# ISO Rules
# Part 300 System Reliability and Operations
# Division 304 Routine Operations
# Section 304.9 Wind and Solar Aggregated Generating Facility Forecasting

**External Consultation Draft**
**August 31, 2018**

## Applicability

**1** Section 304.9 applies to:

(a) the **legal owner** of a wind or solar **aggregated generating facility** connected to the **interconnected electric system** or an electric system within the service area of the City of Medicine Hat, including a wind or solar **aggregated generating facility** situated within an industrial complex that is directly connected to the **interconnected electric system** or to an electric system within the service area of the City of Medicine Hat and ~~that has a **gross real power** capability equal to or greater than 5 MW; and~~:

(i) has a **gross real power** capability equal to or greater than 5 MW; or

(ii) such wind or solar **aggregated generating facility** is associated with **offers** a **pool participant** submits in the energy market, or with **ancillary services**;

and

(b) the **ISO**.

## Requirements

### Functional Specification

**2(1)** The **ISO** may issue a written functional specification containing details, work requirements and specifications for the design, construction and operation of an **aggregated generating facility** and associated **transmission facility** connection facilities.

**(2)** The functional specification referred to in subsection 2(1) must be generally consistent with the provisions of this section 304.9, but may contain material variances approved of by the **ISO** based upon its discrete analysis of any one or more of the technical, economic, safety, operational and **reliability** requirements of the **interconnected electric system** related to the specific facility project.

### Successor to Prior Requirements and Compliance Timeframe

**3(1)** The provisions of this section 304.9 succeed all previous forecasting requirements for **aggregated generating facilities**, whether in an **ISO rule** or other document, and those requirements will no longer be in force and effect as of ~~**[effective date of the rule]**.~~September 1, 2018.

**(2)** The **legal owner** of an **aggregated generating facility** connected in accordance with any previous forecasting requirements must bring its **aggregated generating facility** into compliance with this section 304.9 by no later than twelve (12) months after ~~**[effective date the rule]**~~September 1, 2018 unless otherwise agreed to in writing by the **ISO**, and until such time as the **aggregated generating facility** is brought into compliance with this section 304.9, the **legal owner** of the **aggregated generating facility** shall operate its **aggregated generating facility** in compliance with the previously effective forecasting requirements in accordance with which it was being operated prior to ~~**[effective date of the rule]**.~~September 1, 2018.

### Meteorological Data Collection Equipment and Availability Requirements

**4(1)** The **legal owner** of a wind or solar **aggregated generating facility** must ensure that the facility is equipped with meteorological data collection equipment and related devices that are installed and maintained in accordance with the provisions of subsections 4 and 5.

**(2)** The **legal owner** of a wind **aggregated generating facility** must ensure that it is equipped with two (2) sets of instruments for each meteorological parameter in accordance with the requirements in Table 1.

**(3)** The **legal owner** of a solar **aggregated generating facility** must ensure that the facility is equipped with meteorological data collection equipment and related devices in accordance with the following:

(a) one (1) set of instruments for each meteorological parameter in accordance with the requirements in Table 1 per 49 square kilometers of surface area within the facility;

(b) each set of instruments, if required by subsection 4(3)(a), must be less than 8 kilometers apart; and

(c) measurements must be taken at not less than 2 meters and not greater than 10 meters above ground.

**(4)** The **legal owner** of a wind or solar **aggregated generating facility** must ensure that the meteorological data collection equipment and related devices described in subsections 4(2) and 4(3) take measurements of instantaneous values at interval of 15 **seconds** or less.

**(5)** The **legal owner** of a wind or solar **aggregated generating facility** must measure, collect and submit to the **ISO** the meteorological data in Table 1.

**(6)** The **legal owner** of a wind or solar **aggregated generating facility** must determine, at 30 minute intervals, and submit to the **ISO**, the **gross real power capability** with a precision to the nearest 2.0 MW.

**(7)** The **legal owner** of a wind or solar **aggregated generating facility** must determine and submit to the **ISO**, the following data:

(a) any real power limits in megawatts (MW), with a precision for instantaneous measurements to the nearest 0.1 MW; and

(b) actual net to grid real power production in megawatts (MW), with a precision for instantaneous measurements to the nearest 0.1 MW.

### Data Transfer Technical Specification

**5(1)** The **legal owner** of a wind or solar **aggregated generating facility** must submit to the **ISO** the data specified in subsection 4(5) using one **minute** average data.

**(2)** The **legal owner** of a wind or solar **aggregated generating facility** must submit to the **ISO** the data specified in subsection 4 in the method and format the **ISO** specifies.

**(3)** The **legal owner** of a wind or solar **aggregated generating facility** must ensure that its meteorological data collection equipment and related devices including its data transfer equipment is designed and maintained with an availability of 98.0% in accordance with Table 1 and a mean time to repair of forty-eight (48) hours or less.

**(4)** The **legal owner** of a wind or solar **aggregated generating facilities** must keep seven (7) **days** of back up data for any data that has been submitted in accordance with this subsection 5 and must provide it to the **ISO** upon request within thirty (30) **days**.

### Notification of Unavailability, Suspected Failure or Data Error

**6(1)** The **legal owner** of a wind or solar **aggregated generating facility** must, if any component in the meteorological data collection equipment and related devices including data transfer equipment

becomes unavailable due to an unplanned event, is suspected to have failed, or to be providing erroneous data, notify the **ISO** as soon as practicable, in writing, after identifying the unavailability, suspected failure or data error.

**(2)** The **legal owner** of a wind or solar **aggregated generating facility** must provide the **ISO** as soon as practicable, in writing:

(a) a description of the cause of any unavailability, suspected failure or data error reported pursuant to subsection 6(1);

(b) in the event of an equipment failure, a plan acceptable to the **ISO** to repair the failed equipment, including testing; and

(c) in the event of an equipment failure, the expected date when the equipment will be repaired and the required measurements will be restored.

**(3)** The **legal owner** of a wind or solar **aggregated generating facility** must, if an equipment failure described in subsection 6(2) is not repaired and required measurements are not restored by the expected date, notify the **ISO** as soon as practicable, in writing, of the revised date and the reason the component in the equipment was not repaired by the expected date.

**(4)** The **legal owner** of a wind or solar **aggregated generating facility** must notify the **ISO** as soon as practicable in writing after an equipment failure described in subsection 6(2) is repaired and the required measurements are restored.

### Exceptions

**7** Notwithstanding subsections 4 and 5, the **legal owner** of a wind or solar **aggregated generating facility** is not required to comply with the requirements of this section 304.9 relating to meteorological data collection equipment and related devices including data transfer equipment when:

(a) such equipment is being repaired or replaced in accordance with a plan acceptable to the **ISO** under subsection 6; and

(b) the **legal owner** is using reasonable efforts to complete such repair or replacement in accordance with that plan.

### Pre-Commissioning Facility Data and Records Requirements

**8(1)** The **legal owner** of a wind **aggregated generating facility** must provide to the **ISO** the pre-**commissioning** data and records referred to in this subsection 8 in a method and format the **ISO** specifies.

**(2)** The **legal owner** of a solar **aggregated generating facility** must provide to the **ISO,** in a method and format the **ISO** specifies, either:

(a) the pre-**commissioning** data and records referred to in this subsection 8; or

(b) an industry standard model that is approved by the **ISO**.

**(3)** Subject to the provisions of this subsection 8, the **legal owner** of a wind or solar **aggregated generating facility** must retain and provide within sixty (60) **days** of the **ISO**'s written request the following averaged meteorological data and records at ten (10) minute intervals or less, covering the two (2) calendar years prior to the **commissioning** of the wind or solar **aggregated generating facility**:

(a) details on the height of the measurements;

(b) wind speed;

(c) wind direction;

(d) temperature;

(e) barometric pressure; and

(f) for solar **aggregated generating facilities** only, global horizontal irradiance.

**(4)** The **legal owner** of a wind **aggregated generating facility** must, in response to a request by the **ISO** under subsection 8(3), provide the following facility data:

(a) meteorological tower data collection height in meters (m), with a precision for instantaneous measurements to the nearest 1 m;

(b) turbine model name;

(c) turbine model capacity in megawatts (MW), with a precision to the nearest 0.1 MW;

(d) turbine wind speed cut-in in meters per second (m/s), with a precision to the nearest 0.1 m/s;

(e) turbine wind speed cut-out in meters per second (m/s), with a precision to the nearest 0.1 m/s;

(f) turbine temperature cut-out lower in degrees Celsius (°C), with a precision for instantaneous measurements to the nearest 1 °C and an indicator is required to confirm that the numbers are ambient temperature within the rotor or air temperature;

(g) turbine temperature cut-out upper in degrees Celsius (°C), with a precision for instantaneous measurements to the nearest 1 °C and an indicator is required to confirm that the numbers are ambient temperature within the rotor or air temperature;

(h) site latitude and longitude in degrees; and

(i) turbine power curves.

**(5)** The **legal owner** of a solar **aggregated generating facility** must in response to a request by the **ISO** under subsection 8(3), provide the following solar array data and records, including:

(a) site latitude and longitude in degrees;

(b) direct current (DC) **real power** rating;

(c) alternating current (AC) **real power** rating;

(d) inverter manufacturer and model;

(e) mounting height from ground in meters (m);

(f) tilt angle or range of tilt angles to horizontal plane in degrees;

(g) azimuth angle in degrees;

(h) alternating current (AC) **real power** capacity per **solar array** in megawatts (MW);

(i) mounting type, tracking (fixed, single or dual axis); and

(j) module type (crystalline, thin-film etc.).

## Revision History

| Date | Description |
|---|---|
| XXXX-XX-XX | Revised Applicability section to include facilities associated with offers in the energy or ancillary services markets. |
| 2018-09-01 | Initial release. |

**Table 1**
**Wind and Solar Aggregated Generating Facility Meteorological Data Requirements**

| Wind Aggregated Generating Facility Meteorological Data Requirements | | | | | | |
|---|---|---|---|---|---|---|
| **Measurement Type** | **Units** | **Precision** | **Range** | **Accuracy** | **Height of Instrument** | |
| | | | | | **Set-1** | **Set-2** |
| Wind Speed | Meters/Second (m/s) | 0.1 m/s | 0 to 50 | ±1m/s | At Hub Height | At 35 Meters |
| Wind Direction | Degrees from True North | 1 degree | 0 to 360 | ±5° | At Hub Height | At 35 Meters |
| Barometric Pressure | HectoPascals (HPa) | 1 hPa | 800 to 1000 | ±1.0 hPa at -20 to 50°C; and ±1.5 hPa at below -20°C | At Convenient location | At Convenient location |
| Ambient Temperature | Degree Celsius (°C) | 0.1° C | -50 to +50 | ±0.2°C | At Hub Height | At 35 Meters |
| Dewpoint | Degrees Celsius (°C) | 0.1° C | -50 to +50 | ±0.2°C | At Convenient location | At Convenient location |
| Relative Humidity | Percentage (%) | 1.00% | 0 to 100 % | ±2% | At Convenient location | At Convenient location |
| Ice-up Parameter Measured with an Icing Sensor | Scale 0.0 to1.0 | 0.1 | 0 to 1 | n/a | At Convenient location | At Convenient location |
| Precipitation | Millimeters/minute (mm/min) | 0.1 | 0 to11 | 2% up to 0.417 mm/mon 3% over 0.417 mm/min | At Convenient location | At Convenient location |
| **Solar Aggregated Generating Facility Meteorological Data Requirements** | | | | | | |
| **Measurement Type** | **Units** | **Precision** | **Range** | **Accuracy** | **Height of Instrument** | |
| | | | | | **Set-1 per 49 km$^2$** | **Set-2 for each subsequent 49 km$^2$** |
| Wind Speed | Meters/Second (m/s) | 0.1 m/s | 0 to 50 | ±1m/s | Between 2-10 meters | Between 2-10 meters |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wind Direction | Degrees from True North | 1 degree | 0 to 360 | ±5° | Between 2-10 meters | Between 2-10 meters |
| Barometric Pressure | HectoPascals (HPa) | 1 hPa | 800 to 1000 | ±1.0 hPa at -20 to 50°C; and ±1.5 hPa at below -20°C | Between 2-10 meters | Between 2-10 meters |
| Ambient Temperature | Degree Celsius (°C) | 0.1° C | -50 to +50 | ±0.2°C | Between 2-10 meters | Between 2-10 meters |
| Dewpoint | Degrees Celsius (°C) | 0.1° C | -50 to +50 | ±0.2°C | Between 2-10 meters | Between 2-10 meters |
| Relative Humidity | Percentage (%) | 1.00% | 0 to 100 % | ±2% | Between 2-10 meters | Between 2-10 meters |
| Precipitation | Millimeters/minute (mm/min) | 0.1 | 0 to11 | 2% up to 0.417 mm/mon 3% over 0.417 mm/min | Between 2-10 meters | Between 2-10 meters |
| Back panel Temperature | Degree Celsius (°C) | 0.1° C | -50 to +50 | ±0.15°C at -27 to +50°C; and ±0.2°C at below -27°C | Between 2-10 meters | Between 2-10 meters |
| Global Horizontal Irradiance | Watts/Square Meter ($W/m^2$) | 0.1 | 0 to 4000 | ±3% | Between 2-10 meters | Between 2-10 meters |
| Diffused Horizontal Irradiance | Watts/Square Meter ($W/m^2$) | 0.1 | 0 to 4000 | ±3% | Between 2-10 meters | Between 2-10 meters |
| Direct Normal Irradiance[1] | Watts/Square Meter ($W/m^2$) | 0.1 | 0 to 2000 | ±3% | Between 2-10 meters | Between 2-10 meters |

[1] The requirement to provide this parameter will be determined by the AESO based on solar technology used in the project.