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Attn: Mr Peter Adams

General Manager, Market Performance
Australian Energy Regulator
GPO Box 520
Melbourne Vic 3001

Re: Semi scheduled generators - Proposed rule changes – Issue Paper June 2020

Fuclrum3D is a Sydney, Australia based technology company specialising in resource assessment and forecasting for utility-scale wind and solar. With a portfolio including operational monitoring of over 2GW of constructed utility-scale solar and pre-build resource assessment of over 6GW of wind and solar globally, Fulcrum3D has a strong fundamental understanding of the interaction between renewable generators and the natural environment. Fulcrum3D has been providing solar forecasting to off-grid hybrid systems since 2013 and has taken part in the current ARENA funded Short-Term Forecasting trials with both wind and solar semi-scheduled generators. Fulcrum3D will be providing self-forecasting for over 1GW of NEM connected wind and solar semi-scheduled generators by end of 2020.

The objective of the COAG Energy Council's request to promote system security in the NEM by requiring semi-scheduled generators to follow their dispatch targets is understood and supported by Fulcrum3D. As detailed by the AER in the issues paper, the main issue is that some semi-scheduled generators deliberately deviate from their dispatch commands during intervals of negative prices despite the bids being made.

Due to the fundamental technical requirements of maintaining grid stability, Fulcrum3D supports the proposition of a mechanism to discourage **all** generators from actively deviating from their AEMO issued dispatch commands due to negative prices despite market bids being made. In particular, Fulcrum3D believes **a change to the registration requirements would suit the purpose** better than any other alternatives proposed in the AER Issues paper for Semi-scheduled generator rule changes published in June 2020.

Attachment 1 provides Fulcrum3D's comments on each of the options outlined in section 3.3 in the AER issues paper. However, the fact that dispatch targets for renewable generators are driven by generation forecasts which have accuracy limitations cannot be understated. While AEMO demonstrates on a daily basis that the short-term forecasts are certainly fit-for-purpose to maintain grid stability, there is a real potential that the acceptable deviations in a regulatory framework to accommodate forecast uncertainties would not necessarily prevent the undesirable behaviour. This is certainly true for generators which rely on largely persistence forecasts such as that from AWEFS/ASEFS for 5min dispatch forecasts. For this reason Fulcrum3D recommends an administrative control in the form of a change in registration requirements to prevent undesired behaviour.

Regards,

Colin Bonner

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Attachment 1

Remove the semi scheduled classification

Generation deviations from dispatch trajectories are caused by the mismatch of actual and forecast generation. In order to eliminate any deviations, intermittent semi-scheduled generators must not only comply with dispatch targets, but also be issued a dispatch trajectory which is achievable.

With the current technology and linear dispatch trajectories, it is virtually impossible to achieve a near-zero dispatch deviation that is "similar to the scheduled generators" without expensive behind the meter storage or energy spill. Semi-scheduled generators must therefore have an allowance for genuine fluctuations of the natural resources on the time scale at and shorter than the dispatch intervals. Hence the complete removal of its classification is highly unadvisable as they are fundamentally different to scheduled generators.

If wind and solar generators were treated as scheduled generators, their allowable deviation from dispatch trajectories would need be carefully chosen to allow forecast uncertainty along with plant and resource variations within the dispatch interval while preventing the undesired behaviour.

Amend existing arrangements for semi scheduled generation - amend the rules such that semi scheduled generator dispatch instructions are to be followed by the participants subject to the availability of their dependent resource.

The majority of the dispatch deviations from intermittent generators can be attributed to the fluctuation of the natural resources on the time scale at and shorter than the dispatch intervals. This could be significantly mitigated by a good forecast model, however the benefit of a many spatially diverse connected-grid generators is that the stochastic nature of these deviations can average out to a large extend unless a biased/non-linear behaviour is introduced. This proposed option implies that the ramp-ups are to be enforced, whereas the ramp-downs are mostly exempt (typically under sudden change of weather conditions). This could introduce a grid-wise deviation bias, exacerbating the already precarious under-frequency scenario. Therefore, we do not believe this option is viable either.

An energy target may better accommodate variations in resource within 5-minute intervals.

It is hard to see how this can discourage semi-scheduled generators from the aforementioned behaviour, unless some stringent and one-sided regulations are added to the rules which would then create the problems outlined in the previous option.

Operate as an inflexible generator

The exact meaning of an inflexible generator in this context is not clear. The current NEM rules allow market participants to bid/rebid as inflexible generators. If this is practised in precisely the same way as the scheduled generators, renewables will likely require some sorts of "permanent inflexibility", which would not be practical.

Amend causer pays factors for ancillary services to increase economic incentives for semi scheduled generation to follow dispatch instructions

This may be an option but would require detailed analysis to assess whether amendments could create the desired incentives. As an example, semi-schedule generators currently incur FCAS Causer Pays due to self-consumption during low wind speeds for wind farms, or at night for solar farms. This stems from a limitation in AEMOs dispatch engine not being able to issue a generator a negative dispatch target despite it being known, however the FCAS Causer Pays methodology assimilates actual generation which does include negative power generation. Fulcrum3D's analysis suggests this is a material issue with some wind farms in NSW and South Australia accumulating ~15% of their FCAS Causer Pays MPF from self-consumption for typical 28 day periods. Contributions of up to 40% of their MPF have been observed.

Increasing economic incentives for semi-scheduled generators to follow dispatch targets should include changes to AEMOs dispatch engine such that negative dispatch targets can be issued to accommodate self-consumption, or changes to FCAS methodology to accommodate limitation in AEMOs dispatch engine. Failure to do so would exacerbate existing problems.

Amend registration requirements and approvals for semi scheduled generators to prevent the installation or use of either systems or procedures that allow for, or automate, a reaction to price that does not match their target.

To our best knowledge, the behaviour of ignoring the dispatch target in response to negative prices without formal rebidding is largely carried out via controller settings. Given the potential power/energy of a generator is independent of the actual generation, we believe this is detectable via post-analysis. Compliance measures can be done in various ways including:

- For any major deviations (50~100% nameplate capacity) coinciding with relatively stable measurement of the primary variables (wind speed/irradiance), semi-scheduled generators must provide adequate evidence of physical incapability.
- In order to improve system reliability and security, it is highly recommended that multiple independent resource measurements be taken. This will account for the contingencies e.g. partial site outages and communication failure.
- The primary metric for energy source (wind speed and irradiance) does have a direct and rapid impact on actual generation. Secondary quantities such as humidity, air temperature, PVW show more moderate and long-term dynamic behaviour. As such detection of any major deliberate

deviations from actual generation is highly achievable provided there is a up-to-date measurement of the primary resource is available. Highly sophisticated or data intensive power /energy conversion models are not required to detect the undesirable behaviour.

In conclusion and for the reasons outlined above, we believe that this option is the best of those proposed in the issues paper.