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Monday, 30 May 2016

Clare Greenwood
Forecasting
Australian Energy Market Operator
GPO Box 2008
Melbourne VIC 3001

Submitted electronically to Op.forecasting@aemo.com.au

Dear Ms Greenwood,

RE: Amendment to the Wind Energy Conversion Model Guidelines and The Solar Energy Conversion Model Guidelines

AGL welcomes the opportunity to comment on the proposed amendments to the Wind and Solar Energy Conversion Model Guidelines (ECM Guidelines).

AGL is one of Australia's leading integrated energy companies and is the largest ASX listed owner, operator and developer of renewable energy generation capacity in the country. AGL is also a significant energy retailer in Australia with over 3.7 million electricity and gas customers. AGL has a diverse power generation portfolio of over 10,500MW including base, peaking and intermediate generation plants, spread across traditional thermal generation as well as renewable sources including hydro, wind, solar, landfill gas and biomass.

AGL appreciates the extension of the consultation process to allow stakeholders to further examine the critical factors that could improve the resolution of AWEFS scheduling errors and subsequent flow on effects on causer pay factors.

AGL considers that the proposed improvements to the ECM Guidelines should provide more accurate dispatch expectations on individual intermittent generators, thereby improving overall participant factors associated with the Frequency Control Ancillary Service (FCAS) Regulation markets. Further, the proposed changes have the potential to improve market and economic efficiencies which could lead to significant cost savings as dispatch outcomes will likely be more reflective of the characteristics of intermittent generation capacity. Finally, the consultation process provides an opportunity for stakeholders and AEMO to clarify information and operational requirements of intermittent generation capacity which should further reduce the risk and cost future scheduling errors.

In a broader context, some of the proposed ECM changes could lead to developments that will potentially enable intermittent generators to provide some form of FCAS in the future, as witnessed in Europe.

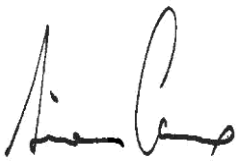
AGL notes that while it supports the proposed changes and improvements to ECM Guidelines, AEMO should carefully consider the implementation costs of the proposed changes on existing wind farms. Specifically, the implementation program, including its timing, should be subject to each participant's assessment of its cost and benefits, as well as its financial readiness to expend the additional costs.

Further comments on the proposed changes are provided in Attachment A: Detailed Responses to Specific Questions.

AGL notes that this submission has raised a number of specific issues that require further clarification. AGL would appreciate a face to face meeting with AEMO to understand and resolve these specific points.

Please contact Kong Min Yep on 03 8633 6988 or kyep@agl.com.au if there are any issues raised with regards to AGL's submission.

Yours sincerely,



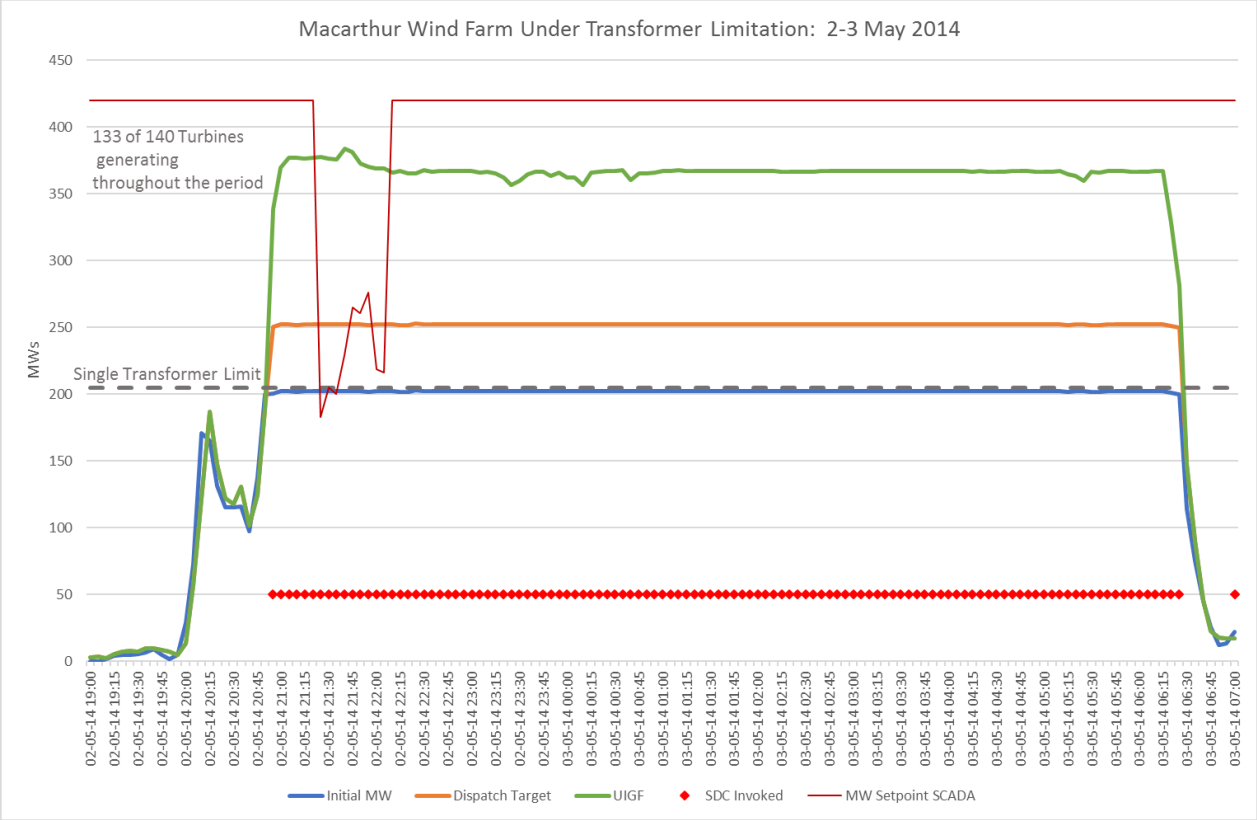
Simon Camroux
Manager Wholesale Markets Regulation

Attachment A: Detailed Responses to Specific Questions

Local Limits

1. Do you agree that the requirement for a SCADA Local Limit will improve your dispatch outcomes?

- Yes, AGL agrees that a SCADA Local Limit will improve dispatch outcomes.
- Highlighted below is a single event at Macarthur Wind Farm, across the period 2-3 May 2014, during a transformer maintenance outage. This clearly shows AWEFS producing an accurate UIGF forecast of approximately 370MW (which was consistent with strong wind conditions and that 133 of 140 turbines on site were available. However, the site export capability was limited to around 205MW given only one transformer was in service, yet the resultant dispatch targets were approx. 50MW above the plant capacity (Initial MW plus 10MW/min rate of change).
- In this particular example, the MW Setpoint SCADA that AEMO received did show some movement from 420MW (maximum generation) for a small period of time.
  Diagram 1. Sample MACWF operation during an SDC period.



- For the duration of this event, Macarthur would have been identified as being 50MW off-target and a major causer of regulation raise FCAS
- If the Local SCADA limit was implemented, the ~205MW limit would be able to inform AWEFS/NEMDE of a more accurate dispatch outcome.

2. Do you agree with the proposed validation of the SCADA Local Limit, and the proposed validation range (see Section 3.1.6)? If not, how should quality be handled?

- Yes, AGL agrees with the SCADA local limit validation criteria.
- Whilst AGL appreciates the need for the validation rules, AGL would like to ensure that the maximum capacity is used throughout the various processes, rather than nameplate or registered capacity, to ensure consistency with other scheduled

generation inputs to NEMDE (AGL understand 'Nameplate capacity' is not used anywhere in NEMDE for scheduled generation).

- In terms of the effectiveness of the limit, AGL would like to further understand what would constitute a 'good' SCADA local limit?

3. What types of limits affect your semi-scheduled generating unit? Who is responsible for determining those limits, how dynamic are they, how often do they occur, and how they are applied?

- The most common limits are:

  Oakland Hill:
  - Powercor limits due to maintenance works on the distribution network;
  - Total Fire Ban limit; and
  - Over current and over voltage limits on the distribution network,

  Nyngan Solar:
  - Limits imposed due to Essential Energy DVAR failure.

  Hallett Area Wind Farms:
  - Issues with DVARS limiting the maximum capacity of the wind farm.

  For all wind farms
  - Transformer limits
  - Internal transmission line limits

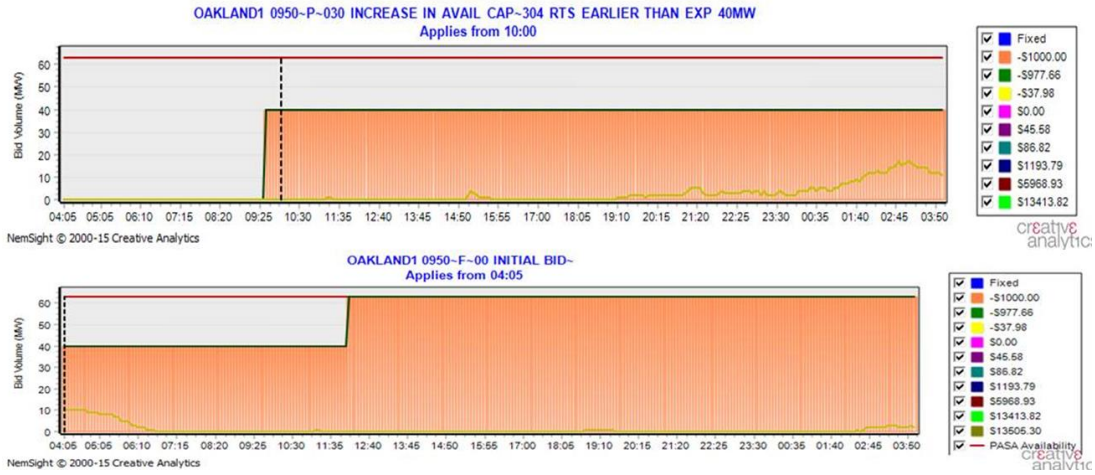
In its consultation paper, AEMO appears to suggest that SCADA local limits need to be automated. However, AGL is concerned that the many possible permutations of local limits may make it unrealistic to cover every scenario, and the cost may also be prohibitive. AGL would appreciate the opportunity to discuss this further with AEMO.

- AGL has previously provided the following material, relating to analysis and frequency of local limits, to AEMO and it is reproduced here.

Wind Farm	Limits	% of time on limit
Wattle Point	**Internal Limits:** • Statcon maintenance	 1%
Hallett	**Internal Limits:** • DVAR maintenance	 6%
Hallett Hill	**Internal Limits:** • DVAR maintenance	 6%
North Brown Hill	**Internal Limits:** • DVAR maintenance	 6%
Bluff	**Internal Limits:** • DVAR maintenance	 6%
MacArthur	NA.	
Oaklands Hill	**Network Limits:** • TFB limit • Overcurrent limit • Overvoltage limit **Internal Limits:** • DSTAT maintenance	 6% 12% 12% 1%

The graph below is an example related to OHWF. This clearly shows how the maximum generation limit of 63MW is not reduced when there is a collector group failure at OHWF.

18/19 Sep 2015, Oakland's was limited to 40MW due to issues with collector group 1 (after an outage).



4. Please quantify for your wind/solar farm(s) the likely impact of the exclusion of distribution network constraints not managed by AEMO from the SCADA 'Local Limit' definition (see Section 3.1.1).

- As an example, Powercor can/will constrain Oaklands Hill via their control system when a total fire ban is declared in the region. This will limit the output of the wind farm to 42.7MW and is directly reflected at the wind farm set point within the AGL control systems and the local site control systems. This limitation must be reflected in AWEFS at the SCADA local limit, otherwise incorrect dispatch targets will continue to be set.

The current and voltage limits at OHWF are dynamic. To manually set this as a local limit is not practical. Some form of automation of this local limit is required.

5. What do you estimate are your upfront and ongoing costs in providing and maintaining a SCADA 'Local Limit'?

Please refer to the section on "Total Estimated Costs For All Data Points" on the last page of this submission.

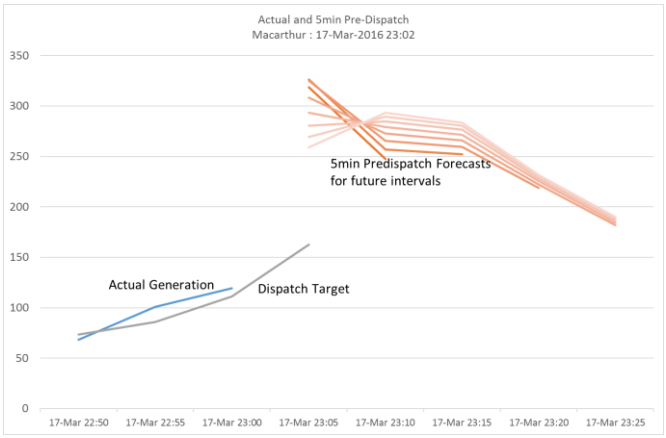
6. Are there other options available to manage the local limit issue not canvassed in this paper?

- AGL agrees that alternatives no. 1/2/3 as outlined in the Consultation Paper are unacceptable, with alternatives 4 & 5 being too problematic and inconsistent with other SCADA inputs from other generators.
- The example discussed above (Diagram 1) also demonstrates why participants must be able to bid semi-scheduled generator availability to a suitable level. AGL appreciates that this will require a NEMDE change to take the minimum of a UIGF or Bid Availability. However AGL considers it a necessary step to improve current outcomes. AGL considers that it could be accomplished by adding another NEMDE input on the left hand side of Figure 1 in the Consultation documentation (p 10).

7. Are there any other related matters you wish to raise?

- AGL would like to clarify and understand further details on how AWEFS vendor ANEMOS will use the SCADA local limit to tune the AWEFS power curves;
- AGL would like to see more data from semi-scheduled plant published in MMS, akin to AGC local limits being published by AEMO for FCAS providers;

- AGL would like to explore with AEMO how current time-dependent ramp-rates and plant limits could be applied for semi-scheduled generators to determine a more accurate 8-minute forecast to help improve the accuracy of the 5-minute pre-dispatch. An example of the impact of this type of error is shown below.



This example shows an actual scenario where the AWEFS forecast for the 5min predispatch was showing very high forecast generation from Macarthur on the evening of 17 March 2016. With a ramp rate of 10MW/min, and generating at approx. 120MW, the wind farm was very unlikely to meet the forecast dispatch around 300MW. Therefore, additional generation would have been required for dispatch without the corresponding market price signal.

Wind Speed

1. Do you agree that the proposed changes will improve your dispatch outcomes?

- AGL agrees that improvements to wind speed calculations will improve the accuracy or timeliness of dispatch forecast.
- For existing wind farms, AEMO should adopt a flexible approach in implementing changes so that each participant is given the option to assess an alternative design, costs and benefits of sampling the wind speed data, including a "do nothing" decision.

2. What do you estimate are your upfront and ongoing costs in applying this proposed definition?

- Please refer to the section on "Total Estimated Costs For All Data Points" on the last page of this submission.

3. The vendor of AWEFS prefers wind speed measurements from turbine nacelle anemometers over meteorological mast measurements. Do you agree, and what information can you give about the suitability and relative accuracy of the two measurement types for your wind farm(s)?

- AGL would agree that the wind speed calculations should provide the best opportunity to forecast the sites generation profile, be that at a meteorological mast level, grouped clusters or individual nacelles: blanket demands for nacelles will not necessarily be the most effective arrangement but will certainly add up-front costs to participants.
- AGL appreciate that the work to understand cluster/layout and wind speed link is somewhat costly at first for a participant, but considers that the benefits are worthwhile and that they will inform what is the best configuration of wind speed measurement to generation profile. This study should be carried during the design and development phase of building the wind farm asset in consultation with AEMO.
- AGL recognise in the first instance (i.e. during commissioning or the months after commissioning), an initial wind speed measurement is required and that meteorological masts will most likely be the best available source. This may result in AWEFS effectively modelling a far simpler wind speed/turbines available/generation model than would otherwise be the case. As the wind farm settles into operation, say within 6 months, this would be a good opportunity to reassess how the farm is operating compared to AWEFS forecast and review a more desirable wind speed indicator for the various clusters or groupings.
- In terms of forecast significance, AGL note that wake effects impact each site to varying degrees as the wind changes direction, so unless AWEFS is mapping individual wind direction vectors to generation output impacts as well, any additional benefit gained from more wind speed measurements at the nacelle may not provide the intended forecast accuracy.

Possible Power

1. Do you agree with the definition of SCADA Possible Power?

- Yes, although AGL would prefer two distinct types: Possible Power for Turbines Generating and Possible Power for Turbines Available.
- Current SCADA Possible Power value can be configured for transmission to AEMO via site SCADA telemetry interface with the various TNSPs

2. Does your wind farm control system currently produce an estimate of Possible Power, or an equivalent? If not equivalent, what can it produce?

- Yes, Capable Power (Suzlon) and Possible Power (Vestas) are calculated.

3. How is this estimate calculated?

- AGL believes Vestas sites Possible Power is calculated at the nacelle level for all available turbines and aggregated. AGL will confirm this arrangement with Vestas.
- For Suzlon sites, Possible power is calculated at the nacelle level for all turbines and aggregated. Turbines that are out of service are included in the aggregation. It is based on a 10 minute average turbine wind speed.

4. If the control system does not currently produce a suitable Possible Power estimate, what would be the implementation costs of doing so?

- Please refer to the section on "Total Estimated Costs For All Data Points" on the last page of this submission.

5. How should data quality, validation and update frequency issues be handled for Possible Power?

- AGL suggests that the UIGF output from AWEFS should be based on the Maximum Plant Capacity or Local Limit or Possible Power whichever is the lowest value.
- Note: The above approach assumes data quality for all items is GOOD. A possible example:
  - If the data quality for "Possible Power" is BAD then replace this with "Wind speed based power (power curve)".
  - If the data quality for both "Possible Power" and "Wind speed based power (power curve)" are BAD then replace this with previous dispatch interval "Actual Generation" from the wind farm effectively providing a persistence forecast.
- Additionally, AGL would like to explore the concept of a possible power projection or forecast for 8-10 minutes ahead (to assist the wind farms in providing a better forecast of where it is likely to be in the coming 5-10 minutes).

Maximum Capacity

- AWEFS should only be statically limited by registration value Max Capacity, as opposed to the Registered or Nameplate Capacity (and thus more akin to what occurs in Scheduled Generators which do not use nameplate/registered for anything)

Slope Tracking Direction

1. Are there other types of tracking that are not covered by the proposed Solar ECM Guidelines?

- AGL do not currently has solar tracking capability. However, AGL would like to be involved with discussions on how this will be implemented for future solar farms.

2. For a given generating system, are multiple tracking axes with different orientation likely to be used at the same site?

- AGL do not currently has solar tracking capability. However, AGL would like to be involved with discussions on how this will be implemented for future solar farms.

Additional Comments

Other Items for consideration

- AGL would like to discuss the implications of turbine blade feathering and whether this needs to be incorporated into AWEFS so that the true nature of all windfarms internal operational limitations are clearly understood and modelled within AWEFS.
- As mentioned above, AGL would like to see the addition to NEMDE of the Available Capacity as bid for a wind farm used within the dispatch process (at present, it is not). Participants must have more control over their desired output instead of using price offers or fixed load bids.

Total Estimated costs for all data points

- These changes will require changes to site and AGL Dispatch Centre SCADA systems.
- The cost of implementation for AGL wind farm and solar sites is approximately upward of $300K, which includes the additional limit information and wind speed data points based on the existing available metmasts.
- The above costs do not include programming of each site control system. AGL estimates the cost for local programming for each site would be approximately upwards of $300k for AGL sites.
- The total costs of implementing the proposed changes in ECM is expected to be upwards of $600k for AGL sites.