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GE STUDY OUTLINES WIND'S BENEFITS TO GRID RESILIENCY DURING LARGE-SCALE INTERRUPTION

GE's Energy Consulting business presented the findings of its frequency response study on wind power and grid resiliency in late August at the CIGRE Session 45 in Paris. The study, which was sponsored by the U.S. National Renewable Energy Laboratory, modeled the country's Eastern Interconnection — one of the largest electrical systems in the world — and determined that when equipped with the appropriate modern plant controls, wind applications can substantially enhance grid resiliency.

Questions about how the U.S. electrical systems would respond to a large-scale interruption of generation, such as multiple power plants tripping offline, were the catalyst for the study. An event like this could result in significantly lower frequencies on the system, customer interruptions or even large-scale blackouts.

The study explored in detail how the grid could respond to a major event and maintain its resiliency with significant wind power added to the generation mix. The conclusions of the study found that wind can be more effective than thermal generation in controlling frequency on the grid due to its ability to respond more quickly.

The study modeled a scenario where there was an instantaneous penetration of 25-percent wind generation in the Eastern Interconnection — a scenario that is an aggressive case in the eastern U.S. today. It showed that at these levels of penetration, there will be operating conditions where traditional frequency responsive resources are scarce. This is typical in systems with high levels of wind penetration.

— Source: GE

Moventas plans wind service shop in Minnesota

Moventas, a leading wind gear manufacturer and service provider, has confirmed plans to set up a wind gearbox service workshop in St Paul, Minnesota, answering the growing demand of expert wind drivetrain service in the area.

Moventas will expand its network of high quality wind gearbox services in North America by opening a service workshop in St Paul, Minnesota. The new workshop will be opening by February 2015.

Moventas already has several U.S. locations but is now investing in the Midwest, where many wind OEMs are located. The investment is part of Moventas' service stratagy, aiming to localize its operations and minimize OEM lifecycle costs. Moventas services its own brand as well as most gearbox brands in the market.

"With this investment, we will be able to serve our clientele with full capability ... a full scale load testing facility, in this rapidly growing area," said Antti Turunen, SVP of Moventas Service. "This underscores our position as a leading wind industry service provider."

Moventas has a wind gearbox assembly facility and workshop in Portland, Oregon, a workshop and field team in Big Spring, Texas, a workshop and field team in Cambridge, Ontario in Canada and a 24/7 remote condition monitoring center in Chicago.

In addition to its workshop service capability, Moventas operates four custom-made Mobile Service Units across the country, carrying out cost efficient, extensive up-tower repair and overhaul. The self-contained, climate-controlled mobile workshops are available for field work including full helical and planetary replacements with specially fabricated Moventas tooling. One of the Mobile Service Units already operates within the Midwest region.

— Source: Moventas

Havlik Gear

Ontario company is poised to meet the drivetrain needs of the wind industry

By Rob Borrelli

Havlik Gear in Cambridge, Ontario is one of several companies competing in the wind energy component market. During the early part of the new millennium, wind power has expanded all over North America, and in particular from a Canadian perspective, in Southern Ontario. In the past, the large gearing market had been dominated by mining and other industries that require large, heavy pitch gearing. With a recent expansion and acquisition of key pieces of equipment, the company is well-positioned in the wind energy market as a prime supplier of gearing and related products.

Gears used in wind power generation usually fall into two categories, namely speed-increaser gears for the actual power generation, and low-speed slewing gears for pitch and yaw mechanisms. From a design and manufacturing standpoint, there are some key differences and necessary considerations that apply to drivetrains used in wind power versus traditional applications. Most machinery operates either on or off, and the failure mode of the associated gearing is either surface failure or bending failure (crack propagation or severe overload). Drivetrains used in wind power generation see other stresses in addition to the ones listed above, one common example is from surface stress and/or particle transfer caused by small vibrations or motions introduced to the teeth while a turbine is stopped. During this condition, lubrication systems are not necessarily functioning and the lubricant's film strength is quickly broken down. These new scenarios are not yet quantified by existing design standards and are therefore left up to the designer and manufacturer to solve together depending on the individual case. Havlik has worked with several customers to achieve a high-quality product that meets all of the designer's requirements while staying within the customers' budget.

In Cambridge, Ontario, Havlik Gear operates two gear manufacturing facilities, each with unique capabilities. The newest location includes a large form gear grinder, namely a Niles ZP40. The Niles machine can grind external gears up to four meters, and internal gears up to approximately 3.5 meters depending on the proportions of the cross section. Internal gear grinding is critical to the manufacturing of gears for the wind industry. The most highly scrutinized drivetrain component usually becomes the main internal ring gear or "annulus gear" used in the speed increaser gearbox. The annulus gear typically has high power capacity with slender cross sectional proportions due to size and weight restrictions. The result is a gear design that has absolutely no

room for imperfections, is made from the highest strength material, and is subjected to best heat treatments available. There is a laundry list of processes and inspections that need to occur before a gear blank can finally be ground to an impressive mirror finish and very high AGMA or DIN quality. On average for a typical case hardened ring gear produced by Havlik, there are several inspections that occur during the process. From the raw material stage there is tensile, chemical, ultrasonic, and hardness testing. After heat treatment there is complete microstructure analysis of the case and core along with destructive testing of coupons to determine exact effective depth of case. After final gear grinding it has become necessary to chemically etch sample numbers of gear teeth with the goal of identifying areas that have been overheated by the grinding operation. The etching is done as a precaution however with advancements in gear grinding technology both in operating principal and in availability of composite grinding wheels of more favorable composition the risk of overheating has greatly reduced from what it once was. The inspections listed are in addition to the standard dimensional and gear tooth geometry checks which are standard practice.

On the economic side of the equation, Havlik uses five-axis milling machines to rough cut gear teeth within one millimeter of finished size. Gear tooth profiles are accurately milled and therefore the finishing stock is very consistent which helps to avoid heavy and light areas of grinding which can cause many issues such as cracking or variations in surface hardness and/or depth. Five-axis milling has proven to be the greatest factor in the company's ability to compete and remain flexible in the wind power market. Havlik Gear can produce both prototypes and production parts for its customers in a cost effective way while meeting specific quality requirements. When requested, Havlik Gear is able to provide consulting services and guidance to its customers with respect to gear design or manufacturing. In several cases Havlik Gear has been presented with a concept or basic design and together with its customer developed that concept to a final product that is adequate for service, cost effective, and practical to manufacture.

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Could you tell us a little about the history of Complete Wind?

Complete Wind Corporation is currently in its fifth year of business. The origins of the company's core management experience comes from 10-plus years of rotor blade manufacturing (600kW to 1.5MW), before it transitioned to rotor blade maintenance, inspection, and repair. CWC provides its services to wind farm owners and operators.

Geographically speaking, what is Complete Wind's service area?

CWC is incorporated in both Canada and the United States; employing citizens in their respective countries while allowing our customers operating assets in both countries consistent services.

What is the most pressing issue pertaining to blade maintenance today?

Awareness. The CWC wind industry experience has been that the trends of rotor blade maintenance fall under reactionary measures, rather than preventative. Increasing rotor blade inspection scope and developing a regular inspection frequency platform will allow owners and operators to identify rotor blades issues and schedule repairs as a part of a preventative maintenance program, thus managing greater control of repair expenses. Unfortunately, it has been the experience of CWC that there is little budget set aside for rotor blade maintenance at the planning stage of a wind farm. Thus, owners and operators find themselves in an undesirable position when it comes to paying for blade repairs and maintenance.

How are emerging technologies changing the way maintenance is performed on blades and other components? How do you adapt to those changes?

The larger rotors and material composition selection, such as carbon fiber, are creating challenges for inspection and repair and how it is performed. Effective data base management of the inspection findings has been aiding CWC to cope with the increase in rotor blade sizes. Drone inspection methods are supplying cost effective inspection alternatives. Also, advances in NDT technology will eventually provide the means to look for anomalies not visible to the naked eye, but there is no substitute for a hands on inspection when a potentially serious issue is found.

Looking forward, what are your expectations for blade maintenance needs?

As the industry matures, I expect there to be more emphasis placed on preventative blade maintenance as the costs associated with reactionary maintenance cannot be controlled or budgeted for. Many of the operators will increase the scope of their technicians to encompass blade inspections at the site level and employ third party companies, like CWC, as specialists to handle out-of-scope maintenance and repair of the composite rotor blades.

Could you tell us a little about Complete Wind's inspection services, the need for inspection, and the benefits?

At a wind farm, there are 3 basic rotor blade inspection scopes that CWC employs: Visual from-ground exterior; visual from-ground exterior and up-tower exterior; and visual from-ground exterior and up-tower interior and exterior.

Aside from identifying early stage wear-and-tear items (e.g. leading edge erosion) and force majeure issues (such as lightning strike damage), the need for inspections early in the life of a rotor blade will identify manufacturing anomalies that could lead to costly repairs later in the service life. CWC's extensive experience has established that 75 percent of the blades inspected have such manufacturing anomalies.

Establishing an inspection program allows owners and operators the ability to plan maintenance and budget for repairs. Effective management of inspection findings keeps the maintenance in a preventative mode.

What other services does Complete Wind provide to its clients within the industry?

We perform rotor blade inspections, remediation, and composite repairs — both on- and off-turbine. We also do quality audits of rotor blade manufacturing facilities, technical consulta-

tion, and on-turbine dynamic rotor balancing and vibration analysis.

How often should blade maintenance or inspection be performed?

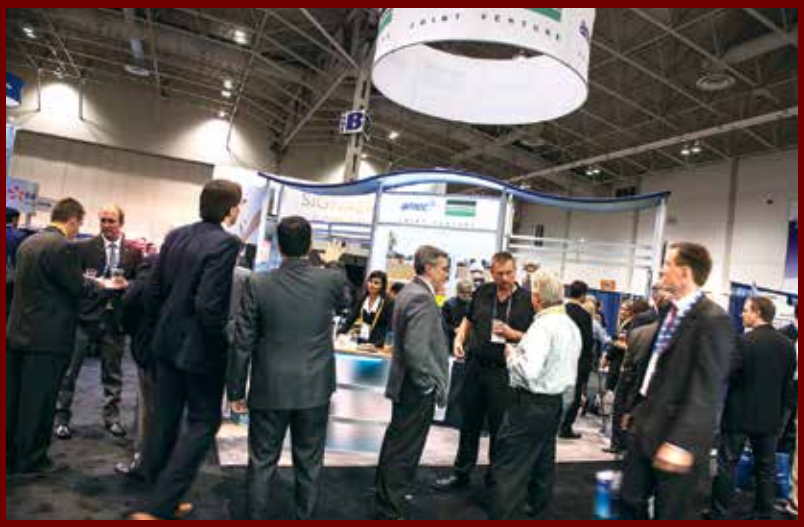
CWC has developed detailed inspection platforms for the different types of blades in the industry, but generally speaking:

- Exterior, from-ground inspections should be performed annually. This inspection looks for damage from exterior wear, operational defects, lightning strikes, and serious manufacturing anomalies.
- Up-tower inspections (both interior and exterior) should be performed at the end of warranty, and every two to three years thereafter. Here, inspectors again look for operational defects, wear, and manufacturing anomalies, but broaden the inspection to include both exterior and interior components.
- The lightning protection system should be inspected according to OEM or IEC61400-24 recommendations. Primary findings commonly includes a down conductor connection, as well as inspection of down conductor connection, as well as a receptor inspection.
- A dynamic rotor balancing inspection, testing for mass and aerodynamic imbalance, should take place when the turbine is commissioned, as well as every two to three years going forward.

What is the best advice you could give to a wind farm owner or operator regarding blade maintenance?

My advice to owners and operators is to begin planning blade maintenance and repair in January, seek out and select a blade maintenance vendor by March, so that preparations are made for the start of the warmer and typically the lower wind summer months.

Market growth, wind integration, and investment among topics slated for CanWEA 2014



The conference program for the Canadian Wind Energy Association's annual exhibition, to be held from October 27-29, in Montreal, Quebec, will focus on a wide range of topics of interest to Canadian and international wind energy investors, wind farm owners and operators, and many other parties within the wind industry. Topics on the conference bill include: from Canadian market growth and investment opportunities, wind energy project development and operations, wind energy integration and storage, and wind energy as a solution to climate change, among others.

Often called the one-stop shop to learn everything about the Canadian wind energy market, the CanWEA 2014 conference is the country's largest annual wind energy educational and networking event. It brings together approximately 1,500 industry experts and 150 exhibitors in Canada's wind energy market to discuss growth opportunities, policy and technology developments and to facilitate networking.

"Canada is one of the world's leading wind energy markets and has installed, on average, more than 1,000 MW of new wind energy capacity annually over the last five years," said CanWEA President Robert Hornung. "Visitors to CanWEA 2014 will gain insights into the new investment opportunities that are now emerging in provinces across Canada."

This year's conference will include a celebration of the association's 30th anniversary and multiple educational sessions.

Operations and maintenance will have a dedicated session track, responding to the growing service market. Senior leaders from Suzlon, Boralex, and Kruger Energy will provide key operational insights along with owners, OEM and third party service providers.

Another key focus will be advances in energy storage capacity, which is critical to scaling up worldwide renewables by integrating remote generation sites into the grid. Senior representatives of Energy Storage Ontario, the Wind Energy Institute of Canada, and Hatch Consulting will provide their perspectives on storage, as well as battery technology developments and utility scale applications.