26th August 2016

Attn. Clare Greenwood, Forecasting, AEMO
GPO Box 2008
Melbourne VIC 3001

Dear Ms Greenwood,

Energy Conversion Model Consultation Stage 2 - August 2016

Thank you for providing Pacific Hydro with the opportunity to provide input into the second stage consultation on the Energy Conversion Model guidelines for solar and wind farms. For the ECM Stage 2 submission Pacific Hydro will also provide the submission for Taralga Wind Farm, which was submitted by CWPR in stage 1.

Pacific Hydro wishes to draw AEMO's attention to the right a market participant has always had to overwrite the AWEFS forecast. This was negotiated as part of the development package for the AWEFS system. The method for doing this is documented in AEMO's "Wind Forecast Override Participant Guide"[1]. At the time that this was developed the right was enabled for all timeframes except for the 5 minute dispatch. This is most likely because MMS management did not see a way to get the data into the system within the dispatch time boundaries, due to the file transferral systems being the primary method for data transfer.

As wind farms currently send data via SCADA to AWEFS, we see no reason why it should not be possible to incorporate forward 5 minute forecast data from the wind farms. We think this is critical to improving the accuracy of the dispatch.

It is not within AWEFS' capability to take into account the more complex control systems that are used within a wind farm for sector management of noise or turbulence. Nor is it AWEFS role to work out whether a wind turbine is returning from a full or partial shutdown, as turbines utilise different brake programs. Under certain circumstances each brake program may have a different period of time in which the turbine will be able to recover its power output. For all of these reasons we believe that the wind farm is in the best possible position to predict the forward five minute forecast.

Without a real time five minute forward forecast taking into account the internal control system, the likelihood of errors remaining within the dispatch is high. These errors adversely contribute to the wind farm's causer pays factor and dispatch inaccuracies. Furthermore, the ability of wind farms to participate more fully in the market will be delayed if forward forecast figures remain inaccurate. Lastly, having participants provide the forward forecast data is in line with providing the pathway for the cost efficient outcomes expected under the NEO.

For this purpose Pacific Hydro recommends that AEMO adopt an option for wind farms to participate in providing the SCADA data signals associated with the forward forecast. That way those farms wishing to implement systems and software to provide it will do so at their own cost, and it would be part of their individual program to achieve better forecast outcomes for the reasons outlined above. We cover our recommendations in Section 4.4 regarding the discussion on possible power and suggest that two signals are required in order to fully realise the potential benefits.

[1] Wind Forecast Override Participant Guide, 2009, Version 1.0

Pacific Hydros responses to the questions raised from the draft determination are below.

4.2 - Dispatch Forecast with Extreme Wind Speed and Direction Cut-out

AEMO has proposed that a new signal that was not present in the stage 1 consultation is added to the ECM.

1. Do you agree with the definition and proposed use of this signal?

Pacific Hydro believes that the proposed signal solves the issues that have been identified.

2. Is your wind farm able to provide this signal?

For the majority of Pacific Hydro's wind farms it would require significant engineering effort to produce the required SCADA values.

3. What upfront and ongoing costs do you estimate your farm(s) will face to provide this signal

The largest cost would be capital expenditure to deliver the required value. In some cases it is possible to retrieve on a turbine basis whether wind speed cut-out has occurred, and other cases require a software upgrade to achieve AEMO's desired outcomes.

4. Do you consider other options more suitable for managing extreme wind cut-out?

Pacific Hydro believes that the proposed possible power signal and forward forecast signals is a more suitable method to capture the impacts of extreme wind affecting the semi-scheduled generating system. The proposed solution appears complex and relies on AEMO predicting the internal controls of the farm; we reiterate that the wind farm control system is best suited to calculate the forward power taking into account the wind speed. AEMO's focus should be lifted to the output of a wind farm; that is what it is expected to export to the grid in the next 5 minutes. Whilst a specific signal to directly address a single factor affecting wind farm generation may be useful, it is proposed that possible power would provide a better outcome in dispatch.

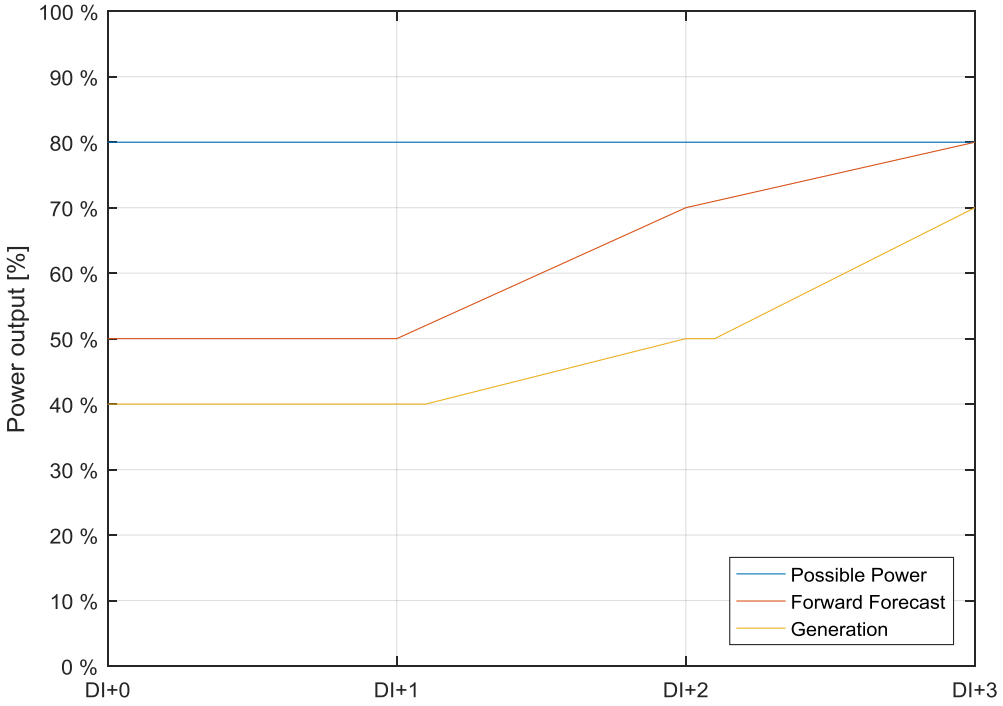
4.3 – Wind Farm Wind Speed Definition

Pacific Hydro notes that the definition of wind speed has changed from Stage 1 to Stage 2 of the consultation. It is believed that the provision of data at a rate higher than 4 seconds provides the best compromise of largest flexibility and insight for AEMO.

4.4 – Possible Power SCADA Signal

Pacific Hydro strongly reiterates its support for an optional possible power signal. Whilst it is acknowledged that manufacturer implementations vary, it is for this reason that AEMO should consider allowing participants the option to provide possible power forecast data suitable for the five minute forward market.

Pacific Hydro proposes the use of two signals to implement possible power. The first signal, a "possible power" signal would identify what the wind farm is capable of due to wind resource and available turbines, and the second signal would identify what it is capable of achieving in a dispatch interval. An example is given in the figure below, where the forward forecast is updated as wind farm output changes and turbines come online.



Pacific Hydro discussed in its first stage ECM submission the benefit of using a possible power calculation supplemented by a forward forecast of generation capability. A possible power signal would identify the possible *unconstrained* output of the wind farm at the point of connection excluding connection asset and DNSP/AEMO constraints, suitable for use within a UIGF context. All effects internal to the wind farm (wind sector management, wind direction, wind speed cut-out etc) would be included in the definition; properly defining the scope of a possible power value should alleviate AEMO's concerns.

A forward forecast signal(s) would include the possible power figure AND the time dependencies such as ramp rate limitations, allowing for a true estimate of the *achievable* power within a dispatch interval. Such a signal could also account for wind speed predictions if the technology was present. Close examination of the chart shows that at DI +1 the forward forecast is providing the figure that the Generation is at DI+2; it is more accurate than the total possible power or UIGF.

Whilst Pacific Hydro acknowledges that such a signal may not be implemented or difficult to achieve on older wind farms, providing the option with broad definitions for turbine manufacturers and wind farm owners enables local controls to be taken into account. This means it could be developed with shorter lead times and less cost. Defining the signal as optional allows wind farms with complicated terrain, wind sector management, and other miscellaneous factors the flexibility to implement an appropriate calculation suitable to their farm control arrangements; they can assess whether it is technically and commercially viable

The definition that should be adopted would be high level allowing the participant to work with their turbine manufacturer to develop an appropriate set of algorithms to generate the figure for that wind farm. As all farms differ with respect to internal management, such as noise sector or turbulence, the algorithm would be bespoke to the wind farm.

The wind farm is in the best possible position to provide a possible power signal, as it has the most detailed information to provide an accurate estimate. A "dynamically tuned" power curve has been shown to have many limitations and factors that affect the accuracy of its forecast. This has been demonstrated within the ECM process as identified in Section 4.2 "Dispatch Forecast with Extreme Wind Speed and Direction Cut-out"[2].

Ultimately, the motivation behind providing a possible power signal is to improve the dispatch outcomes of both the wind farm and the NEM as a whole. This has the potential to reduce the dispatch error and the magnitude and cost of frequency control ancillary services within the market. Without a possible power signal the errors introduced to the dispatch engine remain high, causing increased costs across the market.

Pacific Hydro would propose that a correctly implemented possible power signal would allow AEMO to remove the use of a "hysteresis limit" that incorporates both dispatch and pre-dispatch values. It is noted that many limitations are shown to exist for pre-dispatch values, and that this has both a negative impact to the wind farm and NEM dispatch outcomes[3].

By setting a standard in the ECM on possible power requirements for the industry to follow, it would allow turbine manufacturers to develop improved forecasting for both future and existing wind farms in line with proposed standards.

4.7 – Provision of Signals for FCAS

Pacific Hydro welcomes AEMO's acceptance of wind farms as a future provider of ancillary services in the NEM. In order to provide an accurate estimate of the amount of FCAS available for dispatch, it is necessary to have a representative prediction of active power achievable throughout the dispatch interval. This is even more important if an "FCAS trapezium" is to be used.

It should be recognised that a generator must provide the FCAS services if they are enabled, and as such all endeavours should be made to ensure that the wind farm is not dispatched outside of its plant capabilities. As a generator with an intermittent fuel source, it is envisaged that a more accurate representation of possible power as discussed above is an important mechanism to provide more accurate dispatch targets and ensure the future provision of FCAS in the NEM.

Yours sincerely,

Ryan Jennings
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Pacific Hydro Australia

For enquiries regarding this letter, please contact:
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[2] Wind and Solar Energy Conversion Model Guidelines Consultation Draft Report and Determination, AEMO, August 2016

[3] Factors Contributing to Differences Between Dispatch and Pre-Dispatch Outcomes, AEMO, February 2012