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12-14 Claremont Street
South Yarra VIC 3141
Australia

Taryn Maroney
General Manager
Australian Energy Market Operator
530 Collins Street
Melbourne
Victoria 3000

Our Ref: JC 2018-085

4 December 2018

Dear Ms. Maroney,

S&C Electric Company submission to the Emerging Generation and Energy Storage

S&C Electric Company welcomes the opportunity to provide a response to the Stakeholder Paper on the treatment of Emerging Generation and Energy Storage.

S&C Electric Company has been supporting the operation of electricity utilities in Australia for over 60 years, while S&C Electric Company in the USA has been supporting the delivery of secure electricity systems for over 100 years. S&C Electric Company not only supports the "wires and poles" activities of the networks, but has delivered over 8 GW wind, over 1 GW of solar and over 45 MW of electricity storage globally, including batteries in Australia and New Zealand. We have also deployed over 30 microgrids combining renewable generation, storage and conventional generation to deliver improved reliability to customers.

S&C Electric are particularly interested in facilitating the development of markets and standards that deliver secure, low carbon and low-cost networks and would be very happy to provide further support to the Australian Energy Market Operator on the treatment and potential of emerging technologies and approaches.

Yours Sincerely

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General Comments

We welcome the proposal to incorporate a new market category for "bi-directional technologies" and welcome the process to simplify the bidding process for electricity storage and remove the risks of treating a single asset as both load and generation.

We note there are some disparities between the questions in the Stakeholder Paper and the feedback form downloadable from the AEMO website (https://www.aemo.com.au/-/media/Files/Electricity/NEM/Initiatives/Emerging-Generation/Stakeholder-feedback-template.docx). We have tried to cover both sets of questions where we have comments.

Definition of Electricity Storage

AEMO gave a range of international definitions for energy and electricity storage (Table 6) and proposed its own definition:

"Energy Storage System:

A resource capable of receiving imported energy from the national grid or other energy source and storing it for later export of energy to the national grid or Customer located (or connected) at the same site."

For an electricity system the terms "energy" and "electricity" cannot be used interchangeably. As the AEMO definition currently stands a coal fired power station, using a pile of coal as the storage medium, would count as "energy storage".

Additionally, a facility that uses electricity to convert water to hydrogen via electrolysis, storing energy in the form of hydrogen, which could then be "exported" from the electricity system to fuel the gas grid or vehicles, would also could as "energy storage". In this case, networks would be very concerned that this should be categorised as "load", rather than "energy storage".

A definition for electricity storage should, in its simplest form, be "electricity in, storage, electricity out". This is very generic and does not specify the storage mechanism, only that the electricity imported is stored for later export.

For the example of hydrogen above, should a developer wish to electrolyse water to create hydrogen, store the hydrogen and then pass that hydrogen through a fuel cell to produce electricity, this arrangement, as a single facility, could be classed as "electricity storage". The key issue is that in a single facility the imported electricity is temporarily stored before being exported as electricity.

Electricity in → Conversion for Storage → Electricity out **Electricity Storage**

Electricity in → Conversion for Storage → Other Energy vector out **Load**

There was a great deal of discussion at the workshop (Melbourne, 22 November) on whether the provisions of the NER adequately covered the definition of "energy" as "electricity".

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Any definition should also be applicable more broadly to avoid the need to multiple definitions in multiple locations. This provides clarity for industry and electricity storage developers. It is likely that there are other requirements in locations outside the NER (e.g. metering) that would require an explicit "electricity" definition, rather than an "energy" definition. Without the additional definitions provided in the NER for active and reactive energy being electricity, definitions outside the NER will need to explicitly use "electricity". Best regulatory practice would require a single -fit-for-all-purposes definition, rather than multiple definitions.

Another concern is that the current definition uses the terms "national grid" and "other energy source". It is highly likely that in the future electricity storage devices will import electricity from on-site generation, so not the "national grid". "Other energy sources" could be construed to include on-site generation (renewable or otherwise), but the term "energy" is ambiguous and ambiguity in any definition should be avoided.

We would support the use of either an Ofgem- or FERC-like definition, both of which use "electricity" rather than "energy":

"Electricity storage - Electricity Storage in the electricity system is the conversion of electrical energy into a form of energy which can be stored, the storing of that energy, and the subsequent reconversion of that energy back into electrical energy. - Electricity Storage Facility in the electricity system means a facility where Electricity Storage occurs." *Ofgem, 2017*

Note that the Ofgem and FERC definitions do not specify locations or anything that alludes to a grid or network, giving the definitions broad application.

Suggested revisions of the AEMO proposed definition:

"Electricity Storage System: A resource capable of receiving imported electricity and storing it for later export as electricity." *Revision 1*

"Electricity Storage System: A resource capable of receiving imported electricity from the national grid or other source and storing it for later export as electricity to the national grid or Customer located (or connected) at the same site." *Revision 2*

The inclusion of "national grid", "other source" and "customer located (or connected) at the same site" in Revision 2 adds unnecessary complication. While Revision 1 is generic, not location specific and simple.

It should be noted that an interconnector, could be classed as a "bi-directional technology", although a good definition for electricity storage would exclude interconnectors.

Definition of "Capacity" for Electricity Storage

There is some confusion on how the capacity of electricity storage should be defined, particularly in combination with generation and load.

Typically, electricity storage has a defined capacity equivalent to its maximum export. Occasionally, electricity storage may be defined as a "resource" based on total import plus total export. In the latter case a 20 MW battery would be described as a 40 MW resource (and potentially a 40 MW raise service):

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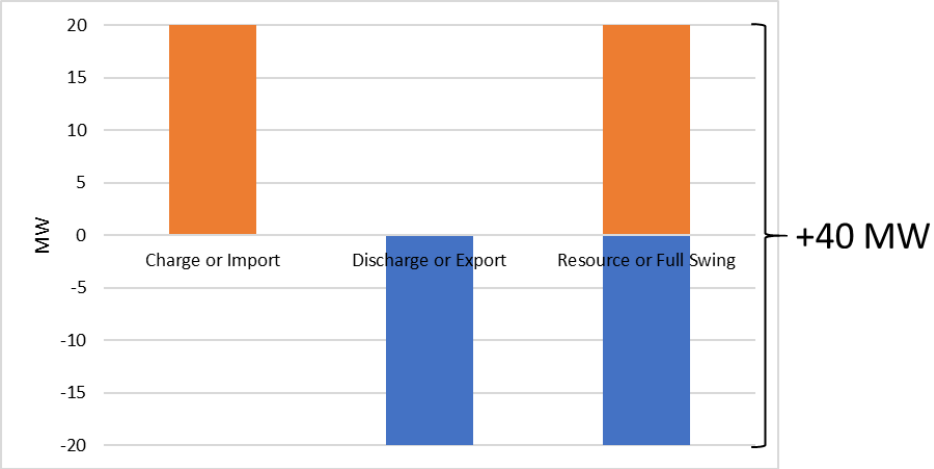

Capacity definitions have implications for connection arrangements, particularly at a hybrid site, where capacity of all the technologies tend to be purely additive, so that a 50 MW wind turbine, combined with 100 MW of solar PV and a 10 MW battery would be counted as a 160 MW connection. This might be appropriate for an entirely new connection, but may cause problems for an existing connectee wishing to retrofit electricity storage to an existing connected site. Retrofitting should be encouraged, since there are cost efficiencies in deploying electricity storage on an existing connected site, plus technical and system benefits to creating a hybrid site. The treatment of electricity storage capacity and treatment at connection are also dependent on how the electricity storage will be operated or how it will behave. Treatment of total capacities and how electricity contributes to that capacity needs further assessment.

Application of Transmission Use of System Charges

We agree that electricity storage should be exempt of import Transmission Use of System (TUoS) charges and we would welcome a deeper review into Use of System charging (at all levels) since the current model provides limited locational signals, does not address the cost of generation (export) using the system, particularly at the distribution level and is not fit for purpose in a decreasing demand environment.

Metering of Electricity Storage

In most jurisdictions electricity storage has an import meter and an export meter to support system balancing requirements and contract with retailers (import and/or export) and customers. Having two meters does not mean that the single electricity storage asset is treated as two metered entities (import and export), but the two meters support appropriate accounting. It also allows for an assessment of the efficiency impact of any given electricity storage technology, since some electricity is "lost" during storage. This loss may or may not incur a cost (e.g. TUoS) and if it does incur a cost, it will need to be metered.

Figure 1 (page 13) implies that electricity storage will have a single "net" meter and it would be helpful for AEMO to confirm that net metering is the intention. If it is necessary for AEMO to have to NMIs, what is the benefit of not actually having two meters (other than the costs of installing meters)? The critical issue is not that a single asset has two meters, but rather that a single electricity storage asset is currently treated as two distinct and unconnected assets (load and generation) creating complexity for bidding, data management and system risks.

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Information requirements for Electricity Storage

Table 7 (page 21) details some of the operating parameters that AEMO considers it may need to allow electricity storage to participate in the market. AEMO has not indicated whether the information provided by an electricity storage participant is confidential or shared with the wider market. There may be some information currently in the table that would be commercially sensitive (e.g. State of Charge).

Other information that AEMO may find valuable includes, but is not limited to: Time for full swing (time needed to go from full import to full export), rates of charge/discharge and ability to control those rates and efficiency of storage.

Responses to Questions

Questions		Feedback
Section 2 – Energy Storage System (ESS) definition		
1	Do you have any views on whether a definition of ESS should be included in the National Electricity Rules (NER)?	A definition should be included in the NER for Electricity Storage.
2	Do you have any views on whether a definition of ESS should be generic and encompass technologies other than batteries, for example, pumped hydro?	Yes, but see above
3	Do you have any views on AEMO's suggested definition of ESS?	See above
Section 2 – Integrating ESS		
4	Do you have any views on the appropriate participation model for integrating ESS into the NEM?	Arrangements and models need to be flexible to support a broad range, of as yet unspecified, business models. AEMO has suggested some approaches, but they are not complete and if pursued may limit future options.
5	Would the proposed aggregation model meet your future needs, both in terms of participating in the NEM with an individual ESS or where multiple resources (e.g. ESS and generating units) are to be aggregated? AEMO is particularly interested to understand the additional benefit that you would derive from aggregating hybrid systems and offering them to the market as a single resource that is not available by separately offering the components to the market.	The proposed model seems complex and needs further work. There are many ways of operating a hybrid facility, that may not be full aggregation. Some assets may aggregate, and some may operate separately. This may change over time as markets change. The requirement to register each asset in the system separately seems to negate any benefits of aggregating all the assets together. If AEMO needs to know explicitly what is behind every connection (particularly with individual DUIDs), then the benefits

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Questions		Feedback
		of aggregating everything behind the meter and presenting a single bid into the market would appear to be lost.
6	Do you have any views on AEMO's proposed approach to implement a single participation model to integrate ESS and other 'new' business models into the NEM?	An overly complicated approach that may limit rather than support a full range of new business models.
7	Do you have any views on the key requirements AEMO has identified for an ESS participation model?	Option 1 seems reasonable, although there may be issues with specific requirements (e.g. Table 7, MLFs), which will need further work with stakeholders.
Section 2 – NER recovery mechanisms		
4	Do you have any views on how to integrate ESS into the NEM's recovery mechanisms? If so, please provide them.	No comment
Section 3.1 – The application of performance standards to a generating system or load in an exempt network		
5	Are there other options to address the issue identified for connecting plant in an exempt network?	No Comment
6	Are there other costs, risks and benefits associated with the options presented? If so, please indicate what these are.	No Comment
7	Which option to address the issue is your preferred option? Why?	No Comment
Section 3.2 – Providing NEM information to project developers		
8	Should a person intending to develop or build a generating system or ESS (and not subsequently register as a Generator) be allowed to register as an Intending Participant?	Seems reasonable.
9	What is the market benefit associated with allowing a person intending to develop or build a generating system (and not subsequently register as a Generator) to be an Intending Participant?	No Comment.
10	Referring to section 3.5.3, are there other options to provide a person intending to develop or build a generating system (and not subsequently register as a Generator) with the necessary NEM data?	No Comment.

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Questions		Feedback
11	Are there other costs, risks and benefits associated with the options presented? If so, please indicate what these are.	No Comment.
Section 3.3 – Separation of operational and financial responsibility		
12	What is the market benefit associated with allowing the separation of operational and financial responsibilities?	May support investment.
13	What are the risks associated with allowing the separation of operational and financial responsibilities?	No Comment.
14	Are there other models of separate operational and financial responsibilities that should be considered?	No Comment.
Section 3.4 – Logical metering arrangements		
15	What is the market benefit associated with using logical metering arrangements?	Logical metering seems to raise more problems than it seeks to resolve. Are there many potential new market participants seeking to avoid installing a meter? Having a NEM compliant meter seems to be an appropriate for participants want to play in the market.
16	What are the risks associated with allowing the use of logical metering arrangements?	Why should a potential market participant "free-ride" on the metering installation of other participants. If the separation of operational and financial arrangements progress (and even if they don't), there may be multiple owner/operators of generation/storage behind a connection and it doesn't seem appropriate those parties that installed a NEM compliant meter, now have their metering data used to support an entity that didn't install a meter. At the workshop there were queries around other market activities that may also be dependent on accurate meter readings (e.g. LGCs).
17	If logical metering arrangements are permitted to be used instead of a NEM compliant metering installation, who should pay for this? Please identify any cost recovery arrangements that you consider appropriate.	Facilitating logical metering would place a significant data processing and reporting burden on AEMO, which appear to outweigh any benefits.

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Questions		Feedback
Other Comments		
23	Do you have any further comments?	No.