PURPOSE

This document applies to wind Generators and describes technical standards that such wind Generators must satisfy to be qualified as a Participating Intermittent Resource (PIR) under the CAISO’s Participating Intermittent Resource Program (PIRP). The requirements set forth herein apply to all applicable Eligible Intermittent Resources (EIR) whether pursuing initial or continuing PIR status.

Background

In 2008, the CAISO, in conjunction with AWS Truewind, documented for all wind Generators in PIRP during 2007 the relationship between forecast accuracy and site data availability.\(^1\) The CAISO’s report concluded that the ability to develop an accurate real time production forecast for any particular wind Generator correlates to the availability of site specific and precise real time data. Other studies performed by other system operators have reached similar conclusions.\(^2\) The CAISO subsequently evaluated the root cause of data unavailability.\(^3\) The root cause analysis identified power loss due to planned or forced outages and other equipment failure at the generating site as accounting for over 90% of the data unavailability during the study period. The requirements imposed on all PIRs, in part, implement the recommendations articulated in the root cause study.

Resource Eligibility

It is an ongoing and continuous obligation of PIRs to satisfy all criteria\(^4\) set forth in the Eligible Intermittent Resource Protocol at Appendix Q of the CAISO Tariff (EIRP).\(^5\) This document facilitates compliance by providing information on the following:

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\(^1\) (CAISO Website upon posting


\(^3\) ERCOT([http://nodal.ercot.com/docs/pd/ems/pd/wpforc/ems_wind_power_forecasting_req_b2_v3_0.doc](http://nodal.ercot.com/docs/pd/ems/pd/wpforc/ems_wind_power_forecasting_req_b2_v3_0.doc)

\(^4\) NYISO Presentation/Anecdotally UWIG conference Oct 2, 2008

\(^5\) [http://www.caiso.com/1fdb/1fdb6b0c5e170.pdf](http://www.caiso.com/1fdb/1fdb6b0c5e170.pdf). EIRP Section 2.4.5 addresses the procedures associated with and consequences of the failure of a PIR to fully comply with the PIR’s obligations under the CAISO Tariff or EIRP.
CAISO PIRP Wind Telemetry Requirements

- The form of the Letter of Intent to become a PIR (Appendix A) [EIRP Sec. 2.2.1(c)]
- Data relevant to forecasting, including operational and meteorological data [EIRP Sec. 2.2.3 and 3.1]
- Monitoring and communications requirements [EIRP Sec. 3.2]
- Forecasting data equipment requirements [EIRP Sec. 2.2.3, 6, and 6.2]

Letter of Intent

The form Letter of Intent required by the EIRP is set forth as Appendix A hereto. The Letter of Intent includes the requirement that the proposed PIR submit, as Attachment A to the Letter of Intent, a copy of the California Energy Commissions’ Renewable Portfolio Standard (RPS) Certification identifying the facility as RPS eligible.

Physical Site Data

Wind power producers or their SCs must provide the CAISO with accurate information regarding the physical site location of the EIR before a forecast will be produced. The information must include (1) the location (latitude and longitude coordinates), and elevation each wind turbine hub height and (2) the location (latitude and longitude coordinates), and elevation of meteorological collection devices.

Meteorological and Production Data

Under the Eligible Intermittent Resource Protocols, an Eligible Intermittent Resource must install and maintain equipment required by the California ISO to support accurate power generation forecasting and the communication of such meteorological and other

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7 California ISO Tariff, Appendix Q, EIRP 2.2.3 and 6.

8 The California ISO is proposing that the forecasting and communication equipment and data requirements of the EIRP apply to all intermittent resources interconnected, or interconnecting, to the California ISO Controlled Grid. Currently, the requirement applies to only those Eligible Intermittent Resources that elect to become Participating Intermittent Resources. The reason for this change is to ensure that as intermittent resources become a greater percentage of California’s generation fleet, an accurate assessment of forecasted output from such resources becomes critical to the efficient and reliable operation of the grid.
needed data to the California ISO. Communication of such data to the California ISO will remain via the Data Processing Gateway (DPG).

The EIR must install a minimum of one (1) meteorological station with barometric pressure, temperature, wind speed and direction measured at the average hub height placed on the prevailing upstream side of the wind farm. A second meteorological station is required to measure barometric pressure, temperature, wind speed and direction. The second meteorological station may be co-located on the primary meteorological station tower. The height of the second station should be approximately 30 meters below the average hub height.

The California ISO also requires that wind speed and direction data be provided from multiple turbines in addition to meteorological tower(s) within the footprint of a wind park. In particular, the EIR must provide data from a nacelle anemometer and wind vane9 (wind information) in accordance with the following:

Definitions:

A Designated Turbine (DT): A turbine for which nacelle wind speed and direction data is provided.

Average Horizontal Spacing (AHS): The average horizontal distance between a turbine's and its closest neighbor.

Vertical Distance (VD): The elevation difference between the height of a turbine's base and the height of the base of another turbine.

Requirement:

DTs should be selected such that each turbine within a wind farm is within a horizontal distance of 5 X AHS and a vertical distance of 75 m of a DT.

In addition to the wind information from the DT, the real time production power data will be required. The DT must be capable of sending the wind and power information to the California ISO via DPG along with data received from the meteorological tower(s) and MW production data.

The objective of this guideline is to ensure a dataset that adequately represents the variability in wind within the farm. It is recognized that individual farms may have issues

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9 This requirement applies to all turbines that have the capability of providing the data. Existing wind parks that have the ability to provide the wind information will have six months from tariff modification to comply.
that may prohibit them from meeting this requirement. In these cases, a cost-effective distribution of DTs that approximates this guideline and adequately measures the variability of the wind within the farm will be formulated by mutual agreement among the park owner, the CAISO forecast service provider and the CAISO.

If DT wind and MW production data is being sent to the California ISO, the requirement for an average hub height meteorological tower will be waived. The requirement for a meteorological station 30 meters below the average hub height, however, does remain.

It is understood that wind data collected at the nacelle will not represent the true wind value at a park, but instead will represent the apparent wind, which can be correlated to the co-located turbines.

The need for this requirement is to a) ensure multiple data streams for anemometer information and b) ensure a more accurate representation of the data points to calculate wind energy production at the park.

Each meteorological station must have a backup power source that is independent of the primary power source for the station.

The FSP requires production and meteorological data will be collected for a minimum of sixty (60) days before the PV or ST EIR is considered in the PIRP. This data must be collected in advance in order to train the forecast models (e.g. artificial neural networks) responsible for producing the power production (MW) forecast for each site.

Table 1 details the units and precision of measurements to be sent to the CAISO.

Table 1

<table>
<thead>
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<th>Measurement</th>
<th>Units</th>
<th>Precision</th>
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<td>Wind Speed</td>
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<td>Wind Direction</td>
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<td>Ambient Air Temperature</td>
<td>Degrees Centigrade (°C)</td>
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<td>Barometric Pressure</td>
<td>HectoPascals (HPa)</td>
<td>60 Pa</td>
</tr>
<tr>
<td>Aggregate Resource</td>
<td>Mega-Watts (MW)</td>
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</tbody>
</table>
Maintenance & Calibration

The non-turbine meteorological information sent to CAISO must be calibrated annually traceable to national or international standards.

Outage Data (3/1/09 still in rewrite)

If a PIR is reducing its production from its stated maximum production value (pMax) by more than one (1) MW, it is the responsibility of the PIR (or its Scheduling Coordinator) to provide the CAISO with plant outage information via the CAISO’s Scheduling Logging for the ISO of California (SLIC) reporting system. This data is needed to ensure the energy forecast does not exceed the plant’s reported derated capability and to ensure an accurate forecast.
Appendix A
FORM OF LETTER OF INTENT TO BECOME PARTICIPATING INTERMITTENT RESOURCE

[Entity Letterhead]

[Date]

Attn: Project Manager, Model and Contract Implementation
California Independent System Operator Corporation
151 Blue Ravine Road
Folsom, CA 95630

Re: Intent to become a Participating Intermittent Resource

In accordance with Section 2.2.1 of the California Independent System Operator Corporation’s (“CAISO”) Eligible Intermittent Resource Protocol (the “Protocol”), this letter provides __________________ [name of Entity]’s notice to the CAISO that it intends to become a Participating Intermittent Resource (the “Letter of Intent”).

____________________ [name of Entity] requests that the CAISO initiate the process of certifying its facilities known as _________ [project name] as a Participating Intermittent Resource.

____________________ [name of Entity] agrees that, prior to the date of such certification, it will execute a Participating Generator Agreement and a Meter Service Agreement for ISO Metered Entities as required by Section 2.2.1 of the Protocol and thereafter will pay the Forecast Fee as required by Section 2.4.1 of the Protocol.

Further, ___________ [name of Entity] agrees that _____ [project name] will remain a Participating Intermittent Resource for a period of at least ____ [insert number of years greater than or equal to one] year(s) following the date of its certification, over which time the maximum Forecast Fee shall be as specified in Schedule 4 of CAISO Tariff Appendix F in effect as of the date of this Letter of Intent, and that ____________ [project name] shall thereafter continue to be a Participating Intermittent Resource unless this Letter of Intent is cancelled with thirty (30) days written notice to the CAISO.

Finally, attached to this Letter of Intent as Attachment A is a copy of the California Energy Commissions’ Renewable Portfolio Standard (RPS) Certification identifying ______________ [name of facility] as RPS eligible.

Sincerely,

[Name of Entity]

[Name and title of person with authority to sign commitments for Entity]

**APPROVAL**

<table>
<thead>
<tr>
<th>Approved By</th>
<th>Signature</th>
<th>Date</th>
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<tr>
<td>Jim Blatchford</td>
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