ARENA Demand Response Trial: Knowledge Sharing Project performance report

Report Date: 21 December 2020

Activity title	Advancing Renewables Program – Demand Response
Contract number(s)	G00917, G00920
Recipient	Enel X Australia Pty Ltd (formerly EnerNOC Pty Ltd) ABN 49 104 710 278
Ref	Knowledge Sharing Report #7
Applicable Time Period	Program Period #6: 1 June 2020 to 30 November 2020
Applicable Payment Instalment(s)	Payment Milestone #8: Payment Instalment 8
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This Project received funding from ARENA as part of ARENA's Advancing Renewables Programme - Demand Response and from the New South Wales Government."

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1. Report summary

As this is the final Knowledge Sharing Report, it will provide a detailed summary of all lessons learned across the 3-year ARENA Demand Response Trial program, including knowledge sharing pertaining to the final program period **1 June 2020 to 30 November 2020 (Program period #6).**

This report will also provide:

- Details of the two test events for its VIC and NSW portfolios undertaken in October 2020, as required for Program Period #6

- Summary of lessons learnt from the operation of the project during this period, including Enel X's reflections **on customer demand levels from January to November, including any significant shifts in demand patterns as a direct or indirect result of COVID-19 restrictions (and therefore any impact on the demand response capacity available).**

2. Overview of demand response being provided

In accordance with its contracts with ARENA and AEMO, Enel X has developed the following:

- **20 MW reserve in New South Wales (NSW)**

- **30 MW reserve in Victoria (VIC).**

The combined 50 MW DR portfolio is comprised of Commercial and Industrial (C&I) energy users who have agreed to safely reduce their electricity consumption during DR events when activated 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.

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 <u>APPENDIX A, B AND C</u> 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:

- 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.

Customer types and geographic location

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
	Paper Product Manufacturing

The percentage split (in terms of MW capacity) is approximately 30% commercial, and 70% industrial. In terms of overall customer numbers enrolled in the program, the percentage split is approximately 50% commercial / 50% industrial. This reflects the fact 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

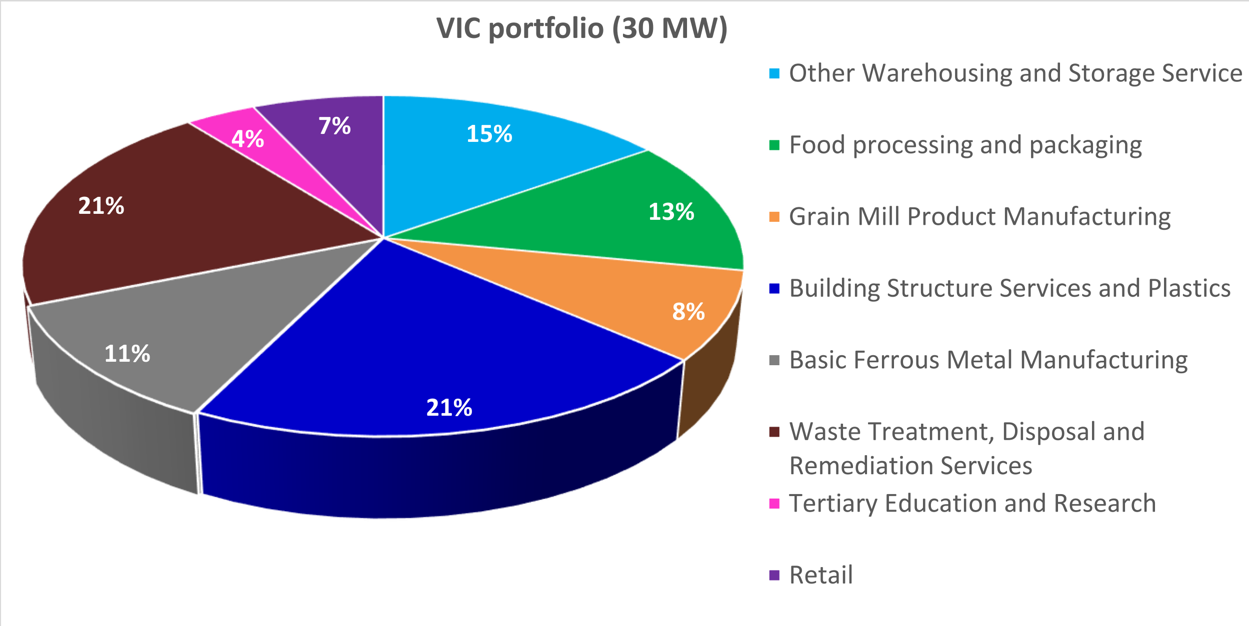
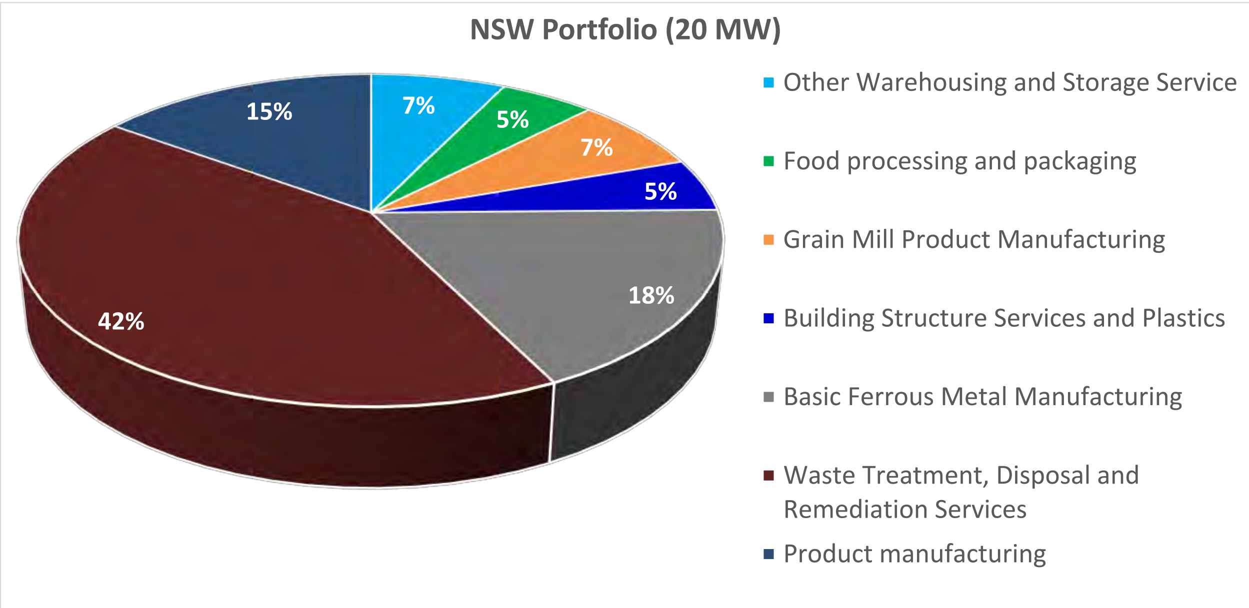


Figure 2. NSW customer segments by percentage of portfolio



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. For this program period, Enel X requested testing in mid-late October 2020, as negotiated with ARENA and AEMO, due to the operational and commercial impacts of Covid-19 on our customer portfolios.

Test events

Victoria (30 MW)

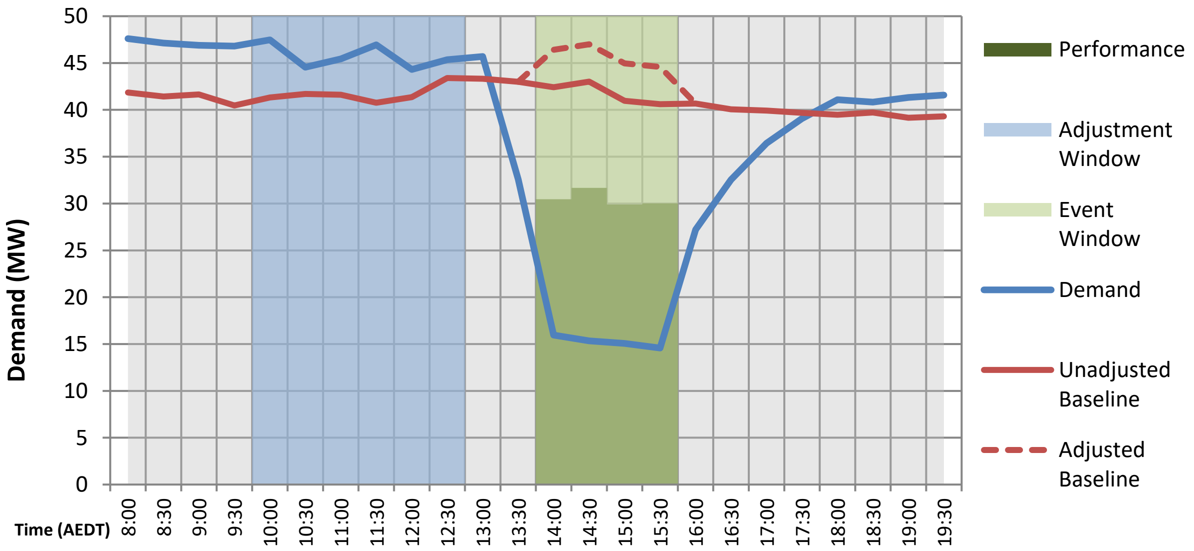
Enel X requested testing of its VIC portfolio the week commencing 5 October, with the actual test day being Wednesday 7 October. Weather conditions leading up to the test day itself were average, however the test day itself was a very mild 15 C. Initially this appeared challenging given our VIC portfolio contains numerous temperature-sensitive sites – cold storage facilities, retail shopping centres, as well as technical colleges whose energy consumption was already well down due to majority of staff and students working or attending classes remotely.

Fortunately, several of our customers performed strongly on the day, particularly sites in the food production and manufacturing sectors. Highlights included:

- Two flour mill sites giving their best dispatch performance since program start, combining to provide 2.5 MW of DR which was 116% of expected capacity.
- Our one and only regional water reclamation plant (WRP) providing 0.82 MW which was 117% higher than expected, and its highest dispatch performance for the program.
- A timber manufacturing site providing 0.85 MW of DR which was 143% higher than expected and its highest dispatch performance since program start.

These combined with other positive results lead to a solid **32.2 MW (107%) performance.**

Figure 3. VIC portfolio (30 MW) test event performance – 7 October 2020



New South Wales (20 MW)

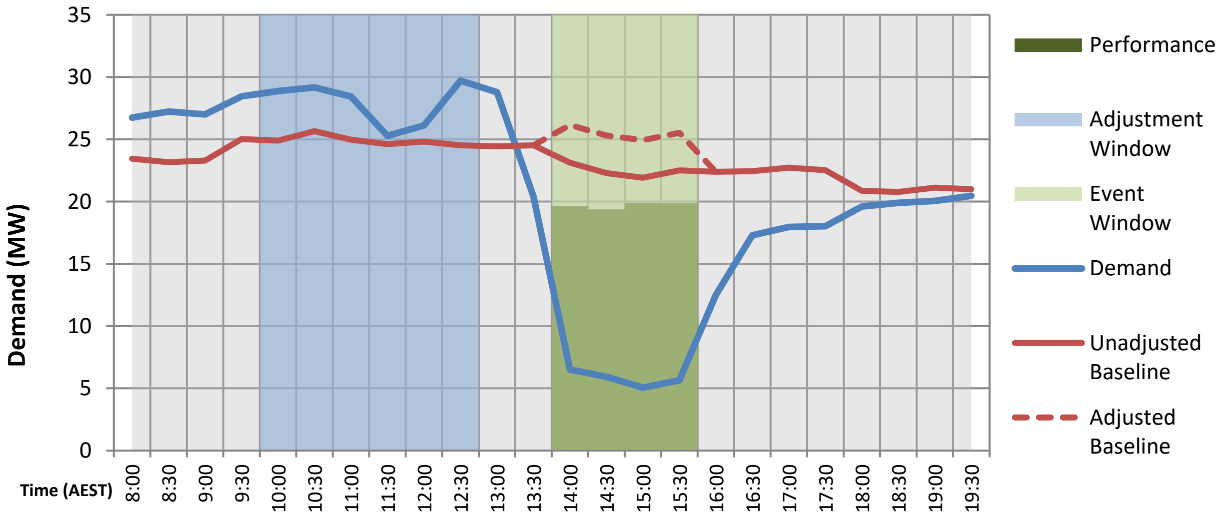
Enel X requested testing of its NSW portfolio the week commencing 19 October, with the actual test day being Thursday 22 October. Temperatures were slightly above average leading into test week while the test day itself was a slightly above average 24 C. All customers in the portfolio had confirmed their participation earlier in the day, so we were expecting a solid performance of around 22 MW which included our 10% operating buffer.

Unfortunately, just prior to the event of our largest industrial sites had an unplanned outage which meant their consumption went down to zero for an hour – as per the RERT methodology, baseline is adjusted on the day using a sites' consumption in the 4 hours to 1 hour prior to event start time.

This lower adjusted baseline meant that even as the site restored operations within 90 minutes and still curtailed for the 2-hour event, their "load drop" was measured from a lower starting point. Their DR performance ended up at 0.48 MW, however our data shows if the plant had kept running as per normal during the whole adjustment period from 10:00am to 1:00pm, their measured DR performance would have been approximately 1.74 MW.

On a positive note, the portfolio had enough operating buffers and combined with positive performances from all other customers this resulted in a **20.4 MW (102%) performance.**

Figure 4. NSW portfolio (20 MW) test event performance – 22 October 2020



Dispatch events

Enel X did not receive any Invitations to Tender (ITT) from AEMO for any real dispatch events during this program period.

4. Lessons learned from the 3-year Demand Response Trial

As discussed with ARENA, Enel X will provide a detailed summary of key lessons learned across the three-year program for this final Knowledge Sharing Report. Topics covered will include:

- Benefits of automated control over manual curtailment for DR events;
- Reduced DR capacity around extended public holiday periods;
- Commercial & Operational impacts of COVID-19 on DR capacity;
- Challenges using the High 10 of 10 with adjustment baseline methodology and customer suitability for Demand Response.

Benefits of automated control over manual curtailment

As noted above Enel X has installed its own proprietary hardware at customer sites to monitor the facility's demand and facilitate effective demand response. This technology also includes control equipment that allows Enel X to remotely initiate a load reduction – this option was taken up by a portion of our customers. Enel X worked closely with these customers to automate their energy reduction plans, with the controls tested prior to program commencement.

However, several customers did not proceed with automated control by Enel X, instead preferring to initiate manual curtailment on-site once dispatch notifications were received. The reasons were varied, ranging from operational/safety requirements to personal preference for initialling curtailment themselves rather than giving control over to a third party, Enel X.

As illustrated in the charts below, sites that agreed for Enel X initiated automated control performed better on average (as a percentage of expected capacity) against sites which opted for manual curtailment.

Figure 5. Manual vs Automated site performance – VIC portfolio

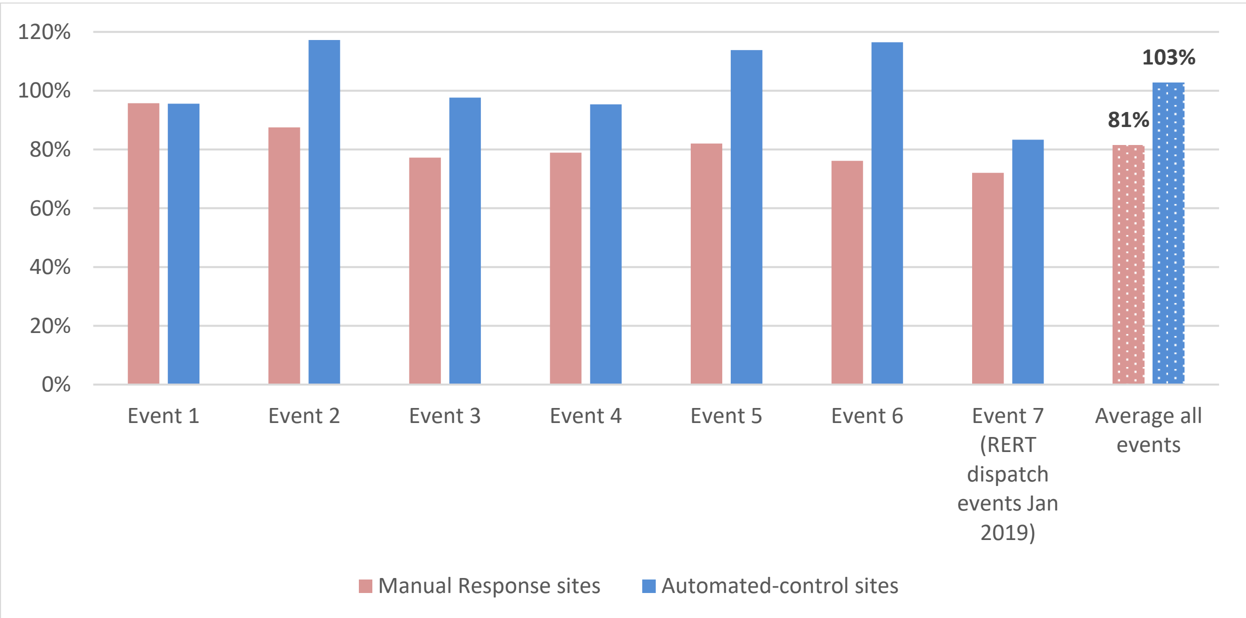
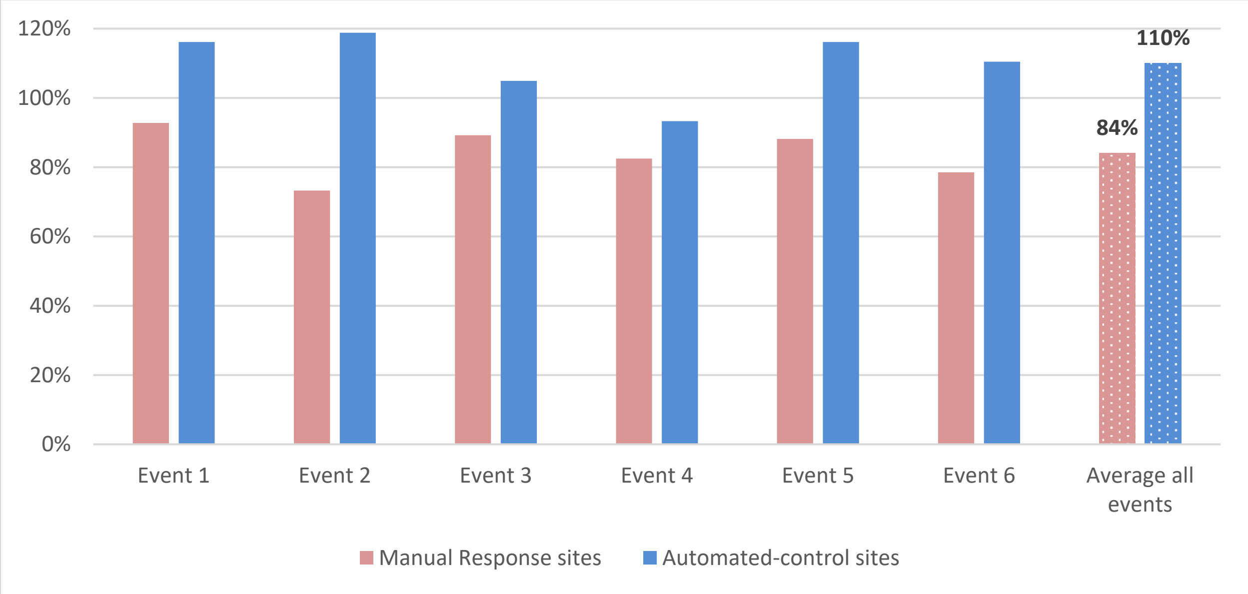


Figure 6. Manual vs Automated site performance – NSW portfolio



From our experience, the reason for the outperformance of automated sites was due primarily to the ability for those customers to trust in the Enel X technology solution to notify customers an event was starting soon, and then remote curtailment to take place. In addition to this, customers who had chosen to automate their curtailment processes during the program noted it meant fewer actions to take on their end, and lead to higher dispatch performances.

In contrast, we found those who opted for manual curtailment often faced the following challenges:

- Competing operational priorities on the day of a test or dispatch event
- Having suitably qualified people (e.g. Technicians) available on-site to be able to partake in load curtailment on the day
- Personnel changes over the 3-year program period, meant loss of knowledge & experience, and constantly having to train new staff in being able to initiate load-reduction process.

Moving forward for future Demand Response programs, Enel X will continue to advocate for customers to allow automated curtailment of loads and present evidence of demonstrated higher performance and commercial outcomes. However, we will remain 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.

Reduced DR capacity around extended public holiday periods

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 reports, 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.

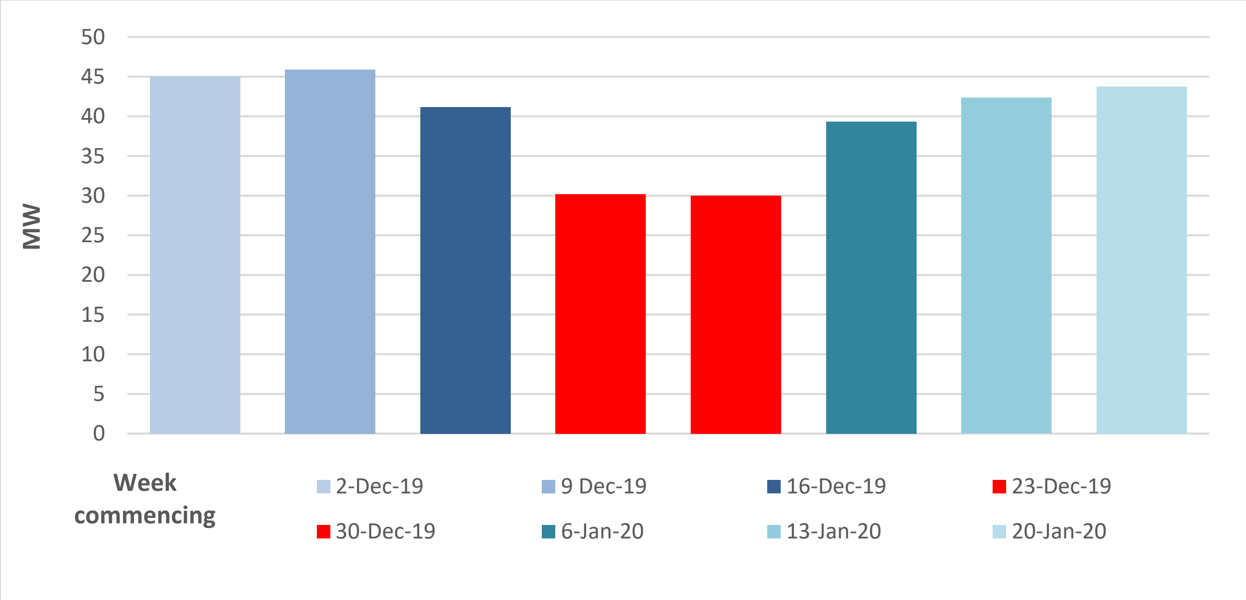
Obviously, this can have implications for both the DR aggregator and for AEMO's operation of the RERT, which Enel X experienced first-hand in having its VIC portfolio put on standby on 30

December 2019, and a separate RERT contract dispatched despite extremely low baselines during the Christmas holiday period.

The charts below illustrate that even on official working days, aggregators and demand response providers in general need to be mindful of reduced site loads (and therefore DR capacity) around holiday periods, and to adjust their availability accordingly for programs like RERT.

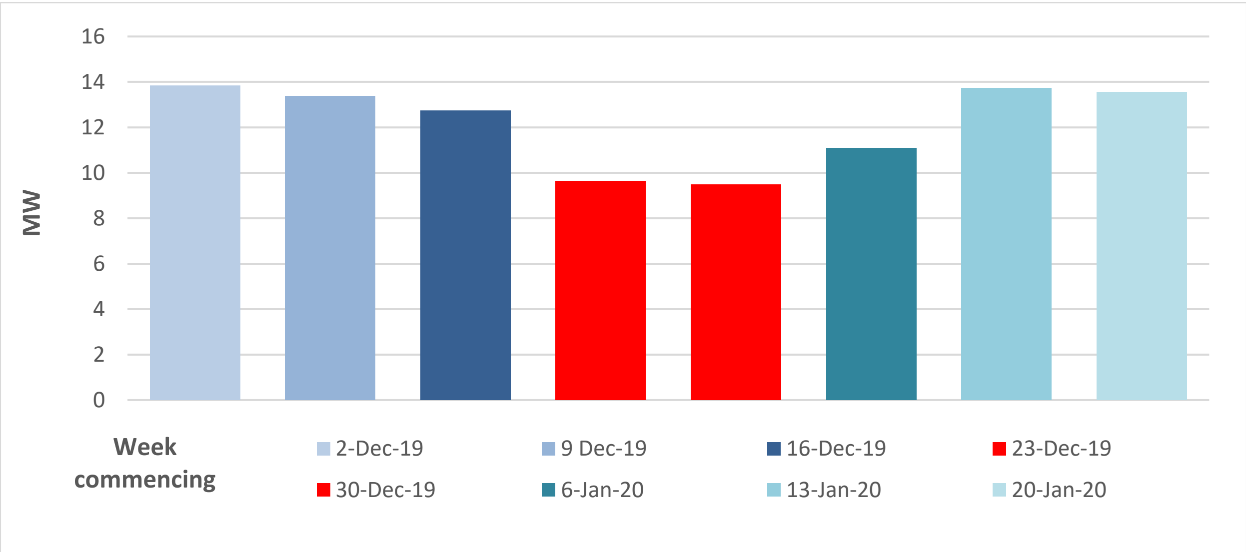
Reduced demand during Christmas and New Year's holiday periods

Figure 7. VIC Portfolio demand (Christmas / New Year's period 2019/20)



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

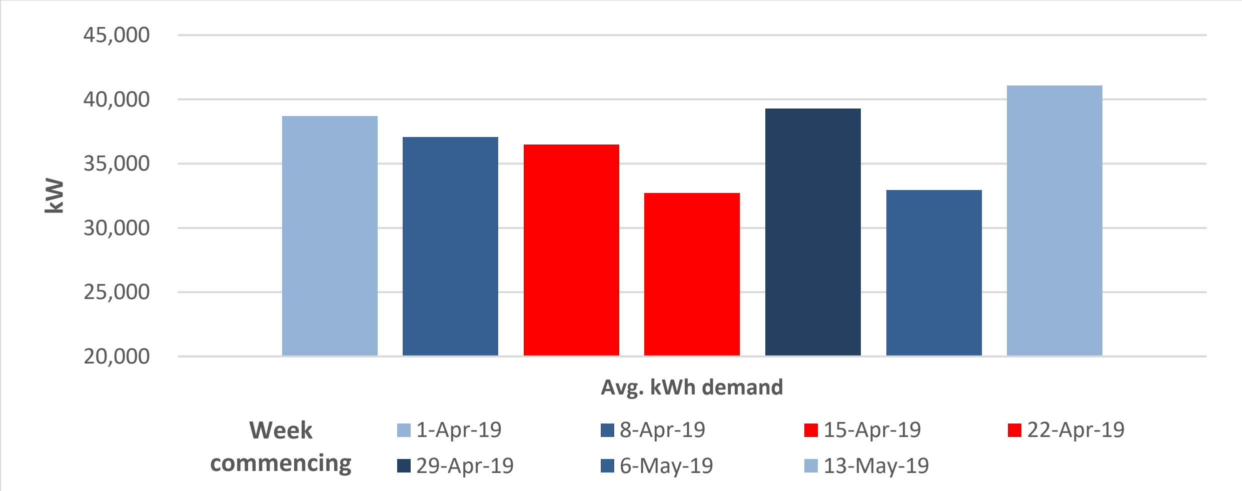
Figure 8. NSW Portfolio demand (Christmas / New Year's period 2019/20)



Note: chart does not include public holidays 25 Dec 2019, 26 Dec 2019, and 1 Jan 2020, or data from our largest NSW site which had been deemed an 'essential service' and continued business-as-usual operations during the Christmas due to the COVID-19 pandemic.

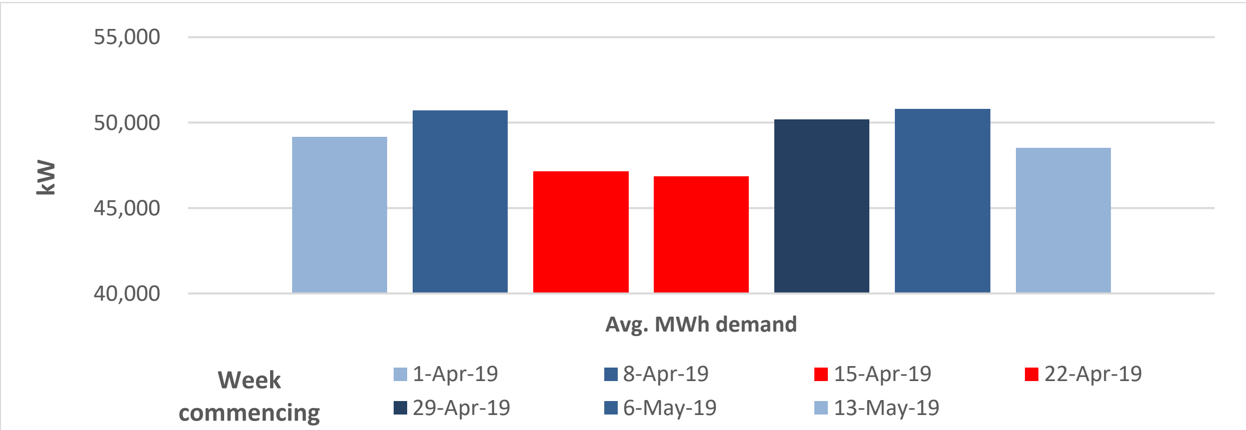
Reduced demand during Good Friday and Easter holiday period

Figure 9. VIC Portfolio demand (Good Friday / Easter period)



Note: data does not include public holidays 19 Apr, 22 Apr and 25 Apr 2019.

Figure 10. NSW Portfolio demand (Good Friday / Easter period)



Note: data does not include public holidays 19 Apr, 22 Apr and 25 Apr 2019.

As noted previously, Enel X has updated its internal procedures to deal with reduced demand around public holiday periods – this includes reducing our declared availability in AEMO's portal.

More importantly, Market Operators or Network Businesses procuring demand response capacity either for a whole year or full summer that include that holiday periods, should consider their requirements around these times and make alternative arrangements for capacity if required.

Commercial and Operational impacts of COVID-19 on DR capacity

This section of the report specifically looks at the broader impact of COVID-19 restrictions on our customers' business operations (and energy consumption), analysing the 11-month period from January to November 2020 in comparison to the same period over the past two years.

Enel X postponed testing of its portfolios from the usual April/May 'pre-winter' testing period until October. This was due to various operational constraints at several customer sites, including those both directly and indirectly impacted by COVID-19 restrictions.

As noted by AEMO earlier in the year, COVID-19 was expected to have significant short term, and uncertain longer term impact on electricity demand that will impact the 2020-21 financial year, as a result of changes to consumption patterns and the potential ongoing impact of economic downturn – AEMO also noted significant uncertainty about the magnitude of this impact.[1]

Figure 11 and Figure 12 shows energy consumption levels for VIC and NSW respectively. **Note: the data used does not include public holidays or weekends.**

Figure 11. VIC Portfolio demand (2018 to 2020, January to November)

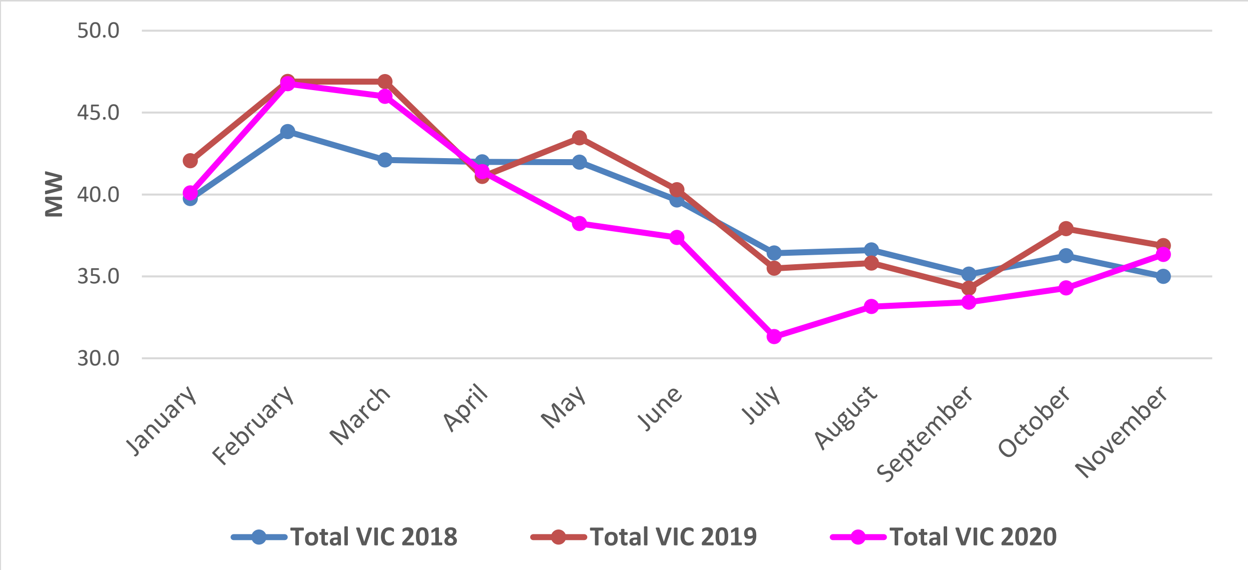
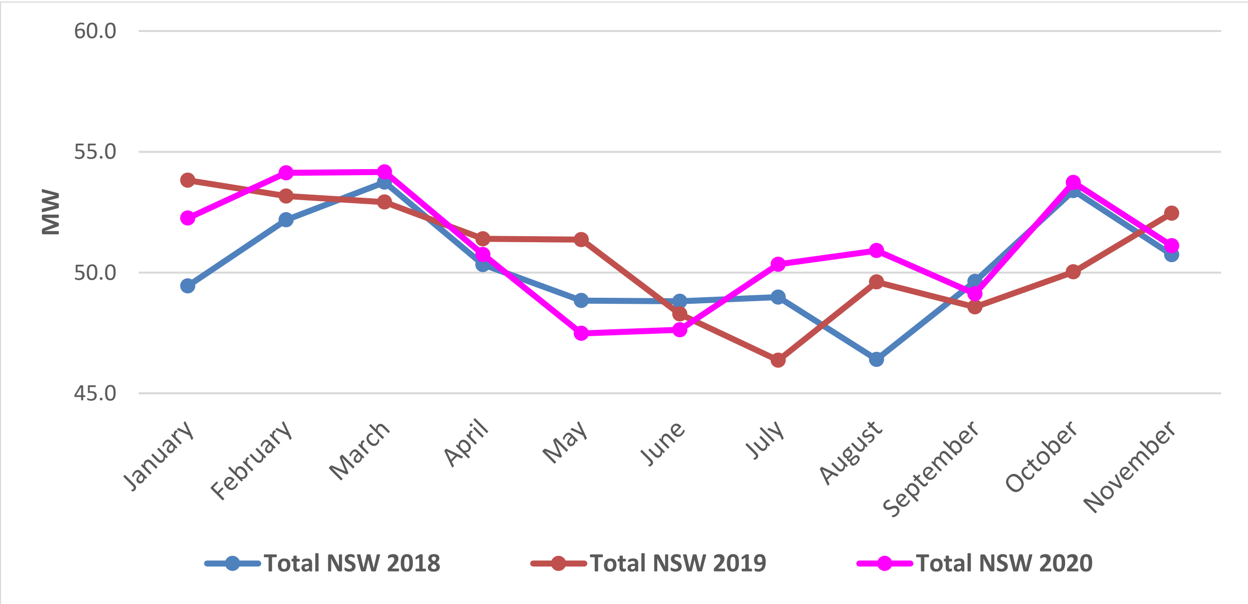


Figure 12. NSW Portfolio demand (2018 to 2020, January to November)



[1] Regions and Marginal Loss Factors: FY 2020-21 – A report for the National Electricity Market https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/loss_factors_and_regional_boundaries/2020-21/marginal-loss-factors-for-the-2020-21-financial-year.pdf?la=en

Despite mixed trends during January to March, data for both portfolios showed:

- Energy demand levels were similar year-on-year for April, which is traditionally a period of reduced operations particularly around Easter public holidays and school holidays
- Demand clearly below historical averages in May and June, approximately 10% and 4% for VIC and NSW respectively.

However, from July onwards there was a fairly clear divergence between our VIC and NSW portfolios, with our data indicating:

- VIC sites energy consumption 8% below historical averages, before stablising in November

- NSW consumption was approximately 6% higher across July to August, before trending more consistently with historical demand levels from September to November.

Overall for 2020, VIC consumption has been on average 5% and 3% lower than 2019 and 2018 respectively – with the period from May to August seeing demand 10% lower than historical averages.

In contrast, NSW consumption in 2020 has averaged 1% and 2% higher than 2019 and 2018 respectively. As noted above, May and June consumption was around 4% lower than historical averages, but rebounded strongly from July and ended up 3% higher than 2019 and 2018 levels for the period July to November.

It is worth noting our findings are based on Enel X's 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 their industries, it would not be accurate to assume the same behaviour applies for those industry segments.

Furthermore, to improve the 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 charts below exclude consumption on mandated public holidays.**

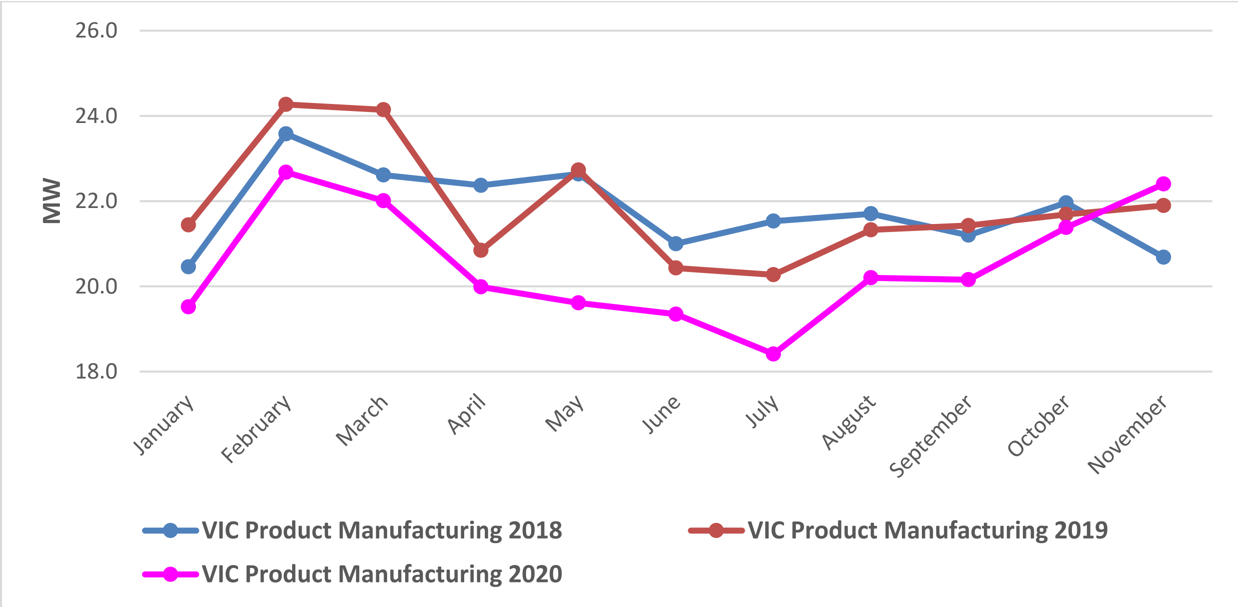
Reduced operations due to COVID-19 related restrictions (Industry-specific level)

- **Product Manufacturing**

In VIC, load across our manufacturing sites were 8% lower for the initial six months of the year – while there is normally a drop during April due to reduced operations around Easter (followed by a stabilisation in demand), this year we have seen consumption remain low and even experience a slight drop across May and June.

Following this, consumption remained lower from July to September during the period of additional restrictions caused by a second wave of COVID-19, with demand 7% and 9% lower than 2019 and 2018 levels. However, with the easing of restrictions, demand has been trending upwards to near historical average levels in October and even surpassing 2019/2018 levels for November (see Figure 13).

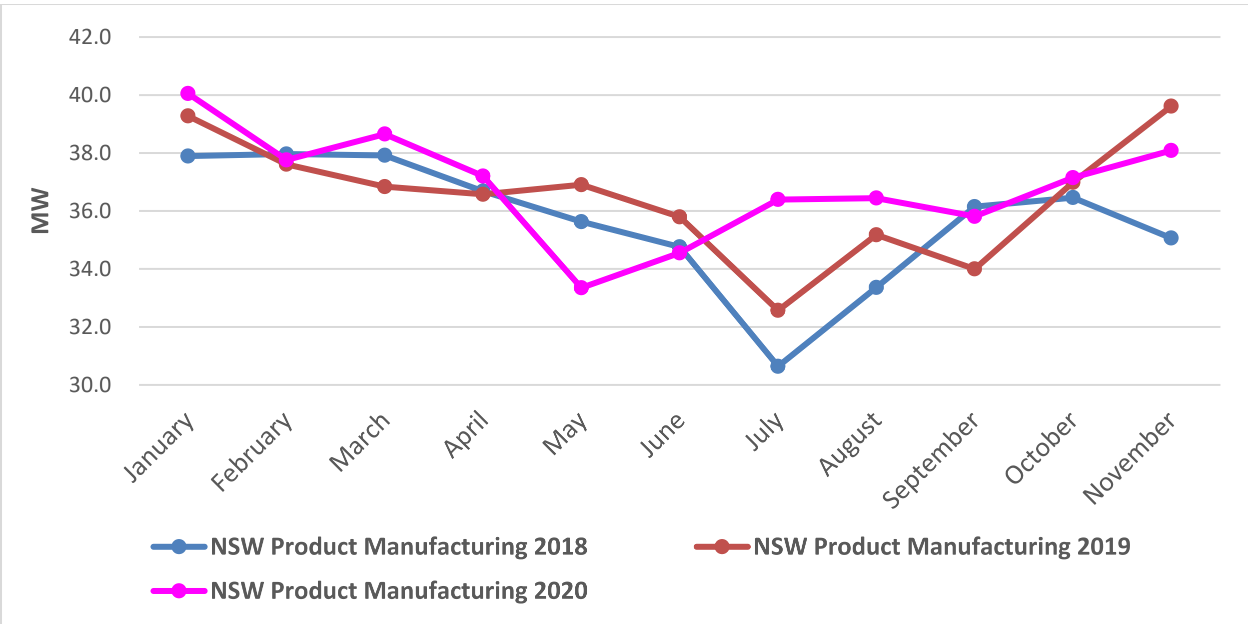
Figure 13. VIC Product Manufacturing demand (2018 to 2020, January to November)



For NSW, it has been a tale of four distinct periods (see Figure 14) – with 2020 Q1 consumption being 2% higher than previous years, but Q2 demand being 2% and 4% down on 2018 and 2019 respectively. July and August saw a large rebound in consumption, 8% and 14% higher than previous years; while September to November has been more in line with historical averages.

In terms of highs and lows, May saw product manufacturing consumption at 9.6% lower than last year; while July was 11.8% up on 2019 levels.

Figure 14. NSW Product Manufacturing demand (2018 to 2020, January to June)



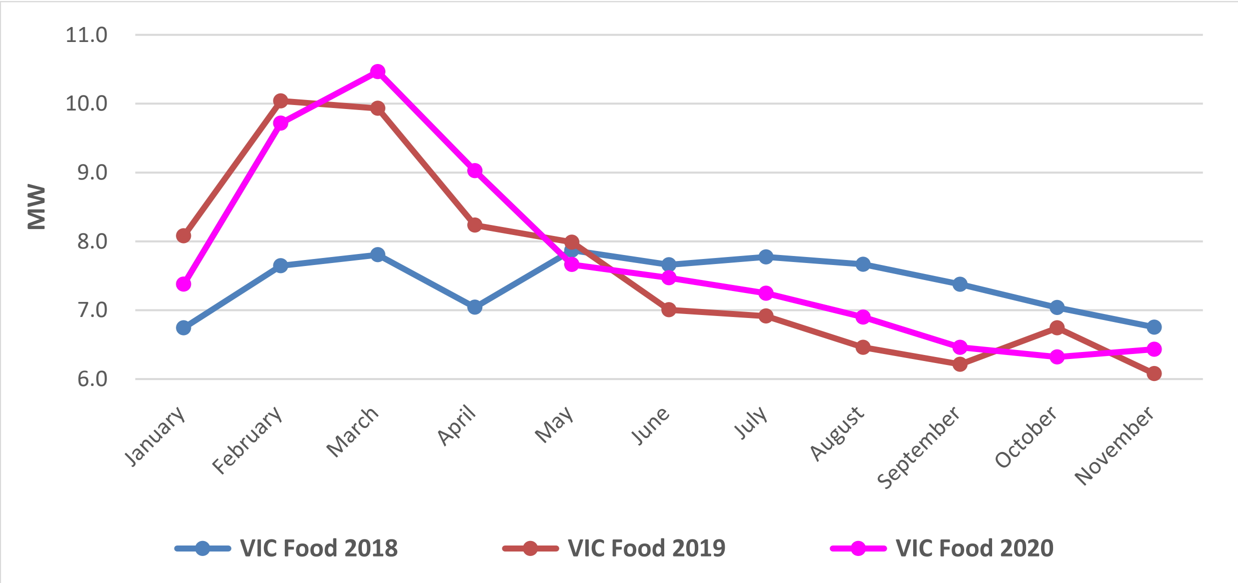
Overall, the Q2 demand trends at our NSW product manufacturing sites are broadly consistent with the overall NSW Portfolio, and as per the case in VIC the largest reduction in year-on-year consumption levels appears to have been in May. However, the NSW sites appear to have rebounded more strongly in the second half of 2020 compared to our VIC sites in this sector.

- **<u>Food production and processing</u>**

In VIC, demand began below 2019 levels, but were 5.5% and 9.5% higher in March and April, on a year-on-year (see Figure 15). This was consistent with conversations with some our customers who confirmed increased production volumes during February-April, especially in March, due to increased "panic-buying" from customers as COVID-19 restrictions came into place.

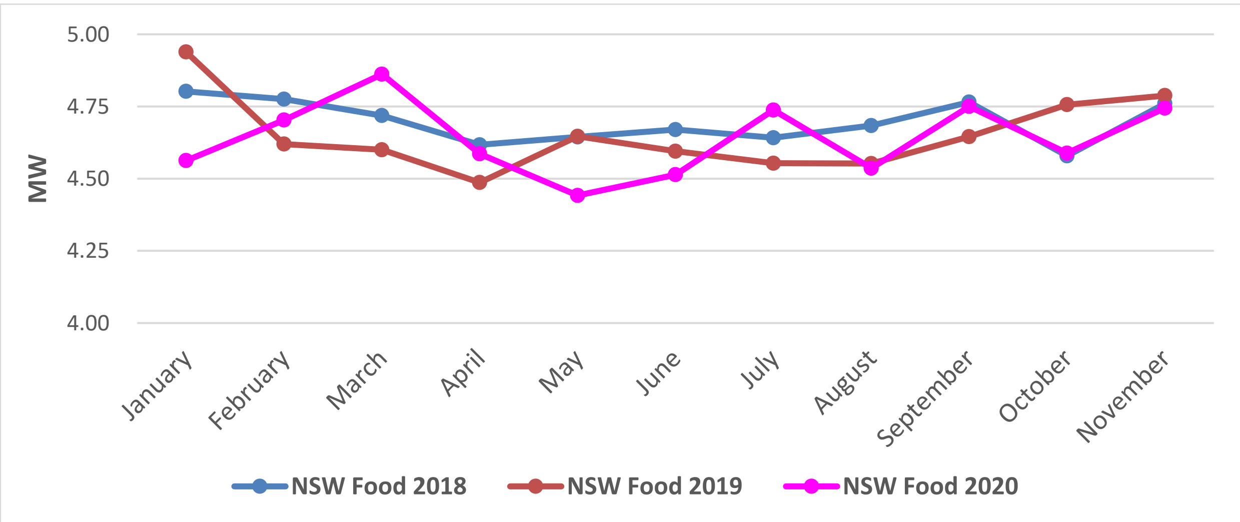
Following this panic-buying phase, energy usage in May and June returned to more historical levels and has largely remained below 2018 but slightly above 2019 levels.

Figure 15. VIC Food production & processing demand (2018 to 2020, January to November)



The story for our NSW food sites was broadly similar, with average monthly demand higher than 2019 over the period of February to April. On the other side of the panic-buying rush, production levels in May and June were lower due to maintenance and operational staff taking leave; and then followed broadly historical trends for the remainder of the year (see Figure 16).

Figure 16. NSW Food production & processing demand (2018 to 2020, January to November)



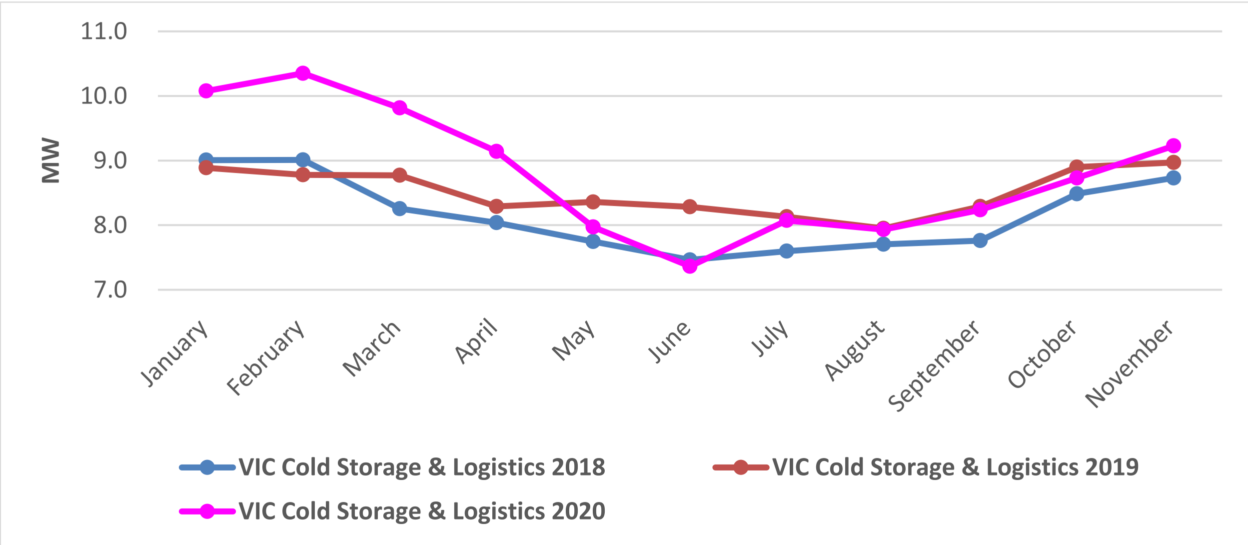
- **Cold Storage & Logistics**

In VIC, energy consumption across our Cold Storage sites from January to April were 13% and 15% higher than 2019 and 2018 levels respectively. Following this, demand dipped well below 2019 levels in May/June, and then broadly followed historical trends for the remainder of the year (see Figure 17a).

One reason for the increase in early 2020 was due to our largest site upgrading its operational capacity in November 2019 by 25% (approximately 1 MW of additional maximum energy consumption). COVID-19 related restrictions and the panic buying which followed between February and April also contributed to some of our customer sites being busier than normal.

There were some similarities with the food production & processing sites, which also experienced larger year-on-year increases from February to April, before a slight dip in May/June, and then consumption broadly following historical trends for the rest of the year.

Figure 17a. VIC Cold Storage & Logistics demand (2018 to 2020, January to June)



Figures 17b and Figure 17c illustrate the differences between large cold storage sites that primarily service small supermarkets and grocery stores, compared to the smaller sites who supply the hospitality industry – restaurants, cafes and bars, and indirectly through wholesale suppliers.

In the former sub-category (see Figure 17b), energy consumption compared to previous years was on average 23% higher in Q1, especially in February and March when panic-buying at supermarkets and grocery stores set in. This continued into April (up 21% on 2019 levels) as COVID-19 restrictions on the hospitality industry remained in place, before dipping slightly in May/June, and then following historical patterns for the remainder of 2020.

In the latter sub-category (see Figure 17c), energy consumption in January/February was consistent with 2019 levels, as COVID-19 restrictions had not been enacted. However, as these came into effect in March, there appears a clear reduction in operations at these sites (and therefore energy consumption). Demand was 13% lower on average from March to May compared to 2019, including almost 15% lower during the height of the lock-down in April. However, as restrictions eased slightly in July, consumption returned close to 2019 levels but were still approximately 5% down on 2018 levels.

Figure 17b. VIC Cold Storage (supplying Grocers/small supermarkts) demand (2018 to 2020, January to November)

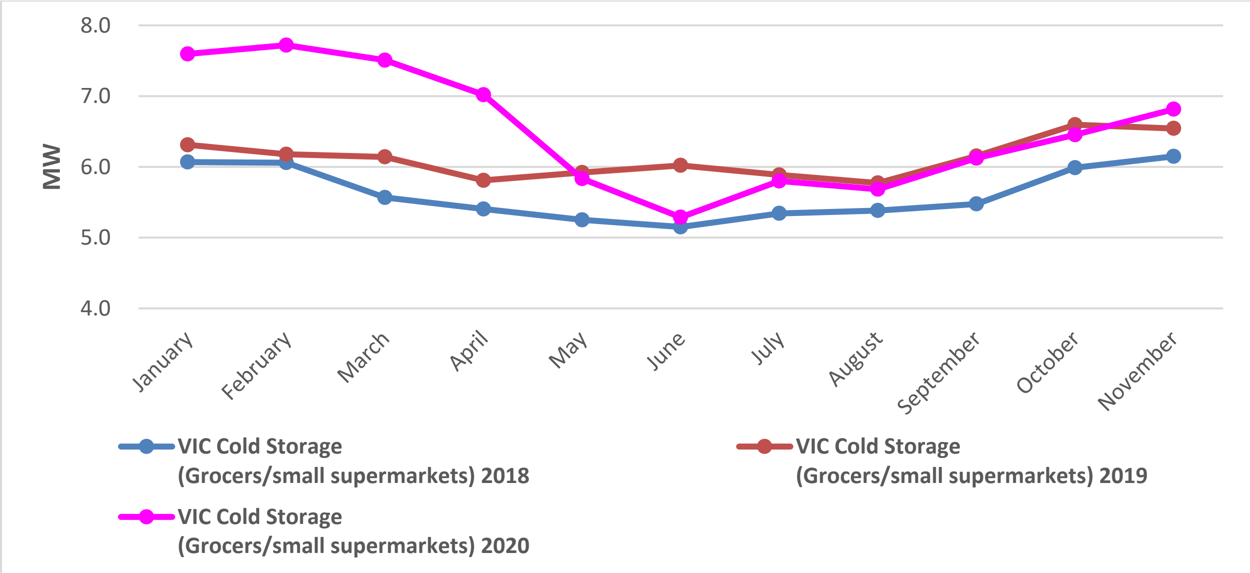
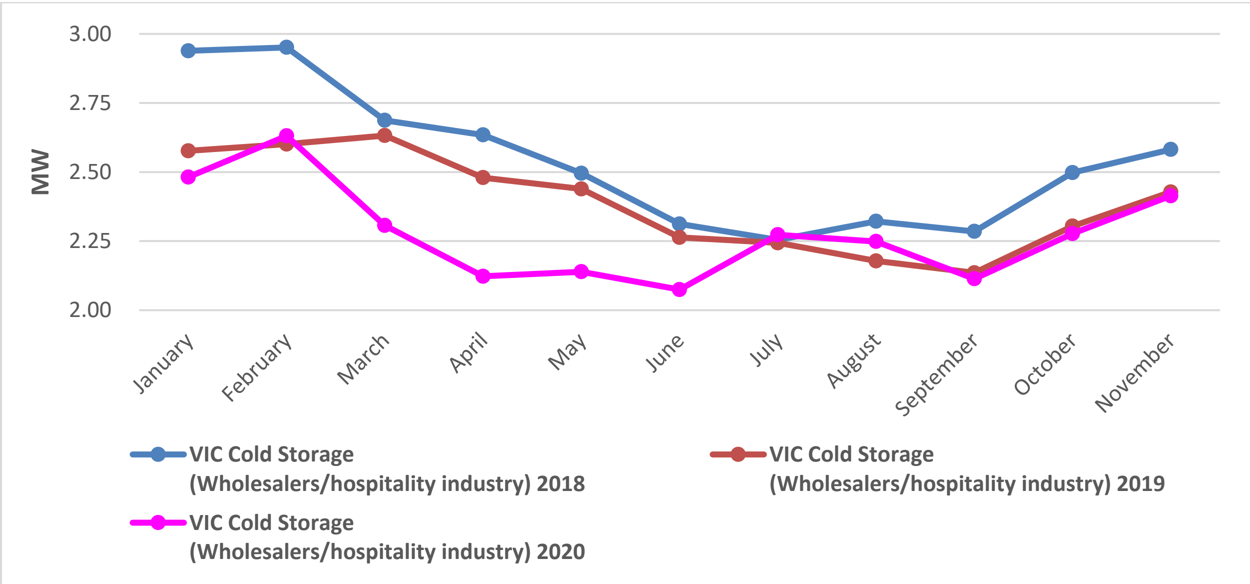


Figure 17c. VIC Cold Storage (supplying wholesalers/hospitality industry) demand (2018 to 2020, January to November)



Over the year, the smaller cold storage sites who primarily supply wholesalers and/or directly to the restaurant & hospitality industry, have experienced a 4% reduction on 2019 levels and a 10% reduction compared to 2018 levels.

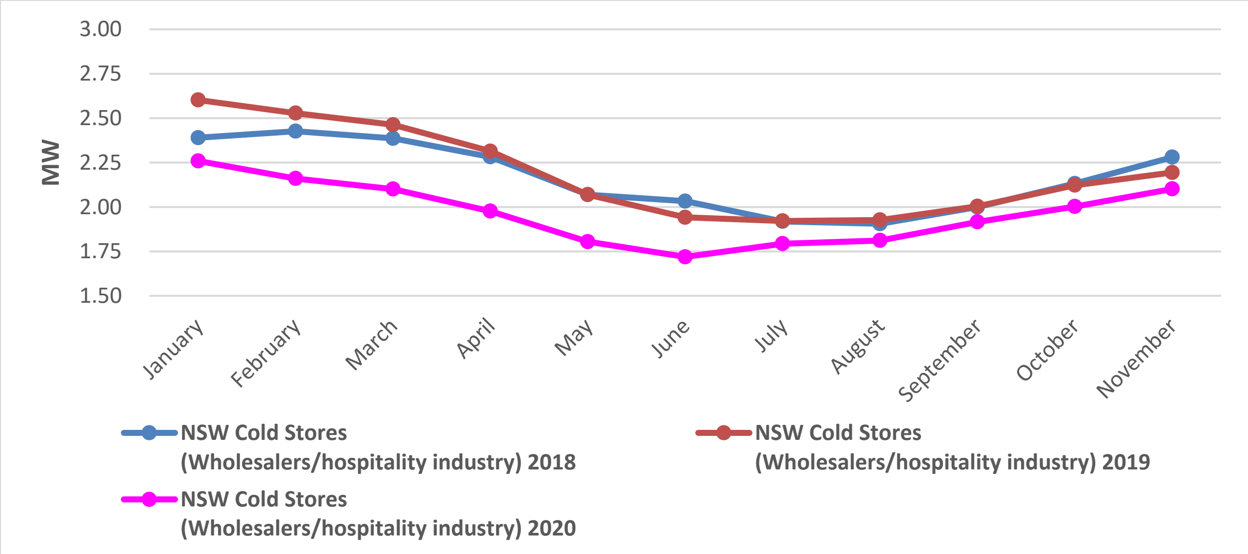
From discussions with sites, it was noted COVID-19 restrictions on the restaurant & hospitality industry had a significant impact on their business operations, with customers having fewer items to store and deliver. While there was a brief recovery with some lifting of restrictions in July, this was short-lived as new restrictions came into place due to the second wave of COVID-19.

However, conditions have improved since late October and sites expect business activity to keep trending up and broadly in-line with 2019 levels moving forward.

In NSW, we have fewer than five cold storage sites in our portfolio so therefore cannot provide a sufficient sample size for sector analysis. However, it is worth noting these sites all share the same owner as several sites that supply the wholesalers/hospitalty sector in our VIC portfolio.

These NSW sites also experienced similar reduced demand (14% on average) across January to June this year compared to 2019; however with the easing of restrictions in July, consumption was only on average 5% lower than 2019 levels over from July to November (see Figure 18).

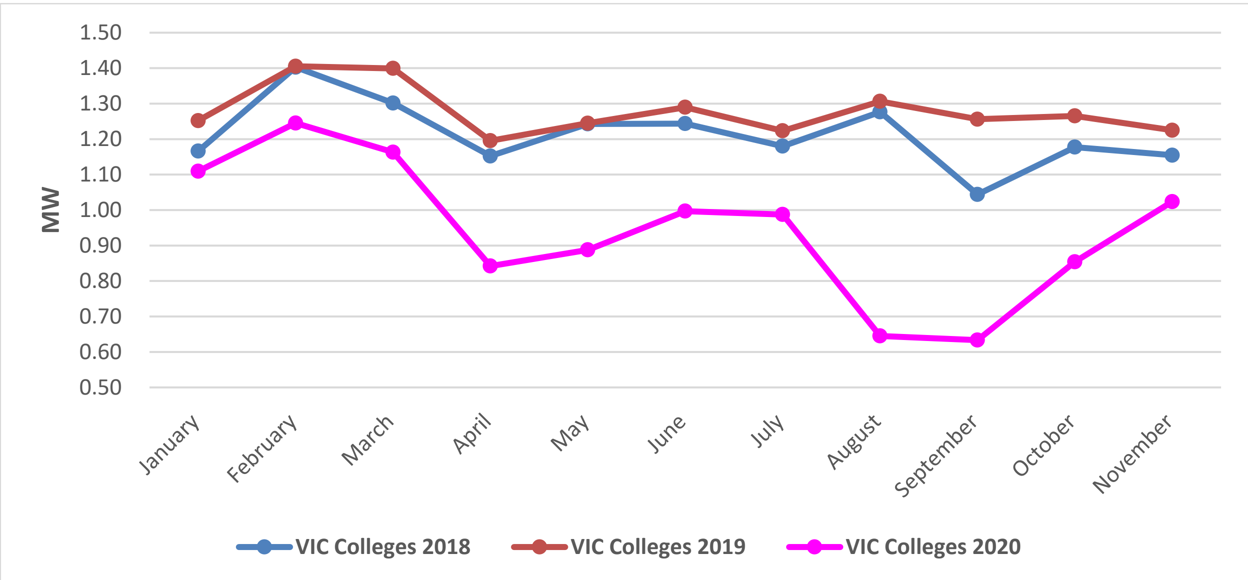
Figure 18. NSW Cold Storage (supplying wholesalers/hospitality industry) demand (2018 to 2020, January to November)



- **<u>Education</u>**

Figure 19 shows consumption at our nine vocational education sites in VIC. Our previous report identified these customer sites' energy consumption is largely driven by HVAC systems – energy used for space cooling (and heating) make up a significant portion of their energy consumption.

Figure 19. VIC Vocational Education demand (2018 to 2020, January to November)



From our data, it appears this sector in our portfolio was hardest hit by COVID-19 and it appears the impact was even greater in the second half of the year, despite some recovery in November.

The situation across our VIC college campus sites appears consistent with the broader experience across the higher education sector. Average energy consumption across the first six-month period was 20% and 17% lower than 2019 and 2018 levels respectively; while over July-November demand was 34% and 29% down on 2019/2018 levels.

Looking at each month individually provides a more detailed picture on the extent of the impact of COVID-19 restrictions. This was broadly consistent with discussions with our primary customer contacts, which indicated:

- **January and February** energy consumption would have been slightly down (11% lower) with campuses running fewer classes over summer, due to fewer international students enrolled because of travel restrictions.

- **March** demand (17% lower) was similarly impacted by lower enrolments, but the bigger driver of reduced energy usage was due to most on-campus classes moving to online-learning mode from mid-late March because of COVID-19.

- **April** energy consumption, while historically lower due to the mid-semester break around Easter, was down 30% year-on-year, both due to COVID-19 and slightly milder temperatures this year (19.8 C compared to 21.8 C last year).

- **In May and June**, demand was slightly higher with the resumption of some classes and more energy used for heating, but still well down on 2019 levels (26% lower), despite temperatures at the same levels as previous years.

- **July,** demand only 19% down from 2019 – a relatively small gap compared to previous months as this is typically a low demand period due to extended breaks mid-year

- **In August and September,** demand was 50% down from 2019 levels with the second wave COVID-19 restrictions meaning all, if not most, staff and students moved to remote working and online learning – Note: September demand is usually lower due to mid-semester break but given average consumption levels were practically identical to August levels, this indicates the min. energy usage levels when campuses are empty.

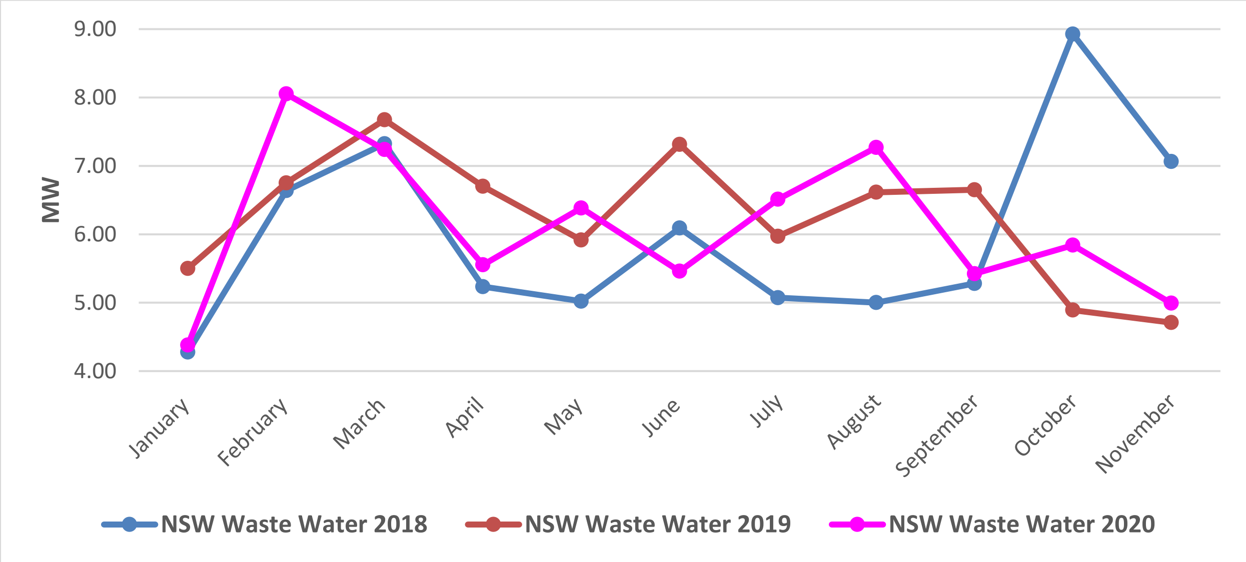
- **In October and November,** demand increased slightly with the recommencement of some classes in mid-late October and warmer weather leading to increased HVAC usage; although still 32% and 16% down on October/November 2019 levels.

According to our site contacts, this broader trend is likely to continue into at least the first half of 2021, with uncertainty remaining over international student enrolments and many classes to be delivered via "remote learning" and several staff working remotely where possible.

- <u>**Water Waste Treatment, Disposal & Remediation Services**</u>

Figure 20 shows consumption at our water waste treatment sites in NSW. As noted in our previous Knowledge Sharing Report, this sector provides essential services to the community – therefore, while sites may operate at reduced staffing levels over certain periods, any drop in energy demand is likely to be lower than other sectors. In fact, energy usage is primarily driven by pumps for wastewater treatment processes and is therefore determined by rainfall levels.

Figure 20. VIC Wastewater Treatment Plant demand (2018 to 2020, January to November)



Demand in the first six months of 2020 followed a similar trend to previous years – starting low in January before increasing for February/March, dropping in April/May before rising again in June. However, there were some differences to 2019 and 2018 trends, which were driven by varying rainfall volumes as outlined below:

- **February** – energy consumption was 20% higher, with total rainfall of 134.9mm and average daily rainfall of 6.8mm (compared with 60.5mm and 3.0mm in 2019)
- **May** – while demand has historically dipped during this month, this year it was 8% and 27% higher than 2019 and 2018 levels, primarily driven by much heavier rainfall volumes:
  - May 2020 – Average rainfall 2.9mm
  - May 2019 – Average rainfall 0.3mm
  - May 2018 – Average rainfall 0.4mm
- **June** – energy consumption in the previous two years went up, as historically June has more rain than April/May, however this year saw an opposite trend for rainfall volumes:
  - June 2020 – Average rainfall 1.1mm
  - June 2019 – Average rainfall 3.38mm
  - June 2018 – Average rainfall 5.3mm
- **July/August** – higher consumption due to a significant increase in rainfall (average 3.86mm) compared to 2.38mm and 0.35mm in 2019 and 2018.
- **September –** demand lower due to a drier than average month (1.02mm) compared to 2-3mm in previous years.
- **October/November** – demand higher due to decent rainfall consistent with Spring season (2.6mm), higher than 2019 (0.9mm), but far below the 4.6mm observed in 2018.

As per discussions with sites, although some sites have been operating with non-essential staff working remotely, primarily all sites still need to perform critical front-line operations in treating wastewater as part of their core functions; therefore, the impact from COVID-19 has been minimal.

In addition to this, our facilities have noted that energy consumption is still primarily driven by the volume of rainwater to be treated (rather than office building energy usage), and always higher because of storms and heavy rain – due to the need to run their energy-intensive pump operations.

Once again, it is important to again remind readers 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, it would not be accurate to assume the same behaviour applies for those industry segments.

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

- **Current AEMO 'High 10 of 10' baseline methodology punitive for several C&I customers**

Based on our experience with participating in RERT in both this program and outside this program, we note the standard high 10 of 10 baseline methodology with day-of-adjustment for intervals t-4 to t-1 can be very punitive for certain C&I customer loads, who would otherwise be recognised for providing valuable load reduction to the grid.

Consider the following examples:

A.	On an extremely hot day where AEMO has published market notices of market intervention and intention to activate RERT, a C&I makes the decision to shut down its plant earlier in the day, thereby substantially lowering energy consumption and reducing stress on the grid. However, the baseline methodology looks at the site's consumption in the 4 hours to 1 hour prior to RERT event start time to determine the 'adjusted baseline' level; therefore as the site had already curtailed load prior to this 3-hour window it will not get recognised for providing any service to the grid, despite the best of intentions.
B.	A temperature sensitive C&I site (e.g. Commercial building) has HVAC (air-conditioning units) make-up most of its energy consumption. In the prior 10 days to the RERT event day, temperatures were less warm and therefore its consumption was relatively unremarkable – however on the RERT event day, with 40 C plus temperatures its energy consumption increased by 200%. Unfortunately, AEMO's RERT baseline methodology used over last 3 summers has put a 20% cap on any day-of-adjustment uplift. Therefore, rather than being credited with the full amount of load drop on the day (i.e. what they were using in the t-4 to t-1 window prior to event start time which is 200% higher than normal), AEMO only measures the load drop from a level which is 20% above their average load from past 10 days. Once again, customers do not receive recognition of providing DR despite the best of intentions to relieve stress on the grid.

C. Some C&I customers can have very volatile loads, particularly those that depend on inputs such as raw materials or waste etc. One such customer being a metals recycling plant depends on metals coming through for shredding, therefore its consumption can range anywhere from 50 kW to 5 MW depending whether its high-powered shredders are running at full capacity.

This customer can always respond to a RERT activation, but unfortunately is at the mercy of when the RERT event starts, and its corresponding consumption levels in the t-4 to t-1 hours prior to event start time.

For example, if the event started at 6pm, if they were at close to full consumption (i.e. shredders running at max. capacity) between 2pm-5pm they would get close to the full credit for reducing demand from 5 MW to 0 MW (i.e. 5 MW result). However, if the event had started earlier at say 4pm, and consumption was down during noon/lunch time (reduced average load from 12pm-1:30pm), this would several affect their baseline which looks at consumption from 12pm-3pm.

So, despite them running higher all the way until prior to 4pm event start time, the DR result according to AEMO's baseline methodology would be around 33% lower – this is despite them turning off all loads at the event start time.

- **Regulatory frameworks**

There have been extremely few opportunities to provide wholesale demand response (apart from RERT over the past 3 summers). A large part of this are due to the regulatory framework and rules in place which do not naturally provide straightforward and simple ways to provide demand response to the market. To be fair, there are provisions for 'scheduled loads' to bid in the market, but these have been used on only a very small number of occasions and the requirements around bidding are very onerous to loads and aggregators.

While the Wholesale Demand Response mechanism is a welcome development, there are concerns about the overall design and whether it will be too difficult for less sophisticated C&I customers to participate in providing demand response to the market. Based on our RERT experience over the past 3 summers, C&I customers and their aggregators should be able to bid in "Negawatts" (i.e. we can provide X MWs of demand response over a certain number of intervals across a day).

Requiring customers and aggregators to actively monitor load on a 30-min or 5-min interval basis, and then have to bid in how much their load can drop to for every interval where they can provide DR, will be difficult for those customers who do not have a flat load profile.

Participant lessons learnt on DR business model design

In reiterating Enel X's earlier position, the philosophy underpinning the RERT framework[2] 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 prices[3]. In this way, RERT resources (which are paid outside the wholesale market) can be thought of as truly "additional" resources.

[2] As codified in the NER.
[3] i.e. curtailing load in response to a high spot price.

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 Report[4].

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.

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 a registered Market Ancillary Services Participant (MASP), a special category enabling 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 139 low-frequency excursions since 1 December 2017 program start, including 15 events in program period #6 which had an average duration of just over 5 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 30 times.**

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[4] Refer https://www.aemc.gov.au/sites/default/files/2018-02/EnerNOC.pdf

Period the DR was activated for these other activities

These FCAS excursions occurred between 1 June 2020 and 30 November December 2019 and 31 May 2020. None of the events occurred during our October 2020 test events for the ARENA DR program or had any significant impact on baseline demand levels for those events.

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 contracts[5], 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 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

[5] i.e. following the issuance and acceptance of an AEMO ITT

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