Australian Energy Market Operator (AEMO)

Via email to mass.consultation@aemo.com.au

11 March 2021

Dear AEMO VPP Team

AEMO MASS Amendment Consultation – Tesla response

Tesla Motors Australia, Pty Ltd (Tesla) welcomes the opportunity to provide the Australian Energy Market Operator (AEMO) with feedback on the Market Ancillary Services Specification (MASS) Amendment that is currently out for consultation (**"MASS Consultation Paper"**).

Tesla supports the work that AEMO is undertaking in updating the MASS. This approach reflects the technology advances that are being made in the market, and the increasing penetration of new technology types that are providing valuable frequency control ancillary services (FCAS). It is also a particularly important recognition of the emerging role of virtual power plants (VPPs) in providing FCAS.

Tesla strongly supports Option 2 put forward in the MASS Consultation Paper. This option is a reflection of the critical role that VPPs and aggregated distributed energy resources (DER) can play in providing critical system services. We believe that this should be taken as a long-term reflection of how DER can be integrated into the existing market structure and provide high quality market services – and should set the future basis for market design principles based on optimal system use. We also welcome the General MASS review and updates to the general MASS settings, reflecting the broader technology advancements that the industry has made since the last full MASS review.

In saying this, there are several elements within both the DER and General suggestions that we feel are not warranted and could be amended slightly to improve the experience for technology providers and customers. Specifically, Tesla questions the need for the following:

DER

- 1 high-speed meter per every 5MW of aggregated VPPs; and
- A 1MW threshold for individual assets.

General

- Consider alternatives to the proposed "no more than 8 second latency" requirement, considering delays in AEMO/TNSP SCADA systems on large generators typically exceed 20 seconds.

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We would also strongly encourage AEMO to maintain the timelines proposed with this review. This will allow a seamless transition for those VPP participants that are currently participating in the trial. As Tesla believes this is a low-risk/ high-reward review process, adopting these changes quickly will also enable AEMO and the rest of the industry to start building up more significant portfolios of aggregated DER, and progress the variety of other market reforms impacting on DER at the moment.

A summary overview of our response, as well as consideration of specific points is outlined below. For more information on any of the content included in this submission, please contact Emma Fagan (efagan@tesla.com).

Kind regards

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DER MASS Review

As noted above, Tesla strongly supports a review of the MASS to better utilise distributed energy resources (DER) and VPPs in the FCAS markets. From a first principles perspective, Tesla believes that any asset that is capable of providing a particular service should not be artificially prevented from doing so on the basis of how market rules, regulations or specifications have been written or interpreted over the years. The energy market is in a period of rapid reform, and industry players are trying to both remove legacy barriers and create new fit-for-purpose market settings. The MASS review is a first step to removing legacy barriers, but will also influence the future market framework for aggregation as it will encourage more and more DER to participate under VPP arrangements.

This position is also supported by the Energy Security Board (ESB). The ESB Directions Paper makes the following points in respect of Demand Side Participation:

> *"Market arrangements, along with those for metering and connection, do not support consumer preferences to access the products and services that could be offered (and which consumers may want from the providers they choose)"*

The DER changes proposed in Option 2 in the MASS Consultation Paper represent an immediate low-risk/ high reward opportunity to address this issue on a permanent basis.

Further, the MASS Consultation Paper recommendations made by AEMO under Option 2 are well supported by the AEMO VPP Demonstrations Trial. The VPP Demonstration Trial has been running since July 2019 which provides almost two years of in-market data verifying the technical capability of VPPs in providing FCAS and confirming the appropriateness of the settings being proposed by AEMO under this MASS consultation.

Currently the AEMO VPP Trial has seven different market participants using five different technology types across a mix of proportional and switched controllers. More than 20MW of capacity is registered and participating in all six contingency markets. For context, half of the market participants currently registered with AEMO as a Market Ancillary Services Provider (MASP) registered as part of the VPP trial. This demonstrates just how influential the VPP Demonstration Trial was in bringing new FCAS providers into the market.

The approach taken by AEMO in enabling open access for any technology type and market participants to participate in the trial has provided an incredibly robust basis for supporting the market changes proposed and should be considered as the gold standard approach for trial-based, technology-led market reform. The trial has been backed by three detailed knowledge sharing reports and AEMO ran a comprehensive survey process to bring customer views into the program – this provides critical insights for the future market integration of DER.

The VPP performance in delivering high quality FCAS services over the duration of the trial supports the changes proposed in Option 2. Figure 1 below highlights how the Tesla/ Energy Locals SAVPP responded during the South Australia Islanding event on 31 January 2020. As AEMO noted in their report

> *To help suppress the high frequency, the VPP very quickly increased its power drawn to beyond the enabled minimum response. Of particular note is the speed of the response: from zero to approximately 1.9 MW output in under 10 seconds, with a peak rate of change in this period of over 1.1 MW/s.*

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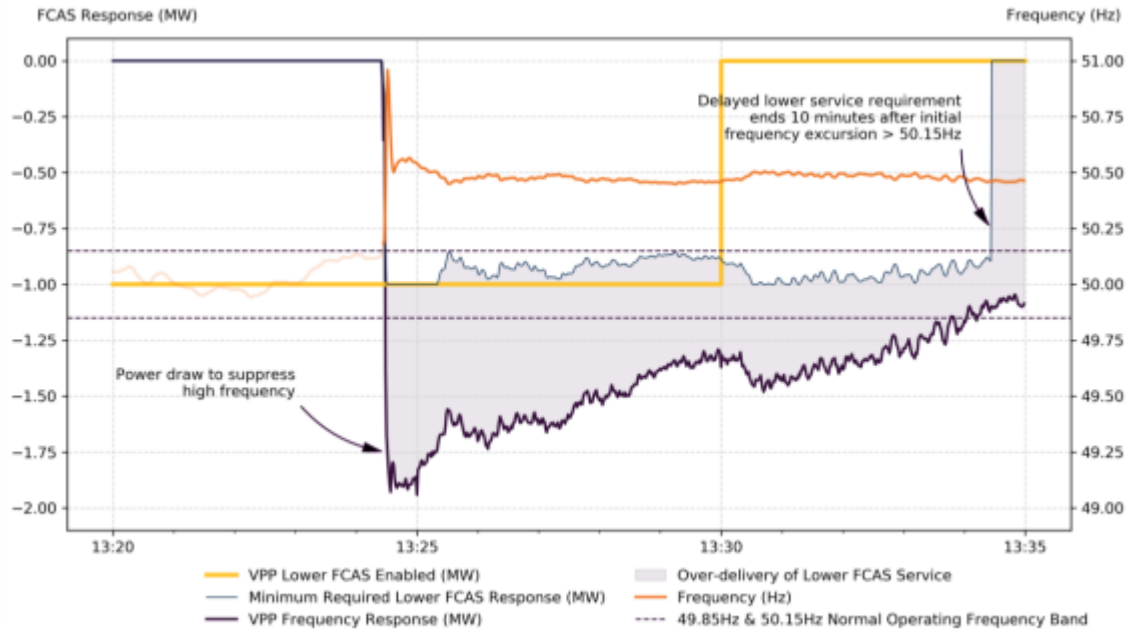

Figure 1: SAVPP response to SA Islanding Event - AEMO Knowledge Sharing Report 2

Tesla understands that the future potential of market integration options for aggregated DER is enormous and creating these early opportunities and quick wins is important in setting the right framework for the future.

Detailed feedback

Our detailed feedback on specific proposals contained in the MASS review are outlined in our response tables to the DER and General sections below. We have also included some additional considerations for AEMO in respect of some out of scope changes that might be considered with this MASS review. However our preference is that the reform timelines put forward by AEMO are maintained – so we would not consider these a priority if it resulted in delaying the proposed DER changes.

MASS review element	Tesla understanding of rationale	Tesla position	Proposed alternative
AEMO Proposed Measurement Resolution -			
Frequency Injection test requirements	Frequency injection test on every different type of controllable device must be provided to demonstrate asset type performance.	Tesla supports this requirement.	N/A
All controllable units within the same VPP operate with the same type of FCAS controller	N/A	Tesla notes that this may conflict with the proposed "General" change that delayed services must be provided by switched controllers. Tesla is unsure how both requirements will be managed, particularly for VPP fleets that may use multiple technology types.	AEMO to clarity how this requirement will work in effect if all delayed services need to be provided by switched controllers.
Additional metering requirements – 1 meter / 5MW	This is a change from the current AEMO VPP requirements of 1 meter per jurisdiction. Tesla understands that this requirement is designed as a means of reviewing individual system performance to try and catch individual systems that are not performing.	Tesla does not agree with this perspective. A 1 high speed meter/ 5MW appears like an arbitrary measure of individual system performance, as it will only provide site data for ~1/1000 systems. So using this as a rationale for the catching non-performing systems does not appear to be a sensible solution. Our primary concern with this approach will be the potential high cost of the solution (if utility spec. meters are required), the lack of affordable technologies that are proven to be MASS compliant, and the potential requisition issues if external meters need to be recovered from customer properties. Our preliminary estimates of the cost of high-speed metering is: ~$10-15k. This can be broken down as follows:	Tesla believes that 1 meter per ***technology type*** per jurisdiction should provide AEMO with sufficient confidence on the asset level performance. This means that AEMO will have visibility on the performance of all systems participating in a broader VPP fleet. Tesla believes that this approach will provide more value to AEMO than the 1 meter / 5MW proposal

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MASS review element	Tesla understanding of rationale	Tesla position	Proposed alternative
		- $5,000 - $10,000 cost of utility grade meter (depending on type) - $2500 cost of installation - $2500 cost of additional works (non-standard installation requiring space for the metering in a new subboard, as well as independent network connection and setup) We understand that there are a number of companies that are working towards being able to provide 50ms data resolution in the future, however as none of these systems are currently registered to provide FCAS, both AEMO and VPP market participants would be taking a risk on these systems both being developed, and being deemed to comply with the MASS requirements. The lack of clarity on whether this may actually happen, and the timeframes for doing so will push VPP operators to the more expensive solutions in the short to medium term. It is also unclear as to whether these technologies will be capable of measuring frequency and power at the device terminal (as is proposed through this review process) and whether the technology is sufficiently neutral to be used by multiple VPP aggregators. A bad outcome of this review process would be if the MASS review inadvertently created a monopoly for a single aggregator or technology type.	that has been put forward in the Consultation Paper.
Measurement location			
Allow measurement at the inverter or controllable device level	Enables DER to more easily and accurately provide FCAS services.	Tesla fully supports this proposed change.	N/A

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MASS review element	Tesla understanding of rationale	Tesla position	Proposed alternative
Power flow measurements from the controllable device and generating units behind the connection point, and the grid flow must also be captured	N/A	Tesla supports this proposed change.	N/A
AEMO must be able to determine the non-controlled load using the data provided by the FCAS provider for compliance purposes	N/A	Tesla supports this approach, provided that load can be calculated based of the other measurement points, rather than being directly measured.	N/A
The high-speed meter installed for every 5 MW of aggregated ancillary service capacity must capture the power	N/A	If the actual frequency performance is measured at the device terminal, Tesla does not understand the value in having high-speed meter data which also captures the other data points listed.	We believe that the key high speed data points required by AEMO are simply the power flow measurements from the controllable device and the local frequency. Measurements from other generating units or grid flow will not

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MASS review element	Tesla understanding of rationale	Tesla position	Proposed alternative
flow measurements from the controllable devices, generating units behind the connection point, grid flow, and local frequency			impact on the frequency performance of the site and do not provide additional value to AEMO if the frequency performance is measured at the device level.
1MW threshold – per	Unclear. This was the limit imposed at the start of the trial – based on the idea that any single asset over 1MW providing FCAS might have negative grid impacts. AEMO is open to accepting alternative proposals	Tesla has a few concerns with this approach. • It introduces an unjustified, arbitrary, additional threshold for battery storage assets above and beyond the 5MW threshold that currently exists (utility scale batteries over 5MW need to be registered as a scheduled generator/ scheduled load). • 1MW batteries can still register as a non-scheduled asset and classify that asset as an ancillary services generating unit, which would still be able to provide FCAS in a way that is invisible to AEMO. • This approach will, however, make it very difficult to operate assets >1MW as an aggregated fleet. Operating assets individually results in operational inefficiencies and additional costs, and may lock assets of this size out of the FCAS market even though they are technically capable of delivering high quality FCAS services.	Tesla believes that 5MW should remain as the only threshold with individual assets <5MW allowed to aggregate using the proposed DER settings. Suggest at a minimum, that the measurement location is still allowed at the device terminal. Larger systems will have more scope to afford high speed meters, but if we're measuring at a site level, will need to avoid a situation where we inadvertently lock out a huge subset of systems from providing FCAS.

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General MASS review

MASS review element	Tesla understanding of rationale	Tesla position	Proposed alternative
S3.2 Reformat of MASS & Clarifications	Improved readability and understanding; Clarify FOS relationship	Tesla supports the aim to simplify and clarify the MASS. Also support improved specification (and greater clarity on relationship with the FOS). Containment Frequency range should refer clearly to the FOS document itself which is the Containment Band (49.5 - 50.5Hz) for Generation/Load events (mainland), avoid parallel definitions.	n/a
S3.3 Require proportional controllers set deadbands <±0.1Hz	Improve frequency responsiveness	Workable for utility-scale battery storage and should provide AEMO greater clarity on response quantities from assets not providing PFR. Tesla agree that the level of non-frequency responsive FCAS providers is a serious issue for the NEM, particularly for frequency overshoot when non-enabled providers respond. Tesla support the requirements for active market enablement, as well as non over responding more than 50%. Tesla supports and reiterates the statement: "all frequency response would be measured as contributing to Contingency FCAS."	n/a

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S3.4 Co-ordination of FCAS and PFR	Provide balance between guidance and flexibility for plant control design	Support AEMO ensuring all response contributes towards contingency obligations (and associated uplifts of contingency FCAS enablement levels) AEMO has repeatedly stated that procurement volumes for FCAS will not be changed due to PFR as they are seeking to achieve different things. Need to provide participants comfort by embedding/codifying this – to ensure investment signals for FCAS reliant battery storage projects are maintained and future projects avoid uncertainty from price and volume risk. Agree on including AGC signal (per figure 8) and adding proportional control to this value, however note that currently AGC is ignored outside the NOFB so there will need to be a transition period to allow this logic change. Tesla is in agreement that this is necessary, as there have been several events where AGC has been locked out due to system frequency failure to return to the NOFB (however accept that this will be less frequent post PFR).	Also provide more certainty on FCAS procurement volumes
S3.5 New Regulation FCAS requirements	Improve regulation FCAS compliance and performance	1. The “no more than 8s data latency” is not workable. It is inconsistent with and ignores the delays in TNSP and AEMO’s own systems (i.e. AGC suffers delays ~ 30 seconds or more). 2. The 2MW limit is arbitrary and inconsistent with “no less than half the bid size” (i.e. 1MW/2 = 500kW). 3. Providing local PFR (MW) telemetry to AEMO may be problematic for batteries, as this value isn't readily available on the SCADA system (it exists locally at inverter) and operates at a faster time scale. It is unclear what value this provides.	• An alternative solution is to use timestamps as applied at each generator’s RTU for generator originating SCADA data. AEMO/TNSPs also need to continue addressing these delays on their own systems directly. • Remove arbitrary limits, and/or recognise technology differences - it is much easier to observe a clean 1MW regulation response on a

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		4. For maximum limit duration (batteries) this is a good initiative, it is unclear how this will be implemented in dispatch however. More information and industry feedback on this requested. 5. Testing cycle - recommend be implemented via operational AGC regulation response via a defined 5-minute test period (without taking out of market). Test data can be provided by Participant via high speed data for correlation with AGC signal data. This minimises the cost to the Generator and consumers for compliance.	battery than it might be to observe a 5MW on a thermal plant.
S3.6 Delayed FCAS to be only switched control	Improve delayed contingency FCAS compliance and performance	Tesla is open to exploring this option further, and note that proportional response (primary frequency control) in the delayed service is not meeting the intention of what is really a reserve service (secondary frequency control). Delayed response could be provided by a switched linear ramp response which is more beneficial to the power system than a switched (step) response and would only require minor programming in local RTAC for batteries). Delayed response via AGC could also be provided for Scheduled Generators (utility projects) as it would allow regulation to continue via addition of AGC Energy/Reg/Delayed into one signal, however note that this would not be appropriate for DER response.	Batteries can use logic to implement based on local frequency measurement or AGC for Scheduled Generators only.

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Additional suggestions

MASS review element	Tesla understanding of rationale	Tesla position
S3.7 FFR	Improve frequency responsiveness	• Support AEMO expediting its work to consider how FCAS timing requirements and associated specifications should be revised to incorporate fast frequency response (FFR) as a separate service. Optimally this could be done by a new FFR market (R1/R2?) to replace existing FAST R6, with consolidation of R6/60 into SLOW market, which would have minimal disruption and require no change to the NER. • Tesla understands there is potential for FFR to be implemented through the MASS immediately - as ESB and AEMC explore reforms to incorporate an additional co-optimised product over the longer-term, support AEMO undertaking this work in parallel. • There is significant room within the NER definitions to redefine the desired response timeframes and still retain the defined terms of fast raise, slow raise, and delayed raise - the NER is not specific about the nature of these contingency responses and defers to the MASS • Updating the fast FCAS contingency response from 6 sec to <2 sec could allow much higher enablement from fast-response assets and value the response provided in the initial seconds. This could be framed as an 'opt-in' service to avoid changing existing generator settings. • For proportional controllers, an effective droop increase to allow full power output at 49.5Hz (50.5Hz) is considered appropriate based on closer frequency control in the NOFB post PFR, With mandatory PFR for batteries outside 15mHz this would potentially mean a 485mHz range to reach full power (.97% droop) which would allow full registration of the nameplate value for existing and new batteries, facilitating an increase in high quality proportional FCAS supply at low marginal cost to meet the objectives of the NEO.

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		It is important that if a high speed market is introduced, the MASS registration takes the full nameplate capacity of the System into account without artificial limits due to the droop. Tesla also question the appropriateness of switched controllers in this market, noting that high speed markets are required to recover the frequency as well as overshoot due to load drop/switched controllers. • Inertial response should be excluded from any FFR market, with the focus being on Primary Frequency Control, with a preference for proportional controllers • This approach will also ensure both utility-scale and VPP assets are able to design and develop hardware and software requirements to be future proofed
Regional procurement	Provide clarity on FCAS procurement and ensure sufficient enablement across NEM	• As an immediate step, Tesla supports AEMO implementing regional based minimum quantities for contingency FCAS procurement, as previously explored in the Frequency frameworks review.

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Transparency	Improve ability for market participants to plan and develop future projects, forecast potential revenues/costs, and provide even playing field across all assets	• • The existing FCAS registration route for grid-scale battery storage systems (BESS) is not transparent or consistent. Market participants continue to seek guidance on what is practicable; where responsibilities lie (AEMC vs AEMO vs Reliability Panel); where technical requirements are defined (NER vs MASS vs FOS); and what change processes are required (e.g. rule change or not). • • In January 2019, AEMO formalised droop requirements for all future BESS projects in guidance: “Unless an alternative droop limit is specified by AEMO, the minimum allowable droop setting of any BESS is 1.7%, regardless of its capacity” • • We understand there may be some battery systems (including VPPs) operating with 0.7% droops and so inconsistent application of droop limits must be addressed if it has not already. Refer to alternative droop suggestion above. • • AEMO must also clarify (or potentially codify) the calculations used in the MASS (as used by HPR to justify >57MW registration (with PFR) for R6 and R60). • Causer pays: • • For regulation FCAS we understand AEMO continues to review contribution (causer pays) factor procedures and cost recovery processes and as part of this process must ensure that fast responding battery storage technologies are not unfairly penalised due to interim registration requirements (e.g. multiple DUIDs) and the technology’s dual dispatch classifications as a scheduled generator and market customer • • An immediate clarification to remove these perverse outcomes should ensure the battery system as a whole is viewed as not contributing to a deviation in frequency if either its load or generation side has been enabled and is providing regulation services accurately.