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

## Applicability

**1** Section 304.9 applies to:

(a) the **legal owner** of **aggregated facility** containing wind or solar resources that is connected to:

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

(b) the **ISO**.

## Requirements

### Functional Specification

**2** The **ISO** must, in accordance and generally consistent with this Section 304.9, approve a written functional specification containing details, work requirements, and specifications for the design, construction, and operation of an **aggregated facility** containing wind or solar resources and any associated **transmission facility** connection facilities.

### Successor to Prior Requirements and Compliance Timeframe

**3** The provisions of this Section 304.9 succeed all previous forecasting requirements for **aggregated facilities**, whether in an **ISO rule** or other document, and those requirements will no longer be in force and effect as of September 1, 2018.

### Meteorological Data Collection Equipment and Availability Requirements

**4(1)** The **legal owner** of an **aggregated facility** containing wind or solar resources 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 an **aggregated facility** containing wind resources must ensure that it is equipped with one set of instruments for each meteorological parameter in accordance with the requirements in Table 1.

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

(a) one 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, except where otherwise noted in Table 1.

**(4)** The **legal owner** of an **aggregated facility** containing wind or solar resources 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 intervals of 15 **seconds** or less.

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

**(6)** The **legal owner** of an **aggregated facility** containing wind or solar resources 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 an **aggregated facility** containing wind or solar resources must determine and submit to the **ISO**, the following data:

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

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

### Data Transfer Technical Specification

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

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

**(3)** The **legal owner** of an **aggregated** facility containing wind or solar resources 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 48 hours or less.

**(4)** The **legal owner** of an **aggregated facility** containing wind or solar resources must keep 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 30 **days**.

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

**6(1)** The **legal owner** of an **aggregated facility** containing wind or solar resources 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 is suspected 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 an **aggregated facility** containing wind or solar resources 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); and

(b) in the event of an equipment failure:

(i) a plan acceptable to the **ISO** to repair the failed equipment, including testing; and

(ii) the expected date when the equipment will be repaired and the required measurements will be restored.

**(3)** The **legal owner** of an **aggregated facility** containing wind or solar resources 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 an **aggregated facility** containing wind or solar resources 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** The **legal owner** of an **aggregated facility** containing wind or solar resources is, notwithstanding subsections 4 and 5, 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 an **aggregated facility** containing wind resources 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 an **aggregated facility** containing solar resources 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)** The **legal owner** of an **aggregated facility** containing wind or solar resources must, subjectto the provisions of this subsection 8, retain and provide within 60 **days** of the **ISO**'s written request the following averaged meteorological data and records at 10 minute intervals or less, covering the 2 calendar years prior to the **commissioning** of the **aggregated facility**:

(a) details on the height of the measurements;

(b) wind speed;

(c) wind direction;

(d) temperature;

(e) barometric pressure; and

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

**(4)** The **legal owner** of an **aggregated facility** containing wind resources 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 m, with a precision for instantaneous measurements to the nearest 1 m;

(b) turbine model name;

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

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

(e) turbine wind speed cut-out in 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 with an indicator 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 with an indicator 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 an **aggregated facility** containing solar resources 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**real power** rating;

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

(d) inverter manufacturer and model;

(e) mounting height from ground in m;

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

(g) azimuth angle in degrees;

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

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

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

## Revision History

| Date | Description |
|---|---|
| 2023-04-01 | Amended, as approved in **Commission** Decision 28176-D01-2023 issued on June 13, 2023. |
| 2023-03-31 | Updated to align with current AESO drafting principles. |
| 2019-12-11 | “Removed duplication with new Section 103.14, Waivers and Variances; standardized functional specifications language; capitalized references to “Section”.” |
| 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** |
| Wind Speed | Meters/Second (m/s) | 0.1 m/s | 0 to 50 | ±1m/s | At Hub Height |
| Wind Direction | Degrees from True North | 1 degree | 0 to 360 | ±5° | At Hub Height |
| 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 |
| Ambient Temperature | Degree Celsius (°C) | 0.1° C | -50 to +50 | ±0.2°C | At Hub Height |
| Dewpoint | Degrees Celsius (°C) | 0.1° C | -50 to +50 | ±0.2°C | At Convenient location |
| Relative Humidity | Percentage (%) | 1.00% | 0 to 100 % | ±2% | 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 |
| 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 |

| 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.