

FEATURES

**Company Profile:**

Samuel, Son & Co., Limited

Leading Blade  
Edge Erosion

Improving with  
Condition Monitoring

BPM Software for  
Case Management

**THE EVOLUTION OF THE  
GEARBOX OIL CHANGE**

DEPARTMENTS

Construction—Signal Energy Constructors

Maintenance—Rev1 Power Services, Inc.

Technology—UMASS Wind Energy Center

Logistics—Vectora Transportation LLC

Business—Jones Day

**Q&A: Roger Simonson**

One Eye Industries, Inc.



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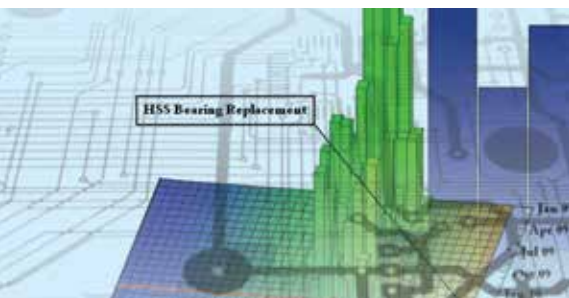
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# EDLETTER

After more than 10 years of controversy and planning, the United States, the world leader in installed land wind energy, still has no offshore wind capacity, but it seems we are a little closer.

Cape Wind recently signed a purchase and sale agreement for East Marine on Falmouth Heights Road on Falmouth Harbor where the company will base its operations headquarters. It's been a long road for Cape Wind as it faced opposition to offshore turbine construction from local residents, environmentalists, courts and others, but now it is America's first offshore wind farm to secure Federal and State approval for construction three-miles offshore.

A co-worker and I were discussing this today as we discussed plans to travel to the AWEA Offshore Windpower Conference & Exhibition in Virginia Beach, Virginia, October 9 through 11.

Although the United States has built no offshore wind projects to date, about 20 projects representing more than 2,000 MW of capacity are in the planning and permitting process. Most of these are in the Northeast and Mid-Atlantic regions, although projects are being considered along the Great Lakes, the Gulf of Mexico, and the Pacific Coast. Untested regulatory and permitting requirements in federal waters outside the three-nautical-mile state boundary have posed major hurdles, but recent progress, Cape Wind being one of those, gives signs of hope.

The United States offshore winds have a gross potential generating capacity four times greater than the nation's present electric capacity. Although Europe now has a decade of experience with offshore wind projects in shallow water, the technology essentially evolved from land-based wind energy systems. This suggests that opportunities remain for the United States to lead the way in developing this technology.

I'm from the Gulf Coast so I'm accustomed to seeing booming oil towers off the coast on our beaches. The threats from natural disasters like the BP Oil spill was one we all anticipated and feared, but we seem to have survived it and our beaches are back to normal. While there are still unknown variables about the impact of offshore wind projects, particularly those on floating platforms, I'm much more inclined to support wind rather than oil expedition as a first priority in providing self-sustaining electricity for our country.

There is no doubt the wind blows and blows with much more certainty than is true of digging for oil and even tapping natural gas lines. And few can argue that wind is a dirty business.

Let's hope that this first attempt at U.S. offshore energy generation is the beginning of a long process of ensuring our leadership in renewable energy development.

I mentioned that we'll be on the road in Virginia, but I also wanted to mention that we'll also be attending the CanWEA 2012 Annual Conference and Exhibition in Toronto this month from October 14 through 17.

If you're at the offshore show, please stop by the booth and say hello. If you attend CanWEA, look for a copy of the magazine in your registration bags.



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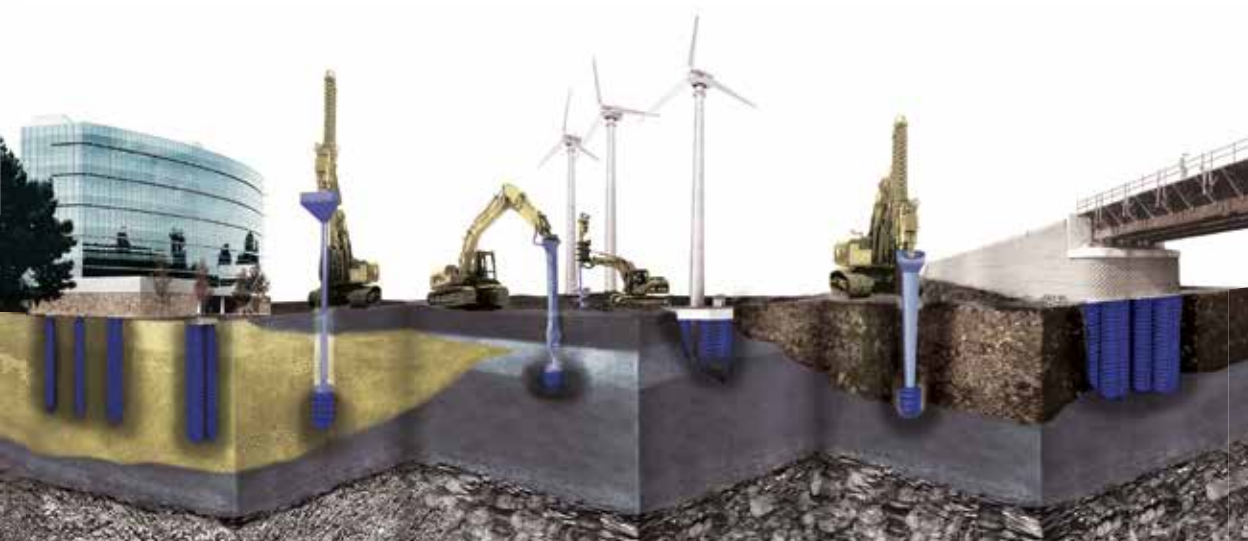
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## **NPS™ 100 TURBINES DELIVER 98 PERCENT AVAILABILITY**

Northern Power Systems, a next-generation wind turbine company, announces that its NPS 100 permanent magnet direct drive (PM/DD) wind turbine fleet has achieved more than two million hours of operation. The Company's 100 kW fleet has been operating at more than 98 percent availability since 2008, which means that turbine owners benefit from high-energy production and little downtime. Over 175 NPS 100 wind turbines are installed and operating in 25 states in the United States, Bahamas, Canada, Italy, Ireland and the United Kingdom.

Just over one year ago, Hurricane Irene, a Class III hurricane, passed directly over two NPS 100 turbines in the Bahamas. As a testament to the robust design and safe operation of Northern Power turbines, the turbines detected high winds of up to 107.1 mph (47.9 m/s) and automatically entered safe mode. The following morning, the NPS 100 turbines returned to normal operation without any intervention. NPS turbines are designed to stand up to winds up to 133 mph (59.5 m/s).

As market leader, Northern Power Systems is continuously expanding its global fleet of NPS 100s, which require minimal infrastructure, provide easy installation and maintenance, and eliminate the need for transmission lines for grid connectivity.

"Our NPS 100 customers get clean, cost effective renewable energy from turbines that fit perfectly in remote locations as well as industrial areas and communities. The turbine's reliable, safe and simple operation gives owners peace of mind and delivers the highest energy output in its class for the best return on their investment," said Reinout Oussoren, Vice President of Global Sales at Northern Power Systems.

"We are very proud to have achieved the two million hour milestone while maintaining high fleet availability," said Troy Patton, President and CEO at Northern Power

Systems. "Northern Power's PM/DD technology delivers the performance and reliability that are fundamental to the long term success of distributed power generation around the world."

For more information, please visit [www.northern-power.com](http://www.northern-power.com).

## **NATIONAL WIND TECHNICIAN ORGANIZATION FORMED**

The National Wind Technician Organization is able to provide safety training services for all personnel involved in the process of building, maintaining, operating, and managing wind turbines and wind sites.

Scott Battles, National Wind Technician Organization's Northwest and Midwest Operations Manager stated, "My father was an OSHA compliance officer. I did not realize that having him hammer safety into my head when I was young would be such a strong focus later in my life."

Battles is a professional wind technician and wind industry educator who carries a "great interest in and passion for the safety of the wind industry professionals." In his role as educator, Battles follows his father's lead, preaching safety to his students every day.

Battles holds certifications from FCC licenses to G.E. 1.5 wind turbines to Microwave which have been a surprisingly good mix of knowledge bases.

A solid and unique background in communication electronics, railway, wind turbines and wind farm construction enables Battles to provide professionals and students with first-hand knowledge, along with practical experience when discussing various aspects of products, service, and safety topics.

At the opposite side of the country Matthew Soto serves as National Wind Technician Organization's Southwest Operations Manager.

"We are certified to train individuals in the use of the Skylotec Milan rescue and evacuation devices. We can train you and your employees in harness inspection, basic rescue techniques and evacuation techniques all at your site or location. Membership to the National Wind Technician Organization will entitle members to a discount on equipment, for example, harnesses, rescue devices, etc."

Soto has been in the wind industry for more than six years and comes to the National Wind Technician Organization with experience in operations and maintenance, commissioning, site construction, large corrective, recruitment, technical and safety training. Recently, Soto has been focusing on the safety aspect of training entry-



level wind technicians in the use of fall protection and working at heights training and has spent a year-and-a-half as a technical instructor and safety trainer. Soto is certified in the following areas:

- Miller Fall Protection Competent Person
- Skylotec Competent Person (Milan A-024 and A-020)
- Siemens Level 2 Basic Harness Instructor
- Siemens Safety and Rescue Instructor, basic rescue and basic evacuation
- ICM Personal Fall Protection Equipment Product Knowledge

Additional members of the National Wind Technician Organization team are:

- Nancy C. Caralla, East Coast & International Operations Manager
- Mike Kyes, ITT Administrator
- Paul Bosworth, UK Division Administrator
- Tony DelMonaco, Organization Photographer

National Wind Technician Organization is preparing to open individual memberships for professional wind technicians, wind industry educators, wind industry safety professionals and construction professionals worldwide.

Memberships are expected to be available in September, featuring the National Wind Technician Organization "Turbine Card," filled with tailored discounts from well-known vendors, franchises, and companies only for National Wind Technician Organization members and handpicked by the organization.

A few membership partners offering their tailored discounts are: La Quinta Inns & Suites, 1800flowers.com and Enterprise Rent-A-Car.

The "Turbine Card" will be offered at the low one-year membership fee of \$50.00 USD. Students receive a 25 percent discount off the yearly membership fee: \$37.50 USD. Student ID is required.

For more information, visit [www.nationalwindtech.org](http://www.nationalwindtech.org) or email: [nationalwindtech@yahoo.com](mailto:nationalwindtech@yahoo.com).

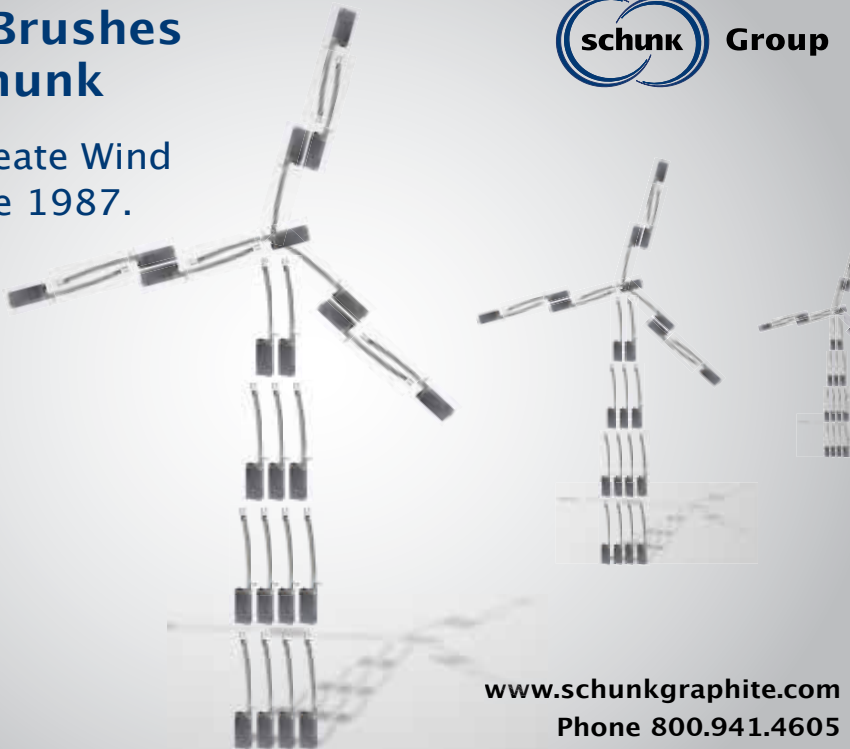
### **CATCH THE WIND IS NOW BLUESCOUT TECHNOLOGIES**

Catch the Wind Ltd., providers of predictive Optical Control Systems (OCS) for optimized wind energy generation, announces the complete rebrand of the company, now operating through its wholly-owned subsidiary (formerly Catch the Wind, Inc.) as BlueScout Technologies, Inc.

"Our name, BlueScout, is about the future," said Jo S. Major, Ph.D, President and CEO of BlueScout Technologies, Inc. "Our passion is to use our technolo-

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gies and skills to help our customers in the wind industry understand and manage their wind resource more effectively. We will use this rebranding to show our customers, investors and partners our commitment to helping turbines reliably produce cleaner, renewable energy. To us, the blue of the skies holds intelligence to be discovered and applied, and our passion for exploration is embodied within the concept of scouting what is ahead."

BlueScout reveals a new image, complete with a fresh logo, mission, vision, values, and domain name. The company's optically based wind forecasting technology for control systems, the BlueScout OCS-210, is a next generation turbine control system for utility-scale wind turbines. From its position on top of the nacelle,

it measures wind speed and direction in the approaching free-stream inflow and employs predictive control architectures to increase energy production and reduce harmful effects of wind turbulence on wind turbines. The optical wind sensor, BlueScout OWS-150, is a lightweight, portable, all-weather wind assessment tool that precisely measures wind speed and direction of vertical profiles above the ground or off shore water surface – reaching the full blade height of most utility scale wind turbines.

Major continued, "BlueScout aspires to develop a unique capability using an understanding of wind characteristics, gained through more than three years of controlling operational wind turbines, to fundamentally change the control philosophy of the wind industry. To realize these goals, we will consistently innovate in collaboration with our customers, always looking to push the envelope of thought leadership, and relentlessly work to use measurement data to dramatically improve reliable performance."

In the coming days the company will provide an operational update – details to be announced separately. The company will continue to be traded on the TSX Venture Exchange (TSX-V) under the stock symbol "CTW" until such time as its trading symbol is changed to reflect this rebranding, which the company expects will occur later this month. In addition, at the company's upcoming shareholders meeting the company will seek the approval of shareholders to change the name of the parent compa-

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ny's name from "Catch the Wind Ltd." to "BlueScout Technologies Ltd." All prior trademarks of the company will no longer be used following this rebranding.

For more information, contact BlueScout Technologies at (703) 956-6554 ext 103 or email [jgreen@BlueScout.com](mailto:jgreen@BlueScout.com).

#### FRENCH TECHNICAL CENTER (CETIM) CENTRALIZES TESTING SERVICES ON LMS

One of France's leading technical centers, CETIM, has recently acquired multiple LMS SCADAS Mobile Testing systems for NVH. With the new systems, CETIM engineers can efficiently perform numerous diverse measurement and analysis tasks ranging from in-vehicle measurements and vibration diagnosis to failure, vibro-acoustic and modal analysis.

"Our customer base covers all types of industries from defense and rail to marine and off-highway. We are definitely seeing a trend on forever more complex products and greater testing efficiency that require us to test with more data acquisition channels and perform more parallel measurements," said Patrick Vincent, sales manager noise and vibration engineering department at CETIM. "Many of our customers are LMS users as well. Using exactly the same testing systems simplifies communication immensely."

"With our robust LMS solution, we work with one centralized database. The team no longer wastes time looking for data or converting and transferring files. With a single testing platform, we also save time on training. Our team is ready to test in no time," said Thomas Vervaeke, responsible for the LMS platform on the Noise and Vibration Engineering Department at CETIM.

A key asset for CETIM is flexibility. On average, a test set-up

requires 40 channels, but certain customers require more channels than others. To solve this, CETIM simply chains separate LMS systems together to reach the additional channel capacity and handle simultaneous test runs.

"Since we have very limited time to test our customers' prototypes, we need to work as fast and efficiently as possible. We recently linked 3 LMS SCADAS Mobile systems into a 120-channel configuration. This way we could do on-site parallel data acquisition and collect as much data as possible for later processing at the CETIM facilities," Vincent said. In addition, the

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team noted various other positives in regards to the LMS SCADAS, including robust design that can handle extreme temperatures and environments as well as the GPS tool to locate critical test points, especially during long distance rail and road tests.

“At CETIM, approximately 30% of our tests are done in tough environmental conditions or without good accessibility. This is why the Bluetooth feature for remote operation is essential as well. Clearly, the LMS SCADAS is a rugged solution that meets our extremely diverse needs,” Vervaeke said.

For more information, visit [www.cetim.fr](http://www.cetim.fr) or [www.lmsintl.com](http://www.lmsintl.com).

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**TRELLEBORG SEALING  
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Trelleborg Sealing Solutions has launched an easy-to-use glossary where engineers can find definitions for commonly used engineering and sealing terms at the click of a mouse or touch of a button. Free of charge, it is available online or via an app for both iPhone and Android, downloadable by searching for “Trelleborg” from the Apple app store or Google play.

The glossary is easily searchable by entering key words, with results displayed where the searched item is in the title or in the definition of the searched word. There is also the option of using an alphabetical listing. Robert Zahiri, Director Global Marketing and Communications, says: “The glossary is not just about sealing; it has been designed as a general engineering tool, perfect for anyone who wants a quick and simple definition of engineering terms. We’re always striving to develop new



The glossary joins a range of industry-leading e-tools for the Web and smartphones. These include:

- **O-Ring Calculator:** Calculates O-Ring dimension tolerances and recommends parts – iPhone, Web
- **ISO Fits and Tolerance:** Provides ISO fits definitions – iPhone, Android
- **Aerospace Groove Selector:** Covers the most important SAE aerospace groove standards – iPhone
- **Unit Hardness and Converter:** Quick and easy conversions of both engineering-related and general units – iPhone, Android
- **Seal Configurator:** Provides the most suitable solutions for your application – Web
- **Electronic Catalog:** Search for seals by item number, types of seal or by operating condition – Web
- **CAD Service:** Easy access to 2D and 3D drawings – Web
- **Material Search:** Quickly find suitable materials for your application – Web
- **Chemical Compatibility Check:** Find materials compatible with media utilized within an application – iPhone, Web
- **Catalogs and brochures:** Access to the full range of literature from Trelleborg Sealing Solutions – Web.

Repower Systems SE has signed projects with an overall capacity of more than 1 GW in the United Kingdom following today's announcement of an additional five onshore contracts. In 2012, the company signed about 200 MW in the United Kingdom. With a market share of 12 per cent in 2011 Repower is the United Kingdom's third largest wind turbine supplier.

The contracts announced today add a further 66 MW to REpower UK's fast growing portfolio. They include the supply of 10 MM92 turbines – each with a rated output of 2.05 MW – for RidgeWind's wind farm at Wandylaw in Northumbria, North West England; and eight MM92 turbines for the Yelvertoft wind farm in Northamptonshire, Central England, developed by AES Wind Generation.

REpower has also signed three new Scottish contracts. The company will supply five MM82 turbines – rated output 2.05 MW each – for FIM Services and Whirlwind Renewables' Wathegar wind farm in Caithness, as well as six MM92 turbines for the Blantyre Muir wind farm in South Lanarkshire and four MM92 turbines for Barlockhart Moor wind farm near Glenluce in Dumfries & Galloway, both International Power (GDF SUEZ Group) developments.

"Reaching 1 GW of signed contracts is a huge achievement for us," said Andreas Nauen, CEO of REpower

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Systems SE. REpower UK is enjoying a period of steady growth having signed contracts totaling 190 MW since the end of last year. I believe this demonstrates the growing reputation of REpower turbines in the British market, and is a solid indication that the wind sector remains in good health."

Since its launch in 2004, REpower UK has delivered 39 onshore wind farms in Scotland, England and Wales and two offshore wind farms: Project Beatrice in the North Sea and its largest offshore contract to date, Ormonde wind farm in the Irish Sea. Owned by Vattenfall, this offshore wind farm consists of 30 REpower 5M wind turbines with a total rated output of 150 MW.

For more information, visit [www.repower-uk.co.uk](http://www.repower-uk.co.uk).

**WESTERN PACIFIC CRANE & EQUIPMENT  
ESTABLISHES FACILITY IN HAWAII**


Western Pacific Crane & Equipment (WPCE) is pleased to announce a new facility in Kapolei, Hawai'i in order to better meet the equipment and maintenance needs of customers in the Pacific Rim region. WPCE is an authorized distributor for Manitowoc, Grove and National Boom Truck that is expanding rapidly throughout the Pacific Rim, the West Coast of the United States and Western Canada.

"We bring decades of knowledge and experience in heavy equipment gained from our sister company, Walter Payton Power Equipment, one of the leading Manitowoc Crane distributors in the US," said Robert Johnson, presi-

dent of WPCE. "Walter Payton Power Equipment has set the standard for sales and service in the industry, and we are applying the same basic principles at Western Pacific. Foremost is our commitment to building strong relationships with our customers and always striving to exceed their expectations."

The new WPCE facility will offer regional sales, maintenance, and parts distribution for our customers in Hawaii, Guam and the Marshall Islands. The grounds will feature a full-service shop and almost an acre of yard space in the Campbell Industrial Park. In addition to Manitowoc, Grove and National Crane equipment sales, Western Pacific will provide these customers with a modern parts center and state-of-the-art service bay staffed with factory-trained technicians.

Dennis Piatek has been named the Branch Manager of the new WPCE Hawaii facility. "I am pleased to have joined Western Pacific Crane and Equipment a year ago and to have the opportunity to continue representing the premier leader in lift equipment - Manitowoc Crane Group," he said. "As part of the Lanco Group of Companies, WPCE has demonstrated their commitment to the Hawaiian 'Ohana' with their dedication to their customers in the Pacific Rim region", says Piatek. "I look forward to continuing working hard for our Hawaiian, Guam and Marshall Islands customers to fulfill their lifting and service needs."

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## Preconstruction planning on wind projects yields budgetary benefits for developers.

**ONE OF THE MOST VALUABLE TOOLS** that an owner or developer of wind projects has in its planning toolbox is a good preconstruction value engineering methodology. Developers can realize large short- and long-term economic payback if they commit time and resources to value engineering each aspect of the engineering and construction of a wind project early in the development process. Engaging an experienced design/build contractor at an early stage to perform this value engineering analysis insures that a project is designed in a way that maximizes long-term energy production and short-term capital costs for construction.

Wind project construction is made up of five main areas: (1) civil infrastructure—roads, crane pads, crane paths; (2) electrical collection system—underground and overhead; (3) wind turbine foundations; (4) substation and interconnection facilities; and (5) wind turbine erection. By gathering the right information at an early stage, each of these areas can be optimized to achieve the highest quality with the lowest cost.

Effective preconstruction planning depends upon the early accumulation of basic, but critical, information. Developers should make every effort to develop the following information at the earliest possible stage in the development process:

(1) **Geotechnical Information:** Solid geotechnical information is the underpinning for the effective design of a number of major wind farm components: (a) wind turbine foundations; (b) roads, crane pads and paths; and (c) underground electrical collection system. Wind turbine foundations make up a significant portion of the overall project cost, and represent one of the most critical risk management items. No shortcuts should be taken in determining the proper wind turbine foundation design. This design begins with a complete understanding of the geotechnical characteristics of the project site. On many projects, the geotechnical investigation is postponed until late in the project development process and costs are budgeted based upon assumed geotechnical conditions.

(2) **Topographical/geographic Information:** Further optimization of the civil infrastructure (wind turbine locations, project access and turbine string road locations, crane path locations) and the electrical collection system (location) requires detailed knowledge of the physical properties of the project site (i.e. topography, wetlands, existing road system, existing structures, underground pipelines, etc.). In addition, this optimization requires knowl-

edge of the landowner, governmental and regulatory rules and regulations that will apply to the project (easement restrictions, setbacks, road agreements).

(3) **Interconnection information and utility requirements:** Substation and interconnection facility costs comprise a large percentage of the overall project costs. Accurate interconnection information is critical to the design of the project substation and interconnection facilities.

Ultimately, substation and interconnection facilities design, optimization and pricing is finalized after the Interconnection Agreement ("IA") is available. The IA typically includes the Facility Study, which specifies the material and equipment that the utility will require for interconnection with the transmission line. However, early stage planning and cost estimating can be done with some basic information:

(a) interconnection voltage; (b) point of interconnection location; (c) available routing for transmission line from the project site to the POI, if applicable. The interconnection voltage will help to determine the substation design and the main power transformer specifications.

(4) **Turbine Selection and Delivery Timeframe:** Early stage development of the project schedule and pricing is highly dependent upon the wind turbine

selection and the anticipated delivery dates and delivery rate. The wind turbine loading helps to determine the foundation type and size. The selection of the proper main erection crane (itself a major cost and schedule component) depends upon the turbine type, weight, and hub height. The timing and rate of the wind turbine component deliveries helps to determine the unloading crew size and necessary equipment to mobilize to site (e.g. number of unloading crews, number of unloading cranes and ancillary equipment).

The project schedule must be developed such that the construction of project infrastructure is not impacted by the thaw restrictions, especially when turbine component deliveries are timed immediately before or after thaw restrictions are placed, or lifted.

Experienced design/build contractors can use their construction expertise to assist project developers in the proper design of all major wind project construction components. Early engagement of a contractor to employ a methodical value engineering analysis to develop preliminary project designs can be the difference between an economically viable project, and one that is left on the drawing boards. ↘



Forest Creek Wind Farm near Big Spring, Texas.

**Some of the best ideas that have improved working conditions in the wind industry have come from people who have seen things differently.**

**WHAT NUGGETS OF INNOVATION** are under our noses, held quietly in the minds of the young men and women who simply wish for a different, yet better way to do their job? Read on to be inspired about the future of the wind industry.

Anyone who maintains a wind turbine has a sense that our industry is in constant pursuit of finding innovative ways to improve our working environment. Compact tooling, climb assist and elevators, lighter harnesses with cast aluminum safety hooks, interchangeable replacement parts, and up tower remote condition monitoring are all products of our pioneering industry. Seemingly, just when we found a better mousetrap, we turn a corner as a new product redefines the way we conduct our business. This is not to say that we work in an industry of new inventions – wind power has been around for centuries. Innovation by its definition is a unique discovery or finding. Innovation on the other hand, can be an application of someone else's invention in a new and practical way. Not surprisingly, many of the concepts that improve or enhance our service work have originated from outside our own industry and are a result of someone looking at a problem and applying an existing solution in a different way.

Like many situations, in the wind world necessity is the mother of invention. Among the many wind turbine blade patents out there, you can find dozens of ideas from visionaries who have considered making a blade stronger, more efficient, lighter, and even some that extend and retract when the wind ebbs and gusts. Someone is thinking about insects too, having patented a sensor that measures the insect density in the air and then curtails the turbine production at times when there are too many bugs flying around. Might sound a bit unusual or even impractical, yet those of us who have experienced firsthand the efficiency drop from smashed bugs on a leading edge can appreciate the concept. Imagine then the innovative idea of leveraging rain to clean the blades. Yes, a system that determines the presence of precipitation and adjusts the rotor speed and blade pitch to create the optimum cleaning speed and angle. Perhaps someone came up with that after they were forced to stop during a thunderstorm and buy new washer blades for their truck.

How to quickly and safely change oil in a gearbox sitting 325 feet in the air was the concept of one innovator who found a way to avoid spilling oil when he changed it in his land-based irrigation engines. Both environmentally responsible and faster than using drain lines and toting buckets, his wind turbine oil change system allows for a completely enclosed transfer of oil using compressed air to draw a vacuum in a tank and pull used oil out of the gearbox oil

sump high in the air. Looking for a solution that was comparably inexpensive to a crane mobilization, another tinkerer patented a portable crane for servicing wind turbines that can be disassembled into components small enough to be manually carried by a technician. When assembled in just about any existing turbine, the crane is capable of removing individual components such as blade pitch drives, yaw drives, high speed shaft couplings, oil pumps, and gearbox bearings. This would also be a helpful accessory for handling the improved and fully removable generator bearings that are designed to be part of a bolt on subassembly rather than being directly shrunk to the generator shaft. I suspect that when it comes to finding ways to avoid the expense of a crane, innovation is at its best. I applaud the technician who was tasked to design, build, and field test an air scoop for a side-mounted generator air cooler. Rather than produce one that fit from the outside and bolted on in one piece, his strategy was to make it in two parts that could be assembled from inside the nacelle.

We also benefit from companies that have made their mark across diverse industries, particularly those in the fields of high elevation service and heavy industrial bolting. A prominent supplier of ladders for more than 125 years found they could provide the wind industry not just with ladders but with service lifts as well. It was likely a technician who first said, "I wish someone would put an elevator in this thing!" that sparked the idea of designing one that would work well inside a turbine tower. Industrial tool companies have been leading the innovation on turbine tooling, modifying and optimizing for the inherent weight and size restrictions of this often used gear. Taking their cue from technicians in the field, these companies have produced lightweight, compact, and many times customized fittings that have shed hours off torque and tensioning procedures. Even while such companies serve multiple industries, they are able to adapt to the uniqueness of wind turbines and enhance the work of the technician.

It has been said that innovators don't see different things; they simply see things differently.

The examples here show that that some of the best ideas that have improved working conditions in the wind industry have actually come from people who have seen things differently, and have been inspired by the very people we know who climb, trouble-shoot, and maintain our turbines each and every day. While the laws of physics may dictate where and how high we build wind turbines, we have an unlimited capacity to change our environment for the better, beginning in one where innovation is valued and proactive leadership is there to champion it. ↵

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Merritt Brown is vice president of Rev1 Renewables, an energy services company supporting wind, solar, and biomass clients worldwide. To learn more, call 866-738-1669 or visit [www.rev1renewables.com](http://www.rev1renewables.com).

## Multi-rotor wind turbines may be a novel solution to increase energy output offshore.

**OFFSHORE WIND TURBINES** continue to grow, with the latest technology having rated powers of six to seven MW, and rotor diameters as large as 150 meters. There are a number of factors driving this growth, in particular the desire to increase the energy capture per offshore support structure. Because of the high fixed cost associated with an offshore support structure, including installation with specialized vessels and interconnection, the economics of offshore wind make maximizing energy capture, and thus rotor diameters, an imperative. This drive towards larger rotors applies to both fixed and floating offshore turbines. Moreover, the architecture of offshore wind turbines has converged to the industry standard three-bladed, upwind, horizontal axis configuration.

Increasing the size of wind turbine rotors, however, also presents significant engineering challenges. Manufacturing a 75-meter blade, installing it offshore, and then ensuring its reliable operation in the offshore environment is extremely difficult, and requires a wide range of engineering disciplines from material science to aerodynamics and controls. These challenges have led to a number of possible conceptual solutions that differ from the standard three-bladed, upwind, horizontal axis architecture. These solutions include segmented blades, vertical axis turbines, and downwind oriented rotors, all of which offer various advantages and drawbacks.

Another solution to capture more energy per offshore support structure is to have multiple rotors on a single support structure. Researchers at UMass Amherst (Professor Manwell and Professor Lackner) are investigating this multi-rotor concept and analyzing its potential. As far as can be determined, Hermann Honnef of Germany was the first person to propose multi-rotor wind turbines more than 80 years ago, and the idea appeared again in the 1950s in work of the American Percy Thomas. The first detailed conceptual designs for multi-rotor offshore wind turbines can be traced back over 40 years, to Professor William Heronemus at UMass Amherst in the early 1970s. At that time, technical limitations in blade construction necessitated relatively small rotors, and so the only apparent solution for large scale offshore wind entailed a multi-rotor turbine, in which multiple rotors are supported by a super-structure that sits on top of an offshore support sub-structure such as a monopile or floating platform. The concepts developed at the time ranged from two

or three rotors per support structure, to well over ten rotors.

While the current motivation for employing a multi-rotor turbine has evolved compared to 40 years ago, many of the inherent benefits of such a solution have remained. Multi-rotors have built-in redundancy by definition, and so if a single subsystem fails, e.g. a blade pitch actuator, the remaining rotors can operate normally and still produce power. Thus, there is the possibility for partial availability for a multi-rotor and a reduced number of trips for maintenance. This could be especially beneficial in locations where offshore access is limited for much of the year. Another potential advantage of a multi-rotors turbine is that each rotor operates in a relatively more uniform flow field (compared to a standard single rotor), with less shear and turbulence variations across the rotor face. This may allow each turbine to operate more efficiently, resulting in a higher overall energy output for the identical total swept rotor area.

Multi-rotor turbines also present additional complexities, most notably the super-structure that must support each rotor and connect to the offshore support structure. The cost and mass of the super-structure must be accounted for in assessing the overall economic tradeoff. Furthermore, controlling the yaw of either individual rotors or the entire super-structure for a multi-rotor turbine is a challenging design issue.

The research conducted at UMass Amherst so far has investigated the relative mass and cost of a multi-rotor system versus a standard configuration. Using scaling laws developed at the National Renewable Energy Laboratory (NREL), which defines relations for the mass and cost of the major components of a wind turbine as a function of scale, the overall mass and cost of a single 5 MW rotor was compared to a variety of multi-rotor configurations. The multi-rotor configurations varied in terms of number of blades per rotor, and number of rotors. As an example, it was determined that the overall mass of the rotor-nacelle assemblies of a multi-rotor configuration with three rotors of three blades each would be 10% less or more than that with an equivalent single rotor, and the cost would be significantly lower as well. The major caveat of this analysis is that the super-structure mass and cost has not been estimated. ↵

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**Advanced planning for foul weather is important when moving overweight cargo and assets.**

**IT IS THE END OF SUMMER** and I am finally taking a break after a busy summer building schedule. As I relax on the beach, I reflect on all the wind components that have been moved. Because of the economic and political environment it has been a robust season. And it is not over yet. Many open projects are still in process and will continue to be that way until the end of the year. But the season is changing and so logistically we have to change our approach to transporting equipment. As fall and early winter set in here are some things to consider:

Shorter days will have an impact on schedules. Less daylight translates into fewer hours on the road. Depending on the state, over-the-road permitting may change. What was acceptable in June may not be in October. At the delivery site, portable lighting may have to be brought in to assist in either loading or discharging cargo. This is also a consideration for ships discharging at ports. Do they have adequate lighting to work after sunset?

Weather becomes a factor, especially in the north as the season changes. Foul weather has to be planned for and staff and equipment have to be properly prepared. The risk of accident and injury is greater. It is critical that employees and vendors are thoroughly trained, and procedures and processes are in place and audited. Cold and wet weather can make seemingly routine tasks more difficult. Consider something as routine as climbing onto a trailer for lashing in the summer, becoming more difficult due to thicker clothing and slick conditions in the fall and winter.

Weather also has an effect on road conditions. Frost laws are applied differently depending on state regulation. Overweight cargo that was permitted in the summer may have to be rerouted due to these laws. When routing your cargo, take into consideration ports, rivers, channels and lakes closures because of either low water at the end of summer or early ice. This will also shift the volume of cargo towards southern ports, which will increase time and costs, forcing you to use less experienced terminals to handle project cargo.

Equipment maintenance is critical. Transport assets such as trucks, cranes, forklifts or other material handling equipment need to be winterized. The fall and winter seasons are hard on equipment. Things seem to break more often and take longer to fix. Plan for adequate spare parts and service personnel to meet your schedule. Remember that the type of

equipment may change. Where as a normal tractor-trailer setup would handle the cargo in the summer, now due to poor conditions, lower geared power may be required for movers. This is especially true in ridgeline projects.

**“By recognizing weather days in advance you can negotiate lower rates and lessen demurrage with contractors at the time of contract negotiations.”**

All of the above add time and cost to the project. These need to be recognized up front and accounted for. Adding weather days into the planning process helps mitigate costs. How does this happen? By recognizing weather days in advance you can negotiate lower rates and lessen demurrage with contractors at the time of contract negotiations. But let me point out, the approaching fall and winter season isn't all doom and gloom for projects. As the summer season winds down, more and more transport capacity is freed up. This creates an opportunity for lower pricing. Also with more assets available, more assets may be applied to the project to shorten the overall lead-time. For example, if in the summer you could only find 18 blade trailers to service your project. Now 24 or 36 may be available in the fall or winter. It is a good time to bargain shop. For projects located in the south, the weather becomes more temperate, leading to better working conditions. It's no fun loading cargo onto a rail car in Texas in July or working in the hold of a ship in New Orleans in August.

I have a few more days at the beach before I head back to the office and face the approaching fall. I am soaking in the last warm days in summer, but I am also thinking about the approaching season and wondering where my foul weather gear is stored and if my winter boots are weatherized. 🌬

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## The authors discuss economic curtailment and its potential impact on wind energy growth following implementation of FERC Rule on grid integration.

**RECENT REGULATORY DEVELOPMENTS** continue to further the trend of increased participation by wind energy generators in the forward energy markets. This trend potentially places wind energy generators at greater risk of economic curtailment, which can result in lower investment returns and decreased project development.

On June 21, 2012, the Federal Energy Regulatory Commission ("FERC") approved a new rule intended to help improve the integration of wind and other renewable energy generation into the transmission grid (<http://html.dnv66>). When it takes effect next summer (twelve months after publication in the Federal Register), the new rule will require transmission providers to offer wind and other renewable energy generators the option to schedule transmission service in intervals of fifteen minutes or less, rather than the current hourly intervals originally designed for fossil-fuel and nuclear generation, in order to lessen their exposure to imbalance charges attributable to the intermittency of their wind or other renewable generation resources.

The rule will also require new renewable generators to provide meteorological and forced outage data for their facilities to their transmission service providers, to help the transmission providers manage the flow of renewable energy onto their systems with improved power production forecasting. FERC declined, however, to adopt a proposed component of the new rule, a standard for transmission providers to provide renewable energy generators with generation balancing services, which use capacity reserves to offset the frequent changes renewable generators' output. In adopting the new rule, FERC observed that "over time, implementation of intra-hour scheduling . . . will allow public utility transmission providers to rely more on planned scheduling and dispatch procedures, and less on reserves, to maintain overall [transmission] system balance."


Implementation of the new rule may increase the trend toward grid operators requiring, or at least permitting, wind energy generators (and possibly other renewable energy generators) to participate in forward energy markets in which the grid operator schedules and dispatches generation on the basis of bids submitted to supply energy, with the lowest bidders taking precedence. If participation in forward markets increases, wind generators will likely become more exposed to economic dispatch and the resulting risk of "economic curtailment" of their output.

What is economic curtailment? It is curtailment of a wind generator's output due to market price (and not

operational) reasons. Let's assume the typical case of a wind generator that has entered (or will enter) into a power purchase agreement ("PPA") with a load-serving utility that obligates the utility to purchase all of the wind generation facility's output. Economic curtailment of that facility's output may occur in energy markets whose rules allow the transmission-system operator to:

- Administer a forward market for energy (such as a day-ahead market);
- Use locational marginal prices for energy in the forward market as price signals reflecting electricity supply and demand at multiple locations on the transmission system; and
- Use the forward market and market-determined prices to schedule and dispatch generation facilities, on the basis of the lowest prices to supply energy bid into the forward market.

If the market rules require (or permit) wind generators to participate in such a forward market, the PPA buyer typically acts as the scheduling coordinator for the generator's output in the forward market. In this capacity, it must (or may choose to) bid a minimum price at which the PPA buyer/scheduling coordinator is willing to sell the wind generator's output into the forward market at a particular location in a given hour. If other generators bid lower prices than the scheduling coordinator for a sufficient quantity of output to serve the load at that location and hour, the system operator would schedule and dispatch the output of those other generators, rather than the output of the wind facility – that is economic curtailment of the wind generator.

Economic dispatch of wind generation is a fairly recent phenomenon, one the parties to the PPA may not have foreseen and thus failed to address whether and how the seller would be compensated for the resulting decrease in its revenues and possible tax benefits and renewable energy credits. More recent PPAs with provisions that expressly permit economic curtailment by buyers (sometimes with limited compensation to sellers) make it potentially difficult for investors and lenders to forecast the impact of economic curtailment on returns for proposed projects. At a time when wind energy is facing various challenges, the prospect of increased economic curtailment has become another material factor to consider for future project development. 

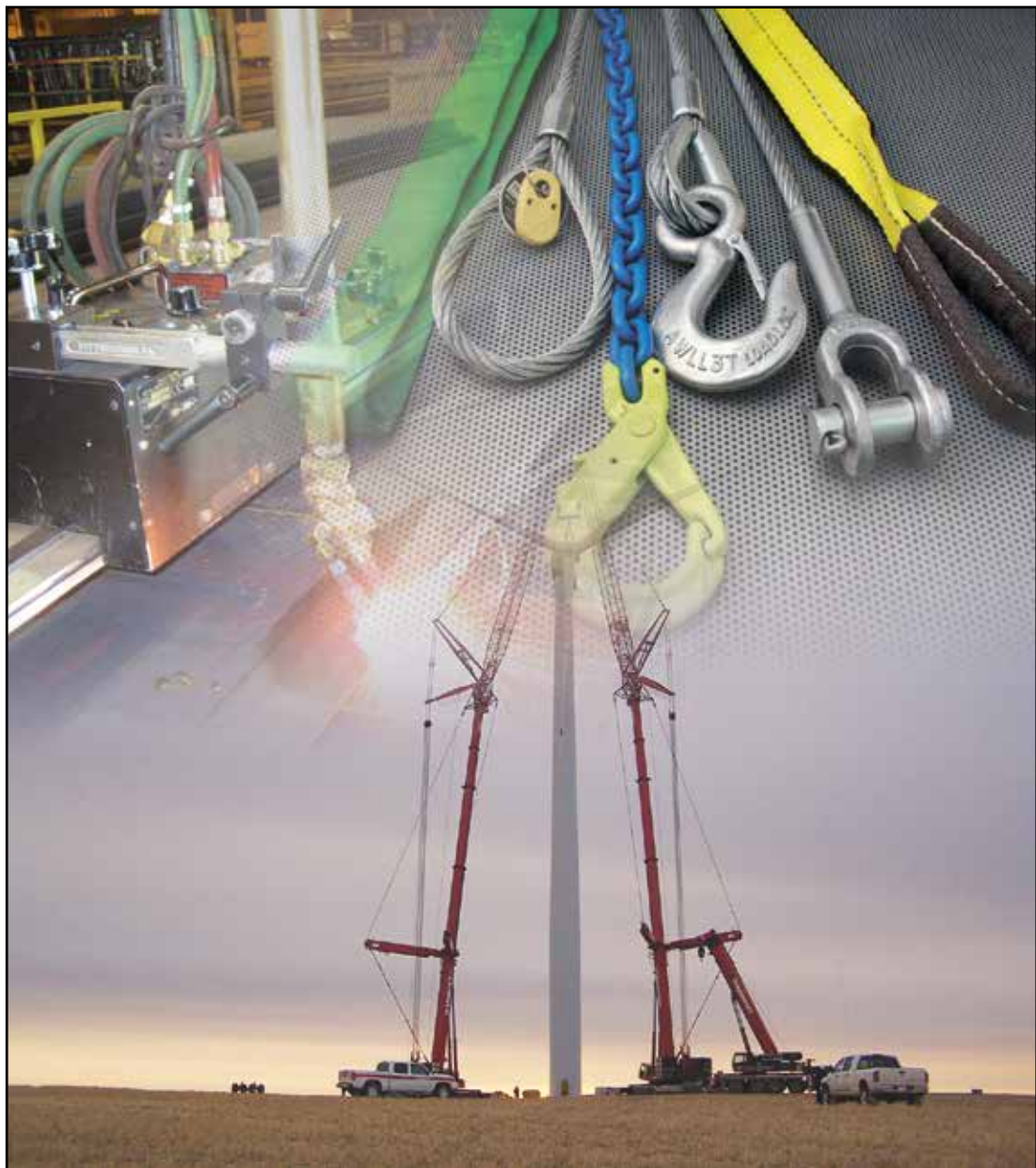
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# COMPANY PROFILE

## SAMUEL, SON & CO., LIMITED

By Sherri Mabry



A company with long history as metals processor and distributor serves diverse needs of wind energy industry.

**SAMUEL, SON & CO., LIMITED** is a 5th generation, family run metals processor, distributor, and metal manufacturing company. Samuel is also the largest privately held service center in North America. Based in Mississauga, Ontario, Canada, the company has a long history of selling and purchasing metal throughout North America and around the world.

Founded in 1855 as a trading company between England and Canada, Samuel is a fifth generation, 100 percent privately owned, family run company with anticipated sales of \$3.3 billion this year. Samuel has 108 locations in Canada, the United States, Mexico, Australia, China and the United Kingdom; the company is positioned in key areas where customer demand exists.

Their United States head office is located in Lancaster, New York, and the company boasts 4,800 employees who serve customers through its metal service centers and manufacturing divisions, providing products and processing to market leaders. The company also invested \$605 million in capital improvements and acquisitions during the past five years, while processing more than 3.8 million tons of metal.

"Last year we purchased more than 2.6 million tons of metal from companies like U.S. Steel, Arcelor Mittal, Aleris, and Thyssen Krupp," said Bill Hutton, Corporate Vice President of Marketing and National Accounts for Samuel. "We take that metal and sell to our customers or process it by adding value by slitting it, cutting it to length, or flame cutting into different shapes and sizes that could be used in various end use markets. Our customers then use our product to make their own product."

Hutton says forming a division catering to the wind industry with the Samuel Wind Energy brand was a natural progression for this diverse company.

"We looked at the wind industry and it looked to be a promising segment financially," he said. "Wind seemed to be one of the most interesting to Samuel because of our product offering and we thought the wind energy market could be sustained for the next 10 to 15 years. Wind energy caught on better than solar, and right now, our carbon flat roll steel, carbon plate, all forms of stainless steel and aluminum fit that market segment extremely well."

Samuel Wind Energy started in 2010 and is headed by Jennifer Bonner who extensively researched the market and made a case for Samuel's investment in this industry. "We have a lot of wind energy business that we do directly or indirectly for businesses."

Samuel Wind Energy specializes in value added processing for the Wind Energy market. They supply Carbon Plate, Carbon Flat Rolled, Aluminum, and Stainless Steel products for the wind industry.

"The big product for Samuel Wind Energy is the embedment rings," Hutton said. "When the tower is going into the ground to be secured, we manufacture that round piece of metal plate with holes in it and beveled to the customer's exact specifications. If everything doesn't line up, you can't raise the tower. We spent a lot of time researching this particular product."

Unalloy is a division within the Samuel Group, supplies wire, ropes, chains and other rigging products used during tower erection. This shows the Wind Energy market the diversification that Samuel can offer this market.


"Many people don't even know Samuel is in the Wind Tower business, because our name isn't stamped on the turbine, but we are there in many ways," he said.

Hutton says Samuel's vision is to add value for customers, and he believes it's a successful formula that has maintained growth and stability for 157 years, while other service centers were struggling through economic downturns.

"Anybody can supply a piece of metal or a piece of plate, but there is some technical knowledge to making products such as embedment rings, and not everybody can do that," he said.

As an example, Hutton says a company in the wind tower business traditionally will buy a thousand tons of metal from a producing mill. The mill produces and ships the order to the customer who then stores the shipment in their yard until the steel is needed in the manufacturing process.

"By using Samuel you don't have to marshal around the metal in the yard while it sits. The beauty of Samuel is that we can buy material competitively because of our buying power. We don't have to buy a thousand tons at a time because we buy millions of tons a year. We bring it in when we need it; get it cut, and ready for our customer. Our customers only pay for a truckload of steel at a time, which could be 20 tons to 40 tons, but not a thousand. Our customers are getting the product cut to size and it is ready to use when we deliver it to them, freeing up their processing equipment to concentrate on their own core competencies."

In this business model, Hutton says cash flow, logistics and efficiencies improve for the customer, providing the value-added service Samuel is committed to delivering day in and day out. 

# ROTOR BLADE LEADING EDGE EROSION – REAL LIFE EXPERIENCES

When leading edge erosion is not repaired or is repaired incorrectly, the health of the blade and the turbine is jeopardized.

By Lisa Rempel

Lisa Rempel is director of quality assurance with Complete Wind Corporation. For more information, call 519-524-6226 or visit [www.completewind.com](http://www.completewind.com).

**DURING THE EARLY YEARS** of the North American Wind Industry, the general misconception regarding blade maintenance was that once the blades were in the air, routine maintenance was not required. As the industry matured, some tough lessons were learned. Maintenance, especially on the leading edge of the blade, is not only recommended but essential if blades are to reach their design life expectancy.

In this article, CWC offers answers to the most frequently asked questions by owner/operators using real-life experience data. Those questions are:

- What measures can be taken to reduce the costs associated with rotor blade maintenance?
- At what point in the life of a rotor blade does the leading edge require attention?
- What detrimental effects will result if the blade leading edge isn't maintained?

As the name suggests, the leading edge of a blade is the foremost edge of the airfoil or the part of the blade that first contacts air. Any turbine located in terrain that has an abundance of dust, bugs, rain, sleet, snow or any other abrasive air particulate is more susceptible to erosion than a turbine located





in an area where these factors are not present. Since wind farms are typically constructed in rural areas where farmers turn the soil multiple times every year, and weather pattern changes are a common occurrence, the majority of all blades manufactured are subjected to abrasives daily.

To mitigate leading edge erosion, many manufacturers offer leading edge protection in the form of a tape or paintable coating; however, not all do. Companies purchasing blades should be sure to make it clear to the original equipment manufacturer that leading edge protection should not be an optional feature. The small increase

in cost to apply leading edge protection during manufacturing will be worthwhile throughout the life of the wind farm. The application of leading edge protection will aid in the prevention of erosion, provided the protection isn't damaged during shipping or construction. The smallest tear or scratch in leading edge protection will result in a weak link and a point where the erosion will initiate. There are also significant differences in each form of protection, so it's best to do your research before choosing the protection that best suits your needs. It's important to understand that even the best leading edge protection system isn't infallible; therefore blades should be inspected periodically to make sure they are still in good shape.

Unfortunately, leading edge erosion begins early in the life of a blade. If leading edge protection has not been applied during the manufacturing process, blades as young as three years old will begin to show signs of wear. The tip of the blade is more susceptible to wear due to the operating speed of the blade at the tip; however, erosion does present itself inboard of the tip at this stage as well. Even if leading edge protection has been applied, quality issues, perceived as minor in the factory, also play a role in the rate at which a leading edge degenerates. Small air pockets along the leading edge are routinely overlooked and covered up with coating. As the blade bends and flexes, these air pockets expand and contract causing the leading edge to erode from the interior of the coating.

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Simultaneously, external debris causes deterioration on the leading edge from the exterior. When erosion is identified in the early stage, repair is relatively inexpensive when compared to waiting until more severe coating damage appears. If repairs are not done early, damage to the underlying laminate will be present as early as year five. Regrettably, there remains a large gap in the knowledge and experience of those performing rotor blade repairs, and often the wrong choice of materials is used to repair laminate damage. Generally, cost is the driving factor when improper materials and an insufficient repair program are chosen. Although the cost of repair is much lower, a repair using incorrect materials will only mask the damage for a short period of time before a compounded problem returns.

When leading edge erosion is not repaired or is repaired incorrectly, the health of the blade and the turbine is jeopardized. Vibrations create undesirable loads that neither the turbine nor the blades were designed to carry. Chordwise and spanwise cracks in the blade coating occur. A blade shell is made of a

“sandwich structure”, either balsa or foam core with laminate layers on either side. Over time, the laminate under the coating cracks and water enters the core material of the blade. As freeze-thaw cycles occur, the blade core expands and contracts separating the laminate from the core. A waterlogged core is also cause for an unbalanced rotor which leads to more unwanted vibrations throughout the drivetrain. When a blade sustains this level of damage, repair options are limited. Either the blade must be brought to the ground to be repaired, which will cost a minimum of \$75,000 per set, excluding crane costs; or new blades can be purchased, which is an even more expensive option than that of repair.

The information provided, is based on 16 years of experience in rotor blade inspection and repair and portrays an accurate picture of what can be expected if blades are not maintained properly. Even though there are factors other than leading edge erosion that can cause a blade to fail, the chances that a blade will reach its desired life expectancy are greatly increased if the leading edges are maintained. 

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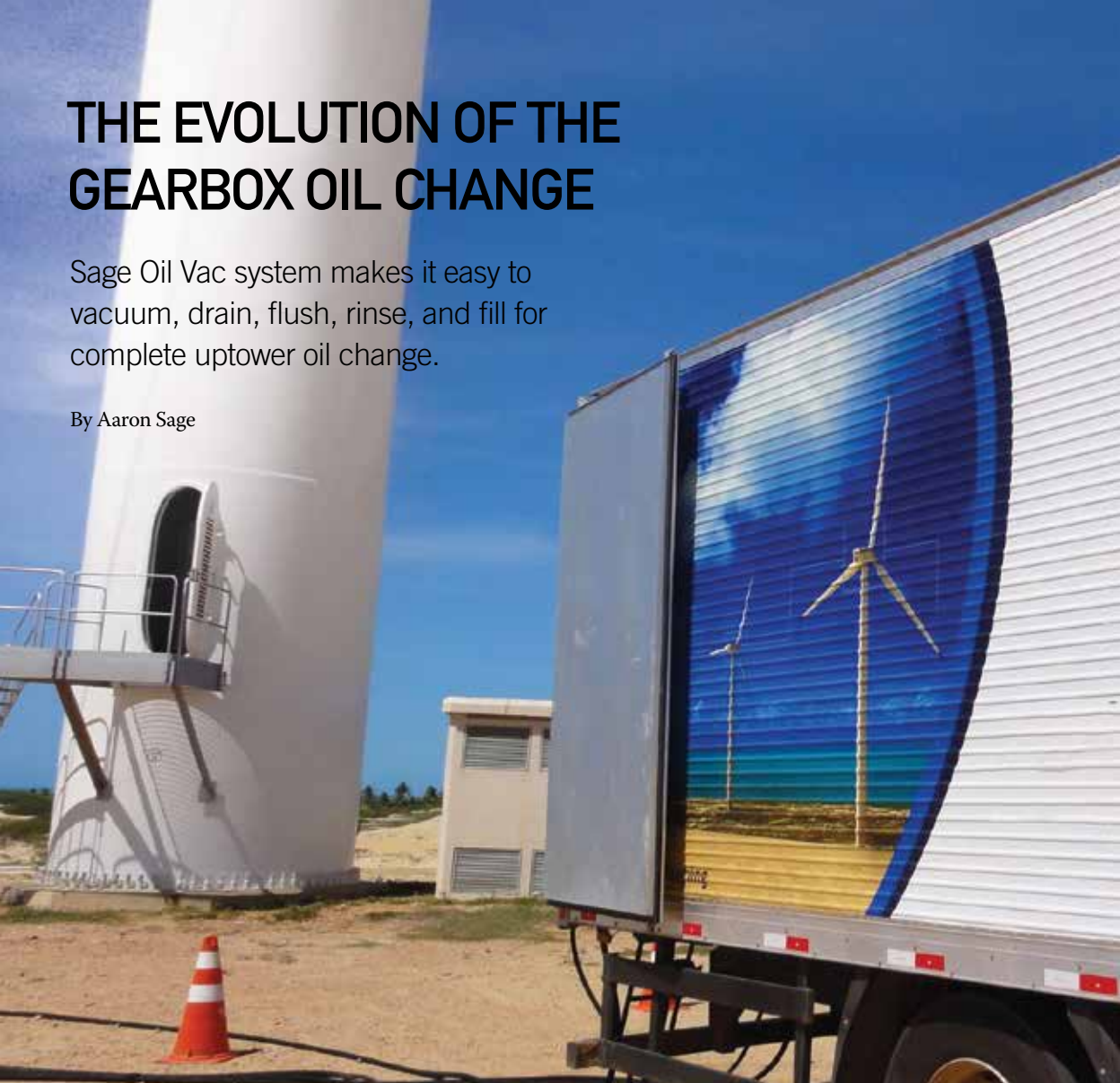
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# THE EVOLUTION OF THE GEARBOX OIL CHANGE

Sage Oil Vac system makes it easy to vacuum, drain, flush, rinse, and fill for complete uptower oil change.

By Aaron Sage



Aaron Sage is C.O.O. for Sage Oil Vac, Amarillo, Texas. For more information, call 806-372-7559; email [aaron@sageoilvac.com](mailto:aaron@sageoilvac.com) or visit [www.sageoilvac.com](http://www.sageoilvac.com).

## IT SEEMED THAT ONLY A FEW SHORT YEARS

ago much of the wind industry didn't have a plan for when or how they would change the factory fill oil that was in their newly commissioned wind turbines.

"I can remember pulling into an O&M barn at a wind site back in 2007 and asking, 'Is there oil up there?'" said Gary Sage, CEO of Sage Oil Vac.

Before that, Sage had been building mobile oil change equipment for a number of industries for more than 10 years prior to this impromptu wind farm stop and he was curious if there was a market for such a system for the wind industry. The site manager responded that there were 80 gallons of

synthetic gear oil in each turbine and his crew didn't know when they would be required to change the oil. Sage was more astonished when he realized that the site didn't have tools and processes for replacing the oil in the turbine.

"I guess we will have to do the bucket brigade when it comes time," the site manager said.

Sage and his team immediately started working with different wind companies to develop an effective tool to automate this important task and developed the Sage Oil Vac Gear Oil Exchange System.

Gearbox oil change decisions are sometimes based on service times such as every two or every three





for understanding oil types, oil properties, proper sampling and maintaining target cleanliness levels are all factors for determining the life of the oil. Oil is key to any gearbox or hydraulic system and if applied, the 3C's (Clean, Cool, and Contain) the results can be very positive."

### JUSTIFYING EQUIPMENT FOR THE OIL CHANGE

The investment in equipment to perform gearbox oil changes and flushes, like any business decision, must be weighed against economic benefit. The investment in a trailer or truck mounted gear oil exchange system has an easy, purely numbers analysis side to it, and four or five years ago, it was a simple formula for the analysis. The evaluation was using a gear oil exchange system versus manual bucket oil changes. An 80 gallon gear oil replace and fill can be done in under two hours with a gear oil exchange system, versus up to two men working 12 hours to do it by hand.

"Our first system was a simple two-tank, two-step system — vacuum the used oil down the tower, and pump new oil back up," says Phil Seidenberger, vice president of product development for Sage Oil Vac. "Customers wanted to know how many towers they could get done in a day. The more they could get done, the more easily they could justify the purchase."

Another big change in the industry came when gearbox life cycle started to become an issue for then industry and it became evident that gear oil cleanliness and oil change frequencies could be the difference in a gearbox failing or lasting.

### FLUSHING

The industry started to realize that a basic two-step oil change process didn't necessarily guarantee clean oil. Also, using buckets up and down tower left a lot of room for contamination of the fresh gear oil. As it became clear that more than a basic oil exchange was needed and the gearbox needed to be flushed, then using a gear oil exchange system is necessary. "It's not economically feasible to change oil and perform an effective flush on a gearbox using buckets manually," says Gary Sage.

Kevin Dinwiddie of Amsoil was instrumental in developing a two-phase flush procedure, drain and fill and the four-phase flush procedures (Drain, Flush, Rinse and Fill).

"In the past, wind turbine companies depended on normal oil analysis iron levels as a determination of a good oil change. It seemed that just draining and filling the gearbox was enough. We know that normal ICP oil analysis can only see particles about five microns in size and smaller, whereas Analytical Ferrography can detect all ferrous particles of all sizes and is a much better evaluation in this case.

A recent field test comparison study was performed on eight turbines and the result was that

years, while some rely on oil analysis samples taken from the gearbox. The industry has evaluated and debated oil change procedures and frequencies over the last few years, ranging from getting as many years out of their factory fill synthetic as possible, to some determining that they will change the oil at the one or two year commissioning anniversary regardless of oil samples. Over the last four to five years, much has changed in the processes and technology related to oil changes in gearboxes.

"Evaluation of lubricating oils in wind towers, is at an all-time high," says Randy Andersen of Dakota Fluid Power in Sioux Falls, SD. "The need

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just draining and filling will leave 50 percent of the particles in the gearbox. The study compared normal ICP iron analysis and Analytical Ferrography in two types of oil change procedures; drain and fill and the four-phase flush procedure. The four-phase procedure left just over .1 percent of wear particles compared to the 50 percent in the two-step drain and fill.

When the benefits of flushing the gearbox were realized, then essentially a single oil change became two or three oil changes at one tower. With the four-phase process, you are vacuuming and dispensing used oil, flush oil, rinse oil, and the final fill oil a number of times.

"Over the course of the year starting in 2007, customers went from the basic two tank system to asking about three and four tank systems with flushing capabilities. They weren't as concerned about how many they could get done; they wanted to know how to replace the oil as cleanly as possible in a multi-step process. Customers didn't care if they only got one turbine done a day, as long as they ended up with clean oil in the turbine. The industry shifted from quantity to quality, so to speak," Seidenberger said. "The payback analysis went from 'how many can we get done in one day?' to, 'what is it worth to see how clean can I keep my gearbox and oil during uptime and during oil changes?'"

### HIRE, RENT OR BUY

The industry has options to obtain proper gearbox flush and oil changes. Equipment can be rented or bought outright or they can choose to contract with a third party who has equipment.

"Our customers include integrated wind farm owner-operators who have their own personnel running and maintaining the wind farm, third-party service providers, startup businesses that





specifically offer oil change and flushing capability, manufacturers with personnel on-site during warranty periods, and O&M companies,” Seidenberger said.

The decision to rent or buy equipment versus contracting

the service has pros and cons on each side of the equation. If a wind farm with 60 towers wants to have their own unit, it might be difficult to justify the \$60,000 to \$70,000 investment just to be used on their own farm. But they

may be able to rent a unit only during the time period that it is needed, then use it for a month or two, and they are good until the next oil change is due. Some wind farms want to have ultimate control over the gearbox oil change and flush, from selecting the oil all the way down to using their own trained technicians to perform the work.

On the other hand, some wind farms want the expertise of a third party crew who are experts on the operation of the system and who have practice leaving the gearbox free of contaminants with very clean oil.

### CLEANLINESS OF OIL

Sage’s Gear Oil Exchange System has an onboard CC Jensen 54/27 Fine filter system that will filter fresh gear oil down to ISO 16/14/11 levels. It is necessary in some cases to filter the new oil that is put in the gearbox as final fill. New gear oil out of the tote or drum can be less clean than the

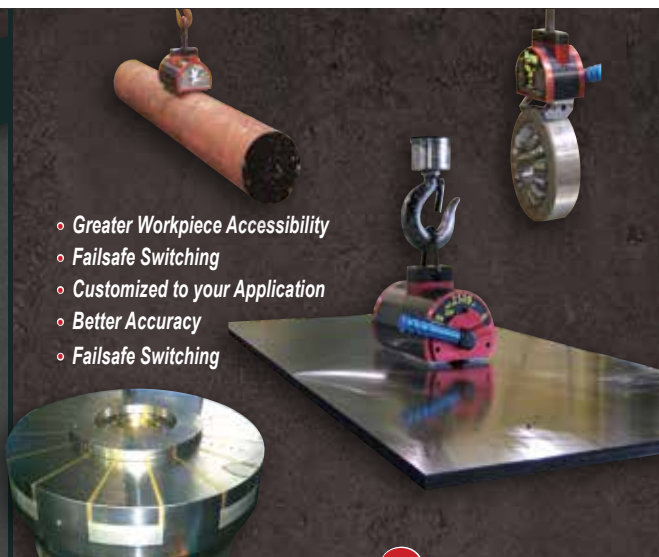
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wind farm wishes to put in as the final fill.

"New oil is not always clean oil and needs to be considered when changing oil. If possible, it is recommended to run the oil through a filter every time

you transfer and provide good housekeeping with storage and containment," says Randy Anderson, sales manager of Dakota Fluid Power of Sioux Falls, South Dakota. "The ease and handling of oil is key to promoting cleanliness

and eliminating accidents. Sage Oil Vac is a leader that has provided the equipment to handle your change out and filtration requirements of oil with ease. Sage has provided an air system for simple filling with the storage of new oil and ease of removing the waste oil, while also including a flush and a rinse for increasing the end result of a complete oil change in the field."

"Building reliability starts with effective contamination control," said Justin Stover, sales manager for C.C. Jensen Filtration. "The importance of clean oil in gearboxes has been well documented over the last four decades. Contamination in a wind turbine gearbox must be controlled throughout its life cycle. Contaminants are defined as anything foreign to the lubricant that alter its performance. Over 90 percent of the damage done to a gearbox is a direct result of particle and moisture contamination. Dirt and water are inevitably introduced during service and



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maintenance. These “wrecking balls” create wear particles that act as catalysts — in effect microscopic spark plugs — that cause more wear, tear and lubricant failure. While it is important that particles large enough to be seen or felt are not exposed to lubricants, more frequently it is the invisible particles that cause the most damage. That is why it is essential that a filter with a fine micron rating and water removal capabilities be selected and installed. Lubricants are what we buy - lubrication and contamination control are what we do to ensure optimum lifetime and reliability. We cannot wish greater reliability into existence. It must be the right lubricant, in the right place, in the right amount, at the right time, keeping it clean, and keeping it dry. Their design allows for ISO 320 Gear Oil to be vacuumed from a drum or a tote at a rate of 15 to 20 gallons per minute. This is done without a fluid pump or venting of tanks. The operator builds vacuum on the fresh oil tank and connects the barrel tote or straw and quickly vacuums fluid. This is a time saving step that most people don’t factor in. The customer does not have to have a pump to transfer from the tote or drum to the Gear Oil Exchange unit.”

Once oil has been brought onto the Sage Oil Vac system, the customer can filter the new oil using a kidney loop fine filtration system, while simultaneously passing oil through a shell and tube heat exchanger adding heat to the oil for easier pumping capability.

The use of a 1000 PSI modified diaphragm pump with the Sage Gear Oil Exchange System leaves no gear pump wear metals in the filtered clean fresh oil. The unit

also has a flushing wand that allows the uptower technician to insert the wand inside the inspection plate and wash down individual gears and ledges inside the box.

Certainly, much has changed in just a short period of time when it comes to gearbox maintenance, from the “bucket brigade” mentality to the gear oil exchange trailer two-step process of flushing and filtration. Whatever comes next, there is no doubt that much more thought and care has gone into extending the life of the gearbox. ✨



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# IMPROVING PERFORMANCE AND RELIABILITY WITH CONDITION MONITORING

Improvements to power plant reliability and performance can be made with sufficient cost justification for return on investment.

By Dr. Ashley Crowther, Dr. Tugen Eritenel and Dr. Xiaoqin Ma

## HSS Bearing Replacement

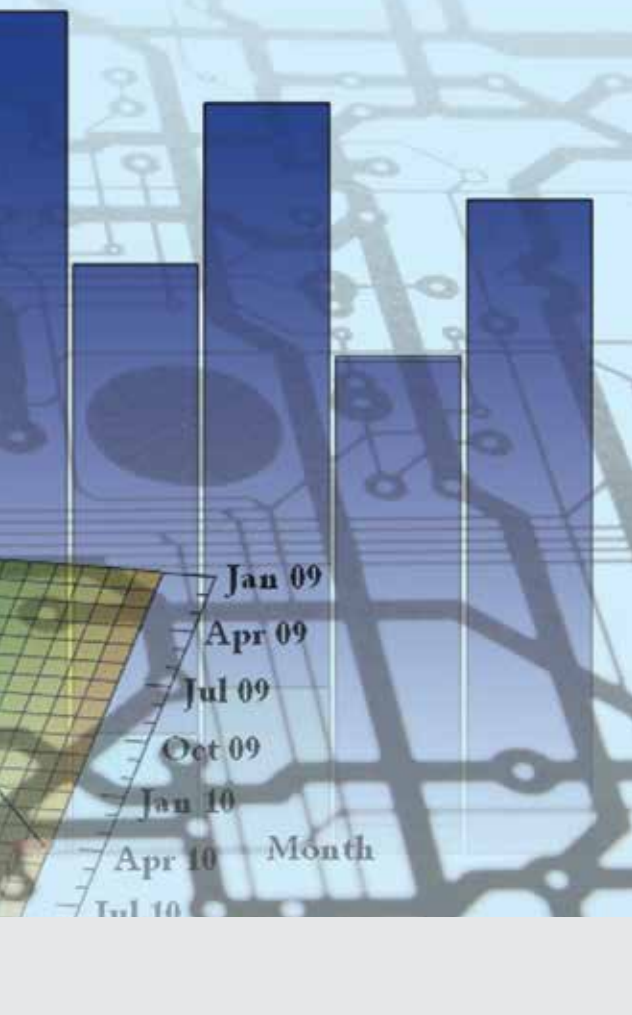


Dr. Ashley Crowther V.P. engineering – Wind, Romax Technology, Inc.; Dr. Tugen Eritenel, Turbine Condition Monitoring Specialist, Romax Technology, Inc. Dr. Xiaoqin Ma, Head of Technology Development, Romax Technology Ltd.

**POWER PLANT OPERATION** is a bottom line driven business. Once an asset is built and providing power, every dollar spent on operation and maintenance affects that bottom line. Improvements to the plant reliability and performance can be made, but only with sufficient cost justification to demonstrate return on investment. For condition monitoring (CMS), one factor is the known reliability of the particular wind farm, for example, take three onshore wind farms with MW class turbines with three point mounted drivetrain turbines with double spherical roller main bearings (DSRB). This type of turbine

arrangement is known to have its issues, with failure of the downwind raceways and rollers. In this article we use a case study using site data to examine the bottom line. First from Weibull curves (a well known reliability analysis method) from several United States wind farms we have the data in Table 1. Note that main bearing failures are dependent on site conditions, bearing type, maintenance practices, etc. – this data is for problematic sites.

From these three farms we can construct a typical US wind farm with this issue for studying costs. The farm has 80 turbines, the size of turbine



is approximately. 2MW and over ten years the average number of main bearing failures per year is 2.91 (based on the average data from table 1), PPA is \$55/MWhr, capacity factor is 0.35 and availability sits at 97% (excluding downtime from any main bearing failure). Each wind turbine brings \$900 per day in revenue.

A question for the asset manager is: will condition monitoring improve the bottom line for main bearing issues on this wind farm? We paint a few scenarios in Table 2 (pg. 36). First compare Scenario A and B, both with no condition monitoring, in each case the bearing fails and little warning was

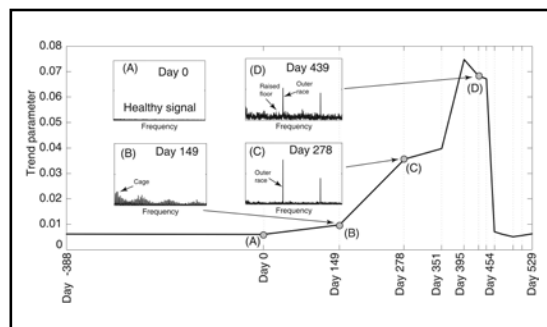


Fig 1: Romax customized frequency analysis technique showing main bearing damage (DSRB) for turbine A.



Fig 2: Rollers as inspected during factory teardown. Downwind roller takes majority of load under normal operating.

received. Only when the bearing availability is scarce (Scenario B), with three months lead time for repair, is the downtime a significant part of the cost. The cost is largely driven by crane mobilization and repair or replacement costs (costs quoted are typical but vary from site to site and are based on a refurbished bearing). Compare to Scenario C, the CMS system gives early warning of the failure, yet there are still separate crane mobilizations. Savings thanks to CMS are in the order of \$40K where bearings are readily available and up to \$300K when a lot of downtime is prevented (Scenario C versus A and B). More savings made when maintenance is scheduled more effectively due to the CMS (Scenario D). Given the early warning on the bearings (and it takes months for the DSRB failure mode to progress) repairs for the two failures are now scheduled for the same week, the crane is only mobilized once and savings are now in the order of \$150-400K, depending on downtime saved (Scenario D versus A and B). Here the CMS system has added value with payback for retrofit installation and monitoring over three to four years, without considering potential benefits to the gearbox and generator. For different turbines and sites costs vary and where a known reliability issue exists, ROI calculations for CMS systems can be completed to evaluate benefits.

With the slow rotation it is often said that a damaged main bearing is difficult to detect with

Wind Farm	Weibull Shape Factor	Weibull Scale Factor	% Failures in 5 years	% Failures in 10 years
A	1.60	21.26	9.40	25.9
B	1.15	32.98	10.8	22.4
C	1.97	10.32	21.3	60.9
Average			13.8	36.34

Table 1: Failure data for DSRB's for several wind farms.

vibration; this is true where a standard envelope spectra or vibration RMS may not discern the damage from other vibration sources. However with the right techniques the condition monitoring is very effective for the main bearing and the progression of damage can be monitored over three to six months while the bearing deteriorates, finally when the temperature rises the bearing condition is very poor and replacement within a few weeks is recommended. Figure 1 provides an example where a low frequency accelerometer recorded time series data which was then processed in the Romax InSight iDS software for early detection of main bearing failure. This typical example illustrates how no special hardware is needed for main bearings, just good signal processing. By point D in the diagram the condition of the bearings is very poor, typical to a set (Figure 2) inspected in a factory teardown.

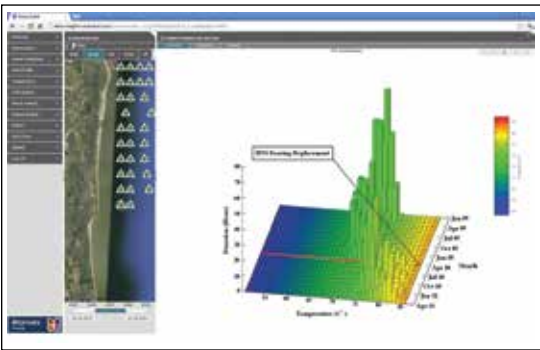


Fig 3: SCADA bearing temperature histogram shown from Romax InSight SCADA software.

SCADA MONITORING

Aside from condition monitoring (via accelerometers, oil particle counters and so on) the turbine SCADA system is a valuable source of data for monitoring the turbine. From the 100's of channels of data

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## USING SCADA AND CMS DATA TO IMPROVE END OF WARRANTY

Many end of warranty inspection RFP's are written with a SCADA and vibration analysis component to the scope of work. A sensible choice if the data is available, but generally the work is timed to coincide with the uptower inspections. Then the effort to identify faults in the turbine is less worthwhile. An improved RFP would separate the workscopes, the SCADA and vibration analysis should take place one to two months before the inspections and help lead the inspecting technicians to find evidence of particular faults. Take a bearing axial crack an intermediate shaft for example, this can be a difficult bearing to inspect, with only a small portion of the bearing visible and many borescope inspections won't find these cracks. A vibration report indicating where damage is expected will aid the technician in planning better the two to four hours they have allocated for each machine looking for damage in the gearbox. From the SCADA system Romax takes a data dump of pitch and yaw positions, component temperatures, pressures and currents, wind speeds, power, alarms and various other parameters and using the InSight SCADA software perform an exhaustive search of each and every problem that is identifiable from SCADA. Where there is a CMS system installed a data dump to Insight IDS allows for thorough assessment of the condition of the main bearing, gearbox and generator. Using portable CMS is another option and this can be cost effective if the measurements are made during regular maintenance in the lead up to the EOW inspection.

coming in (typically at a 10s sample rate) there are sets of parameters useful for checking the health of machine and also the performance. In many cases they are related, e.g. a high yaw misalignment will reduce performance, but also effect the health of the turbine longer term, as the rotor bending moments are increased and accelerate structural fatigue for all major components in the load path: pitch bearing, rotor hub, main bearing, main shaft,

main frame, yaw bearing and depending on the drivetrain architecture also the gearbox. Analyzing SCADA data together with the maintenance records is also an effective way for the wind farm operator to monitor and control the maintenance quality. Figure 3 shows a bearing temperature histogram from a European offshore wind farm analyzed in the Romax InSight SCADA software. After replacement of the high speed shaft bearing,

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Scenario	Description	CMS?	Failures per year	Downtime per failure (days)	Number of crane mobilizations	Lost Production for 2.91 failures (\$)	Crane for 2.91 failures (\$)	Refurbishment + labor + shipping + other for 2.91 failures (\$)	Total cost for 2.91 failures (\$)
A	Crane required for each failure. No early detection aside from late stage temperature warning. Bearing availability assumed as very good	No	2.91	20	2.91	52,380	363,750	305,550	721,680
B	Crane required for each failure. No early detection aside from late stage temperature warning. Bearing availability assumed as poor	No	2.91	90	2.91	235,710	363,750	305,550	905,010
C	Failures are detected by CMS allowing scheduled repair, downtime only 4 days for each failure	Yes	2.91	4	2.91	10,476	363,750	305,550	679,776
D	Failures are detected by CMS allowing scheduled repair for all bearings at the same time, bearings closely monitored and run to near failure, some downtime (average 40 days per bearing) as turbine(s) may need to be shutdown to repair all at once	Yes	2.91	40	1	104,760	125,000	305,550	535,310

**Table 2: Several scenarios for main bearing failure in 80 turbine MW class wind farm.**

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Earlier this year two leading specialists in wind turbine condition monitoring and health management joined forces, providing wind asset owners and operators with exemplary solutions combining world class hardware, software and monitoring services. A strategic alliance was forged between Gram & Juhl (<http://gramjuhl.com>), providers of the world leading TCM® turbine condition monitoring system and Romax Technology the industry leader in gearbox and drivetrain monitoring and design. The alliance offers customers Romax's highly innovative InSight iDS (Intelligent Diagnostic System) as a configurable interface for TCM,® with expert monitoring services worldwide. InSight iDS comprises powerful front-end software, providing an intuitive and user-friendly dashboard. The alliance provides customers with ‘the best of all worlds’ bringing together best in class hardware, software and monitoring services. The combined offering significantly enhances customers' understanding of the current and future condition of their wind assets, enabling them to implement a highly effective predictive maintenance regime, resulting in significant improvements in yield, availability and profitability.

Axel Juhl, CEO of Gram & Juhl, said “We are excited by the prospect of developing this complementary relationship with Romax, as it enables Gram & Juhl to strengthen our position as the leading provider of condition monitoring systems and to provide an exceptionally high level of local support and monitoring service to TCM® users, globally.”

Stuart Cameron, Head of Global Sales & Marketing for Romax commented, “We believe that combining the tried and tested hardware capabilities of TCM® with Romax’s innovative software technology and design knowledge of gearboxes offers a uniquely positioned offering to the market.”

Gram & Juhl is one of the most experienced providers of turbine condition monitoring solutions and have installed over 5500 TCM® systems worldwide since 1997.

Romax Technology is a global engineering consultancy offering technical solutions for O&M, advanced design services and software tools. Their field service portfolio includes end-of-warranty assessment, failure analysis, drivetrain health monitoring and strategic review; as well as concept design, analysis and modelling, detail design, design review and certification.

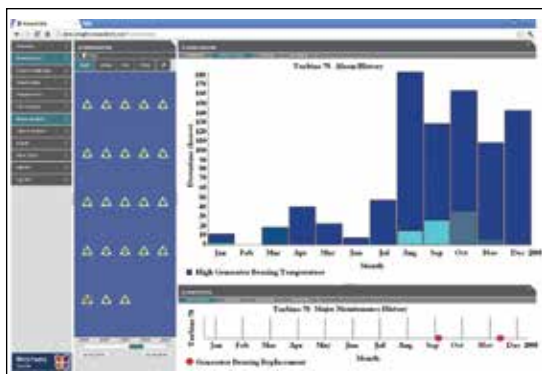


Fig 4: SCADA alarm history vs. maintenance history shown from Romax InSight SCADA software.

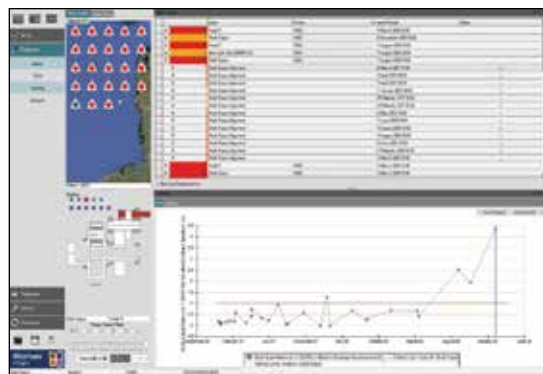


Fig 5: Intuitive and easy to use Romax InSight iDS drivetrain monitoring software.

the temperature histogram for the following months shifted to a higher temperature range with maximums up to 85°C. Unfortunately, this temperature shift was not identified at that time. As a result, the bearing had been running under this unhealthy condition and failed the gearbox within 12 months. Due to access and availability issues offshore, the gearbox wasn't replaced until seven months later and the cost of downtime and repair was in excess of \$1M.

Figure 4 provides the SCADA alarm history for another offshore wind farm. Here Turbine 78 has a large number of generator bearing temperature alarms and shutdowns. The total downtime for this machine from this one fault accumulated to 780 hours (an 8.9% availability reduction) over 12 months. This many production hours is around \$75k at the site but as the alarms were more regular during high wind speeds, the real production loss was nearly \$150k. In order to reduce the downtime, a reactive generator bearing replacement was carried out in September. However, the high temperature alarms continued. Another generator bearing replacement program was carried out two months later. The alarm problem still wasn't solved after the second bearing exchange program, and

with the issue prevalent on other machines at the site, an investigation was carried out by Romax to solve the problem. The replaced bearings were examined and a root cause analysis was conducted. This RCA determined the alarm wasn't triggered by faulty bearings, but due to other factors. The misdiagnosis not only caused production loss, but also incurred unnecessary maintenance cost, with totals nearing \$500k. Romax InSight SCADA brings together maintenance records, inspection reports and analysis reports with SCADA data to provide a powerful tool for assessing the site. This allows for a clear visualization (Insight) so the site manager or control center operators can easily see such correlations and make more informed decisions in operations and maintenance. ✈



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# INNOVATING WIND TURBINE PERFORMANCE WITH BPM SOFTWARE FOR CASE MANAGEMENT

Dynamic Case Management (DCM) gives EDPR North America an overall competitive advantage in process management.

By Stephan Blasilli



Stephan Blasilli is corporate development manager of EDPR North America LLC. For more information, visit [www.edprenovaveis.com](http://www.edprenovaveis.com).

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North America (EDPR NA), is the third largest renewable energy company in the United States. We design, develop, construct and operate 28 wind farms throughout North America, and have developed more than 3,400 megawatts (MW) of wind energy. Our parent company, which operates facilities in Europe and South America, is the third largest wind energy company in the world.

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## TURBINE PERFORMANCE – THE KEY TO WIND ENERGY COMPETITIVENESS

According to the American Wind Energy Association's First Quarter 2012 Market Report, the United States





wind industry has added more than 35 percent of all new generating capacity over the past five years, second only to natural gas, and more than nuclear and coal combined. Today, U.S. wind power capacity represents more than 20 percent of the world's installed wind power. The report also states that the U.S. wind industry represents not only a large market for wind power capacity installations, but also a growing market for American manufacturing. More than 470 manufacturing facilities across the U.S. make components for wind turbines, and dedicated wind facilities that manufacture major components such as towers, blades and assembled nacelles can be found in every region.

So wind energy has become a serious contributor to our national energy market, and the economy itself. This growth has been fueled in part by rapid improvements in wind turbine technology. However, despite these technological advances, competitive market pressures continue to demand that wind energy suppliers pursue innovation throughout their organizations to operate as efficiently and reliably as possible.

Like most wind energy companies, EDPR NA's assets are in very remote locations dispersed across the United States. Modern technology enables companies to accurately forecast wind speeds and generation potential, but the industry as a whole must still grapple with prioritizing performance issues based on severity and wind patterns, communicating knowledge across a geographically dispersed organization, and the challenge of working around the availability of resources to schedule maintenance – a more dynamic process than what traditional energy generation sources face.

At EDPR NA, this relentless focus on performance improvement has led us to think of turbine issue management in terms of a Dynamic Case Management approach that links governance to operations to ensure that farms perform optimally while the wind is blowing.

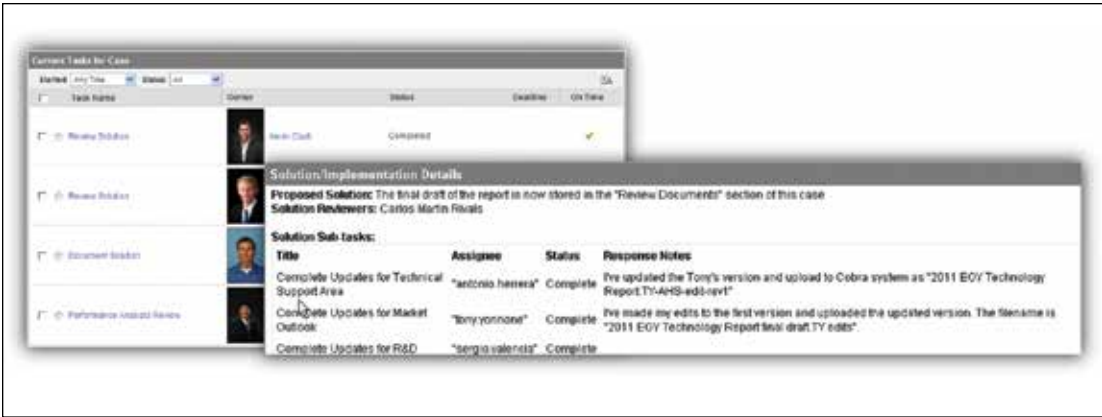
Dynamic Case Management (DCM) is a term coined by global IT analysis firm Forrester Research. Forrester describes DCM as “a new way of thinking about how complex work gets done. For enterprises, DCM provides a transformational opportunity to take the drudgery out of work and enable high-value, ad hoc, knowledge work.” [1]

Forrester also said, “Functional and industry-specific packaged applications have worked well for well-defined, highly structured processes where volume, scale, and straight-through processing dominate system design. But these apps are difficult to change, appear increasingly less relevant, and form a barrier to innovation for companies in fast-moving industries like energy, healthcare, and financial services...These [industries] will leverage advanced dynamic case management (DCM) and business process management (BPM) suites.” [2]

## OUR APPROACH TO DYNAMIC CASE MANAGEMENT

EDPR NA decided that embracing Dynamic Case Management would give us a competitive advantage in overall process management against our energy industry competitors. To prove the concept, the company initially focused specifically on the area of operations issue management. In using technology as an engagement vehicle to boost asset performance and maximize potential earnings, EDPR NA targeted three specific areas:

- Prioritization – Which problems are the most critical to address and solve first?
- Geographic Dispersion & Department Specialization – EDPR NA's distributed assets require that our



**Fig. 1:** Task-oriented transactions provide accountability at every level: clear allocation of resources, seamless handoffs between projects, and ad-hoc subtask functionality.

technical service department assist multiple wind farms from a centralized location.

- Knowledge Retention and Learning – given the pace of technological advancement, EDPR NA needed to document maintenance techniques, technical solutions, and best practices.

### BUSINESS PROCESS MANAGEMENT PLATFORM

To transform the industry-standard approach to case and process management, we designed a solution called

COBRA (short for “COlaBoRAtion”). COBRA is a system for Dynamic Case Management built of a Business Process Management (BPM) software platform from Appian. The platform provides the typical core BPM capabilities, such as a comprehensive process engine, integrated business rules, event management and real-time analytics. Importantly, Appian also combines these with native mobility and social business collaboration. Taken in sum, these capabilities allow us to conduct fast and intelligent resolution of dynamic case scenarios.



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Case Number	Case Title	Case Type	Current Stage	RPN Score	Risk Level
CM20110348	Underperformance	Turbine Control Software	Solution Documentation	1,000	Red
CM20110503	generator rotor shaft wear	Turbine Components	Solution Documentation	844	Red
CM20110532	Main Bearing Failures	Turbine Components	Solution Documentation	750	Red
CM20110234	High Speed Bearing Failures	Turbine Components	Implementation	682	Red
CM20110161	Blue Canyon V End of Warranty	Contract/Commercial	Implementation	648	Yellow
CM20110368	BOP Spares - Identify and Purchase BOP Spare Parts	BOP Electrical	Closed	623	Yellow
CM20110193	- Intermediate Stage Bearing Failures	Turbine Components	Solution Documentation	621	Yellow
CM20110115		Faults	Solution D.		
CM20110189	Reactive Power Displays	BOP Electrical	Solution R.		
CM20110238	Mechanical Pump	Turbine Components	Solution D.		
CM20110561	NERC CIP - OEM Access	SCADA	Solution D.		
CM20110295	Quality Main Component QA/QC Process	Document Review	Solution D.		
CM20120323	EPORA Tier 8 2011 Report	Environmental Compliance	Solution D.		
CM20110171	Post Warranty GB Inspection Program	Turbine Components	Closed		

**Risk Priority Number (RPN) Scoring**

**RPN Score: 682** (Max. Score: 1000)

Event Duration: Multi-day, Event (Main Component Change-out)

Event Frequency: One Event per Month

Dollar Impact: \$10,000 - \$50,000 (Medium-sized part, e.g. motor, IGBT)

COBRA Calculations:

Potential MW Impacted: 1593 MW

Average SRECs: 100

Average SRECs: \$1800

Fig. 2: COBRA uses a complex algorithm to assign each case a Risk Priority Number, an objective analysis of which issues are the most urgent.

PRIORITIZATION

In COBRA, issues encountered in remote sites are logged and assigned a priority for solution creation. COBRA uses real-time data about a problem’s size, combined with location-specific pricing information in order to determine the issue’s ability to affect the company’s bottom line. Through a complex algorithm, issues are assigned a score from 1-1000, which provides an absolute basis for objective comparison. We use this data to make transparent

decisions about where to assign resources and focus improvement efforts.

GEOGRAPHIC DISPERSION & DEPARTMENT SPECIALIZATION

Wind turbines are highly complex machines, and problems that affect the fleet can have wide-ranging consequences. COBRA gives us a platform for structured collaboration around each issue, allowing departments to weigh in on the ramifications

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(technical, engineering, wind resource assessment, environmental, safety, procurement, legal, regulatory, and others) of problems, as well as their potential solutions. COBRA also assigns internal resources to each case that serve as a dedicated collaboration contact to assist on-site managers in reaching solutions. COBRA makes collaboration between disparate locations easy by also serving as a platform to discuss updates and new developments.

**KNOWLEDGE RETENTION AND LEARNING**

Not only does COBRA assign dedicated resources to serve as a point of contact for each case, but the system also centralizes the information generated, creating a constantly expanding knowledge base of solutions for future problems. This ensures that EDPR NA staff can rapidly respond to similar problems encountered in the future, and prevents the company from having to constantly reinvent the wheel for solution creation.

**RESULTS**

With COBRA we were able to capture over one hundred million dollars worth of issue solutions in the first nine months of use. It gives us a modern mobile and social platform for Dynamic Case Management that drives business performance by turning tacit knowledge into explicit knowledge.

The system has created a searchable knowledge base of detailed solutions for potential future issues, including the original case’s context, to aid decision-making. COBRA also allows us to track the frequency of issues related to specific equipment suppliers. COBRA is also rapidly eliminating our reliance on ad-hoc email-based issue tracking, collaboration and document sharing. The files in the COBRA system were accessed more than 3,000 times in those first nine months. Each of those points of access is part of a structured and auditable record of a particular solution instance.

Based on this success, we are now looking at other core areas of our operations that would benefit from this combination of Dynamic Case Management and Business Process Management software. There are many candidates, including our processes for Energy Assessment (site design/suitability analysis for meteorological tower installations), Procurement (RFP issuance and supplier qualification) and Origination (Utility Bid Response including Investment Analysis, Estimation, and Energy Assessment). ✌

**REFERENCES:**

- 1) Forrester Research, “Dynamic Case Management: Definitely Not Your Dad’s Old-School Workflow/Imaging System,” Sept. 2011
- 2) Forrester Research, “Stuck In Cement: When Packaged Apps Create Barriers To Innovation,” Jan. 2012



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# PRODUCT SHOWCASE

## Werner's New Line of Fall Protection Equipment Provides Safe Access

---



The new Werner Fall Protection product portfolio reaffirms Werner's commitment to safety and position as a professional products manufacturer. Werner is extending their promise to end-users by providing safe access at any height with the introduction of this new category.

Werner has complemented their extensive line of climbing equipment with a wide range of Fall Protection products. The complete line includes a variety of anchors, connecting devices, harnesses, vertical lifelines, compliance kits and accessories.

Unique features of the Werner equipment include WebAlert Inspectable webbing with contrasting colored fibers embedded in the harness and lanyard structure to provide an instant visual indicator of wear, impact or damage. INSPECT™, a safety label/tag system, is also featured on all harnesses to ensure safety monitoring, maintenance and data recording.

The harness family includes the LITEFIT™ safety harness, the Blue Armor 1000 inspectable harness designed to meet the needs of pros, and the Blue Armor 2000 manufactured for serious professionals with the most demanding jobs. The harness line also offers a complete range of safety levels with the right harness, the right fit and the right value based on the user's working conditions. Harnesses come in standard, climbing, positioning, retrieval and construction styles with alternate attachment hardware for specific applications.

Lanyards are available in DeCoil™ energy absorbing, DeCoil™ Stretch with energy absorbing elastic, and SoftCoil™ internal energy absorbing models with various configurations and lanyard hook options. AutoCoil™ self-retracting and vertical lifelines, along with a variety of anchor connectors, accessories, and compliance kits round out the new Fall Protection line by Werner.

For more information, visit [www.wernerfallprotection.com](http://www.wernerfallprotection.com).

# New E-RAD System Introduced

Torkworx, a leader in bolting solutions, introduces an electronic digital torque control solution for the wind energy industry. The E-RAD system provides a safer, more repeatable and user-friendly tooling solution that increases accuracy and includes torque data recording capabilities, where not previously available in older hydraulic methods.

The E-RAD system uses electricity directly from the WTG along with digital torque control firmware to insure high accuracy and repeatability. This eliminates the possibility of hydraulic failure that may result in injury or environmental contamination in the WTG.

With user-friendly controls that are completely programmable by the operator. In addition, the E-RAD electronic torque system operates at 75 db reducing the noise level considerably from older hydraulic torque systems. With exceptionally low vibration levels and a lightweight pistol grip style design, the E-RAD is ergonomic.

The E-RAD's capability of real time torque data collection enhances the traceability of critical bolts that require regular maintenance torque checks. It also includes torque and angle bolt torque operation as a standard in a single actuation eliminating possible user error and incorrect torque being applied.

The unsurpassed power-to-weight ratio and the convenience of a lightweight ultra-durable portable carrying case eliminate the need to move heavy hydraulic pumps and reduce operator fatigue.

The E-RAD is available in several models with torque ranging from 200 to 6000 foot-pounds and accurate to +/- 3%. The E-RAD electronic series pistol-grip torque wrenches are lighter, faster, quieter, and more reliable than older hydraulic means of bolting, which insures that each bolt is tightened to exacting standards.

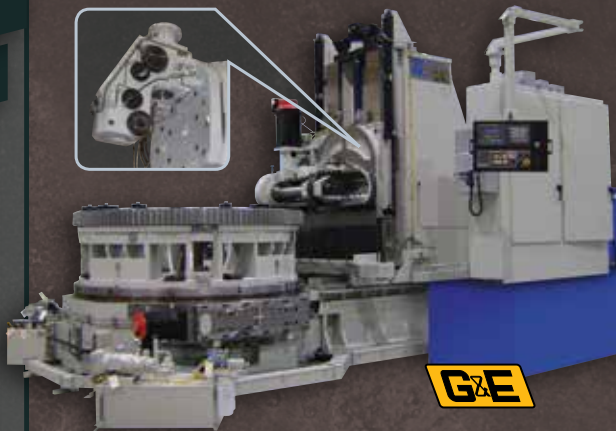
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## Condition Analysis for Bearing Grease in Turbines Improves Reliability

Klüber Lubrication's analysis service is now available for lubricants in generators, blades and main bearings of wind turbines. It examines several aspects of a grease's current condition, including overall status, oxidation, wear particles and behavior of additives, mixing with foreign matter and oxidation and the extent to which old and new lubricant are mixed after changeovers. A sampling kit with a detailed description is available from Klüber Lubrication. The company also will provide a report on the results of the analysis, along with future recommendations.

In addition, Klüber introduces a new line of lubricants. The new versatile adhesive lubricant, Klübersynth AG 14-61 is designed for girth gear/pinion drives and plain bearings, or yaw bearings, in wind turbines. The wide service temperature range of the synthetic lubricant, which is also spreadable at low temperatures, ensures trouble-free operation. Klübersynth AG 14-61 can be applied by central lubrication systems down to -30 °C. The product ensures excellent wear protection and contributes to longer girth gear/pinion drive lifetime due to its combination of selected solid lubricants and additives. Furthermore, the new lubricant is very versatile.

The synthetic gear oils of the Klübersynth GEM 4 N series offer high scuffing load capacity, micro-pitting resistance and wear protection, meeting the specific requirements of the wind industry. They are also resistant to ageing and oxidation and have good viscosity-temperature behavior. Additionally, the synthetic gear oils of the Klübersynth GEM 4 N series also have excellent anti-foam properties, as they contain raw materials with low tendency to foam combined with highly effective anti-foam additives.

For more information, visit [www.klueber.com](http://www.klueber.com). 



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I have yet to come across serious discussions on the employment of quality filtration for all the applications on a windmill. There appears to be little interest in these two critical areas.

### WHY DO YOU SAY THAT?

Our observations identified that the windmill OEM's and the service industries have a closed shop when it comes to aftermarket filtration technology. This is a similar culture to what we have experienced over the past 10 years in many other industries where many OEM's and the related service industry rely on parts and service to support their business model.

Over the past five years we have noticed a significant increase in the importance of equipment reliability in the mining and oil & gas industries by the OEM's and the end users. Reliability is the focus of informed maintenance managers, and quality filtration is the foundation of ensuring high cleanliness levels to extend equipment component life thereby increasing profitability.

### TELL ME A LITTLE ABOUT YOURSELF.

In 1995 I invented a magnetic filter for the automotive industry as an aftermarket compliment to the traditional disposable paper filter. We conducted testing and product development for five years. We went to market with it in 2000 and found the domestic market to be a costly challenge to educate the customer of the value. In 2002 we redirected our marketing and sales into the industrial market. Acceptance of our technology was positive and in answer to application demand our product range of magnetic filters expanded to over 200 different formats. We supply our filters to the Oil & Gas, Mining, Manufacturing, Marine and Power Generation industries. Our main focus is for filtration of rotating equipment: hydraulics, gear lube, fuels and coolants.

### HOW DID YOU BECOME INVOLVED IN THE WIND INDUSTRY?

We have been trying to enter the wind industry for about eight years and have found it's not a very friendly place to bring new technology to market. When I read product information to improve technology the focus is directed at component design and quality. Very little information is directed at the type and quality of lubrication oil, hydraulic and coolant fluid and management.

### WHAT IS THE ONE EYE MAGNETIC FILTRATION SYSTEM?

OEI environmental industrial and magnetic filtration systems have been developed over the last 10 years and are designed to work with and complement existing traditional filtration and in many cases replace them. Incorporating the new rare earth magnetic technology in our patented designs allows filtration of ferrous and non-ferrous contamination down to sub-micron levels without flow restriction.

### HOW DO YOU FILTER NON-FERROUS CONTAMINATION WITH A MAGNETIC FILTER?

There are two very simple ways. (1) Entrainment: This occurs when ferrous contamination (under 10 microns) makes contact with the non ferrous contamination and becomes entrained in the larger non ferrous contamination while in flow. (2) Static Adhesion: When flowing as gas or liquid through pipes a static charge is created and attaches itself to every particle in the flow. A static charge has a magnetic field. When the non-ferrous contamination is entrained with ferrous contamination and or has a static charge and exposed to our powerful magnetic fields they are trapped on our magnetic filters. This occurs in engine oil, gear oil, coolant, hydraulic and diesel fuel systems.

### WHERE DOES THE FERROUS CONTAMINATION UNDER 10-MICRONS IN SIZE COME FROM?

There are many sources. (1) Equipment component manufacturing and assembling leaves this fine contaminant in the pores of the metal. (2) New hydraulic fluid, coolant, lube oil and fuels all have ferrous metal contamination under 10 microns to sub-micron in size resulting from corrosion and erosion of carbon steel storage reservoirs and pipelines that transport them to the end user. (3) Component wear (4) Inadequate air breathers on reservoirs and engines. Keep in mind your eye can only see particles over 40 microns in size. ✎

For More Questions and Answers with Roger Simonson, visit [windsystemsmag.com](http://windsystemsmag.com).



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