California ISO Your Link to Power	Technical Requirements		
		Version No.	1.0
		Effective Date	
CAISO Wind Generator Communication and Forecasting Data and Equipment Requirements			

Applicability

The requirements set forth in this document apply to Eligible Intermittent Resources (EIRs) powered by wind with a Participating Generator Agreement (PGA) or Qualifying Facility Participating Generator Agreement (QF PGA), except as otherwise specified below and whether or not the Participating Generator is certified or seeking certification as a Participating Intermittent Resource.

Purpose

Participating Generators must comply with all applicable provisions of the ISO Tariff. (ISO Tariff § 4.6.1.1; PGA Sec. 4.2.) The Eligible Intermittent Resources Protocol (EIRP) at Appendix Q of the ISO Tariff imposes various communication and forecasting equipment and forecasting data requirements on EIRs with PGAs as well as additional requirements on such EIRs electing certification as a Participating Intermittent Resource (PIR).[1] This document facilitates compliance with the EIRP by providing additional information regarding:

- The form of the Letter of Intent to become a PIR (Appendix 1) [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 and communication equipment requirements [EIRP Sec. 2.2.3, 6, and 6.2]

Letter of Intent

The *pro forma* Letter of Intent required by the EIRP is set forth as Appendix 1 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 Commission's

[1] The EIRP does not currently extend any obligations to EIRs other than to those seeking PIR certification. This document, as drafted, assumes the EIRP has been modified to incorporate the policies described herein. Consistent with ISO practice, once the policies underlying any potential tariff changes have been defined, the ISO will modify applicable tariff provisions accordingly and will publish such changes for stakeholder review. At that time, this document will be finalized by removing this footnote.

Renewable Portfolio Standard (RPS) Certification[2] identifying the facility as RPS eligible.

[2] *http://www.energy.ca.gov/2007publications/CEC-300-2007-006/CEC-300-2007-006-ED3-CMF.PDF*

Communication and Forecasting Data and Equipment

1. Background

In 2008, the ISO, in conjunction with AWS Truewind, documented for all wind Generators in Participating Intermittent Resource Program (PIRP), the relationship between forecast accuracy and site data availability.[3] The ISO's report concluded that the ability to develop an accurate real time production forecast for any particular wind Generator strongly correlates to the availability of site specific and precise real time data. Studies performed by other system operators have reached similar conclusions.[4] The ISO subsequently evaluated the root cause of data unavailability.[5] 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.

In response to state mandated RPS, EIRs will produce an increasing percentage of the Energy delivered within the ISO Balancing Authority Area. Given this greater reliance on EIRs, the ISO must obtain accurate forecasts of EIR production to maintain reliable and efficient system operation. Accordingly, the ISO has expanded the applicability of EIRP requirements, which reflect the recommendations articulated in the root cause study, to all EIRs with a PGA, except as otherwise exempt, rather than only to those EIRs obtaining or seeking PIR status.

2. Physical Site Data

As part of an EIR's obligation to provide data relevant to forecasting Energy from the EIR,[6] each applicable wind EIR or its Scheduling Coordinator must provide the ISO with accurate information regarding the physical site location of the EIR. The information must include (1) the location (latitude and longitude coordinates), and elevation each

[3] http://www.caiso.com/208a/208a86fd68120.pdf

[4] AESO (http://www.aeso.ca/downloads/Work_Group_Paper_Final_(3).pdf ,)

ERCOT(http://nodal.ercot.com/docs/pd/ems/pd/wpforc/ems_wind_power_forecasting_req_b2_v3_0.doc)

, NYISO Presentation/Anecdotally UWIG conference Oct 2, 2008

[5] (CAISO Website)

[6] ISO Tariff, Appendix Q, EIRP 3.1.

wind turbine hub height and (2) the location (latitude and longitude coordinates), and elevation of meteorological collection devices.

3. Meteorological and Production Data

Each EIR must install and maintain equipment required by the ISO to support accurate power generation forecasting and the communication of such forecasts, meteorological and other needed data to the California ISO.[7] Communication of such data to the California ISO will remain via the Data Processing Gateway (DPG).

In accordance with this requirement, the EIR must install a minimum of one (1) meteorological station measuring barometric pressure, temperature, wind speed and direction that is representative of the microclimate and winds at hub height 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[8]. This requirement will not require any EIR with an existing meteorological station tower(s) or final regulatory approvals to construct a meteorological station tower(s) as of ____, 2009, to modify the location or configuration of such meteorological station(s). Further, in instances where placement of the meteorological Station tower(s) in accordance with this requirement would cause a reduction in production or violation of a local, state, or federal statute, regulation or ordinance, the ISO, in coordination with any applicable forecast service provider, will cooperate with the EIR to identify an acceptable placement of the meteorological station tower.

Except where an EIR with a PGA or QF PGA does not have an installed nacelle anemometer as of ____, 2009 the ISO requires that wind speed be provided from multiple turbines, in addition to meteorological tower(s), within the footprint of a wind park in accordance with the following:

Definitions:

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

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

[7] ISO Tariff, Appendix Q, EIRP 2.2.3 and 6.

[8] Existing plants will have 6 months to comply with installation of the second station.

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 75m of a DT. (See Appendix 2.)

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 EIRs may have circumstances that prohibit them from reasonably satisfying 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 EIR will be formulated by mutual agreement among the park owner, the CAISO forecast service provider and the CAISO. EIRs seeking a variance from this requirement should do so as part of development of their Interconnection Agreement and for those EIRs with an Interconnection Agreement, as part of entering into a Meter Service Agreement for CAISO Metered Entities.

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.

Many sites provide the primary power for the meteorological stations and DPGs by either backfeed from the transmissions line or directly from the wind turbine feeders. Each meteorological station and DPG must have a backup power source that is independent of the primary power source for the station (e.g. station power, battery or

solar panel). The backup power source must provide power until primary power is restored.

Production and meteorological data will be collected for a minimum of sixty (60) days before the EIR can be certified as a PIR. 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.

Measurement	Units	Precision
Wind Speed	Meters/Second (m/s)	1 m/s
Wind Direction	Degrees from True North	5 degrees
Ambient Air Temperature	Degrees Centigrade (°C)	1 degree C
Barometric Pressure	HectoPascals (HPa)	60 Pa
Aggregate Resource Generation	Mega-Watts (MW)	--

Table 1

Communication of data to the ISO will remain via the Data Processing Gateway (DPG).

Maintenance & Calibration

Meteorological Equipment should be tested and, if appropriate, calibrated, per manufacturer's recommendations or when indications are suspect or maintenance has been performed that may have interrupted or otherwise adversely impacted the accuracy of operational data.

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

Appendix 1

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

Appendix 2

The following algorithm outline the steps the software takes to define the average distance between turbines to identify the designated turbine (DT)

AVDST is defined as the average horizontal distance between a turbine and its nearest neighbor. Each turbine must be within a distance of 5 times AVGDIST of a designated turbine. The base of each turbine must also be within 75 m of elevation of the base of a designated turbine which also satisfies the first criterion.

ALGORITHM:

1. The distance between each turbine and every other turbine is calculated.

2. The distance between each turbine and its nearest neighboring turbine is determined from the calculation in step 1.

3. A preliminary average distance between a turbine and its nearest neighboring turbine is calculated.

4. If any turbine is more than 5 times the preliminary average distance between turbines and their nearest neighbor it is considered an outlying turbine. It will become a designated turbine. It is removed from consideration and the average distance between a turbine and it's nearest neighbor is re-calculated.

5. The number of turbines for which each turbine satisfies the location and elevation criteria is calculated.

6. The turbine which satisfies the location and elevation criteria for the most other turbines is tentatively selected as the first designated turbine.

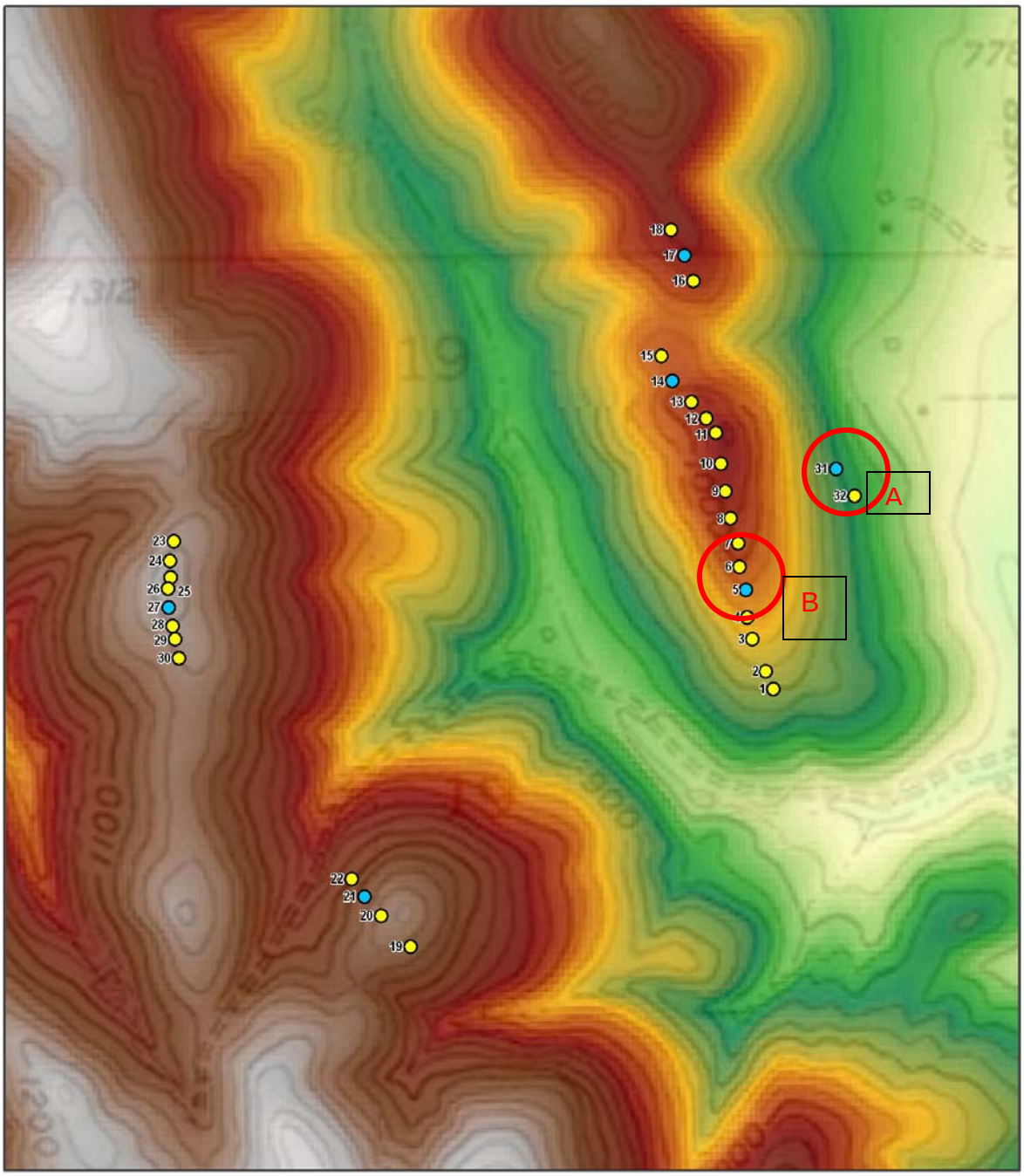
7a. If there is more than one turbine that satisfies the selection criteria for an equal number of other turbines, then the one which has the least average distance between itself and the other turbines for which it satisfies the criteria becomes a designated turbine.

7b. If one turbine satisfies the selection criteria for more other turbines than any other turbine then it becomes a designated turbine.

8. All turbines for which the new designated turbine satisfies the selection criteria are removed from consideration.

9. If there are turbines left without an associated designated turbine repeat the process from step 5 considering ONLY those turbines without an associated designated turbine.

The attached map illustrates a proposed solution for a mock wind park. The yellow and blue dots represent wind turbines. The blue dots represent the DTs. Although the average distance of the circled turbines A to B appear to be within 5 times the average distance criteria, the DT in circle A was designated based on the difference in elevation from A to B.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APPROVAL

Approved By	Signature	Date
Jim Blatchford		