Director, Climate Change and Energy Savings Policy
Department of Planning, Industry and Environment
New South Wales Government
via email: energysecurity@environment.nsw.gov.au

22 June 2020

Re: Energy Security Target and Safeguard Consultation paper

Dear Director,

Tesla Motors Australia, Pty Ltd (Tesla) welcomes the opportunity to provide feedback on the Energy Security Target (EST) and Energy Security Safeguard Scheme (ESS).

As a world-leading manufacturer of battery energy storage systems, Tesla is acutely aware of the role that new technologies can play in securing renewable energy supply, given our mission to accelerate the world's transition to sustainable energy.

We support the ongoing work being undertaken by the NSW Government to create a stable policy environment to underpin long-term investments over the decades to come. As such, Tesla is fully supportive of the overarching NSW Energy Strategy that will coordinate the EST and ESS to ensure a clean, reliable and affordable future system for all NSW consumers. We also support both schemes being introduced as soon as practicable to realise immediate savings for consumers.

As these two schemes develop, we provide the following considerations:

- The entry of new-grid scale and behind the meter storage assets provides one of the most efficient and flexible solutions for NSW to address reliability shortfalls under the EST. Grid-scale storage solutions have much greater deployment flexibility relative to alternatives. Residential storage can also play a critical role, particularly when operating as virtual power plants (VPPs).
- The ESS should be designed to leverage existing programs that have demonstrated the technical capabilities and benefits of price responsive assets (e.g. AEMO's RERT and VPP trials), noting market-facing assets unlock the greatest value for customers whilst ensuring scheme efficiency.
- We recommend simplicity in design, via upfront certificate payments tied to capacity size ($/kW) with additional consideration to reward operational flexibility, bi-directional benefits (charging and discharging) and emissions reduction.
- We support the ESS providing additional 'capacity' revenue, complementing other market payments, with reporting streamlined with existing processes.

Additional detail relating to Tesla's position is included in the content below.

Kind regards

Emma Fagan
Head of Energy Policy and Regulation

1. Energy Security Target

General Comments

Tesla is looking to accelerate the integration of energy storage across Australia to help deliver new, low cost, low emissions generation and create greater market competition. However, given existing barriers currently preventing uptake at the pace and scale required, we see an important role for government – both through direct investments to support asset and infrastructure deployment over the next 5 to 10 years, as well via effective policies to scale these technologies and facilitate long-term private sector investment and ongoing innovation.

We recognise the State's electricity market is currently going through a period of massive transformation – away from the ageing fossil fuel generation fleet (with Liddell retiring in 2023), and towards increased penetrations of wind and solar, particularly in the north and western regions. However, it is not just about increasing the proportion of renewable generation coming from wind and solar assets – as recognised by both NSW Government and the market operator, appropriate integration of energy storage will be critical to supporting this aim. We expect the uptake of storage from 2020 onwards to be seen at all levels, from grid-connected utility-scale storage, to behind the meter assets supporting commercial and industrial businesses, through to the integration of household battery systems to complement the rapid and promising uptake of solar PV across Australia.

Following half a year of extreme events in 2020, resiliency and system security is also gaining renewed attention, particularly for essential services such as water and electricity. As average summer temperatures increase and the reliability of the existing NSW coal generation fleet decreases, ensuring adequate supply is available, alongside grid back-up protection is becoming an increasing focus for all customers.

Government funding support through an appropriate mechanism will provide greater investment certainty for vital projects that can support a stable and smooth transition, particularly as existing market rules and regulations lead to additional barriers and costs and limit the full potential of revenue opportunities. Such projects provide continued demonstration for the Australian market that significant renewable penetration can be reached without sacrificing grid security or reliability, and provide affordability benefits for all consumers.

From an energy storage perspective, whilst still a growing sector, the NEM currently provides mixed signals for investors looking to develop private storage projects, highlighting a significant gap in meeting AEMO's forecast levels of storage deployment at all scales by 2030 (i.e. up to 6GW by 2030 in NSW alone as projected in the 2018 ISP 'fast change' scenario). These projects are crucial to contribute to both reliability and system security outcomes in the short term, and to drive affordability and efficiency outcomes for consumers over the longer term. From a wider market design perspective, AEMO highlights the increasing role of storage to provide an attractive alternative to investment in network infrastructure, provide key grid services, and enhance market competition for wholesale energy and ancillary services as stand-alone or aggregated assets in the form of additional dispatchable generation capacity.

It is within this context that the NSW Government should consider what potential market design features in the EST and ESS will be necessary to stimulate the requisite levels of private investment.

The role of battery storage

Both solar and wind are well-established technologies to provide clean and reliable power generation, and a necessary pathway to support NSW's energy goals and long-term net zero emissions strategy.

However, without some way to store or 'time-shift' the renewable generation to match both on-site and grid peak load times, renewables alone will never deliver the full benefit of a secure, reliable and clean energy system.

As a technology, battery energy storage provides an immediate and flexible solution to support system security and improve reliability, on top of any broader sustainability goals. In addition, with a fully flexible operating profile (i.e. acting as both load and generation), battery storage can directly optimise and accelerate the uptake of renewable generation, whilst simultaneously providing frequency control and network stability benefits.

Increasingly, behind the meter batteries can be aggregated as Virtual Power Plants (VPPs) so they not only participate in traditional “behind the meter” activities (optimising on-site generation for solar self-consumption), but can now also unlock “front of the meter” revenue streams by enabling participation in wholesale energy and Frequency Control Ancillary Services (FCAS) markets.

This allows operators to tap into the full “value stack” of energy storage – critical to make customer investments economically attractive and to maximise the value proposition for the entire system across NSW and the NEM more broadly.

Market Benefits

Ensuring storage is appropriately incentivised to enter and participate in the NSW energy system, will unlock direct benefits to NSW, including reductions in peak demand (flowing through to reduced electricity costs), provision of fast and flexible dispatchable generation, system back-up for critical loads, and acceleration of carbon emissions by maximising the value and use of both on-site renewable energy, and more broadly in the grid through stabilisation services being provided (see Appendix for additional background on these benefits).

There are also multiple sources of value that a battery storage solution can provide customers indirectly, either as benefits to network companies, or via system operations. Whilst non-network alternatives are still facing barriers under Demand Management Incentive Schemes, these benefits can be clearly assessed and articulated by the RIT-D market benefit test (see Table 1). By ensuring appropriate incentives are introduced under the Energy Security Target and Energy Security Safeguard programs, NSW Government can accelerate and maximise these benefits for the state’s consumers.

Table 1: RIT-D Market Benefits and battery storage potential

Benefit category	Potential battery contribution
Changes in fuel consumption - arising through different patterns of generation dispatch	Allows inter-temporal optimisation between times where fuel costs are high and other times where fuel costs are low
Changes in voluntary load curtailment and involuntary load shedding	Mitigates the risk of peak load, thereby increasing the probability of maintaining system stability following the loss of a network element
Changes in costs to other parties - due to differences in the timing of new plant, differences in capital costs and differences in operational and maintenance costs.	May avoid (or defer) the need for new investment to maintain the same level of reliability and dispatchable supply; can provide voltage control and system strength services, reducing the need for investments by other parties
Differences in the timing of distribution investment	May avoid (or defer) the need for new investment to maintain the same level of reliability and dispatchable supply; can relieve other distribution network limitations
Changes in network losses	Allows inter-temporal optimisation to minimise losses in the local network
Option value benefit - high-impact, low probability events can carry significant cost implications	Modular/rapid deployment allows flexibility to respond to new information as or when it emerges; BESS provides option value benefits, and would allow better management of uncertainty in network development/load projections; and the ability to design network solutions with optionality for scale-efficient expansion in future

Deployment speed and flexibility

We note that of all the corrective actions in the case of an expected breach to the EST, aside from 'doing nothing', the most efficient action to implement, providing government with greatest optionality, would be to incentivise the entrance of new flexible capacity into the system – for example grid-scale or behind the meter storage assets that can be deployed in a matter of months, weeks or days depending on the project scale. This is in contrast to years of design and development required for alternative technologies (e.g. gas peaking plants or pumped hydro storage assets), attempting to progress upgrades to the transmission network, or developing new regulatory frameworks – all of which can take multiple years, even when being fast-tracked. This flexibility also provides government a natural hedge against large-infrastructure projects being coordinated inter-jurisdictionally and/or with Commonwealth support, where delays may be unforeseen or less in control of NSW Government directly (e.g. Snowy 2.0, transmission interconnector upgrades navigating AER approvals, other projects contingent on AEMC regulatory reforms).

For example, Tesla's grid-scale storage solutions have been specifically designed to have a flexible and modular deployment profile – systems can be installed in any location on the network and are fully scalable – with project size based on customer need and timing. Projects up to ~100MW can be deployed in less than 6 months, with larger projects around 10 months. In the US we are seeing much larger projects being planned along similar timeframes.

Interactions with National Mechanisms

It would be helpful to provide industry with clear interactions of the EST with national frameworks and in particular how it is complementary to the short- and medium-term strategic reserve reliability measures such as the Reliability Emergency Reserve Trader (RERT) and Retailer Reliability Obligations – particularly given latest updates that tighten the triggers for both mechanisms to have unserved energy (USE) to be less than 0.0006%. Acknowledging differences in temporal priorities between national reliability schemes and those proposed in NSW over the longer-term, there are also likely overlaps arising with the Energy Security Board's Post 2025 work program that is exploring a suite of forward looking resource adequacy mechanisms, alongside other reforms to update market investment signals to be more appropriate to our future energy system requirements.

Assessing the firmness of storage generation

Tesla recommends a clear framework for assessing the contribution of storage, including further consultations with industry to support design of a capacity factor for storage to assess firmness.

As a starting point, we recommend leveraging international precedence for battery storage participating in capacity markets receiving upfront or annual capacity payments based on a de-rate:

- In California, for storage to be eligible for 100 per cent capacity credit, it must have "the ability to operate for at least four consecutive hours at maximum power output" (the 4-hour rule)
- In Great Britain, there are ~500MW of battery storage projects currently participating in the capacity market, with varying contract lengths and de-rating factors, but the scheme currently offers >98% of the full capacity payment for 4 hour systems.
- In France, batteries are de-rated at 100% (i.e. awarded for their entire capacity). This reflects a lack of security of supply issues in the near term, with policy makers and grid operators seeking to increase their understanding of how battery storage performs at a system level – ahead of an expected influx in later years (when de-rates may be revised downwards).

This approach should also apply to aggregated storage assets such as Virtual Power Plants, which will form an increasingly viable part of the demand and supply mix in NSW.

Data provision and reporting requirements

Tesla agrees that the NSW Government should first seek to leverage existing data and information gathering platforms already managed by AEMO to ensure there is no unnecessary duplication of reporting requirements and to avoid overly burdensome administrative costs on market participants with multiple projects across multiple states. Alternatively, NSW may which to explore whether it can be agreed for AEMO to collect and monitor the information required on government's behalf to further streamline the process.

2. Energy Security Safeguard Scheme

Battery storage and VPP benefits

Distributed energy resources (DER) will play a critical role in the future of NSW's energy supply mix, with residential solar and home battery storage systems increasingly participating in energy markets as virtual power plants (VPPs). Battery storage in particular, has demonstrated its ability to provide both peak demand response and peak demand shifting and accordingly should be enabled to access potential incentives across both ESS components[1].

The ESS can play a clear role in enabling and incentivising growth in battery assets, whilst also ensuring deployment unlocks the potential benefits that aggregated assets can provide in terms of critical network support and reducing consumer and market costs when operating as part of a VPP.

These benefits have already been demonstrated by several trials in Australia (e.g. AEMO's VPP Demonstration Trial; South Australia Power Networks Salisbury Trial; and Energex), which highlight how the aggregation and smart management of battery energy storage assets operating as a VPP can reduce peak demand, reduce peak export, respond to negative price events/minimise curtailment, and minimise overvoltage issues:

> *"… the data received so far indicates that VPPs can effectively respond to power system events and price signals. This includes responding to frequency excursions beyond the normal operating range (49.85-50.15 Hz) and pre-charging (or discharging) to cater for future high (or low) price events, respectively."*
>
> *"VPPs can benefit:*
>
> - *Participating consumers by sharing the value earned through the VPP participating in FCAS or responding to energy market prices; and*
> - *All other consumers by creating more competition in these markets to reduce prices and, if VPPs scale up enough, potentially deferring/displacing the need for large-scale generation assets."*

AEMO VPP Knowledge Sharing Report March 2020[2]

There are already thousands of residential battery systems deployed across NSW, with only a small percentage of this fleet operating as VPPs. The vast majority of these systems are not being capitalised for market participation, largely because of the lack of market incentives, but also due to perceived complexity and upfront investment cost. Ensuring ESS design includes incentives for VPP capability is a simple way to encourage grid interactivity and remove some of these key barriers.

Managing solar and battery operations in a controlled manner under a VPP arrangement means that systems not only reduce peak demand stress, but can contribute to the grid when energy or system security services are required, as well as minimise grid exports during periods of low demand. Therefore, continuing to encourage the uptake of VPPs is critical. As an example, Tesla's SA VPP, which recently expanded from public housing trust customers to private customers in South Australia, is leading the way in highlighting opportunities that can be realised across multiple stakeholders, with local network utility SAPN, market operator AEMO and residential customers enjoying some of the benefits of aggregated storage and solar systems providing energy and ancillary services.

VPPs can also have a demonstrable impact on reducing wholesale price exposure of the utilities themselves, where they have invested in appropriate active DER infrastructure. For example, Green Mountain Power in Vermont, has invested in a VPP consisting of 2,000 Tesla Powerwalls as part of a pilot project. In July 2018, Green Mountain Power estimates that the VPP saved the utility $500,000 over the course of a week.

Tesla is also seeing increasing appetite from commercial and industrial customers (e.g. wineries, factories, schools, and council buildings) to address affordability and reliability issues using battery technology. Incorporating these larger industrial-scale sites into VPPs can ensure businesses with high and increasing annual electricity costs can immediately reducing bills and provides greater control of energy usage at a larger scale – further reducing peak demand impacts across NSW. Market integration also increases competition and can provide flow-on benefits across the network – e.g. voltage control, frequency services and back-up power (see Appendix for additional detail on benefits from battery storage).

[1] As electric vehicles become more common, charging infrastructure will also be able to provide peak load reduction and shifting services.

[2] https://aemo.com.au/-/media/files/electricity/nem/der/2019/vpp-demonstrations/aemo-knowledge-sharing-stage-1-report.pdf?la=en

Timing

Tesla supports a market based scheme as designated by the Government. We also highlight that industry already has the technical capability to support this scheme – as evidenced by the AEMO VPP and ARENA RERT trials, as well as the proposed introduction of the Wholesale Demand Response Mechanism confirmed for October 2021, starting with large customers.

The trials provide a good example of how rapidly shifting from consultation into physical operations can provide valuable market insights and customer benefits. The technical capability to provide a wide variety of services including peak demand reduction already exists. However, a structured framework with sufficient government incentives is still required to accelerate the uptake and unlock the true value potential of DER in providing these services, and to ensure the consumer benefits are realised ahead of locking in unnecessary alternatives such as expensive network or generation plant upgrades.

Accordingly, Tesla recommends the re-constituted ESS commence as soon as practicable. In line with the principles of maximising value for money and reducing electricity costs for consumers, if there are energy efficiency and peak demand reduction solutions readily available, it makes sense to capture these opportunities, even if NSW does not foresee reliability risks in the near-term.

These advantages have become an even greater priority following the black summer of bushfires, coupled with ongoing difficulties and uncertainty for consumers imposed through COVID-19. Whilst short-term impacts of the pandemic may see relief from typical demand levels, the general expectation is for demand to rebound as soon as lockdowns are eased.

NSW launching these additional incentives can help give businesses certainty, particularly following COVID-19 impacts, whilst simultaneously reduce consumer electricity prices. Further, as noted in the consultation paper, *"Irregular payments in response to peak events alone may not be enough to incentivise deployment of significant demand response capacity"* which is equally applicable to battery storage uptake more generally. Therefore additional capacity payments under the ESS will provide a critical catalyst to support immediate progress towards NSW's net zero emissions ambitions.

Provided the NSW Government supplies industry with clear guidelines for scheme participation, and ensures scheme design is simple and logical (see comments below), there should be no barriers to the accreditation of certificates. Energy schemes targeting small scale assets in other jurisdictions (e.g. direct grant and discount loan programs running in SA and Victoria) have already demonstrated industry's ability to be flexible and innovate products and services to maximise consumer benefits with relatively short turn-around following scheme announcements.

Scheme design – keep it simple for storage

Tesla recommends leveraging learnings from past and ongoing trials to help structure the ESS, most notably the Demand Response Reliability and Emergency Reserve Trader (RERT) trial[3], AEMO's VPP Trial, and related state-schemes applying to DER. Collectively, these programs have already demonstrated the benefits provided across residential, commercial and industrial portfolios and highlight the capabilities across a range of different participants, including retailers, demand response aggregators, VPP operators, storage, industrial loads and electricity network distribution companies.

<u>Elements to avoid</u>

Design principles for the ESS to consider should focus on keeping structures simple and easy to understand for customers and providers, avoiding more complex structures used at the grid-scale under the EST.

For example, we suggest NSW Government:

- Avoid introducing additional operational requirements which may be at odds with the economic signals customers receive via their retail tariff or market signals as part of VPPs, as this would introduce unnecessary complexity in dispatch optimisation.
- Avoid % based project caps. We note reference to the international example of California, where Pacific Gas and Electric scheme has facilitated the uptake of behind the meter storage through its targeted incentives, with up to 75% of total installed costs. Whilst we agree with the sentiment of

[3] https://arena.gov.au/assets/2019/03/demand-response-rert-trial-year-1-report.pdf

this scheme, we note that incentives that include a specified % of project costs artificially constrain customer choice, as this structure rewards higher priced projects relative to projects where the % cap becomes binding. Instead, a flat $ cap would provide a more equitable signal across different technologies, so long as the cap is set at a level high enough to ensure a strong signal is provided to underpin customer uptake, as well as for industry to dedicate effort in leveraging the scheme benefits.

- Eliminate locational restrictions (e.g. via postcode tranches) as these create significant disruption to the wider industry as the unintended outcome is a deflation of demand that would have otherwise existed - as customers rationally postpone business as usual purchases on the hope their post-code or nominated area becomes included in future subsidy rounds.

<u>Recommended Scheme Design</u>

In keeping with the principles of simplicity and economic efficiency, market signals should be relied upon as much as possible. This will ensure optimisation of dynamic assets to provide the most efficient customer and system-wide outcome, and will avoid the need for overly complex accreditation design considerations for capable technologies.

NSW can leverage the fact that market facing assets (e.g. battery storage operating under a VPP) are already responding to market signals (and optimise their charging/discharging profiles accordingly), and the ESS can therefore layer a structure onto this to further avoid peak demand shortfall events in NSW, and ensure assets are available and incentivised to provide energy (or reduce load) when it is needed most.

As a preliminary design structure to implement (and to be further refined with NSW Government), Tesla recommends:

- AEMO notifications for Market Price Cap events form the basis for peak demand events defined under the ESS
- The ESS issues Peak Reduction Certificates based on capability to respond to these notifications. Assets would therefore need to have price response algorithms to be eligible to ensure appropriate dispatch (e.g. battery storage would need to be part of a VPP)
  - NSW Government could also look to limit the frequency of response (e.g. assets may only be required to respond to [5] events per year)
  - Capability should be tied to asset type, with either additional payments for fast (and short notice) response assets, or alternatively consider different notice periods to account for different technological requirements (e.g. day ahead vs hours)
- Accredited assets would receive both ESS capacity payments, and any additional revenue from market dispatch to ensure appropriate incentivisation (see sections on Scheme Complementarity and National Mechanism Interactions below)
- For storage, scheme compliance could leverage VPP base tests to demonstrate capability to deliver appropriate response prior to program accreditation and onboarding assets (e.g. see AEMO VPP Fleet Wide test requirements[4]).
  - This approach avoids NSW Government conducting its own ex-post compliance tests
  - As long as each accredited battery system meets minimum functionality, the ESS need not layer on additional conditions (e.g. temperature, timing, price or other activation thresholds)
- We also support non-expiry of certificates to maximise flexibility and ensure customers achieve maximum savings.

Under this design structure, NSW can minimise the need for extensive customer consents to force response each and every day on the assumption that this operating profile is supporting peak demand reduction. Instead, the scheme simply bolsters incentives for the uptake of peak shifting technologies, and then lets existing market signals and processes ensure they are operated appropriately.

[4] www.aemo.com.au/-/media/Files/Electricity/NEM/DER/2019/VPP-Demonstrations/VPP-Demonstrations-Enrolment-Guide.pdf

Additional Accreditation Considerations

- **Scaled capacity payments ($ per kW)** - we recommend upfront certification payments, tied to the system's capacity size (e.g. via $/kW scalars) to ensure customers are not facing perverse incentives to undersize systems or sacrifice quality products in order to maximise subsidy payments. This also keeps scheme design simple when recognising the potential for additional complexity arising from dispatchable assets (relative to lifetime savings captured from static and upfront efficiency saving measures such as upgrades to air-conditioning).
- **Reward Flexibility** - NSW Government may want to consider offering a scaled incentive mechanism that rewards 'better' response assets (i.e. faster, more accurate, greater granularity in real-time and dynamic flexible control) relative to more blunt control systems that may only offer on-off functionality. This provides a simple pay for performance aspect to the scheme and allows customers to consider technologies that offer a broader set of services to the benefit of both themselves and the wider grid, beyond simply peak kW provision. It can ensure the scheme is future-proofed as technology innovation also flows through to the household energy sector – where batteries and electric vehicles will continue their rapid uptake, and become a staple of households in the same way that appliances, air-conditioners and pool pumps have previously.

  This approach would better recognise the changing characteristics of the demand curve in parallel with the transition towards a mostly renewable generation fleet (e.g. very soon it won't make sense to reward a peaking generator or demand response provider that is slow-start, unresponsive and can't also provide valuable ancillary services).

  This also avoids the need for Government to be overly prescriptive about peak reductions required in future months, allowing for changing parameters based on seasonality, supply side risks or interruptions, extreme weather events etc. And perhaps most importantly, this approach provides an additional value stream for battery storage assets – allowing providers to innovate commercial models – as has already been seen in VPP models referenced above.
- **Bi-directionality** - the ESS could be used to support investments in both the load and generation sides of storage to improve firmness of renewable output. Allowing an uplift in the ESS accreditation for generating at peak times; and an increase in capacity credits for charging during low demand events should be highly encouraged as this would both maximise efficient investment in generation (without requiring additional network investment); and improve power system reliability by providing flexible charging. As highlighted above, this would also support a streamlined evolution as the electrification of transport and associated charging infrastructure scales.
- **Emissions reduction** - given NSW is seeking to achieve net zero emissions by 2050 – the ESS could also be used to help drive this and could aim for net improvement in power system emissions reductions by providing additional value for zero emission assets only.

Scheme Complementarity

We agree with the approach to complement the declining SRES funding with incentives to 'attach' battery storage to existing solar PV installations to unlock greater network and system value, including any additional valuation of the ability to dynamically adjust load and generation behind the meter in line with network requirements (i.e. respond to peak events and allow systems to fully swing from charging to discharging to not only reduce demand, but provide supply).

Accordingly, we support the principle that the NSW scheme can provide additional 'capacity' revenue (i.e. to encourage the entry and scale uptake of beneficial assets), whilst national energy markets (both existing and those currently under development) can be relied upon to compensate for the operation of these assets. However, in order for the ESS to be effective, these capacity payments will need to be sufficiently high to appropriately incentivise uptake – particularly while market design and reform processes are yet to capture and value all network and system security services being provided (e.g. inertia services, fast frequency response, voltage control). These payments could then be pro-rated downwards as the cost of assets falls with technology innovation, and the value of services increases as market reforms progress.

As a point of comparison, we point to the South Australian Government's Home Battery Scheme, which successfully leveraged an initial upfront grant of $6,000 for VPP-ready systems to incentivise thousands of new battery storage assets across the state, and which have been contributing significant benefits to peak demand reduction as well as driving savings in wholesale energy and ancillary service markets – benefiting all consumers.

Interactions with National Mechanisms

As above, it would be beneficial to outline any expected overlaps or planned interactions with national market designs, for example the Wholesale Demand Response Mechanism that will commence from October 2021, proposed 2-sided market designs being explored by the Energy Security Board, Reliability and Emergency Reserve Trader (RERT), and the Demand Management Investment Schemes already applying to Network Service Providers administered by the AER. We understand NSW government is approaching scheme design from the perspective of complementarity rather than additionally, and agree that a key benefit from this approach is allowing individual assets to value stack and integrate multiple contracted revenue streams with merchant revenue through dispatch in order to maximise utilisation and optimisation of assets across multiple services (whilst maintaining commitments towards NSW's goal to provide a peak demand service).

For example, during a peak demand shortfall event, providers would have access to secured capacity payments ($/kW) from NSW Government for response availability, in addition to any potential wholesale market revenues ($/kWh) obtained from energy discharged as part of a Market Price Cap event. This provides appropriate incentivisation to ensure uptake, and also recognises the benefits of avoiding potential RERT or even shortfall events in NSW, which represent significant financial value to residential and business customers – much higher than the Market Price Cap itself (see value of customer reliability studies[5]).

Product Safety

NSW Government can also leverage existing processes to ensure customer protections are maintained and products satisfy minimum quality requirements. We refer to established Clean Energy Council (CEC) accredited product and supplier lists, alongside product safety requirements which have become the central gating criteria for other battery storage incentive schemes (e.g. South Australian, Queensland and Victorian Home Battery Schemes). This ensures all customers have access to products that have already obtained certification against the Best Practice Guide for Battery Safety, and are registered on the CEC Battery Energy Storage product list.

[5] www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/values-of-customer-reliability

Appendix: Benefits of battery storage

1. Reduce electricity prices for all customers

Batteries can reduce prices by providing additional dispatchable power and stored capacity, increasing competition in wholesale markets and lowering end prices for customers.

For behind the meter systems, by optimising load, maximising self-consumption of on-site solar generation, and leveraging the benefits of battery energy storage, customers (including Government sites) will be able to actively avoid consuming electricity from the grid during periods of peak demand. This reduces both the likelihood and severity of any shortfalls in electricity supply, and is the most impactful way to reduce electricity usage charges. It should also place NSW Government in a much stronger position to re-negotiate any future electricity supply contracts.

At both grid-scale and when aggregated into VPPs, Tesla's systems actively participate in the wholesale energy and FCAS markets using Tesla's Autobidder. Autobidder uses an optimisation algorithm to maximise the value of services provided to the market for each 5 minute dispatch interval (assessing thousands of combinations across market price forecasts, physical dynamics, asset constraints, and risk management). By performing this optimisation in response to market prices, batteries can operate in a way that creates the most downward pressure on market prices, creating savings for all customers. This capability has been proven by the Hornsdale Power Reserve (HPR), and SA VPP, which both use Tesla's battery hardware systems together with Autobidder. Additionally, providing new grid services (Ramping Services, Inertia Services and Voltage Support Services) can defer or avoid expensive network augmentation, the costs of which would ultimately be borne end-customers.

2. Improve system reliability and security, through the provision of existing and new market services

Battery storage also has the potential to improve the reliability of electricity supply in several key ways:

a) Provide flexible 'peaking' generation: By optimising its charge and discharge times, battery systems actively avoid consuming electricity from the grid during periods of peak demand and instead dynamically export electricity to the market when it is most needed. This reduces both the likelihood and severity of any shortfalls in electricity supply. Battery systems directly participate in wholesale energy markets and are incentivised to export energy during high price periods. This energy can be sourced from both on-site generation energy (e.g. rooftop PV or co-located renewable assets), as well as energy imported from the grid to charge batteries during periods of high supply (e.g. high wind output and low demand). This improves reliability and creates wider market efficiency for all customers.

b) Optimise network demand management: Battery storage can also be operated as a large dynamic load to reduce the need for renewable generation curtailment during periods of excess generation. This is a clear benefit for leveraging storage to complement demand management as a viable option to defer traditional network infrastructure projects and reduce strain on local assets. As per AEMO's wider integrated system plan modelling, this will be increasingly required in the coming years – such that even 12 month delays could result large volumes of renewable curtailment.

In addition, if assets are aggregated into VPPs this unlocks Tesla's leading battery hardware and proprietary software platforms to provide flexible and fast system security services including:

c) Grid frequency stability- Similar to services demonstrated at HPR, batteries can help maintain sustainable, stable operation of the grid through directly participating in all available frequency control ancillary service markets. Using Autobidder, this unlocks additional value for the asset and allows the grid to leverage the services of precise and rapid response storage technology that would otherwise be inaccessible to the wider grid and frequency markets. Since it was commissioned in November 2017, Hornsdale has responded to tens of thousands of frequency events, provided critical support during the SA separation event in August 2018 and increased dispatchable generation capacity. Its ability to optimise for these events and capture appropriate value is unlocked by 5MS – and reduces the need for support funding from external parties (e.g. state government, ARENA).

d) Inertial response (‘Digital Inertia’) – Tesla battery systems can mimic the inertial response of traditional generators to support secure grid operation. As the response is created purely through inverter controls, it can be adjusted based on the grid’s needs.

e) Network services –amplified by the reactive power capabilities and voltage support offered by controllable batteries distributed across the network. Providing these services directly at the site of large renewable generation assets can support stable grid operation (e.g. reducing the extent of curtailment schemes), and facilitate additional renewables, particularly in regional areas of low network strength. In October 2018, AEMO removed the 35MW Heywood Interconnector requirements for pre-contingent regulation FCAS due to “having HPR in service”.

f) System backup - Embedding batteries at the site of large loads provides back-up power directly to critical infrastructure, allowing continued operations following unplanned events as recently experienced over the summer of bushfires. This is a clear benefit not achievable from solar only or demand response only designs and recognises that there are essential sites (water, health, IT) that provide a critical service to the community. Ensuring resiliency in the energy supply, and improving the energy independence of key facilities is a fundamental component of any long-term energy and infrastructure strategy.

Tesla is continually working with market participants, policy makers, and project developers to outline how each service can be offered by battery storage systems, whether directly through battery control settings, or via participation in any existing or evolving markets that will increasingly be seeking a battery’s premium response. These discussions inevitably focus on the introduction of near term programs and incentives as proposed in NSW, and their ability to further unlock the value that batteries can provide.

In the absence of existing markets for the monetisation of such services, or in the event of delays to critical reforms, the NSW Government can play a critical role in helping customers supporting the investment case until the necessary regulatory changes can be implemented.

3. Increase demand for local jobs and services and complement existing investments in Australia’s new technology sector

Tesla, alongside its ‘new technology’ competitors, are already making major investments in hiring, training and upskilling Australian based labour. There are currently hundreds of personnel working on battery projects across NSW. This includes employees, Certified Installer (CI) employees and Installation Subcontractor employees. Employees cover a huge range of disciplines including Manufacturing (to support remanufacturing capabilities), Installations, Service, Distribution/Logistics, Technical and Financial Modelling, Policy Advocacy, and Engineering.

4. Accelerate carbon emission reductions

By maximising the value and optimising the use of renewable generation and loads, a NSW energy system that effectively scales the integration of storage will be able to reduce needs to purchase carbon offsets required for meeting net-zero emissions targets in the longer term, as increasingly the state’s energy demand will be able to be sourced from state-based large-scale renewable energy projects and rooftop solar.