

ARENA Demand Response Trial: Knowledge Sharing Project performance report

Report Date: 1 April 2020

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

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1. Report summary

This report provides an overview of the demand response (“DR”) provided by Enel X and its customers across New South Wales and Victoria for the ARENA Demand Response Trial, and knowledge sharing pertaining to the following period: **1 June 2019 to 30 November 2019 (Program period #4)**

Consistent with Enel X’s previous knowledge sharing reports, this report:

- describes Enel X’s technology used to provide DR, including the software and hardware solutions used to monitor customer load and remotely initiate curtailment
- provides a summary of Enel X’s DR business model and the pricing structures and incentives for recruiting customers
- Enel X lists the various industries from which Enel X has recruited its commercial and industrial (C&I) customers. A full list of customer types and their general locations is in **Appendix 1**.

This report also sets out the knowledge and experiences gained by Enel X during the reporting period, including:

- Enel X details of the test undertaken in June 2019 (‘winter 19 test’) for Program Period #4
- Enel X details of the two test events in November 2019 (‘summer 19/20 test’) during Program Period #4
- Summary of lessons learnt from the operation of the project during this period, including Enel X’s reflections on the reduced baseline demand on working days before and after public holiday periods, including Queens Birthday, Melbourne Cup Day (VIC), and the Christmas/New Year’s period.

Note: the report is structured and labelled such that many section and subsection headers are verbatim prompts excerpted from the *Knowledge Sharing Agreement* (“KSA”) Enel X and ARENA agreed to. Use of these headers helps to ensure that Enel X has addressed all topics and included all information specified in the KSA.

2. Overview of demand response being provided

In accordance with its contracts with ARENA and AEMO, Enel X has developed a **20 MW reserve in New South Wales (NSW)** and a **30 MW reserve in Victoria (VIC)**.

The combined 50 MW DR portfolio is comprised of C&I energy users who have agreed to safely reduce their electricity consumption during DR events when dispatched by AEMO. These C&I energy users (Enel X’s customers) are capable of implementing load curtailment within 10 minutes of receiving dispatch instructions from Enel X indicating that a DR event is commencing.

In the first six months following program start on 1 December 2017, Enel X recruited an additional 5.2 MW (approx. 17%) in firm capacity for its VIC portfolio. Since then, Enel X also recruited an additional 3.2 MW for VIC (including 1 MW just before the busy summer 2018/19 summer), as well as 2.5 MW for its NSW portfolio. This presents a total 10.9 MW (or 22% of the 50 MW combined portfolio) of additional capacity recruited since program start. As noted in the previous Knowledge Sharing Report, Enel X planned to build a 20% buffer for its portfolio.

The intention of this is to provide an operating buffer in the event of unplanned unavailability at customers' sites, and to offset lower operational demand from temperature-sensitive sites such as cold storage facilities. Enel X is confident that its expanded portfolio will be able to perform strongly for all upcoming test and dispatch events for the remainder of the three-year trial program.

Summary of technology being used to provide DR

As stated in previous Knowledge Sharing Reports, Enel X has developed individual Energy Reduction Plans ("ERPs") in consultation with each of its customers – these are stored in Enel X's customer database and accessible to customers via the Enel X desktop application.

Each ERP includes the following three-step process:

- 1) Enel X will notify customers that a DR event has been called.
- 2) Customer to confirm phone and e-mail notifications.
- 3) Customer sites to commence load reduction processes (E.g. safely reduce energy usage, shut down equipment, and processing units etc.) – **Note: this part of the ERP is customised to each customer's facility.**

Enel X has installed its own metering technology at customer sites to monitor the facility's demand and facilitate effective demand response. The Enel X Site Server (ESS) is a highly secure, low-latency communications gateway for energy management and demand response applications.

During DR events, an "event performance dashboard" becomes available in the Enel X Demand Response portal, which Enel X's staff and customers can use to assess the near real-time "performance" of each facility: the instantaneous and average load reduced from its adjusted baseline – superimposed against a "reduction target".

Additionally, a portion of the sites has been equipped with control equipment that allows Enel X to remotely initiate a load reduction. Automated DR capability is provided via the ESS relay control module, providing a clean contact state change at both the start and end of the dispatch period. Customers integrate this signal into their Programmable Load Control and/or Building Management Systems to provide a safe, controlled initiation of load curtailment.

Enel X works closely with customers that are able to automate their energy reduction plans, with the controls tested prior to full customer enrolment. As participation by these customers in DR events is automated and pre-authorised, the customer will simply receive notification from Enel X that a DR event is taking place. **See APPENDIX A, B AND C for more details of the Enel X technology being used to provide DR.**

Business model and pricing structures/incentives employed to recruit capacity and activate load reduction

Enel X presented customers with the following pricing structures/incentives to participate in the trial:

- 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 customer's short run marginal costs including the costs of additional resources associated with load curtailment during DR events.

Payment terms with customers are negotiated on a case-by-case basis, depending on:

- individual operational requirements
- size of loads, cost of reducing load
- magnitude and complexity of required on-site technology and controls work
- opportunity cost of other energy management strategies
- other commercial considerations.

Updates from previous report

Enel X has made various observations of customer payment preferences, all the way from its experiences in recruiting customers for program start on 1 December 2017, and during subsequent customer enrolments throughout the program. It has been evident the majority of customers we have recruited have a stronger preference for firm Availability Payments over Energy-only payments for energy delivered during events.

During contract signing, which often requires approval from senior management including the Chief Financial Officer or General Manager Procurement, customers have indicated they prefer a steady and reliable stream of revenue (i.e. Availability Payments). This is considered “bankable” revenue, in contrast to what they might potentially earn by way of Dispatch Payments during emergency events. One particular customer mentioned they did not want to have to depend on a grid emergency in order to make money from the program.

In addition to this, customers from our other DR programs (who may have previously enrolled with other ARENA DR providers) have also indicated that in future they would lean towards more guaranteed Availability Payments over “opportunistic” Energy-only payments for dispatch events. One particular customer also observed that in hindsight they may have been better off overall signing up with an Enel X High Availability / Low Energy payment option, as opposed to a Low Availability / High Energy program which included the promise of potentially large

payments due to forecast high temperatures over summer leading to increase probability of grid emergencies.

Many of the ARENA DR portfolios, including that of Enel X are available at 10 minutes notice, so therefore it would appear these reserves would be the last to be dispatched by AEMO, and therefore have the least chance of being dispatched. This means those customers on ‘Energy-Only’ payments would have the least chance of earning revenue compared those on firm Availability Payments.

Customer types and geographic location

Enel X’s initial approach was to target C&I customers in industries where it had prior experience developing flexible loads in other markets. This included businesses such as chemical manufacturers, metalworkers, and cold storage and refrigeration facilities.

Following program commencement, Enel X has been able to identify and contract new customers in industries in which we had less prior experience. This included industries such as fruit and tree nut growing, product manufacturing, as well as HVAC customers in the tertiary education sector and more recently, the retail space – as would be expected the majority of the retail customers are in metropolitan regions of Melbourne (i.e. inner and outer suburbs, as opposed to inner-city or regional rural areas).

All new customer loads will provide an invaluable resource as part of our VIC and NSW portfolios because they help to offset lower baseline demand from seasonal customers (such as cold storage facilities) in the winter months. This provides Enel X with a more diversified DR customer portfolio, which is not heavily reliant on seasonal HVAC loads, and ensures Enel X is not reliant on any single industry to deliver its aggregated reserve.

The newly recruited customers from the aforementioned industries have demonstrated an ability to successfully participate in this ARENA DR program, with strong results in the recent test events.

To date, Enel X has recruited a range of C&I customers from the following industry sectors:

Table 1: Commercial and Industrial customer segments

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

With the recent additions to our VIC and NSW portfolios, the percentage split (in terms of MW capacity) is now approximately 30% commercial, and 70% industrial. This is in line with the forecast guidance Enel X provided to ARENA in its application to the Demand Response Competitive Round. In terms of overall customer numbers enrolled in the program, the percentage split is approximately 50% commercial and 50% industrial. This reflects the fact that several of our Commercial customers are multi-site customers, who typically have a much lower MW consumption than Industrial sites.

The charts below provide an illustration of the various industry segments that make up our VIC and NSW portfolios (by MW).

Figure 1. VIC customer segments by percentage of portfolio

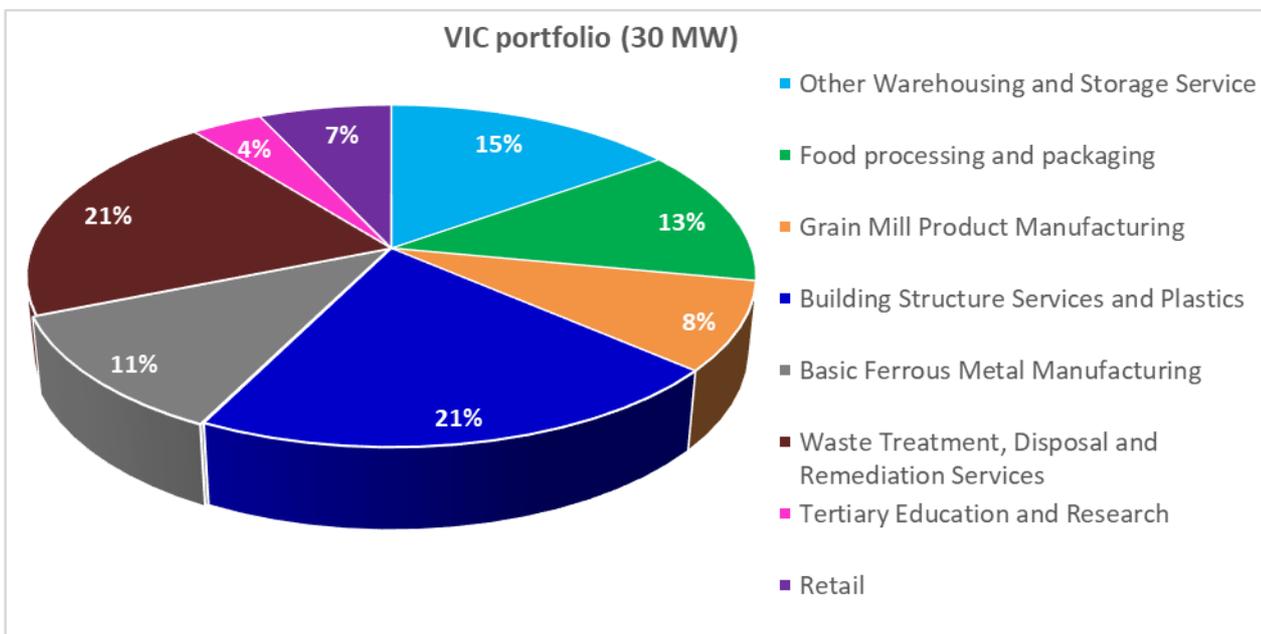
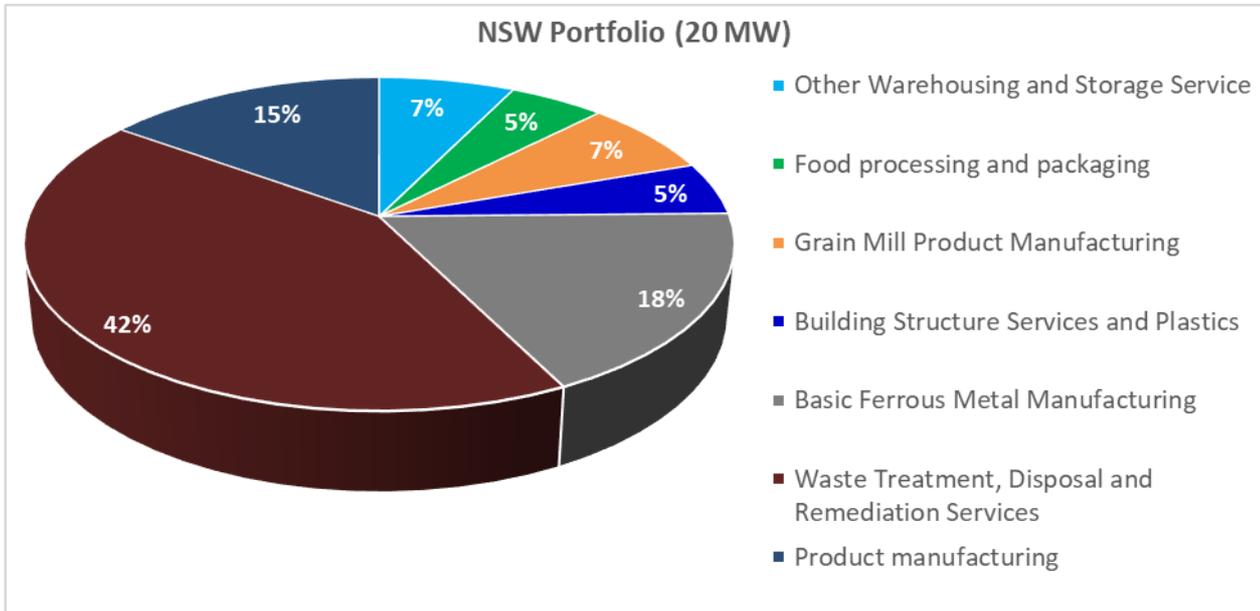


Figure 2. NSW customer segments by percentage of portfolio



In VIC, most commercial customers are located in the outer suburbs of Melbourne, such as Campbellfield, Clyde and Laverton, and others in regional cities such as Shepparton. The industrial customers are mainly located in the inner Melbourne suburbs such as Altona and Kensington. In NSW, both commercial and industrial customers are mainly located in the outer western suburbs of Sydney between Parramatta and Penrith.

A more detailed table outlining each customer’s general location and industry type is provided below in **Appendix 1**.

3. Analysis of performance based on six-monthly test data and any real activation data

Enel X is required to test its VIC and NSW portfolios every six months – once in the two months prior to June, and once in the two months prior to December each year.

The reserve quantities to be tested are:

- 20 MW in NSW
- 30 MW in VIC.

Enel X requested testing of its NSW portfolio in early June 2019 (for Program Period 4), and both NSW and VIC portfolios in mid-late November 2019 prior to Program Period 5 commencement.

Winter 2019 testing

Victoria (30 MW)

As Enel X’s VIC portfolio performed strongly over back-to-back dispatch event days over the 24th and 25th of January, Enel X sought and received approval from both ARENA and AEMO to forgo testing of this portfolio in April/May.

New South Wales (20 MW)

Enel X had initially planned to undertake testing in early April 2019; however, this was postponed until May due to a fire emergency caused by an explosion at one of our large industrial sites, which put exceptional limitations on the on-site staff's ability to respond to a test event.

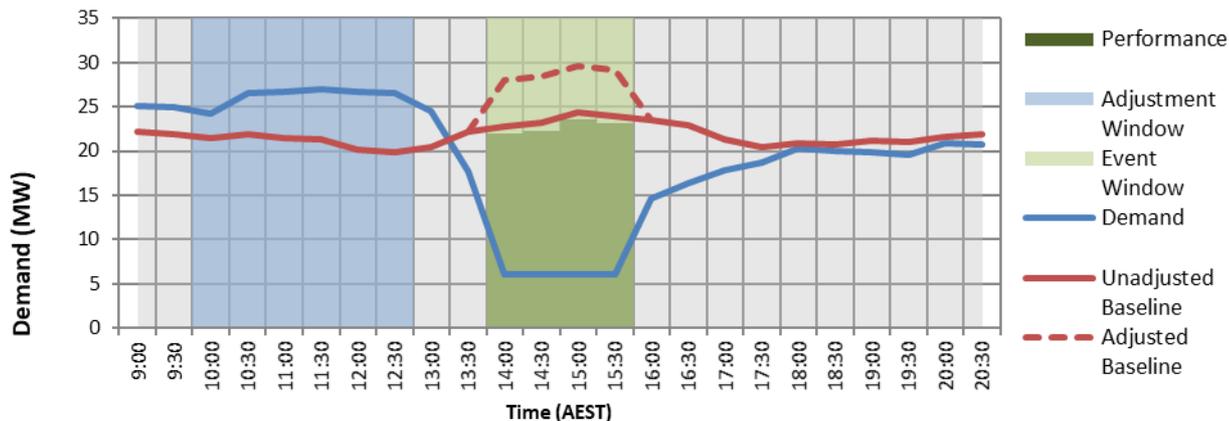
Unfortunately, due to storms and lightning strikes in late May that caused a major outage at our largest site (and required major electrical works), Enel X had to postpone the test to the first week of June. During this test week, NSW temperatures were 2-3 C below historical averages, with the actual test day being only 18 C – this was substantially lower than what we would have expected on a real RERT, dispatch day.

However, as Enel X's NSW portfolio (in contrast to VIC) does not contain many temperature-sensitive sites, it is therefore not heavily reliant on warm days in order to simulate a real dispatch scenario for summer.

Fortunately, as Enel X was able to recruit an additional 2.5 MW in the previous year, this provided a robust operating buffer, notwithstanding the fact that all customers had indicated their availability and willingness to participate in the test event.

All customers performed strongly, and Enel X was able to deliver a very strong result of 23 MW (115% of target) with several individual customers performing much better than expected (**see Figure 3 below**).

Figure 3. NSW portfolio (20 MW) test event performance – 6 June 2019



Summer 2019/20 testing

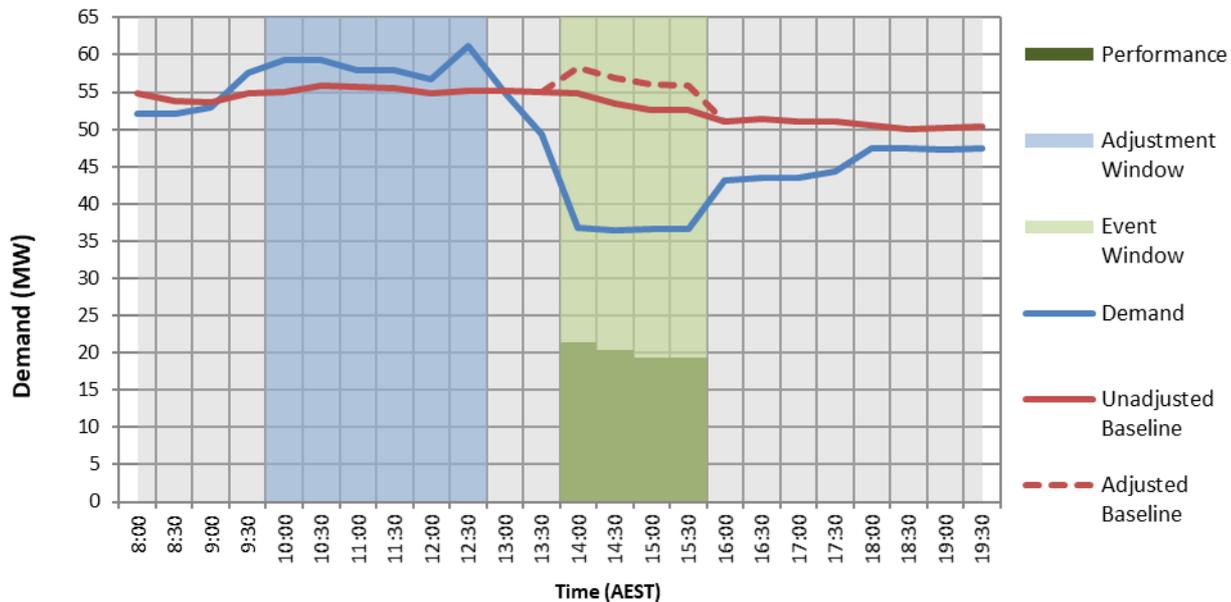
New South Wales (20 MW)

Enel X requested testing of its NSW portfolio the week commencing 18 November, with the actual test day being Thursday 21 November. While weather conditions were favourable, with 29 C on the day following warmer-than-average temperatures over the week, this did not have a significant impact on performance as our NSW portfolio contains very few temperature-sensitive sites.

Unfortunately, one of our largest industrial sites advised they could not participate in the test, due to competing operational and commercial requirements on the day. This was despite our Operations Team providing them with advance notice of the test in the prior week, and encouraging participation to test site capabilities prior to the peak summer period.

On a positive note, despite losing this key customer, our portfolio had sufficient operating buffers, and combined with strong performances from other customers this resulted in a 20.4 MW (102%) performance (see Figure 4 below).

Figure 4. NSW portfolio (20 MW) test event performance – 21 November 2019



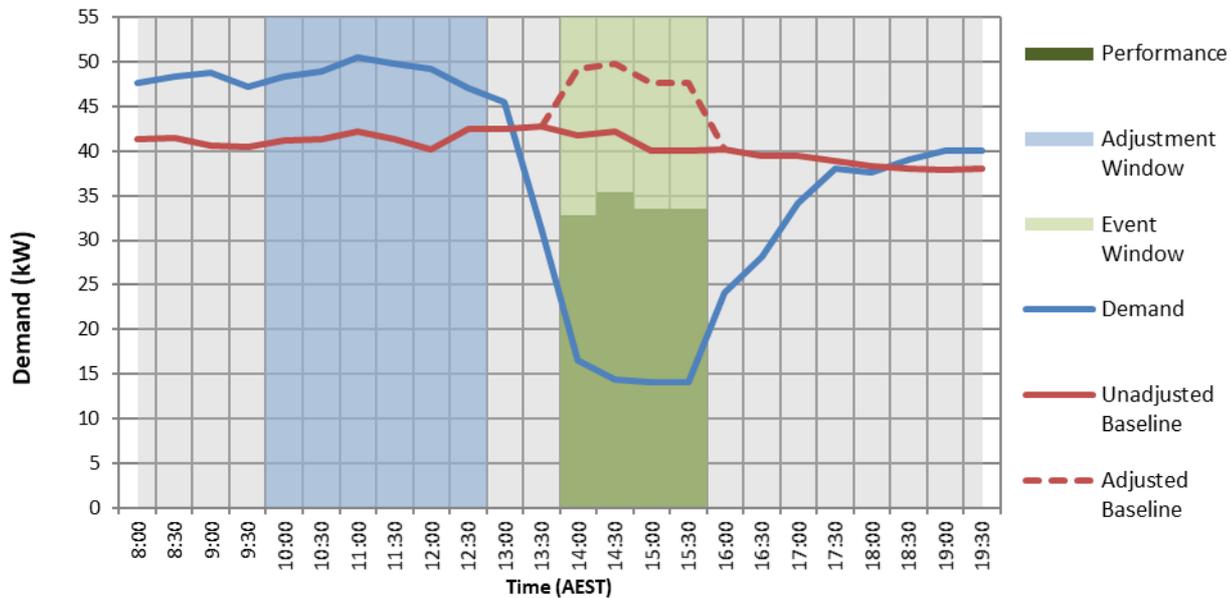
Victoria (30 MW)

Enel X requested testing of its VIC portfolio the week commencing 25 November, with the actual test day being Wednesday 27 November. Weather conditions leading up to the test day were generally above average and included a 41 C day during the previous week. However, the test day itself was a relatively mild 25 C, which appeared challenging given our VIC portfolio contains numerous temperature-sensitive sites such as Cold Storage facilities and retail shopping centres.

Fortunately, several of our industrial customers in the manufacturing sector achieved their highest levels of performance in the program to date – a particular highlight being one of our large metals processing sites achieving a **29% increase** on their average delivered MW to date. Another product-manufacturing site achieved a **20% jump** on their previous summer’s performance, while one of our large cold storage facilities was able to **increase delivery by 33%** due to an upgrade in their site’s operating capacity in late October (only a few weeks prior to the test event).

However, the most pleasing aspect about this test result was that every single site in the portfolio returned a positive result (a first for the ARENA program), with the overall result being 32.9 MW (110%) (see **Figure 5 below**).

Figure 5. VIC portfolio (30 MW) test event performance – 27 November 2019



Summer 2019/20 dispatch events

Enel X received and accepted six separate Invitations to Tender (ITT) from AEMO over the recent summer period. Although Enel X placed its respective portfolio(s) on standby for dispatch and remained on high alert during each of the contract periods, ultimately our portfolios were not dispatched by AEMO. Details of these ITTs are outlined below:

VIC (30 MW)

- 20 December 2019 from 17:30 to 20:00 AEST
- 30 December 2019 from 15:30 to 23:30 AEST
- 30 January 2020 from 19:00 to 22:00 AEST
- 31 January 2020 from 14:00 to 22:00 AEST

NSW (20 MW)

- 23 January 2020 from 11:30 to 20:00 AEST
- 31 January 2020 from 15:30 to 21:00 AEST.

4. Summary of most recent lessons learnt from the development and operation of the project

Participant reflections on the functioning of the DR market and the impact of market incentive structures on performance

As mentioned in the previous report, our business model for the ARENA DR Program is effective for customers with a predictable load that can be safely and quickly curtailed. As mentioned in the previous report, Enel X made a conscious decision to recruit more customer

sites that are less reliant on seasonal HVAC loads in order to improve DR potential in non-summer months.

This followed our 2018 winter test in NSW which yielded a result lower than 100%, largely due to lower baseline demand as a result of milder temperatures in April. For our VIC portfolio, Enel X made the decision to recruit less seasonal / temperature-dependent loads (such as 24/7 operating product-manufacturing sites), to help diversify the portfolio and reduce dispatch risk.

Updates from previous report

Enel X has observed that reduced operations around extended public holiday periods could have a large impact on the volume of DR capacity within the portfolio. As per the previous report, several customers advised the Christmas and Easter holiday period was also likely to impact on energy consumption levels and the level of DR available due to commercial priorities.

Obviously, this can have implications for both the DR aggregator and for AEMO's operation of the RERT, which Enel X experienced first hand in having its VIC portfolio put on standby on 30 December 2019, and a separate RERT contract dispatched despite extremely low baselines during the Christmas holiday period.

Enel X has updated its internal procedures to deal with the reduced demand around public holiday periods. This includes reducing our declared availability in the AEMO portal, and plans to recruit additional customers that continue to operate during these periods – **Note: as these customers typically have a higher short-run marginal cost, it is expected to come at a significantly higher cost to Enel X.**

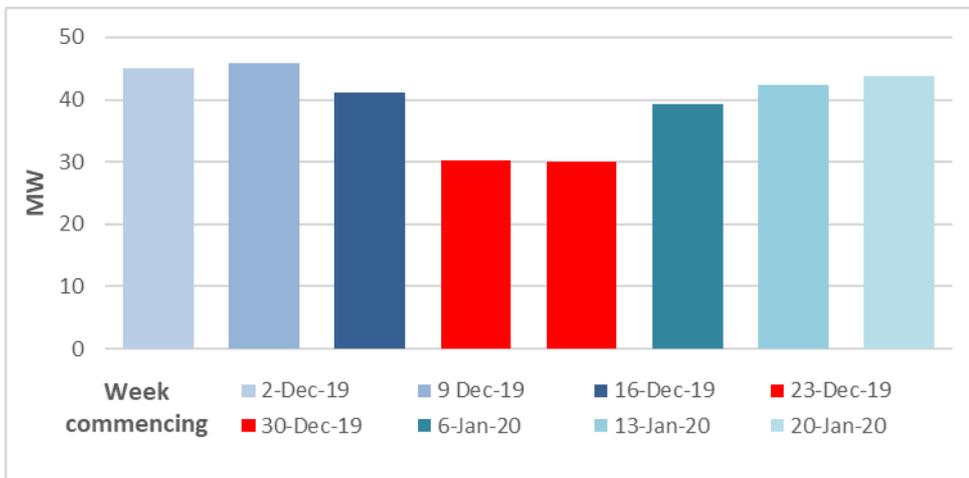
Enel X is strongly of the view that AEMO should consider the reduced operations around public holidays, particularly at Commercial & Industrial customer sites, and encourage DR participants to be open and transparent about any reduced capacity. If AEMO adopts a more punitive approach this may dis-incentivise participants to update MW availability in the AEMO portal on a consistent basis, and in the longer-term may end up discouraging participants to develop DR resources, or altogether not participate in the RERT and other demand response programs in future.

Reduced operations around extended public holiday periods (Portfolio level)

In its previous report, Enel X looked at reduced business operations (and energy consumption levels) in the days prior to and after extended public holiday periods. While Enel X provided this analysis at the portfolio level for NSW and VIC – as foreshadowed in the previous report, this report includes analysis undertaken for specific industry sectors within our portfolios.

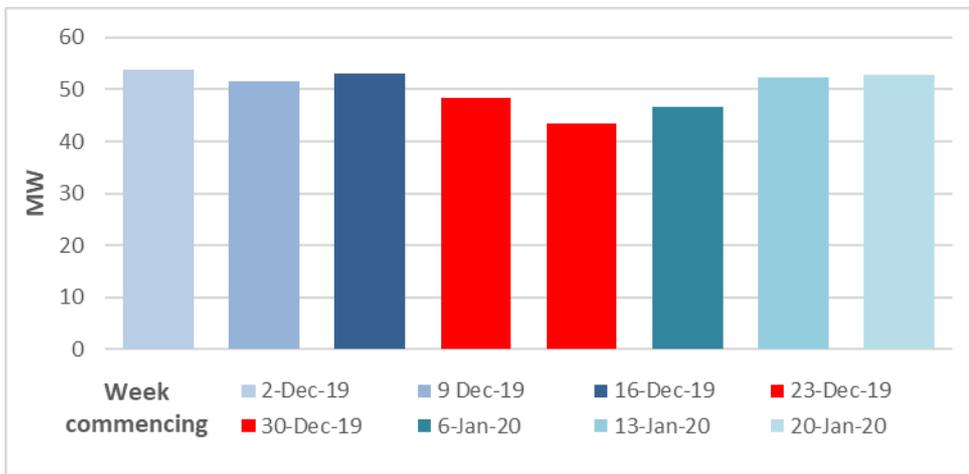
Several customers advised of reduced business operations (and energy consumption) in the days prior to and after public holidays. As shown in Figure 6 and Figure 7, energy consumption levels were certainly down in the weeks of Christmas and New Years of 2019/20 in both VIC and NSW.

Figure 6. VIC Portfolio demand (Christmas / New Year's period 2019/20)



Note: data does not include public holidays 25 Dec 2019, 26 Dec 2019, and 1 Jan 2020.

Figure 7. NSW Portfolio demand (Christmas / New Year’s period 2019/20)



Note: data does not include public holidays 25 Dec 2019, 26 Dec 2019, and 1 Jan 2020.

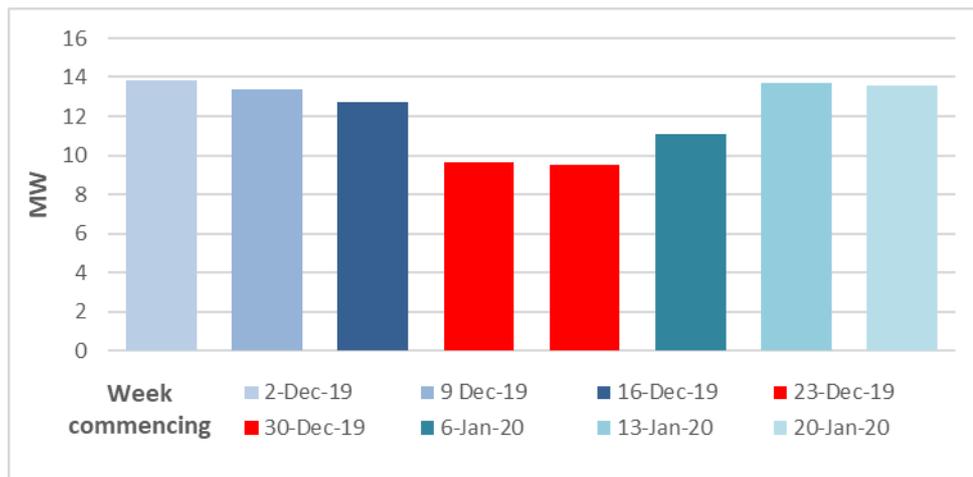
It appears average consumption levels were still around business-as-usual levels in the period up to Christmas (week commencing 16 December 2019). This was especially the case for NSW where average demand was 53 MW, and still at 51 MW on the last day of that week.

In contrast, demand in VIC started the week at 46.5 MW and gradually declined throughout the week to finish at 38.5 MW on Friday 20 December (a 17% drop over the week). Discussions with several customers indicated many had reduced site operations from midday or early afternoon, for work Christmas parties, or to let staff go home early; while for others it was the start of a two-week shut-down over the Christmas and New Year’s break.

As shown in the above figures, average daily consumption levels are visibly lower during the two weeks of Christmas and New Year’s Day, which is the typical Christmas holiday ‘shut-down’ period, or time of reduced operations. Interestingly however, daily consumption for NSW during the week commencing 23 December remained relatively high (averaging 48.5 MW), compared to VIC – this was courtesy of our largest NSW customer site continuing operations during this week to meet customer order for its manufactured products. On a side note, this customer advised recently in late March 2020 that it has been deemed an ‘essential service’ and would likely continue business as normal operations despite business shutdowns because of the COVID-19 pandemic.

For a more ‘apples-with-apples’ comparison, Figure 8 illustrates our NSW portfolio demand during the same period, but excluding this largest customer. The result appears more consistent with the consumption patterns observed in VIC, and for NSW over the same period last year.

Figure 8. NSW Portfolio demand excluding largest site (Christmas / New Year’s period 2019/20)



It is important to note that the above findings are based on Enel X’s customer portfolios in VIC (30 MW) and NSW (20 MW), and are reflective of the individual customers in those portfolios. As these portfolios represent an extremely small sample of the broader industry segments, it would not be accurate to assume the same behaviour applies for those industry segments as a whole. This would be even more important to keep in mind for the below charts and our discussions at the industry-specific level.

Furthermore, to improve the relative robustness of the below industry-specific findings, we only looked at industry sectors where we had a sample size of at least five customer sites. **Note: As per the portfolio-based analysis, the data excludes consumption on mandated public holidays.**

Reduced operations around extended public holiday periods (Industry-specific level)

- **Manufacturing**

As shown by Figure 9 and Figure 10, average daily demand at our manufacturing sites over the same December and January period were down for the two weeks commencing 23 December 2019 and 30 December 2019. This is consistent with our observation of overall demand levels, and from discussions with the majority of our manufacturing customers across both states, which suggests these two weeks are the standard ‘Christmas Holiday shut-down’ weeks.

Any demand observed during this time is due to reduced operations, keeping essential and critical equipment running, including any required space cooling / air-conditioning, and standby power requirements. It should also be noted that a small number of our customers re-commenced operations, albeit on a much reduced scale, after New Year’s Day, which is reflected in both portfolios with slightly higher demand for the week commencing 30 December compared to the previous week commencing 23 December.

Figure 9. VIC Manufacturing sites (Christmas / New Year’s period 2019/20)

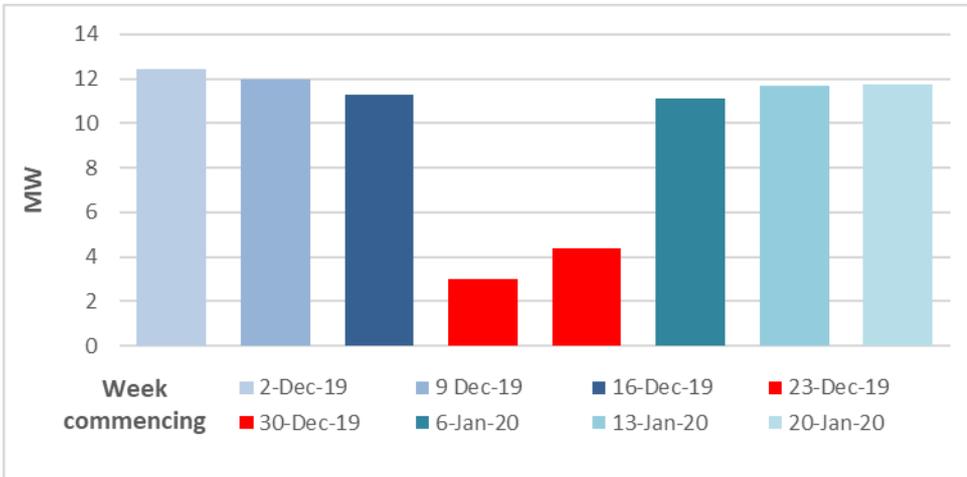
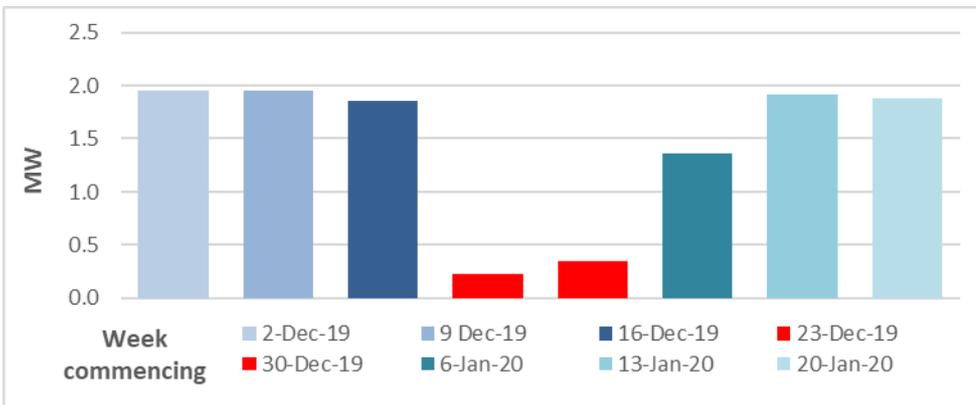


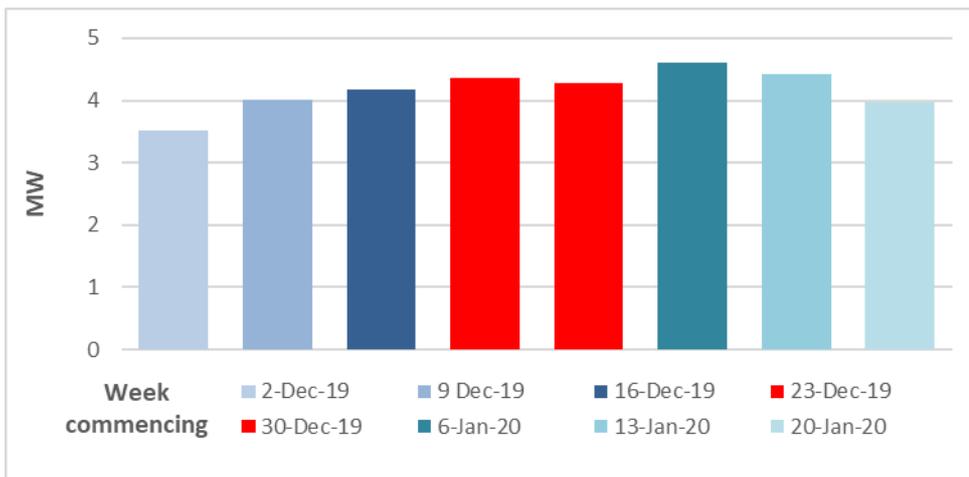
Figure 10. NSW Manufacturing sites excluding largest site (Christmas / New Year's period 2019/20)



- **Food production and processing**

Figure 11 shows consumption at our food production & processing facilities in VIC (Note: there was an insufficient number of customers for NSW to provide meaningful analysis).

Figure 11. VIC Food production & processing sites (Christmas / New Year's period 2019/20)



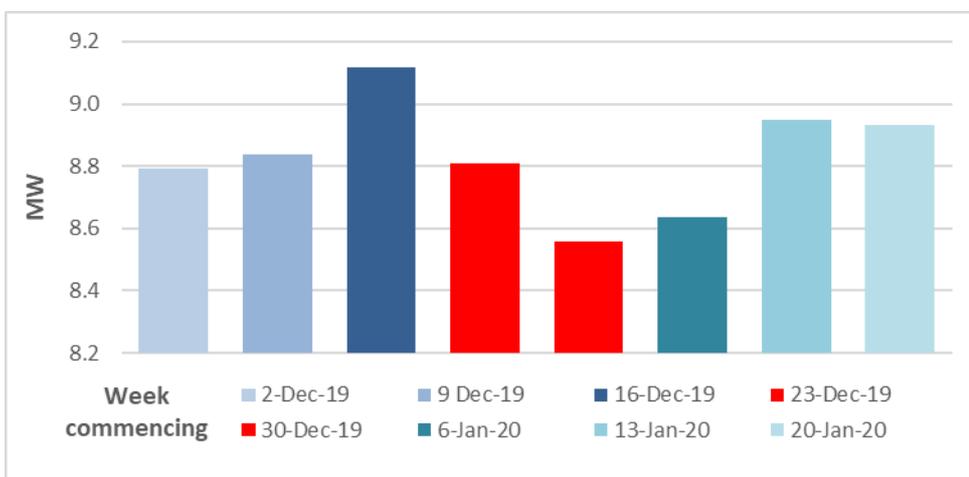
Interestingly, this sector for our VIC portfolio bucked the overall trend, and largely kept operating as per normal. Demand was even marginally higher for those two weeks compared to earlier in December – this was consistent with our discussions with several of these customers who noted there is usually a large push for increased production of finished goods in the lead up to Christmas and New Year's festive period.

In addition to this, our two largest food-production & processing companies noted increased export demand, particularly from Asia, had driven the businesses to keep operating at almost maximum production levels even during this Christmas period, in order to keep up with this extra demand.

- **Cold Storage & Logistics**

Figure 12 shows consumption at our cold storage & logistics facilities in VIC and NSW combined.

Figure 12. VIC-NSW Cold Storage & Logistics sites (Christmas / New Year's period 2019/20)



In contrast to the other industries, our cold storage facilities in VIC and NSW had significantly increased demand in the final week before Christmas. This was not surprising given they supply customers such as butchers, restaurants, supermarkets and grocery stores, who also experience significant demand for fresh food & produce over the festive period.

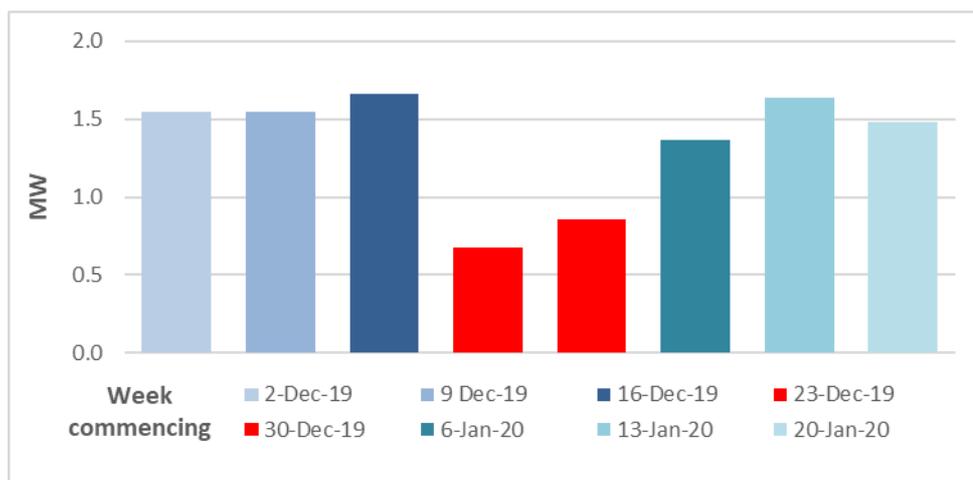
Another interesting observation was the relatively normal level of demand in the days around Christmas and Boxing Day on the week commencing 24 December – which was around the same level as observed in early December. A possible explanation for this is the steady demand for fresh food and produce even just before and following Christmas Day and Boxing Day, and before New Year’s Eve/Day festive gatherings.

Demand was lowest in the weeks commencing 30 December 2019 and then on 6 January 2020, before returning to more normal levels from mid-January. This appears to be a function of our customer sites in this industry sector, having their ‘two weeks’ reduced operations following the busy Christmas period – so essentially starting their Christmas down-time a week later than other industries due to market demand for their services.

- **Education**

Figure 13 shows consumption at our nine vocational education sites in VIC (Note: there was an insufficient number of customers for NSW to provide meaningful analysis).

- **Figure 13. VIC Vocational Education sites (Christmas / New Year’s period 2019/20)**



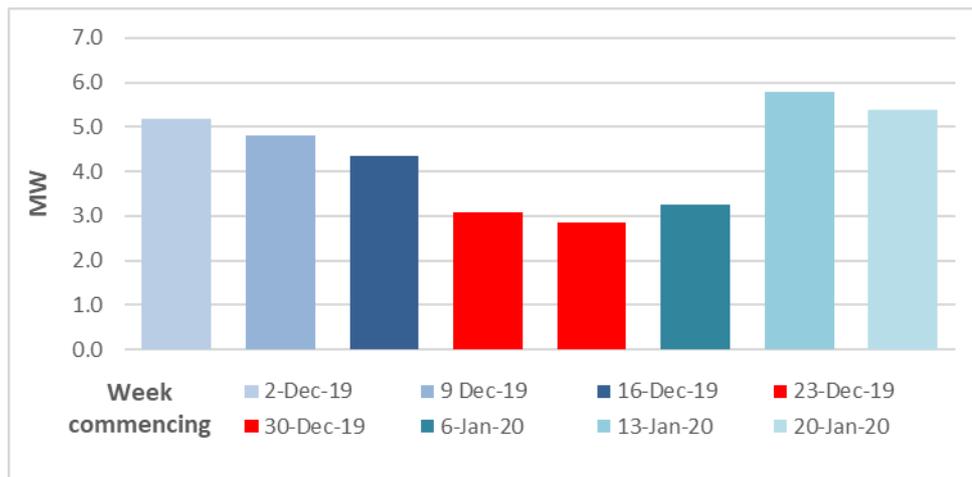
As expected, average daily demand levels were at their lowest in the two weeks of Christmas and New Year’s Day, with the majority of staff and all students on holidays. The only aspect worth observing was the slight difference between those 2 weeks was purely due to temperature – these college campuses maintain HVAC systems to ensure critical facilities, such as server rooms, computer labs, and Building Management Systems (BMS) infrastructure remain at safe temperatures. Therefore, energy used for space cooling (and heating) make up a significant portion of their energy consumption.

As the week commencing 30 December experienced two very hot days (41 C on Monday and then a 37 C on Friday), it was not surprising that energy consumption was 25% higher compared to the previous week, which had relatively mild temperatures in the mid 20 C range.

- **Water Waste Treatment, Disposal & Remediation Services**

Figure 14 shows consumption at our water waste treatment sites in NSW (Note: there was an insufficient number of customers for VIC to provide meaningful analysis).

Figure 14. NSW Water Waste Treatment, Disposal & Remediation Services (Christmas / New Year’s period 2019/20)



Although the overall trend is similar to most other industries, our water treatment facilities in NSW had less of a drop in energy consumption relative to other customers in VIC and NSW. From our discussions with customers, this is because they provide essential services to the community, and although they may operate at reduced staffing levels during this period, they still need to perform critical front-line operations in treating wastewater as part of their core functions.

In addition to this, our facilities have noted that energy consumption could still be much higher as a result of storms and heavy rain – due to the need to run their energy-intensive pump operations. However we have noted from Bureau of Meteorology data that there was little to no rainfall during this two-week period – in contrast their energy consumption was substantially higher in the weeks commencing 13 January and 20 January 2020, which experienced heavy rainfall on the 16th and 17th January (31.5mm and 14.0 mm respectively).

Once again, it is important to again remind readers that these findings are based on Enel X’s customer portfolios in VIC (30 MW) and NSW (20 MW), and are reflective of the individual customers in those portfolios. As these portfolios represent an extremely small sample of the broader industry segments, it would not be accurate to assume the same behaviour applies for those industry segments as a whole.

Participant lessons learnt on hardware and software technology requirements to support firm delivery of DR

Enel X’s reflections on the challenges associated with installing hardware and software at customer sites prior to program start date are set out in the previous knowledge sharing report. As identified in its previous report, Enel X found there was clear difference in performance depending on whether the customer opted for an Enel X-automated curtailment or chose to use manual on-site curtailment.

In addition to this, customers who had recently had automated-curtailment enabled for their site loads mentioned to Enel X that this was preferred, as it meant fewer actions to take on their end, and also lead to higher dispatch performance for the test event. Moving forward Enel X will continue to advocate for customers to allow automated curtailment of loads, but is cognisant of the fact many customers may be reluctant to accept this due to operational considerations and concerns about ceding control of their loads to an aggregator. Enel X understands other demand response aggregators face the same challenges when recruiting customers to provide DR.

Participant lessons learnt on DR business model design

In reiterating Enel X's earlier position, the philosophy underpinning the RERT framework¹ is clear and well intentioned – that is, resources are only eligible for RERT if they are not already providing wholesale (supply or demand) response by actively managing generation/load in response to energy spot prices². In this way, RERT resources (which are paid outside the wholesale market) can be thought of as truly "additional" resources.

Enel X has continued to focus on recruiting new DR customers and 13.5 MW of new customer sites recruited since program commencement have been Greenfield DR sites (including the 2.6 MW of retail sites recruited just before the January 2019 dispatch events in VIC). Therefore, Enel X will not have issues with forgoing FCAS revenue to participate in this ARENA trial program.

Further to this and as mentioned in previous reports, Enel X hopes any future permanent Strategic Reserve mechanism, participants will be given the opportunity to make firm commitments at least six months in advance of the time they are required to be available. Running tenders only 2-3 months prior to program start will see participants mobilise fewer MW, at a higher per-unit cost than if six months' lead-time were provided. Enel X detailed its thoughts on the 'timeline problem' in a submission to the AEMC's Reliability Frameworks Review – Interim Report³.

Participant lessons learnt from the recruitment of different customer types

As stated in previous reports, Enel X has recruited customers from various industries, including some which Enel X has not had substantial prior experience in other markets. The diversification into new industries such as the tertiary education sector has helped Enel X with achieving the 50 MW portfolio target for its ARENA contract.

Recently, Enel X has also found industries with high levels of regulatory and environmental compliance requirements, such as wastewater services, may also face difficulties in being able to provide DR at certain periods. As noted earlier in the report, one of Enel X's wastewater treatment sites advised of being unable to participate in the November DR test due to aeration issues on site, which were a regulatory compliance risk.

Finally, in the process of recruiting additional capacity to provide operational buffer for its VIC and NSW portfolios, Enel X also again found some program parameters restricted the pool of potential customers. These restrictive parameters included the maximum 4-hour curtailment duration, 10 min response time, along with the dynamic baseline and adjustment rules, made it unviable for some customers, particularly those with intermittent or unpredictable load profiles.

¹ As codified in the NER.

² i.e. curtailing load in response to a high spot price.

³ Refer <https://www.aemc.gov.au/sites/default/files/2018-02/EnerNOC.pdf>

5. Details of other commercial or wholesale DR activity that the Recipient (pertaining to the DR funded under this Agreement) is participating in

Enel X is registered as a Market Ancillary Services Participant (MASP), a special category that enables independent aggregators to provide market ancillary services (including contingency FCAS).

The primary purpose of contingency FCAS participation is to restore grid stability following a contingent loss of generation. Contingency FCAS is used to correct major drops and rises in frequency (when the frequency is outside of the Normal Operating Frequency Band). Enel X has several customers in VIC and NSW who are registered to provide FCAS and are participating in the ARENA DR program.

Number of instances and duration the DR was activated for these other activities

Enel X's FCAS customers have responded to 94 low-frequency excursions since 1 December 2017 program start, including 13 events in program period 4 which had an average duration of just over 4 minutes each.

Note: based on the various availabilities and operating profiles of Enel X's constituent customers, this does not necessarily mean all Enel X customers have responded 13 times.

Period the DR was activated for these other activities

These FCAS excursions occurred between 1 June 2019 and 30 November 2019. None of the events occurred during our June or November 2019 test events for the ARENA DR program, or had any significant impact on baseline demand levels for those events.⁷⁰⁸

6. Participant lessons learnt from co-optimisation of ARENA-funded DR and other services provided by individual customers, including FCAS

As previously noted, Enel X has several customers dual-enrolled to provide both FCAS and ARENA DR. These customers already understand load flexibility from their FCAS participation so are well educated to consider and evaluate incremental DR opportunities.

For some of Enel X's FCAS customers, signing up for the ARENA DR trial seemed like a logical next step. Customers also appeared to appreciate that Enel X could not always make them available for both FCAS and ARENA dispatch at the same time. However, despite the potential impact on FCAS earnings during the forming of ARENA DR reserve contracts⁴, customers have all trusted Enel X to optimise their overall earnings across both programs.

The FCAS events are infrequent and only require load curtailment for a short time period of 10 minutes or less. Enel X is able to opt customers out of the FCAS market when needed, to ensure that loads are fully available for the ARENA program.

The trigger for bidding dual-enrolled customers out of the FCAS market is an AEMO invitation to tender (ITT) for reserve notice. Enel X will bid dual-enrolled customers out of FCAS markets during specified ITT and/or activation periods, in accordance with guidance Enel X received from AEMO. From a risk management point of view, Enel X will bid customers out as early as

⁴ i.e. following the issuance and acceptance of an AEMO ITT

possible to ensure any potential FCAS trip does not affect customer baselines for measurement and verification of performance during an ARENA DR event.

Following receipt of an ITT from AEMO, Enel X rebids to remove all dual-enrolled customers from the FCAS market for the time period specified in the ITT, plus an additional four hours prior to the commencement of the ITT window (if possible) to minimise the possibility of an untimely frequency excursion causing adverse impact to the ARENA baseline.

7. Participant lessons learnt from “value stacking” ARENA funded DR with other services provided by individual customers, including opportunity costs

FCAS events are short in duration, so generally limited impact to customer operations. The ARENA program provides more certain availability payments and an energy payment (which Enel X’s FCAS program does not). However, the ARENA program causes a much more significant disruption to site operations due to the length of time involved.

As stipulated in the RERT Panel Agreement for the ARENA DR Trial and detailed previously, the reserve provided by Enel X’s customers cannot be offered to the market through any other means during the period of a reserve contract. This means if Enel X accepts an AEMO ITT for provision of short notice reserve during a specified period, then those dual-enrolled customers cannot be offered into the FCAS markets or other programs for that period.

Accordingly, customers incur an opportunity cost of not receiving FCAS revenue when Enel X accepts and forms a short notice reserve contract with AEMO, however in general Enel X expects the opportunity costs will be small compared to the annual value of ARENA Availability payments. Therefore, while there are opportunity costs for being removed from FCAS, customers are positively aware they will also earn Availability Payments and Energy Payments based on their dispatch performance, as per their contracts with Enel X for the ARENA program.

Enel X’s customers also understand the ARENA DR Trial is a three-year program funded by the Commonwealth and state governments, as part of initiatives to improve overall system reliability. Therefore as noted, in addition to financial incentives on offer, Enel X’s customers seem to place some 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.

Appendix 1 – Customer types and geographic location

Key:

CC	City Centre
IS	Inner Suburbs
OS	Outer Suburbs
RC	Regional City
RA	Rural Area

VIC Portfolio (30 MW)

Customer	Type	Geographic location
VIC1	Agricultural Product Wholesaling	IS, north
VIC2	Building Structure Services	OS, east
VIC3	Building Structure Services	IS, west
VIC4	Fruit and Tree Nut Growing	RA, north
VIC5	Fruit and Tree Nut Growing	RC, north
VIC6	Fruit and Tree Nut Growing	RC, north
VIC7	Fruit and Tree Nut Growing	RA, north
VIC8	Other Warehousing and Storage Services	OS, west
VIC9	Other Warehousing and Storage Services	OS, west
VIC10	Other Warehousing and Storage Services	OS, north west
VIC11	Other Warehousing and Storage Services	RA, west
VIC12	Other Warehousing and Storage Services	OS, west
VIC13	Other Warehousing and Storage Services	OS, south east
VIC14	Other Warehousing and Storage Services	IS, west
VIC15	Other Warehousing and Storage Services	RA, north
VIC16	Other Warehousing and Storage Services	OS, north
VIC17	Other Warehousing and Storage Services	OS, north
VIC18	Grain Mill Product Manufacturing	OS, south east
VIC19	Tertiary Education	IS, north
VIC20	Tertiary Education	IS, east
VIC21	Tertiary Education	IS, north
VIC22	Tertiary Education	IS, north east
VIC23	Tertiary Education	IS, north east
VIC24	Tertiary Education	IS, south east
VIC25	Basic Chemical Manufacturing	OS, south west
VIC26	Basic Ferrous Metal Manufacturing	OS, west
VIC27	Fruit and Vegetable Processing	RC, north
VIC28	Grain Mill Product Manufacturing	RC, north west

VIC29	Grain Mill Product Manufacturing	IS, north
VIC30	Grain Mill Product Manufacturing	IS, north
VIC31	Other Wood Product Manufacturing	RC, north east
VIC32	Waste Treatment, Disposal and Remediation Services	OS, west
VIC33	Waste Treatment, Disposal and Remediation Services	OS, south west
VIC34	Water Supply, Sewerage and Drainage Services	RC, north
VIC35	Other Goods Wholesaling	OS, south east
VIC36	Other Goods Wholesaling	OS, south east
VIC37	Other Goods Wholesaling	OS, south east
VIC38	Basic Non-Ferrous Metal Manufacturing	OS, north
VIC39	Retail	IS, west
VIC40	Retail	OS, south east
VIC41	Retail	OS, east
VIC42	Retail	OS, north
VIC43	Retail	OS, south east
VIC44	Retail	RC, south west
VIC45	Retail	OS, north
VIC46	Retail	OS, south east
VIC47	Retail	CC
VIC48	Retail	CC
VIC49	Retail	IS, north
VIC50	Retail	OS, north

NSW Portfolio (20 MW)

Customer	Type	Geographic location
NSW1	Grain Mill Product Manufacturing	OS, south west
NSW2	Other Warehousing and Storage Services	OS, west
NSW3	Other Warehousing and Storage Services	OS, west
NSW4	Basic Chemical Manufacturing	OS, south west
NSW5	Building Structure Services	IS, west
NSW6	Basic Non-Ferrous Metal Manufacturing	OS, west
NSW7	Grain Mill and Cereal Product Manufacturing	IS, west
NSW8	Waste Treatment, Disposal and Remediation Services	IS, south
NSW9	Basic Ferrous Metal Manufacturing	OS, west
NSW10	Waste Treatment, Disposal and Remediation Services	OS, west

NSW11	Waste Treatment, Disposal and Remediation Services	IS, north
NSW12	Waste Treatment, Disposal and Remediation Services	RC, south
NSW13	Meat and Meat Product Manufacturing	OS, west
NSW14	Meat and Meat Product Manufacturing	OS, west
NSW15	Meat and Meat Product Manufacturing	OS, west
NSW16	Meat and Meat Product Manufacturing	OS, west
NSW17	Paper Product Manufacturing	OS, south west