MANUFACTURING

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CARBON BRUSHES FACTOR IN COMPONENT LIFESPAN AND RELIABILITY

Given that maintenance for wind turbines involves the replacement of costly parts as well as time-consuming and dangerous ascents of turbines up to 100 meters tall, there is a constant focus within the industry on improving the reliability of these devices. Though it is impossible to predict all of the necessary maintenance in any device, taking a few steps whilst building turbines and during routine maintenance can reduce the risk of unscheduled downtime and the associated costs.

WIND TURBINE SYSTEMS

The system of power generation within a wind turbine is fairly simple. Wind turns the blades of a turbine, which in turn rotate a slow-moving crankshaft. The motion of this shaft is amplified by a gearbox before being applied to a rapidly spinning generator. The generator produces power, which is applied to the slip ring and is drawn off by carbon brushes in a brush holder mounted near the slip ring, and the resulting power is taken to the grid.

Operating time is key to effective power generation by wind turbines. Since wind is not constant, turbine operators strive to keep turbines spinning for more than 98 percent of the time during adequate-wind events. In order for this to be possible, all of the components of the turbine must be working properly. When the time, danger and difficulty in replacing components, nearly all of which are concentrated at the very top of a turbine, is factored in, it becomes clear that long component service life is critical to effective power generation.

The carbon brushes resting on the slip ring are responsible for creating a brush film on the ring. Film conditions vary based on service conditions and brush grade. Excessively heavy films inhibit transfer of current, while films that are too thin lead to slip ring damage. An ideal brush film allows the slip ring to continue spinning smoothly, without being damaged by the brushes, while still effectively transferring power into the grid.

CHOOSING A RELIABLE GEARBOX

Gearboxes are the components that fail most often within wind turbine power generation systems. Choosing a reliable, appropriate gearbox for the turbine is therefore important in reducing downtime. Because of this, performing adequate scheduled maintenance on the box, such as ensuring proper lubrication for the environmental conditions of the turbine, is also a key step in improving reliability.

Wind turbines are often placed in some of the harshest conditions on the planet. Offshore wind farms, for example, must contend with the high salinity of sea air, while wind farms in desert conditions contend with the dry air containing abrasive sand, high temperatures and low wind speeds. Proper maintenance is especially important in these cases, as harsh environmental conditions wear down turbine components much faster than laboratory service conditions might indicate, especially if not maintained properly.

SELECTING THE CORRECT BRUSH GRADE

Carbon brushes are the least expensive component in a turbine system and one of the easiest to replace; however they must be replaced the most frequently. A suitable brush can last up to three years and help to extend the service life of other components such as the slip ring; however, unsuitable brushes can lead to drastically increased costs and unnecessary downtime. When an unsuitable grade of brush for the turbine's operating conditions is used, or worn brushes are left un-replaced for too long, they can create additional wear on the slip ring, causing it to degrade or lose roundness and force early replacement.

Selecting the correct brush grade is, therefore, an important step in turbine upkeep. The brush grade required depends on the service conditions of each turbine. Morgan Advanced Materials offers the widest range of brush grades currently available in the

industry. Each grade contains a different material composition and impregnation designed to optimize service life of the brushes and rings in a given service condition. The brushes are primarily made from graphite, though the percentage of graphite can vary; some grades include copper or other metals as abrasive or cleaning materials in service conditions where brush film buildup is likely. Similarly, impregnations, or chemical compounds that are introduced into the graphite during production, help to optimize brush film and therefore protect turbine components.

Monitoring environmental conditions such as humidity, temperature and salinity and consulting with an expert, such as Morgan's sales representatives or application engineers, can help turbine operators to find the ideal brush grade for each turbine installation. This leads to extended brush life as well as extended service life for slip rings and brush holders.

ENSURING ROUNDNESS

Another critical step in improving the reliability of wind turbines is checking the roundness of slip rings while they are in service. The new MSPro14 surface profiler supplied by Morgan's Electrical Carbon business does just that, and helps wind turbine operators to combat the detrimental effects of slip rings that have lost their roundness.

Non-round slip rings place additional stress on carbon brushes, wearing them out faster than in normal conditions and causing early failure. Slip rings that are not round can also cause carbon brushes to spark due to a poor electrical connection. If this is the case, power is not being drawn from the slip ring as efficiently as possible, and overall power generation decreases.

With this information, wind turbine operators can reduce the overall maintenance necessary for their turbines, and therefore reduce downtime, time-consuming trips up and down turbines, and the danger to workers associated with these trips. In addition, the selection of appropriate components such as carbon brushes and scheduled roundness checks with a profiler can reduce the costs associated with turbine upkeep. Increased power generation uptime and reduced cost lead to the most cost-effective wind turbine operation possible.

— Morgan Advanced Materials

DOE PROGRAM EYES COMPETITION IN CLEAN ENERGY MANUFACTURING

Energy Department recently launched the $2 million Technologist in Residence (TIR) pilot to strengthen U.S. clean energy manufacturing competitiveness and enhance the commercial impact of its national laboratories. TIR will catalyze strong laboratory-industry relationships that will lead to high-impact collaborative research and development and will develop mechanisms to help interested companies more easily connect and form relationships with the Department's national labs moving forward.

With the launch of TIR, the Energy Department has released a competitive solicitation to invite the national labs to partner with industry and apply for TIR in "technologist" pairs. The competitively selected technologist pairs will comprise one senior technical staff member from a national lab and another from a manufacturing company or consortium of companies. Over the two-year TIR pilot, each technologist pair will work together to first identify the technical challenges of interest to the participating company or consortium and the resources and capabilities within the national laboratories that may address them. They will then propose collaborative R&D efforts to address the identified challenges in industry-relevant technologies including (but not limited to) developing advanced controls in smart manufacturing, increasing the efficiency of next-generation electric machines, and other R&D to enhance manufacturing of clean energy technologies or to reduce energy intensity in any manufacturing process. In addition, the teams will develop a framework partnership agreement with specific scopes of work, which would take place outside of the TIR pilot.

Additionally, the pilot will organize a Council of Technologists that will broaden the partnerships beyond the "one-company, one-lab" model. The Council will function as a network across the national lab system to promote labs' industry-relevant resources and help form partnerships. Most importantly, the Council of Technologists will meet throughout the pilot to provide individual feedback that the Energy Department

will consider in order to develop a clear, streamlined set of best practices to help other interested companies establish similar relationships with national labs beyond the pilot's duration.

The solicitation will be open for two months, and during this time labs will conduct industry outreach activities such as open houses and webinars to raise companies' awareness of this opportunity and to facilitate pair formation. Interested national labs and companies will determine areas of mutual interest, identify technologist pairs, and apply to TIR. The Energy Department will provide $2 million to fund the national labs participating in this pilot, which will support approximately five technologist pairs.

This effort is part of the Department's broader Clean Energy Manufacturing Initiative (CEMI), which aims to increase American competitiveness in the production of clean energy products and boost U.S. manufacturing competitiveness across the board by increasing energy productivity. For more information about the TIR pilot and CEMI, please contact the CEMI team or visit CEMI's website.

— Source: U.S. Department of Energy

Out-of-Service Turbine Blades Get New Life as New Products

Seattle-based company innovates composite wind blade decommisioning recycling

Global Fiberglass Solutions Inc. and Washington State University recently announced that they have successfully manufactured a variety of composite products with fiberglass material taken from decommissioned wind blades.

Prior to installation, the 173-foot long wind turbine blades were damaged in a storm and harvested by GFSI from Portland General Electric's Tucannon River Wind Farm in Eastern Washington. The WSU Composite Materials and Engineering Center processed small sections of the wind blade and blended the fibers with a new composition of resins and other materials developed by GFSI.

Testing conducted for the manufactured products showed overall superior mechanical and physical properties compared to many current wood composites. According to WSU Associate Professor Dr. Karl Englund, the resulting base composite material, Ecopolycrete, is suitable for a whole range of green manufacturing applications and products expected to have a significant impact on reducing the practice of landfilling fiberglass scrap from wind turbine blades and other sources.

According to CEO Don Lilly, GFSI now has a patented process in place that in combination with innovative machinery can take fiberglass and carbon fiber from efficient shredding and grinding to manufacturing commercially ready high-grade products.

Both GFSI and WSU plan to continue their collaborative work to develop new applications for recycled FRP and CFRP.

The Composite Materials and Engineering Center at WSU provides a unified program of research, education, and technology transfer in the areas of sustainable composite materials, processing innovations, and enhanced design methodologies for structural performance and public safety.

— Source: Global Fiberglass Solutions

DHi receives UL certifications for pitch control slip rings

Virginia-based Defense Holdings, Inc. (DHi) recently announced it has received unrestricted certification from Underwriters Laboratories for its pitch control slip rings with HiPerCon Brand metal fiber brushes.

With this significant accreditation, DHi becomes: only the second company to achieve a UL listing for WTG pitch slip rings; and the first and only company to achieve UL certified and listed WTG pitch slip rings using metal fiber brush technology.

DHi's UL Certified pitch control slip rings are currently available for use in all GE1.X, GE2.X and Suzlon S88 WTGs. The company's "T00XXXX" series pitch slip rings are pre-certified to provide design flexibility for current and future slip ring demands for other OEM designs, as well as being capable of incorporating many other features including but not limited to high quality multi-GigaBaud signal transmission capabilities (>100MBPS/channel), high quality transmission of signal over power (PLC requires capable monitoring and control methodologies), and other aftermarket needs such as; blade de-icing or tip illumination, and advanced blade monitoring and control.

DHi entered the wind industry with its revolutionary patented Metal Fiber Brush (MFB) technology in the spring of 2011 under the mentorship of H&N Wind (A Timken Brand Company). Due to the general lack of knowledge throughout the wind industry of the existence and nature of DHi's HiPerCon Brand MFBs, legacy pitch slip ring carcasses were used in a program through which customers were provided slip rings refurbished with DHi's metal fiber brushes.

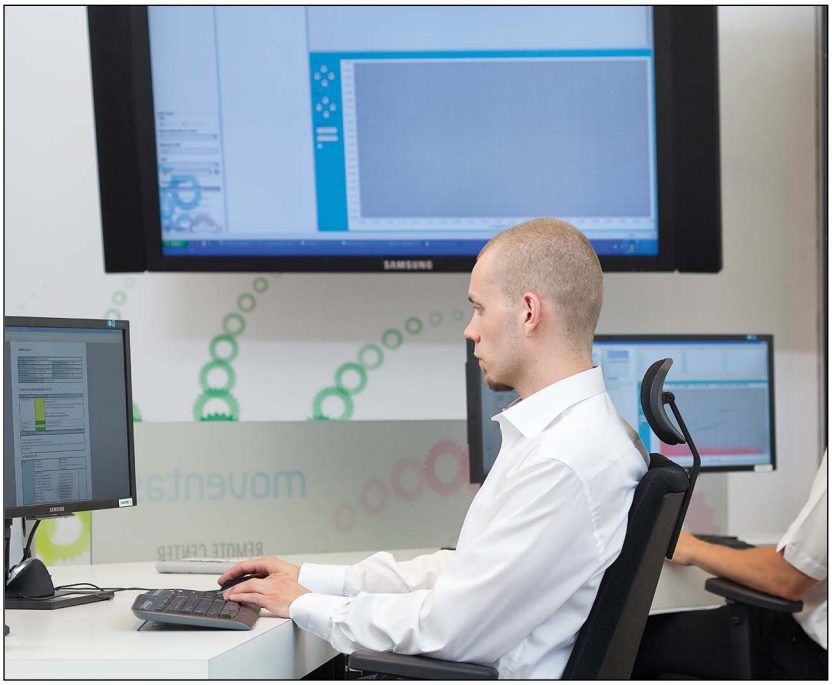
The primary goal was to familiarize the industry with the multitude of benefits associated with HiPerCon Brand patented metal fiber brushes as compared to carbon-based, metal-graphitic, or other metal brush technologies in use at that time. A secondary and very important goal was to demonstrate reductions of operations and maintenance (O&M) costs and increased operational availability.

"We are excited to set new industry benchmarks by becoming the first company in the world to provide the first unrestricted UL certified carbon-free slip rings to the wind industry," DHi president and CEO Rich Martin said.

— Source: Defense Holdings, Inc.

Moventas seeks to ease cost burden of CMS retrofits

Lease program rolls installation costs into monthly payment program

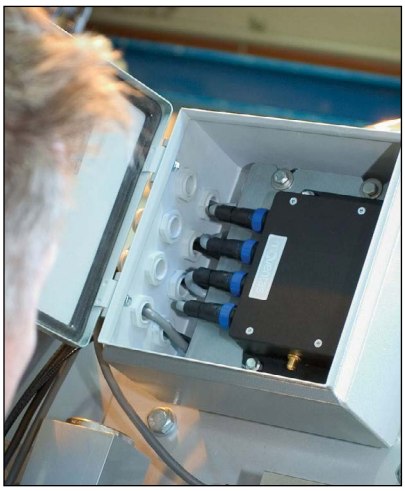


Moventas North America has introduced an innovative financial solution with their Condition Monitoring Lease Program that converts the upfront installation costs for condition monitoring into an affordable monthly payment for wind farm owners. Additionally, this financial innovation translates condition monitoring from a hardware-only business to a complete life-cycle service.

Developed by Moventas, CMaS condition monitoring service maximizes gearbox life with early detection of mechanical problems through remote, real-time monitoring of gearbox vibration, oil condition, and temperature. A strong majority of all new wind turbines are sold with advance condition monitoring on the

drivetrain. Unfortunately, a large majority of the existing fleet of 40,000 wind turbines were built without this valuable technology, and owners find it difficult to afford and deploy.

"The lease payment removes barriers to the deployment of condition monitoring hardware, 24/7 analysis by expert technicians, nationwide multi-brand boroscoping and a complete suite of lower cost multi-brand up-tower repairs for the North American fleet," said Mike Grunow, vice president of Sales and Marketing, Americas at Moventas.



Currently, wind farm revenues are down due to lower electricity prices, and these farms typically cannot afford the upfront costs to retrofit the existing fleets with condition monitoring capability. However, today's low interest rates enable low cost operational leases of this kind of equipment. Leveraging the innovative leasing structures that are prevalent in other industries spreads the cost out over multiple years for the wind farm owner.

"Outside of Moventas' comprehensive offering, a wind farm owner would have to contract with at least four separate entities for condition monitoring, the lease, follow on boroscope inspections, parts and repairs. Having all of these under one roof enables access to lower cost repair savings and less downtime for wind farm owners," said Grunow.

Moventas currently monitors over 2 GW of wind turbines globally and has repaired over 1500 multi-brand wind turbine gearboxes in North America alone.

— Source: Moventas