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Rebecca Knights

Director Energy Policy and Projects

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Dear Rebecca,

South Australian Draft Energy Security Target

Tesla Motors Australia Pty Ltd. (Tesla) welcomes the opportunity to provide the South Australian Government with a submission on the proposed SA Energy Security Target, including the draft Electricity Security Target Regulations.

Tesla is the world's only fully vertically integrated clean energy company. Our global workforce of more than 28,000 people manufacture advanced electric vehicle systems and battery energy storage systems, with sales and service operations in over 25 countries globally.

Tesla views South Australia as global leaders in renewable energy generation and we support continuous innovation in the renewable energy space in a manner than encourages more secure, dispatchable energy supply in South Australia.

It was this view of South Australia that encouraged Tesla's focus on the South Australian region.

Tesla believes the rapid innovation and cost reduction in distributed and centralised battery storage, electric transport and renewable energy can create a driver for economic and job growth in South Australia.

However, we do not feel that the draft Regulations and supporting consultation paper are representative of the current South Australian position as leaders and innovators in the renewable energy space.

The Regulations support incumbent gas generation assets that are neither low-emissions, nor capable of providing a long-term flexible technical solution to South Australian grid frequency excursions.

We understand that the stated goal of the Energy Security Target is to increase competition, put downward pressure on prices and provide more energy system stability. More specifically the scheme is looking to achieve the following:

- Encourage dispatchability of SA based generation.
- Incentivise for generation that provides local security services of fault current and inertia.

Managing grid frequency is a complex engineering issue. There is a raft of work being done in this space already and a number of rule changes to the National Electricity Rules (NER) set to be introduced within the coming years that will each impact on grid frequency. Current work includes the

Australian Electricity Market Commission (AEMC) 5 minute settlement rule change, the AEMC System Security Framework Review, the COAG Independent Review into the Future of the National Electricity Market (NEM), and the Australian Energy Market Operator (AEMO) Future Power System Security Program.

These work programs are also focused on transitioning to larger penetrations of renewable energy across the NEM whilst maintaining system security. Tesla is concerned that the approach proposed by the South Australian Government runs counter to a number of these rule changes and work streams by explicitly excluding fast frequency response (FFR) technologies, and supporting this transition.

The existing rule changes look to manage frequency excursions across the entirety of the NEM by imposing engineering based solutions to a defined problem, and are supported by a substantial body of publicly scrutinised evidence on the proposed solutions.

In contrast the draft Regulations proposes an inferior solution without formally providing a clear overview of the specific issues that the Energy Security Target is looking to address. Further the proposed solution allows only one incumbent technology the current opportunity to participate.

Our primary concerns are as follows:

- The draft Regulations suppose that kinetic inertia is the only way to manage frequency excursions in South Australia. International evidence shows synthetic inertia provides improved network reliance, and it can provide a superior option for South Australia.
- The current draft Regulations will hold back technology innovation whilst incentivising incumbent technology.
- The scheme locks in a single solution until 2030 – imposing barriers on innovation by excluding rapidly evolving fast response technologies.
- The approach will not improve the dispatchability of South Australia's large penetration of wind generation – and as a result will not drive low emissions or low cost electricity generation.
- The regulations are not supported by a mandated review processes or technical guidelines to ensure future consideration of emerging technologies. This issue is compounded by the extremely short consultation period that will not provide a number of South Australian market participants the opportunity to provide a response.

Based on the stated program and our issues outlined above aims, Tesla asks that the South Australian Government to consider the following:

- Ensure that the Regulations remain technology agnostic. The South Australian Government should work with AEMO to outline set the actual South Australian requirements from a frequency management perspective. Provided a technology can deliver an explicit service and meet technical requirements this should be sufficient.
- Ensure that the future introduction of the Energy Security Target is supported by peer-reviewed technical guidelines that clearly outline the engineering problem and the technical solution that is needed to be rectify the specific issue, beyond the solutions proposed by the AEMC. The scheme should also include designated review points to ensure that the rapidly growing responsive, clean energy technology space is properly integrated into the scheme at a later date.

Tesla encourages the South Australian Government to undertake a very detailed look into the long-term impacts that this proposed policy will have on innovation in the state – particularly in respect of the emerging smart technology sector that focuses on areas with high renewable energy growth potential.

We hope that the South Australian Government reconsiders their current position, and adopts an approach which will allow global technology leaders such as Tesla to continue to grow their presence in South Australia.

Synthetic inertia vs. kinetic inertia

Tesla is very concerned that the current draft Regulations propose long-term barriers on innovation by excluding rapidly evolving fast response solutions such as battery energy storage.

Based on the current draft Regulations, the one requirement set by the South Australian Government in respect of frequency management, is that it is provided by kinetic inertia. No justification was made supporting the position that synthetic inertial response or fast frequency response (FFR) provided by inverter based technologies cannot be used to solve this issue.

Pushing for kinetic inertia over synthetic inertia in the context of the modern electricity market is akin to supporting paper records over digital files. Only the form of the service differs, and it is a relic of traditional electricity generation technologies – not the innovative renewable energy market that South Australia has developed.

The key issue that South Australia is looking to address through this scheme is maintaining the frequency of the grid. To that extent it does not matter whether the response comes from the spinning mass of a generator or the controls of an inverter – provided the response is quick enough.

In the context of South Australian grid frequency issues, synthetic inertia is in many ways superior to kinetic inertia and can be used to address a number of the issues previously raised by the South Australian Minister for Mineral Resources and Energy (the Minister) in his rule change request to the AEMC on 12 July 2016 in respect of System Security. The notion of synthetic inertia generally appears to be misunderstood, so below we aim to address the benefits of inverter based solutions – both generally and specifically in South Australia.

Overview of synthetic inertia – and its role in South Australia

As properly highlighted in the AEMC's Directions Paper1, frequency control of a grid requires both Inertial Response and Fast Frequency Response (FFR) from grid resources. The Inertial Response of a resource is based on the Rate of Change of Frequency (RoCoF), whereas the FFR is based on the changes in grid Frequency. Tesla battery energy storage systems utilize two separate control schemes to provide both FFR and Inertial Response by reacting to the grid frequency changes and its RoCoF, respectively.

Introducing FFR as a technical solution – which the AEMC is currently proposing to do, will allow greater flexibility in the level of RoCoF that can be permitted and, as noted by the AEMC, is a 'long-term solution to managing frequency in a low-inertia market'[1]. Tesla battery energy storage systems have been successfully deployed in other parts of the world to provide FFR and help with frequency control of the grid. Battery energy storage will be able to provide this service to enable further innovation and improvement in the renewable energy space in the SA grid.

Tesla utilizes a virtual machine operating mode to provide Inertial Response. From the power system dynamics perspective, there is no difference between Spinning Inertial Response of traditional generators and Synthetic Inertial Response of Tesla Powerpacks. Both forms of inertia respond to RoCoF of a grid in a very short timeframe (milliseconds) before other frequency control mechanisms in the grid start to respond.

Right after a frequency event on the grid, traditional generators momentarily absorb or inject energy at a rate proportional to their inertial constant and the RoCoF. While this phenomenon is referred to as "inertia" due to the momentum of the rotating generator mass that provides the source of energy, it is rather the resulting injection or absorption of energy that helps reduce the grid frequency deviations. Therefore, while this inertial response occurs due to the physics of traditional rotating generators, it can be provided by other very-fast responding resources through controlling their output energy based on the RoCoF of the grid.

A key differentiator between traditional spinning and synthetic inertial response is that the characteristics of the inertial response from battery energy storage can be modified in its control

[1] http://www.aemc.gov.au/getattachment/5a04b185-23f8-4690-9ad3-2a59b6010772/Directions-paper.aspx

software to achieve the optimal frequency response of the grid. Whereas traditional generators spinning inertial responses are constrained by the physical characteristics and design of generators and cannot be modified to achieve the desired grid response.

Battery energy storage also includes bi-directional inverter capabilities, capable of fast injection or absorption of energy from the grid in order to manage the impact of contingency frequency events. Peaking gas capacity does not have this same fast-response bi-directional capability, and as such cannot quickly absorb energy in the event of high frequency events, or during periods of excess generation.

We note that the emergency frequency control schemes for excess generation events was raised by the Minister as a key issue in the South Australian System Security rule change request. Traditional generators cannot provide this fast bi-directional service – and will not be able to provide improved grid services during high generation, high frequency events.

A further example of the superiority of synthetic inertia can be shown when the ratio of renewables to total generation of the grid changes over the course of the day. At higher renewable penetrations, this change in the ratio can cause a dramatic change in the grid's total inertia (assuming that the renewables don't provide inertial response as it is the case today) and the grid's dynamic behaviour. Battery energy storage has adjustable inertial response which provides grid operators with the ability to achieve the desired dynamic behaviour of the grid at any point in time to overcome this issue.

For regions such as South Australia with such a high penetration of renewable generation, inverter based battery energy storage solutions provides dual benefits of improving dispatchability of the local generation fleet and managing frequency issues in a dynamic fashion

Design of the scheme

As a broader issue, Tesla is concerned with the design of the scheme itself and the approach taken to introduce it.

The primary concern with the current proposed approach and legislative package is that it provides a regulatory solution to what is effectively an engineering problem. Further it locks in one technical solution rather than taking a technology agnostic approach, or detailing the technical problem to be solved and allowing the market to determine the best low-cost, low emissions solution.

Tesla is especially concerned by the fact that such a complicated problem will not be supported by technical guidelines. A core component of the approaches taken by the AEMC and AEMO approach is the establishment of detailed technical guidelines outlining the technical specifications required to solve the problem.

In the context of System Security we support a technology agnostic approach which provides inverter based solutions the opportunity to participate, provided they can meet the technical requirements specified. This ensures competition in the market, and will diversify the asset portfolio providing inertia – providing an additional hedge for ongoing system security risks.

Further, we would suggest that the scheme needs designated review points to assess performance of the scheme in the future.

Kind regards

Mark Twidell

APAC Director – Energy Products