



Market Rule Amendment Proposal

PART 1 – MARKET RULE INFORMATION

Identification No.:	MR-00362-R01		
Subject:	Renewable Integration – Forecasting		
Title:	Centralized Forecasting – Data Obligations		
Nature of Proposal:	<input checked="" type="checkbox"/> Alteration	<input type="checkbox"/> Deletion	<input checked="" type="checkbox"/> Addition
Chapter:	4, 7	Appendix:	
Sections:	Ch 4, sections 7.1.6 (new), 7.3.2A (new), 7.7.2, 7.7.2.2, 7.7.3, 7.7.4, Ch 7 section 3.4.1.4		
Sub-sections proposed for amending:			

PART 2 – PROPOSAL HISTORY

Version	Reason for Issuing	Version Date
1.0	Draft for Technical Panel review	April 13, 2011
2.0	Publish for Stakeholder Review and Comment	April 21, 2011
3.0	Publish for Stakeholder Review and Comment	May 4, 2011
4.0	Submitted for Technical Panel Vote	May 11, 2011
5.0	Recommended by Technical Panel; Submitted for IESO Board Approval	May 17, 2011
6.0	Approved by IESO Board	June 16, 2011
Approved Amendment Publication Date:	June 16, 2011	
Approved Amendment Effective Date:	November 1, 2011	

PART 3 – EXPLANATION FOR PROPOSED AMENDMENT

Provide a brief description of the following:

- The reason for the proposed amendment and the impact on the *IESO-administered markets* if the amendment is not made.
- Alternative solutions considered.
- The proposed amendment, how the amendment addresses the above reason and impact of the proposed amendment on the *IESO-administered markets*.

Summary

It is proposed to amend the market rules to:

- obligate variable generators to submit static and dynamic data for purposes of centralized forecasting;
- specify the performance standards for the communication of data to the IESO for variable generators that have no existing requirements to communicate with the IESO.

This proposal is based on the “SE-91 Renewable Integration Final Design Principles” – Principles 1, 4 and 5” as part of SE-91 Renewable Integration¹.

The proposed static and dynamic data requirements for wind and solar generators as discussed and agreed with the Visibility Technical Working Group (VTWG)² will be contained in the applicable market manual – refer to Attachments A and B.

Background

Centralized forecasting will replace the existing decentralized forecasting approach and as a result, market participants with variable generation will no longer be required to submit energy forecasts for their facilities. Instead, those market participants will be responsible for providing site specific data that will be used as inputs to variable generation forecasts generated by a third party service provider.

Discussion

Through the Green Energy Act (Bill 150), amendments to the *Electricity Act, 1998* give the IESO the explicit authority to create and enforce market rules related to reliability, including market rules relating to electricity supplied by generators connected to a distribution system.³

Embedded generators selling electricity through a distributor (i.e. settling for amounts through a distributor's retail settlement system for energy injected into the distribution system) are also required to have an OEB license, which obligates the licensee to comply with all applicable market rules.⁴

¹ SE-91 Renewable Integration Final Design Principles: http://www.ieso.ca/imoweb/pubs/consult/se91/se91-20110309-Final_Design_Principles.pdf

² For further information and materials on VSWG, please refer to: [Renewable Integration \(SE-91\) - Visibility Technical Working Group](#)

³ Electricity Act, section 32(1)(c) [Electricity Act, 1998, S.O. 1998, c. 15, Sched. A](#)

PART 3 – EXPLANATION FOR PROPOSED AMENDMENT

Chapters 4, 7 – Static and Dynamic Data Obligations

Under a centralized forecasting service, wind and solar photovoltaic (PV) generators with an installed capacity of 5MW or greater (i.e. market participants or embedded non-market participants), as well as wind and solar PV generators directly connected to the IESO-controlled grid (i.e. market participants) will be responsible for collecting and submitting site specific data and relaying that data to the IESO. Once the centralized forecasting service is implemented within the IESO's operations, wind and solar PV generators currently subject to decentralized forecasting will no longer be required to submit their own energy forecasts to the IESO. During the transition period between decentralized and centralized forecasting, wind and solar PV resources will be required to submit site specific data as well as their own forecasts for an interim period.

It is proposed to amend the market rules in chapter 4, section 7.1.6 (new) and chapter 7, section 3.4.1.4:

- Ch 4, 7.1.6 obligates variable generators (wind and solar PV) to provide the static and dynamic data in accordance with the applicable market manual (see Attachments A and B).
- Ch 7, section 3.4.1.4 specifies that an intermittent generator that is a variable generator will no longer be required to submit their own forecasts on the implementation date of centralized forecasting.

Chapter 4 – Communication Requirements

All variable generators (wind and solar PV) subject to centralized forecasting will have a requirement to communicate with the IESO. Existing or new market participants will continue to be bound by the existing communication requirements in section 7 of chapter 4 and appendix 4.

It is proposed that embedded variable generators (wind and solar PV) that are not market participants but 5MW or greater be classified as “medium” performance facilities per Appendix 4.19, for which the dynamic data in Attachments A and B must be provided to the IESO.

It is proposed to amend the market rules in chapter 4, sections 7.3.2A (new), 7.7.2, 7.7.2.2, 7.7.3, and 7.7.4:

- Section 7.3.2A specifies variable generators that do not have communication requirements as per the existing market rules will be required to meet at a minimum, the medium performance standards in Appendix 4.19 for sending the required dynamic data to the IESO. Acceptable monitoring and control devices will be specified in the applicable market manual.

⁴ Electricity Generator Sample License, sections 4.1 and 4.2:

http://www.ontarioenergyboard.ca/OEB/Documents/Licences/FIT_Generator_SAMPLE_application.pdf

FIT Generator Sample License, sections 4.1 and 4.2:

http://www.ontarioenergyboard.ca/OEB/Documents/Licences/licence_EG_template_2008.pdf

PART 3 – EXPLANATION FOR PROPOSED AMENDMENT

- Section 7.7.2 adds variable generators that are not market participants and do not have communication requirements per the existing market rules to the medium performance standard maintenance and repair requirements for monitoring and control equipment (i.e. response no later than the next day following the day on which the equipment outage or defect is discovered).
- Section 7.7.3 builds on section 7.7.2 and requires variable generators that are not market participants to restore to a fully operational state any monitoring and control equipment within 48 hours of the time the outage or defect is discovered, consistent with medium performance standards.
- Section 7.7.4 allows the IESO to direct variable generators that are not market participants to respond and restore monitoring and control equipment within such longer or shorter time periods than those referred to in section 7.7.3 (i.e. longer or shorter than 48 hours) based on the impact of the unavailability of their equipment on the IESO-controlled grid.

PART 4 – PROPOSED AMENDMENT**Chapter 4****7. Provision of Connection-Related Information****7.1 Provision of Information**

7.1.1 [Intentionally left blank]

7.1.2 *A market participant* that becomes aware of any material change to or inconsistency with any information or data previously supplied to another *market participant* or to the *IESO* in accordance with a new or modified *connection* that could affect the *reliability* of the *IESO-controlled grid* shall promptly notify the *IESO* and such other *market participant* in writing of that change or inconsistency.

7.1.3 Each generator whose generation facility is connected to the IESO-controlled grid, connected wholesale customer and distributor connected to the IESO-controlled grid, and transmitter shall provide to the IESO the information described in Appendices 4.5A to 4.9, as applicable prior to placing any connected facility into service.

7.1.4 Each *embedded generator* whose *embedded generation facility* includes a *generation unit* rated at greater than 10 MVA and that is designated by the *IESO* for the purposes of this section 7.1 shall provide to the *IESO* the information described in Part A of Appendix 4.6 as may be requested by the *IESO*.

7.1.5 Each embedded generator that:

7.1.5.1 participates in the *IESO-administered markets* and whose *embedded generation facility* includes a *generation unit* rated at 1 MW or higher;

7.1.5.2 is a non-market participant and whose *embedded generation facility* includes a *generation unit* rated at 10 MVA or higher,

and that is not required to provide data pursuant to section 7.1.4, shall provide the *IESO* with the data listed in Part B of Appendix 4.6.

7.1.6 Each *variable generator* shall provide data to the *IESO* in accordance with the applicable *market manual* for the purposes of deriving forecasts of the amount of energy that the *variable generator* is capable of producing.

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7.3 Monitoring Information Provided by Generators to the IESO

7.3.1 Subject to section 7.3.2, in order to permit the *IESO* to direct the operations of the *IESO-controlled grid*, each:

7.3.1.1 *generator* (i) whose *generation facility* is *connected* to the *IESO-controlled grid*, or (ii) that is participating in the *IESO-administered markets*; and

7.3.1.2 *embedded generator* (i) that is not a *market participant* or whose *embedded generation facility* is not a *registered facility*; (ii) whose *embedded generation facility* includes a *generation unit* rated at greater than 20 MVA or that comprises *generation units* the ratings of which in the aggregate exceeds 20 MVA; and (iii) that is designated by the *IESO* for the purposes of this section 7.3.1 as being required to provide such data in order to enable the *IESO* to maintain the *reliability* of the *IESO-controlled grid*,

shall provide the *IESO* with the data listed in Appendix 4.15 on a continual basis. Such data shall not be modified by the *generator* and shall be provided:

7.3.1.3 with equipment that meets the requirements set forth in Appendix 2.2 of Chapter 2; and

7.3.1.4 subject to section 7.6A, in accordance with the performance standards set forth in Appendix 4.19.

7.3.2 Section 7.3.1 does not apply to:

7.3.2.1 a *small generation facility*;

7.3.2.2 a *self-scheduling generation facility* that has a name-plate rating of less than 10 MW; or

7.3.2.3 an *intermittent generator* or a *transitional scheduling generator* that is comprised solely of a *generation unit* rated at less than 20 MW or of *generation units* the ratings of which in the aggregate is less than 20 MW unless designated by the *IESO* at the time of registration as affecting the *reliability* of the *IESO-controlled grid*.

7.3.2A Each *variable generator* not otherwise subject to any communication requirements specified in this chapter shall at a minimum, meet the medium performance standards set forth in Appendix 4.19 for the purposes of providing data in accordance with section 7.1.6.

7.7 Reliability, Maintenance and Repair of Monitoring and Control Equipment

7.7.1 Each person referred to in section 7.3.1, 7.4.1, 7.5.1, 7.5.2 or 7.6.1, as the case may be, shall maintain the monitoring and control equipment referred to in Appendices 4.15 to 4.18 as applicable, in accordance with *good utility practice* and shall ensure that such equipment:

7.7.1.1 has an overall mean time between failures of:

- a. no less than three years; or
- b. no less than five years, if the equipment is designated by the *IESO* as significant for purposes of enabling the *IESO* to maintain the *reliability* of the *IESO-controlled grid*;

7.7.1.1A each person referred to in section 7.7.1 shall report and schedule with the *IESO* all planned changes to monitoring equipment referred to in section 7.7.1.1 and associated potential and current transformers and other devices affecting the accuracy or the reliability of such equipment;

7.7.1.2 is secure from the effects of interruptions in power supply for a period of at least eight hours.

- 7.7.2 Each person referred to in section 7.7.1 [and 7.3.2A](#) shall respond to an *outage* of or defect in the equipment referred to in section 7.7.1 [or the applicable market manual](#):
- 7.7.2.1 immediately, in the case of equipment relating to *facilities* to which the high performance information monitoring standard applies pursuant to Appendices 4.19 to 4.23 other than *significant generation facilities* and *significant dispatchable load facilities*;
- a. [Intentionally left blank]
 - b. [Intentionally left blank]
 - c. [Intentionally left blank]
 - d. [Intentionally left blank]
 - e. [Intentionally left blank]
 - f. [Intentionally left blank]
 - g. [Intentionally left blank]
 - h. [Intentionally left blank]
- 7.7.2.2 no later than the next day following the day on which the *outage* or defect is discovered, in the case of equipment relating to *significant generation facilities*, ~~and~~ *significant dispatchable load facilities*, [variable generation](#), and *facilities* to which the medium performance information monitoring standard applies pursuant to Appendices 4.19 to 4.23.
- a. [Intentionally left blank]
 - b. [Intentionally left blank]
 - c. [Intentionally left blank]
 - d. [Intentionally left blank]
 - e. [Intentionally left blank]
 - f. [Intentionally left blank]
- 7.7.3 Each person referred to in section 7.7.1 [and 7.3.2A](#) shall ensure that the equipment referred to in section 7.7.1 [or the applicable market manual](#) is restored to a fully operational state following an *outage* of or defect in such equipment as follows:
- 7.7.3.1 in the case of equipment relating to the *facilities* referred to in section 7.7.2.1, within 24 hours of the time at which the *outage* or defect is discovered;

- 7.7.3.2 in the case of equipment relating to the *facilities* referred to in section 7.7.2.2, within 48 hours of the time at which the *outage* or defect is discovered; and
- 7.7.3.3 in all other cases, within 14 days of the time at which the *outage* or defect is discovered.

7.7.4 The *IESO* may direct a person referred to in section 7.7.1 [and 7.3.2A](#) to respond and restore the equipment referred to in section 7.7.1 [or the applicable market manual](#) to a fully operational state following an *outage* of or defect in such equipment within such longer or shorter time periods than those referred to in sections 7.7.2 and 7.7.3 based on the immediate or short-term impact of the unavailability of the equipment on the reliable operation of the *IESO-controlled grid*, provided that where a person is directed to respond and restore any such equipment in less than 24 hours, the person shall use commercial best efforts to achieve such direction.

Chapter 7

3.4 The Form of Dispatch Data

3.4.1 *Dispatch data* shall relate to a specified *dispatch hour* of the *dispatch day* and to a specified *registered facility*, shall comply with the applicable provisions of this section and sections 3.5 to 3.9 and shall take one of the following forms:

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- 3.4.1.4 for an *intermittent generator*, a forecast of *energy* expected to be provided to the *energy market*. *Energy* actually provided by an *intermittent generator* results in sales in the *real-time market* only to the extent that, for the *registered market participant* designated for such *intermittent generator*, the total value of *energy* provided to the *real-time market* is greater than the total value of *physical bilateral contract quantities* notified to the *IESO* by that *registered market participant* pursuant to Chapter 8. [For an intermittent generator that is a variable generator, this section shall cease to have effect on a date to be determined by the IESO with such date to be published by the IESO;](#)
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Chapter 11

1. Definitions

[Note: the proposed definitions for “variable generation” and “variable generator” below are included for reference only; they are proposed under MR-00362-R00: Centralized Forecasting – Cost Recovery.]

variable generation means all wind and solar photovoltaic resources with an installed capacity of 5MW or greater, or all wind and solar photovoltaic resources that are directly connected to the IESO-controlled grid;

variable generator means a generator whose generation facility is classified as variable generation;

PART 5 – IESO BOARD DECISION RATIONALE

Centralized forecasting for variable generation is an essential tool for the IESO to maintain system reliability and market efficiency.

Attachment A – Wind Generator Data Requirements (to be included in the applicable market manual)

1. Wind Static Data

The following table lists plant data requirements for the physical layout of the facility and details of the turbines that will be required at the time of a connection assessment/registration application.

#	Static Plant Information	Description
1	Turbine Hub location	Turbine Hub location (latitude and longitude), height, and elevation from sea level.
2	Meteorological (MET) Tower location	Physical location (latitude and longitude), height, and elevation from sea level.
3	Type of turbine	Whether the turbine is a horizontal or vertical axis type.
4	Manufacturer's power curve	Power curve maps containing expected output for a turbine at varying wind speeds.
5	Cut in speed	The lowest wind speed (metres per second [m/s]) at which the turbine will generate power.
6	Cut out speed	The wind speed (m/s) at which the wind turbine will be shut down to prevent physical damage.
7	Cut out temperature	The maximum and minimum ambient temperature (in °C) at which the wind turbine will be shut down to prevent physical damage.

2. Wind Dynamic Data

The following dynamic plant data shall be provided to the IESO by the participant, to be used by the centralized forecasting provider in developing plant specific energy forecasts and to satisfy visibility requirements for the IESO control room to reliably operate the IESO-controlled grid.

#	Measurement Type	Unit of Measure	Height of Measurement	Precision (to the nearest...)
1	Wind Speed	Metres per Second (m/s)	Hub height	0.1 m/s
2	Wind Direction	Degrees from True North	Hub height	1 degree
3	Ambient Air Temperature	Degrees Celsius (°C)	Hub height or 2m	0.1 °C
4	Barometric Pressure	Hectopascals (hPa)	Hub height or 2m	60 Pa
5	Relative Humidity	Percentage (%)	Hub height or 2m	1.0%
6	MW output ⁵ (per facility)	Megawatt (MW)	N/A	0.1 MW

⁵ Megawatts shall be provided per existing generator requirements.

#	Measurement Type	Unit of Measure	Height of Measurement	Precision (to the nearest...)
7	Available Megawatts ⁶	Megawatt (MW)	N/A	0.1 MW

Note: Planned outages and derates shall be reported per existing reporting requirements.

Wind Dynamic Data Collection

Each wind facility shall provide dynamic data elements numbered 1 through 5 inclusive in the above table from nacelle mounted meteorological data collection points such that no turbine is further than 5km from the nearest data collection point. This is a minimum requirement, and facilities are encouraged to collect and send this data from as many points at the facility as are available.

In addition to the above requirement each wind facility shall provide dynamic data elements numbered 1 through 5 inclusive from multiple standalone meteorological towers per the following table. The towers shall be located on the prevailing upstream side of the wind facility in areas that have representative microclimates and winds at hub height.

Facility Size	Total number of meteorological towers per facility
Less than 10MW	None
10MW to less than 100MW	1 minimum
100MW to less than 200MW	2 minimum
200MW to less than 300MW	3 minimum
Etc.	

Dynamic data elements numbered 1 through 5 shall be reported to the IESO at least once every 30 seconds from all nacelle mounted meteorological data collection points and meteorological towers. Such data shall not be modified by the generator (i.e. the reported value is an instantaneous measurement and not an averaged value).

The dynamic data requirements are based on a per facility basis. The ownership of the collection points/devices may not need to be the same as the owner of the facility. However, the facility owner shall be responsible for the provision of the required information and maintenance of the equipment as prescribed in the proposed communication requirements.

All wind dynamic data shall be communicated to the IESO per IESO-approved methodologies and standards.

⁶ Available Megawatts shall be reported as the sum total of the capacities of all available turbines

Attachment B – Solar Generator Data Requirements (to be included in the applicable market manual)

1. Solar Static Data

The following table lists static plant data requirements for the physical layout of the facility and details of the solar arrays that shall be required at the time of a connection assessment/registration application.

#	Static Plant Information	Description
1	Solar facility location (latitude and longitude)	Physical location (GPS coordinates) of each solar array.
2	Meteorological data collection device location and elevation (latitude and longitude)	Physical location (GPS coordinates) of each met data collection device, its elevation and height of measurement.
3	Elevation and orientation angles of arrays	Height from ground level and angle of each solar array, Tilt (angle with horizontal plane) and Azimuth (angle in North-East-South West Plane)
4	Power Rating	Rated Power at standard test conditions.
5	Generation capacity of the generating facility and each generating unit	The name plate capacity of the entire facility with a breakdown for each array within the system. (DC and AC Power at standard test conditions for arrays and power of inverters.)
6	Temperature Coefficient	Temperature coefficient of the module power at the maximum power point,
7	Type of Mounting	Ground Mount, Rooftop, Rack Mount, Fixed or Solar Tracking etc
8	Module Type	Crystalline, Thin-Film, Concentrated PV (CPV) etc

2. Solar Dynamic Data

The following dynamic plant data shall be provided to the IESO by the plant operator, to be used by the centralized forecasting provider in developing plant specific energy forecasts and to satisfy visibility requirements for the IESO control room to reliably operate the IESO-controlled grid.

All dynamic data shall be communicated to the IESO per IESO approved methodologies and standards.

- Dynamic data elements numbered 1 through 8 inclusive in the following table shall be collected from a meteorological data collection point.
- Each facility shall have a minimum of two meteorological data collection points. Dynamic data elements (1 through 8) shall be collected and sent to the IESO from all data collection points.
- All solar arrays shall be within a 12km radius of a meteorological data collection point.
- Dynamic data elements numbered 1 through 8 shall be reported to the IESO at least once every 30 seconds from all data collection points. Such data shall not be modified by the generator (i.e. the reported value is an instantaneous measurement and not an averaged value).
- The dynamic data requirements are based on a per facility basis. The ownership of the collection points/devices may not need to be the same as the owner of the facility. However, the facility owner shall be responsible for the provision of the required information and maintenance of the equipment as prescribed in the communication requirements.

#	Measurement Type	Definition	Unit of Measure	Data Required for;	Measurement Precision
1	Plane-of-Array Irradiance (POA)	Measurements perpendicular to the solar receiver	Watts/ Square Meter	Crystalline, Thin-Film, CPV	+/- 25W/m ²
2	Global Horizontal Irradiance (GHI)	The solar resource available to a flat-plate collector oriented horizontal to the earth's surface	Watts/ Square Meter	Crystalline, Thin-Film, CPV	+/- 25W/m ²
3	Global Diffused (GDIFF)	Solar radiation that has been scattered out of the direct beam	Watts/ Square Meter	CPV	+/- 25W/m ²
4	Direct Irradiance (DNI)	The amount of solar radiation received per unit area by a surface that is always held perpendicular (or normal) to the rays that come in a straight line from the direction of the sun at its current position in the sky.	Watts/ Square Meter	CPV	+/- 25W/m ²

#	Measurement Type	Definition	Unit of Measure	Data Required for;	Measurement Precision
5	Ambient temperature at the average height of the array	Ambient temperature at the array average height	Degrees Celsius (°C)	Crystalline, Thin-Film, CPV	1 °C
6	Back of Module Temperature	Average temperature at the back of module	Degrees Celsius (°C)	Crystalline, Thin-Film, CPV	1 °C
7	Barometric pressure	Barometric Pressure	Pascals (Pa)	Crystalline, Thin-Film, CPV	60 Pa
8	Wind speed and direction at the average array height	Anemometer, wind vane or wind mast readings	Meters/Second (m/s)	Crystalline, Thin-Film, CPV	1 m/s
9	MW output (per facility) ⁷	Current Megawatt (MW) output for the facility	Megawatt (MW)	Crystalline, Thin-Film, CPV	0.1 MW
10	Available Megawatts ⁸	What the facility can produce after deducting outages	Megawatt (MW)	Crystalline, Thin-Film, CPV	0.1 MW

⁷ Megawatts shall be provided per existing generator requirements.

⁸ Typically at the Combiner level that would be accurate to 0.2 MW