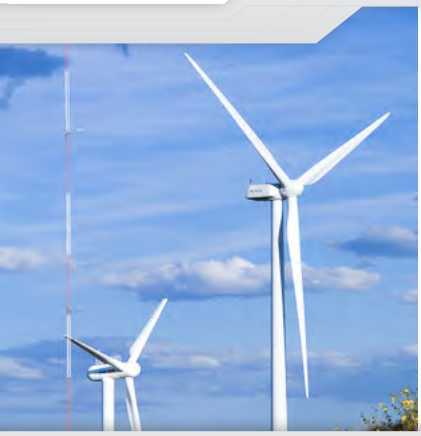
EnerNex

Wind Power Plant Studies



System Interconnection Studies

Short Circuit Analysis

Calculates the maximum available short circuit currents at all interrupting device, buses, and cables within the collection substation and interconnect switchyard.

The results from short circuit analysis are utilized to specify equipment ratings, and for protective device coordination studies.

Steady State Power Flow Analysis

To determine if the wind plant can be operated to meet the voltage and power factor requirements specified by the Interconnect Agreement, which is usually to design within voltage limits of 0.95 to 1.05 pu and power factor limits of +/- 0.95 at the POI.

If voltage and power factor requirements are not met with the turbine compensation packages, appropriate size of the reactive compensation equipment needed to meet the stated interconnect requirements is determined.

To identify if Load Tap Changers are required at the main station transformer for voltage regulation.

Stability Studies/Dynamic Performance/Voltage Ride Through

To determine the dynamic behavior of the transmission system/ wind plant/ dynamic Var compensation equipment to ensure that system reliability is maintained for various system disturbances and operating contingencies.

All the wind plants are required to satisfy Low Voltage Ride Through (LVRT) or Zero Voltage Ride Through (ZVRT) criteria.

The study will help to develop control strategies and help to fine tune the size, ratings and response times of voltage/VAr compensation equipment (DVAr, DSTATCOM) required to meet the LVRT or ZVRT criteria.

Balance of Plant Operation Studies

Transient and Temporary Overvoltage (TOV) Analysis

Evaluate the transient overvoltages from capacitor bank energization.

Analyze the inrush currents from back-to-back switching of capacitor bank steps.

Analyze the outrush currents from the capacitor banks due to fault conditions and determine if a Current Limiting Reactor (CLR) is required to limit the outrush current.

Transient and Temporary Overvoltage (TOV) Analysis (cont'd)

Evaluate the Initial-Rate-of-Rise-of recovery Voltage and peak magnitude of the Transient Recovery Voltage (TRV) across the capacitor bank circuit breaker for faults between the Current Limiting Reactor (CLR) and the capacitor bank.

Assess transient overvoltages and arrester energy during capacitor bank de-energizing with capacitor bank circuit breaker restrike.

Evaluate Transient Recovery Voltage (TRV) across the high side circuit breakers during fault initiation and clearing operations.

Evaluate the effectiveness of the high speed mechanically interlocked circuit breaker/grounding switch (VDH/GSMI) for adequate protection against the Temporary Overvoltages (TOVs) on the 34.5 kV feeders following substation breaker operation for a collector system ground fault.

Sizing of Grounding transformers for adequate protection against the Temporary Overvoltages (TOVs) on the 34.5 kV feeders following substation breaker operation for a collector system ground fault.

To determine whether the feeder arrester ratings are acceptable during the temporary overvoltage conditions.

Harmonic Analysis

To determine if there are any harmonic issues, and/or any resonance conditions near characteristic harmonic frequencies due to interaction between the wind plant and the transmission system.

If harmonic distortion levels exceed IEEE Standard 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems, or equipment duties are exceeded, harmonic mitigation solutions are recommended.

Insulation Coordination

Determine protective margins and maximum allowed arrester separation distances to protect equipment from incoming surges.

Suggest appropriate BIL (Basic Impulse Level).

Arc Flash Analysis Studies

Identify locations in the power systems where personnel are exposed to energized equipment.

Calculate the incident energy at these locations using an NFPA-approved method. The incident energy mainly depends on fault current levels, fault clearing times, and working distances, but also on the equipment type, the gap between conductors, and the voltage level.

Calculate the flash protection boundary to determine the area around the energized equipment where PPE is required.

Determine the flash hazard category that determines the selection of PPE that is appropriate for work on the energized equipment.

Document the results and provide arc flash hazard labels for each location.

If the predicted incident energies exceed acceptable levels, offer consultation on how to reduce the incident energies through system changes or temporary protection settings.

Sub-synchronous Control Interactions (SSCI) Studies

To study problems encountered for series compensated wind plants.

Clients for Whom We've Performed Wind Power Plant Studies

AES Wind Generation // Alliant Energy // Aldridge Electric // Babcock and Brown
Consulting Engineers Group // Don Keef & Associates // GE Energy // Invenergy
Mortenson Construction // Rosendin Electric // RMT Wind Connect
Renewable Energy Systems Americas // Suez Energy // North AmericaTerra-Gen Power

WIND POWER PLANT STUDIES

Alta Wind Energy Center 1020 MW
Shepherds Flat 845 MW Wind plant
Fowler Ridge 400MW Wind Plant
Loraine 250.5MW Wind Plant
Biglow canyon I 125.4MW Wind Plant
Biglow canyon II 163.3MW Wind Plant
Biglow canyon III 161MW Wind Plant
Panther Creek II, and III Wind Plants
Turkey Track 169.5 MW Wind Plant
Willow Creek 72 MW Wind Plant
Goodnoe 94 MW Wind Plant
Camp Springs 130.5MW Wind Plant
Stanton 120MW Wind Plant
Buena Vista II Wind Plant
Wildorado Wind Plant
Walnut Wind Plant
McAdoo Wind Plant
St. Joseph Wind Plant
Mesquite Wind Plant
Wild Horse Wind Plant
Noble Thumb Huron Wind Plant
Locust Ridge Wind Plant
Mountain Wind
Flat Ridge 100MW Wind Plant
Buffalo Gap Wind Plant
Mountain View Wind Plant
Lost Creek Ridge
Milford Wind Plant
Noble Thumb Huron
Beech Ridge Wind Plant
Milford Wind Plant
Caribou Wind Plant
Five Sweetwater Wind Plants
Lakefield Wind Plant
Elk Wind Pant
Rippey Wind Plant
Hawkeye Wind Plant
Quality Wind Power
Wild Cat
Vantage Wind Plant

620 Mabry Hood Road, Suite 300, Knoxville, TN 37932 // 865-218-4600 **(p)** // 865-218-8999 **(f)** // www.enernex.com