6 August 2021

Australian Energy Market Operator
Via email: mass.consultation@aemo.com.au

Response to Amendment of the Market Ancillary Service Specification – DER and General Consultation

Thank you for the opportunity to comment on the ongoing Market Ancillary Service Specification (MASS) consultation process.

Quinbrook Infrastructure Partners (www.quinbrook.com) is a private equity business that invests in clean energy in the UK, the US and Australia. Our portfolio companies include:

- A NEM connected baseload renewable energy generator, Cape Byron Power (www.capebyronpower.com). Cape Byron's Condong and Broadwater plants are a non-scheduled generator that also serves a significant co-located load (Sunshine Sugar, www.sunshinesugar.com.au) which is served behind Condong's connection point meter.
- An electricity retailer that prides itself on not gouging customers and who just won the 2021 Finder Award for Green Energy Retailer of the Year (Retail-Only) in Australia, Energy Locals (www.energylocals.com.au). Energy Locals is partnered with Tesla to deliver the SA VPP, one of the VPP Demonstrator projects.
- An embedded network business that prides itself on helping customers save costs by taking control of their energy needs, Energy Trade (www.energytrade.com.au). Energy Trade recently installed Australia's largest Powerwall battery installation, 201 kW of solar PV and a community battery comprising 24 Tesla Powerwall systems at the Schofields Gardens apartment complex in Western Sydney (www.aland.com.au/groundbreaking-solar-and-battery-storage-solution-in-sydney-apartment-building-goes-live).
- Lockyer Energy Management Pty Ltd (www.lockyerenergy.com.au) which is developing a hybrid peaking and utility battery project in Queensland.

Our multiple channels of involvement in the NEM, across different levels of the industry, allows us to provide a balanced "whole of industry" opinion and set of potential refinements to the MASS. Additionally, our portfolio companies in UK and US markets (which include utility wind, solar and batteries, distributed peaking generation and Flexitricity (www.flexitricity.com) a demand response and flexibility platform) give us an operating knowledge of alternative market designs and detailed technical knowledge of ancillary markets.

SUMMARY

There are four key issues relating to AEMO's draft decision on the MASS where we believe an alternative approach is preferable:

1. **Location of measurement.** We believe allowing device level metering allocates risk to where it is best managed, reduces barriers to entry and business model innovation. This change is likely to increase FCAS supply, reduce system costs and prices to customers while improving the long-term efficiency of the NEM. These outcomes are consistent with the NEO.
2. **Metering frequency.** We believe that there is limited risk to system security if FCAS metering resolution is reduced. Absent system security concerns, we believe there would be net benefits consistent with the NEO. There is an issue of metering accuracy, especially with 1s metering resolution. We propose that AEMO's transitional arrangements for VPPs be made permanent and apply to all participants.
3. **Transitional arrangements.** We believe that if the transitional arrangements are not made permanent and universal as part of point 2, they should at least be made permanent for existing VPP Demonstration participants.
4. **Ambiguity on service prioritisation.** We suggest there is ambiguity in the proposed changes to sections 2.2 and 10.3 of the Draft MASS and that this should be remedied for the final determination.

We discuss each issue in turn.

LOCATION OF MEASUREMENT

AEMO has stated:

"*After considering the issues raised and assessing the options against the NEO, AEMO proposes not to change the FCAS measurement point in the MASS. AEMO considers that power measurement at, or close to, a relevant connection point represents more accurately the FCAS delivered to the power system and minimises the risk of market distortion.*"[1]

We disagree that device level measurement is inconsistent with the NEO on several grounds.

The issue relates to the proper allocation of risk for behind the meter FCAS resources which share a common meter with other uncontrollable generation or load resources (solar PV or onsite load respectively). It is worth considering arrangements for a load with and without a co-located FCAS resource:

[1] AEMO, Amendment of the Market Ancillary Service Specification – DER and General Consultation, 14 June 2014, p27.

- Without FCAS resource: In the case of a load and in the absence of the FCAS resource, variations in load will contribute to system level demand fluctuations. FCAS will be procured at the system level to manage frequency deviations arising from aggregate system level generation and load fluctuations. Procuring FCAS resources at the system level is least cost as frequency is a system property and localised supply and demand fluctuations cancel out at the system level (reducing requirements, minimising demand) whilst providing access to the greatest number of FCAS resources (maximising supply). The cost of FCAS procurement (for some services) will be recovered proportionally from load.
- With FCAS resource: In this case load variations still occur, are still managed at the system level and costs are still recovered in part from the load. The addition of the storage FCAS resource should, other things equal, reduce system level FCAS costs for all users on the margin by increasing the supply of FCAS resources. However, under AEMO's proposal, this specific FCAS resource is also responsible for managing local demand fluctuations (which are uncontrollable) such that FCAS delivery at the connection point meets enablement targets. This is highly inefficient as the site specific resource is now required to absorb load fluctuations on a specific load which would cancel out in whole or in part at the system level. It also limits the ability of the FCAS resource to provide services on an equal basis to stand-alone FCAS resources that do not have to account for local variability behind a common meter.

This treatment creates several issues which we believe are inconsistent with the NEO.

Foreclosure on business models. The only way to operationally manage AEMO's proposed approach on measurement is to control net injections at the connection point such that FCAS enablement targets can be met accounting for any other variations in generation and/or consumption behind the connection point meter. This requires that the operator of the FCAS resource is also the operator of all other generation and load behind the connection point. This requirement has far reaching consequences. It forecloses on business models where one party operates and is responsible for the FCAS resource, and another party or parties operate and are responsible for generation and load at the same site.

This approach locks in 'whole of site control' business models (e.g. Reposit Power) but effectively blocks all multi-partite aggregation models (e.g. EV charging VPPs which are separate from customer retail arrangements for household supply).

Such an approach is a severe and unnecessary constraint on evolving innovation in business models. It impacts small scale aggregations (EV charging VPPs), commercial sites with third party solar and storage resources behind the meter, industrial load sites with co-located solar and storage and many hybrid generation sites.

The AEMC states that successful application of the NEO "considers the prospects for having the right mix of resources, to produce the maximum amount for the minimum cost, over time. Such markets are characterised where there are no barriers to innovation, the exit of technology or the uptake of new technology and efficient

long-term investment."[2] AEMO's determination imposes significant barriers to innovation and conflicts with the NEO.

Risk allocation. The AEMC states that in applying the NEO "Risks should be allocated to those best placed to manage them"[3]. Behind the meter FCAS resources are not best placed to manage uncontrollable variations in the output or consumption of collocated generation and load. Fluctuations in supply and demand are best managed at the system level where aggregation cancels out many of the fluctuations at more localised levels of the market. Allocating risks to FCAS resource operators simply because they share a meter with other assets does not allocate risks to those best able to manage them. AEMO's determination is therefore in conflict with the NEO.

Barrier to entry. Requiring that FCAS resources at hybrid sites must have operational control of all site assets creates a significant barrier to entry to bring these FCAS resources to market. At the household scale, this means FCAS resource operators need to also have arrangements with retailers (or be retailers).[4] At the commercial and industrial scale this means that supplying a battery to a big box retailer or a data centre means also convincing them to give you their bulk supply contract. This significantly increases the complexity of new product offerings as FCAS can only be bundled with other retail and wholesale services, creating high commercial barriers to adoption.

To the extent that such barriers to "the uptake of new technology"[5] reduce or delay the deployment of FCAS resources this will reduce supply and increase the cost of meeting FCAS requirements. Reduced supply of FCAS resources may also jeopardise "the reliability, safety and security of the national electricity system"[6] to the extent that shortfalls in FCAS resources occur. Such outcomes are in conflict with the NEO.

Price. Creating barriers to entry and innovation will, other things equal, reduce supply and increase costs. The result will be higher prices for customers in conflict with the NEO.

Unlevel playing field. Imposing unique conditions on FCAS resources that share a meter creates an unlevel playing field for those resources, reducing competition. This is clearly the case for competition between FCAS resources. Two identical assets, with the same technical ability to provide FCAS services would be treated materially differently from a market perspective as a result of imposed metering arrangements.

AEMO's draft determination is not only inconsistent with the NEO (in our opinion) but inconsistent with its own stated position on related issues.

As part of its 2020 Renewable Integration Study AEMO surveyed all DNSPs and found:

---

[2] AEMC, Applying the energy market objectives, 8 July 2019, p12.
[3] AEMC, Applying the energy market objectives, 8 July 2019, p14.
[4] For example, whilst not purely related to FCAS services, Reposit Power had to pivot its original aggregation business model to a retail partnership model in order to gain control of sites.
[5] AEMC, Applying the energy market objectives, 8 July 2019, p12.
[6] National Electricity Objective, see: https://www.aemc.gov.au/regulation/regulation.

"very little direct monitoring of DER generation output. Net metering arrangements mean that only the total site is monitored"[7]

AEMO concluded:

"This limited visibility makes it difficult for DNSPs to quantify the secure technical operating envelope of their LV networks, necessary to determine where constraints exist or where they are likely to develop in the future. This in turn makes it difficult for DNSPs to identify and develop optimal strategies for alleviating the constraints. Without this visibility, DNSPs have had to evaluate DPV hosting capacity (and subsequent export limits) conservatively, based on an assessment of worst-case operating scenarios."[8]

All DNSPs and AEMO identified net metering and limited visibility of behind the meter resources as a barrier to effective system operation. Retaining the requirement for net metering at the connection point under the MASS entrenches this issue. AEMO risks missing an opportunity to not only increase BTM asset visibility but to incentivise investment in BESS and other DER that could help manage voltage and other issues related to excess localised export of power.

As part of its 2019 Integrating ESS into the NEM, AEMO stated that it:

"… considers that it is no longer appropriate to base performance standards on the registered participant category as we are expecting to see more ESS and 'hybrid' facilities. A registered participant's performance standard should be based on its assets."[9]

We agree with this conclusion with regard to performance standards generally. Adherence to FCAS enablement targets is one element of such performance standards, creating an inconsistency with the MASS.

AEMO also stated:

"Further, since the NER currently requires a single metering installation at each connection point it is challenging to determine the energy flows occurring between individual assets in 'hybrid' facilities to calculate fees, charges or non-energy cost recoveries for separate energy flows an individual asset. For example, if the policy is for an ESS to be exempt from TUOS charges (as proposed in section 4.2.3) and the 'hybrid' facility includes a load, battery and generating unit, the load's consumption from the national grid is impossible to determine on the basis of the metering data from a single metering installation at the connection point. Further consideration of the appropriate metering arrangements for 'hybrid' facilities is needed …"[10]

AEMO risks exacerbating these issues by entrenching connection point level metering via the MASS.

Finally, AEMO's draft determination on the MASS on this issue is inconsistent with the ESB's NEM2025 reform objectives. The NEM2025 reforms have a core workstream dedicated to developing two-sided markets. The

[7] AEMO, Renewable Integration Study, Appendix A – Distributed Solar PV, May 2020, p25.
[8] AEMO, Renewable Integration Study, Appendix A – Distributed Solar PV, May 2020, p25.
[9] AEMO, Integrating ESS into the NEM, August 2019, p18.
[10] AEMO, Integrating ESS into the NEM, August 2019, p18.

ESB has set the objective goals of "enabling access to products and services that innovation offers"[11] and "integrating flexible DER and demand-based assets into the market at all levels"[12]. Updating the MASS to allow device level metering is, in a number of cases, a necessary pre-condition to aggregators being able to offer innovative services to customers.

The ESB also states that "DNSPs need visibility of DER to manage the variability of energy production and system security within their operating limits and facilitate wholesale market integration of aggregated DER resources."[13]

Updating the MASS to allow device level metering for the provision of FCAS services is consistent with these objectives and the wider NEM2025 reform.

Recommendation

Our preferred position is that the MASS is updated to require measurement at the inverter or controllable asset (AEMO's Measurement Location Option 2[14]). We do not believe this would exclude any existing business models and would reduce barriers to entry, increase business model innovation and FCAS supply, and ultimately reduce system costs and prices to customers while improving the long-term efficiency of the NEM consistent with the NEO.

Alternatively, connection point metering could remain the default approach with device level metering allowed wherever qualifying measurement equipment is installed to ensure the same beneficial outcomes can be captured. This approach would be less interventionist but may result in reduced system visibility on the margin compared to our preferred approach (but significantly higher visibility compared to AEMO's draft determination).

METERING FREQUENCY

AEMO has concluded:

"… that it is not appropriate to change the measurement resolution for Fast FCAS.

The main reasons for this are:

- *Concerns regarding the behaviour of DER inverters and whether, or to what extent, this could impact power system/distribution network security.*

[11] ESB, Post 2025 Market Design Options – A paper for consultation Part A, April 2020, p55.
[12] ESB, Post 2025 Market Design Options – A paper for consultation Part A, April 2020, p55.
[13] ESB, Post 2025 Market Design Options – A paper for consultation Part A, April 2020, p57.
[14] AEMO, Amendment of the Market Ancillary Service Specification – DER and General Consultation, 14 June 2014, p8.

- *The error introduced in the FCAS verification/compliance process when lowering the measurement resolution and the uncertainty of specifying the quantity of FCAS to be procured and actually delivered.*

While changing the measurement time resolution requirement to 1s may increase competition in the short term, the distortionary impact on the Fast FCAS markets does not promote the NEO. Similarly, the impact of the error on power system security does not promote the NEO. While measurement resolution of 100/200ms and changes to the FCAS assessment methodology may present a reasonable compromise, it is anticipated that in the time required to assess and confirm whether this is the case, advances in high speed metering will reduce this as a barrier to entry. Notwithstanding the potential pathway AEMO has identified to address the errors associated with a lower data time resolution, given the power system security concerns associated with DER inverter behaviour, AEMO does not consider it to be prudent to reduce the granularity of the measurement resolution until approaches to address these concerns are implemented."[15]

System security concerns

We believe AEMO's stated concerns about metering resolution relating to system security are not supported by the evidence presented to date. AEMO does not use high speed metering data as part of real-time operation and monitoring. The Draft MASS requires that Ancillary Service Facilities transmit real-time data via SCADA "every 4 seconds to AEMO via SCADA and with no greater than 8 seconds latency"[16]. As such, measuring FCAS resources on a 50ms, 100ms or 1s basis does not impact the real-time data sent to AEMO on a 4s basis and therefore cannot impact AEMO's ability to monitor and manage system security in real-time.

High speed metering data at FCAS resources is used for *ex post* analysis, especially around major events. A move to 100ms or 1s basis may limit the ability to analyse *ex post* outcomes on a sub-second basis to some degree. We note that where major incident reports do focus on high-speed data (50ms or less) the focus is typically system frequency and interconnector flows which would still be fully available to AEMO as would high speed data from transmission and distribution operators. AEMO does not explicitly highlight this as a risk and we would be interested to understand AEMO's view on how a different metering basis may impact its ability to conduct *ex post* event analysis now and in future with greater levels of DER penetration.

AEMO does raise several risks in the MASS draft determination relating to "DER inverter behaviour" such as: unexpected disconnection due to a local network fault; behaviour during local distribution network and global power system disturbances posing a risk of under-delivery of FCAS due to inverter requirements; large-scale, rapid active power injection or withdrawal … exceeding [operational] limits. These issues are analysed in a supporting report (DER Behaviour Report).[17] It does not appear that the analysis of any of these issues or the proposed solutions depend on 50ms metering of FCAS resources. The DER Behaviour Report uses high

[15] AEMO, Amendment of the Market Ancillary Service Specification – DER and General Consultation, 14 June 2014, p19-20.
[16] AEMO, Amendment of the Market Ancillary Service Specification – DER and General Consultation, 14 June 2014, p22.
[17] AEMO, Behaviour of distributed resources during power system disturbances, May 2021.

speed data (which appears to be 5ms or 10ms resolution) as part of its analysis, however this data is from distribution feeders, not specific DER assets, and in any case is higher resolution than the proposed MASS standard. There is no mention in the DER Behaviour Report of FCAS metering speed requirements in the MASS.

AEMO does raise another risk in the MASS report:

"Unexpected responses from inverters that cannot be identified using low granularity measurement, for example, if inverters deliver an oscillatory response within 1s intervals due to a voltage or frequency disturbance."[18]

AMEO recommends a potential action to "maintain the 50 ms measurement resolution requirement in the MASS in order to identify phenomena such as oscillatory responses".[19] This issue is not covered in any of the referenced reports and we are interested to understand the basis of AEMO's concerns and to have access to the supporting analysis informing their position as has been provided with the other issues. We suggest that even if this issue were to manifest:

- The issue could be analysed in the field in the same manner as the issues covered by the DER Behaviour Report – namely using distribution feeder level high speed data. It seems unlikely that AEMO would need individual device data to analyse a sub-second oscillatory issue at the distribution system level.
- Individual devices could be analysed on the bench using high speed measurement.
- Specific, not all, devices could be analysis in the field using high speed measurement.

Finally, AEMO states that it is "critical that the Fast FCAS response from proportional or switching FCAS controllers can be verified over the first 6s of a frequency disturbance"[20]. We agree. However, as noted above, AEMO only monitors the system on a 4s basis in real-time, so this is not a real-time operational requirement. We also note that even 1s metering resolution would allow AEMO to confirm *ex post* that a given FCAS resource was responding across the 6 seconds after a frequency disturbance as opposed to ramping to full response at the very end of the 6 second response period.

We do not believe AEMO has made the case that system security requires all individual FCAS resources to record high speed measurement at all times when this data is only used on an *ex post* basis in highly limited circumstances.

[18] AEMO, AEMO, Amendment of the Market Ancillary Service Specification – DER and General Consultation, 14 June 2014, p18.
[19] Ibid.
[20] AEMO, AEMO, Amendment of the Market Ancillary Service Specification – DER and General Consultation, 14 June 2014, p14.

Consistency with the NEO

AEMO states that "changing the measurement time resolution requirement to 1s may increase competition in the short term, the distortionary impact on the Fast FCAS markets does not promote the NEO."[21]

As outlined above, we do not believe AEMO has made the case that there is in fact a "distortionary impact on the Fast FCAS markets" related to any change in metering resolution. AEMO's ability to safely and securely operate the system in real-time is not contingent on metering resolution below 4s (the resolution of SCADA monitoring). AEMO's ability to anlayse the system *ex post* gives access to many other resources (such 10ms distribution feeder data) and could be complemented by benchtesting and field testing of specific, not all, devices.

Putting aside these system security concerns, we agree with AEMO that these is likely to be an "increase competition in the short term" for similar reasons to those outlined with regard to the metering location issue. Moving to a lower metering resolution would likely:

- reduce barriers to entry and innovation; and,
- increase supply of FCAS resources, resulting in reduced system costs.

This would reduce prices to consumers both short-term and long-term and result in a more efficient market consistent with the NEO.

Settlement accuracy

AEMO's final concern relates to measurement error for the purpose of determining procurement quantities and in settlement. We believe this issue is overblown and can largely be managed by altering the MASS to a compromise metering resolution and adopting the trapezoidal rule for calculating quantities.

AEMO states "*While measurement resolution of 100/200ms and changes to the FCAS assessment methodology may present a reasonable compromise, it is anticipated that in the time required to assess and confirm whether this is the case, advances in high speed metering will reduce this as a barrier to entry*". We believe 100/200ms metering resolution is a reasonable compromise, and that given the results of the VPP Demonstrator projects there is ample evidence that this will work in practice. We also believe that moving to 100/200ms will ensure barriers to entry are reduced. In our experience there are many cost-effective metering solutions even at 100ms but this reduces significantly at 50ms for small scale devices and usually involves secondary costs beyond the unit cost of the meter (e.g. expensive annual subscriptions for meter reading platforms).

[21] AEMO, Amendment of the Market Ancillary Service Specification – DER and General Consultation, 14 June 2014, p20.

Recommendation

Our preferred position is that the MASS is updated to require measurement on less than or equal to 200ms and that the trapezoidal measurement rule is adopted. 200ms with the trapezoidal rule strikes the right trade-off between the short-term benefits highlighted by AEMO, the wider benefits under the NEO identified in this submission and manages metering accuracy.

Alternatively, we would suggest that the transitional arrangements proposed by AEMO (MASS, Section 11.3) for the VPP Demonstrators are made permanent and opened to all participants.

TRANSITIONAL ARRANGEMENTS

Subject to any changes to AEMO's determination on metering frequency, we propose that the transitional arrangements proposed by AEMO (MASS, Section 11.3) for the VPP Demonstrators are made permanent and opened to all participants, or at least be made permanent for existing participants. This would be on the basis of the considerable time and expense provided as part of the demonstrators which is at risk of non-recovery in the event there are requirements to change metering arrangements and incur additional costs.

AMBIGUITY ON SERVICE PRIORITISATION

We believe that a combination of proposed MASS changes create unnecessary ambiguity regarding the priority of response across the Primary Frequency Response (PFR) and FCAS services.

Changes to MASS, Section 2.2 move from a clear prioritisation of Contingency to a requirement to adhere to AGC unless otherwise advised by AEMO. We note AGC instructions are provided with 4s latency. This would therefore introduce circumstances where responding to AGC (with a 4s delay) exacerbates a real-time frequency event (which has changed dynamically within the 4s delay).

Changes to MASS, Section 10.3 outline an unclear process by which Contingency and PFR responses are aggregated with AGC requests. The section requires providers to ensure net delivery is additive. The MASS states "Occasionally, the direction of the Contingency FCAS or PFR response may oppose the AGC request; this is not unexpected."[22]

It is not clear how the requirement to adhere to AGC (over Contingency) in Section 2.2 is reconciled with the requirements in Section 10.3.

[22] AEMO, Market Ancillary Service Specification Draft Determination Version, June 2021, p22.

Recommendation

We are unclear on the outcome that AEMO is trying to achieve with changes to sections 2.2 and 10.3 of the Draft MASS. We recommend AEMO explain its objectives and revise its proposed changes to clearly achieve those objectives.

CONCLUSION

We look forward to supporting AEMO, the wider industry and our customers and investor to deliver a more innovative, distributed, secure and efficient NEM through considered changes to the MASS and the value these changes can unlock.

Yours Sincerely,

Brian Restall
Senior Director
Quinbrook Infrastructure Partners