Tesla Motors Australia Pty Ltd
650 Church St
Cremorne, Victoria, 3121

Gerard Reiter
Executive Manager Network Planning and Operations
TransGrid
180 Thomas Street
Sydney NSW 2000
Submitted to: regulatory.consultation@transgrid.com.au

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Re: Expanding NSW-QLD transmission transfer capacity, Project Assessment Draft Report

Dear Gerard,

Tesla Motors Australia, Pty Ltd (Tesla) welcomes the opportunity to provide TransGrid and Powerlink with feedback on the Project Assessment Draft Report (PADR) for expanding NSW-QLD transmission transfer capacity. Tesla welcomes the consideration and assessment of the potential for grid-connected battery systems to address near-term transmission needs and looks forward to working with TransGrid and Powerlink and engaging more broadly on virtual transmission opportunities going forward.

We understand the greatest value under this PADR's market benefit test arises from avoided/deferred generation and storage needed in NSW, relative to the base case. We also note the PADR found that whilst Option 5B had the greatest estimated gross benefit of all options, it had lower net benefits due to the relatively high upfront capital cost and the need to re-invest due to a comparatively shorter system life.

From the general perspective of RIT-T modelling of battery energy storage solutions (BESS), Tesla highlights the importance of testing the robustness of key assumptions underpinning these non-network solutions, which may have led to a different outlook in the PADR's assessment of Option 5B in particular. This includes:

1. **Cost sensitivity analysis** should include lower bound cost envelopes to align with latest industry figures (up to 50% lower BESS capital costs) rather than rely on possibly inflated/outdated public data. We note that the GenCost BESS assumptions used by AEMO, tend to be at the high end of public BESS costs. Transparency of outcomes (including a goal-seek capital cost threshold) will be critical to provide industry confidence on the viability of virtual transmission projects in the NEM;
2. **Key technical parameters** (asset life, duration, round-trip efficiency) should also seek to maximise the overall value of non-network assets – including longer duration energy storage capacity (e.g. 1.6 hour or 2 hour systems rather than 30 minutes); and longer technical life assumptions (or whether 25+ year capacity guarantees could be contracted as a cheaper alternative to completely replacing assets); both of which would drive substantial increases to the net benefits assessment and provide a less biased comparison against long-life network assets; and
3. **Broader market benefit assessments** to explore upside scenarios that capture additional services beyond short-term network requirements (e.g. ancillary services, wholesale energy arbitrage, voltage stability, inertia contributions, MLF improvements) – noting ongoing transformation of regulatory frameworks, third-party ownership structures, and potential for additional revenue streams to be provided by BESS solutions over the medium to long-term.

Context

The PADR and underlying market modelling clearly demonstrates how Option 5B delivered higher gross market benefits than all the other options, and by a significant margin:

Table 1: Summary of gross market benefits; Real June 2019; $m

Option	Neutral	Neutral + low emissions	Fast Change	Slow Change
1A	379	382	451	240
1B	179	230	284	71
1C	146	94	112	159
1D	95	59	67	115
5B (BESS)	499	462	532	438

Source: EY modelling

Reinforcing this outcome, modelling by both HoustonKemp and EY show that the grid-scale battery option provides the greatest source of market benefits through avoided generation build costs, driven by the largest increase in transfer capacity of all options. However, as made clear in the PADR, these benefits were dampened by key modelling input assumptions and estimations, most notably the capital costs and BESS asset life timeframes. Whilst still an emerging application for network companies in Australia, the concept of virtual transmission with BESS has already proven valuable in other jurisdictions (e.g. see 6MW / 48 MWh battery system in Nantucket Island, Massachusetts)[1] and given the demonstrated gross benefit advantages and scale of the build, warrants more detailed sensitivity analysis and engagement with technology providers.

<u>Additional sensitivity analysis</u>

Scenario analysis is a useful way to reflect market, commercial and regulatory uncertainties, particularly at such a transitory period of NEM development. We note the PADR's range of sensitivity analyses have been conducted across Liddell's retirement deferral, coal price variations, and potential impact of outages. In the same way, it is worth exploring additional input scenarios and sensitivities – such as battery capital cost and duration estimations as noted above, or how early retirement of thermal plant may drive timing requirements – which would presumably provide additional value to the rapid deployment potential of Options 5A and 5B.

Although four scenarios have been used, it appears the underlying assumptions for each of the four scenarios still effectively uses only two battery storage capital cost inputs (aligning with the methodology undertaken by AEMO for the ISP), both of which are significantly higher than industry estimations. As such, the envelope of net benefit outcomes for the storage options is artificially inflated relative to the other options being assessed.

<u>Hybrid / staging opportunities</u>

Modelling could also include a staging of deployment – driving economic benefit by deferring capital requirements until market outcomes are better understood, or providing flexibility to scale-up/down the capacity depending on interdependencies with other network or generation investments occurring over the period (not to mention the potential for any government policy announcements). BESS are unique in this regard, with their scalability combining with potential for rapid deployment timeframes, relative to traditional network investment (months as opposed to years).

This approach could also be combined with the 'hybrid' opportunities touched on under Option 5A – to further explore the advantages provided from early deployment (ahead of June 2022) of a 'modest' BESS coupled with incremental network investment. Benefits from any immediate upgrades are also expected to be realised immediately - through avoided fuel costs, increased generator efficiency from Queensland, limiting congestion, as well as short-term risk mitigation should any unexpected outages or system security events occur in the next 2 to 3 years (ahead of Liddell's expected retirement).

[1] www.utilitydive.com/news/Tesla-national-grid-battery-energy-storage-8hour-long-duration-diesel-generation-system-nantucket/564428/

This approach would also ensure a more consistent increase in capacity on the network – as opposed to the network only options that appear to be significantly affected by temperature, demand and nearby generators (i.e. the Sapphire wind farm).

1. Technical Parameters

Duration

The PADR outlines two battery storage options of 30 min duration (a 40MW/20MWh and a 200MW/100MWh). It also notes that this shorter duration may be insufficient to re-secure the system under some conditions. Tesla encourages assessment of longer duration storage options, to recognise the increasing value provided by longer duration battery storage in the NEM. At a minimum, we recommend the Project Assessment Conclusions Report (PACR) incorporate 1.6-hour and 2-hour energy storage options as part of modelling – both of which could provide additional energy capacity benefits without commensurate increases in cost. This approach aligns with ISP modelling that has been updated from 2018 to now include both 2-hour and 4-hour battery storage variants with increasing recognition of the role storage can play in supporting high-penetration renewable grids.

For storage, service provision is fundamentally an opportunity cost assessment – using dispatch models and forecasting software to optimise when, in what markets, and how much to bid the limited energy capacity that is available in order to maximise returns. This is where longer duration battery storage will allow for greater flexibility in service provision beyond simply network security – e.g. bidding strategies to capture peak price events. The surplus energy capacity can also be used to provide additional ancillary services to deliver higher project revenues (‘revenue stacking’).

It is important to note a doubling of the energy capacity of a battery does not result in a doubling of the cost, as this is not a simple linear relationship. Whilst some deployment costs will vary (depending on project specifications, size, location and other unique installation costs), many of the costs of deploying a battery storage system are largely fixed (e.g. inverters, transformers, control systems, balance of plant, market registration, grid studies and connection). Tesla’s cost estimates provided in the table and figures above highlight how 1.6-hour energy duration cost estimates are already lower than assumed 30min cost inputs.

Across the lifetime of the BESS asset, it is expected that the value of these services will only increase as more thermal generators retire and market changes are made to incentivise and reward all fast acting and flexible frequency, voltage and inertial responses that battery storage can offer. Overtime, for future developments, these non-energy services should increase their proportion of the value stack, particularly as non-traditional network support services and grid infrastructure deferrals are able to be monetised, and as regulatory reforms unlock more appropriate markets to value the services being provided.

Asset life

The RIT-T analysis spans a 26-year assessment period from 2019/20 to 2044/45 and the PADR includes an asset life for BESS at 15-years. There is clearly a true-up needed to match the assessment period with the useful technical life of BESS assets. However, we view the PADR’s method of completely replacing the BESS at year 15 as a blunt and simplified approach which significantly disadvantages the non-network options.

We understand that inputs to BESS asset life assumptions are often based on a guaranteed energy provision warranty from manufacturers, which may have led to the 15 year figure. However, the market is already seeing a shift to 20 year warranties being offered, alongside ‘capacity maintenance availability’ (CMA) guarantee products as an innovative and more economically efficient way to ensure no degradation in energy capacity over the operating life of the BESS (i.e. rather than completely replace the full 40MW or 200MW, vendors can guarantee ‘x’% of the MW at the end of each year for an annual fee, and then ensure battery system capacity is ‘topped-up’ throughout the duration of the asset’s life – which also smooths out the investment profile.

Moreover, beyond this 15 to 20 years, storage assets are not worthless and will still be able to provide value to the grid (and market), albeit with declining levels of energy. This should be equivalent to assumptions commonly made for ageing coal and gas plants that are still factored into models up until their effective retirement date (or in more sophisticated models may even include increasing levels of full/partial outage rates and expanding de-rate factors prior to retirement).

2. Market Benefit Assessments

In the context of Option 5B providing the greatest level of gross benefits – it stands to reason that if more market benefits can be identified (alongside modelling a lower envelope of battery costs and increased asset duration), then it would also provide greater net benefits relative to the proposed preferred network Option 1A. This would be re-enforced through the use of third party contracting arrangements (with TransGrid / Powerlink sharing opex rather than capex service payments) to allow for increased market participation.

Tesla notes the PADR specification that the full power capacity of the BESS needs to be reserved for managing interconnector stability limits. It is presumed there is a network risk/benefit assessment that underpins this requirement, but given the suite of additional benefits that BESS solutions can provide more broadly to the market, it may be worth exploring dynamic requirements that free up some BESS capacity at times of low risk, or to stagger capacity requirements depending on particular set points. Over time, as the performance of BESS in virtual transmission applications becomes better understood by contracting parties, these capacity requirements could be further relaxed to allow BESS to expand provision of services across multiple markets and drive increased system benefit.

At a high level, in addition to grid stability services, BESS assets can provide:

- Premium FCAS services (across all 8 contingency and regulation FCAS markets) – a non-trivial revenue stream for 3rd party asset operators;
- Addition power system services such as VCAS – which could be included as additional revenue streams;
- Virtual inertia – currently being demonstrated via AEMO trials as part of wider frequency control reforms; and
- MLF improvements for projects located in neighbouring regions - noting the relatively smaller size of the modelling outcomes for MLF benefits)

Even technical commentary included in the PACR on the potential for BESS solutions to manage system security constraints or provide some of these services will be valuable to clarify expectations for industry, particular in light of recent decisions being made to procure large synchronous condensers and an increased focus on inertia requirements going forward.

Conclusion

With updated assumptions and sensitivities run on BESS costs, technical parameters, and potential market benefits, RIT-Ts will provide a more thorough and instructive assessment of non-network solutions and provide a more transparent signal to the sector of the potential for grid-scale storage to provide virtual transmission. We look forward to seeing the results of the PACR, engaging with TransGrid and Powerlink on subsequent RIT-Ts and consultations made for expanding transmission transfer capacity, along with other network upgrade assessments being considered and explored as part of the 2020 Integrated System Plan.