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Kerry Schott
Energy Security Board
via email: info@esb.org.au

12/02/2021

RE: Tesla feedback on ESB interim REZ framework Consultation Paper

Dear Kerry,

Tesla Motors Australia, Pty. Ltd. (Tesla) welcomes the opportunity to respond to the Energy Security Board's Interim REZ framework Consultation Paper ('Consultation Paper'). We see the formation of a fit-for-purpose renewable energy zones (REZ) framework as useful in streamlining regulatory and investment signals in the transition to a high renewables penetration grid; and in enabling connection, reducing congestion and improving power system security while lowering cost for consumers.

Tesla's mission is to accelerate the world's transition to sustainable energy. As such we are particularly supportive of the acknowledgement throughout the paper of the need to facilitate entry of new renewable generation and firming capability – such as energy storage.

Tesla Motors Australia, Pty Ltd (Tesla) is a global leader in manufacturing electric vehicle and clean energy products. Tesla produces a unique set of energy solutions such as [Powerwall] and [Megapack], enabling homeowners, businesses, and utilities to manage renewable energy generation, storage, and consumption. Our mission is to accelerate the world's transition to sustainable energy and globally Tesla has deployed more than 6.2GWh of residential and utility scale energy storage systems across 40 countries. In 2020 alone, Tesla deployed more than 3GWh of energy storage systems around the world.

In Australia, Tesla is leading both utility scale and virtual power plant (VPP) developments and playing a key role in the transition to higher penetrations of renewable energy. We have deployed more than 200MW of utility scale assets to date since 2017, with an additional 350MW of Tesla Megapacks to be deployed in 2021 – including the 300MW/450MWh Victorian Big Battery which will be the largest battery storage system in the Southern Hemisphere and will be critical to supporting Victoria's energy reliability while helping to achieve Victoria's 50% Renewable Energy Target (RET).

Tesla is also a leader in delivering high quality VPPs. The South Australia VPP (delivered by Tesla and Energy Locals) currently has 10MW registered to provide all six contingency frequency services – and has been providing high quality frequency response services for almost two years.

Tesla currently employs more than 120 people in Australia to undertake the full range of the development and deployment of utility scale energy storage and VPP work. Our permanent employees provide end-to-end development of all Tesla's local energy projects including Business Development, Engineering, Project Management, Project Deployment, Software Development, Market Integration, Service & Operations.

A summary of our key points is included below:

- Tesla recommends a technology neutral REZ framework that allows the unique capabilities of distributed, flexible and modular assets such as battery storage to compete against centralised network infrastructure assets. Recognising storage's modularity and flexibility, such as in delivering scalable virtual transmission infrastructure, and its role in de-risking REZs will deliver maximum system and market benefits – and best value to consumers.
- Battery energy storage will play a key role in the rollout of REZs beyond the narrow applications of congestion relief identified in the Consultation Paper. Advanced battery inverters have proven capability to provide system strength, inertia, frequency control in the form of fast frequency response (FFR), primary frequency response (PFR), contingency frequency control ancillary services (C-FCAS) and regulation frequency control ancillary services (R-FCAS), and voltage management services – tuneable to the unique network topology of a given region. These services are of particular value in electrically remote and high-renewables penetrations regions such as REZs.
- Energy storage assets located within REZs must not be penalised for the provision of system security and network support services and market participation above and beyond storage assets located outside of REZs. If the opportunity cost is higher for locating within a REZ than outside – due to risk of being constrained for a lack of access rights – storage providers will be encouraged to locate assets outside of where they would be needed.

Tesla looks forward to continuing to work with the ESB on future refinement of the interim REZ framework, and in each of the key focus areas being progressed through the Post-2025 Market Design program. For more information on any of the items raised, or to organise a follow up discussion, please contact Emma Fagan (details below).

Sincerely

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Tesla supports the ESB's ambition for a well-planned REZ model to strengthen and add fidelity to the investment signals needed to drive the transition to a high renewables penetration grid. Provided the detailed design ensures appropriate incentives (and avoids financial complexity), REZs can provide a suitable framework to facilitate connection, reduce congestion, integrate storage, and improve system security while lowering the level of risk and cost borne by consumers through a streamlined regulatory and investment process.

The role of storage within REZs

The ESB's consideration of storage in its REZ Stage 2 paper is welcome, however Tesla believes there is further scope for consideration of additional scenarios and applications of storage within REZs, in particular in reference to the provision of ancillary and system services and following major contingency events when storage's unmatched capabilities are of particular value to the system.

As now noted by all market bodies, battery energy storage will play a key enabling role in facilitating efficient investment in transmission infrastructure within REZs - to increase transmission hosting capacity utilisation, reduce congestion and curtailment, minimise loss factor risk and to firm renewables. Locally sited storage will also provide much needed system strength, synthetic inertia, frequency and voltage management services to strengthen system security both within the REZ and the wider shared network. Where REZs overlay onto populated areas, VPPs located within REZs will also enable local consumers including households and businesses to play a part in sharing the benefits of the REZ while improving system outcomes and economic efficiency, thereby reducing costs.

Access rights models

From first principles, it is critical that any buildout of REZ infrastructure is conducted by an independent body that does not preference particular forms of network investments over others. If a service is required, for example system stability services, or staggered development of increased transfer capacity, an open, competitive and technology neutral process will be critical to ensure that the technology selected delivers maximum benefits for consumers across a variety of services (and includes optionality and the full suite of ancillary service benefits). Critically, this process should allow assets such as VPPs and standalone utility scale storage to bid for the lowest cost provision of network support services.

VPPs have unique capabilities to assist with network management while providing energy arbitrage, contingency FCAS and FFR – doing so with unmatched speed and accuracy. Insights from AEMO's VPP Demonstrations Trial have also demonstrated how orchestrated DER can respond to energy market prices, fostering increased competition in wholesale and frequency markets and potentially deferring the need for further large-scale investment[1]. Tesla is also doing work through the SAVPP Phase 3A to prove out the capability of VPPs to provide inertia, FFR and local voltage support. REZ coordinators and network service providers should be encouraged to value the capabilities of

[1] AEMO's VPP Demonstration Trial Knowledge Sharing Reports 1 & 2

distributed and centralised assets to provide network and system services on a like for like basis – using a services- rather than an asset-based framework, allowing a 10MW VPP to compete with a 10MW battery asset for the same desired outcomes.

A key advantage of battery storage is its modularity and deployment flexibility. Following detailed design and network modelling, energy storage configurations can be scaled up or down depending on required applications to serve grid and market needs. For example, a 2 hour system (250MW/500MWh) for a dedicated REZ may be suitable for near-term system security, ahead of longer duration 1GWh (4hr) options for system reliability benefits and during future network augmentation stages.

A fit for purpose REZ framework should also enable REZ coordinators to work with both public and private investors with low cost of capital and access to land to ensure REZ network planning includes consideration of the benefits that modular and flexible storage assets can provide in terms of optionality. For example, over-sizing a central battery storage asset ahead of the full REZ generation capacity may be more cost effective than individual generators retrospectively procuring individual batteries. This centralised battery (whether owned by the REZ coordinator, network service provider, private market participants, or some combination) can then be partitioned and leased to REZ generators for their own commercial operations. This scenario is likely to drive efficiencies in infrastructure costs and siting, thereby delivering maximum benefits to consumers. We understand this may be the model TransGrid is exploring as part of its New England Connection Capacity Auction. Tesla is happy to workshop this model with the ESB to ensure this approach is encapsulated in final design of the REZ framework.

Network support services:

Batteries offer greater benefits than traditional network upgrades or individual system strength remediation assets at each generation connection point, and can provide a more efficient deployment of capital and much faster (and scalable) implementation than alternative technologies such as pumped hydro storage, gas plants, or targeted assets such as synchronous condensers and STATCOMs. Batteries can play a crucial role in supplying multiple services to de-risk an entire REZ scheme by providing flexible energy and ancillary services where it's needed most (whether that's close to the largest renewable generators within the REZ, or along the corridor to a major load centre; or both). In effect, this maximises the efficiency of the scheme, whilst minimising the risk of supply issues that may otherwise come from network trips or generator outages.

As seen with Neoen's Victoria Big Battery (VBB) and Hornsdale Power Reserve (HPR), battery storage can provide value to network operators through the System Integrity Protection Scheme (SIPS). SIPS allows for increased inter-regional interconnector flows, providing critical support to transmission infrastructure during contingency events. It reserves a pre-determined level of storage capacity (e.g. 250MW) during peak seasons, allowing the network to operate at its 5min-rating (closer to its rated capacity) - thereby giving AEMO time to re-route energy flows, or enact a plan in a contingency event.

Tesla's batteries also have the capability to operate in Virtual Machine Mode (VMM) that mimics the behaviour of a rotating machine. VMM enables Tesla battery inverters to act as a voltage source, like synchronous machines -

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thereby providing much-needed provision of system strength and inertia. Having adequate levels of system strength is essential in enabling and maintaining maximum penetrations of inverter-based resources in electrically remote regions such as REZs. Though synchronous condensers also have the capability to provide system strength and inertia, they lack critical capability to address thermal constraints or curtailment risk in REZs. Key benefits of grid-forming battery storage over synchronous machines are detailed below.

Batteries with VMM enabled are also capable of operating in islanding mode, in the event of a major disturbance in the wider network. This would enable generators and consumers within a REZ to continue operating with minimal risk of loss-of-load. With dynamic operating profiles, system operations could always ensure a minimum state of charge is available to serve islanded load within a REZ across one battery or a fleet of batteries, for example through reserving 20 to 50% - depending on modelled requirements. Dynamic application of state of charge requirements, leveraging day-ahead forecasting of wind, solar and local loads would allow this back-up capability to be modified depending on day-to-day conditions.

Storage assets can optimise across multiple services and markets to provide what is needed when it is needed the most – driving increased flexibility, improved competition and enhanced stability to the local grid and the NEM more broadly. Multiple services can also be provided by a single asset simultaneously, ensuring the provision of system strength and inertia services are co-optimised against multiple priorities.

System support services:

As noted by the ESB, there is a clear role for storage to provide valuable services and operational efficiencies by reducing curtailment, disorderly bidding and loss factor risk whilst relieving congestion. However, there is also a critical role for storage in the provision of short-duration services, including frequency control (FFR, PFR, C-FCAS, R-FCAS), inertia, voltage stability, system strength, system restart services and SIPS for large generation contingency events (particularly given the extent of new generation to be located in the REZ) and interconnector support - recognising the volume of coal generators planned for retirement in coming years. It is also true that currently, system services provided by storage assets often go uncompensated, particularly with respect to their speed, flexibility and accuracy.

In the event that a REZ is congested, storage should still be able to provide critical system services, in particular during edge cases where the opportunity cost for storage in responding to extreme price events would be considerably higher for storage located within a REZ as opposed to outside of it. If storage assets within REZs are unable to provide critical system services, while also providing these services in the most accurate, rapid and flexible manner, it would not create efficient market outcomes – counter to the national energy market objectives.

It is incumbent upon the ESB to ensure storage assets are not penalised through reducing the potential revenues available to storage facilities and providing locational signals to storage providers to locate assets outside of REZs where access to these value streams can be ensured.

Scenario testing

Beyond the ESB's scenario outlined in Box 5, there are countless scenarios in which storage plays a critical role in maintaining system integrity. For example, in the event of the trip of a major interconnector or thermal plant, it is critical that fast, flexible assets such as batteries are able to respond, and be duly compensated for their critical role in maintaining system security. It is possible, and even likely that such an event may occur when generation within a REZ is constrained, including for storage facilities. During these events it is critical that assets (such as storage) capable of responding within the milliseconds necessary to ensure system security are not penalised over and above assets outside of REZs participating in an unconstrained open access model.

An additional scenario for consideration would be during an islanding event when the spot price reaches the market price cap of $14,500/MWh, and REZ generators with access rights are operating at the capacity of the shared REZ network infrastructure – in this instance would storage (operating without access rights, as suggested by the ESB) receive $0?

Should storage facilities within REZs be placed at a competitive disadvantage, this is likely to distort market outcomes and lead to worse outcomes for consumers. As such, Tesla recommends that the ESB clarify the treatment of storage during contingency events, including where necessary, an exemption on financial or physical constraints on storage output for the provision of critical system services.

The following section outlines our responses to the questions in the Consultation Paper.

Consultation Questions	Tesla Feedback
1. Are REZs an appropriate interim solution to the challenges associated with open access?	REZs have the potential to be a useful tool for providing efficient and locational investment signals to address the transmission investment challenges given the transition towards large volumes of variable renewables in new areas of the grid. Tesla supports the ESB in its ambitions to explore how a well-planned REZ model can strengthen the investment signals needed to drive the transition to a high renewables-penetration grid. REZs can provide a suitable framework to facilitate connection, integrate storage, and improve system security while lowering the level of risk and cost borne by consumers through a streamlined regulatory and investment process.
2. What are the likely consequences of a framework that addresses these challenges on a localised rather than a system wide basis?	N/A
3. Do stakeholders agree with the proposed objectives for a	N/A

regulated REZ development model?	
4. Are there alternative, preferable options for deciding which generators become part of the REZ?	N/A
5. Which party is best placed to perform the role of REZ coordinator where the REZ is being developed in accordance with the regulatory framework? **Should the decision regarding the identity of the REZ coordinator lie with the State government?**	N/A
6. Are the functions to be undertaken by the REZ coordinator in the regulated model appropriate?	We see a role for the REZ coordinator above and beyond that identified by the ESB in the Consultation Paper, in the procurement of system strength remediation assets, demand response capability, network support services and potentially centralised and shared storage assets, to be leased on to REZ generators.
7. What, if any, qualification criteria should the REZ coordinator apply to prospective REZ participants?	N/A
8. What objective or objectives should the REZ coordinator should seek to achieve when selecting successful tenderer?	N/A
9. Should the Rules establish a framework to ensure that the REZ delivers an optimal supply mix?	If Option 1 is selected, achieving an optimal supply mix would allow REZ coordinators to more easily achieve higher power transfer capability set points. This will drive efficiencies in shared REZ transmission infrastructure and allow any gaps in network investments to be met by non-network solutions.
10. Should regulated REZ developments be subject to a requirement that they may only proceed if a certain proportion of the planned capacity of the	N/A

preceding REZ stage is subscribed?	
11. Should the REZ coordinator return any surplus auction proceeds to customers in the form of a reduction in TUOS charges?	N/A
12. Should the ESB consider REZ models that allow for speculative investment that departs from the ISP, in order to reallocate risk away from customers, such as the one put forward by the Public Interest Advocacy Centre (PIAC)?	N/A
13. How should pre-existing developments be treated within a REZ framework? At what stage of development should a project be considered a pre-existing development?	N/A
14. Should the REZ framework contemplate brownfields developments? If so, should developers have the ability to influence the location and configuration of the REZ transmission assets within a brownfields REZ?	N/A