ENERGY CONVERSION MODEL GUIDELINES CONSULTATION - ISSUES PAPER

PREPARED BY: Systems Capability

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FINAL

Contents

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1.0	8/2/2013	Systems Capability	First version

1   Introduction

1.1   Matter under consultation

This discussion paper and the Schedule A have been prepared as part of the National Electricity Rules (Rules) requirement for the amendment of the Energy Conversion Model Guidelines ('the ECM Guidelines').

The energy conversion model (ECM) is defined in Chapter 10 of the Rules as:

> The model that defines how the *intermittent* input energy source (such as wind) is converted by the *semi-scheduled generating unit* into electrical output. That model must contain the information set out in the guidelines *published* by *AEMO* in accordance with clause 2.2.7(d).

The current ECM Guidelines[1] were published and took effect on 28 April 2009. The ECM Guidelines outline the data required to develop forecasting modules for wind generators in the Australian Wind Energy Forecasting System (AWEFS) along with details on ECM submission timelines, and guidelines for wind turbine aggregation to turbine clusters.

The requirement to amend the ECM Guidelines stems from a recommendation of the AEMO investigation of a scheduling error in the NEM. This investigation report is available on the AEMO website[2]. A brief description of this scheduling error is given below.

On 13 April 2012 AEMO declared that a scheduling error had occurred as AEMO determined it failed to follow the central dispatch process set out in clause 3.8 of the Rules. This was in relation to the unconstrained intermittent generation forecasts (UIGF) applied to the dispatch of semi-scheduled wind generators.

On 7 June 2012 AEMO published a report on this scheduling error informing the circumstances and time frames of the error and to assist market participants who wished to apply to the dispute resolution panel for a determination for compensation under clause 3.16.2(a) of the Rules.

The real-time control system set point of semi-scheduled wind generators is a key input required by AWEFS to correctly calculate the UIGF. Submission of this input is not a mandatory requirement of the current ECM Guidelines, hence it had not been provided by the affected semi-scheduled generators resulting in the scheduling error.

Investigation of the causes of the scheduling error highlighted the importance of using the real-time control system set point of semi-scheduled wind generators as an input to the AWEFS. Therefore AEMO contacted all affected semi-scheduled wind generators and requested them to provide this real-time input so that the UIGF can be correctly calculated. The semi-scheduled wind generators agreed and AEMO is currently receiving this input from all semi-scheduled wind generators. AEMO is seeking to update the ECM making the provision of control system set-point mandatory, so that semi-scheduled wind generators expecting to join NEM will make this input available prior to their connection.

1.2   The scope of the consultation

The scope of this consultation is to amend and publish the ECM Guidelines in accordance with clause 2.2.7(d) of the Rules, in order to address the issue described above. These Guidelines are only applicable for semi-scheduled generators.

Clause 2.2.7(d) of the Rules requires amendments to the ECM Guidelines to be made in consultation with the participants. The clause 2.2.7 (d) states the following:

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[1] Current ECM Guidelines: http://www.aemo.com.au/Electricity/Market-Operations/Dispatch/Energy-Conversion-Model-Guidelines
[2] The Scheduling Error Report – Incorrect UIGFs for Semi-Scheduled Generators is available at: http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/Market-Event-Reports/Scheduling-Error-Report_Incorrect-UIGFs-for-Semi-Scheduled-Generators

> *AEMO* must develop and *publish* guidelines in consultation with *Semi-Scheduled Generators* and such other person that *AEMO,* acting reasonably, considers appropriate setting out the information to be contained in *energy conversion models.* Any amendments to the guidelines are also to be made in consultation with *Semi-Scheduled Generators* and such other person that *AEMO,* acting reasonably, considers appropriate.

AEMO has prepared the following documents for this consultation:

- this Issues Paper;

- amended draft ECM Guidelines (Schedule A of this Issues Paper).

The primary objective of this issues paper is to highlight the amendment proposed to the ECM Guidelines, specifically to make the provision of real-time control set-point via SCADA, including a SCADA quality flag, as mandatory provisions for existing and future semi-scheduled generators.

The secondary objective of this issues paper is to propose clarifications and comprehensive descriptions for some items of information included in the ECM guidelines.

The proposed amended ECM Guidelines in Schedule A retain the existing form of the ECM Guidelines, in terms of type, style and scope of content. Consulted persons are invited to comment on this issue, and to raise any other relevant issues.

1.3 Benefit of using Real-Time Control Set-Point input for AWEFS for the 5-minute dispatch time frame

The AWEFS produces wind generation forecasts for multiple time frames. The forecasts produced by the AWEFS are used in market processes in the NEM as the availability of semi-scheduled wind generators.

In the 5 minute dispatch time frame, the AWEFS forecasts are strongly correlated to the wind farm generation most recently measured.

There are two related issues relevant in the 5-minute dispatch time frame.

- Whenever the AWEFS observes generation reduction of a wind farm it is unable to differentiate whether a reduction of wind speed or other actions such as a binding network constraint caused reduction of the output of wind farm. The reduction of wind generation caused by other such actions is called down regulation. In such situations the AWEFS assumes that the reduction of wind generation was caused by reduced wind speed and produces wind generation forecasts for the subsequent dispatch intervals accordingly. However when the cause of the down regulation has ceased, since the AWEFS does not use the change in down regulation as an input, unless the wind farm actually increases its generation, the AWEFS will continue to produce forecasts of relatively lower magnitudes. This may cause a wind farm to be ramped up slower than it may otherwise have been.

- A positive feedback can occur that progressively reduces wind generation to very low levels. When low priced wind generators are competing with high priced generators with low ramp rate to generate through the same transmission path, one outcome may be that the wind generators get some level of down regulation due to the power transfer limit of the transmission path. Both wind generators and the other generators move to the new dispatch targets by the end of the dispatch interval. Since the wind generator outputs drop because of the down regulation the AWEFS assumes that the wind speed has reduced causing the reduction of the wind generation. Since the AWEFS assumes a reduction in the wind speed, it would then derive further reduced wind generation forecasts for the next dispatch interval, resulting in further reduced wind generation even though the low priced wind generation should be displacing other higher priced generation.

Both problems can be addressed if the semi-scheduled wind generators provide their control system set point via SCADA to AWEFS. The AWEFS design uses the control system set point to

indicate the reduced output is due to down regulation rather than due to a reduction in the wind speed. If this is the case, AWEFS system up-scales the wind generation to an adequate level so that AWEFS produces wind generation forecasts as if the wind generator was not down regulated.

2 Proposed amendments to ECM Guidelines

The ECM specifies two sets of data. They are the standing data for wind farms and a list of SCADA data that should be provided by the wind generators. This data is required to support the AWEFS forecasting modules. Some of the data is required for physical forecasting modules, while others are required for the statistical forecasting modules. SCADA data is also used for continuous tuning of the forecasting modules.

2.1 Provision of real-time control set-point via SCADA, including the SCADA quality flag, as mandatory provisions

In order to resolve the issue described in the section 1.3, AEMO proposes to make the following amendments to the ECM Guidelines by making the provision of data IDs 1.26, 2.26, and 2.32 as a mandatory requirement. The required amendments are depicted in table 1. New additions are shown in bold green font and the proposed deletions are shown with red strikethrough. AEMO invites submissions from consulted persons on these amendments.

Table 1: Proposed changes to the ECM Guidelines

Amendment #	Id	Wind Farm Parameters	Mandatory	Description
1	1.26	**Wind Farm Control System Set-Point (in MW)** ~~NSP MW Control Scheme Set points~~	**Yes** ~~No~~	**MW set-point applied in the wind farm's control system to limit (down regulate) its output to at or below the level required by AEMO or the NSP. At other times when no limit applies, the set-point to be set to above the wind farm's registered maximum capacity, but below 250% of it. Control system set-point quality flag and control system operation status (On/Off) is also to be provided via SCADA.** ~~To be provided if NSP MW Control Scheme setpoints are in place, e.g. GDL in SA. Operation status (On/Off) also to be provided via SCADA along with the MW set point values.~~
2	2.26	NSP MW Control Schemes in operation~~?~~	**Yes** ~~No~~	Provide details of NSP MW Control Schemes used to down regulate the wind farm **at wind farm and/or cluster level.** ~~e.g. GDL in SA.~~
3	2.32	**Wind Farm Control System Set-Point (in MW) at cluster level (if any)** ~~MW Control Scheme Set points available? - Yes/ No~~	**Yes (if any)** ~~No~~	**MW set-point applied in the cluster's control system to limit (down regulate) its output to at or below the level required by AEMO or the NSP, at cluster level. At other times when no limit applies, the set-point to be set to above the cluster's registered maximum capacity, but below 250% of it. Control system set-point quality flag**

Amendment #	Id	Wind Farm Parameters	Mandatory	Description
				and control system operation status (On/Off) is also to be provided via SCADA. ~~To be provided if NSP MW Control Scheme setpoints are in place, e.g. GDL in SA. Operation status (On/Off) also to be provided via SCADA along with the MW set point values.~~

2.2   Additional clarifications and comprehensive descriptions

AEMO is proposing some additional clarifications and comprehensive descriptions to be included in the ECM guidelines. These additional clarifications and descriptions are not related to the issue as described in section 1.3.

The proposed additional clarifications and descriptions are depicted in table 2. New additions are shown in bold green font and the proposed deletions are shown with red strikethrough.

Table 2: Proposed additional clarifications to the ECM Guidelines

Amendment #	Id	Wind Farm Parameters	Mandatory	Description
4	1.11	Wind farm altitude (m ASL)	Yes	Representative value for the wind farm altitude (given as a unique value in m ASL [meters above sea level]). **It should be average of ground altitude for turbine locations.**
5	1.16	Meteorological mast (met mast) measuring height (m AGL)	Yes	If a met mast available, indicate the ~~measurements~~ height(s). (repeat line if several). **Please provide measuring heights for both the SCADA wind speed data (ID 1.23) and also wind Farm Historical measurements (ID 1.28 and 1.29).**
6	1.17	Met mast geographical coordinates (Lat/Lon)	Yes	If a met mast is available, indicate the geographical coordinates. (Repeat line if several). **Please provide geographical coordinates for both the SCADA wind speed data (ID 1.23) and also wind Farm Historical measurements (ID 1.28 and 1.29).**
Wind Farm SCADA to AEMO:				
7 **Wind Farm SCADA to AEMO**	**Unless otherwise stated, instantaneous measurements are required. Instantaneous means values sent every 2 seconds to AEMO, or more often.**			
8	1.21	Number of wind turbines available for generation data	Yes	As number of turbines available for generation. **This is the summation of:** • **Turbines operating** • **Turbines available to operate, but not operating due to ambient conditions**

Amendment #	Id	Wind Farm Parameters	Mandatory	Description
				(very low / high wind speeds, ambient temperature) • **Turbines available to operate, but paused due to down regulation.** **This definition excludes all the following cases:** • **Turbines under maintenance or repair** • **Turbines with a fault or damage** • **Turbines not yet built** • **Transmission/distribution network not available**
9	1.22	Number of wind turbines **actively generating** ~~in operation data~~	Yes	As number of turbines in operation, i.e. generating
10	1.23	Wind speed data	Yes	**Measurements from turbine nacelle anemometers much preferred over measurements from meteorological mast(s).** ~~Also provide the height at which this is measured. 10 min averages acceptable.~~
11	1.24	Wind direction data	Yes	**Measurements from turbine nacelle anemometers much preferred over measurements from meteorological mast(s).** ~~Also provide the height at which this is measured. 10 min averages acceptable.~~

3   References

- Australian Energy Markets Commission *National Electricity Rules*, Version 54, 2013: http://www.aemc.gov.au/rules.php
- AEMO Generator Registration Guide: http://www.aemo.com.au/en/About-AEMO/Energy-Market-Registration/Registering-in-Energy-Markets#electricity
- AEMO Semi-Scheduled Energy Conversion Model Guidelines: http://www.aemo.com.au/en/About-AEMO/Energy-Market-Registration/~/media/Files/Other/electricityops/0260-0004%20xls.ashx

4   Schedule

The following document is incorporated as a Schedule to this discussion paper.

- **Schedule A:** *Proposed Amended Energy Conversion Model Guidelines*, February 2013.