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12 November 2021

Discussion Paper – Low Load Responses – Distributed Photovoltaic Generation Management.

Thank you for the opportunity to comment on Energy Policy WA's Discussion Paper – "Low Load Responses – Distributed Photovoltaic Generation Management" dated 19 October 2021.

This response is a joint response on behalf of both Rheem Australia Pty Ltd (RAPL) and Combined Energy Technologies Pty Ltd (CET), as we have a complementary interest in the Discussion Paper.

As the largest Australian manufacturer of water heaters with products in over 4 million Australian homes, we offer a wide range of traditional and renewable energy water heater models to the domestic water heating market under the Rheem, Solahart, Vulcan, Aquamax & Everhot brands, and we are the third largest supplier of photovoltaic (PV) systems in the country. Over the last three years we have also commenced the manufacture and installation of smart electric water heaters, controlled remotely by our technology partner, CET.

Combined Energy Technologies (CET) is an Australian technology company specialising in energy management for residential, commercial, and micro grid systems. CET provides home gateway devices and has extensive experience in the integration and orchestration of systems with multiple DER devices including the integration of solar PV, batteries, water heating, electric vehicle chargers, pool pumps and A/C for the benefit of the homeowner, retailer, and the grid.

Together, Rheem and CET are already actively participating in the emerging DER market with thousands of online, mixed, orchestrated DER sites (Solar PV, batteries, smart water heaters, HVAC, pool pumps, EV chargers, other loads) across the NEM and the WEM and have developed a DER aggregation platform for grid services. For example, a joint Rheem/ARENA /South Australia Government minimum demand project is currently in the field with the aim of orchestrating the DER in 2,400 homes to address the state's "Duck Curve" problem.

Over the past 8 years we have identified and resolved many issues (at live field sites) to ensure that mixed, smart DER sites can be orchestrated to achieve the best financial outcomes for consumers, whilst providing a foundation for grid support services and grid security of supply.

We have a strong background in DPV management.

- We hold "relevant agent" status in South Australia. As such we are authorised by the owner or operator of an electricity generating plant connected to the South Australian Distribution Network to carry out the remote disconnection/reconnection of PV generation plant as directed by SA Power Networks /AEMO.

- We are founding members of the ANU led IEEE2030.5 working group that has just released the Australian IEEE2030.5 implementation guide. As such we are well placed to give our insights into the role that IEEE2030.5 might play in DPV Management.
- We are working with SA Power Networks (SAPN) in South Australia, to implement NMI connection point Dynamic Operating Envelopes (DOE's) at homes/businesses via an IEEE2030.5 connection between our ***Consumer Self-Install HEMS Energy Management Unit (EMU) edge gateway*** at the site/home and the SAPN DERMS, ahead of the formally required implementation from 1 July, 2022.

We have extensive experience in the deployment of solutions to enable DPV System curtailment (disconnect), export limiting (zero or dynamic value) and the implementation of DOE's. Our orchestration capabilities extend beyond DPV Systems to other DER such as smart hot water heaters, BESS, EV charging, air conditioners and pool pumps.

We believe that these experiences have given us a unique insight, and particular interest in the proposed solutions to DPV Management raised in the Discussion Paper, and it has informed our responses to the questions raised within the paper.

Whilst we have provided answers to each of the questions posed, we have also provided what we believe is some useful background / architecture information for your consideration.
In summary we would suggest the following for your consideration:

- Curtailment of DPV generation is the least desirable outcome for the both the Consumer and for the grid. DPV System export control is more desirable, is consistent with industry direction, supports dynamic operating envelopes, (e.g. SAPN DOE requirement from 1 July 2022), and can enable "Whole of Site" (Load and Generation) energy management. The costs of implementing basic solutions (Inverter turn off via meter/relay, DRM0/relay) are in our experience more expensive, more problematic and do not provide confirmation feedback when compared to implementing DPV System power control.
- While SA commenced with a minimum requirement for rudimentary remote PV production stopping, they have announced this will soon be replaced by a requirement for remote export limiting (zero or dynamic value). This architecture aligns with AEMO's objective for DNSP's to have Dynamic Operating Envelopes and avoids the inequitable situation of the customer having to pay for grid electricity when they have invested in a PV system.
- This approach would also provide the platform to integrate "demand turn-up" services and a future 2-sided market. This would have the dual benefits of bringing additional financial benefits to customers, maximising the use of PV production, and provide a capability that could be extended for localised demand / supply balancing for the DNSP.
- In SA Rheem has been required to install a second meter to enable dynamic export limiting to access the real time data on the net household energy demand and supply. It is recommended that Western Power (as the owner of the smart meters), be required to provide local power quality data access to approved parties to avoid imposing this additional metering cost on the customer.

- That IEEE2030.5 be considered as the default connection protocol between the Synergy DERMS and/or Aggregator cloud and the customer site for the purposes of DPV Management. This will provide the foundation for further site wide BTM orchestration of DER (Load and Generation), the implementation of Dynamic Operating Envelopes (DOE) and is consistent with Clause 4.2.2 of the Discussion Paper in providing **"distribution network-level responses that could increase load on the power system to help manage system security"**.
- That Solar PV Inverters (DPV Systems) should have their external communications capability enabled and be free of any fees as a default requirement of sale. Currently many inverter providers have read only access, and do not provide local control. The connectivity is typically enabled via Wi-Fi. However Rheem is pushing for the national inverter specification to mandate ethernet/RS485 communications due to unreliability of Wi-Fi to an external device.
- That reliance on inverter Wi-Fi communications for enabling DPV management of the site Solar PV Inverter be avoided, noting that for many Solar PV Inverter models Wi-Fi capability cannot be used for power control. (Please see our further reasoning based on our field experience across thousands of sites within this response).
- That authorised access to smart meter power quality data (Ref NER S7.5.1) locally at the customer revenue meter is considered, to advance the cost-effective deployment of DER, and minimise the cost of providing export limiting and DOE services at a DPV System location by negating the need for additional power metering technology.

We elaborate further on our reasonings for the above suggestions within our detailed response that follows.

For the suggestions we have raised above, we have applied the National Electricity Objective (NEO) as the basis for our recommendations.

Given the importance of implementing the DPV Management system correctly, we would welcome an opportunity to have a discussion with you to further share our experiences and expand on the ideas raised in this submission.

As this submission has been prepared using the expertise of several Rheem and CET personnel, I would ask that any enquiries related to the submission are directed in the first instance to myself. I will then co-ordinate follow up responses to your enquiries or further meetings, if required, with the appropriate personnel within our organisations.

Yours Sincerely

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RHEEM/CET RESPONSE

Background and experience:

Rheem Australia Pty Ltd (RAPL) and Combined Energy Technologies Pty Ltd (CET) have jointly deployed thousands of mixed DER systems across the NEM and WEM at residential and commercial sites whereby our ***Consumer Self-Install HEMs Energy Management Unit (EMU) edge gateway*** at the site/home provides sitewide orchestration of DER such as solar PV (DPV Systems), smart water heating, battery systems, pool pumps, heat pumps, air conditioning, and EV chargers. The installations are orchestrated/controlled for the financial benefit of the consumer, for DNSP services such as DR (Minimum and Maximum constraint mitigation) and for AEMO grid services such as contingency FCAS for security of supply.

Our implementation approach is consistent with the ARENA DEIP program (including the DER Interoperability and DER Dynamic Operating Envelopes (DOE) working groups), and the ESB / energy market regulators' desires for a future fully integrated open source 2-sided market. Further we fully support the ANU led, Australian IEEE2030.5 working group of which we are members and have assisted in the development of the Australian IEEE2030.5 Implementation Guide which is now in the Standards Australia process.

Of note we are a "relevant agent" in South Australia, i.e., a party authorised by the owner or operator of an electricity generating plant connected to the South Australian Distribution Network for which we carry out the remote export limiting of PV generation plant as directed by SAPN /AEMO.

Behind the meter DER orchestration philosophy:

Our philosophy in enabling a home / site for NMI level power control is to orchestrate the site DER (load and generation) to achieve a desired operating envelope, by maximising solar PV self-consumption and by varying and shifting load and generation.

Our approach is to mitigate network security of supply issues, addressing network minimum and maximum demand issues whilst maintaining customer amenity and optimising customer financial savings.

On simple Solar PV only sites we can implement export limiting where there is no other controlled DER to implement dynamic operating envelopes.

Our systems fully encompass the functional requirements and desired outcomes of the Low Load Responses – Distributed Photovoltaic Generation Management Discussion Paper.

Our deployed DER orchestration systems are the result of over 8 years R&D inclusive of extensive field-based development and testing.

Responses to Section 4.4. Questions of the Discussion Paper:

a) Are there any practical considerations Energy Policy WA should have regard for in implementing the proposed DPV Management model?

1) All Solar PV inverters (DPV systems) should be communications enabled when sold. All Solar PV inverters should include a physical means of enabling external communications with the inverter such as Ethernet or RS485. This readies the home/site for the option of Solar PV export control, future dynamic operating envelopes, and intelligent site wide interoperable DER orchestration and is consistent with the ESB / regulators desire to move to a 2-sided market.

   Our experience of many thousands of sites is that Wi-Fi connectivity of an inverter to the home/site Wi-Fi LAN is problematic and requires a high level of remote and site level support. Issues include the location of the inverter relative to the Wi-Fi transmitter (router etc) and hence varying signal level, changing site conditions, changing ISP's, changing access points and changing passwords. A small number of our original sites that still utilise a Wi-Fi connection to an inverter require a disproportionally higher level of total support. Further, several Solar PV inverter brands/models (DPV's) do NOT support control commands over their Wi-Fi connections for the purposes of inverter power control and ONLY support power control over their wired connections (Ethernet or RS485).

   Recommendation:
   - That Solar PV Inverters (DPV Systems) should support a hardwired interface connection for external communications (i.e., Ethernet or RS485) to be included as a default requirement of sale or installation.
   - Reliance on Inverter Wi-Fi communications for enabling DPV management should be avoided.

2) All Solar PV inverters (DPV systems) should have their external communications protocols enabled by default when sold. It is our experience that most all Solar PV inverters support Sunspec Modbus (or a close variant) as a means of controlling inverter functions such as output power settings including export control settings. However, this functionality is normally disabled by the manufacturer by default and requires enablement at time of installation (by a suitably qualified person) OR it requires a site visit at a later date.

   Recommendation:
   - That Solar PV Inverters (DPV Systems) should have their external communications capability enabled, and free of any fees, as a default requirement for sale or installation. This is consistent with the desire of energy market regulators to enable DER interoperability for a future fully integrated open source 2 sided market.

b) What mechanisms should be used to provide information to consumers about DPV Management events and what form should this information take?

Our solutions for DER orchestration and, in its simplest form for Solar PV Inverter (DPV System) management, are enabled via a ***Consumer Self-Install HEMS Energy Management Unit (EMU) edge gateway*** with optional support for IEEE2030.5 (see Image 1).

The mechanisms that we support for providing information to consumers about DPV management events include:

1) SMS to registered site owner or as otherwise nominated.
2) Email to registered site owner or as otherwise nominated.
3) Push alert to the nominated smart phone(s).
4) Via the site orchestration user App.
5) Visual indicators on the EMU site gateway.
6) Any combinations of the above.

Figure 1 Self-install EMU edge gateway showing event programmable LEDs. Colour, activity (eg flashing) remotely programmable.

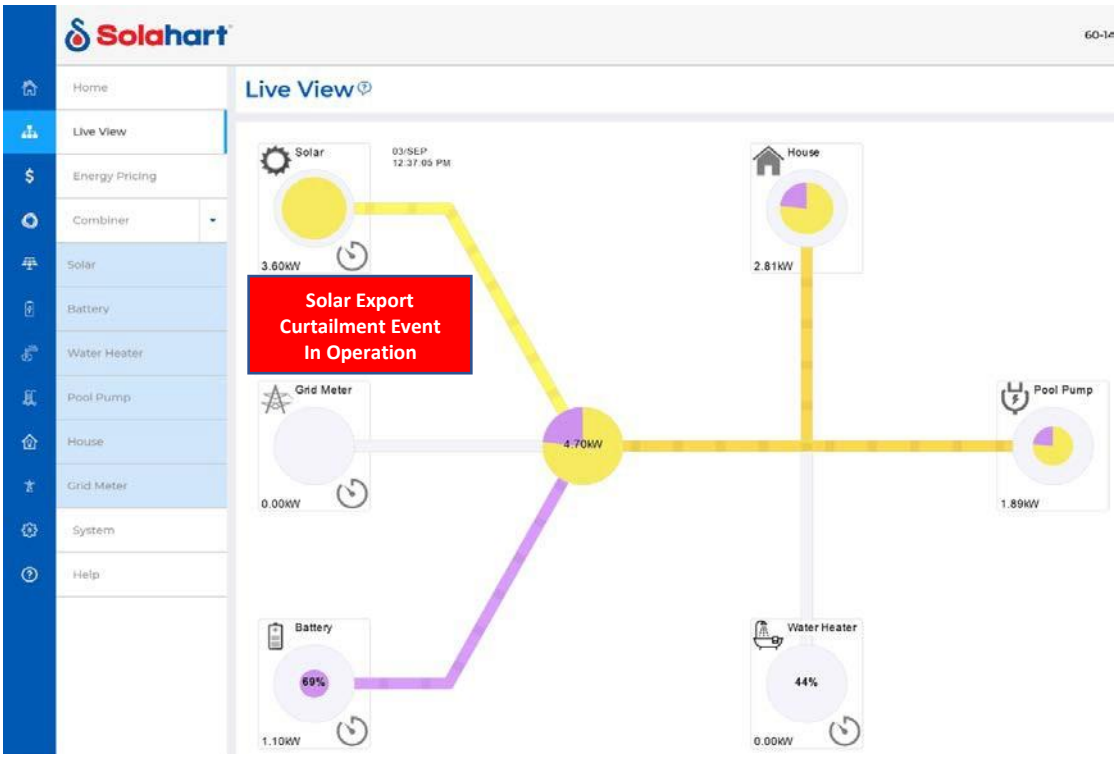

Figure 2 Screenshot of typical site orchestration app showing event notification on the consumer's smart phone, tablet or computer.

We believe that information should be descriptive, and a combination of the information delivery mechanisms detailed above to alert/inform the site/home occupier with the following minimum information:

1) Date and time of the event (if known in advance);
2) Type of event, e.g., DPV System curtailment (Off), Zero Export, Export Limited;
3) Duration of event (if known), with updates as/if duration of event is changed;
4) Event conclusion notification.

c) What sort of customer support information should be made available by Synergy to assist customers to maintain compliance with remote communication – for example, if a Wi-Fi connection needs to be re-established?

As detailed previously we have thousands of connected, orchestrated, mixed DER sites across the NEM and WEM. All sites are cloud connected and monitored in real time. Our cloud and "OnWatch" portal monitor all customer sites for anomalies, outages, device failures etc using a combination of site heuristics, excursions from parametric operating limits of DER under orchestration and DER failure notifications.

Our experiences have shaped our technology and support services and in addition to our cloud "OnWatch" platform we maintain a help desk for customers and provide customers with a comprehensive real time user application.

With regards to Wi-Fi, and as we have detailed above, we avoid using any Wi-Fi connections except as a last resort connectivity option. Where issues do arise, our robust systems provide the necessary site information in real time to enable us to assist the customer in resolving the issue, though in most cases we have diagnosed the issue and initiated a required resolution before contact with the customer is made. This is a very complex topic, and we are happy to have a further discussion.

We recommend that this standard of pro-active system monitoring and unsolicited support should be the minimum standard set to protect both the interests of the consumer and network stability.

d) What assistance or training might be provided for installers to help meet requirements for validation, at the point of installation, and on an ongoing basis

We can speak confidently on this topic from our extensive experience in the installation of thousands of cloud connected, orchestrated DER sites across the NEM and WEM including sites installed under the South Australian "Relevant Agent" program for Solar PV curtailment.

Due to the large number of Solar PV Inverter (DPV Systems) brands and models that we support, along with the wide and varied number of smart DER devices that we integrate, we have taken an all-inclusive approach to installer training and assistance as follows:

1) Prior to attending the customer site, the installer can review the upcoming installation with the job allocated via our "OnSite" installer app. This provides job information as loaded by Rheem / Solahart and/or CET.

2) We maintain an online repository of all DER device manuals that is accessible by installers from their Smart Device (e.g., phone or tablet).

3) We maintain specific online installation workflow manuals that describe step by step the process for the installation and configuration of DER devices such as DPV systems.

4) We maintain a real time, cloud connected "Guided Installation" application called "OnSite", that is typically loaded on an installer's smart device (e.g. phone or tablet) and used to guide the installer through the installation process for the specific brand & model of the DER. As all our sites are connected to our cloud-based aggregation platform, once a site is installed the DER device installation is monitored in real time and corrective instructions are pushed to the "OnSite" installer app should an installation error be detected.

5) We maintain an installation knowledge repository where the installer can access information about similar installations, specific DER types etc if a particular issue arises during an installation.

6) If for any reason the installer cannot resolve an issue themselves, we maintain an installer help desk offering the installer phone-based tech support during the installation process, with a guaranteed 5 min response / call back if not immediately answered. This "speed dial" for support is accessed directly from the installer's "OnSite" app.

7) The "Onsite" app requires the installer to take pictures of the entire installation, e.g., DPV System, Switchboard, Cabling etc for upload to our cloud, with information regarding the installation logged for later reference if needed.

8) Prior to the installer leaving the site, our cloud-based systems run diagnostics to confirm the installation, the communications, and functionality are enabled (e.g. DPV system export limit, DOE etc).

9) Only then is the site installation signed off and "closed" and the installer allowed to leave the site.

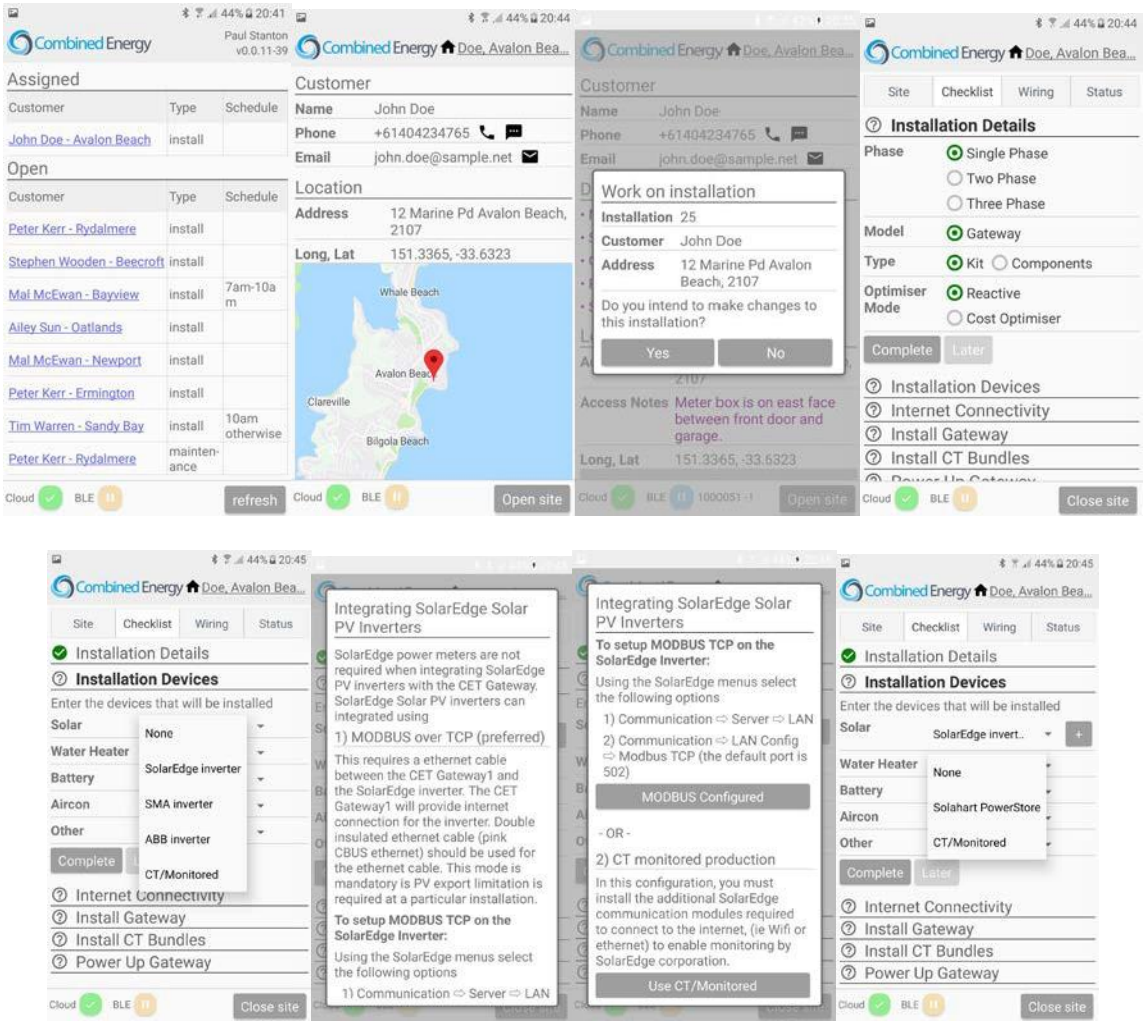

Figure 3
Screenshot Examples of the "Onsite" guided installation app

As installation and return site visits are costly, we have refined the above process and "Onsite" installer app over many years. As new DER devices come to market the resources are updated along with the installation App to accommodate new devices and installation procedures. All our own devices support remote software updates with failure fallback.

All DER devices such as the DPV System can be viewed in real time on a user application and via the system wide "OnWatch" portal. Site anomalies, device failures etc as detected on the site from A.I. algorithms and site heuristics are uploaded to our "OnWatch" monitoring platform for resolution.

Copies of our installation resources may be provided under NDA on request.

e) Energy Policy WA will assist customers and installers in providing fact sheets and other communication tools to support the changes. Do you have any suggestions for information that you would like included within these fact sheets?

For DPV System Customers.

It is important to provide clear and concise information on the DPV System management rules and regulations and importantly the reasoning behind the introduction of the program, e.g. to enhance grid security of supply etc.

It is also important to clearly convey the mechanism(s) by which the Consumer will be notified of an impending event. What will happen before, during and after the event, e.g., to the DPV system and what the likely effect will be to the Consumer especially in respect to allaying fears of a financial nature. It is our experience that more information is better than less information.

For DPV System Installers.

We have detailed our approach to educating and assisting installers of DER / DPV management systems in our answers to the previous questions. It is also important that installers are briefed with the same information that will be provided to the Consumer as quite often it is the installer that will play a large role in the education of the Consumer at the time of system installation.

f) Do you have any other questions, or comments?

Comments to Clause 4.2 Low Load response hierarchy model:

Whilst the proposed implementation model can be accommodated purely for DPV management, we believe that consideration should be given to optional models that can provide additional functionality consistent with (per Clause 4.2.2) providing ***"distribution network-level responses that could increase load on the power system to help manage system security"***.

Each one of our thousands of mixed DER sites across the NEM and WEM can respond to grid signals including pricing, demand response, DOE's and Solar PV curtailment, and/or load increases within the limits of the individual DER devices under control at each site.

For example, whilst direct control of both load and generation at each home/site or aggregation of homes/sites can be carried out by any tag (e.g., ID, NMI list, feeder, substation, postcode street etc), our capability to control connection point power flow during an "event" at Solar PV enabled sites extends beyond DPV management to encompass load control (e.g. smart water heaters, BESS, pool pumps, air conditioners, EV chargers etc) that can be turned up (increase load) to assist in mitigating a minimum demand event.

We raise this option as it is a logical extension of the implementation of an IEEE2030.5 based link to a "GFEMS" site edge gateway as defined under the Australian IEEE2030.5 implementation guide. In our case the GFEMS is our ***Consumer Self-Install HEMS Energy Management Unit (EMU) edge gateway.***

This "whole of home (site)" approach to DER orchestration and control of connection point power flow is also the basis of the work we are doing with SAPN ahead of their 1 July 2022 DOE implementation in South Australia.

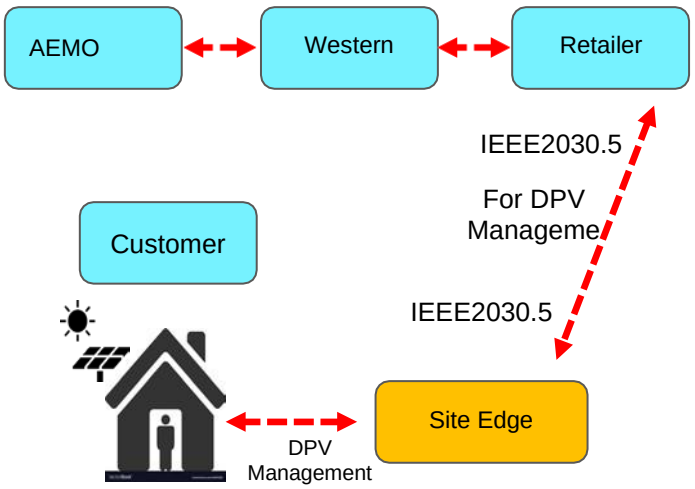

Figure 4
Proposed implementation architecture consistent with Clause 4.2: Low Load response hierarchy model with IEEE2030.5 edge gateway.

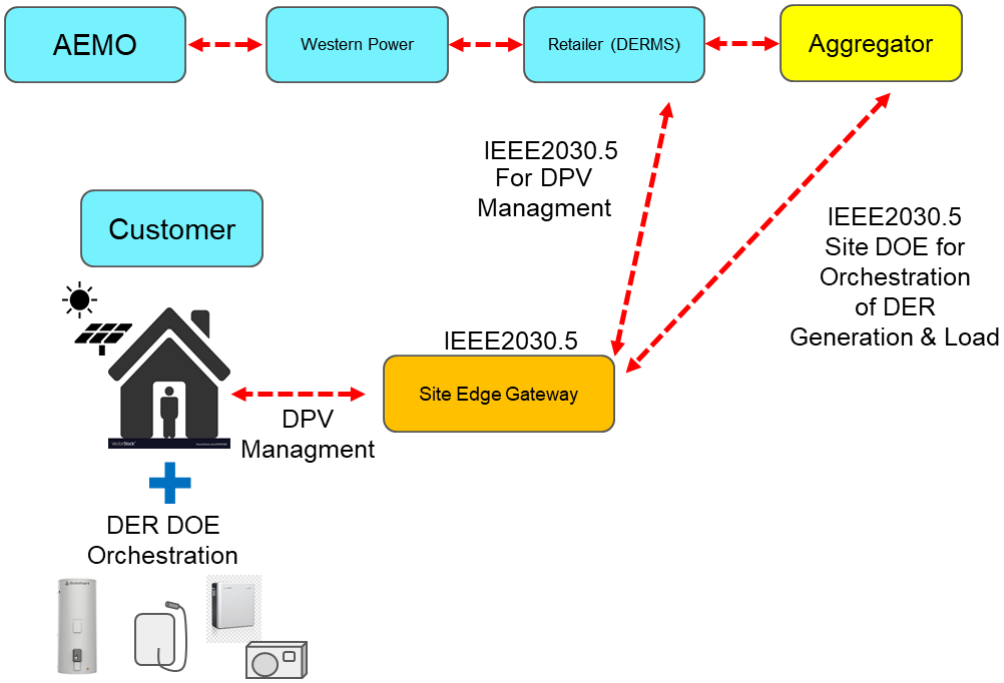

Figure 5
Optional proposed Architecture a) for consideration: Low Load response hierarchy model with DER orchestration including Retailer DPV management and Aggregator DOE / load control.

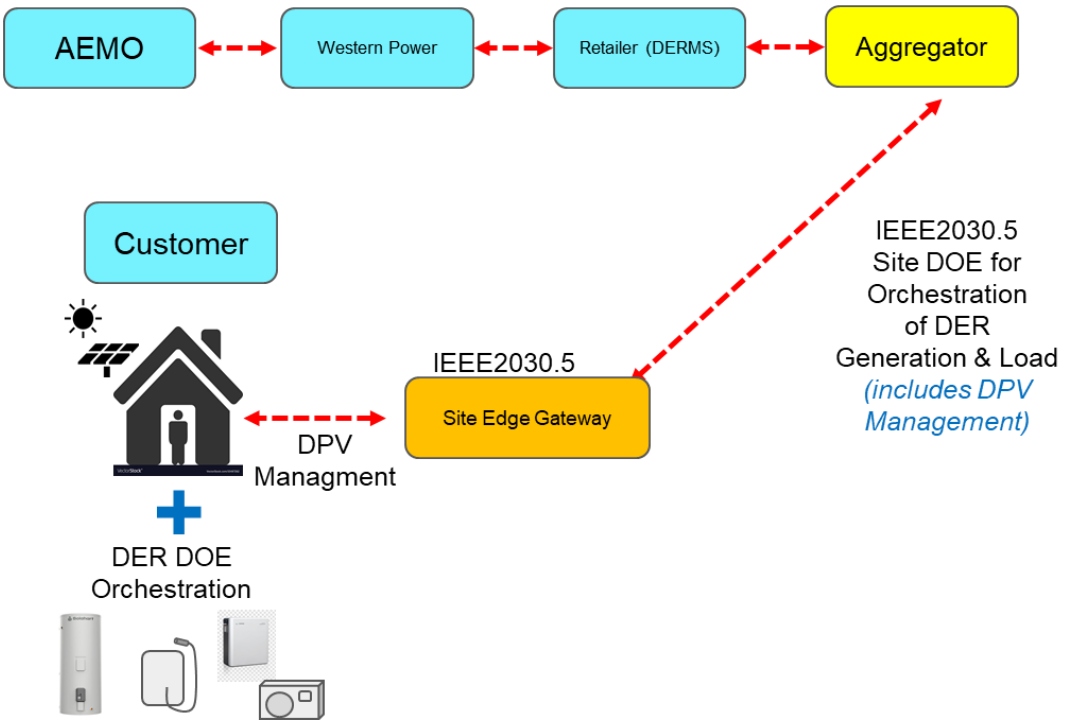

Figure 6

Optional proposed Architecture b) for consideration: Low Load response hierarchy model with DER orchestration, DOE, including DPV management / load control by Aggregator.

Recommendation:

- We believe options a) and b) above can be accommodated as potential implementation solutions from the proposed mid-February 2022 implementation date. We would welcome further discussion on the deployment architectures above and optional whole of site/home DER orchestration (inclusive of load control) as an enhancement to the required DPV management as proposed.
- Further, we believe that the proposed multiple approved methods as detailed in Clause 4.3.1 for DPV management should be reconsidered from a support and future direction perspective. Standards based communications such as IEEE2030.5 should be considered for DPV management by the authorised agent with any site level device (gateways). From Clause 4.3.1 it is unclear how the authorised agent will otherwise implement the 3 proposed methods (other than the smart meter option) in a manner that is cost effective, leverages standardised communications, and minimises complexity of installation and ongoing support.

Local access to revenue meter power data.

With regards to this discussion paper and DPV management, we believe smart meters can play a greater role in the cost-effective deployment of behind the meter distributed energy resources, supporting export control and DOE in management of DPV Systems.

We draw on our daily experience as a tier 1 provider of orchestrated DER sites across the NEM and WEM in proposing that access to real-time local revenue meter power quality data (Ref NER Table S7.5.1.1 specifically connection point: - voltage, power factor, frequency, active power, and current flow information) at a customer site in real time (i.e., at no greater a frequency than 1 second updates) will reduce costs to Consumers.

It is unrealistic to assume that all BTM DER is purchased or installed by a Consumer at the same point in time. Our experience with existing consumer DER installations is that there are multiple (and in many cases up to 4) power meters in addition to the revenue meter. This situation presents several issues:

- From a financial perspective, the Consumer will be paying either directly or indirectly for the multiple meters.
- Multiple meters create space constraints at the Consumer's metering installation, which adds to the installation support costs and complexity.
- Once a Consumer site DER comes under orchestration, e.g., by a site edge gateway, then all but one meter becomes redundant, as only one measurement of the NMI connection point power flow is required to orchestrate the site DER, provide export limiting and DOE services via a common connection point gateway,

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