## Clients for Whom We’ve Performed Wind Power Plant Studies


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### Wind Power Plant Studies

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<th>Plant Name</th>
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<td>Hawkeye Wind Plant</td>
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<td>Beech Ridge Wind Plant</td>
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<td>Biglow Canyon I 125.4 MW Wind Plant</td>
<td>Locust Ridge Wind Plant</td>
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<td>Biglow Canyon II 163.3 MW Wind Plant</td>
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<td>Biglow Canyon III 161 MW Wind Plant</td>
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<td>Buena Vista II Wind Plant</td>
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<td>Panther Creek II and III Wind Plants</td>
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<td>Goodnow 94 MW Wind Plant</td>
<td>Mountain Wind</td>
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Balance of Plant Operation Studies

**Transient and Temporary Overvoltage (TOV) Analysis**

Evaluate the transient overvoltages from capacitor bank energization.

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

Analyze the overvoltage stress on the collector system due to outages/arresters and determine the rating of the individual components.

Analyze the relay coordination and protective device settings.

Evaluate 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 due to de-energizing with capacitor bank circuit breaker restrike.

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

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

Size of Grounding transformers for adequate protection against the TOVs on the 34.5 kV feeders following substation breaker operation for a collector system ground fault.

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

**Harmonic Analysis**

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).

System Interconnection Studies

**Stability Studies/Dynamic Performance/Voltage Ride Through**

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.

Develop control strategies and help to fine tune the size, ratings and response times of voltage/var compensation equipment (DVar, DISTATCOM) required to meet the LVRT or ZVRT criteria.

**Short Circuit Analysis**

Calculate the maximum available short circuit currents at all interrupting device, buses, and cables within the collector 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**

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 limit +/− 0.95 at the POC.

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.

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

**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 voltage level, and the incident 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**

Study problems encountered for series compensated wind plants.