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Central Wind Power Forecasting Programs in North America by Regional Transmission Organizations and Electric Utilities: Revised Edition

2008 to 2010

Jennifer Rogers and Kevin Porter
Exeter Associates, Inc.
Columbia, Maryland

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September 2010
The information presented in this report is current as of September 2010.

and incorporating review comments from:

Mark Ahlstrom, WindLogics
Jim Blatchford, California Independent System Operator (CAISO)
Jacques Bourret, Hydro Québec
David Edelson, New York Independent System Operator (NYISO)
Erik Ela, National Renewable Energy Laboratory (NREL)
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David Maggio, Electricity Reliability Council of Texas (ERCOT)
Matt Neel, Bonneville Power Administration (BPA)
Michael McMullen, Midwest Independent System Operator (Midwest ISO)
Kenneth Pennock, AWS Truepower
Keith Parks, Xcel Energy
Jacques Duchesne, Alberta Electric System Operator

The following table addresses the implementation of central wind power forecasting by electric utilities and regional transmission organizations in North America. The first part of the table focuses on electric utilities and regional transmission organizations that have central wind power forecasting in place; the second part focuses on electric utilities and regional transmission organizations that plan to adopt central wind power forecasting in 2010. Table entries are organized as follows:

- What the record peak demand is for the electric utility or regional transmission organization.
- What total generating capacity is available.
- What amount of wind capacity has been installed.
- What area is served by the electric utility or regional transmission organization
- When the wind power forecast was put into operation, or will be in operation.
- What wind power forecast vendor and model is used.
- What wind power forecast tools and techniques are used.
- What applications the wind power forecasts are used for.
- How wind power forecasts are paid for.
- What data is required, by wind turbine and wind project.
- How the wind power forecast is conducted.
- Whether a ramp forecast is prepared.
- How the wind power forecast performed.

Caution should be used in the interpretation of the performance data. The data encompasses different time periods, and can vary significantly based on location, season, weather regime, geographic distribution of the wind projects, potential wind curtailment, wind turbine availability, and other factors.

	CAISO	ERCOT	Hydro-Québec	Midwest ISO
Record Peak Demand	50,270 MW (July 24, 2006)	63,400 MW (July 2009)	37,230 MW (January 16, 2009)	109,157 MW (July 31, 2006)
Available Generating Capacity	48,954 MW (excludes 10,350 MW of net imports)	About 81,000 MW	44,192 MW	131,284 MW (Designated Capacity)
Installed Wind Capacity	2,953 MW (CAISO total); 1,005 MW in CAISO's wind Settlements program.	9,117 MW	659 MW	7,579 MW 8,169 registered in Midwest ISO quarterly report as of June 2010.
Area Served	75% of California load	85% of load in Texas; 75% of Texas by geography.	Quebec, Canada	All or most of North Dakota, South Dakota, Minnesota, Iowa, Wisconsin, Illinois, Indiana, Michigan and parts of Montana, Missouri, Kentucky, and Ohio.
Date of Operation of Wind Forecast	June 2004	July 2008	November 2006	June 2008
Wind Power Forecast Vendor	AWS Truepower	AWS Truepower	Environment Canada: operational GEM 15-km NWP	Energy & Meteo GmbH
Forecast Model	eWind	eWind	Anemos/WPPT; HQ proprietary models; Forecasting tools operated by HQ	Previento

	CAISO	ERCOT	Hydro-Québec	Midwest ISO
Forecast Tools/Techniques	Uses ensemble forecasts and statistical analysis to prepare wind power forecast. Uses the following inputs: grid point output from regional-scale and global-scale NWP models; measurement data from several meteorological sensors; high-resolution geographical data; and meteorological and generation data from wind projects.	AWS Truepower uses a composite of the individual members of an ensemble of forecasts for each wind project in the ERCOT territory. Uses three NWP models, one run every 3 hrs and two run every 6 hrs; Wind Generation Resource (WGR) output model mixed approach: some statistical using WGR data and some specified power curve. Plan to use: 9 NWP model ensemble run every 6 hrs; single NWP model run every hr (known as a Rapid Update Cycle); Statistical optimized ensemble procedure that will weight ensemble members according to performance in a rolling training sample; Statistical power output model: all WGRs with adequate data.	Statistical models using NWP and actual wind project generation and turbine availability as inputs. Extensive R&D program on additional and complementary forecasting tools at the Institut de recherche d'Hydro-Québec (IREQ), Hydro-Québec's research institute.	Physical model that uses Numerical Weather Prediction (NWP) forecasts as input. Energy & Meteo uses NWP input, a combination of several numerical weather models weighted according to the weather situation, site-specific power curves based on historical data, and a shorter-term model (0-10 hours) based on wind power measurements and NWP input.

	CAISO	ERCOT	Hydro-Québec	Midwest ISO
Forecast Applications	Used in hour-ahead market, as Participating Intermittent Resource Program (PIRP) participants must self-schedule wind power forecast. Day-ahead wind power forecast advisory.	Day-ahead Unit Commitment uses 50% exceedance forecast for day-ahead planning (i.e., 50% chance production meets or exceeds wind power forecast). This is accompanied by an 80% probability of exceedance forecast. Until ERCOT completes its capacity studies for the next day, Qualified Scheduling Entities (QSEs) are required to use a day-ahead wind forecast provided by ERCOT as the planned operating level for wind power in their day-ahead resource plan. QSEs may provide a lower value if capacity will be unavailable. Forecasts also used as input to determine need for monthly non-spinning reserve service.	Day-ahead and intra-day scheduling (generation scheduled to meet expected load, transaction schedules, and reserve requirements); Intra-day rescheduling; short-term maintenance scheduling.	Transmission security planning and outage coordination; and forward and intra-day reliability analysis. Also can use wind power forecast to determine impact of wind variability on transmission flowgates and to manage transmission constraints. Midwest ISO is working with stakeholders on a Dispatchable Intermittent Market Product to allow Intermittent Resources to offer into the market and follow a setpoint from the Security Constrained Economic Dispatch output.
Forecast Payment Method	Fee assessed on all eligible intermittent resources (PIRP and non-PIRP) of $0.10/MWh, and the CAISO covers about $0.03/MWh from within its operating budget. The CAISO also charges an export fee for energy from PIRP facilities exported outside CAISO balancing area.	ERCOT pays for the central wind power forecasting service.	HQ pays for the wind power forecasting service.	Midwest ISO pays for the central wind power forecasting service.

	CAISO	ERCOT	Hydro-Québec	Midwest ISO
Wind Turbine Data Requirements	Real-time telemetry data requirements: wind speed, wind direction, barometric pressure, ambient temperature, real-time MW production, MW production revenue meter. Data requirements: latitude/longitude and elevation of the turbine hub height that will be used as a designated turbine. A designated turbine is the turbine designated to send in anemometry data to represent a surrounding group of turbines.	The number, MW rating, and model of turbines. Also requires average hub height of the project and geographic location of the center of the wind project. Turbine Outage/Availability data is currently voluntary; however ERCOT is working on making it a requirement.	Operational planning data (planned turbine availability); turbine specifications (power curve, control system, cold weather packages, etc); real-time data including kW of active power, nacelle direction, blade position, temperature at nacelle level, wind speed, wind direction, and turbine status.	Not applicable - wind projects do not provide any turbine-specific information to Energy & Meteo. Wind turbine outages not currently factored into the wind power forecast, but the Midwest ISO anticipates doing so in the future.
Wind Project Data Requirements	As of July 1, 2010: Outage reporting: Each wind project must submit outages of at least 1 MW and greater if their overall capacity is greater than 10 MW. A second met tower must be installed. Alternatively, a second data recording device may be on the same met tower, located at approximately 30 meters below the average hub height.	AWS Truepower Data Requirements: Observed Generation; Observed Meteorological Data (Wind Speed, Wind Direction, Temperature, and Atmospheric Pressure). Observed Availability and Observed Basepoint required, but not currently available to the wind power forecaster. Intended to be available and used under the nodal market.	Specifications (wind project layout). Real-time data including: kW of active power; kW power available from wind turbines, substation, and wind project; number of available turbines; numbers of turbines stopped due to weak wind, strong wind, and low temperature. Meteorological data (horizontal and vertical wind speed, wind direction, temperature, humidity, and atmospheric pressure).	Market participants required to provide non-binding day-ahead intermittent resource forecast to Midwest ISO. Midwest ISO provides the latitude and longitude values of each wind project, the hub heights, maximum and historical MW output, and real-time output for each wind project to Energy & Meteo. Energy & Meteo uses this information to create the wind power forecasts.

	CAISO	ERCOT	Hydro-Québec	Midwest ISO
Description of Forecast	Next day: production (MW) for each hour of next calendar day, delivered by 5:30 AM. Next hour: production (MW) for each of the next 7 hours, delivered by 15 minutes after each hour and at least 1 hour and 45 minutes before real time. For hour-ahead and day-ahead forecasts, AWS Truepower also sends 80% and 20% MW probability of exceedance values for each interval of the forecast period.	Short-term wind power forecasts are updated hourly and cover 1-48 hours ahead. Forecast delivered by 15 minutes past each hour and represent a 50% and an 80% exceedance level. Provided it out-performs the ERCOT forecast, QSEs may use their own short-term forecast during the operating day. QSEs may provide a lower value if capacity will be unavailable. Though not currently required, the following will be a requirement when the nodal market is launched in late 2010: Long-Term (one year) forecasts: The long-term forecast is a "typical" energy profile for each day of a future month out to 36 months. Wind developers will be required to submit the long-term wind power forecast each month for a rolling 36 month period.	NWPs updated twice daily [at midnight and 12 PM (UTC)], covering 48 hours ahead. Recently added additional 6 AM and 6 PM runs. Wind power forecasts updated hourly. Alarms sent to the network and wind project operators when expected storms, icy conditions, or very low temperatures risking turbine shutdowns are foreseen.	5 minute granular forecasts for each Commercial Pricing (CP) node (100+), and updates every 5 minutes are provided for the next 6 hours. The Midwest ISO also receives hourly updated forecasts from Energy & Meteo for each hour beyond 6 hours for the next seven days, for the same CP nodes. Energy & Meteo provides forecasts at 4 levels: CP nodes, zones, regions and all of Midwest ISO. Generally, the CP nodes represent an individual wind project. Three different NWP models are used for each of these levels. Energy & Meteo also forecasts wind power output as an optimal combination of all three forecasts. Statistical power curve for each wind project. PJM and the Midwest ISO exchange forecasts to assist in maintaining and improving reliability.

	CAISO	ERCOT	Hydro-Québec	Midwest ISO
Ramp Forecast	No ramp forecast; currently working with the DOE and BPA to develop a Short Term Event Predictor along with a ramp forecast tool.	Have a ramp forecast in the control room for the ERCOT Operators. AWS Truepower provides probabilistic ramp rate forecasts every 15 min for the next 6 hours; a MW forecast for ramp events, a 90% confidence band of the expected MW value, and a ramp event forecast that gives probabilistic values of ramp parameters (expected start time, duration, maximum ramp rate, and total amplitude). The tool is currently used for situational awareness purposes and does not directly feed any ERCOT system applications.	No ramp forecast.	No ramp forecast; under consideration.
Forecast Performance Metrics	Average MAE for system-wide aggregate for April 2009-June 2010 was 6.53% for the 105-minute forecast (the forecast for the hour beginning 105 minutes after the forecast is delivered). Day-ahead forecast MAE for the same period was 10.0%. All numbers quoted are % of capacity.	For all of ERCOT, monthly averaged MAE for the 4:30 PM system-wide day-ahead forecast, for May 2009-May 2010, ranged from 7.08% to 10.73% of capacity for all hours.	For April 2009 -March 2010, the MAE was 6.30% of capacity for the hour-ahead forecast, and 9.51% of capacity for the 24-hour ahead forecast.	For December 2008-December2009, the average MAE was 2.25% for the hour-ahead forecast and 4.03% of capacity for the day-ahead forecast (calculated at 1600 for the next day).

	NYISO	PJM	SCE	Xcel Energy
Record Peak Demand	33,939 MW (August 2, 2006)	144,644 MW (August 2, 2006)	23,303 MW (August 31, 2007)	Concurrent system-wide peak data unavailable. Xcel subsidiary peaks are as follows: NSP: 9,126 MW (August 9, 2010) PSCo: 6,750 MW (July 24, 2007) SPS: 5,502 MW (August 5, 2008)
Available Generating Capacity	37,416 MW (Summer 2010)	167,326 MW	SCE considers data as confidential.	System-wide capacity data unavailable. Installed capacity of Xcel subsidiaries are: NSP: 8,666 MW PSCo: 7,922 MW SPS: 5,508 MW Xcel also has several power purchase agreements that are not reflected in these numbers.
Installed Wind Capacity	1,274 MW (1,256 MW included in the forecast – 2 older wind plants considered too small to include).	About 2,500 MW	1,583 MW	3,165 MW
Area Served	New York	All or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia.	50,000 square mile area of California, excluding the City of Los Angeles and certain other cities	Xcel Energy serves parts of eight states, including Colorado, Michigan, Minnesota, New Mexico, North Dakota, South Dakota, Texas, and Wisconsin.
Date of Operation of Wind Forecast	June 2008 – for dispatch decisions; May 2009 – for individual wind plant economic dispatch decisions	April 2009	November 2000	October 2009
Wind Power Forecast Vendor	AWS Truepower	Energy & Meteo GmbH	AWS Truepower	The National Center for Atmospheric Research (NCAR)
Forecast Model	eWind	Previento	eWind	RTFDDA-WRF with DiCast technology

	NYISO	PJM	SCE	Xcel Energy
Forecast Tools/Techniques	Uses ensemble forecasts and statistical analysis to prepare wind power forecast. Uses the following inputs: grid point output from regional-scale and global-scale NWP models; measurement data from several meteorological sensors; high-resolution geographical data; and meteorological and generation data from wind projects.	Physical model that uses Numerical Weather Prediction (NWP) forecasts as input. Energy & Meteo uses NWP input, a combination of several numerical weather models weighted according to the weather situation, site-specific power curves based on historical data, and a shorter-term model (0-10 hours) based on wind power measurements and NWPs. Wind turbine de-rating data is integrated in the forecast.	Uses ensemble forecasts and statistical analysis to prepare wind power forecast. Uses the following inputs: grid point output from regional-scale and global-scale NWP models; measurement data from several meteorological sensors; high-resolution geographical data; and meteorological and generation data from wind projects. SCE inputs outage and curtailment data both prior and post-production.	NCAR incorporates observations of current atmospheric conditions from a variety of sources using 3 NCAR-based tools: the Weather Research and Forecasting model; the Real-Time Four-Dimensional Data Assimilation system; and the Dynamic Integrated Forecast System.
Forecast Applications	Used to review day-ahead unit commitment schedules to ensure enough generation is committed to meet load forecast. Also used in real time to make real-time commitment and dispatch decisions.	Used to determine whether there is sufficient generation scheduled within PJM to meet expected load, transaction schedules, and reserve requirements.	Energy scheduling.	Forecasts used for day-ahead commitment and to influence real-time dispatch.
Forecast Payment Method	Fee assessed to each wind project. Charge includes the sum of a monthly fee of $500 and a separate monthly fee of $7.50 per MW of nameplate capacity. Fees are subject to change as more wind projects are added.	PJM pays for the central wind power forecasting service.	SCE pays for the wind power forecasting service.	Xcel Energy pays for the wind power forecasting services and R&D.

	NYISO	PJM	SCE	Xcel Energy
Wind Turbine Data Requirements	Turbine manufacturer specifications; plant configuration (latitude/longitude of each turbine); manufacturer's power curve; plant/turbine availability; plant level or turbine level power output data; both planned and unplanned outage information; and cut-in, cut-out, and cut-back-in settings data.	General turbine information (class of turbine, turbine capacity); min/max wind speed; manufacturer power curves; geographic location; hub height; ambient temperature operating limits and information on installation of cold weather packages. Along with these turbine-specific requirements, the initial project data required includes aggregate historic power output, meteorological and outage data; and the aggregate reactive capability curve.	MW production metering.	Static data including latitude/longitude of each turbine, hub height, elevation, and turbine make/model. Dynamic data including generation data, nacelle wind speed, and turbine availability status.
Wind Project Data Requirements	Meteorological data from at least one point at least every 30 seconds, and from locations such that no individual turbine is more than 5 km from a reporting sensor. On-site meteorological data [wind speed, wind direction, pressure, temperature, humidity, dew point] from multiple heights. Daily penalties of the greater of $500 or $20/MW for persistent lack of or bad data.	Real time aggregate wind project MW output. Must install at least one meteorological tower (or wind speed and direction from selected wind turbine anemometers and wind vanes) with wind speed and wind direction data required; temperature and pressure data preferred; and humidity data accepted. Outage of turbines ≥ 1 MW or an outage lasting 1 hour or more must be reported.	Meteorological data (wind speed, direction, temperature, humidity). SCE uses 12 met towers (six each in Tehachapi and San Gorgonio). SCE inputs outages and curtailments into the system both before wind production (for forecast correction) and after wind production (for calibration of the wind forecasting system).	Generation data, availability forecast, and on-site and turbine level meteorological tower data (latitude/longitude, elevation, sensing heights, wind speed/direction, temperature, and pressure).

	NYISO	PJM	SCE	Xcel Energy
Description of Forecast	Day-ahead forecasts updated twice daily, covering next two operating days at 4 AM and 4 PM. Real-time forecasts updated every 15 minutes on a 15-minute interval basis, covering an 8 hour time horizon. Real-time forecast is blended with persistence forecast to develop wind plant schedules in real-time commitment (which looks ahead in 15-minute intervals for 2.5 hours) and real-time dispatch, which looks ahead in 5 to 15-minute intervals for 60 minutes. 100% persistence used in very short-term.	Forecast 28 of the 32 wind projects in PJM [4 are considered too small to include]. Long Term: Provided hourly, from 48 hours ahead to 168 hours ahead. Medium Term: Updated from 6 hours ahead to 48 hours ahead. Short Term: Updated with frequency of every 10 min, forecast interval of 5 min for next 6 hours. PJM currently has a confidence interval of 70%. PJM has flexibility to change the confidence interval with vendor if needed. Forecast on the following aggregation levels: wind projects; electrically close wind farms; Transmission Owners; Regional – West, Mid-Atlantic; Council – RFC or SERC (currently none in SERC); PJM RTO PJM and the Midwest ISO exchange forecasts to assist in maintaining and improving reliability.	Forecast updated twice a day (at 5 AM and 5 PM), and both forecasts look forward 7 days. In addition to day-ahead forecast, AWS Truepower also delivers hourly MW forecasts covering an 8-hr period.	3-km nested forecasting grid updated every 3 hours.
Ramp Forecast	No ramp forecast; under consideration.	Updated every 10 minutes at 5-min intervals for next 6 hours.	No ramp forecast; under consideration.	Ramp Forecasting is being pursued in a joint contract with Vaisala and NCAR (currently under development).

	NYISO	PJM	SCE	Xcel Energy
Forecast Performance Metrics	For the April 2009-April 2010 period, 1-hour ahead forecasts had an average MAE of approximately 4%, and the average MAE for day-ahead forecasts was approximately 9%.	For all of PJM monthly averaged mean absolute error (MAE) for the May 2009 - July 2009 period ranged from 4.9% to 5.1% for intra-day; 5.9% to 7.9% for day-ahead; and 5.2% to 5.6% for the evening forecast at 4:00 PM, which covers 8 to 32 hours ahead.	Aggregate 3-hour forecast MAE was 5.35% for the period Sep 2009 - June 2010. Day-ahead forecast average MAE for that period was 11.07%.	Comparable wind power forecast performance data is unavailable.

Central Wind Power Forecasting under Development in the United States and Canada

	Alberta ESO	BPA	Ontario IESO
Record Peak Demand	10,236 MW (December 14,2009)	10,500 MW	27,005 MW (August 1, 2006)
Available Generating Capacity	12,781 MW	21,580 MW	About 35,485 MW
Installed Wind Capacity	629 MW	2,780 MW	About 1,100 MW
Area Served	Alberta, Canada	300,000 square miles All of Washington, Oregon and Idaho, and western Montana. Small contiguous portions of California, Nevada, Utah, Wyoming and eastern Montana	Ontario, Canada
Status of Centralized Wind Power Forecasting as of March 2010	Issued a 2 year contract with WEPROG in January 2010, following a wind power forecasting pilot project completed in 2008. All interconnected wind generators will be required to participate. A workgroup has been formed with wind project owners to obtain real time data at each wind project for WEPROG to use to update the forecast, which is intended to be accomplished by Nov 2010. The wind power forecast is expected to be integrated into AESO's systems in early 2011. Proposed to recover costs from wind generators via a $/MWh charge, which escalate annually by 10%. Differences between the wind power forecast costs and surcharge revenues would be reconciled annually. Real-time and near-term aggregated forecasts would be available to market participants.	BPA is currently using an internally developed prototype for planning and advisory functions, and to provide insight for future comparison to vendor services. A Request For Offers was released in 2010 to forecast vendors.	A competitive centralized forecasting trial is expected to launch in late 2010. The trial is the first step in selecting a vendor for the enduring program. The IESO plans to release a Request for Information for the trial and follow that up with a Request for Proposals. Proposed: Generator funded model whereby cost of forecast service is recovered from wind generators through a $/MW of installed capacity charge.

	Alberta ESO	BPA	Ontario IESO
Wind Power Forecast Vendor	WEPROG	In the process of determining whether to purchase forecasting service from an external vendor, use an internally built system, or combine the two approaches.	To be determined through a competitive RFP process.
Forecast Tools/Techniques	WEPROG uses a short-range ensemble prediction system based on a multi-scheme approach, which is an integrated weather forecasting system that uses 75 individual forecasts to replicate weather uncertainty for the next six days. Each ensemble member is based on a single NWP kernel, where the ensemble members are generated by varying dynamic and physical processes within the NWP model. WEPROG will also provide AESO visualization tools, uncertainty forecasts, and notifications of any potential system events such as multi-hour wind ramping.	The prototype system creates wind generation forecasts for each wind plant in the balancing area, as well as an aggregate forecast for the entire fleet. These forecasts have a horizon of 84 hours and are updated hourly. The system uses National Weather Service models at various grid resolutions. BPA also currently uses data from 20 BPA-owned met towers: 14 were recently installed and 6 have existed for many years. This met data is publicly available, and within the next year the aggregate wind fleet forecast will also be made publicly available. BPA will be developing a wind desk over the next two years to help dispatchers.	Currently operating a decentralized forecasting system, where wind generators submit a forecast of expected generation output. Forecast accuracy is subject to compliance requirements; wind generators required to provide updates if actual output is reasonably expected to differ from original forecasts by 2% or 10 MW, whichever is greater. Real-time scheduling done on a 5-minute basis, relying on a telemetry snapshot of wind output from 10 minutes prior to setting the schedule in real time. Day-ahead forecasts aid assessment of expected system conditions leading up to real-time. Forecasts are included in pre-dispatch every hour; results used to aid decisions on day-ahead unit commitment, spare generation on-line, and intertie transaction scheduling. Decentralized forecasting will eventually be replaced by centralized wind power forecasting.

	Alberta ESO	BPA	Ontario IESO
Data Requirements	Subject to AESO rulemaking, AESO will impose data requirements on wind plants, i.e., 10-minute met tower and wind generation data, and available capacity. Operational power limit will be used as well. Forecasts to incorporate up to two years of historical met and power data.	Wind plant generation and meteorological data from BPA's met towers are currently used. BPA is actively seeking further data from wind plants.	To be determined. Plans to issue new telemetry requirements: data taken from at least one point in the project typical of the climate and winds at hub height; historical data were available; real-time MW output data; planned and forced outages; derating data; location and elevation of each met tower and turbine hub; turbine type; manufacturer's power curve; and cut in and cut out speeds. Also plans to require meteorology data recorded on a 10-min average basis and submitted to the IESO at least hourly. Proposed met data requirements include wind speed, wind direction, barometric pressure, and ambient temperature.
Forecast Update Frequency	WEPROG will be providing a long-term forecast of up to 6 days, and a wind ramping forecast updated every ten minutes, looking ahead several hours. AESO interested in expanding forecasting to 72, 96, or 120 hours ahead and rolling 6-hour intra-hour forecast at 10-minute intervals.	BPA's internal wind generation forecast prototype produces a new forecast every hour for each wind plant and for the wind fleet.	As per existing market rules, the market participants submit day-ahead wind power forecasts by 10:00 AM on a daily basis. Additional forecast updates are required as conditions change. Forecast update frequency varies by participant. IESO's Market Assessment and Compliance Division looks for evidence that the market participant has exercised due diligence in revising/updating dispatch data (forecasts) to reflect changed conditions or expected injection. Existing processes will be updated upon the start of centralized wind power forecasting.

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