Eastern Wind Dataset

The Eastern Wind Dataset contains modeled wind farm data points for the eastern United States for 2004, 2005, and 2006. It is intended for use by energy professionals such as transmission planners, utility planners, project developers, and university researchers who perform wind integration studies and estimate power production from hypothetical wind plants.

Learn about:
- The dataset methodology
- Site selection
- Wind plant output
- Forecasts
- The June 2012 data update.

Or learn more about the dataset, including the similarities and differences between the Eastern and Western datasets.

Methodology

The Eastern Wind Dataset consists of three years (2004–2006) of 10-minute wind speed and plant output values for 1,326 simulated wind plants as well as next-day, six-hour, and four-hour forecasts for each plant. AWS Truepower created the dataset with oversight and assistance from NREL.

After testing various mesoscale models, AWS Truepower settled on the MASS v.6.8 model for the generation of wind data for the Eastern Wind Integration and Transmission Study. The model is initialized with input from the National Centers for Environmental Prediction-National Center for Atmospheric Research Global Reanalysis data set and assimilates both surface and rawinsonde data. The model used a nested grid scheme, with the final output resolution of 2 km.

Wind plant locations were determined using a proprietary AWS Truepower wind speed map of the study area along with 10 years of speed distributions previously computed by AWS Truepower. The wind resource at each cell was computed by combining these data sets with a composite turbine power curve. Wind plants were then created by combining cells with close proximity and similar wind characteristics (subject to environmental, topographic, and other exclusions). Size and state-by-state distribution of wind plants were controlled to give a diverse selection of plants. (For example, it was necessary to reduce the minimum capacity factor threshold to get enough plants in Connecticut, Rhode Island, New Jersey, and Delaware.)

The wind speed and power output time series for each wind plant were computed by combining the mesoscale grid output with the composite turbine power curves, the list of cells contained in each plant, and other data. Adjustments were made for model biases, wake losses, the impact of gusts, availability, and other factors.

AWS Truepower's final report describes the overall project and provides more information about the modeling and inputs.

Site Selection

Land-based sites are actually simulated wind plants composed of many nearby grid points that have similar wind characteristics. Sites range from 5 to 160 km2, and maximum power output ranges from 100 to 1,435 MW. (Data from the individual grid points and the shape and layout of the sites are not available.) The site screening process excluded areas of open water, wetlands, parks, steep slopes, and non-public federal land. Airports and developed areas, along with buffer zones surrounding them, were also excluded.

The final site list contains 1,326 sites totaling 580 GW. The bulk of the sites fall between 100 MW and 600 MW. A smaller number (150) of "megasisites" with rated capacities exceeding 1,000 MW were also chosen. All of these are in the Great Plains. A separate screening with a lower capacity factor threshold was performed for Connecticut, Rhode Island, New Jersey, and Delaware, with 30 sites selected in these states.

Offshore sites were chosen from a 2-km grid, where each grid point represented 20 MW of offshore wind capacity. Selected grid points were at least 8 km from shore and in water no deeper than 30 m. A total of 4,948 sites in the Atlantic Ocean and four of the five Great Lakes were selected.

Wind Plant Output

Wind plant output time-series values were computed by adding up the contributions of each grid cell in the site. Three composite power curves (computed by averaging two or three power curves from commercial turbines) were available, and the choice of power curve was based on the average wind speed at the site. Adjustments were made for model biases, wake losses, wind gusts, turbine and plant availability, and other factors.

Forecasts

AWS Truepower produced hourly forecasts for three time horizons: next-day, six-hour, and four-hour. Each set of forecasts was synthesized by running a statistical forecast synthesis tool written by AWS Truepower called SynForecast. This tool uses actual forecasts and observed plant output to develop a set of transition probabilities that are then applied stepping forward in time from a random starting point in a process known as a Markov chain.

Data Update
The Eastern Wind Dataset, originally developed as part of the Eastern Wind Integration and Transmission Study, was updated in June 2012 for use in the Eastern Renewable Generation Integration Study. The update was necessary to correct a discontinuity in aggregate wind power profiles at 12-hour intervals.

As part of the wind data synthesis procedure, observed data were assimilated into the weather simulation at 12-hour intervals, which caused the data discontinuity. The problem was identified during the Eastern Wind Integration and Transmission Study and partially fixed. The discontinuity was not significant in individual wind plant profiles. However, it was more prominent in aggregations of wind plant profiles. Because much of the statistical analysis in the Eastern Renewable Generation Integration Study will be performed on aggregations, it was necessary to develop and implement a fix.

Although the primary goal of the update was to mitigate the 12-hour discontinuity in aggregate profiles, the wind power conversion was also updated to better reflect future wind turbine technology. The 12-hour discontinuity was addressed by a technique that adjusted the correlated component of the wind power fluctuations by adding a proportion of the adjustment to each individual site. It was applied on a state-by-state basis. The updated wind power conversion incorporated new composite power curves that use larger wind turbines.

The wind power hourly forecasts were also updated based on the new synthesized 10-minute wind power profiles. In general, the same methodology was used to generate these forecasts as was used in the original Eastern Wind Integration and Transmission Study wind database.

For more information, see the report [Updated Eastern Interconnect Wind Power Output and Forecasts for ERGIS](http://www.nrel.gov/electricity/transmission/eastern_wind_methodology.html).