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# Short-term Wind Farm Generation Forecast using Spatial-Temporal Analysis

**AzTE Case # M13-092P**


## Inventors

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## Background

Efficient integration of wind energy in power grids is challenging due to the variability of wind energy. The uncertainty of wind impacts various system level considerations, such as the reliability and operational planning of power grids. Mischaracterizing these uncertainties can lead to significant loss of the wind generation. Accurate wind generation forecast models are imperative for efficient integration of wind generation in power grids. This is particularly true in the context of smart grid technologies where wind integration must seamlessly coexist with sophisticated systems such as consumer demand response and variable pricing. For example the relationship between wind speed observed at a location in a wind farm and the aggregate wind generation from the farm is far more complicated than a simple model based on the turbine power curve. The power outputs from identical turbines within a farm are not necessarily equal, even if the turbines are co-located. This "mismatch" is particularly severe when the turbines are far apart as in most wind farm applications.

## Invention Description

Researchers at Arizona State University have developed a data analysis framework that takes into account both the space and time dynamics of power outputs from turbines within a wind farm. Using graph theory and auto-regression analysis the probability distribution of the aggregate wind generation from the farm can be applied to a Markov chain forecast. The model provides accurate forecasts of wind resources and power generation.

## Potential Applications

- Modeling of wind resources
- Design tool to develop efficient wind farms
- Grid analytic tool for proper deployment of resources

## Benefits and Advantages

- **Lower Costs** – Enables the construction of better more efficient projects with lower cost to power ratios.
- **More Power** – Allows projects to get the best use of available wind resources.
- **Retrofit** – Provides models for improvement of older existing wind farms.

## Intellectual Property Status:

*Patent Pending*


## Contact

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