Grid Solutions

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To: AEMO

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General Electric's feedback and responses to the "Emerging Generation and Energy Storage in the NEM"

General Electric (GE) is pleased to provide our response to Emerging Generation and Energy Storage in the NEM, stakeholders paper published on November 5th.

GE is one of the world's leading providers of energy solutions, with over one third of all power across the planet being generated by GE technologies. The electricity industry globally is undergoing significant transformation. Complex interrelationships across the entire energy ecosystem pose challenges to power providers and consumers. GE is uniquely positioned to assist the Australian market as we offer solutions across all forms of generation technologies and hybrid solutions. As Battery Energy Storage solutions provider, GE focuses on full system performance and applications, rather than on individual components, allowing customers to match power production with power demand in real-time and utilize assets more efficiently.

- We're focused on helping our customers to improve Financial Performance by monetizing assets through new revenue streams, increase utilization, improved yield, and reduced operating costs;
- We support Renewables Integration by improving overall performance and maximizing utilization of energy generated from PV, Wind, thermal assets with Energy Storage Systems and hybrid controller;
- We help to optimize the Electrical Grid by allowing deferred upgrades, relieving congestions, controlling voltage, providing reserves and ancillary services as well as improving reliability with backup power and black start functionality

GE welcomes the review of the Emerging Generation and Energy Storage in the NEM as it is necessary considering the growing role that Energy Storage is expected to have both as standalone facility and as hybrid solution.

Below responses to AEMO Question's and few GE recommendations, we kindly ask AEMO to consider allowing further refinements to the proposed requirements.

GE looks forward to working with AEMO to ensure that we build resilience in the grid and ensure efficient energy security and reliability into the future.

Should you have any queries in relation to this response then please do not hesitate to contact me.

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1 GE's Answers to Section 2.4.1 – Defining ESS

- **Question 1: Referring to Section 2.3, are there any other issues with the current arrangements for ESS?**

Response: Yes. GE believes there is a need to include the following:

1. The definition should clearly indicate that the resource is capable of storing and releasing energy, but that it need not be stored from the grid; rather, it can be from a multitude of energy sources (local or not). Similarly, releasing energy need not be to the grid, but can be locally.

2. An energy storage system as part of a hybrid may operate entirely complementarily to a generator and not be superimposed on top to provide capacity beyond the generator, thus storage and release may be entirely local. In certain cases, it may be beneficial to increase output beyond the generator capability, or import energy, so it should be allowed to operate beyond the generator capacity but not be required to do so.

3. To qualify the Energy Storage System and an Energy generating asset, NEM should define the storage duration of an ESS (Power & Energy) to be credited as a generation asset. There could be a partial credit reaching 100% subject to the desired duration of the ESS. For example, an asset could qualify as a 100% generation asset or it can have a more energy application from 3 hours of storage or above.

4. It is also helpful to consider ESS interconnection to the network-based capacity which is more aligned to actual output capacity, not nameplate capacity. As FERC Order 845 implements, using the capacity which is more aligned to actual output capacity in the interconnection process will support more ESS to be integrated into the network better.

5. In case the asset will be intended for capacity, to qualify, it needs to be defined by its instantaneous discharge capability

6. In the case of DC coupled storage systems, the resource may share inverters with other generation. If it is registered as a market customer, it must be understood that not only cannot it not simultaneously import and export, but in certain cases it cannot be operated by the market as that would restrict the generating ability of a generator behind those same inverters.

7. As further suggestion, GE proposes an analogy with the ISO market in the US: determine whether the ESS is Behind the meter, In front of the meter, or as a distributed energy resource.

- **Question 2: Do you have any views on whether a definition of ESS should be included in the NER?**

Response: A definition of ESS should be included in the NER to reduce complexity and reflect the changing nature of the technologies being connected to the grid.

- **Question 3: Do you have any views on whether a definition of ESS should be generic and encompass technologies other than batteries, for example, pumped hydro?**

Response:

GE consider that the definition should be generic enough to cover all forms of energy storage and future proof against any further changes to the NER resulting from new storage technologies not yet developed.

Also it would be easier to have a generic definition to include Potential, Chemical, Thermal or Kinetic energy as the means for different energy storage technologies that could discharge into the grid, avoiding future amendments.

Where specific capabilities are required to add clarity to resource characteristics to participate in specific services (e.g. duration of storage), they should be done generically as well (e.g. requires 20 minutes of storage). Specific domains of energy should not be called out explicitly, so as to avoid restricting the field of technology.

- **Question 4: Do you have any views on AEMO's suggested definition of ESS?**

Response:

AEMO's suggested definition is appropriately broad enough to be technologically agnostic.

However, GE has a following suggestion to improve it.

The clause of "*storing it for later export of energy to the national grid or Customer located (or connected) at the same site*" introduces the location to where discharge occurs. One interpretation could be that the discharge must be done to the grid or customer connection, but that this discharge must have occurred at the same site or connection as the charging. This disqualifies concepts such as mobile energy storage devices which may charge locally in one location and discharge in another. A suggested change would be the following, which associates the locality clause with the intended use of allowing for local discharge (as in a hybrid) but does not restrict discharge to the same physical location: ***"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.***"

2 GE's Answers to Section 2.4.2- Participation and Operation

- **Question 1: What are your views on the appropriate participation model for integrating ESS into the NEM?**

Response:

Option 1 is undesirable as it may hinder innovation, produce an intractable computational problem, and may yield a suboptimal outcome.

- Hybrid systems may offer the best outcome (performance, environmental impact, etc.) when optimized in real-time by the registered participant than by AEMO. This registered participant optimization opens the space for innovation.
- Further, hybrid system optimization may occur in real-time and in time periods shorter than the timeframe for which individual asset bids can be entered in the market. Thus, requiring scheduling for individual components of a hybrid becomes undesirable.
- If the individual components of the hybrid system are optimized by AEMO, the complexity may drive computation time so high that the services intervals need to be increased. With the extra dimensional variables, the problem becomes intractable in real-time. This is a known issue that North America ISOs are also struggling to deal with.
- A self-managed hybrid system can be designed to compensate for failure of individual assets within the system while still maintaining performance at the interconnection (thereby increasing availability), while individual assets would require schedules to be modified for all assets within the system and optimization to be re-run.

Option 2b is undesirable as it restricts a generating unit/system and a load from being aggregated together or with a BESS when certain hybrid configurations may produce an optimal outcome with an aggregation of this kind.

Option 1 ,2a and 2b, each could be covering a different scenario and having all 3 options simultaneously for participants is an alternative. For example, option 1 would cover those who would offer an Energy Storage System only intended for specific products (Arbitrage, capacity or Ancillary Services), option 2a would cover who would offer an integrated hybrid system from a greenfield standpoint while option 2b could cover a case where an existing generation asset is being complemented with an ESS.

Option 2a seems to be the broader, most flexible and least restrictive, enables standalone to complex hybrid systems, thus recommended as preferable choice in the proposed choices. Option 2a) is an appropriate model, as it allows facilities to register under a combination that ranges from stand-alone BESS to a hybrid plant and operate as a single aggregated system to optimize dispatch and control. A consideration should be made to allow the hybrid system to be non-co-located as well, extending the concept of a virtual power plant to hybrids.

In addition, NEM needs to be aware that the integration of the Energy Storage System with the generating resource, *whether renewable or thermal*, on its own has different applications. For example, a wind farm needing a capacity firming with an Energy Storage System would entail an energy type of batteries that would have hours of storage duration to compete in the energy and FCAS markets, while there could be cases where a thermal asset integrated with a Energy Storage System to fulfill FCAS or other non market ancillary service would entail adding a fast discharge model of the Battery Energy Storage System, so called the Power version.

- **Question 2: Would the proposed participation model (2b) 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.

  Response:

See above answer too.

Perhaps mimicking CAISO in USA and calling option 2 as the single resource ID for the hybrid integrated system, while calling option 1 as the separate resources IDs is an alternative.

An example of benefit is provided. A BESS operating in an FCAS service is time limited and would therefore require an energy neutral dispatch over a duration. A thermal plant participating in such an FCAS market may be economically selected less often due to other assets having lower operating costs, and when operated, it needs to be online in advance of the expected duration, thereby generating significant emissions and efficiency reduction from operating at a large turndown. The thermal plant and the energy storage asset may work in concert to provide the FCAS service by intelligently controlling the dispatch of the thermal unit to minimize emissions and producing the same capability with a more economical operating cost.

- **Question 3: Refer to Table 8, are there other potential challenges and risks associated with option 1?**

  Response:

Aggregation of locations, if applicable , may add another challenge in the MLF (Marginal Loss Factor) assessment

- Q**uestion 4: Refer to Table 9, are there other potential challenges and risks associated with options 2a and b?**

  Response:

Yes, there are, in our views:

1. Under the circumstance of a single hybrid participating facility, there should be a well-defined tariff for the Energy, FCAS and other ancillary services.

2. Option 2b would need to talk to how to manage both participation of the hybrid system in FCAS revenue streams as well as participation under an offtake arrangement which may dictate on the hybrid system what to do and what not do (i.e. solve for highest arbitrage revenues) vs. the hybrid system being called

upon for FCAS services – how do you please both signals from an offtake arrangement and signals from the grid for FCAS?

- **Question 5: Do you have any views on AEMO's proposed approach to implement a single participation model to integrate ESS?**

Response:

It is better to have a single participation model to reduce complexity. See GE's reply to question 1 in 2.4.2.

GE suggests to have a more elaboration on the ancillary services identified as a market such as voltage control, spinning reserve and flexible ramping, to make multiple service provision by ESS within a single participation model be much easier and clearer.

- **Question 6: Do you have any views on the proposed key requirements AEMO has identified for an ESS participation model?**

Response:

1. See also GE's reply to question 1 Section 2.4.2
2. The proposed new information requirements would be very beneficial providing that this is not too onerous or difficult to provide.
3. The status of < 5MW batteries (or ESS) is yet to be defined clearly. They become clear only if the parties proactively want to register and be on market.
4. New Information requirement proposed in Table 7 are substantial. However, it may be difficult for developers to have all the required information in the project development stage due to uncertainty in financial arrangements and land acquisition. These requirements further increase project risks in project development. It may be possible to allow developers submit less intensive information while working toward a Connection Application and determine project viability fast, then let them submit the fully required information once project development/finances are fully set.
5. The ESS categorization should consider the difference between those connected to transmission network and those connected to distribution network, because of their different interconnection access and fortification arrangements and different roles in supply & loads.

- **Question 7: Do you have any views on whether existing ESS should be transitioned to the proposed participation model (2b)?**

Response:

1. This may not be applicable in all cases - See GE's reply to question 1 2.4.2- Also the available products for the Energy Storage System such as load shift and arbitrage may not be the same for the Hybrid integrated facility.

2. Existing ESS should be given the option to transition to the proposed participation model so that they can recognize any benefits from the proposed participation model. This would make it fairer for existing ESS participating in the NEM. This, as long as it does not conflict with existing offtake arrangement that the ESS may be obliged to consider in a hybrid arrangement.

3 GE's Answers to Section 2.4.4 - NER recovery mechanisms

- **Question 1: What are your views on how to integrate ESS into the NEM's recovery mechanisms?**

  Response:

GE's views are:

- It is not clear if there is a difference between the behind the meter and in front of the meter recovery mechanisms in NEM
- Whilst it is true that an ESS is both a Market Customer and Market Generator, being charged non-energy recovery and NEM Participant fees and charges for both would effectively be double charging the ESS. Historically, Market Customers and Market Generators were completely separate from each other and so it makes sense that each would be charged accordingly. If an ESS were charged for both it would mean that it is charged differently to every other unit (load or generator) in the NEM and so is not being treated as technology neutral. The ESS should only be charged on the basis of exported electricity from the NEM and so be treated in the same way as Market Generators since this its primary role is to export electricity to the grid. The ability to import electricity is an advantage of the ESS and this should not be unfairly penalized as any fees or charges incurred to import energy would result in an increased cost of the exported energy. Therefore, storage should not be charged Transmission Use of System (TUoS) on imports basis.
- That being said, the TUoS Charge Regime should be holistically reviewed as AEMO suggested in the paper. In a very distant future, there may be need for TUoS Generator Charge may arise, as it happens in some countries abroad. In such an occasion, technology neutrality as well as the principle ESS role as Market Generator and/or Market Consumer should be carefully weighted and defined to determine the charge regime.

4 GE's Answers to Section 3.1.5 - The application of performance standards to a generating system or load in an exempt network

- **Question 1: Are there other options to address the issue identified for connecting plant in an exempt network?**

Response:

It may be needed to get/define the performance standards for a ESS or Hybrid facility, as those will be key to understand to be able to comment on this section.

- **Question 2: Are there other costs, risks and benefits associated with the options presented? If so, please indicate what these are.**

Response:

See Response Question 1 – 3.1.5 Above

- **Question 3: Which option to address the issue is your preferred option? Why?**

Response:

See Response Question 1 – 2.4.2

5 GE's Answers to Section 3.2.5 - Providing NEM information to project developers

- **Question 1: 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?**

Response:

Yes, as it would enable them to access information from AEMO that is required to accurately assess the business case for the ESS they are intending to develop.

In order not to add complexities of registration to developers, perhaps going with option 1 in table 12 will make it easier to access information with the proper confidentiality agreements. Giving this ability to developers will open the market for more alternatives that could provide benefits to the whole system.

- **Question 2: 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?**

Response:

As highlighted by AEMO, there are a number of developers who have no intention in owning the grid-connected generating system. Therefore, allowing a person intending to develop or build a generating system (and not subsequently register as a Generator) to be an Intending Participant will enable these developers to access the necessary information required to assess the business case for the ESS they are intending on developing. This will result in increased investment in ESS in the NEM which will help drive costs down.

- **Question 3: Referring to section 3.2.3, 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?**

Response:

No Comment from GE.

- **Question 4: Are there other costs, risks and benefits associated with the options presented? If so, please indicate what these are.**

Response:

Safeguards should be in place to ensure that the developer is actually intending on developing the proposed ESS and not just trying to access information from AEMO to use for other advantages such as learning about a competing project to give it an unfair advantage.

6 GE's Answers to Section 3.3.4 - Separation of operational and financial responsibility

- **Question 1: What is the market benefit associated with allowing the separation of operational and financial responsibilities?**

Response:

This approach will open the market for several investors/offtakers to participate via a single or several interconnect point(s). This seems to be an out of the box approach to develop the Australian grid Market.

- **Question 2: What are the risks associated with allowing the separation of operational and financial responsibilities?**

Response:

There is going to be a need to have an entity coordinating between the different FMRP's involved in the operation especially if the various resources are of different technologies where each may require a different dispatch and capacity firming scheme.

- **Question 3: Are there other models of separate operational and financial responsibilities that should be considered?**

Response:

No Comment from GE.

7 GE's Answers to Section 3.4.4 - Logical metering arrangements

- **Question 1: What is the market benefit associated with using logical metering arrangements?**

Response:

Adapting the metering system to the bidirectional resources as ESS or hybrid facilties is expected when moving towards this change. The metering selection has to be applied on a case by case basis and subject to the facility configuration. The hybrid world could involve several combinations of technologies. For instance, if a thermal asset is collocated with a renewables facility there shouldn't be a separate metering for each. The same would apply for a BESS firming a renewables facility.

- **Question 2: What are the risks associated with allowing the use of logical metering arrangements?**

Response:

Important comments could come from specialists in the metering industry.

In general, the logical metering should be examined more carefully as the concept, technical capabilities and risks including costs are not fully clear to stakeholders. For example, how inaccurate or accurate the calculated data will be and how they affect settlement dispute possibilities are not clear yet. The impacts of this arrangement should be examined with additional time to explore various possibilities with technical experts and stakeholders.

- **Question 3: If logical metering arrangements are permitted to be used instead of a NER compliant metering installation, who should pay for this? Please identify any cost recovery arrangements that you consider appropriate**.

Response:

GE has no comment on this question, but important feedback could come from IPP or market participant.