ZEN ECOSYSTEMS™

ARENA/AEMO DR Trial

Project Performance and Knowledge Sharing Report

Summer 2019

19 August 2019

REVISION HISTORY

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1	02-August-2019	Grant Hatamosa	First Draft
2	08-August-2019	Grant Hatamosa	First Release
3	16-August-2019	Grant Hatamosa	Draft for public release
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1. SUMMARY

1.1 Executive Summary

Zen Ecosystems (Zen) managed multiple DR events during the recent summer 2018/2019 months, for the purpose executing on its DR Pilot Program objectives. Unlike the previous year's program where Zen recruited over 1,400 program participants through our RACV partner campaign, along with smaller behavioural DR cohorts, commercial building HVAC and refrigeration loads the participant scope was significantly smaller and the curtailed loads included in our program were limited to cooling loads. Specifically, centralised cooling system in small commercial building and wall mounted split system (heat pump) systems in the residential sector.

The DR testing event was conducted and measured through the AEMO RERT mechanism.

Throughout the testing event, Zen encountered a number of familiar challenges with those experienced in the previous summer that may have influenced the results of the programme. Continued challenges included lack of access to participant data; difficulty in ascertaining accurate baseline methodologies; unexpected participant behaviour; and results being affected by testing times and testing conditions.

There are key learnings that Zen will take away to improve our future DR programme participation and which ARENA and other authorities can reflect on and consider as part of future policy design and opportunities to improve results.

1.1 Programme Summary

This report documents the performance, learnings and findings of the Zen Ecosystems (Zen) Demand Response Programme (DR) in behalf of Planet Innovation (PI). The activities covered include knowledge sharing activities, test Reliability and Emergency Reserve Trader (RERT) events, and documents challenges encountered through the programme's creation and execution.

The report includes:

- PI Zen Air Trial (Nov-Dec)
- Test RERT Event (Dec 6th)
- ARENA DR Workshop (Mar 27th)

1.3 Programme Performance Summary Tables

Summer 2018-2019 (based on Test event on Dec 6)

DR LOAD TYPE	AEMO ADJUSTED BASELINE PERFORMANCE (KW)
Residential reverse cycle 'Split System' air conditioning (cooling) load	-8.4
Commercial Buildings HVAC	29.2
TOTAL	21.4

2. OVERVIEW OF DEMAND RESPONSE BEING PROVIDED

Zen's goal for providing DR during the 2018/2019 summer was to target small to medium sized loads (typically HVAC&R and lighting) at scale, using the Zen HQ™ cloud platform to deliver DR signals manually or automatically.

Zen HQ™ is a centralised energy control system for multi-site businesses. Zen HQ™ combines smart connected thermostats, residential split system AC, and lighting controls with the power of a cloud software solution to view and manage those devices for a simple and effective building energy management system. Lightweight and affordable, Zen HQ™ allows for complete control of HVAC, lighting, or both, depending on needs and energy efficiency goals

The PI DR load portfolio for 2018 / 2019 summer involved a broad span of DR loads located in Victoria and have 2 primary categories:

- Residential Airconditioning NMI's (16) with remote / wireless control; and
- Commercial Building NMI's (7) with Zen HQ™ controlled HVAC loads.

2.1 Residential HVAC Load

3.1.1 Zen Air AC controller

In the prior year, Zen targeted the residential DR space through behavioural DR programs.

For this summer 2018/2019, the focus was on a direct control of air-conditioning systems through Zen Ecosystems hardware and software. To this end, a new product was released in November 2018 – Zen Air™.

Zen Air™ uses infra-red signals to control split-system aircon units that typically have a handheld remote control. It is connected via the internet to the Zen HQ™ cloud, which delivers scheduling, data and energy management tools to the user, as well as being the method for enabling demand response.

The energy used by a typical residential split system is in the range of 2-7kW, and the expectation for load reduction during a DR event was between 0.5 - 1 kW per device. Factors which are likely to affect this are:

- Size of the aircon system
- Temperature of the room prior to the DR event (i.e. pre-cooling)
- Insulation qualities of the room (i.e. does it heat up quickly when the aircon is used less)
- Connection reliability of the device (i.e. internet issue or removal of power may prevent DR event on a particular device)
- Override by user (i.e. DR event does not go for as long as expected)

Compared to the Zen Thermostat™, the Zen Air™ controller has a few key benefits which suit for broad residential deployment. Most notably, they it can be self-installed and does not require any wiring to the HVAC system – it simply acts as a secondary remote control. Power is provided via a USB-style cable plugged into AC/DC converter into a general power outlet (GPO). The device configures to and communicates directly via the existing home Wi-Fi internet connection. (see Zen Air™ brochure on next page)

In earlier customer research, we had received strong feedback that Zen Air™ was best suited as an additional AC control system, but that customers still wanted to keep their old remote. This made sense in that it provided the customer with familiarity of the old control, but the upside of using the new Zen HQ™ enabled features. It also meant that if there was any technology or internet failure, the old remote could be used to override or control the aircon and there was minimal negative customer impact.

ZEN AIR™

SIMPLE, CONNECTED AIR CONDITIONING SOLUTION FOR HOME AND BUSINESS

Zen Air allows users to remotely control and schedule their split system air conditioners to prevent unnecessary energy waste.

EASY INSTALLATION

Set up is so simple, it can be installed within an hour.

PAIRED WITH ZEN HQ

Reduce business electricity costs through centralised control of multiple units across multiple sites using the Zen HQ energy management portal.

REPORTING AND MONITORING

Check operation and track indoor temperature and humidity.

INCLUDED

Zen Air Controller, USB Cable, USB Power Supply, Wall Hanging Hook, Installation Guide.

IMMEDIATE ENERGY SAVINGS OF UP TO

30%

POWER SUPPLY	
VOLTAGE	100 - 240 VAC
OUTPUT	5 - 5.2 V ⎓ 1A
FREQUENCY	50-60 Hz
TEMPERATURES	
OPERATION	0° - 40° C
STORAGE	-10° - 50° C
DIMENSIONS	
ZEN AIR	79.22 x 79 x 29.3 mm
WEIGHT	
NET WEIGHT	65 g
CONNECTIVITY	
RADIO FREQUENCY	2.4Ghz Wi-Fi (5GHz not supported)
WI-FI RANGE	40 meters
LED INDICATOR	
BLUE	Solid: Powering up Flashing: Connecting to network
GREEN	Solid: Sending control signal to AC
RED	Flashing: Disconnected from network
YELLOW	Flashing: Firmware is updating
OFF	Normal operation
CERTIFICATIONS	
REGULATORY	FCC, CE and CB, NCC

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3.1.2 Recruitment for Zen Air™ cohort

Recruitment activities for summer 2018/2019 were restricted to "family and friends" of Zen Ecosystem and Planet Innovation due to late 2018 release date of Zen Air™. This approach was intended to provide Zen with insight into how the devices were used and accepted by customers, as well as mitigate the risk of any large failures or issues.

Email outreach was the main communications channels used for recruitment. The messaging employed is provided below.

[Internal Zen/PI DR recruitment email]

Hi Everyone, We just wanted to keep you all updated on all things Zen, Firstly Zen is now compatible with google home and Amazon echo which makes controlling Zen Thermostats even easier for our users and helps seamlessly integrate Zen into more homes or businesses, Secondly we will be running a new Demand Response program from 1 December 2018 to 31 April 2019 that you can join to help reduce energy demand in your local community for a few hours, on a few really hot days over summer. As a reward for taking part in the program you will receive a free Zen Air unit with an RRP of $159. For those of you that don't know Zen Air is a smart device designed to automate the control of your split system air conditioner and save energy.

During each event you participate in, we'll set your air con to a maximum of 26 degrees for around 3 hours. You will have the option to opt out of any events by overriding the set temperature on your split system by using your remote to manually change the temperature

What you'll need to register:

- Send through your name, address, NMI (your National Meter Identifier which is unique and is shown on your bill) and number of devices required
- Your house or business needs to have a split system air conditioning unit controlled by a remote, a Wi-Fi connection

This trial is also open to friends and family of Zen and PI, so if you have any external people especially business that may be interested in taking part in the trial please forward this email on.

*There is a limit of 2 deceives per home and 5 per business, and to take part in the program you must supply an NMI number from your energy bill.

To take part reply to this email with your name, address and your NMI which is shown on your Energy bill.

What is Demand Response?

Demand response provides an opportunity for consumers to play a significant role in the operation of the electric grid by reducing or shifting their electricity usage during peak periods in response to time-based rates or other forms of financial incentives. Such programs can lower the cost of electricity in wholesale markets, and in turn, lead to lower retail rates

The incentive for participation on the DR program was that the customer received a free Zen Air device and access to Zen HQ web and mobile application. This approach (incentivisation through hardware/software products) has been used extensively in US demand response programs and regions[1].

[1] https://www.energy.gov/eere/femp/incentives-and-demand-response-programs

Through the email outreach campaign Zen continued to emphasize the features and value of the Zen Air product for energy saving and comfort. This is regardless of whether the customer participated in a DR program or not.

A set of Frequently Asked Questions (FAQ) was provided to potential participants, who may not have been familiar with the idea of a remote aircon controller, or demand response.

3.1.3 Deployment and installation of Zen Air

Those who responded to the recruitment email were contacted directly by the Zen team to confirm that they qualify and arrange a time for a technician to complete an on-site installation. A technical specialist was dispatched to sites to ensure Zen Air™ was installed and operating properly. This approach resulted to 100% successful installation of Zen Air™. It is worth noting that the product is suitable for self-installation by the occupant – self install (if done well) will significantly reduce the overhead costs of a DR program for a large-scale deployment.

Various metrics regarding recruitment and participants are provided below:

Key Performance Indicator	Result
Email replies (i.e. participation rate)	25% (50 of 200 emails)
Successful Installation	100% (20 of 20 installation)
Support tickets created	5 tickets (target: 20)
Average support resolution time	2 minutes (target: 5mins)

Demographics

Majority of our participants are technology savvy given that they have been recruited through the "family and friends" of both Planet Innovation and Zen Ecosystems both technology companies. 5% are female and the rest are male. All are adults aged between 30 to 45 years old.

Installation

For this first summer season, installation was conducted by the Zen team and involved:

- Locating the split-system aircon
- Downloading the Zen Air app and creating a customer account
- Plugging the Zen Air device into a power point
- Using the app, connecting the Zen Air device to the home WiFi network
- Using the app, configuring the Zen Air device to send command to the split system aircon via infrared interface (IR)

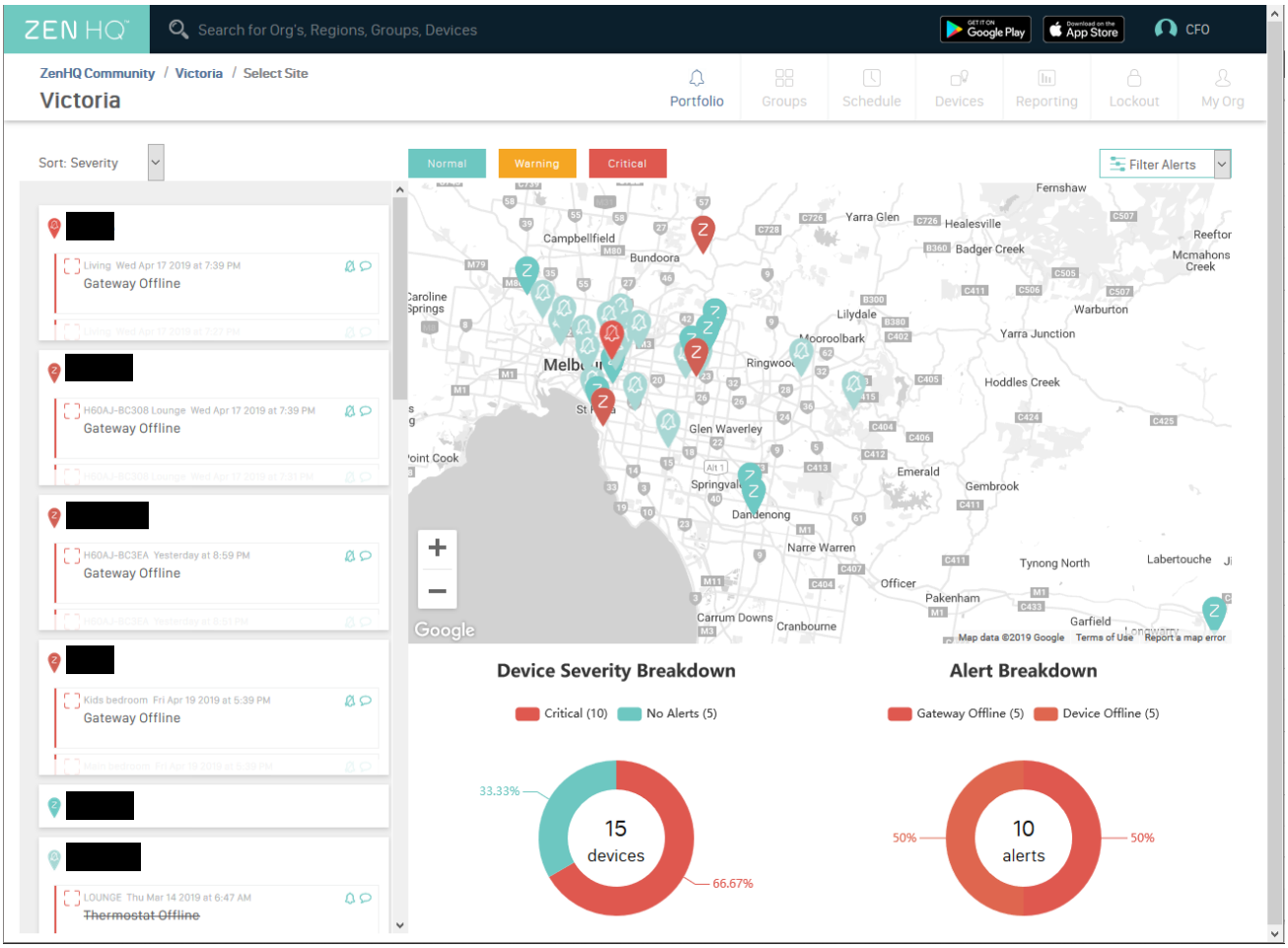
On overage, this process took 20 minutes, and could be conducted by anyone familiar with general technology installation. The Zen team gained important learnings regarding the installation workflow, which are detailed later. These have since been incorporated into the Zen Air app and product features.

In a typical installation, a Zen team member first explains the purpose of the program and the activities that will be undertaken by the Zen team member and the participant. A quick run through of the Zen Air device and app features is then provided by the Zen team member before proceeding to the actual installation. This run through will also enabled the customer to start using the device for their own purposes right away and was intended to increase engagement and continued use of the system.

In the weeks following installation, additional communications via email were sent that provided more information on how to use the software features to get the most out of the Zen Air device.

3.1.4 Demand Response events using Zen Air™

In preparation for a DR event (ideally in the days leading up to the event), Zen HQ™'s portfolio status tool was used to check the connectivity, and readiness of each Zen Air device in the DR program.



Where a device was not ready to participate in a DR event, the participant was contacted to ask them to resolve the error.

On notification of a summer event, the Zen HQ will automatically pre-cool the buildings for 40-60 minutes prior to the start of the event. This is done by adjusting the setpoints of all HVAC controllers to be colder by 3°C via Zen HQ™.

Once the actual DR event was started, the Zen HQ will set the setpoint to be 3°C warmer than the original temperature setting of the split system AC (i.e. 6°C warmer than the precool setting).

2.2 Commercial Building Controlled HVAC Load

Two main building types encompassed the commercial building load:

- Medium size commercial office space; 2 floors, ±2,400m², 20 x control points
- Smaller commercial building; ±120m², < 5 x control points

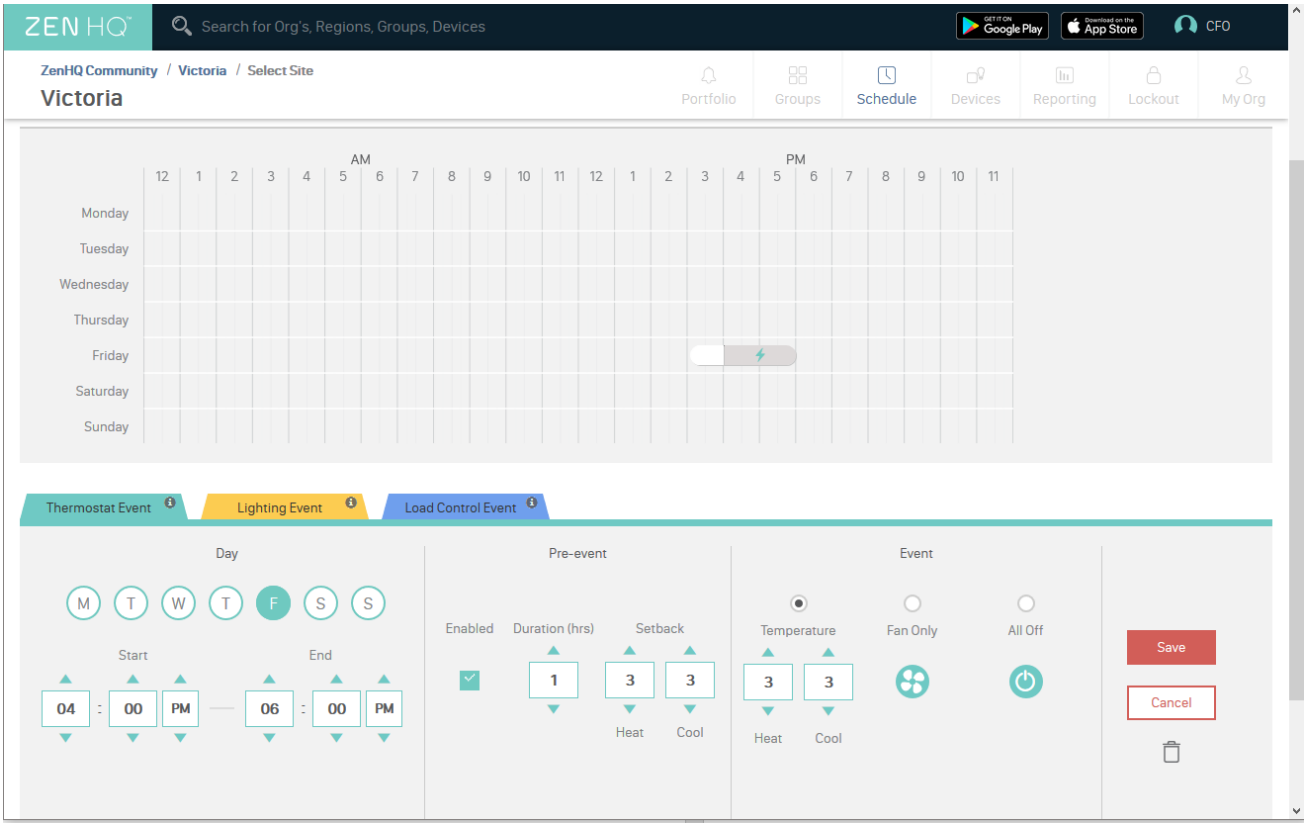
In all cases, the HVAC was controlled via Zen Thermostat™ and connected wirelessly with the Zen HQ™ cloud energy management software.

On notification of a summer event, the AC systems were set to precool the buildings for 40-60 minutes prior to the start of the event, by adjusting the setpoints of all HVAC controllers to be colder by 3°C via Zen HQ™.

Once the actual DR event was started, the AC system setpoint was adjusted to be 3°C warmer than the original temperature (i.e. 6°C warmer than the precool setting).

2.3 Dispatch of events via Zen HQ™

For both commercial buildings and residential AC, Zen HQ™ cloud-based energy management system was used to execute the pre-cool and demand response events. These events were set up specific for each cohort, and then executed automatically at the scheduled time through Zen HQ™.



3. SUMMER PERFORMANCE ANALYSIS

6-Dec-2018 (Summer Test Event)

This test event delivered a result of 21.4 kW using the AEMO adjusted baseline methodology.

This result was substantially below Zen Ecosystems DR target for this summer period. The primary driver for this was a much smaller than anticipated number of Zen devices in field, which mean that the load under management was small.

In general, the technology itself performed as expected, with the pre-cooling, followed by temperature setback, reducing the amount of energy used by the HVAC systems during the DR event.

However, the limited nature of the portfolio means that "average" behaviour may not be adequately replicated at larger scales.

3.1 Commercial Building HVAC Performance

Event Observations

On the day of this test, maximum temperature was 15.5°C and the HVAC systems was in heating mode. The setpoint for the commercial buildings ranged between 20°C and 22°C.
In this case, the temperature was mild enough that no pre-heating was conducted. At the start of the event, the heating was switched off completely and the thermal mass of the buildings was relied on to keep the temperature sufficiently comfortable for occupants. Reports from the business were that the HVAC did in fact turn off and that whilst the internal temperatures of the buildings did drop, there were minimal complaints from occupants.

Event Data Analysis

From the data shown in Figure, 8 there was a very distinct DR delivery during the event, and a recovery after the events as the heating kicked back in to bring the building's back to the desired set-points.

Using this AEMO baseline method, the provided DR delivery was calculated at 17.02kW.

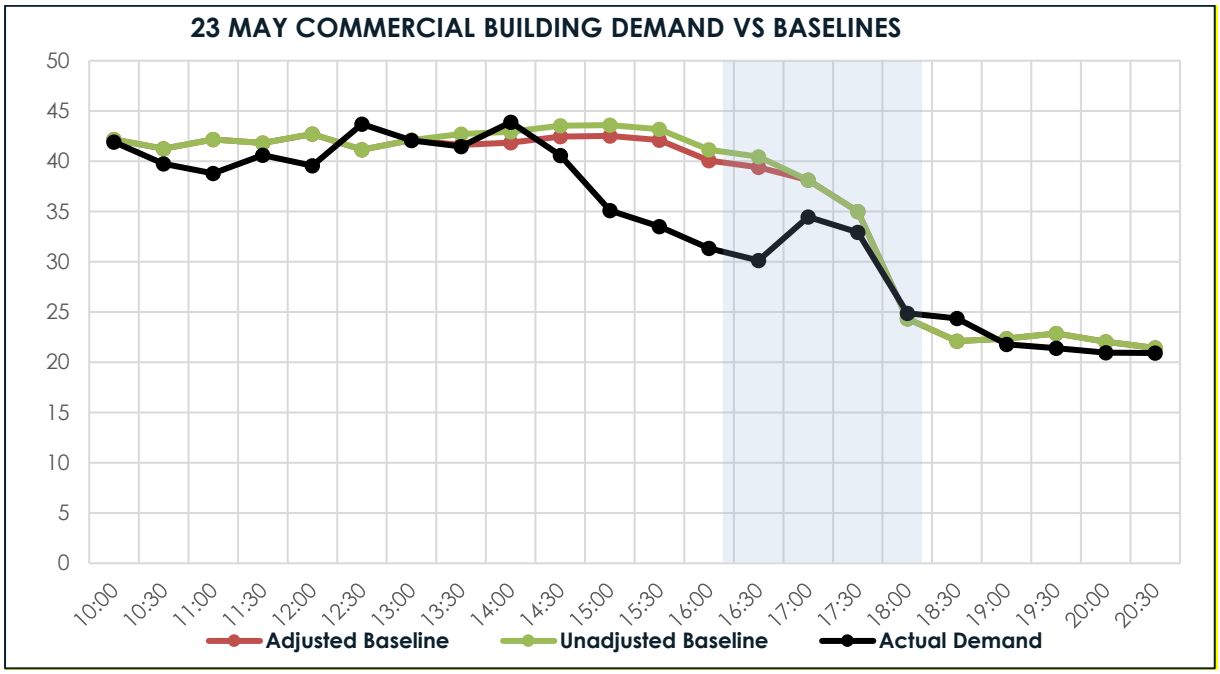


Figure 10 - Energy data on the event day May 23rd for commercial HVAC load cohort.

DR Delivery Conclusions for Commercial Building Group

There is a very visible reduction in demand during the events as a result of shutting off the heating in the commercial building group. As noted earlier, there was only a minor increase in active sites from summer test due to the slower than expected adoption of the Zen Thermostat controllers and Zen HQ software in our target market.

Comparing the DR delivered between summer and winter, the winter DR result (17kW) was approximately 36% of the summer DR amount (47 kW), despite turning off the HVAC systems in the winter event.

This is most likely because the test day, and preceding 10 days, were rather mild in temperature, resulting in a relatively low energy use for heating. Another factor could be differences between the energy use characteristics for heating and cooling of the buildings HVAC systems.

As there were no additional events called during the colder days of the winter period, this was not investigated further.

Nonetheless, these results confirm that demand response can be provided by commercial building HVAC control across all seasons.

3.2 Zen Air Residential Aircon Load

Event Observations

The events were successfully scheduled and deployed to Zen Air™ devices using Zen HQ™. For residential DR, there are a number of factors to consider when looking at performance of an event:

Total number of Zen Air™ devices in the cohort	20
Devices with live connection to Zen HQ™	20
Devices successfully sending control messages to aircon unit	20
Room sufficiently cool/insulated to make DR possible without user override (because it became too hot)	<SHANE>

As a result of the small numbers above, the overall performance of the cohort was not substantial. However, there are a number of isolated examples that demonstrate how DR can be achieved using the Zen Air device.

Event Data Analysis - Portfolio

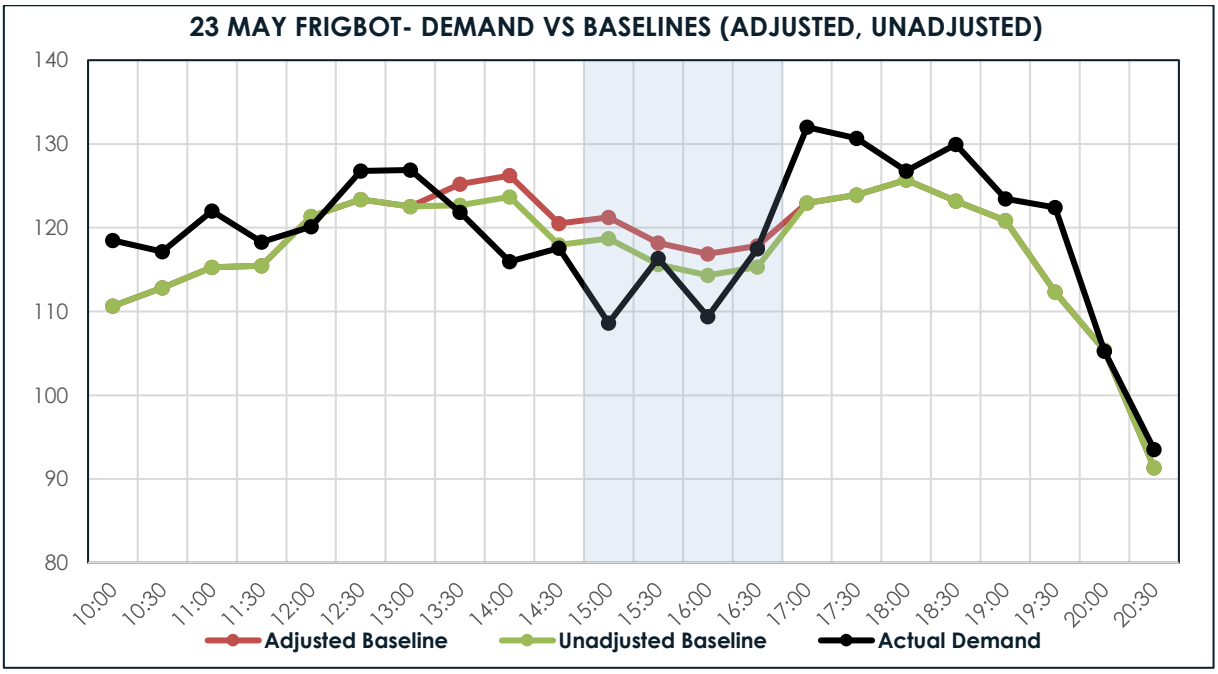
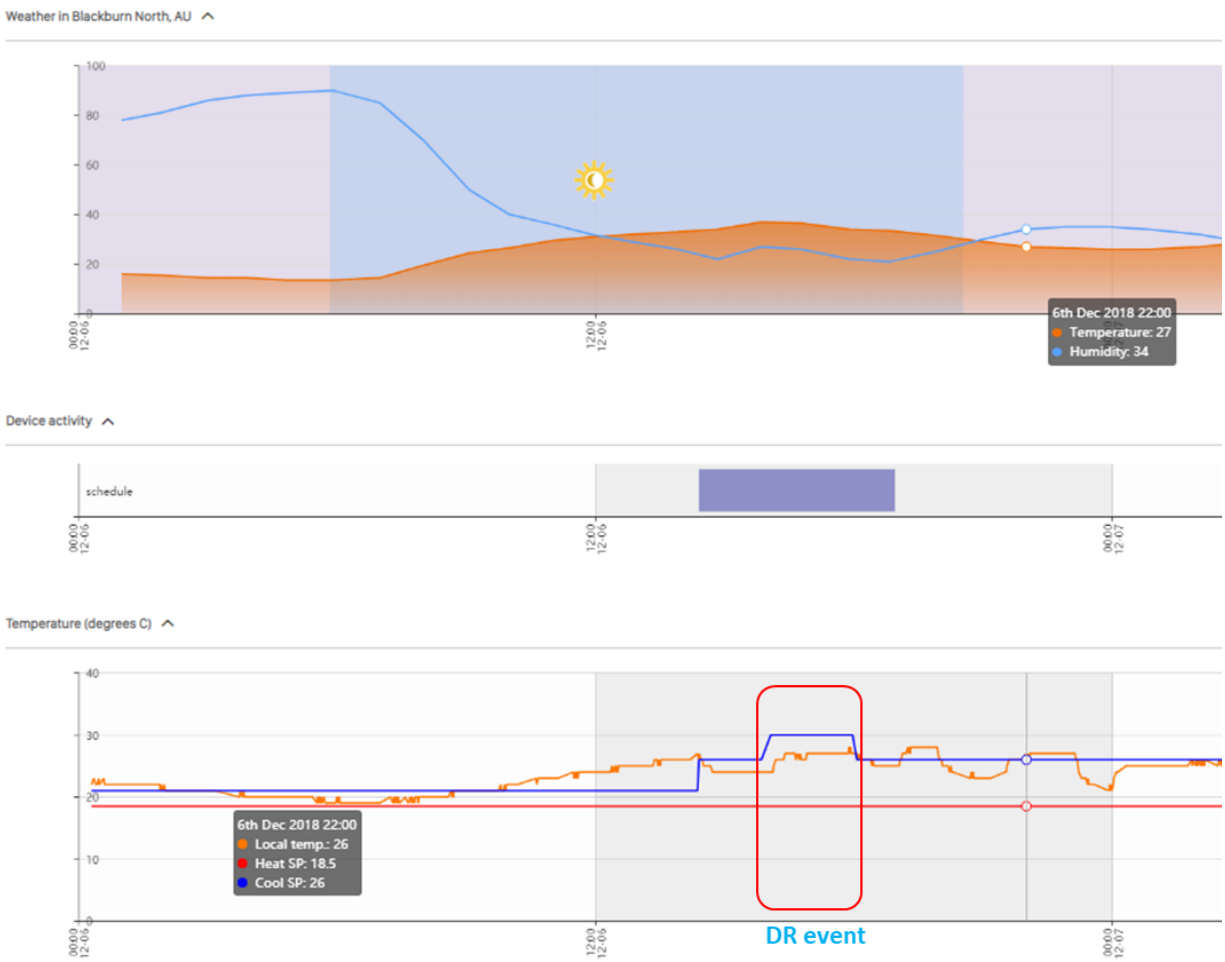


Figure 9 - FRIGBOT data for 13 NMI's with refrigeration loads including AEMO baselines.

The number of Frigbot devices participating in this event was 13, up from 8. Whereas the data from summer 2018 showed no discernible change (and event an increase during 1 event), the 23 May (winter) event does show a clear reduction in demand, followed by a recovery to the baseline. This indicates that the initiation of the defrost cycle did reduce load in those locations.

Event Data Analysis – Specific Example

The following pages show the data recorded for a home with a Zen Air™ device installed, during the DR event. This particular home is an example of how DR can be achieved through control of the split-system AC using Zen Air and Zen HQ™.



The precooling period is clearly visible, showing highest energy usage. This is followed by a substantial drop in energy usage during the event, where the setpoint is raised from 26 to 30 and the aircon system uses less energy because it runs the compressor less often.

Over the 2-hour event, the temperature rises from 26 to 28 degrees, which is a mild increase that did not cause the customer to override the DR event settings. (Note that the exact temperature at which a customer chooses to override depends on a number of factors including whether they are at home, the perceived comfort in the room, whether there are fans blowing or windows open). Feedback from this customer indicated that they were at home, and whilst the temperature did rise, they were not overly uncomfortable (in the context of it being a generally hot day).

A simple business as usual (BAU) calculation (without a baseline adjustment) for energy use if the event had not occurred is that 3.6kWh would have been used over 2hrs.

Actual use was 1.1 kWh over that period, a saving of 2.5 kWh or 1.25 kW.

ZEN ECOSYSTEMS™

NMI – 6407129838
AC cooling capacity = 2.5kW

AEMO DR event – Thursday, 6 Dec 2018 4:00pm to 6:00pm

3:00pm – 4:00pm	4:00pm – 5:00pm	5:00pm – 6:00pm	6:00pm – 7:00pm	7:00pm – 8:00pm
On schedule	DR Event			Schedule off
Baseline: Outdoor temp = 37°C Cooling setpoint = 26°C Average indoor temp = 24°C Average load = 1.6 kW Total Energy = 1.6 kWh $ = 1.6 x $0.29 = $0.46	**DR hour one:** Outdoor temp = 36.5 °C Cooling setpoint = 30°C Average indoor temp = 26°C Average load = 0.54 kW Total Energy = 0.6 kWh $ = 0.6 x $0.29 = $0.17 Temp increase = 2°C Load reduction = 1.06 Cost reduction = $0.29	**DR hour two:** Outdoor temp 34 °C Cooling setpoint = 30°C Average indoor temp = 27°C Average load = 0.54 kW Total Energy = 0.5 kWh $ = 0.5 x $0.29 = $0.15 Temp increase = 3°C Load reduction = 1.06 Cost reduction = $0.31	**Post DR:** Outdoor temp = 34 °C Cooling setpoint = 26°C Average indoor temp = 25°C Average load = 2.0 kW Total Energy = 2.0 kWh $ = 2.0 x $0.29 = $0.58 Temp increase = 1°C Load increase = 0.4kW Cost increase = $0.12	**AC off:** Outdoor temp = 32 °C Cooling setpoint = NA Average indoor temp = 28°C Average load = 0.24 kW Total Energy = 0.2 kWh $ = 0.2 x $0.29 = $0.06 Temp increase = 4°C Load reduction = 1.4 kW Cost reduction = $0.40

BAU if there was no DR event ≈ 3.6kWh
Energy use during DR event = 1.1kWh

DR Delivery Conclusions for Zen Air Residential group

The total adjusted DR delivery for the Frigbot cohort was 11kW, which was achieved across 13 sites with a total of 98kW of cooling under control including kitchen and bar freezers, kitchen, bar and basement cool rooms and shipping container cool rooms.

Based on this result we can extrapolate that the DR load achievable through the Frigbot defrost command is 11% of total cooling load. Further, in order to deliver 1MW of DR from this type of load, assuming DR delivery of 0.84kW per site, would require 1,190 individual sites.

Interestingly, the DR event is quite easily visible in the NMI data, unlike the summer events. This supports the hypothesis that the reduction in refrigeration load during the summer events was achieved, but overwhelmed by other load such as summer aircon, or high patronage. Thus, in the winter, when aircon and patronage are lower, the DR achieved stand out from the background energy usage.

4. LESSONS LEARNT

In previous knowledge sharing reports, there have been a range of lessons learnt that have been discussed:

1) Poor Data Access
2) Difficulty in Ascertaining Accurate Baseline Methodologies
3) Unexpected Behaviour of Frigbot and Refrigeration Loads
4) Summer Testing Times and Conditions Affect Test Results
5) Winter Testing Times and Conditions Affect Test Results
6) Appeal of behavioural demand response programs

Many of the above are relevant to the summer 2018/2109 period, but for brevity have not been repeated. Instead, there are a number of new learnings specific to the summer 2018/2109 period which are discussed below.

4.1 Perceived barriers to expansion and continuation of Frigbot DR Programmes

DR provided through Zen HQ™ and Frigbot controller, by activating the defrost cycle of small refrigeration units, did show some promise in the previous year's events. However, Zen was unable to expand the cohort, and indeed they did not elect to participate in DR this summer, due to perceived effort and lack of benefits for the Frigbot sites.

Specifically:

a) The requirement to supply the NMI for a site was found to be quite difficult for the refrigeration contractors (who own the customer relationship) to access. This was predominantly due to lack of knowledge of the businesses about what an NMI was, and where to find it, as well as general low priority for providing this information. Zen attempted multiple times for each site to request and guide site owners in supplying this information. However, the response was underwhelming. This meant there were many other sites that could have signed on, but did not due to the perceived difficulty of providing their NMI. As a non-retailer, Zen did not have access to the MSATS and other tools which make this a simple thing to achieve for retailers.

b) Due to the small total DR available at each site, the incentives provided for participation and signup were not sufficient for these small sites to go to the effort of signing up, despite the very low involvement for participating in a DR event. A large contributing factor is believed to be the lack of understanding of what DR is, and the impact of this on their business. For large DR customers, it may make sense to spend time individually in this education process. However, for the mass market, a broader awareness and education process is required. Key to this is the ability to access those customers, something which Zen was not able to do economically as we were not an existing supplier.

As a result, we have no longer included any refrigeration DR program participants.

4.2 Barriers to recruiting residential customers for device-based control

Key barriers encountered during the recruitment of residential customers was principally around establishing an enticing value proposition to residential consumers to participate in DR. In this program it was the opportunity to receive a "free" product that has just been newly released to the market (i.e. Zen Air™). The Zen team struggled to get customers as the product was only available

late 2018 and there is not enough time to sufficiently communicate the value proposition of the product both for the customer's improved experience with their split-system AC. In addition to communicating that the impact of a DR event to the customers comfort is minimal. In future a more efficient way of communicating the message and the value proposition is needed.

In addition, the Zen team faced considerable challenges in obtaining DR participant data due to a range of issues related to data privacy concerns. Zen is not an energy retailer the Zen team could not economically retrieve energy data for large (e.g. >50) amounts of NMI's. This meant the performance of those NMI's that signed up for DR with Zen couldn't have their performance evaluated. This made providing incentives and reimbursement for participants very difficult. As reimbursement for cutting load is one of the fundamentals of providing the programme, this was a significant issue for running a successful programme.

It is possible to work around this issue, by providing a lottery style incentive for one programme participant to win or providing individual incentives like movie tickets to every participant that says they participated. On top of that a reliable verification method will be used to discourage participants from gaming the incentive process.

A consolation to this problem was that for this summer, AEMO was able to provide cohorts of NMI's data without exposing any one NMI's data. This was beneficial for Zen as it allowed different types of loads e.g. commercial, behavioural, refrigeration to be grouped to assess the performance of each type of load especially highlighting baseline issues for certain load types.

However, while this was helpful, it still did not solve any of the outstanding issues with non-retailers having no access to the data of participants who have actively signed up to the DR programme and provided NMI's to Zen. It would be beneficial for a universal agreement to exist that stated that providing NMI's for DR by a customer is also agreeing to give access to their energy data.

4.3 Impact of ease of installation

Zen Ecosystems supplies 2 hardware variants:

- Zen Thermostat™, which is wall mounted and requires electrical connection to the HVAC system
- Zen Air™, which is an infra-red (IR) repeater and does not require HVAC wiring

Recent deployments of Zen Air™ during this summer have provided valuable learnings regarding the impact of ease of installation brought about by not requiring HVAC wiring. Specifically:

- **Install time** for Zen Air™ is 15 minutes, versus 45 minutes for Zen Thermostat™. This is due to not requiring any mounting of the device on the wall or electrical rewiring.
- **Compatibility** of Zen Air™ is 95% of split systems, versus 30-40% of ducted system for Zen Thermostat™. This is because the library of IR codes is more easily collected and updated to support all brands. In contrast, most ducted system manufacturers use proprietary wired communications protocols which cannot be accessed by a thermostat other than their own brands
- **Multiple Zen Air™ devices** may be required in a single house, versus one Zen Thermostat™ per home. This is the nature of how split systems are configured and installed, and as a result a large home with many Zen Air™ devices may become more involved and complicated than installing a single Zen Thermostat™ on a ducted system. Unfortunately, this is something that is outside the influence of a DR aggregator
- **Aircon settings** are always known if the customer is using a Zen Thermostat™, but using Zen Air™ there is a chance that the setting may have changed without it being reflected in Zen HQ™.

This is because Zen Air™ installation is done in parallel with the existing aircon remote. If someone uses the manual remote, Zen HQ™ can infer that settings have changed, but cannot be 100% certain. Zen Ecosystems is working on advanced algorithms using the Zen Air data to infer accurately the state of the aircon (and thereby have the best chance of achieving a reduction in demand).

4.4 Commercial vs residential customers

Experience shows that there are key end-user behaviour differences in the lead up and during a DR event. Specifically, behaviours that result in a site dropping out of the DR event by overriding any remote DR controls issued by ZEN. The key difference is that in a commercial site it falls on a site manager to decide whether to opt out or override a DR event. Customers or other staff members does not have the ability to opt out or override a DR event other than to report a level of negative user experience (i.e. the site is getting too hot or cold). In a residential site, occupants in a site typically have the ability to opt out or override a DR event the moment they encounter a negative user experience.

4.5 Reflections on experience in the United States

On 15-July-2016, Zen Ecosystems help stabilise California's power grid after being awarded Demand Response Capacity as part of Southern California Edison's (SCE) Aliso Canyon Demand Response initiative.

Zen's support of the Aliso Canyon program signifies its arrival in the Demand Response Aggregation space, leveraging electrical loads managed by Zen HQ™ and Zen Thermostats™.

For context, in October 2015, Aliso Canyon, the largest natural gas storage facility in California, suffered the nation's worst ever gas leak that lowered Aliso Canyon's gas stores to under 20% of capacity and put Southern California at risk of up to 14 days of blackouts, according to a commissioned Assessment Report.

Zen responded to a call by SCE for DR capacity, and the deal was awarded based on its ability to provide cost-effective demand response. Zen dispatched demand response through the Zen HQ platform, which leverages OpenADR to automate temperature adjustments via Zen Thermostats, and in some cases, turning off non-critical customer loads.

As part of the SCE program Zen reduce commercial and industrial loads from a range of customer verticals, including national retailers, commercial offices, schools, and local government facilities.