Kinelli Pty Ltd

14th October 2020

Mr John Pierce
Chair
Australian Energy Market Commission

By online submission

RE: Requests for Rules – Integrating Energy Storage Systems into the NEM

Dear Mr Pierce

I refer to the detailed submission from Peter Geers of AEMO dated 23rd August 2019 requesting new rules related to energy storage systems (ESS). The proposal considers bi-directional energy storage systems; however, we also wish to draw your attention to uni-directional (from the NEM perspective) energy storage systems.

AEMO presently intends to treat uni-directional storage systems in the same way as bi-directional storage systems. Unfortunately, this will inadvertently create new barriers to entry that are not justified by arguments that are grounded in the bi-directional nature of certain forms of storage. I have provided attachments illustrating the harms arising from misattributing bi-directionality to uni-directional storage.

We request that uni-directional storage additions to solar farms affecting a minor portion of output (see Attachment 1) should not force currently Exempt or Non-Scheduled plants to become fully Scheduled Generators.

An example of a uni-directional (from the NEM perspective) form of storage is where the storage is DC coupled to a solar PV array. In a uni-directional implementation, the DC-coupled storage is incapable of being charged from the grid. The ESS is instead charged directly from the solar PV array via a DC bus. The plant stores solar energy without converting it into AC energy which means the grid does not mediate the charging process. DC solar energy predictably charges the ESS during daylight hours. The ESS predictably discharges into the NEM between 6 pm and 8 pm.

Such storage can be retrofitted to existing solar PV generators to improve the capacity of those generators to deliver energy to the NEM at times when energy demand is higher and thereby better assist with balancing NEM supply and demand.
That retrofit would make no change whatsoever to the AC grid interface of the existing generator and does not change the AC operating range of the plant or the plant's Generator Performance Standards in any way.

Typically, in this arrangement, the plant will deliver approximately 75% of the annual energy production directly (i.e. unstored) to the NEM from solar. The plant would transfer the remaining output (~25%) from storage in the higher demand 6 pm to 8 pm window.

PO Box 6316, QUEANBEYAN EAST, NSW, 2620 - ACN 088 153 084

We understand that if an installation intended to implement uni-directional storage, then AEMO would require any currently Non-Scheduled or Exempt[1] Generator to become a fully Scheduled Generator. Please refer to the attachments for more detail.

The requirement to become fully Scheduled creates substantial additional capital and operating costs when compared to the current operation of an Exempt plant. These additional costs cannot be justified when the plant would mediate less than 5GWh each year via storage through necessarily restricted operating windows.

Accordingly, the additional burdens arising from being fully Scheduled create an economic barrier preventing existing solar generators from adopting storage. AEMO has offered reasons for that barrier based on storage being bi-directional, but such justifications do not apply to uni-directional forms of storage.

Adding DC-coupled storage to an existing solar farm makes that solar farm a more desirable NEM participant on several counts and should be encouraged. It is problematic that a plant without storage can benefit from lower regulatory costs than a plant that helpfully slows down its release of energy so it can helpfully serve the 6 pm to 8 pm window.

After adding DC-coupled storage, the plant will still necessarily deliver most of the solar farm's generation directly (i.e. not stored). It is disadvantageous that the plant must dispatch the unstored bulk in a fully Scheduled manner.

On the 7th of October, the Australian Financial Review reported that AEMO chief executive Audrey Zibelman said that the continued market transition, including challenges associated with **minimum demand in the afternoon and high demand in the evening** when the sun sets, highlight the need for increased power system agility and resilience.

The DC-coupled storage solution directly and harmoniously addresses the challenges expressed by the AEMO CEO. Accordingly, we see that our goals are aligned.

In summary, we request that uni-directional storage additions affecting a minor portion of output should not force currently Exempt or Non-Scheduled plants to become fully Scheduled Generators.

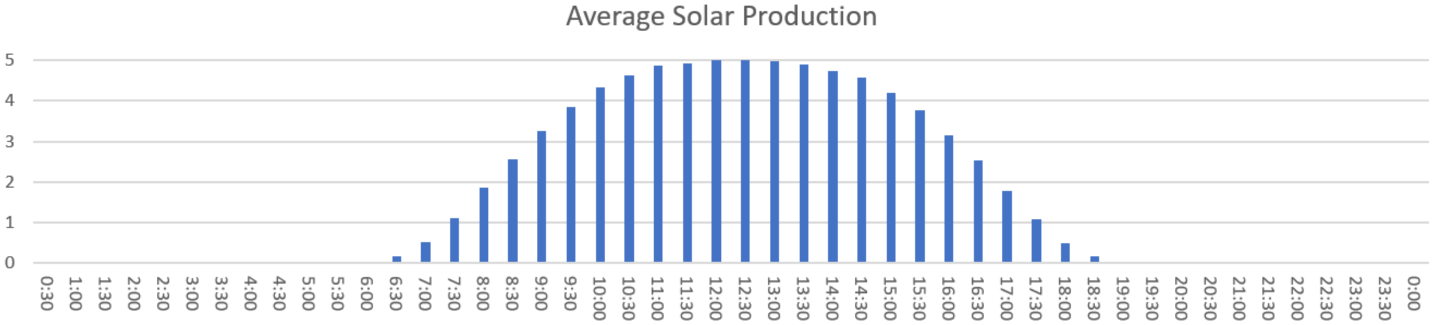
Yours faithfully

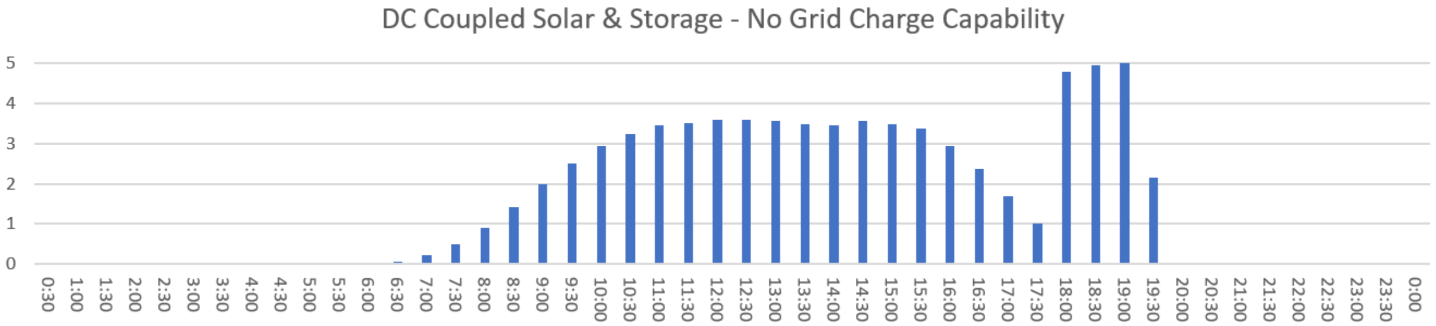
Robert Mailler
Director
Kinelli Pty Ltd
rob@kinelli.com.au

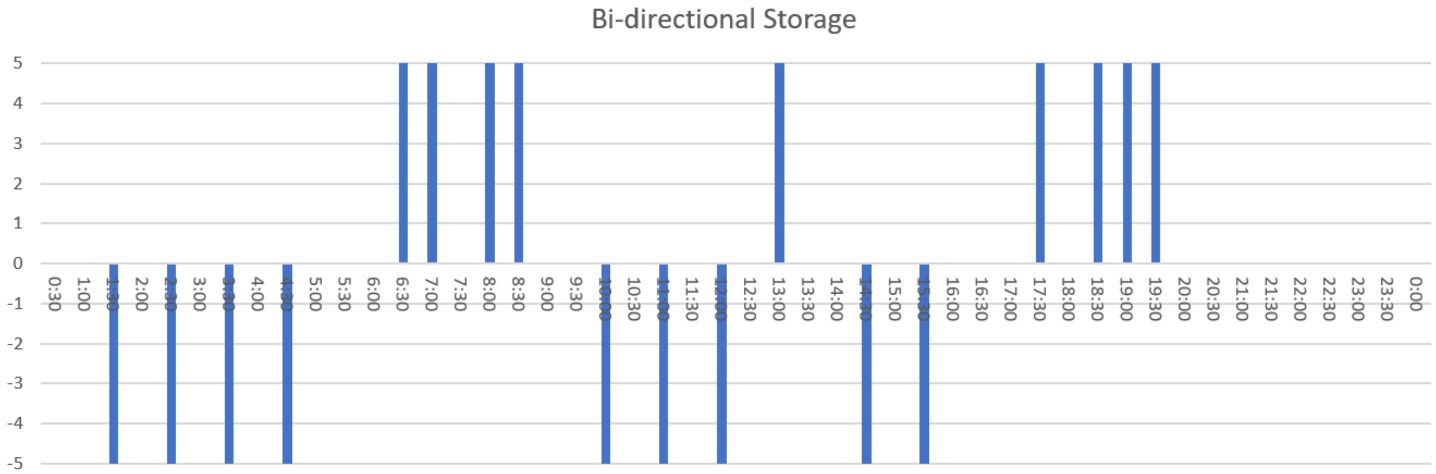
[1] where Exemption is granted based on less than 20GWh annual production.

Attachment 1 – Predictability of output profiles

The figure below shows the difference in output profiles of solar without storage, with DC-coupled uni-directional storage and bi-directional storage.







The uni-directional DC-coupled storage helpfully shaves the problematic midday solar generation peak and usefully delivers into the evening demand peak. The result is a more NEM-friendly profile than solar alone. There is only enough storage to serve the evening peak leaving the battery exhausted until its next opportunity to charge during the following daylight hours. This storage cannot charge during the evening eliminating unpredictability.

There is a strong contrast with the bidirectional storage, which typically only operates at peak capacity and could discharge or discharge in any market interval without constraint.

Attachment 2 – Guide to Generation Exemptions and Classification of Generating Units

Section 3.1 of AEMO's guide is excerpted here:

> ### 3.1. No exemption for battery storage facilities 5MW or more
>
> AEMO treats battery storage facilities differently to other types of *generating systems*. Battery storage facilities are unique in that:
>
> (a) they have extremely fast ramp rates;
>
> (b) they can switch from maximum charge to maximum discharge within one cycle (Hz) (for example, a battery storage facility with a *nameplate rating* of 5 MW can switch from 5MW discharge to 5 MW charge, resulting in an instantaneous change of *generation* of 10 MW); and
>
> (c) their operation cannot be readily forecast.
>
> AEMO therefore requires all persons who own, operate or control battery storage facilities with a *nameplate rating* of 5 MW or more to be registered as *Generators*. This applies to persons with standalone battery storage facilities as well as battery storage facilities that are proposed to be installed as part of a larger *generating system* with non-battery units.

Each of the above justifications can be demonstrated not to apply to storage DC coupled to a solar array as follows:

a) It is a very straightforward matter to deploy battery storage **without** an extremely fast ramp rate. Contrary to the guide, DC-coupled storage is the **most effective** means for slowing ramp rates in solar farms where transitions arise from passing cloud. Accordingly, DC-coupled storage can help **solve** the issue of concern to AEMO.
b) A system that cannot charge from the grid quite obviously **cannot** switch from discharging to charging at its nameplate rating over any time interval let alone in one cycle.
c) It is straightforward to **forecast** the behaviour of storage DC coupled to a PV array without grid charging capability. Please refer to Attachment 1 for further details.

AEMO's documentation has not provided a justification for denying exemption to storage that is DC coupled to a PV array and which cannot charge from the grid.

Attachment 3 – System Types

It is unequivocally true that all dispatchable systems require stored energy. As such storage itself is not contentious. The real issue for AEMO is bi-directional storage. Plants can be considered in three categories, as follows:

	Type A	Type B	Type C
Description	No stored energy	Uni-directional Stored Energy Conversion System	Bi-directional Stored Energy Conversion System
Examples	1. Solar 2. Wind	1. Thermal Gas 2. Thermal Diesel 3. Thermal Coal 4. Hydro 5. Battery without grid charging capability	1. Pumped Hydro 2. Battery Storage able to charge from the grid
Applicable Criteria • Rating >= 5MW and; • Rating < 30MW and; • Output < 20GWh/y	Exempt	Exempt except uni-directional battery	Scheduled
Applicable Criteria • Rating >= 5MW and; • Rating < 30MW and; • Output >= 20GWh/y	Non-Scheduled	Non-Scheduled except uni-directional battery	Scheduled

Refer to Attachment 4 for confirmation of AEMO's intention regarding classifications indicated in the table above.

The output profile of a solar farm with a DC-coupled battery that lacks grid charging capability is best described as a combination being mostly Type A with a minor portion of Type B. The typical proportion of its annual generation profile will be 75% Type A and 25% Type. As such, it is inconsistent for AEMO to treats it as a Type C system, creating a much more onerous, expensive set of requirements without justification. AEMO would place the bulk of the plant's production at a direct disadvantage to its Type A competitors and the remainder at a disadvantage to its similarly-sized Type B competitors in the market having the effect of directly disincentivises the uptake of storage.

AEMO is putting a much higher burden on a battery without grid charging capability than it is on other comparable systems. Specifically, it favours fossil fuel solutions over future grid solutions. Accordingly, AEMO is presently actively inhibiting the uptake of this form of storage based on arguments that very clearly do not apply to uni-directional storage that is DC coupled to a solar array.

Attachment 4 – Guide to Generation Exemptions and Classification of Generating Units

Appendix A of AEMO's guide is excerpted here to support classifications indicated in Attachment 3:

APPENDIX A. EXAMPLES OF CLASSIFICATIONS

Description	Classification
500kW solar panel and AC inverter	Exempt
1MW backup diesel *generating unit* in a high rise building	Exempt
4MW battery storage facility	Exempt
8MW battery storage facility	*Scheduled Generator*[1] *& Market Generator*
10MW thermal *power station* or wind farm under contract to a *Local Retailer* or *Customer* located at the same *connection point*	*Non-Scheduled Generator & Non-Market Generator*
10MW thermal *power station* supply for an electrically isolated country town	Exempt
15 MW gas-fired *generating system* with expected energy production >20 GWhr or *connecting* in *network* location with existing/forecast congestion exporting into a *distribution system* that is entirely purchased by the *Local Retailer*	*Scheduled Generator*[1] *& Non-Market Generator*
20MW battery storage facility within a *power station*	*Scheduled Generator*[1] *& Market Generator*
20 MW solar farm connecting in *network* location with existing/forecast congestion *connected* directly to a *transmission system*	*Semi-Scheduled Generator*[1] *& Market Generator*
30MW *generating unit* that exports up to 3MW into a *distribution system*	*Non-Scheduled Generator & Market Generator*
30MW *generating unit* that exports up to 3MW into a *distribution system* that is entirely purchased by the *Local Retailer*	*Non-Scheduled Generator & Market Generator*
40MW *generating system* internal to a major manufacturing plant that is never expected to export energy	*Non-Scheduled Generator & Non-Market Generator*
40MW hydro station under contract to a Local Retailer for all of its output	*Scheduled Generator & Non-Market Generator*
45MW *generating unit* using 10MW locally within its own site	*Scheduled Generator & Market Generator*
45MW *generating unit* using 30MW locally within its own site	*Non-Scheduled Generator & Market Generator*
45MW *generating unit* using 30MW locally within its own site and selling all export to the *Local Retailer* or *Customer* at its *connection point*	*Non-Scheduled Generator & Non-Market Generator*
45MW *generating unit* using 10MW locally within its own site and selling all export to the *Local Retailer* or *Customer* at its *connection point*	*Scheduled Generator & Non-Market Generator*
50MW co-generation plant or run of river hydro station	*Scheduled Generator & Market Generator*
150MW wind farm with all output sold to the market	*Semi-Scheduled Generator & Market Generator*
200 MW brown coal *generating unit* with a 60% minimum load capability	*Scheduled Generator & Market Generator*
200 MW power station connected to a transmission system	*Scheduled Generator & Market Generator*

The issue highlighted by the table is that the cases show that AEMO does not distinguish between predictable uni-directional storage and difficult to forecast bi-directional storage.