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ENERGY

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Australian Energy Market Operator (AEMO)
Submitted electronically: mass.consultation@aemo.com.au

30 June 2021

Subject: Notice of Second Stage Consultation on Draft Report and Determination on the Amendment of the Market Ancillary Services Specification

Dear Sir/Madam,

Social Energy is an energy retailer and operator of the UK's largest residential Virtual Power Plant, comprising over 6,500 domestic solar and battery systems. Our VPP platform enables our customers to benefit by seamlessly participating in multiple flexibility markets while consuming more of their own renewable energy generation. In 2019 we became the first provider of primary frequency response services from residential assets in the UK, and November 2020 Social Energy Australia became an AER-authorised electricity retailer. We believe passionately in the potential of intelligent, small-scale distributed energy resources to support the deployment of renewable and low carbon technologies, while simultaneously helping to promote secure, stable and low-cost electricity supply to customers.

Social Energy welcomes the opportunity to respond to AEMOs Draft Report and Determination on the Amendment of the Market Ancillary Services Specification. We strongly believe that the measures evaluated as part of the VPP Demonstration Trial are vital to enable aggregated DER to participate effectively within the Fast FCAS market for the benefit of consumers through both lower bills and greater power system stability. We submit our response to the assessment and conclusions of the Draft Report below:

The Draft Report and Determination focuses on two primary material issues concerning the participation of DER in the FCAS markets:

1. What type of time resolution should measurements of Fast Contingency FCAS delivered by DER exhibit?
2. Where should the measurement point be located, especially for aggregated DER?

1. Time resolution of measurements

Under 1) AEMO has identified that lower time resolution (e.g. 1s) introduces an average error in the quantity of FCAS delivered using the current FCAS Verification Tool methodology of 15%, and a maximum error of 19.7%.

Whilst we agree with the conclusion that reducing the time resolutions can lead to an error in the quantity of FCAS delivered, this in itself does not necessarily preclude the use of lower time resolution measurements. The University of Melbourne, in its study commissioned by AEMO, proposes an alternative methodology to determining the Frequency Disturbance Time that reduces the error to 0% for up to 200 ms data samples and a maximum of 3% for 1 s data samples. However, it does caveat that time stamp synchronisation is a potential issue to be clarified and warrants further analysis. In any case, AEMO has shown through its transitional arrangement for VPP Demonstration Trial participants that this can potentially be addressed by applying a discount to provider payments reflecting the associated error with the measurement resolution they have implemented.

We urge AEMO to conduct further analysis with the aim of applying fair and proportionate discounts to all providers who are able to provide Fast FCAS response so as to avoid excluding valuable capacity from the market whilst ensuring power system security. This mechanism will bring lower data rates inline with AEMOs stated NEO

assessment principles: promoting competition by minimising barriers to entry and avoid unnecessary costs in provision of FCAS.

2. Location of measurements

AEMOs primary concerns about measurement location centre mainly around three issues:

- AEMO is not satisfied that asset-level measurement accurately measures FCAS delivered to the grid due to absorbed response energy which might lead to a significant under-delivery and an adverse impact on power system security in the future. We have referred to this as **absorbed energy** in our response below.
- AEMOs assessment is that changes in DPV and uncontrollable load are not significant on aggregate during a frequency disturbance, which we have referred to as **baseline stability** in our response below.
- Incentives to game FCAS verification and compliance processes by intentionally negating the FCAS response measured at the asset level. We have referred to this as **gaming** in our response below.

A) Absorbed energy

The concept and impact of absorbed response/energy as described in the Draft Determination is not one that we recognise. In our view it is entirely acceptable for response energy delivered by the asset to be absorbed by changes in other uncontrolled load or generation co-located behind the Connection Point. To consider that this "absorbed energy" in some way diminishes the overall response delivered because it is not delivered to the Connection Point is flawed. It fails to treat co-located loads equally to any other load connected elsewhere to the System. Provided co-located loads behind the Connection Point would have been present and identical in the absence of the responding asset they can be considered to be contributing to the frequency disturbance and it is legitimate that response energy flows to and is absorbed by them as the effect of offsetting them is felt beyond the connection point. This is especially true when the size of such loads is large compared to the size of the responding asset as can be the case with residential sites.

We acknowledge that a key requirement is that the co-located loads do not respond in a manner that is negatively correlated with that of the FCAS asset. This risk is easily handled and we address the point in our comment on gaming below.

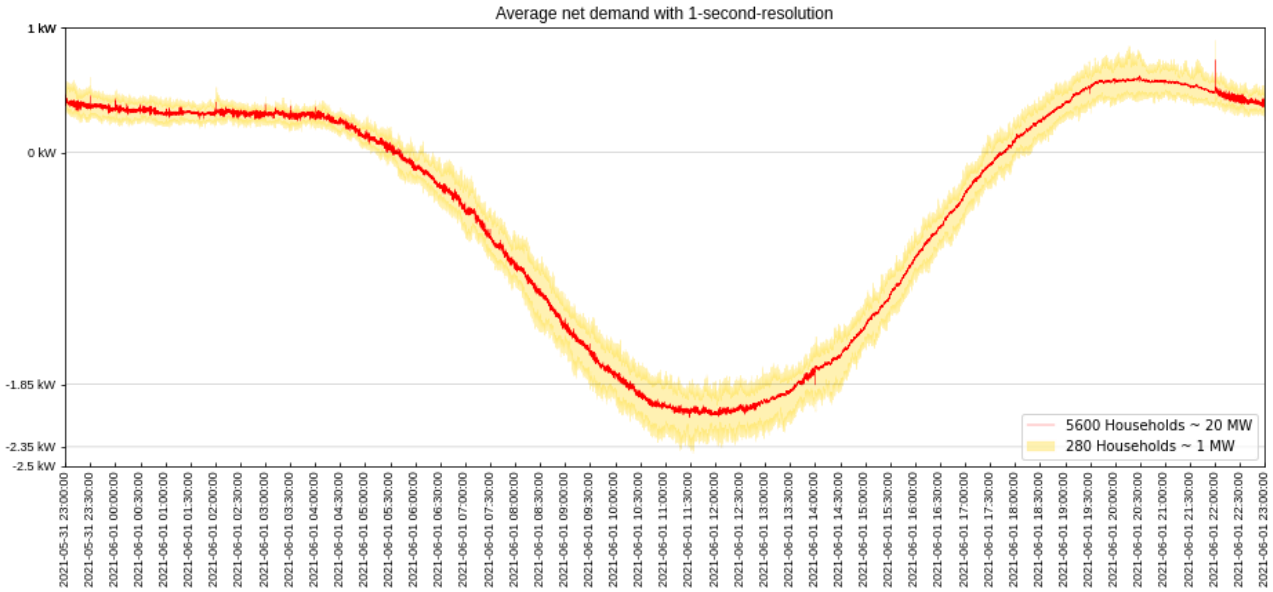
It is our view that measurement of the FCAS response delivered at the asset level is the **only** accurate methodology for doing so when other loads are co-located behind the connection point., and so-called 'absorbed energy' should not be considered as under-delivery.

B) Baseline stability

We strongly disagree with AEMOs assertion that changes in DPV and uncontrollable load are not significant on aggregate during a frequency disturbance. To demonstrate this we have analysed the effect of the current FCAS baselining rules using 1-second-resolution data available from a sample of 5,000 of our own customers taken on 1st June 2021. All customers within the sample have rooftop solar and lithium-ion batteries, which have been removed from the net demand shown. This is possible as additional measurements were available at the grid connection point, as well as the battery and solar inverter output. No filtering or data wrangling was performed, and measurement data as recorded by the meters were used. In the case of the aggregated 5,000 households, the entire dataset was used.

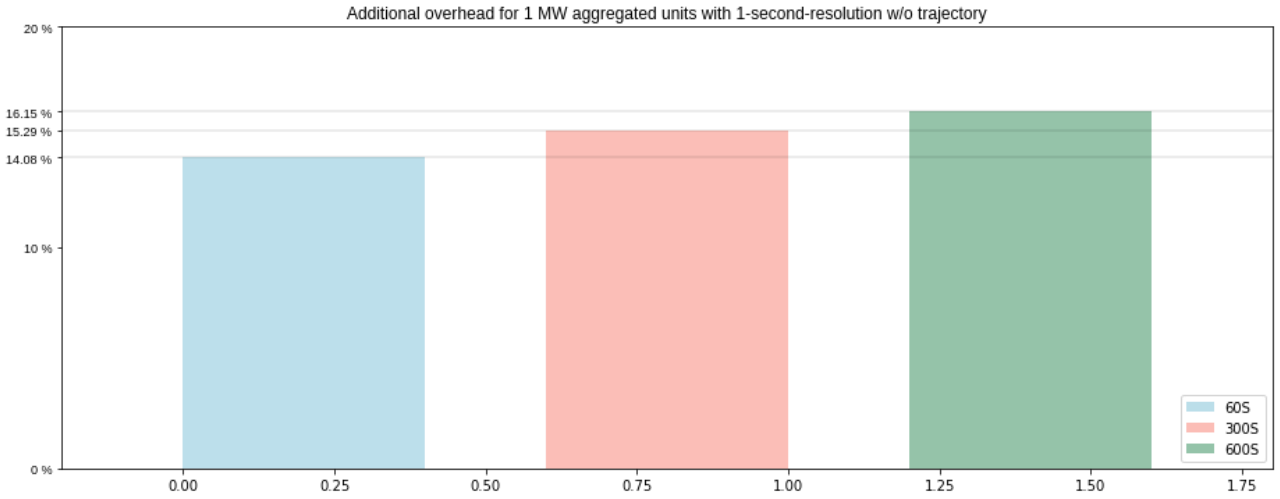
The data was aggregated into ~250 household samples (~1MW). To avoid bias, households were selected uniformly without replacement to produce 30 different sets and derive averages for the additional capacity overhead requirement and extra cycling per battery within the VPP in order to maintain a flat baseline.

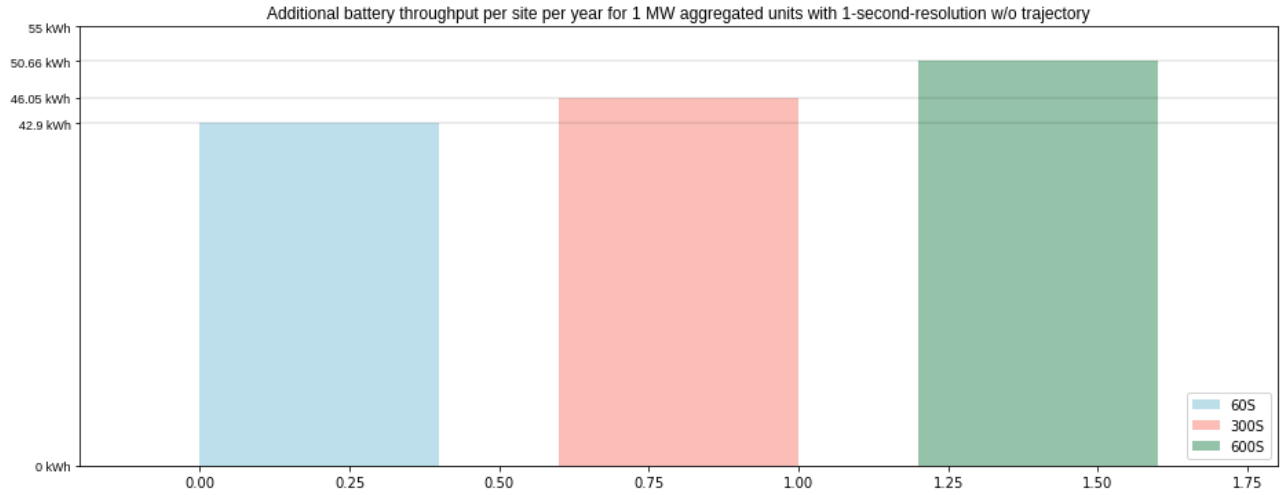
As depicted below using the average net demand, 1MW-aggregated units exhibit considerably higher embedded noise compared to the larger aggregation of over 5,000 households. This is despite the smoothing effect of aggregation which is well-known in residential power time-series, even in high resolution data.



Both the high embedded noise and the trajectory of the net demand profile (particularly during high solar ramp rates) means there is a significant, adverse operational impact on FCAS assets that are co-located with uncontrolled load and solar if FCAS delivery is measured and verified at the connection point. This is because an additional 'overhead' capacity per VPP is required to be able to accommodate all variations in net demand in order to maintain a flat baseline at the grid connection point. Failing to do this will result in being penalised due to under-delivery. The magnitude of required overhead is determined by the capacity of on-site demand or generation installed.

Furthermore, additional battery energy throughput per site will be required to accommodate the fluctuations which reduce the lifetime of the assets and is costly for householders as it implies additional losses and possibly additional import (both depicted below).





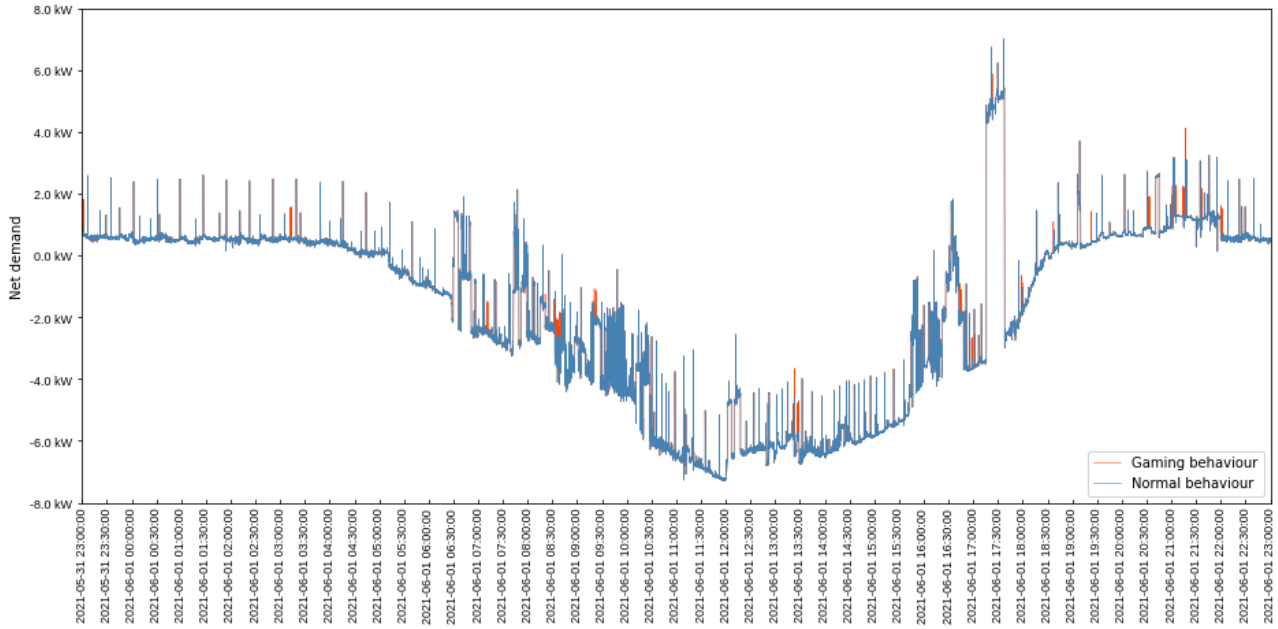
In addition to our contention that measurement at the asset level is the only truly accurate measure of FCAS delivery, measurement at the connection point leads to inefficient utilisation of valuable DER assets to the detriment of residential electricity consumers that own them, through:

- Increased battery cycling
- Increased energy usage
- Reduced capacity for self-consumption

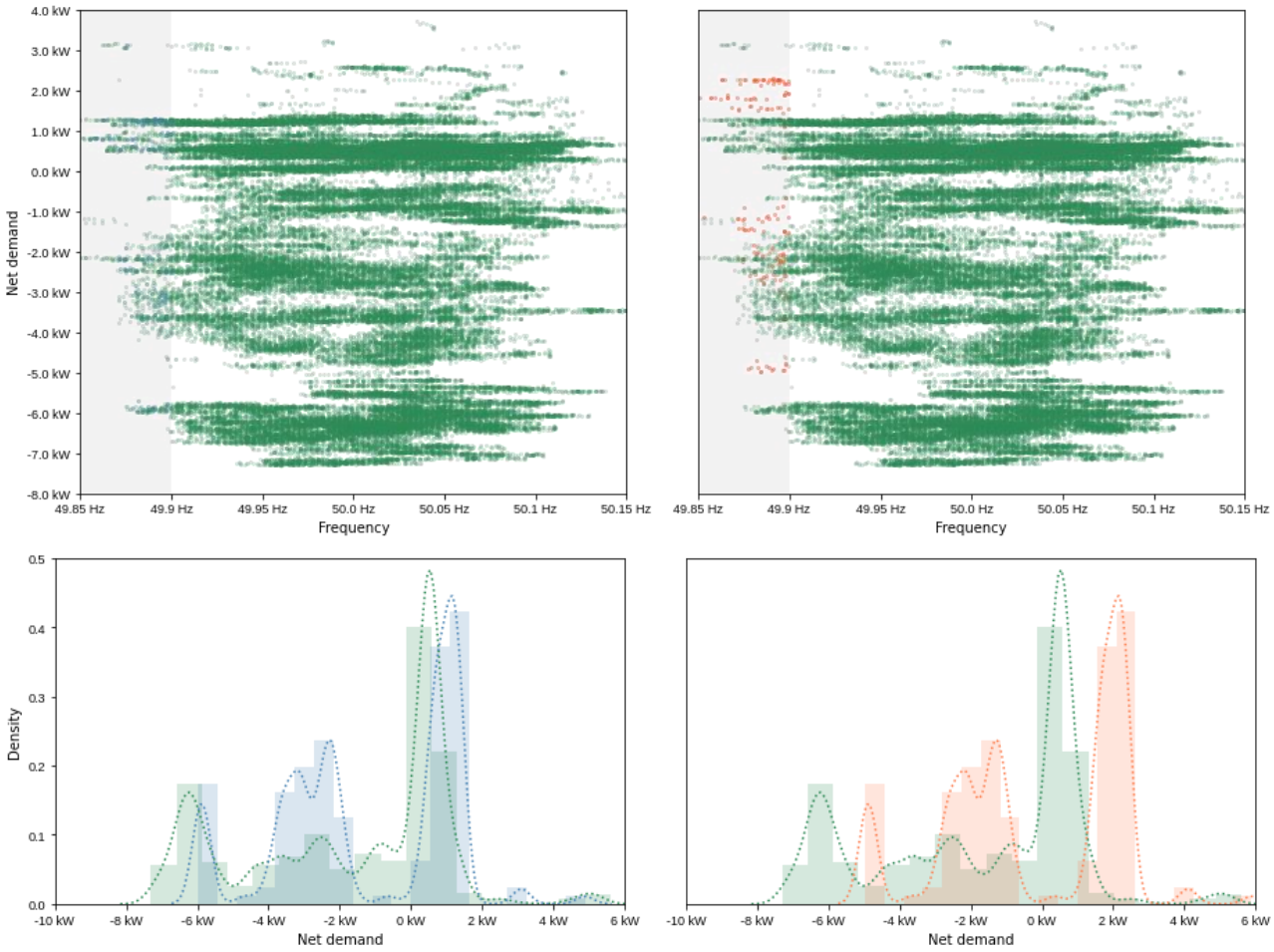
Perhaps more importantly, it represents an unfair competitive barrier to which non-residential providers do not have to deal, especially when trying to ramp up to reach higher market penetration. This is in conflict with AEMOs commitment to the NEO.

C) Gaming

We believe it is trivial to use statistical analysis to detect and flag providers that are gaming the system by using other controlled assets behind the connection point to negate FCAS response. To demonstrate this, we have captured 1-second-resolution data from a dwelling with similar characteristics as the Australian units, also from 1st June 2021. To simulate gaming behaviour we injected a 1 kW additional load 10% of the time whenever the frequency was below 49.9 Hz. This reduces the response delivered whilst making the net loads with and without gaming nearly indistinguishable when looking at their time-series, as depicted below.



Nonetheless, as frequency and net demand are independent, the distribution of net demand values should be the same regardless of the frequency. Thus, when comparing the region below 49.9Hz versus the rest of the frequency range, the distribution and their parameters should remain constant. As depicted in the charts below comparing normal and gaming behaviours, the correlated-demand clearly results in a different frequency distribution. Hence, when analysing the data with a rudimentary significance test one can reject the null hypothesis that their mean and standard deviations are the same, and their distribution is invariant. This implies that gaming behaviours can be trivially detected using the demand-frequency independency and assets that attempt to game can be excluded from participation in FCAS contracts.



* Note the blue & orange are distributions below 49.9 Hz whilst green in the rest. Also, only the right side is required in real life operations.

Power System Security Concerns

Pages 17-18 of the Draft Determination outline several concerns related to DER assets and their impact of the security of the Power system.

Unexpected disconnection due to network fault

We agree that AEMOs mitigation action of requiring participating assets to comply with AS/NZS 4777 should address this concern. We also note that this is not a problem limited to DER and is in fact a strength of distributed assets – where a local network fault occurs, other remote assets can pick up the slack and the wider VPP will deliver the contracted power. Provided that sufficient operational monitoring is performed it is incumbent on the VPP provider to ensure that their fleet can always provide the contracted service level, including when portions of the fleet are having issues. Typically, this is done by oversizing each unit to increase fault tolerance. Our years of experience of using residential assets to provide Frequency Response services in the UK has allowed us to develop robust operational modes and demonstrate strong resilience to localised disturbances at fleet level.

Unexpected responses from inverters

50ms power monitoring will have a higher likelihood of capturing sub-second noise in an inverters AC output compared to one second samples. This is considered a risk by AEMO. In our extensive experience of testing residential battery systems, we know that output noise profiles are inherent properties of a particular inverter model and, systems as a rule, do not develop increased sub-second noise in the field post-install. If they *do,* then it will generally be accompanied by other faults/warnings which will otherwise prevent them from participating in FCAS until an engineer has visited the site. Given this, we believe that AEMOs current process of requiring lab-based verification of an asset responding to injected frequency profiles with power output sampled every 50ms is enough to provide a reliable “type test” of a model of inverter. With the confidence this provides, slower metering can be used operationally which reduces cost and complexity of installation.

In conclusion Social Energy consider that the proposed amendments to measurement location and time resolution set out in the original MASS Issue Paper satisfy AEMOs objectives of enabling greater participation of DER in FCAS markets whilst maintaining power system security and minimising costs to the consumer, and that other concerns expressed in the Draft Determination regarding these points are substantially unwarranted.

Social Energy welcomes further discussion in relation to this submission. Please contact Stephen Day at stephen.day@social.energy to arrange a meeting.