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Alexandra Finley
NSW Electricity Infrastructure Roadmap
Department of Planning Industry and Environment
NSW Government
via email: electricity.roadmap@dpie.nsw.gov.au

12/11/2021

RE: NSW Network Infrastructure Projects Policy Paper – Tesla Consultation Submission

Dear Alexandra,

Tesla Motors Australia, Pty Ltd (Tesla) welcomes the opportunity to provide a response to the NSW Government's Network Infrastructure Projects Policy Paper.

Tesla's mission is to accelerate the transition to sustainable energy. It is clear the vision NSW Government holds for the state's clean, affordable and secure electricity future is aligned with this mission. Tesla firmly believes that battery energy storage is a key enabler of the NSW Electricity Infrastructure Roadmap, and in particular will ensure efficient design, development and delivery of Renewable Energy Zones (REZ) and associated network infrastructure. Batteries offer a flexible range of services over time to maximise value and underpin the lowest-cost and secure transition of NSW's generation mix. For example, large-scale centralised battery storage is likely to offer greater benefits than more traditional network upgrades or reliance on individual assets at each generation connection point, can complement investments being planned for large transmission and interconnector upgrades (as 'virtual transmission'), and can provide a more efficient deployment of capital and much faster implementation than alternative technologies such as pumped hydro storage or a gas plant. Accordingly, we encourage NSW Government to ensure its Network Infrastructure Policy and Transmission Efficiency Test (TET) are designed to drive these optimal outcomes and do not preserve, or introduce, barriers faced by non-network projects as evidenced under current national rules and frameworks like the RIT-T.

Tesla is working closely with market bodies (AER, AEMC, AEMO) to highlight and address these existing barriers in the national framework (e.g. as part of the AEMC's Transmission Planning and Investment Review), but in the meantime, encourages NSW to underpin its Roadmap vision by creating fit for purpose investment rules and guidelines for the state to unlock the immediate investment needed in assets that can simultaneously provide capacity, system services, storage and energy firming.

Tesla looks forward to working with NSW Government's Energy Corporation, Infrastructure Planner, Consumer Trustee AEMO services, AER, and other Roadmap delivery bodies to ensure the best outcome for NSW consumers, ideally through a long-term, technology neutral network planning approach that can ensure innovative, high-value projects are appropriately encouraged and ultimately allow the NSW Roadmap Objectives to be achieved.

Supporting details and recommended design principles are included in the response that follows.

Sincerely,

Tesla Energy Policy Team
[redacted]

Recommended Principles for NSW Network Infrastructure Policy

Tesla commends NSW Government for its transparent and open approach to delivering on the NSW Roadmap. Regarding the Network Infrastructure elements, Tesla recommends the following principles are included as part of detailed design:

1. **Technology Neutrality – ensure TET assesses non-network options fairly and transparently (noting barriers inherent in the existing RIT-T framework)**
    - As the NEM transitions towards a high renewables and low-carbon future, the suite of network and synchronous services are increasingly being substituted by proven (and non-synchronous) technologies that can contribute to fault current and actively support voltage waveforms; and traditional network 'poles and wires' solutions can be complemented by non-network solutions such as battery storage that can effectively arbitrage energy flows over time and space ('virtual transmission').
    - Structuring network investment and regulatory frameworks to value these actual consumer and system benefits (rather than restrict or exclude many of these benefits based on economic cost models) becomes increasingly relevant for the NSW Roadmap design that will need to integrate a suite of investments in different technologies and network infrastructure across multiple time horizons.
    - It appears the current process sees the Infrastructure Planner consulting with AEMO, network operators (current and potential), technical experts etc all who have extensive experience planning, designing and deploying traditional transmission infrastructure. However, the pace of innovation in energy technologies is rapid. There will need to be additional weighting and/or incentives provided to ensure appropriate and fair treatment of novel non-network options that can deliver the same (or better outcomes) but require new models, methodologies, and updated technical understanding (i.e. to overcome the first-project inertia and address inherent risk aversion for new solutions within an essential service industry)
    - As noted in the consultation paper: "It may be prudent for the Infrastructure Planner to consult to identify and assess potential options to remediate system strength or other issues - including both network and non-network options. This may include actively seeking EOI for non-network options to reveal market capability and costs" And: "The Department is considering what incentive schemes may be appropriate to apply to projects carried out under the EII Act, including whether there is scope for new incentive schemes to apply in the NSW framework ". Tesla strongly encourages the NSW Department to look at not only removing barriers to non-network options (see 'RIT-T barriers' section below), but also introducing additional incentives needed to overcome the regulatory and investment burden that applies.
    - This is a key opportunity stemming from the NSW legislation - to over-ride the deficiencies in the RIT-T framework that takes an outdated economic regulatory view that results in inflated costs and discounted benefits of non-network options such as battery storage. Instead, NSW can ensure investment decisions consider holistic program objectives and truly deliver value for money outcomes for governments and consumers (i.e. ensure network *and* energy charges are minimised).
    - As a point of reference, we point to the ongoing Victorian REZ Development Plan process, which is looking to procure technology agnostic system strength services. After initially identifying synchronous condensers as the key solution, consultation with technology providers and developers highlighted the ability for grid forming inverters and battery storage systems to provide equivalent voltage waveform stabilisation whilst also contributing to other objectives of the state's REZ scheme. We envisage similar trade-offs and benefits can be explored for NSW REZ design.

2. Ensure priority transmission projects can extend to multi-purpose non-network storage solutions

- As demonstrated in day-to-day operations as well as during non-credible power system events, battery storage technologies are well aligned with the objective of efficient provision of services to meet multiple system needs, including security, reliability, and resilience. Battery assets have the ability to optimise across multiple services and multiple 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 be provided by a single asset simultaneously – ensuring the cost of provision maximises efficiency, and can be co-optimised across energy, system and network services.
- Additional benefits of battery storage over alternative network or generation solutions include speed and modularity of deployment, as well as minimal social licence and land-use impacts – whereby any reliability risks forecast 12 to 18 months out (i.e. a breach of the NSW Energy Security Target, or potential AEMO identified system strength or inertia shortfalls) can still be addressed by the accelerated procurement and deployment of a battery storage project.
- As captured in the consultation paper: "The optionality for the technical parameters is expected to include different combinations of network and non-network investments as well as variations in the route and timing of the infrastructure." Tesla supports this optionality but underscores the importance of transparency in any assessment that is undertaken relative to the technical or commercial comparisons between the network and non-network options, noting that AEMO's ISP identification of projects may not necessarily have fully considered whether non-network battery storage solutions could have provided a viable and more efficient alternative to any transmission network infrastructure being proposed.
- Tesla also recommends the proposed first guiding principle should restrict its emphasis to achieving a "faster timeframe" than the status quo, and drop reference to having the "same timeframe", which in the case of existing network regulations, is too slow, drives investment uncertainty, and is not fit for purpose.

3. Maximise value for NSW consumers – integrating value streams across Roadmap mechanisms

- As the consultation paper states: "The Roadmap is intended to coordinate investment in new network infrastructure with investment in new energy generation, long duration storage and firming infrastructure". More detail on this coordination, as well as between LTESAs and network infrastructure optimisation would be helpful as this as a key opportunity to maximise value for money outcomes for NSW consumers, whilst successfully delivering on all key Roadmap objectives.
- For example, as a multi-use, fully flexible asset, how can battery storage be recognised to be a non-network option, *plus* be rewarded for its system strength provision (i.e. as both Class 3 and 4 - network infrastructure services & system security), *plus* be seen to contribute to the long-duration storage goals (i.e. as part of a portfolio or partitioning of storage systems to meet the legislated 8-hour duration requirements; noting Tesla's previous comments on the inappropriateness of locking out battery technologies through strict nameplate capacity requirements), *plus* be recognised for its fast and flexible firming capacity to mitigate reliability risks and avoid a breach of the NSW energy security target.
- Instead of procuring many individual, siloed projects and investing extra capital in multiple single-use assets (e.g. designing a REZ with oversized poles and wires, plus syncons for system strength, plus pumped hydro for storage, plus potentially gas for firming capacity), the Infrastructure Planner has a critical role to assess the viability of whether a battery/ies of sufficient MW and MWh can satisfy some or all of these roles simultaneously, and optimise across whatever service is required. Clear and streamlined procurement of LTESAs is a key input to this process, given these same battery assets could be directly participating in REZ auctions, or indirectly participating via negotiations occurring in parallel with renewable projects seeking co-located storage.

RIT-T Barriers

The market is rapidly transitioning to high penetration renewable energy and NSW investments alone are forecast to reach $billions in new transmission network infrastructure to support this transition over the coming decades, as outlined in AEMO's Integrated System Plan. It is important that this capital is deployed in the most economically and time efficient manner in order to avoid unnecessary congestion, reliability, and security risks. Having the right regulatory framework to appropriately assess non-network solutions will be critical to support these outcomes.

For battery storage options, we have observed complexities that appear to stymie the ability for network service providers to successfully procure these assets (or services from them) under the RIT-T, even when they are increasingly recognised as an efficient investment (and in the long-term interest of consumers) by market bodies, governments, and networks, with many valuable applications. We view the current ex-ante RIT-T framework as non-transparent, complex and outdated and as such, not 'fit for purpose' to support the timely and efficient delivery of transmission projects.

Numerous studies have outlined the preferences for NSPs to focus on 'traditional' network-based capital investments, noting capital expenditure biases, lack of contestability, information asymmetries, misaligned incentives, cultural inertia, and institutional risk-aversion as possible explanations[1]. Our experience in navigating Australia's regulatory frameworks over recent years supports the validity of all these issues. This is despite the increasing recognition and signalled intent for NSPs to deploy storage at scale across their service areas.[2] Accordingly, the NSW TET provides a significant opportunity to improve upon the status quo and unlock the substantial value that non-network options such as battery storage can provide.

Capturing Full Benefits in a Network Regulation Model

On top of the well documented drivers for preferring 'traditional' capex (i.e. misaligned incentives, cultural inertia, risk aversion, lack of contestability etc) NSPs are notably unfamiliar with the treatment of battery storage under the RIT-T – undervaluing the benefits and over-inflating the costs.

In Tesla's experience, the RIT assessment framework still presents as a 'black-box' to non-network option providers, with NSPs (and their economic consultants) modelling cost-benefit assessments based on a limited set of cost input assumptions (potentially out-dated or disadvantageous relative to actual specifications) – e.g. for battery storage: inflating capital costs, reducing asset lifetime, and lowering round-trip-efficiency. Again, this provides a clear area for the NSW TET to improve on.

On the benefits side, the array of benefits listed and considered within the RIT are not sufficiently broad to capture the true 'real-world' benefits that arise from otherwise commercially viable projects. In particular, the hard to monetise benefits are commonly excluded, even though they potentially make up a larger proportion of the benefits from non-network solutions relative to traditional network solutions. Tesla has observed the following specific issues:

- **Optionality**: whilst part of the framework, we are yet to see this value ever captured through standard models. We note this requires more complex, probabilistic modelling (to factor in load/generation uncertainty), but this may be warranted as it forms a key part of the value proposition for non-network solutions relative to network assets (e.g. rapid deployment of battery storage that can be deployed in months not years). It would also exclude the modularity value of batteries that can be scaled up or down as uncertain load and generation forecasts are realised (or not). We note that this uncertainty appears to be increasing with the rapid transformation of the

[1] See HoustonKemp Report: Regulatory treatment of large, discrete electricity transmission investments, August 2020; and Simshauser et al paper noting: *"parametric uncertainty regarding aggregate demand, construction costs, policy, long-lead times and the consequences of irreversible investment commitment typically means transmission planners are in fact highly risk averse"*

[2] See TransGrid Wallgrove Battery; Powerlink's battery EOI; ElectraNet Network Vision 2021; Powercor Victorian REZ proposal; Victorian SIPS Big Battery (that derogated from RIT) with underlying cost-benefit modelling; Western Power distributed storage plan for WA; and strong pipeline of network procured battery storage across US markets (e.g. PJM and CAISO).

energy sector. Fast deployable solutions such as grid-batteries or aggregated DER has demonstrated benefits to reduce network upgrade costs, accelerate timelines, avoid sunk costs, or defer the build out of major projects.

- **Market benefits**: battery storage has consistently demonstrated its ability to reduce prices in wholesale energy and frequency control ancillary service markets. NSPs following RIT-T guidance exclude these benefits on the basis of 'wealth transfers' between market participants, but this appears to completely negate the benefits from improved liquidity and/or the removal of price distortions in the market. There would also likely be reduced costs on other partiers (e.g. back-up plant).
- **Resiliency benefits**: Inter-regional resiliency and planning is another prime value opportunity – storage has proven capability to provide resiliency and system security within and across regions (e.g. virtual transmission, batteries providing system restart ancillary services etc.). Hornsdale Power Reserve has already evidenced its premium ability to support arresting frequency in multiple system security events - a clear example of the ongoing need for network investments in batteries and the wider role 'virtual transmission' capacity can play. It remains unclear how any of this value is currently captured through the RIT framework.
- **Ancillary market benefits:** we understand NSPs only typically model wholesale energy changes occurring in dispatch - considering FCAS a negligible class of market benefit. However, this is backwards for battery storage projects that currently see most of their value realised in FCAS markets. More detailed modelling would ensure the true value of these benefits can also be captured, even if it is more complex than energy only models.
- **Capital Cost Asymmetry:** battery storage can provide multiple services to multiple parties. We understand the AER has recently updated guidelines to address asymmetries between capex and opex solutions (i.e. regardless of ownership the total economic cost of solutions should be captured), however recent discussions with NSPs suggest this will disadvantage battery storage even further, which is disconnected from the reality of investment decisions.

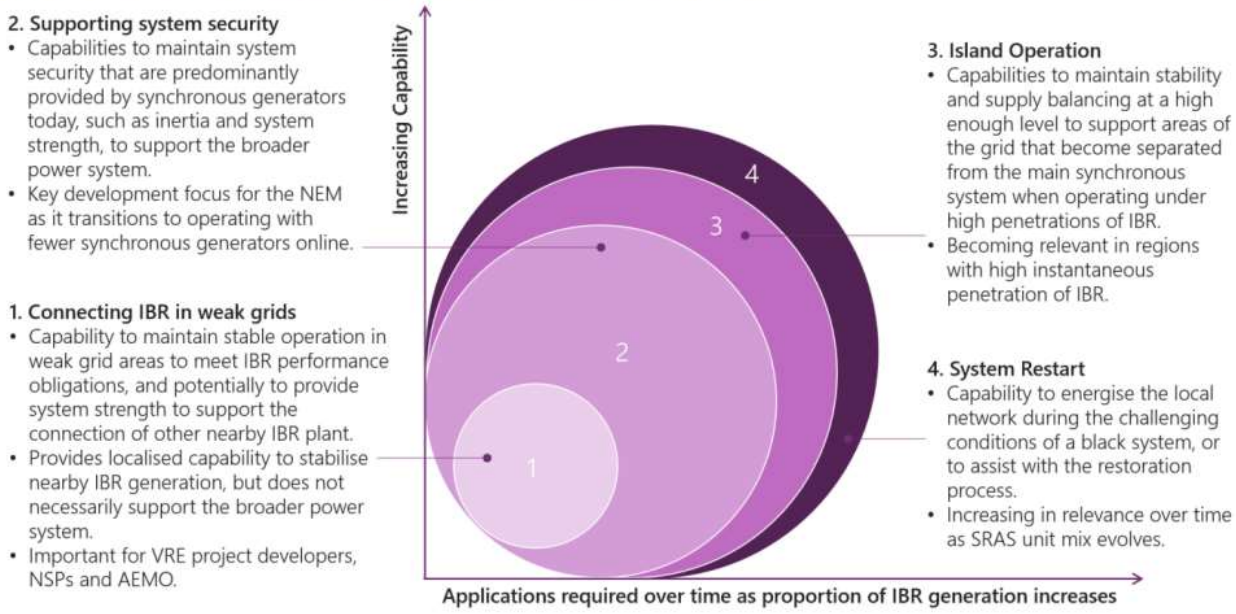
Collectively, these issues create significant distortions in outcomes. Failing to provide for a true assessment of the costs and benefits of non-network options is driving a significant disconnect between what is theoretically modelled in RIT-T rankings, and what is actually the most commercially viable and beneficial projects in practice. Tesla is working closely with market bodies to demonstrate the implications of these barriers to projects and is highly motivated to work with NSW Government to ensure they are not transposed or preserved as part of the NSW Roadmap or TET design, as this would clearly not be in the long-term interest of NSW consumers.

Background: Battery storage benefits

Appropriate planning and integration of energy storage is vital for the long-term reliability, security and emissions reduction ambitions of the Australian energy market. This is now widely recognised by all market bodies: AEMC's recent Integrating Energy Storage draft determination is testament to the importance of storage; with AEMO's 2020 Integrated System Plan anticipating that up to 50GW of new large-scale renewable energy generation will be supported by almost 20GW of new storage capacity (per the step change scenario) to provide resource adequacy. This capacity will be made up of pumped hydro, large-scale battery energy storage systems, and distributed batteries, including virtual power plants (VPPs).

In addition to now well understood wholesale market services (energy and frequency control ancillary services), there are increasing applications where battery storage can competitively provide services, as demonstrated in AEMO's latest white paper on advanced inverter technologies[3] :

Figure 1 Increasing relevance of applications detailed in this paper



Battery storage systems have proven their ability to provide all essential energy, system and network services (e.g. fast frequency response, inertia, voltage stability, system strength) – with premium speed and accuracy. AEMO's white paper[4] highlights the importance of inverter-based technologies, grid-forming battery storage in particular, in supporting the transition to high penetration renewable systems, and the need for new assets to provide inertia, system strength, and voltage stability in place of a retiring synchronous thermal fleet. Tesla is actively working on two leading project trials to demonstrate its grid-forming capabilities through its Virtual Machine Mode (VMM): (1) Hornsdale Power Reserve (HPR) in South Australia; and (2) TransGrid's Wallgrove Battery.

Unlocking provision of all services (stacking wholesale market revenues with essential system and network services) is a necessary precursor to deploy storage at the scale required and will accelerate uptake and support development of new commercial models. This is being increasingly recognised by state-led energy policies, including NSW Government's 2GW storage target, and the Victorian REZ Development Plan to integrate 2.4GW of storage across the state. Whilst some market reforms are progressing to support this future (e.g. TransGrid's System Strength rule change), achieving these targets will require regulatory reforms, rule changes, or innovative state policy that ensure our network planning framework keeps pace with speed and scale of the transition already underway.

[3] See AEMO White Paper – Application of Advanced Grid-scale Inverters in the NEM
[4] Ibid