United Energy Demand Response
Project Performance Report – Milestone 1

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Knowledge Sharing

This document is the United Energy Demand Response Project Performance Report for the ARENA Advancing Renewables Programme – Demand Response programme. It fulfils an obligation under the Knowledge Sharing Plan to provide an update on the status of the delivery of the project including sharing of results and lessons learnt.

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1. Summary

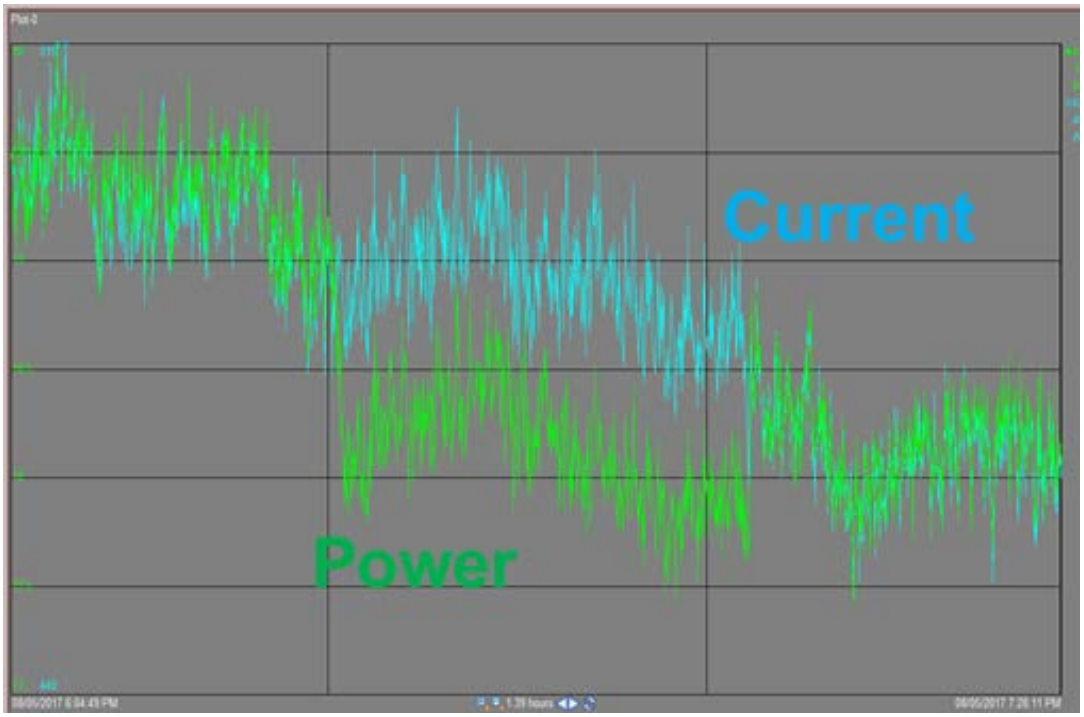
United Energy has now commenced the project by forming a project steering committee and project team to start on a number of activities in preparation for providing demand response services this summer. With the project just commencing, we have not commenced any formal knowledge sharing activities externally, however we plan to undertake this in accordance with our Knowledge Sharing Plan.

This report shares the work that has been undertaken by United Energy to date on this project.

2. Overview of United Energy's Demand Response Service

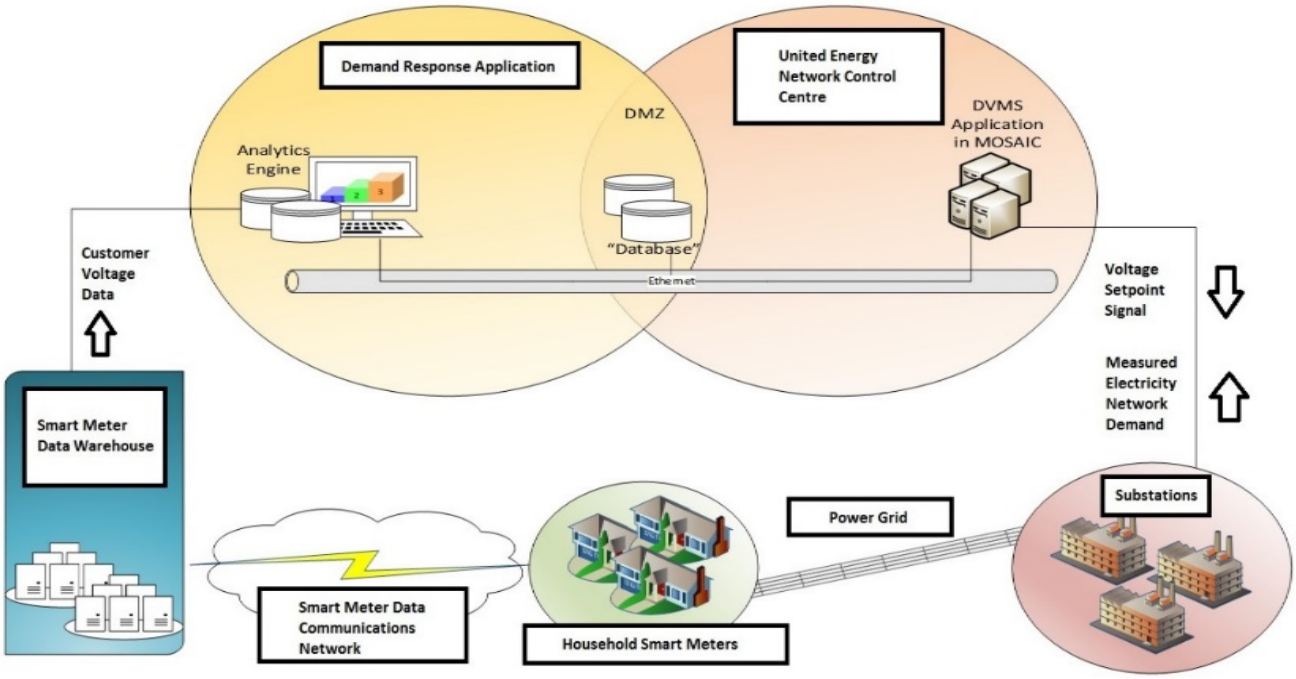
United Energy intends to deliver the demand response services through the use of remote-controlled voltage reduction at our 47 zone substations initiated from our Network Control Centre. This service will use our existing fleet of smart meters deployed across the distribution network to provide time-lagged customer voltage data from all connected smart meters to enable reductions in voltage while maintaining voltage compliance during the demand response event. We intend to reduce the voltage across the network by 3% on average to deliver at least 30MW of demand response within 10 minutes when called upon, sustained over a 4 hour period between 10am and 10pm on business days. Due to the mathematical relationship between voltage and real power, as demand increases, the level of demand response provided by United Energy will also automatically increase.

Results of voltage reduction tests on the United Energy distribution network in 2017 reveal that there is a 0.8% real power reduction on average for every 1.0% voltage reduction and this can be sustained for a number of hours. This voltage reduction was implemented through the remote control adjustment of float voltage settings at our zone substations by our 24-7 manned Network Control Centre and can be implemented within 10 minutes of receiving instruction to reduce demand from AEMO.

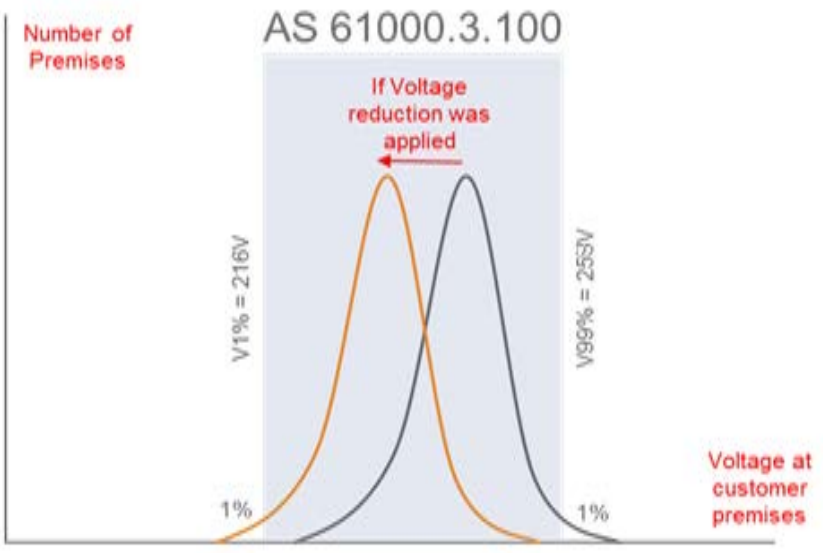


Previous use of this method of demand response always had some level of risk in that it could not be guaranteed that customer voltages did not fall below the stipulated regulated limits during the voltage reduction period, and this elevated the risk of customer claims from appliance damage. This risk has now been addressed with United Energy nearing the completion of a trial of an advanced technique using smart meters to implement demand response using voltage reduction, without deteriorating our regulatory voltage compliance. This technique uses actual time-lagged voltage information (by 25-60 minutes) from our entire

fleet of smart meters (AMI) to provide the feedback loop to inform and set boundaries on our voltage reduction control system.



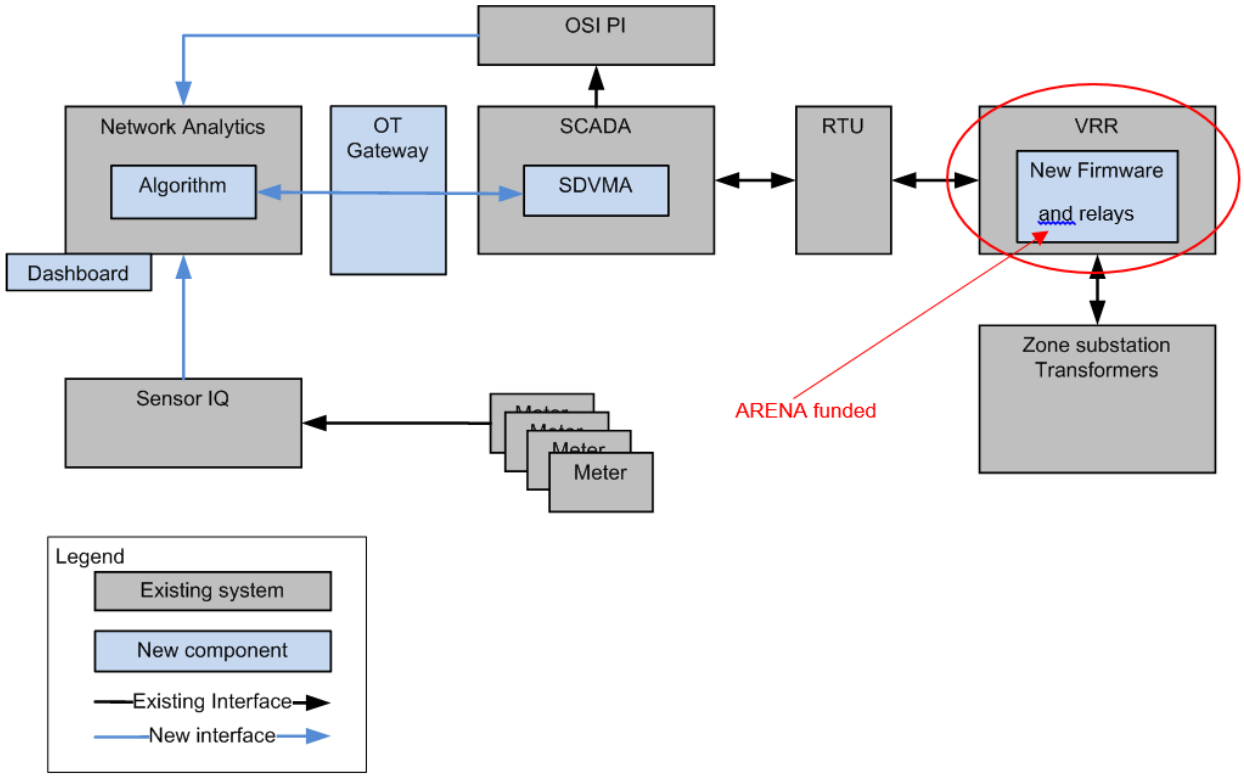
The distribution of voltages supplied to our customers is compared to the regulatory voltage limits through a data-analytics engine and the magnitude of the voltage reduction applied is limited to maintain current levels of regulatory voltage compliance. This is demonstrated in the chart below. The United Energy network will normally be operated to V99% as per AS 61000.3.100 and during a demand response event, will be triggered to operate to V1%.



To be able to implement this advanced demand response technique across our entire network to provide the magnitudes of the demand response offered, United Energy needs to replace the bulk of its voltage regulation relays (VRR) at our zone substations to cater for multiple float voltage settings. We intend to utilise the

ARENA Funding to justify the replacements of all of these relays staged over a two-year period. The ARENA funding is also being used to accelerate our distribution tap change programme to address the tail ends of the voltage distributions to reduce the standard deviations of the distributions to maximise the size of the voltage reductions (hence demand reductions) achievable.

Below is the architecture of the system currently under development and the item being funded by ARENA.



Our demand response solution is diversified across 47 sites, meaning that an outage (planned/unplanned) of equipment or communications at any one site dilutes the total magnitude of the demand response by only (1/47), but this is not below the firm level offered under this proposal. This diversified solution makes this demand response solution highly reliable. Furthermore, as we plan to continue to maintain voltages so as not to deteriorate compliance during a demand response event, there is no requirement for us to seek approval from our customers to undertake such a demand response service. Therefore, every customer within our service area will be participating and contributing to the demand response. This diversification of load contributes to a predictable and secure demand response outcome.

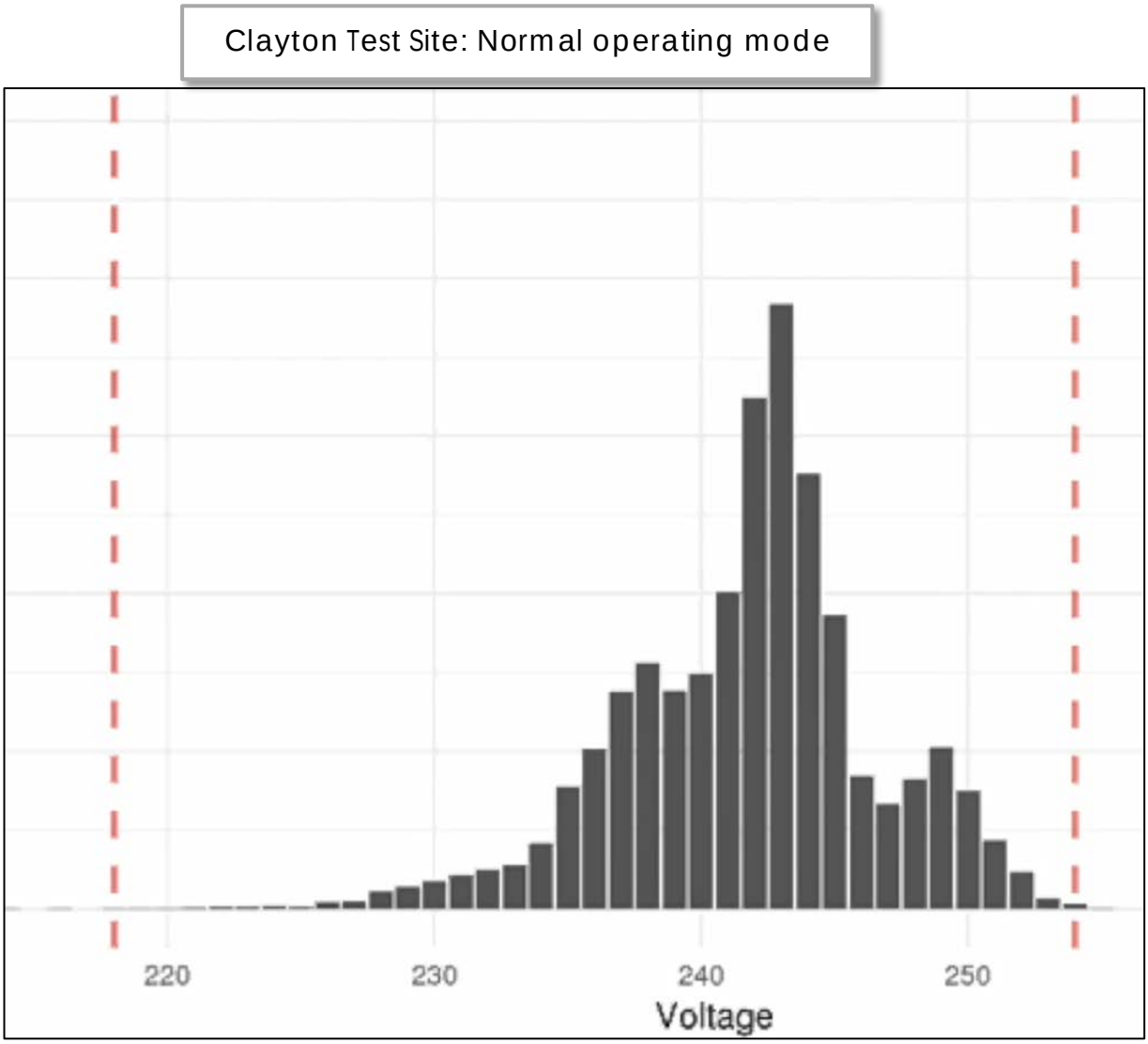
We intend to use the wholesale United Energy boundary metering to verify dispatch for settlement purposes and work cooperatively with AEMO on identifying an optimal baselining method for the service.

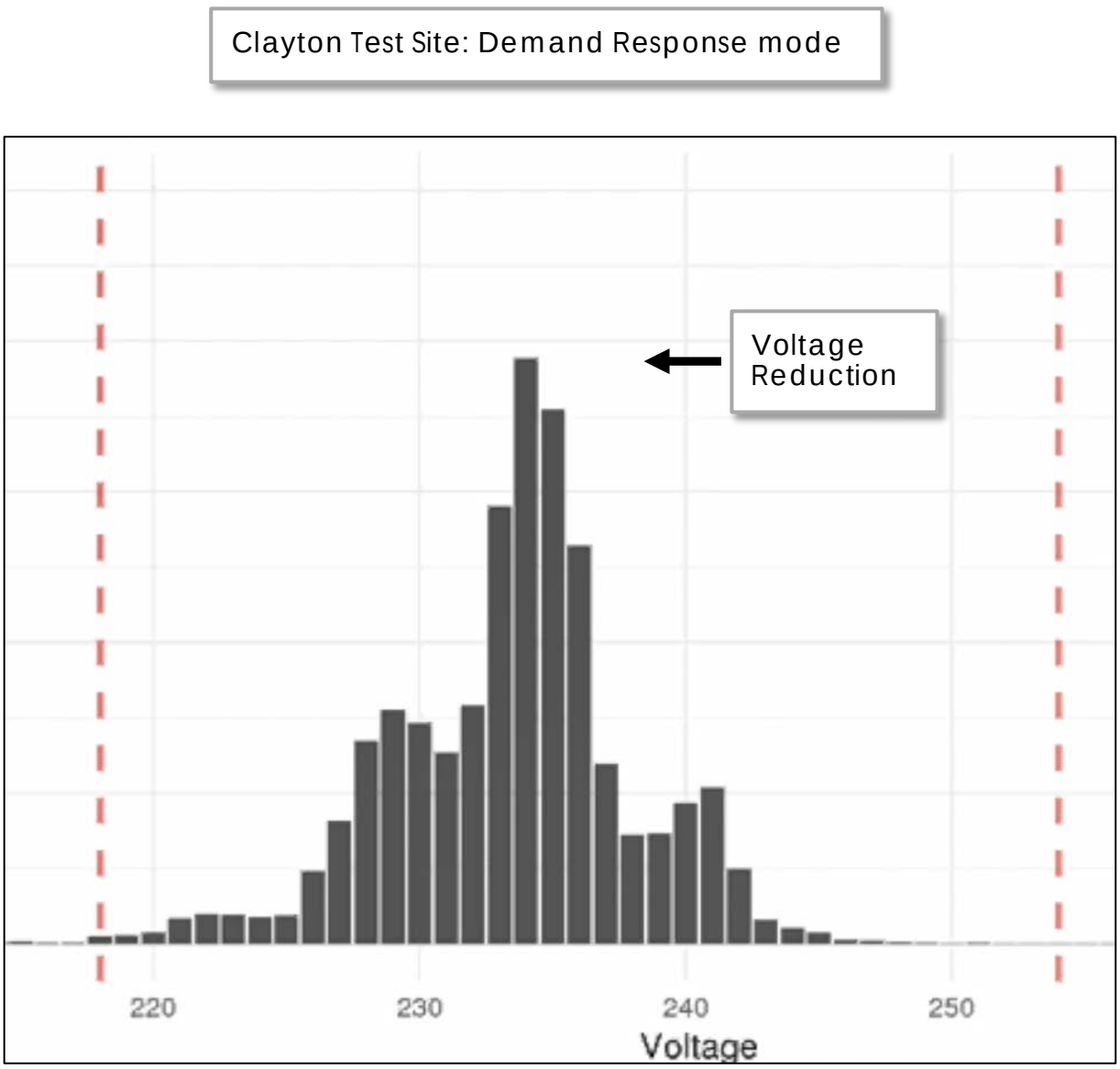
Since the voltage reduction is applied across all of our service area customers totalling more than 660,000 in number, each customer from all sector types is contributing to the reduction in demand. While the demand reductions vary from customer to customer, UE has undertaken system tests (and will demonstrate through further system tests for ARENA and AEMO) that the aggregate demand reduction is sufficient to provide the agreed demand response during the event period.

3. Testing and In-Service Performance

3.1 Dynamic Voltage Management Capability Testing

United Energy has been developing the Dynamic Voltage Management Capability at one of our 47 sites during 2017. Some recent test results from this site at Clayton (Clarinda) in Melbourne's south eastern suburbs has shown that we are now able to dynamically shift the voltage profile for customers connected at this substation between the regulatory limits using feedback from smart meters. The example below shows the voltage profiles shifted by 4% between the V99% (first chart) and V1% (seconds chart) operating limits (dashed), with the bars representing numbers of customers at each voltage level. The capability is now in its final stages of testing.





More detailed results and assessment of the trial at the Clayton test site will be included in our next Project Performance Report

3.2 Summer 2017/18 Readiness Testing

United Energy is now undertaking system tests across a number of our 47 zone substations to deliver 12MW of demand response for this summer. The sites currently selected already have remote control capability from our control centre and until the Dynamic Voltage Management Capability is operational and deployed across all of our zone substation sites, customer voltages will be monitored manually with operational dashboards and alerts similar to the charts shown in 3.1.

We are undertaking the system tests at different times of the day, days of the week and at different ambient temperatures, to understand the relationship between voltage and demand in more detail and to confirm the capability.

Once this testing is proven, we intend to call on AEMO to undertake an end-to-end test of the capability.

Results of this testing will be included in our next Project Performance Report.

4. Lessons Learnt

Lessons learnt from the testing and summer dispatch will be included in our next Project Performance Report.

5. Other Services

Not applicable.

6. Definitions

Term	Definition
AEMO	Australian Energy Market Operator
ARENA	Australian Renewable Energy Agency
VRR	Voltage Regulating Relay
UE	United Energy

Appendix A

Not applicable.