

Wind Integration Studies

Wind power is the fastest growing source of new electric power generation in the world. The cost of energy from large commercial wind plants in good wind sites is now competitive with that from more conventional sources, and costs are forecast to decline further with future generations of multi-MW turbines.

EnerNex has extensive experience with wind turbine technology, wind plant design and operating issues and technical questions associated with transmission grid interconnection and power system operation.

Our years of power systems engineering expertise, along with more than a decade of experience working with wind generation technologies and systems, is unparalleled in the industry. We can assist with almost any power system issue relating to electric system planning, design and operations relating to wind.

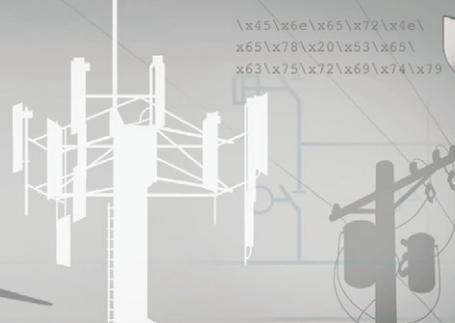
EnerNex is the pre-eminent consulting firm for **Wind Integration and Interconnection**.

Our Services

EnerNex is a research, engineering, and consulting firm specializing in the development and application of new electric power technologies. Our focus is to aid in the understanding and solution of electric power related issues, as well as the development of technology and expertise that will ultimately improve the operation and reliability of electric power systems. We offer services organized around these areas of emphasis:

- ▶ Power Systems Analysis
- ▶ Wind Integration
- ▶ Information Security
- ▶ Systems Monitoring & Analysis
- ▶ Testing and Research & Development
- ▶ Smart Grid Development
- ▶ Advanced Metering Infrastructure
- ▶ Utility Communication Architecture & Implementation
- ▶ Utility Automation
- ▶ Demand Response & Energy Efficiency

EnerNex



\x45\x6e\x65\x72\x4e\x65\x78\x20\x53\x65\x63\x75\x72\x69\x74\x79



Wind Integration Studies

Bulk Transmission System Studies: Evaluate the impacts of large wind plants on bulk transmission system operations, including steady-state and contingency analysis, impacts on interregional power transfer capability, network voltage stability, reactive power requirements and transient stability.

Distributed Wind Plant Integration Studies: Assess the influence of smaller distributed wind plants on distribution feeders and local loads, including voltage flicker, harmonics and protection system operation. We maintain feeder simulator and flicker calculations for UWIG's Distributed Wind Impact Project.

Design and Operational Analysis of Wind Plant Power Systems:

Evaluate intra-plant electrical systems within large wind plants, focusing on:

- *Transient and switching surges*
- *Reactive power management*
- *Voltage regulation*
- *System dynamics including capacitor operations and reactive power generation from advanced turbines*
- *Event analysis to determine root causes*
- *System and equipment performance validation and design improvements*
- *Investigations of equipment misoperation and failure*

Software Tools: Provide expert opinion and perspective on wind generation and electrical system technologies, including power electronics and electric machinery for wind turbines and transmission and distribution system equipment.

Monitoring and Information Systems: Specify, design, install and operate data acquisition systems for collecting, analyzing, and reporting on plant operations.

Special Studies: Use sophisticated simulation and analysis tools to conduct specialized and custom studies of new technologies for wind generation applications, including advanced power electronics systems for wind turbine and electric power system applications.

Our staff has extensive experience working with a wide range of clients on wind issues including:

- Nebraska Power Association // U.S. Department of Energy // Sacramento Municipal Utility District**
- The National Renewable Energy Laboratory // Electric Reliability Council of Texas**
- Xcel Energy // Public Service Company of New Mexico // Vestas-Americas Wind Technologies**
- GE Wind // Minnesota Department of Commerce**

EnerNex also provides technical and marketing support for the Utility Wind Integration Group (UWIG), the leading resource for technical know-how about integration of wind generation. UWIG is the only organization exclusively focused on delivering technical knowledge and information about interconnection and operation of wind plants on electric power systems.

