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Cold weather can impact the reliability of a wind project, as well as the productivity of its service team. This first in a two-part series examines how preseason preparations benefit both.

LEAVING BEHIND THE MEMORABLE heat wave of 2011, it won't be long before our offices at 300 feet off the ground become standing popsicles. As warm summer months give way to freezing temperatures, snowstorms, and ice storms, the harsh winter working environment will subject technicians to a variety of conditions in which to perform their maintenance tasks. Preparing both the turbine and the technician is an important seasonal transition to assure safe and reliable winter service and operations.

In recent years more turbine manufacturers have introduced cold weather packages for their systems, allowing the installation of projects in regions that were previously restricted to milder climates. With such modifications turbines are able to sustain greater flexibility of operation in high wind and extreme low temperature environments, and can reliably restart following long shutdowns due to icing conditions. Undoubtedly, winter in many regions of the U.S. can be brutal. Manufacturers gain higher unit availability operating in these areas by integrating such add-ons as weather screens, nacelle heaters and improved internal airflow designs, gearbox heaters, heaters for controller cabinets and converters, and seasonal parameter changes that focus on temperature-sensitive components. When it comes to preparing a turbine for winter operation, the tasks include making a thorough preseason walkthrough to ensure these components are operating correctly and that weatherproofing plates and seals are in place.

Just as we do for our service vehicles, preseason checks should also involve testing the turbine coolant system, if liquid cooled, to ensure the proper amount of antifreeze for the expected ambient lows. Tower door seals, nacelle hatch seals, frame plugs, and hub and blade seals should all be in good shape. If you fail to inspect these locations, you may as well pack your snow shovel each time you climb since snow can penetrate almost any unprotected opening. Unless the nacelle is protected, snow will easily accumulate inside the nacelle and damage vital equipment. Verifying that greases and oils used in the turbine have been specified for the appropriate cold weather operation is also good practice, since viscosity of the lubricant is dependent upon its ambient temperature limitations. During a restart in cold weather, damage to gearbox internals can occur in the first few seconds of operation where oil is too thick and its flow is insufficient. In addition, greases that are not rated for low temperatures will become solidified, preventing the lubricant component from contacting the moving parts of the bearings.

Possibly the most-recognized winter hazard is severe icing. In the U.S. areas that see winter weather will likely experience at least one annual ice storm, and the types and amount of ice accumulation is often localized according to regions. Freezing rain in the northeast and rime ice in high elevations of the northwest are common, but such unforgettable storms as Kansas in 2005 and the Midwest in 2009 remind us that many areas of the country are susceptible to the hazards of winter ice. Winter ice storms are a serious event for a wind farm, imposing not only an equipment integrity concern but a personnel safety risk as well. Ice accumulation on wind turbine blades can interfere with anemometers and pitch control, increase loads on the rotor, affect vibration, and reduce energy capture. Special algorithms that shut down the turbine during icing conditions are typical in cold weather packages and should also be verified prior to the cold season. Such installed logic may recognize the loss of production from an airfoil profile change, less power output than expected from the anemometer reading, or higher output than the anemometer expected as an anticipated icing condition and will safely remove the turbine from service. While a turbine may sit idle during these periods, being unable to physically reach the turbine for maintenance for days on end can be standard practice in many parts of the country.

More importantly, ice throws from blades present a clear danger to technicians working near the turbine, so much so that ice conditions must be routinely monitored and safety policies enforced. Refresher training in safe work practices related to turbine icing should be part of the annual winter preseason checklist. If not already determined by the manufacture, the service provider should dictate a safe working distance on operating turbines during ice conditions and should specify that no work will be performed if icing conditions exist. On restart a turbine can throw ice chunks at distances of greater than 1,000 feet, presenting a safety hazard for people and property in the vicinity.

These preseason checks and refresher instructions can have significant payback during the winter months and lead to higher reliability and safety of the project. We'll continue our discussion to better prepare the service team for cold weather in the December issue of *Wind Systems* magazine.

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