BPA DATA REQUEST FOR WIND CUSTOMERS

Bonneville Power Administration (BPA) requests that your company provide certain operational and meteorological data in order to support three major BPA initiatives described below, which are intended to facilitate integration of wind generation:

- BPA is re-examining the Wind Scaling methodology used in the calculations of the Transmission Rate Case in an attempt to improve how BPA calculates Generation Reserves. BPA needs to examine the relationship between different wind project locations from meteorological data collected at those plants. Information about the current Wind Scaling methodology is contained in the Generation Inputs Study for the 2010 BPA Rate Case: http://www.bpa.gov/corporate/ratecase/2008/2010_BPA_Rate_Case/docs/WP-10-FS-BPA-08_Web.pdf

- BPA is acquiring a wind energy forecasting system for future system advisory and state awareness purposes. BPA is requesting the operational and meteorological data collected at wind plants connected to BPA's transmission system to develop a highly diverse data pool to allow the highest accuracy possible in these forecasts. Additional information describing this future forecasting system is in Attachment 1.

- BPA is a participant in the Pacific Northwest Smart Grid Demonstration Project (Smart Grid Project) led by Battelle Memorial Institute Pacific Northwest Division (Battelle). One of the goals of the Smart Grid Project is the application of smart grid capabilities to support the integration of a rapidly expanding portfolio of renewable resources in the region. BPA proposes to share the plant-specific and meteorological data collected with Battelle and 3Tier to support the Smart Grid Project's data needs for integration of renewable resources. Additional information describing the Smart Grid Project is included as Attachment 2.

Expected Benefits

The requested data will allow BPA to manage its load-resource balance and, as a result, will benefit wind owners and operators. It will allow better estimates of future wind plant facility output and help BPA better manage reserves needed to balance wind variability in the BPA Balancing Authority.

The forecasts generated using this data as input will assist the new BPA Wind Dispatcher to more accurately determine what will be needed over the next few hours. It will also assist the Hydro Duty Scheduler to more accurately assess the needs of the Federal Columbia River Power System (FCRPS) over the next several hours. This will help optimize the river system and minimize issues that can occur due to unforeseen movement of the FCRPS. As a wind plant operator that collects various forms of operational data in real-time, BPA requests that you provide the data needed to support these efforts. This real time data will also satisfy sections 2.2 and 8 of the WI-09 rate case settlement.

From the Smart Grid Project, BPA will learn what existing and emerging technologies are most efficient and cost effective for integrating wind generation within the BPA Balancing Authority. This will help keep delivered power costs lower than they otherwise would be, augment use of power from renewable resources, and reduce the region's carbon footprint. BPA believes your company's participation as a source of generation output and meteorological data will allow Battelle and 3Tier to conduct analysis to provide BPA, regional utilities, and the nation the best possible guidance for making future decisions about how to integrate more wind and other intermittent resources in power portfolios to help reduce the nation's reliance on fossil fuels, greenhouse gas emissions, and dependence on imports.

Data Requested

BPA requests that your company provide historical and real-time operational and meteorological data for each wind project, if possible on a turbine-specific basis, to support the three initiatives identified above. Specific data needs are included as Attachment 3.

Privacy and Security

BPA realizes that your company may have concerns about the treatment, vulnerability, or unauthorized access to or use of the data being requested. Both BPA and Battelle adhere to strict national cyber security standards and will maintain the data on internal systems unavailable for public use. All data transfers will be through secure means and transfer from your wind project to BPA and from BPA to Battelle will occur for the duration of the Smart Grid Project. While the data itself will be considered and treated as business sensitive, its applications may become publicly available. For example, the data could be used to create plant-level and fleet-level wind energy forecasts for BPA's wind fleet, with the possibility that the forecasts would then be made public. We are seeking your feedback regarding this possibility.

Next Steps

Your Transmission Account Executive will contact you to set up meeting to discuss this data request. These discussions will include specifics about the data format, when data streams need to begin, feedback from your organization on making aggregate forecasts public, and answering any questions or concerns you may have. BPA, Battelle, and 3Tier will work with you on the details of data collection and transfer, and address concerns regarding use of data by the Demonstration Project.

BPA is optimistic that support provided on these activities will: (1) improve grid reliability, (2) facilitate wind integration and mitigate intermittent resource issues, (3) enhance the region's green resource portfolio, and (4) aid the national policy of reducing reliance on imports and fossil fuels. Further, BPA is looking forward to being part of the Smart Grid Project and expects research findings will encourage rapid adoption of cost-effective smart grid technologies leading to dramatic improvements in resource optimization and consumer energy usage patterns. BPA looks forward to your company contributing to a joint and regional success.

Transmission Account Executive
Transmission Marketing & Sales

ATTACHMENT 1:

WIND FORECASTING SYSTEM

Background of the Project

Acquiring a wind generation forecasting system will improve BPA's ability to forecast wind power generation, and develop and deploy tools for dispatch and hydro duty schedulers to understand and predict wind generation patterns and manage operational risks**.** As reliability issues come to the forefront as a result of integrating a rapidly increasing amount of variable energy resources (VERs), BPA has a need for greater visibility into actual wind generation along with submitted schedules to operate our system. Superior forecasting accuracy relies on superior data granularity, frequency of delivery, number of state variables measured (wind speed, temperature, etc.) and diversity of data sources.

To accomplish this, BPA has taken the following steps:

- Installed 14 new meteorological sites to support real-time weather observation and share the data with general public
- Developed an in-house, wind generation forecasting prototype to gather use feedback, discuss error metrics and identify unique features of forecasting wind in the Pacific Northwest
- Created new displays and state awareness tools that will allow operators to see atmospheric changes and their effect on power generation and transmission systems

Anticipated Project Benefits

- Forecast our wind serving BPA Load
- Better planning of the hydro system leading to greater flexibility, secondary marketing (purchases & sales) and ensuring that we can accommodate pinch-points
- Better planning for wind energy storage and balancing energy consumption
- Predicting within-hour ramp events and better management of our fish spill programs
- Predicting positive or negative reserve deployment
- Better preparation for extreme swings in generation
- Better manage transmission congestion

BPA's finalized forecasting system could be comprised of an upgraded internal system, a service BPA purchases from a vendor or a combination of the two. Data provided to BPA would be valuable for all three possibilities. BPA will develop both plant-level as well as fleet-level forecasts, and it expects to make the fleet level forecasts public. To protect market sensitive information BPA does not expect to make plant level forecasts public. However, if specific wind generators give permission for publication of plant level forecasts we will do so.

Justification for Requested Data

- Plant-Level Forecasting

    - Historical Data Need – Historical plant generation, turbine unit availability and met data (wind speed, wind direction, temperature, pressure humidity) are typically used together to create direction-dependent power curves in forecasting. In order to forecast generation for the plant, the forecaster will need unit availability to modify the expected power curve in such a way that a realistic generation prediction can be made. Assuming 100% turbine availability inevitably leads to unrealistically large generation estimates. For these reasons, plant-level generation which we already receive ("Plant X is generating 50MW"), projected plant-level availability or instantaneous capacity ("Plant X has 4 GE turbines down" or "Plant X has a 70MW capacity for the next 5 days due to outages") and met data onsite are necessary.
    - Real-time Data Need – Real time generation, availability and met data become important in the next-hour forecast horizon where short-term, statistical approaches seem to be the only means of approaching and beating persistence forecasts. Real-time data is also needed to bias-correct and calibrate weather model output to create superior forecasts that bridge the gap between time-lagged ensemble models and real-time changes onsite. For these reasons, real-time plant-level generation, plant availability or instantaneous capacity and met data are necessary. One minute reporting frequency of one-minute averages is necessary to ensure that we capture weather information in rapidly changing conditions such as wind ramps, thunderstorms, etc.

- String-Level Forecasting

    - As expansion phases to larger plants become more common and weather model grid resolution becomes finer (12km down to 1-4km), it will be necessary in the future to forecast output for each turbine string in a wind plant for the highest accuracy. As such, the data listed above will also be necessary at string level: turbine string generation, string availability or instantaneous capacity, and nacelle-based met data as well as tower-based met data.

ATTACHMENT 2:

PACIFIC NORTHWEST SMART GRID DEMONSTRATION PROJECT

Background of the Project

BPA is a participant in the Pacific Northwest Smart Grid Demonstration Project (Smart Grid Project) led by Battelle Memorial Institute Pacific Northwest Division (Battelle). The Project, with a budget of $178 million over five years, is the largest of 16 national demonstration projects to receive funding from the U.S. Department of Energy (DOE) under the American Recovery and Reinvestment Act of 2009. The Smart Grid Project is a collaboration of public and private utilities, universities, and technology partners in a unique smart grid demonstration of unprecedented geographic breadth across the states of Idaho, Oregon, Montana, Washington and Wyoming, spanning the electrical system from generation to end-user, and containing all key functionality of the future smart grid. The demonstration includes residential, commercial, industrial, and irrigation consumers and will validate new smart grid technologies; provide two-way communication between distributed generation, storage, and demand assets and the existing grid infrastructure; quantify smart grid costs and benefits; advance interoperability standards and cyber security approaches; and validate new smart grid business models.

By determining that that these outcomes can be readily and flexibly adapted and replicated throughout the national grid, this demonstration will be a foundation for the region's and the nation's future electric power grid. The Project will be in the design phase for the first six months beginning February 1, 2010; build and install facilities in the following 24 months; be on-line and in the data-gathering phase during the second 24 month period; and conduct analysis and evaluation in the final six months, ending January 31, 2015.

Anticipated Project Benefits

The four primary objectives of the Project are:

- Develop and validate an interoperable distributed communication and control infrastructure using incentive signals;
- Measure and validate smart grid costs and benefits for customers, utilities, regulators, and the nation, thereby laying the foundations of business cases for future smart grid investments;
- Contribute to the development of standards and transactive control methodologies for a secure, scalable, interoperable smart grid for regulated and non-regulated utility environments across the nation; and
- Apply smart grid capabilities to support the integration of a rapidly expanding portfolio of renewable resources in the region.

Several utilities contributing to the Project will be testing smart grid technologies intended to mitigate intermittent and renewable resources, particularly wind generation. Facilitating integration of renewable energy is specifically identified in DOE's funding opportunity announcement for the smart grid demonstration project grant. At the conclusion of the demonstration, Battelle will evaluate the technologies and processes, contribute findings to a national cost-benefit analysis that can be used

for business cases, and transition to BPA the work on a regional business case and the institutionalization of viable technologies and processes.

ATTACHMENT 3:

DATA REQUEST SPECIFICS

Data Requested for BPA

- **Wind Turbine Data**
    - Turbine/Plant Specifications (Static, or provided once as plant information and updated every time it changes, i.e. a new unit is added or removed, etc.)
        - Each turbine in the plant will have its own number, a string number, a model type and its generation capacity (if it cannot be determined from the model type). Example, "Turbine #72 is part of String #3, is a Vestas model and can produce up to 2.3MW." This information can be conveyed in the form of a report or electronic file. See example below:

Turbine #	String #	Model	MW
1	1	Vestas	2.3
2	3	GE	2.4
Etc.	Etc.	…	…

- **Real-time Data (Dynamic, reported at intervals) and Historical Data (Static, or provided once covering the span of 10/1/2007 to the present with the same frequency)**
    - Turbine String Generation
        - Current output by string, e.g. "String #3 is currently producing 10MW."
        - Data reported in 1-minute averages at the end of each 1-minute interval from each wind plant. See example below:

Time	String #1 MW	String #2 MW
01/01/10 14:20	14	18
01/01/10 14:21	15	17
01/01/10 14:22	15	16

    - Turbine Availability
        - Real-time unit status for each turbine with 1-minute granularity
            - Available
            - On-line
            - Unavailable
            - See example below:

Time	Turbine #1	Turbine #2
01/01/10 14:20	On-line	On-line
01/01/10 14:21	On-line	Unavailable
01/01/10 14:22	On-line	Unavailable

- Outage schedules reported as far into the future as information is available, including recent unplanned unit outages. (e.g. "Turbine #45 will be down between 08:00 on 5/20/10 and 21:00 on 05/23/10").

Turbine	Down Time	Up Time	Details
#1	01/01/10 14:00	01/05/10 20:00	Maintenance
#5	02/10/10 15:00	02/15/10 16:00	Maintenance

o Meteorological Data

Any information from met towers as well as representative nacelle-mounted instruments (wind speed, wind direction, temperature, pressure, humidity). In regard to nacelle-mounted instruments, it is sufficient to receive data from at least one nacelle per five blade diameter square across the wind facility. For example, for a wind facility with turbine blades that have a 90 meter diameter sweep, we would need the readings from at least one nacelle in 450 x 450 meter square across the facility. This would allow for a sufficient number of intra-plant data points to capture meteorological events on the spatial order of large strings and large plant areas. Report data in 1-minute averages at the end of each 1-minute interval from each wind plant.