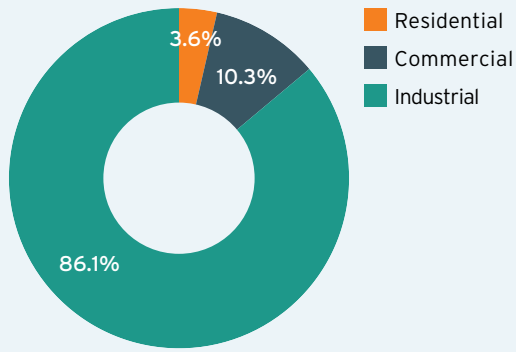


Figure 6: SA recruited DR (22.1 MW)

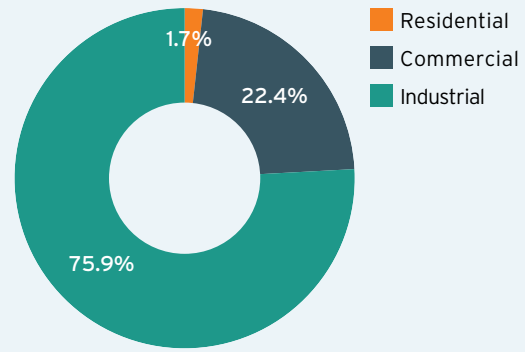


Figure 7: NSW contracted DR (61 MW)

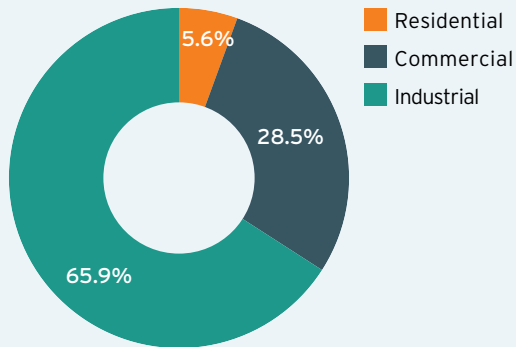


Figure 8: NSW recruited DR (73.2 MW)

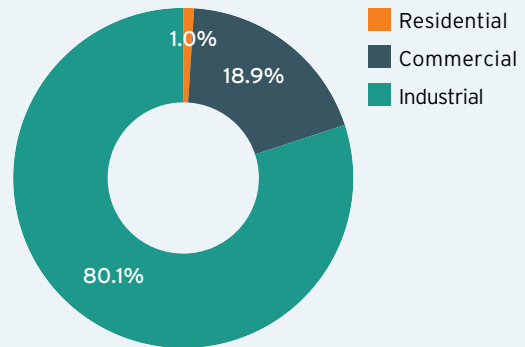


Figure 9 and Figure 10 show the capacity contracted for and recruited in the program as a whole in 10- and 60-minute notification portfolios by customer sector.

Figure 9: Contracted / recruited MW (10-minute)

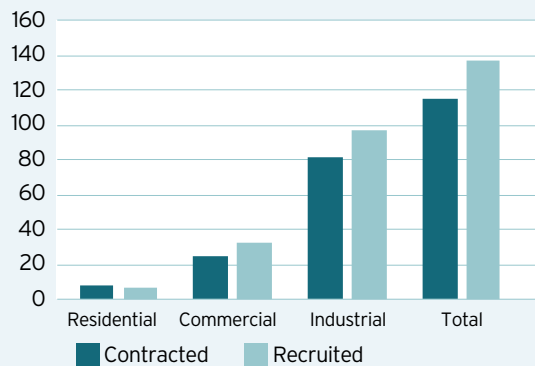
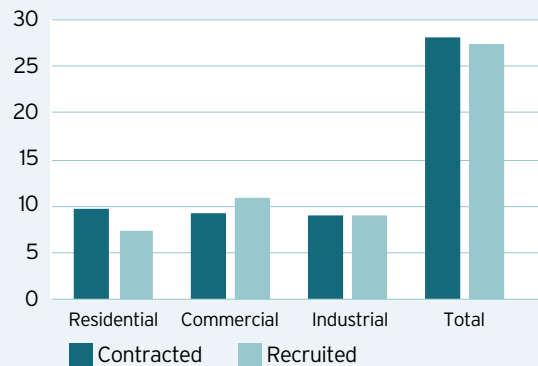


Figure 10: Contracted / recruited MW (60-minute)



Significantly more capacity was contracted for (and even more was recruited) in 10-minute as compared to 60-minute notification portfolios. This is a reflection of both the advances that have been made in communications and control technologies in the past five to 10 years, and the enablement funding that was made available by the ARENA program.

This level of difference varied across customer sectors, with it being most pronounced in the industrial sector. By contrast, the residential DR was about evenly split between the 10- and 60-minute notification programs, but recruited capacity did not meet the amount of capacity that had been contracted.

Figure 11 and Figure 12 show the MW capacity contracted for and recruited at the state level in the 10- and 60-minute notification portfolios.

Figure 11: Contracted / recruited MW (10-minute)



Figure 12: Contracted / recruited MW (60-minute)



As can be seen:

- Recruited volumes in 10-minute notification portfolios exceeded the amount of capacity that had been expected to be contracted in each of the jurisdictions.
- The 60-minute portfolio recruitment was less than contract volumes in Victoria, and exceeded expected contract volumes in New South Wales, resulting in a shortfall of capacity for the 60-minute notice program overall.

3. YEAR 1 OUTCOMES

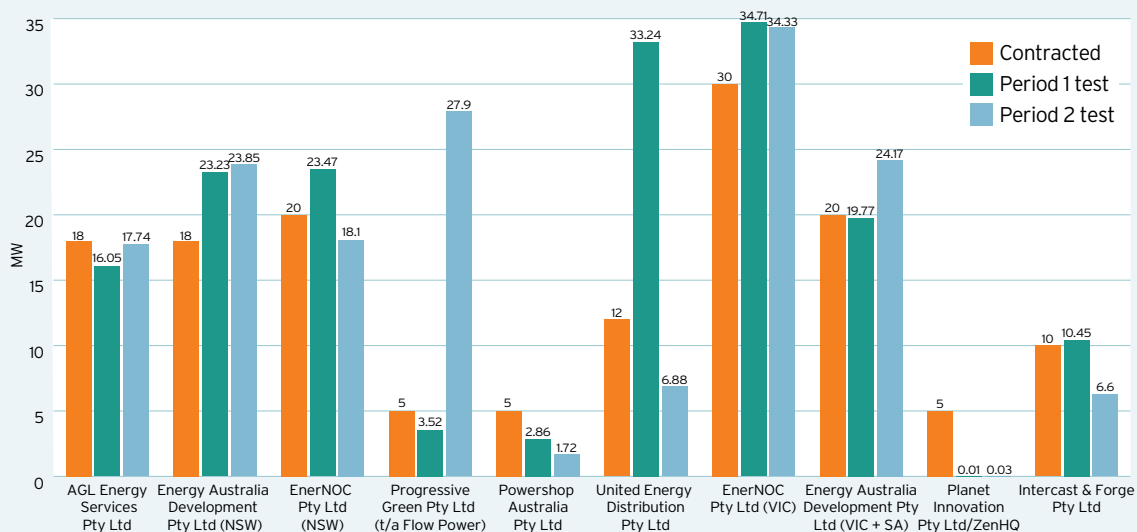
3.1 BUILDING CAPACITY THROUGH TESTS

The ARENA program requires that each proponent be tested prior to the commencement of program periods (as outlined in Table 2). The test, facilitated by AEMO, is used to confirm that the proponent can deliver the amount of DR they have been contracted for. AEMO selects test days that, to the extent possible, are similar to the type of day on which a RERT event would be called. Ideally, for Period 1, this would be a hot weekday in November and for Period 2 it would ideally be a cold weekday in May.

Overall, the combined portfolio delivered more DR than contracted for in Year 1. Results in the Period 1 test showed an aggregate delivery of 167.3 MW (117.0 per cent) against the aggregate contracted amount of 143.0 MW, and in Period 2 the proponents delivered 161.3 MW, representing 112.8 per cent of the contracted capacity.

However, as indicated in Figure 13, individual performance by the proponents varied, with some over delivering, and some under delivering. Section 5 of this report outlines a range of lessons learnt that help to explain some of the causes for these outcomes. Further, specific outcomes from each proponent is available in project knowledge sharing reports published on the [ARENA Knowledge Bank](#).

Figure 13: Year 1 outcomes by proponent



Note: Powershop's Period 2 result remains under review at the time of publishing this report. AGL Period 2 result includes C&I portfolio only.

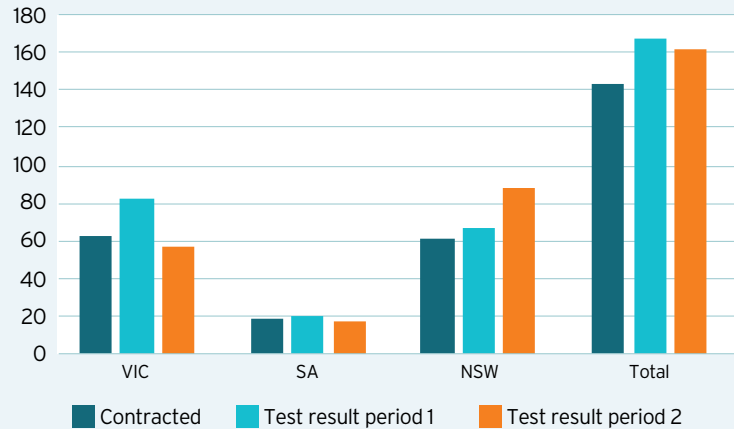
Table 5: Number of proponents with delivered DR as a percent of their contracted amount

Test	Less than 50%	50% to 75%	75% to 100%	100% to 125%	125% to 150%	More than 150%
Period 1	1	2	2	3	1	1
Period 2	2	2	2	2	1	1

3.1.1 RESULTS BY STATE

Figure 14 compares the contracted DR amount and test results for each of the Year 1 test periods by state.

Figure 14: Period 1 and 2 test results compared with contracted DR volumes (MW, by state)

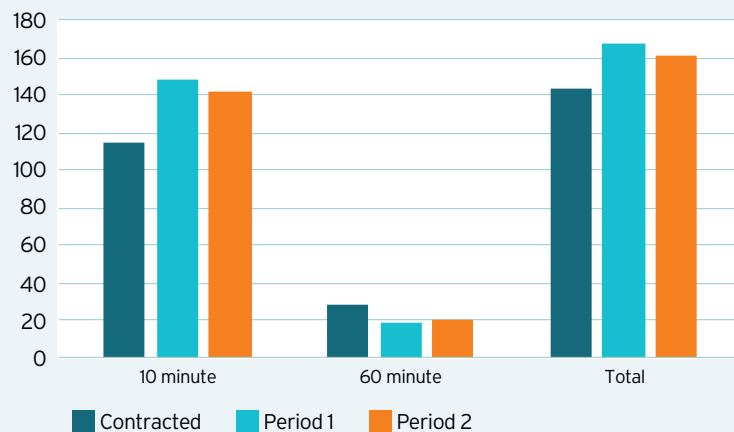


As can be seen, while test results exceeded the contracted DR volume in NSW in both the Period 1 and Period 2 tests, Period 2 test results did not meet the contracted DR volume in either Victoria and South Australia. While limited information is currently available, we know that NSW has a higher proportion of industrial load in its DR portfolios than the other states, and industrial loads tend to be more consistent sources of DR than the other sectors.

3.1.2 RESULTS BY NOTIFICATION PERIOD

Figure 15 shows the test results for portfolios by the notification period used.

Figure 15: Period 1 and 2 test results compared with contracted DR volumes (MW, by notification period)



While test results in aggregate exceeded the contracted DR volume in both the Period 1 and Period 2 tests for portfolios using a 10-minute notification period, the portfolios using a 60-minute notification period did not meet their aggregate contracted DR volume in the tests in either of the periods. To a significant extent, this is a reflection of the fact that the residential sector under-delivered its contracted level of DR in both Year 1 tests, and as shown in Figure 9 and Figure 10 above, comprises a significantly larger portion of the load in the 60-minute as compared to the 10-minute notification programs.

3.1.5 PROPONENT LED TESTS

In order to maintain customer engagement with the program, AGL held four dispatches of the residential behavioural demand response program, Peak Energy Rewards. The dispatches were undertaken on business days when temperatures were forecast to be above 30°C to simulate the type of conditions that would be likely to characterise an actual RERT event. Details of these dispatches are available in the table below, and in AGL's Knowledge Sharing report.

Table 6: Details of AGL's four dispatches of its residential portfolio based on its baseline methodology

Parameter	19 Jan	14 Feb	19 Mar	13 Apr
Day of the 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%
Reduction by customers with measured reduction (kW)	365	665	378	255
Average reduction of customers with measured reduction (kW)	0.77	1.35	0.86	0.62
Survey responses stating no loss of comfort	96.7%	79.0%	90.7%	89.3%

Source: AGL

3.2 PARTICIPATION IN RERT EVENTS

In Year 1 of the program, AEMO did not dispatch ARENA projects in actual RERT activations.

There were two occasions in Period 1 in which AEMO did consider dispatching several of the ARENA-funded portfolios and spoke with those proponents about activating their DR capacity. These 'near misses' took place on the following dates:

- AEMO thought a RERT event might occur on 30 November 2017, one day before RERT Panel Agreements and ARENA Funding Agreements officially commenced. After AEMO confirmed which of ARENA's proponent portfolios would be willing and ready to participate, AEMO sent Invitations to Tender (ITTs) to two of the proponents. In the end, neither project was activated as AEMO determined that conditions had changed and there was no longer a need for a RERT activation.
- On 19 January 2018 AEMO sent ITTs to two of the proponents, both of which were 60-minute notification portfolios. One proponent had not yet recruited its fully contracted capacity and therefore did not activate.
- Enel X reported that they responded to and accepted ITTs issued by AEMO for NSW on 7 and 8 June. However, on both occasions AEMO did not dispatch Enel X's DR portfolio.

4. PROGRAM MODELS

4.1 OVERVIEW

This section provides an overview of the program models offered by the proponents.

4.1.1 RESIDENTIAL PORTFOLIOS

The residential portfolios included both behavioural DR programs (BDR) as well as controlled load programs:

- In Year 1, the BDR programs that were offered primarily used SMS to notify participating customers of an event, with participation in each event based on an opt-in basis. Examples included:
 - AGL's *Peak Energy Rewards*
 - EnergyAustralia's *Mass Market Behavioural Demand Response* program
 - Powershop's *Curb Your Power* program
 - Zen Ecosystems' *PI Behavioural DR Programme* and its *Help the Grid* program, which is offered to the market through the RACV.
- The proponents also offered a range of residential controlled load programs, including:
 - AGL's *Managed for You* program, in which AGL installs a device to manage the customer's air conditioner, and an *Electric Vehicle (EV)* program, in which AGL manages when the end customer's EV battery is charged.
 - EnergyAustralia's *Mass Market Circuit Level Control Device Campaign*, under which EnergyAustralia installs high-level circuit monitoring and remote control of appliances nominated by the end user. This includes air conditioners, pool pumps and other loads, and its battery storage group control program, in which EnergyAustralia installs controllers on end customers' batteries and then (after notification to the customer) pre-charges the batteries (if needed) and discharges them remotely during a RERT event.
 - Powershop's *Grid Impact* program, which is offered through Reposit Power and works through controlled dispatch of end customers' battery storage capabilities. These are almost always paired with a rooftop PV system.

In all cases, the behavioural programs enjoyed a much higher level of participation than the controlled load programs. This is not surprising given that:

- no customer-side equipment needs to be installed for participation in the BDR programs that were offered
- virtually any customer is eligible to participate
- the customer retains sole and complete control over their energy use, including the decision as to whether to participate in any particular event
- the customer retains the ability to use their appliances and equipment as and when they please.

4.1.2 COMMERCIAL AND INDUSTRIAL (C&I) PORTFOLIOS

The most common type of program offered to C&I customers is based on load curtailment, either manually by the customer in response to a notification by the proponent, or through automated controls exercised by the proponent with the agreement of the customer.

Load curtailment programs were offered by EnergyAustralia, Enel X, Flow Power, Zen Ecosystems and AGL. One end-use customer, Intercast & Forge, a foundry in South Australia, provided load curtailment on its own upon notification from AEMO, without an aggregator as intermediary.

Examples of controlled load programs in the C&I sector include:

- Enel X provides metering at all its customers sites to monitor energy consumption. It also develops an individual Energy Reduction Plan in consultation with each of its customers and provides control equipment for those customers that want it. The Enel X Site Server provides a communications gateway for customer site metering data to the Enel X platform on a five-minute basis. This allows near real-

time assessment of site DR capability, automated dispatch of DR on its own or via the customer's Programmable Load Control and/or Building Management Systems, and near real-time assessment of DR performance.

- Flow Power installed a proprietary control unit (the kWatch Intelligent Controller) in the premises of all its DR customers. The kWatch unit provides live energy consumption data feeds to both the end customer and Flow Power, as well as alerts to the end customer regarding the scheduling, commencement and end of RERT tests and events. Once the end customer responds to the alert with an acceptance, the unit provides an automated response by sending a signal to the customer's equipment to reduce load.
- Zen Ecosystems provides two controlled load DR options:
 - (a) retrofitted remote load control of commercial sector refrigeration loads such as cool rooms, refrigeration cabinets and chest freezers
 - (b) control of commercial building HVAC loads.

The refrigeration load control is provided by control devices provided by Frigbot which trigger a defrost cycle upon request from Zen. The defrost cycle is part of normal daily operations, but can be timed to coincide with the need for demand response. Zen's proprietary ZenHQ system is used to provide automated load control of HVAC systems in smaller commercial buildings (those with approximately 1,200m² of floorspace and less than five control points). Zen also contracted medium-sized commercial buildings (those of approximately 2,400m²) where load control was manual and tended to apply only to non-critical areas of the building, and involved complete shutdown of the HVAC load.

4.1.3 UNITED ENERGY

United Energy (UE) provides DR through the use of remote-controlled voltage reduction at its 47 zone substations through its network control centre. UE's smart meters have been deployed across the distribution network to provide information on voltage at the meters of all its customers. This allows the company to ensure that the level of voltage reduction it undertakes remains above the minimum level required. This use of smart meter data is an important innovation because it ensures that voltage is maintained at the customer connection point, avoiding the potential for a voltage reduction to damage customers' end use equipment.

4.2 RECRUITMENT

In Period 1, proponents had less than four months following notification that their applications had been successful to recruit customers to meet their contracted capacity. The shortness of this timeframe presented challenges for most of the proponents. It was particularly challenging for Zen Ecosystems, a non-retailer proponent, who did not have an existing set of customers, and for Flow Power, whose portfolio was in a region in which they had only recently begun to operate. However, several of the other proponents with existing retail businesses also commented on the challenges posed by this timeframe. It is important to note that notwithstanding these challenges, the program did achieve its recruitment target for Year 1.

4.2.1 RESIDENTIAL PORTFOLIOS

The residential programs were primarily recruited via electronic direct mail:

- AGL recruited 700 residential customers in seven business days through an email campaign. Customers whose accounts indicated the presence of life-support equipment were not included in the recruitment effort for health and safety reasons.

AGL also used email to recruit customers into its *Managed for You* program. The response was much lower as 123 customer signed up to be enrolled in the program but only 58 were ultimately confirmed and onboarded to the program. Another 15 signed up for the EV stream.

- Powershop used electronic direct mail to recruit customers but added digital ads and account banners as well to different online platforms. About 7,500 registrations were received from an email campaign directed to around 56,000 of its customers that was implemented between 14 and 16 November 2017. That equates to a response rate of 13.4 per cent. By May 2018, the company had over 10,500 residential customers signed up to its *Curb Your Power* program.

Subsequent digital ads and account banners provided a continuing source of registrations such that by May 2018, the program had attracted a total of 10,634 participants accounting for 10,856 sites, of which 10,675 were residential and about 200 were commercial customers.

- EnergyAustralia's residential recruitment effort started modestly, with 'friendlies' (i.e. company staff, their friends and family members, and residential customers who had volunteered to help the company develop and test new products and services through its Brighter Council) targeted in the initial phase of the program. EnergyAustralia used electronic direct mail and an engagement portal as the primary means for getting a larger number of customers to sign-up to its Peak Response BDR program. By the end of Period 1, they had about 380 residential customers in their program, rising to approximately 450 by September 2018.
- Zen recruited its staff and their family members and friends for its modest-sized Save the Grid BDR program. The successor program, Help the Grid, was marketed by RACV to its members and achieved over 1,400 sign-ups between its commencement on 30 January and the end of February 2018.

4.2.2 C&I PORTFOLIOS

In most cases, the initial recruitment efforts within the C&I sector were based on proponents' knowledge of customers with suitable loads and potentially some prior involvement in DR activities. Recruitment efforts in the C&I sector were usually directed to specific customers rather than via the more broadcast approach used in the residential sector. Specific examples include:

- Enel X initially targeted C&I customers in industries where it had prior experience in developing DR for other applications, including the FCAS market. Enel X was also able to recruit the local entities of global organisations, including manufacturing and transport and logistics companies, who Enel X had an existing customer relationship with from other DR markets such as the United States. However, it also identified and contracted customers in industries where it had less experience. According to the company, this was done as part of its broader risk strategy and to provide:
*'A more diversified DR customer portfolio across NSW and Victoria that is not impacted by particular seasonal fluctuations in energy usage (i.e. Enel X's portfolio is not heavily reliant on seasonal HVAC loads), and ensures Enel X is not reliant on any single industry to deliver its aggregated reserve.'*⁷
- AGL employed a direct marketing approach based on their knowledge of customers who had a high peak demand and had previously participated in peak demand or had registered an interest with AGL to participate in DR programs. Using this knowledge AGL was able to recruit participation widely.
- Flow Power's recruitment campaign consisted of working with local government, producing webinars and proactively reaching out to organisations in the right target markets to develop a DR portfolio. Utilising these channels to reach out to customers helped to provide background education as to what DR is and how businesses can provide DR with their existing loads.

⁷ Enel X Knowledge Sharing Project performance report, 15 June 2018, p5

4.4 PARTICIPATION INCENTIVES

4.4.1 RESIDENTIAL PORTFOLIOS

The proponents that offered residential programs employed sign-up, participation and performance-based incentives. The mix and level of the incentives varied by proponent, but tended to be significantly higher for load control programs, as shown in the table below.

Table 7: Examples of incentives provided to residential DR providers

Proponent	Program	Sign-up incentive	Participation incentive	Performance incentive
BDR programs				
AGL	Peak Energy Rewards	\$50		\$2/kWh reduction
EnergyAustralia	PowerResponse	\$25 bill credit	\$10 per event	\$10 per event in which load was reduced by at least 10% \$25 for responding to surveys
Powershop	Curb Your Power			Differing \$ amounts based on minimum level of kWh reduced in each hour of the event Additional \$30/kWh for average kWh reduced for end-use customers that participated in every event
Zen Ecosystems	Save the Grid Help the Grid		2 movie tickets (value: \$29) Entry into a draw for a weekend holiday	
Controlled load programs				
AGL	Managed for You	\$300 for AC \$300 for EV	\$30 per event (AC and EV)	

In its *Peak Energy Rewards* BDR program, AGL offered customers a sign-up incentive of \$50, as well as \$2 per kWh reduction as compared to their baseline consumption. Over the four events that AGL ran during Year 1 of the program, the average incentive earned by customers participating in the *Peak Energy Rewards* program was \$12. The average for the top 10 per cent of participating customers was \$43, while for the bottom 10 per cent it was \$2. Incentives in AGL's *Managed for You* load control program (in which AGL managed the customer's air-conditioner or EV battery charging) were significantly higher, with a \$300 sign-up incentive and a flat \$30 payment per event.

EnergyAustralia have a range of incentives for customers participating in their *PowerResponse* BDR program. All of the incentives are structured as bill credits and are applied in the following way:

- customers taking part in an event receive a \$5 bill credit
- customers receive a \$10 credit when they reduce their usage by 20 per cent compared to normal usage during an event.
- customers receive a \$20 credit when they reduce their usage by 50 per cent compared to normal usage during an event.

Powershop only offers performance-based incentives in its *Curb Your Power* BDR program. They are

provided as 'power credits' that the customer can use to buy electricity from Powershop, and were mostly paid on the basis of the level of by which the customer's kWh consumption was reduced, using the following schedule:

Table 8: Powershop Curb Your Power base performance incentives

Reduction (kWh in each hour of the Event)	Reward (power credit)
10 per cent reduction from baseline or 1 kWh reduction for every hour	\$10
2 to 5 kWh reduction for every hour	\$20
5 to 10 kWh reduction for every hour	\$50
10 to 20 kWh reduction for every hour	\$100
20+ kWh reduction for every hour	\$200

Source: Powershop

It is worth noting that:

- The lowest level of incentive offered to the customer for achieving a 10 per cent reduction as compared to their baseline even if that was less than 1kWh/hr. This feature provided a means for participating customers with low baseline energy consumption to earn performance incentives.
- Setting the incentive with reference to the kWh reduction achieved in every hour of an event means that the incentive is based on the lowest kWh/hr achieved by the customer over the course of each event. This rewards customers that achieve an even reduction across the hours of an event and is a means of preferencing a reduction in instantaneous demand (where average hourly demand serves as the proxy for instantaneous demand) as compared to total energy reductions.

Powershop also offered an additional incentive for customers that achieved particular levels of load reduction in all events over the course of the year, as shown in Table 9 below.

Table 9: Powershop's additional rewards for participation in all events

Average reduction across all events	Reward (power credit)
Greater than 5 kWh	\$150
Greater than 10 kWh	\$300
Greater than 20 kWh	\$600
Greater than 30 kWh	\$900

Source: Powershop

The incentive used by Zen in its initial *Save the Grid* program was based on intention. When Zen notified participating customers of an event, they asked whether the customer intended to participate and reduce their energy consumption. If the customer answered in the affirmative, they were given 2 movie tickets. Zen's intention was that the customer would go to the movies as a way to reduce their energy consumption at home during the event. However, surveys that Zen undertook with its customers identified that (a) none of the customers that responded to the survey used the movie tickets at the time of the event, but instead used them later, and (b) about half of the respondents would have actually preferred a Coles voucher.

The *Save the Grid* program included 50 customers and was the forerunner to the much larger *Help the Grid* program that was marketed by the RACV and attracted about 1,400 participants. The only incentive in that program, which was marketed as a way for RACV members to 'make a difference in the community by... [participating] in energy-reducing behaviour to help avoid a blackout', was an entry into a draw for a chance to win a weekend at an RACV resort on the Surf Coast. Only RACV members that participated in the *Help the Grid* program were eligible for the draw.

4.4.2 C&I PORTFOLIOS

In many cases the level of the incentives offered to C&I customers was flexible, in that more in one area could be traded off with less in another and were negotiated with the customer.

The three most commonly provided types of incentives offered to C&I end users were:

- availability payments
- dispatch payments
- free communications, monitoring and/or control equipment needed to enable their DR, particularly in the case of 10-minute notification portfolios.

Enel X provides a very good representative example of the nature of the incentives provided. Enel X presented customers with the following pricing structures/incentives:

- *availability payments, based on customers' daily availability for responding to a DR event. The units for these payments are \$/MW/year*
- *energy payments, based on the energy delivered/reduced per interval during a DR event. The units for these payments are \$/MWh*
- *availability payments cover the costs of searching for, contracting, commissioning, account managing, and ensuring continuous availability of each customer facility. Energy payments are intended to cover the short run marginal costs associated with load curtailment during DR events.*⁸

Enel X also provided its end-use customers with a range of technology to provide DR, including solutions for continuous monitoring of customers' energy consumption in near real-time, and for remotely initiating load reduction during DR events.

Flow Power provided availability payments, the magnitude of which were based on the volume of capacity that the end-user provided in tests or events, and activation (dispatch) payments, which were based on the volume of load shed during an event. To participate customers invested in the kWatch Controller, which gave them visibility of their use throughout the year.

AGL provided its end-use customers with both an availability fee and a dispatch fee. AGL's availability fee is paid to the end-use customers monthly and is reset after each test or dispatch to reflect the capacity provided by the customer. AGL noted that:

*'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.'*⁹

Zen provides its end-use customers with DR enabling equipment including Frigbots, which provide remote control of refrigeration loads and ZenHQ, a centralised energy control system for multi-site businesses. It combines smart thermostats and lighting controls with a cloud software solution to provide a simple and effective building management system.

⁸ Enel X Knowledge Sharing Project performance report, 15 June 2018, p6

⁹ AGL NSW Demand Response Knowledge Sharing Report, September 2018 p20

5. LESSONS LEARNED

5.1 GENERAL

5.1.1 BASELINES

Certain issues with the CAISO 10 of 10 baseline methodology were noted early in Period 1 of the program. ARENA has commissioned a separate study on the applicability of the 10 of 10 baseline methodology to specific types of loads that had been recruited for this program, but had not previously been used in RERT applications.

The 10 of 10 baseline methodology uses an average of the previous 10 'like days' (i.e. not weekends, public holidays or event days) to create a base profile of consumption against which metering data is compared to calculate the DR contributed on an event day. If a facility's load shape is quite different on a very hot day from a medium temperature day, DR on a hot day may be difficult to calculate accurately if the days comprising the baseline are characterised by moderate temperatures. A similar effect may result if a facility has a PV system. Where the amount and pattern of solar radiation on a DR day differs markedly from that of the baseline days, the result can over- or -understate the actual DR provided.

Several proponents noted that particularly for residential and smaller commercial customers, consumption against the baseline can vary significantly across the customers within a portfolio in regard to any particular DR event, and for any particular customer across DR events.

5.1.2 SHORT TIMEFRAMES

A number of the proponents noted that, while it was unavoidable, the very tight timeframe of Year 1 posed a significant challenge, specifically for recruitment. However, it should be noted that this is not a recurring issue, with several proponents commenting that they had succeeded in meeting or exceeding their recruitment targets for Year 2.

By contrast, Enel X noted that as they had previously entered the Contingency FCAS market (in response to the opportunity provided by the Ancillary Services Unbundling rule change) they had already developed their organisational capability to recruit and manage DR resources. This included an existing base of customers that could be drawn upon to recruit for the Short Notice RERT. This indicates that the time required to mobilise DR resources for the provision of additional services is likely to decrease in the future, as DR that has been contracted for any particular use will be known to aggregators and more easily recruited for the provision of DR for other uses.

5.1.3 DATA ACCESS

Proponents that were not the retailer of the customers within their portfolios reported several issues regarding access to metering data. In relation to C&I customers, AGL noted that metering data for non-AGL customers comes in a wide variety of formats from different metering data providers (MDPs). This required AGL to develop and use manual processes to integrate the data from different MDPs so it could be processed on a consistent, portfolio basis. They also noted that it sometimes takes significant time to receive the data from some MDPs despite the fact that AGL provided them with signed authorities from the customers giving their permission for AGL to receive the metering data.

Zen reported similar problems with regard to the customers in its residential portfolio, which they said were related to privacy issues. This made it impossible for Zen to provide feedback to individual customers on their success, or lack thereof, in reducing their demand, and therefore to provide performance-based incentives. Zen said this left them no alternative but to provide participation-based incentives. Zen noted that such participation-based incentives were relatively ineffective and that the lack of a means to provide feedback to customers on an individual basis could result in them losing interest in the program.

5.1.4 DATA VERSIONING

EnergyAustralia noted that revisions to metering data from the market can be made several months after an event, and this has the potential to materially change the level of performance achieved by an aggregator and that of individual customers within the aggregator's portfolio.

5.2 RESIDENTIAL PORTFOLIOS

5.2.1 CUSTOMER AWARENESS AND PRESENTATION OF THE VALUE OF THE PROGRAM

All of the proponents used electronic direct mail (except for Zen, though their channel to market, the RACV, did use that approach) and other forms of electronic marketing including websites and electronic portals.

AGL identified that while reducing their bill (whether directly or by earning incentives) was the primary motivation for most participants in its residential BDR program, helping to protect the community against blackouts and helping to support the transition to renewable energy were both strong secondary motivations.

AGL also identified that participation in their residential BDR program was 'skewed towards more progressive and engaged energy users', many of whom had already been motivated to reduce their energy consumption. The strong response among Powershop customers to its BDR program and the experience in other residential BDR program supports these findings.

Powershop reported that they are considering the use of more segmented messages to customers based on their performance in providing DR. AGL and EnergyAustralia's experience was similar in this regard. Both companies noted that their residential BDR customers have been happy with the program's email communications, and particularly the post-event summaries that showed customers how they performed during tests and events.

Relatively high percentages of the residential program portfolios had rooftop PV systems. In Victoria, Powershop and EnergyAustralia both reported that approximately 23 per cent of their participating customers have PV systems, whereas in New South Wales, AGL and EnergyAustralia reported that over half of their customers had PV.

5.2.2 MANAGEMENT OF PARTICIPATING CUSTOMERS

Powershop noted that providing feedback to customers after tests and events is important for customers' continuing engagement. They noted that although their original and current messaging is provided through a one-way communications system, they are considering adding two-way functionality.

AGL and EnergyAustralia supported the importance of feedback. EnergyAustralia added that providing customers with practical information on the actions they could take to effectively reduce their consumption during events is also important for continuing customer engagement and the success of the portfolio. It may also provide insight into additional product and service offerings to these customers.

5.2.3 PARTICIPATION IN EVENTS

AGL, EnergyAustralia and Powershop reported that customers participating in residential BDR programs tended to be very active. Customers' self-reports of their participation in events was relatively high, and examination by AGL of billing data among these customers indicated that more than 60 per cent of the customers that were exposed to the four AGL-declared events participated in them, and 90 per cent said they were either likely or very likely to participate in future events.

EnergyAustralia also reported high levels of engagement among its residential BDR customers, and a high degree of spread in their outcomes. They noted that, based on test results, the BDR program has delivered less demand reduction than they had expected. They have identified several reasons for this including the fact that tests may be called when the DR potential and capability of their portfolio is not at its highest level.

5.2.4 RESIDENTIAL CUSTOMER MOTIVATION AND ENGAGEMENT

Several of the proponents undertook their own research and/or worked with consultants to better understand customers' motivations regarding DR programs and how best to design their messaging, incentives and other program features to maximise interest and engagement.

In addition, ARENA commissioned ThinkPlace, a strategic design consultancy, to research residential customers' motivations for participating and experience in behavioural DR programs. Overall, the [ThinkPlace study](#) found that people are willing to change their energy usage to respond to extreme events. However, they found that there is scope for demand response aggregators to include better feedback mechanisms (e.g. informing participants after events) and reward systems that better align to the customer's social preferences (such as status incentives).

Other findings include:

- As the events are not considered significant to the average energy user, it's challenging to maintain importance and therefore guarantee continued participation.
- A lack of real-world activations under the trial may provide a barrier to customer recruitment and retention.
- Retailer recruitment and messaging could be more effective if targeted to specific customer segments.

5.2.5 TECHNOLOGY ISSUES

A number of technology related issues arose during the year that required individual proponents to make adaptations to their programs.

Ability to retrofit remote load control technology

AGL noted that the primary barrier to participation in the air-conditioner stream of its *Managed for You* program was the lack of compatibility of the customer's air conditioner make and model with Australian Standard AS 4755, making it impossible for it to be remotely controlled. Approximately 40 per cent of the customers that signed up for the program had air conditioners that were compatible with AS4755.

This was further complicated by the fact that the information required to ascertain whether the unit is compatible with remote control is often only available on the nameplate of the equipment, which is typically located in places that are difficult or potentially unsafe to reach. Site visits were often required to ascertain compatibility, which increased the time spent by both AGL personnel and customers, and the expense incurred by the program.

Additionally, once the customer's equipment proved suitable for the program, it was found that most of the air conditioners required additional Original Equipment Manufacturer (OEM) parts (demand adapters) and some required translation of commands.

Equipment warranty and cost issues

EnergyAustralia observed a reluctance on the part of residential customers to purchase batteries. They surmised that customers may be expecting that in the near-term, prices will come down and/or material technical improvements may be made to the technology. Either of these perceptions could serve to defer purchase decisions.

5.3 C&I PORTFOLIOS

5.3.1 C&I CUSTOMER AWARENESS AND DECISION FACTORS

Awareness

Flow Power reported that businesses in NSW were much less aware of demand response as something they could provide and that could have value in the market. Flow Power felt that this was possibly due to the fact that NSW has been less exposed to price variability issues than Victoria and South Australia. As a result, customer education required more effort and time than initially expected. Flow Power has since established an office in NSW to service these customers.

AGL reported similar findings regarding C&I customers in NSW.

Decision factors

Flow Power noted that a number of the larger customers they approached (i.e. those with maximum demands of 1 MW or more) felt that the financial reward was not sufficient to offset the operational and reputational risks that the program might entail for them. However, customers who were spot market exposed saw more benefit in the program, even those who were not Flow Power retail customers. Flow Power also reported that in some cases, there were conflicting drivers within the businesses. Often agreements were signed by financial teams while operational teams were left to implement. Training and awareness programs within businesses have resolved some of these issues.

AGL also reported pursuing smaller sources of C&I DR due to the difficulty of identifying 'sizeable curtailable C&I loads that can sustain a four-hour continuous outage' without the benefit of a generator. However, they also noted that the installation of the hardware required to enable DR is not economic for many smaller or multi-site C&I customers.

On the other hand, Enel X noted that while financial incentives were a key motivator for program participation, customers 'also appeared to place value on... being part of an industry-wide solution for easing demand on grid infrastructure and helping to ensure system reliability during peak demand periods'.

AGL noted similar motivations beyond the financial and noted that state and local government-owned bodies often participated 'largely because of the community benefit'.

5.3.2 PORTFOLIO-LEVEL OF DR RESPONSE, DIVERSIFICATION AND OVER-SUBSCRIPTION

Several of the proponents including Flow Power and Enel X explicitly acknowledged the need for strategies to reduce the risk of under-delivery during an event due to some customers not participating at all on a certain day or responding at a level below their usual level due to operational factors¹⁰.

While both Flow Power and Enel X said that they rely on over-recruitment of DR capacity to manage this risk, Enel X also mentioned that they had consciously adopted a strategy of diversifying the types of C&I customers they recruited.

5.3.3 TECHNOLOGY PROBLEMS AND CONCERNS

Perceptions of operational risk

Flow Power noted that some customers expressed concern about integrating new technologies with their existing controls and processes. In most cases this could be addressed by improving the customer's understanding of the operations of the kWatch Intelligent Controller that Flow Power installs on the customer's site, and the process that Flow Power uses when sending notification, activation and cease DR signals. As the technology develops, this is becoming less of an issue.

AGL reported similar perception of risk on the part of C&I customers, including a concern that the installation of the aggregator's equipment could increase the cybersecurity risk to the facility.

Reliance on Meter Providers

Enel X noted that the installation equipment on customers' sites that enable the collection of real-time meter data to monitor customer DR performance requires access to utility meter pulses. Connection to this functionality can only be provided by the Meter Provider (MP) for that NMI and the timeliness with which different MPs responded to requests for this service varied significantly. Enel X also noted that it was difficult to identify and connect with the right person within the MP organisation. The combination of these issues 'sometimes added several weeks to the hardware deployment process'.

¹⁰ Interestingly, operational factors can include the need to run equipment for production reasons that in most cases would be available to be interrupted, or low loads on equipment that would otherwise be able to reduce load (e.g. space cooling on a mild day that on a warmer day would be able to provide DR through various load management strategies).

Under-performance of DR technology

Zen reported that the Frigbots it had installed in commercial premises were expected to produce a significant level of load reduction in refrigeration applications, but 'did not appear to produce any visible DR'. Zen is seeking to understand the causes of this.

EnergyAustralia also reported that in one instance a generator at an industrial customer had converted to run on bio-fuel required at least 2 hours notice to adequately heat the fuel. This made it impossible for the customer to use the capability installed under the program to respond to a 60-minute activation notice. The alternatives considered were for the customer to:

- (a) respond using diesel, which was not the intent and incurs greenhouse gas emission
- (b) install a heater thermostat and begin heating the bio-fuel at the beginning of the RERT testing window, so the generator can be dispatched using it within the program notification window.

6. LOOKING FORWARD TO YEAR 2

The combined contracted capacity for Year 2 rises from 143 MW to 187 MW. As a result, in nearly all cases, the contracted MW capacity for each proponent also grows in Year 2, with many of the proponents increasing recruitment numbers to reflect this.

Early results indicate that the success of the DR RERT trial will continue to build in Year 2, with a number of lessons learnt from Year 1 already being applied by the proponents with positive outcomes.

Proponent knowledge sharing reports from each Period will be posted on the ARENA Knowledge Bank as they become available, with additional pieces commissioned by ARENA to continue building on the trial objectives. As more data is received, ARENA will look to publish knowledge on the cost effectiveness of DR in the RERT, RERT baseline applicability and insights where possible into actual activations.

For any comments or questions on this report, please contact knowledge@arena.gov.au.

