

FEATURES

Company Profile:

NRG Systems

Avoiding Ground-Fault Arcing

Uptower Tool Management

Increasing Generator Lifespan

International Turbine Adaptation

Managing Wind Station Warranties

SCALING THE HEIGHTS SAFELY

DEPARTMENTS

Technology—Penn State Wind Energy

Maintenance—Rev1 Renewables

Construction—Hayward Baker

Logistics—Professional Logistics Group

Q&A: Andy Kruse

Southwest Windpower



CAUTION!
 Max. 2 persons.
 Max. Load: 240 kg.

ACHTUNG!
 Max. 2 persons.
 Max. Belastung: 240 kg.

GEARS MADE ON GLEASON MACHINES SUPPLY OVER 50% OF THE WORLD'S WIND ENERGY

PROVIDING ALL THE TECHNOLOGIES YOU NEED TO PRODUCE HIGH QUALITY LARGE GEARS FASTER, AT THE LOWEST COST



SOFT PROCESS SOLUTIONS

- ✓ Hobbing
- ✓ Shaping
- ✓ Chamfering & Deburring
- ✓ Up to 6 meters
- ✓ Tooling solutions for every process



HARD FINISHING SOLUTIONS

- ✓ New TITAN[®] Machines deliver up to 50% productivity gain with POWER GRIND
- ✓ Profile Grinding
- ✓ OPTI-GRIND increases productivity up to 40%
- ✓ Up to 6 meters
- ✓ Tooling solutions for every process



METROLOGY SOLUTIONS

- ✓ Analytical Gear Inspection Systems
- ✓ Up to 3 meters



WORKHOLDING & AUTOMATION SOLUTIONS

- ✓ Innovative workholding concepts for reduced set up times
- ✓ Set up tables and/or automated systems for reduced idle times



SERVICE SOLUTIONS

- ✓ Service
- ✓ Parts
- ✓ Training
- ✓ Preventive Maintenance
- ✓ Application Development



Download our Total Solutions Brochure, Big Gears at www.gleason.com/biggears

Gleason

www.gleason.com • sales@gleason.com



The Power of Human Imagination...



FREE
2010/2011
CATALOG

Build your future with industrial products from ReidSupply.com

Our world is constantly changing. Innovators need suppliers that adapt and react to designers and manufacturers. For more than 60 years, Reid Supply Company has helped engineers and technicians to build their machines. From NASA to the smallest Mom and Pop shops, Reid is always there, answering questions, suggesting parts, offering **FREE CAD**, being helpful. So, what are you imagining and how can Reid help? Give us a call or hop aboard ReidSupply.com

- Knobs, Handles and Hand Wheels
- Material Handling
- Structural Systems
- Clamps and Workholding
- Bearings and Power Transmission
- Safety
- Tooling Components
- Metalworking
- NEW ONLINE CATEGORIES
- Fasteners and Hardware
- Maintenance, Repair and Operations
- Apparel and Footwear
- Leveling Devices and Vibration Control
- Pneumatics and Hydraulics
- Packaging and Shipping Supplies

Reid Supply Company®

Nobody will serve the Customer better!

800.253.0421
ReidSupply.com

Stahlwille Tools is the ONLY tool company with dimensionally accurate hand tools!

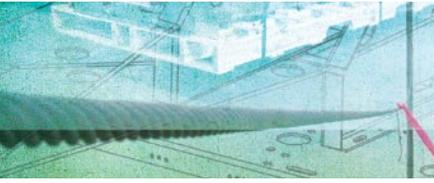


TORQUE WRENCHES

- *Super accurate scale designed for industrial applications*
- *Can be used as a breaker bar with no damage*
- *Designed to ISO 12 month calibration cycle*
- *Does not need to be "zero'd" after use*
- *Interchangeable insert heads*



**STAHLWILLE TOOLS NA. SARASOTA FL. 877-548-1617
WWW.STAHLWILLETOOLS.COM**



24 COMPANY PROFILE NRG SYSTEMS, INC.

BY RUSS WILLCUTT

You can't just talk the talk in the wind energy business, you've got to walk it as well. This company sets an example for others to follow.



26 SCALING THE HEIGHTS SAFELY

BY KENT PEDERSEN

Avanti Wind Systems is dedicated to designing and manufacturing the safest work cages and fall-protection equipment available, but testing and training are critical to their successful use.



32 UPTOWER TOOL MANAGEMENT

BY DALE ALBERTS

The last place where you need to lose a tool is when you're working atop a wind tower. Snap-on Industrial provides solutions that keep your tooling together.



36 INCREASING GENERATOR LIFESPAN

BY OLAF KLEESCH

Not only can upgrades drastically increase the service life of wind turbine generators, they can also prevent serious damage and high repair costs. Avallon provides pointers.



42 INTERNATIONAL TURBINE ADAPTATION

BY TROY HEWITT

The North American wind industry can benefit from the more-mature European market, harnessing existing—and proven—designs to forge ahead.



50 AVOIDING GROUND-FAULT ARCING

BY CURT COLLINS

Grounding transformers are essential for large wind farms, where the substation transformer often provides the sole ground source. Pacific Crest Transformers explains.



54 MANAGING WIND STATION WARRANTIES

BY GLENN MCCOMBS

When a warranty expires, responsibility for future repairs transfers to the owner, who should be proactive in conducting in-depth inspections, as NAES makes clear.

Introducing our new
SW PLUS +[®] Series
12% - 22% MORE STORAGE



**STOR-LOC MODULAR
DRAWER SYSTEM**

880 N. Washington Ave. Kankakee, IL 60901
Toll Free: 1.800.786.7562 · Fax: 1.800.315.8769
email: sales@storloc.com



www.storloc.com

8

NEWS

Developments in technologies, manufacturing processes, equipment design, wind-farm projects, and legislation of interest to all wind-industry professionals.

20

CONSTRUCTION

JAMES HUSSIN—HAYWARD BAKER, INC.

A proven technique for stopping or reducing settlement, cement grouting is an effective, cost-efficient alternative to complete reconstruction of the foundation system.

21

MAINTENANCE

MERRITT BROWN—REV1 POWER SERVICES, INC.

Proper lubrication and contaminant control are critical in order to attain long gearbox service life, both during and after the warranty period.

22

TECHNOLOGY

SVEN SCHMITZ—PENN STATE

Turbine icing is an increasing challenge to the economics of wind energy in cold climates. This installment explains how it happens, what it causes, and how it can be addressed.

23

LOGISTICS

ANNE PUHALOVICH—PROFESSIONAL LOGISTICS GROUP

Why should a developer assess strategic logistics considerations before final OEM selection? Because you need to know what you're paying for!

64

Q&A ANDY KRUSE,
CO-FOUNDER & EXECUTIVE VICE PRESIDENT
Southwest Windpower

RESOURCES

MARKETPLACE 61

ADVERTISERINDEX 63



Wind Systems magazine, published by Media Solutions, Inc., is printed entirely on Forest Stewardship Council certified Domtar Lynx paper. FSC certification ensures that this paper contains fiber from well-managed and responsibly harvested forests. The FSC logo also signals our commitment to improving the environment. *Wind Systems* paper is also Rainforest Alliance certified. Publications mail agreement no. 40624074 Return undeliverable Canadian addresses to: PO Box 503 | RPO West Beaver Creek | Richmond Hill, ON L4B 4R6

EDLETTER

While working with Barton Merle-Smith on this issue's profile of NRG Systems, I had the opportunity to learn about the company's trend-setting green headquarters and manufacturing facility in Vermont. Powered completely by renewable energy, and using the most advanced green materials and building practices available, it was one of only five gold LEED certified industrial operations in the world when the first phase was completed in 2004. This put me in mind of other wind companies here in the States that are making a huge difference in their communities. A recent article on the excellent business environment for wind companies in Portland, Oregon, mentioned Vestas' plans to move its North American sales and service headquarters into the historic Meier & Frank Depot Building in the city's Pearl District—this in addition to its manufacturing activities in Colorado. Also look to Nordex USA, which revitalized Jonesboro, Arkansas, by siting its new manufacturing plant there. These are but a very few examples of how wind companies—both U.S.-based and those relocating here from overseas—are being good neighbors and positive players in their communities.

Speaking of our European friends who are active in the North American wind market, Troy Hewitt of Intertek discusses how designs created elsewhere can be certified for use in Canada and the United States in "International Turbine Adaptation." Glenn McCombs of NAEs provides an end of warranty checklist in "Managing Wind Station Warranties," and Kent Pedersen of Avanti Wind Systems emphasizes the importance of training employees and testing safety devices in "Scaling the Heights Safely." Dale Alberts of Snap-on Industrial describes the company's mobile tool cribs in "Uptower Tool Management," and Curt Collins of Pacific Crest Transformers provides helpful tips in "Avoiding Ground-Fault Arcing." Finally, you'll learn about "Increasing Generator Lifespan" by reading the article by Olaf Kleesch, who is with Availon United Wind Service.

As for our columnists, Sven Schmitz of the Penn State Wind Energy program discusses turbine icing in his technology column, and James Hussin of Hayward Baker provides insights into cement grouting in his construction column. Maintenance expert Merritt Brown of Rev1 Renewables points to the importance of proper lubrication and contaminant control in this month's installment, and Anne Puhlovich of the Professional Logistics Group encourages developers to assess strategic logistics considerations before final OEM selection in her logistics column.

In closing I'd like to congratulate Andy Kruse, co-founder and executive vice president of Southwest Windpower, for his recent appointment to the U.S. Department of Commerce's Renewable Energy and Energy Efficiency Advisory Committee, which you'll read about in this month's Q&A feature. As always, we are grateful to all of these individuals for sharing their expertise with us. I'd like to encourage you to do the same!



Russ Willcutt, editor
Wind Systems magazine
russ@windssystemsmag.com
(800) 366-2185



David C. Cooper
Publisher

Chad Morrison
Associate Publisher

EDITORIAL
Russ Willcutt
Editor

SALES
Brad Whisenant
National Sales Manager

Glenn Raglin
Regional Sales Manager

Tom McNulty
Regional Sales Manager

CIRCULATION
Teresa Cooper
Manager

Kassie Hughey
Coordinator

Jamie Willcutt
Assistant

ART
Jeremy Allen
Art Director

Michele Hall
Graphic Designer

CONTRIBUTING WRITERS

Dale Alberts
Merritt Brown
Curt Collins
Troy Hewitt
James Hussin
Olaf Kleesch
Glenn McCombs
Kent Pedersen
Anne Puhlovich
Sven Schmitz, Ph.D.



PUBLISHED BY MEDIA SOLUTIONS, INC.
P. O. BOX 1987 • PELHAM, AL 35124
(800) 366-2185 • (205) 380-1580 FAX

David C. Cooper
President

Chad Morrison
Vice President

Teresa Cooper
Operations

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage-and-retrieval system without permission in writing from the publisher. The views expressed by those not on the staff of *Wind Systems* magazine, or who are not specifically employed by Media Solutions, Inc., are purely their own. All "News" material has either been submitted by the subject company or pulled directly from their corporate web site, which is assumed to be cleared for release. Comments and submissions are welcome, and can be submitted to russ@windssystemsmag.com.



Experience
the Power
of Dow Inside



WHEN IT'S YOUR JOB TO CAPTURE THE POWER OF THE WIND.

Specifying cables that won't fail when the wind is blowing. That's your job.

All cable compounds are not created equal. When you choose cables made with the power of **DOW INSIDE**, you will get reliable cable performance you can count on for the lifetime of your development. The **DOW ENDURANCE™** family of products from Dow Wire & Cable for MV, HV and EHV underground or submarine cables delivers that peace of mind for a lower cost over the total lifetime of your system. For reliable power transmission and distribution from turbine to grid, there's only one choice. The power of **DOW INSIDE**.

That's the confidence you need when it's your job to keep the power on.



www.dowinside.com



LARGE GEAR HOBBS FROM GLEASON

Gleason Corporation has made major new investment in equipment and processes to optimize the manufacture of large module gear hobs. These cutting tools are used in the manufacturing of large gears for wind energy, mining, and a variety of industrial gearbox applications. The Gleason Cutting Tools facility in Loves Park, Illinois, is now capable of producing hobs up to 450mm in diameter, 530mm in length, and up to 40 module. Through optimization of the new equipment and processes, as well as lean philosophies and techniques already embraced by the facility, large module hob manufacturing lead times now range from seven to nine weeks. The cell is capable of producing DIN and AGMA AAA class hobs. The large module hobs complement Gleason's full line of gear hobbing machines for parts with diameters up to 6 meters, and even larger on request.

The multimillion-dollar investment includes customized equipment with onboard inspection, fast changeover, and

the highest accuracy and repeatability. Robert Phillips, senior vice president of the company's Tooling Products Group, says "This investment allows us to extend our global leadership in gear cutting tools and serve the fast growing markets such as wind energy with the shortest lead times in our industry."

Gleason Corporation's mission is to be The Total Gear Solutions Provider™ to its global customer base. The company is a world leader in the development, manufacture, and sale of gear production machinery and related equipment. Its products are used by customers in automotive, truck, aircraft, agriculture, mining, wind power, construction, power tool, and marine industries, and by a diverse set of customers serving various industrial equipment markets. Gleason has manufacturing operations in Rochester, New York; Rockford, Illinois; Dayton, Ohio; Plymouth, England; Munich and Ludwigsburg, Germany; Studen, Switzerland; Bangalore, India; and Suzhou, China. It has sales and service offices throughout North and South America, Europe, and in the Asia-Pacific region. More information can be obtained by visiting www.gleason.com.

Companies wishing to submit materials for inclusion in this section should contact Russ Willcutt at russ@windsystemsmag.com. Releases accompanied by color images will be given first consideration.

MORTENSON CANADA EXPANDS ITS PRESENCE IN ONTARIO

Delivering renewable energy projects throughout Canada, Mortenson Canada Corporation recently completed construction of the Gosfield Wind Farm near Kingsville, Ontario, adding 50 megawatts to the region's wind generating capacity. An additional 166 megawatts are under construction at Comber Wind Project, the sister project to Gosfield. Located in agricultural land north of Lake Erie, the wind power facilities are developed and owned by Canadian-based developer Brookfield Renewable Power, Inc. Gosfield consists of 22-2.3 megawatt Siemens turbines with 101 meter rotors, currently the largest rotor available in the North American market. Mortenson was responsible for the engineering and construction of the access roads, foundations, collection system, substation, and erection of the turbines.

At the Comber project Mortenson will erect 72 Siemens 2.3-megawatt turbines for a total projected output of 166 megawatts of clean, renewable power that will provide electricity to more than 55,000 households annually. The Mortenson team is responsible for access roads, foundations, underground collection, overhead collection, substation, and erection. The groundbreaking for Comber was in October, and the project is expected to be completed in the fall of 2011.

As an industry expert, Mortenson coordinates the logistics of the construction efforts through hands-on and positive relationship development with town and county officials. "In an effort to ensure traffic safety we use temporary traffic signs, for example, adding stop signs to make a four-way stop, regulating the traffic leaving the project site," says Mark Donahue, vice president and general manager. "Additional speed signs are also installed along some of the road ways reducing speed from 80 to 60 Km/Hour."

The Gosfield project provided approximately 25 million dollars in economic support within a 75 kilometer region of the site. Resources such as labor, supplies, equipment rental, hotels, and food were all supplied through the local community. Comber is expected to bring an even greater economic impact to the area, as it is nearly three times the size of Gosfield. Many of the methods the Mortenson team used to make Gosfield a success will be used during the construction process at Comber since both projects have similar characteristics.

One of Canada's largest construction firms dedicated to renewable energy, Mortenson Canada Corporation provides efficient, quality solutions to meet the demanding needs of

its customers throughout Canada. Founded in 2004, Mortenson Canada Corporation—a sister company of M. A. Mortenson—leverages the collective experience and expertise of Mortenson's Renewable Energy Groups, which has built nearly 100 wind power projects throughout North America since 1995. The company offers a complete range of services, including program management, preconstruction, engineering, EPC contracting, general contracting, and construction management. For more information visit www.mortenson.com/wind.

UNITED TECHNOLOGIES ACQUIRES CLIPPER WINDPOWER

United Technologies Corp. announces that it has completed its purchase of Clipper Windpower Plc by acquiring all remaining shares, as previously announced. Clipper Windpower is a California-based company engaged in wind energy technology, turbine manufacturing, and wind project development. Its acquisition by UTC creates the long-term financial stability necessary for Clipper's continued growth, while enabling Clipper to fully leverage UTC's management capabilities, operational expertise, and world-class technology in blades, turbines, and gearbox design. The acquisition also builds on UTC's existing portfolio of energy efficient products and power generation systems that respond to the world's growing demand for cleaner, more-efficient products.

Based in Hartford, Connecticut, UTC is a diversified company that provides high technology products and services to the building systems and aerospace industries. For more information contact John Moran at (860) 728-7062. Go online to www.utc.com.

CAPITAL SAFETY CREATES GLOBAL WIND ENERGY TEAM

Capital Safety announces the creation of a global wind energy team to meet the growing demand in the renewable energies sector. The team consists of highly trained safety experts from the United States, Canada, Europe, Asia, and Australia who know the issues wind turbine manufacturers are facing in specific regions of the world.

"Over the past five years, we have been working with wind turbine manufacturers in the wind energy sector on a project by project basis, advising them on safety requirements," say Oliver Hirschfelder, global wind energy director for Capital Safety. "Our focus in establishing the global wind energy team is to ensure key manufacturers, wind farms, and construction and service firms have this type of specialized advice for fall protection

solutions and services for employees who work at height.”

Capital Safety offers a wide range of globally certified fall protection equipment, and plans to offer more products specifically for the wind energy sector in 2011, including the global launch of the ExoFit NEX Wind harness, which was recently released in the U.S. and Europe. As the wind energy sector continues to grow, Capital Safety is well placed to meet the increasing demand for safety products and training in the industry.

“There is real growth potential in the wind energy sector right now,” Hirschfelder says. “We are working hard to keep up with demand in China and India at present, as these countries become increasingly energy hungry. The drive toward more renewable energy sources is also expanding demand for our wind energy fall protection expertise significantly in Germany, Denmark, the United Kingdom, and Spain. The Canadian market is growing in megawatts and turbine capacity size and the United States expects long term growth in the wind energy industry.”

The team is experienced in working with both onshore and offshore wind farms, and the company offers a wide range of fall protection products available for use on both offshore

and onshore wind turbines. Capital Safety—one of the world’s leading manufacturers of fall protection, confined space, and rescue equipment, with 12 operating sites worldwide and a passionate commitment to quality, innovation, and safety—is home of the DBI-SALA and PROTECTA brands. All of Capital Safety’s fall protection and rescue systems are backed by extensive training, knowledgeable technical assistance, and professional customer service. To learn more call (800) 328-6146 or visit www.capitalsafety.com.

FEELER BRIDGE MILLS FOR LARGE COMPONENTS FROM METHODS

Methods Machine Tools, Inc., a leading supplier of innovative precision machine tools, has introduced high-performance FEELER FV-Series double column bridge mills featuring extensive design and engineering by Methods. FEELER bridge mills are designed to deliver unsurpassed performance and value and are backed by Methods’ application expertise, support, and extensive network of technology centers. “The main structural components of FEELER bridge mills are manufactured from heavily ribbed cast iron to ensure excellent surface finishes on large, complex parts,” says Paul Hurtig, FEELER product manager at



Methods. “Examples of components include massive gearbox housings, nacelles on wind turbines and pumps, or valve housings for the oil and gas industry.”

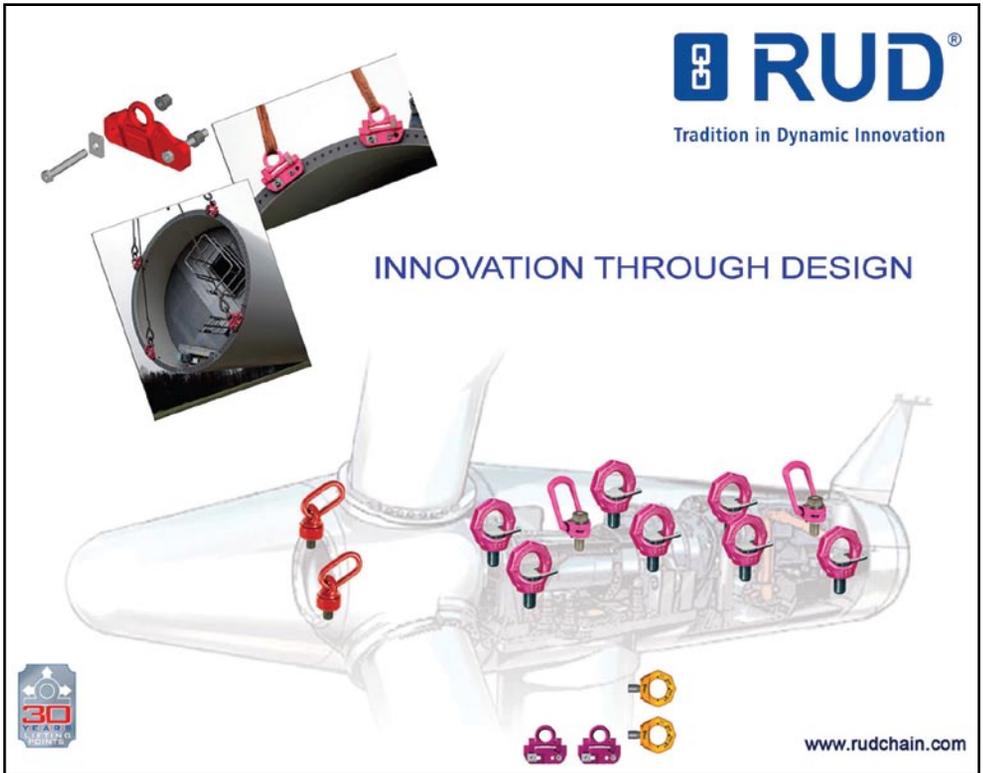
FEELER bridge mills feature a stepped Y-Axis beam and weigh up to 82 tons, contributing significantly to rigidity. For maximum power and torque at low rpms they use a German ZF gearbox with a 1:4 gear ratio. Facilitating the production of large, high-quality components these bridge mills feature THK linear guideways on the X-axis, and Schneeberger roller linear guideways on the Y-Axis. X-axis travels range from 85” (2,160mm) to 284” (7,200mm), and Y-axis travels range from 55” (1,400mm) to 158” (4,000mm). The Z-axis uses boxway construction and travel is 35.4” (900mm) with 47.2” (1,200mm) of travel available as an option. The FV-Series includes 19 models available with either 40-taper 15,000 rpm, 30 HP spindles or 50-Taper 6,000 rpm, 35 HP spindles. Distance between columns ranges from 63” (1,600mm) to 138” (3,500mm). The standard automatic tool changer holds 32 tools. 60, 90 and 120 tool configurations are available as options. The FANUC18i-MB (B) with HPCC control is standard on the 40-taper FEELER bridge mills, and the 50-taper models

use the FANUC 18i-MB (A) control.

FEELER machines are manufactured by Fair Friend Group (FFG). Established in 1979, FFG is one of the world’s largest machine tool builders and has major manufacturing operations in Taiwan, China, Japan, and the United States. FEELER is known for rigorous quality control and has invested significantly in highly advanced manufacturing equipment and research and development. Methods Machine Tools has been a leading supplier of precision machine tools, automation and accessories for over 50 years, providing extensive applications engineering support, installation, parts, service, and training through a network of large state-of-the-art technology centers and dealers throughout North America. For more information call (978) 443-5388, e-mail sales@methodsmachine.com, or visit online at www.methodsmachine.com.

GAMESA TO SUPPLY CALIFORNIA WIND FARM

Western Wind Energy Corp has purchased 120 megawatts of Gamesa G8X Series wind turbines. Gamesa—a world-leading player in the design, manufacture and maintenance of wind turbines—has been awarded a contract to supply a total of 120 MW of capacity



RUD[®]
Tradition in Dynamic Innovation

INNOVATION THROUGH DESIGN

www.rudchain.com

30 YEARS OF INNOVATION

The advertisement features a central image of a wind turbine nacelle with several RUD chains (red and pink) attached to its internal structure. Surrounding this are various RUD chain components, including red and pink links, yellow and orange links, and a red link with a yellow link. A logo in the bottom left corner commemorates 30 years of innovation.

to the Windstar wind project, which is being developed by Western Wind Energy Corporation at the Tehachapi Pass in southern California. It will be the largest wind farm developed to date in the United States by Vancouver, Canada-based Western Wind Energy and also Gamesa's first contract with this developer, which has wind power projects in California, Arizona and Ontario. The agreement also includes Gamesa providing operation and maintenance services for the next 10 years.

Gamesa is to supply Western Wind Energy with a total of 60 wind turbine generators from its G8X-2.0 MW platform with deliveries starting in April 2011. The two models from the G8X-2.0 MW platform supplied under this contract will be manufactured at their factory in Fairless Hills, Pennsylvania. All the turbines, which are specifically designed for high temperature, will be installed on 67-meter towers. Gamesa will also supervise construction of the wind farm, to commence immediately. Western Wind Energy has a 20-year agreement to supply electricity to Southern California Edison.

"This agreement is a first with an important new customer, Western Wind Energy, and will strengthen our footprint and leading position in the U.S. market," says Dirk Matthys, CEO of Gamesa for North America. Jeffrey J. Ciachurski, CEO of Western Wind Energy, notes that "following a rigorous process of due diligence among the main manufacturers, we chose the Gamesa G8X-2.0 MW platform because of its robustness and excellent performance, considering also that there are over 9,200 MW installed worldwide."

Gamesa has been operating in the U.S. since 2005. It has two manufacturing plants in Pennsylvania employing over 800 people and with production capacity of over 1,000 MW/year. The U.S. market, which Gamesa has designated as strategic, accounts for 22 percent of the company's total worldwide wind turbine generator sales. To learn more visit www.gamesacorp.com.

AVANTI BEGINS U.S. LADDER PRODUCTION

The leading world market producer of work cages/service lifts, ladder systems, and other personal safety systems for wind turbine



towers, Avanti Wind Systems (see article in this issue), is starting up production of ladder systems for wind turbine towers in the United States. Avanti Wind Systems has completed a factory for manufacturing of aluminium ladders at the company's North American headquarters in New Berlin, which is close to Milwaukee, Wisconsin. The factory is intended to supply the North American wind market. Until now the company has manufactured its ladder systems in China and Germany. These factories will continue manufacturing for the rest of the world.

"The factory in Wisconsin will enable us to move employment to the U.S., while also allowing us to give faster and better service to our customers throughout North America," says Kent Pedersen, general manager for Avanti Wind Systems in the U.S. The location also gives Avanti and its customers considerable advantages. Finished ladder systems take up a lot of space given the amount of raw aluminium involved. Moreover, the shorter transport times will reduce the amount of damage during transport, which typically occurs during the transport and handling of aluminium ladders, with the consequent major savings in transport costs. The new Wisconsin factory will manufacture ladder sections of up to six meters in length. The sections are subsequently assembled when they are installed in the towers.

"Avanti ladders are tested against North American requirements, which include ANSI 14.3," Pederson says. "Physical tests are performed by Radco, an independent test institute. These show safety factor three for regular duty ladders and safety factor five for heavy duty ladders. This puts them among the best built ladders in the U.S." For more information call (262) 641-9101 or visit www.avanti-online.com.

BROADWIND RECEIVES GRANT FOR DRIVETRAIN SERVICE CENTER

Broadwind Energy, Inc., announces that the Development Corporation of Abilene awarded its Broadwind Services subsidiary Energy Maintenance Service, LLC, a financial assistance package of approximately \$902,000, which will be applied to facility improvements and support equipment at the company's drivetrain service center in Abilene, Texas. A portion of the assistance package will help enable the creation of jobs at the drivetrain service center. Broadwind is currently receiving gearboxes for remanufacturing and plans to hold the grand opening for its drivetrain service center in February 2011.

"Abilene is at the center of wind energy in Texas," according to Peter C. Duprey, president and CEO of Broadwind. "This new drivetrain service center will harness Broadwind's 85 years of gearing experience with our services expertise to offer turnkey gearbox remanufacturing. We appreciate the Development Corporation of Abilene's financial support of this important renewable energy project. With approximately 160 employees in Texas, Broadwind is excited to continue to create jobs that contribute to clean energy across America."

When online, Broadwind's drivetrain service center will provide a comprehensive suite of multi-megawatt gearbox remanufacturing services, including failure analysis, engineering, disassembly, gear regrinding, clean assembly, and testing functions. Richard Burdine, CEO of the Development Corporation of Abilene, says that "on behalf of the DCOA Board, we are very pleased to help Broadwind Energy expand its wind service capabilities in West Texas with this state-of-the-art facility."

Broadwind Energy, Inc., based in Naperville, Illinois, provides technologically advanced high-value products and services to the U.S. wind energy industry. Broadwind's product and service portfolio provides customers, including wind turbine manufacturers, wind farm developers and wind farm operators, with



TRACHTE

Preassembled Collector
and Interconnect
Substation Control Buildings

www.TrachteUSA.com/ws.html
800-837-5707 sales@TrachteUSA.com



access to a broad array of wind component and service offerings. These product and service offerings include wind turbine gearing systems, wind turbine structural towers, industrial products, technical services, precision repair and engineering services, and logistics. To learn more go to www.bwen.com.

ROTALIGN ULTRA VIBRATION ACCEPTANCE CHECK FROM LUDECA

The ROTALIGN ULTRA vibration acceptance check works in combination with the VIBTOOL vibration meter to measure vibration level according to the ISO 10816-3 international standard. The RMS velocity value is wirelessly transferred and stored back onto ROTALIGN ULTRA computer where the result is instantly evaluated against the machine classification threshold. This fulfills the recommendation of the acceptance check after installation of rotating machinery or any alignment job, ensuring that machines run without restrictions. The VIBTOOL vibration meter can measure the following parameters: vibration severity; bearing condition; temperature; RPM; and pump cavitation.

LUDECA is a vendor of preventive,

predictive, and corrective maintenance solutions including machinery laser alignment, vibration analysis, and balancing equipment, as well as software, rentals, services, and training. For more information visit www.ludeca.com.

NEW SALES DIRECTOR FOR U.S. AND CANADA FOR TEREX CRANES

Tony Marlin has joined Terex Cranes as director of sales for Eastern United States and Canada. He has been at Maxim Crane Works for the past 11 years, recently serving



as senior vice president of sales and marketing and major accounts. He has over 20 years of experience in the crane industry, and he is a former owner of Newton Crane Service in Indianapolis.

“His ability to respond to the rapidly changing demands for the crane rental industry and contractors will enable him to help lead Terex toward even greater customer focused service,” says Frank Bardono, vice president and managing director for Terex Cranes in the Americas.

Terex Corporation is a diversified global manufacturer operating in four business segments: aerial work platforms; construction; cranes; and materials processing. Terex manufactures a broad range of equipment for use in various industries, including the construction, infrastructure, quarrying, mining, shipping, transportation, refining, energy and utility industries. Terex offers a complete line of financial products and services to assist in the acquisition of Terex equipment through Terex Financial Services. More information can be found at www.terex.com.

WINDFLOW MARKS MAJOR ENGINEERING ACHIEVEMENT

Windflow Technology has achieved a major engineering success with the news today that Lloyd's Register has awarded its Type Approval Certificate to the Windflow 500 turbine. This confirms that the turbine meets Class 1A of the latest International Electrotechnical Commission (IEC) design standard IEC 61400-1 (edition 3). Class 1A certification attests that the Windflow 500 will operate for more than 20 years in the strongest, most turbulent wind regime in the IEC classification. The company reports that certification has required years of engineering horsepower and has set a new standard in wind turbine excellence in the medium size 500 kW category.

It gives interested parties and purchasers of the Windflow 500 turbine confidence that the turbine has been rigorously tested to operate in the highest strength winds. During the IEC process 2,800 pages of engineering calculations were scrutinized by Lloyd's Register, along with more than 200 drawings and 37 specifications; the prototype turbine at Gebbies Pass (near Christchurch) was put through a regime of safety and mechanical load tests, as well as measuring its acoustics and power output. The blade was tested for its ultimate strength by the University of Canterbury and for its fatigue life at the IRL test hall in Auckland.

According to CEO Geoff Henderson the

confirmation of IEC certification is the end of an engineering marathon and a strong kick-start to the international marketing drive that recently gained critical momentum through a policy change in the U.K. The company has assembled a team of 20 professional engineers in its Christchurch headquarters supported by the company's commercial team, the skilled tradespeople in its nacelle assembly and blade factories, and the windsmiths in Palmerston North servicing its 66 operating turbines. The company, which is the only utility-scale wind turbine manufacturer in Australasia, currently employs more than 50 people directly and about 400 indirectly throughout New Zealand.

“We are immensely proud of our team's work, and despite challenges along the way we always believed that our innovative Windflow 500 would speak for itself and affirm the confidence of our shareholders,” Henderson says. “Windflow Technology, and the Windflow 500, have set a new wind energy benchmark and one that our supporters can feel very excited about. The turbine is designed for New Zealand's lean and mean economic environment as well as our turbulent high wind sites. Its fundamental economic advantage is that it uses fewer tonnes of materials, typically 50 percent, for the same output as competing three-bladers, large or midsize. The class 1A IEC Type Approval validates this lighter, smarter approach to operating at high wind sites.”

Wind turbine certification is an independent determination that provides assurance of a turbine performing for a minimum of 20 years in a specified environment. Because the IEC certification standard prescribes required safety margins for all engineering calculations, compliance provides the statistical backup sought by those who finance and insure wind farms.

Currently 66 Windflow 500 turbines are installed in New Zealand. A full-scale prototype has been operating since 2003 at Gebbies Pass near Christchurch. Five began operation at the Te Rere Hau wind farm on the outskirts of Palmerston North in 2006, with another 60 being installed at Te Rere Hau between November 2008 and October 2009. In addition 32 turbines are in production and are planned to be installed at Te Rere Hau by mid-2011. To learn more go to www.windflow.co.nz.

NEWS FROM KMT ROBOTIC SOLUTIONS

KMT Robotic Solutions, Inc., announces the sale of the first robotic root cut and drill system for utility-scale wind turbine blades

produced in Europe. KMT-RS is the first and only company to supply a robotic root cut and drill solution, and currently has multiple systems in production throughout North America. This new order will be executed out of KMT-RS's office in Ronneby, Sweden, in close cooperation with its offices in Auburn Hills, Michigan, and Wetzlar, Germany.

This new order builds off of KMT-RS's success in the North American market. "Our North American customers have been pleased with the results they have achieved with their robotic root cut and drill systems," says Mark Handelsman, wind turbine industry sales manager. "Only CNC based solutions were available prior to the introduction of the KMT-RS robotic system. Since we introduced our robotic solution, our customers have found that the KMT-RS root cut and drill systems overcome shortcomings of the CNC solutions and provide higher throughput, lower running costs, and far greater flexibility."

"Penetrating the European Wind Turbine Blade market is an important milestone for KMT-RS," according to Frank Thorn, vice president of European sales. "Europe remains the technology leader for the wind turbine industry with decisions impacting plants not only in Europe, but also in North America and Asia. We found that a key to our success in Europe has been our ability to transfer the technology developed in North America to our manufacturing facility in Ronneby, Sweden, and our technology and support center in Wetzlar, Germany. The efficiencies that we gain by manufacturing more closely to our customers and better meeting local market needs will be a key to our success in Europe."

KMT-RS also continues to advance the state of the technology and is offering some new capabilities in this latest system order. "Using advanced vision technology along with KMT-RS's patent-pending AccuFind technology to accurately locate blades is critical to our achieving the demanding tolerances of our customers" says Mike Aeschliman, wind turbine product manager. "Our customers can load blades in 10 to 15 minutes with a standard overhead crane, and within minutes of loading the blade start cutting the root end."

KMT Robotic Solutions has more than 3,600 robots installed around the world and more than 25 years experience developing, designing, building, servicing, and supporting robotic cutting, trimming, and cleaning solutions for manufacturing customers. With direct and relationship partner locations in Europe, the Americas, China, and Japan, KMT is strategically positioned to serve the

global market. KMT Robotic Solutions. Learn more by contacting Roberta Zald, director of business development, at (248) 829-2814 or roberta.zald@kmtrobotic.com. Go online to www.kmtrobotic.com.

NRG SYSTEMS INTRODUCES 80-METER XHD TILT-UP TOWER

In response to industry demand to measure the wind at taller heights, NRG Systems now offers an 80-meter tilt-up tower. Built on the same reliable platform as the company's 60-meter XHD system, the 80-meter tower incorporates bolted joints for a stiffer, stronger tower while offering familiar installation and performance.

The drive for data accuracy has led many developers and consultants to measure directly at turbine hub heights. "Incorporating one or several 80-meter systems into a wind resource assessment campaign has proven to reduce uncertainty and help developers negotiate more favorable financing and power purchase agreements," says Barton Merle-Smith, director of marketing and sales for NRG Systems (see profile in this issue). "In the U.S. and particularly Europe, the best on-shore wind sites have already been developed. The industry has become more sophisticated and disciplined in its approach to resource assessment in an effort to minimize uncertainty. Measuring directly at 80 meters helps make this possible."

The complete 80-meter XHD system includes a galvanized 10-inch diameter tilt-up tower with a steel baseplate, a SymphoniePLUS 15-channel data logger, NRG Systems sensors to measure wind speed and direction, side-mount booms, and other accessories. The high-visibility package, required by the FAA in the U.S., includes an orange-and-white painted tower, a compliant lighting system, and marker balls.

"Strength and ease-of-use were primary drivers for NRG Systems in developing the new system," according to Owen Clay, director of engineering. "We took great care to meet the highest standards for strength and durability, while preserving the simplicity of installation and maintenance."

NRG Systems is an independently-owned company that has served the global wind energy industry for 28 years. Its wind measurement systems and turbine control sensors can be found on every continent in more than 145 countries, serving electric utilities, wind farm developers, turbine manufacturers, research institutes, government agencies, and universities. The 80-meter XHD system will ship via surface freight free of charge in its efficient Enivocrate® packaging starting

in February 2011. Information requests and orders can be placed by contacting (802) 482-2255 or sales@nrgsystems.com. Also go to what.nrgsystems.com.

NEW MANAGER OF NORTH AMERICAN ACCOUNTS AT MICHELS

Building on a stellar career, Dave Hart has been named Michels' wind energy manager of North American accounts. "Dave is one of the most respected minds in the wind energy business," according to Michels Wind Energy General Manager Pat Herzog, who leads a division with more than 3,600 MW of wind farm experience. "His knowledge and experience will continue to help us grow as the industry moves forward."

Hart has directed more than 600 MW of wind farm construction for Michels since 2009, when he joined the company as operations manager. Most prominently he led the Michels team in constructing Shirley Wind Farm, a 20 MW farm with 100-meter towers. Michels executed an EPC contract and self-performed all collection system, substation, foundation, road, and erection work on the project. Throughout his 25-year career Hart has managed or directed the installation of more than 1,500 wind turbines across the United States and Canada. Before joining Michels he was most recently director of projects for Vestas

American Wind Technology.

Michels Corporation—a leading utility contractor in North America and ranked No. 45 on ENR's Top 400 Contractors list for 2010—offers construction, engineering, and procuring services to keep pace with the growing demand in the energy, transportation, telecommunications, and utility construction industries. For more information call (920) 583-3132 or go to www.michels.us.

SOUTHWEST WINDPOWER'S KRUSE APPOINTED TO FEDERAL ADVISORY COMMITTEE

Andy Kruse, co-founder and executive vice president of business development at Southwest Windpower, has been appointed to the Department of Commerce's recently established Renewable Energy and Energy Efficiency Advisory Committee (RE&EEAC). Established on July 14, 2010, the RE&EEAC will advise the Secretary of Commerce on the development and administration of programs and policies to expand the competitiveness of the U.S. renewable energy and energy efficiency sectors. The committee's 29 members represent U.S. companies, trade

Spray Booths for Custom Applications



Global Finishing Solutions specializes in manufacturing:

- Spray Booths
- Ovens
- Finishing Systems

For liquid and powder coating of large equipment.

Follow GFS:



WWW.GLOBALFINISHING.COM

800.848.8738

associations, and private sector organizations focused on the nation's renewable energy goods and services.

"I'm extremely honored to be selected to sit on the Renewable Energy & Energy Efficiency Committee," says Kruse. "I look forward to working with a group of such highly skilled individuals and lending my knowledge and expertise to help support the country's renewable energy efforts and initiatives." In his current capacity at Southwest Windpower, the world's leading manufacturer of residential scale wind generators, Kruse oversees the company's governmental affairs and certification efforts. During his more than 25 years experience in the renewable energy industry, Kruse has traveled to 70 countries promoting and developing distributors for small-scale renewables. In addition to his latest role serving the RE&EEAC, Kruse sits on several boards and organizations within the renewable energy industry and is also chair of the Small Wind Committee with the American Wind Energy Association (AWEA). Kruse has received numerous awards and recognitions throughout his career, most recently being named "National Exporter of the Year" by the Small Business Association (SBA) and "Small Wind Advocate of the Year" by AWEA.

Southwest Windpower has been designing and distributing small wind turbines for more than 22 years and is the recognized global leader in the design, manufacturing, and distribution of small wind systems (400-3000 watts). The company has been a pioneer in the development of wind technology and has built and shipped more than 170,000 wind turbines to over 120 countries worldwide and has sales representation in over 88 countries. Headquartered in Flagstaff Arizona, it also has operations in Cologne, Germany, and a joint venture in Ningbo, China. Applications for Southwest Windpower systems include residential homes, commercial properties, micro grids, remote cabins, telecom transmitters, offshore platforms, water pumping, and sailboats. Southwest Windpower is the manufacturer of Skystream, Whisper, and Air lines of distributed wind systems. Learn more at www.windenergy.com.

NEW ORGANIZATIONAL STRUCTURE AT NAES CORP.

NAES Corporation, a broad-based provider of services to the energy industry, announces that effective January 1, 2011, it has restructured in order to better serve its customers and to extend its maintenance and construction services into new markets.

NAES will create a new division, to be called the NAES Engineering & Construction Group and led by Dale Withers, which will provide a variety of support services for two wholly-owned subsidiaries of NAES. In addition to NAES Power Contractors, Inc., which has long served the union maintenance and construction market, NAES is forming NAES Constructors, Inc., which will pursue projects in the open shop market. The mission of the NAES Engineering & Construction Group is to foster the continued growth of both subsidiaries, and to ensure that each delivers high value, cost-effective projects with uncompromising safety, quality, and timeliness.

NAES Constructors, Inc. will be co-located in Houston with the Turbine Services Division of NAES, with that division embracing the same rigorous standards. Headquartered in Issaquah, Washington, NAES is the energy industry's largest independent provider of operations and maintenance services, also providing complementary and coordinated services through a tightly integrated family of subsidiaries and operating divisions. These services include construction, retrofit, and maintenance services under dedicated long-term maintenance or individual project contracts; on-site turbine inspection/overhaul services; parts refurbishments and equipment repair; staffing solutions; and customized services designed to improve plant and personnel effectiveness (see article in this issue). NAES is owned by ITOCHU International, Inc., the U.S. affiliate of ITOCHU Corporation. With operations in over 80 countries covering a broad range of industries, ITOCHU is among the world's largest corporations. Go online to www.naes.com.

FIRST WIND ADOPTS SEWALL'S ATLAS SYSTEM

National GIS firm James W. Sewall Company announces that First Wind has launched Sewall's ATLAS Enterprise GIS Viewer and Publishing system. ATLAS, an innovative browser-based GIS solution, enables GIS staff to publish a wide variety of spatial data company-wide via a fast, intuitive, and interactive mapping application built on the Google Maps Enterprise API.

High-value environmental and ecospatial information for siting wind projects is now readily available to all staff through a self-service model, reducing the amount of time spent requesting, searching for, and handling data. Because the same information is available company-wide, ATLAS supports collaboration, decision making, and the



strategic planning critical to wind energy siting and development.

“We are very excited about the release of the ATLAS system,” says Ryan Chaytors, First Wind’s director of development. “We worked with Sewall to design a solution that fits our unique business requirements, especially the fast pace of data-driven decision making. We were pleased with both the design and the execution. The new system has been received enthusiastically by users in a wide variety of roles within the company.”

ATLAS is based on the Google Maps platform, extended by unique Sewall technology that enables First Wind to publish proprietary GIS data from a variety of sources as either Microsoft SQL Server tables, or tiled images.

Founded in 1880, Sewall is an integrated team of geospatial, engineering, and natural resource consultants who partner with clients to create practical, sustainable solutions. The company’s diverse portfolio is based on 130 years’ experience in surveying and civil engineering; 60 years’ in aerial mapping; and 20 years’ in GIS and software application development. Sewall has nine offices in cities nationwide. To learn more go to www.sewall.com. First Wind is an independent North American wind energy company focused exclusively on the development, ownership,

and operation of wind energy projects. First Wind is headquartered in Boston, Massachusetts. For more information visit www.firstwind.com.

ROBOTIC SUBMERGED ARC TECHNOLOGY SOLUTIONS FROM LINCOLN

Lincoln Electric Automation has introduced a new robotic arc welding system embedded with advanced technology that redefines available solutions for submerged arc welding (SAW) with a robot. At the core of this next generation release, Lincoln Electric Automation has patented a wire and flux delivery system that expands the possible applications for robotic submerged arc beyond the normal restrictions of previous mechanized operation. The new, integrated torch design with streamlined flux delivery allows the user to incorporate robotic SAW solutions on corners and path variations, previously not possible with other mechanized gravity fed flux delivery systems.

The system integrates the industry leading Power Wave AC/DC 1000 SD welding power source to ensure superior weld quality results. The machine output is rated 1000 amps, 44 volts at 100 percent duty cycle. With 380-575 VAC, 50/60Hz input voltage capability,

Continued on page 59 >

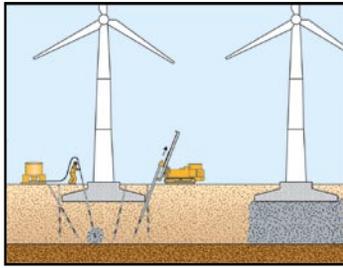
A proven technique for stopping or reducing settlement, cement grouting is an effective, cost-efficient alternative to complete reconstruction of the foundation.

WIND TOWERS FOUNDED ON SPREAD FOOTINGS may settle as a result of loose bearing soils either not identified during the preconstruction geotechnical exploration or remaining after inadequate subgrade preparation. Loose granular soils may also be susceptible to liquefaction during a seismic event, which may result in excessive settlement or complete foundation failure. When wind towers are founded on loose granular soils, cement grouting may be the correct solution for providing long-term support. It is also used to solidify granular soils beneath a structure for both underpinning and excavation support when an adjacent excavation is to take place. Cement grouting has also been used to stabilize a fractured rock mass around cylinder-type wind tower foundations with post-tensioned anchor bolts.

Cement grouting, also known as microfine cement grouting, is a permeation grouting technique that binds granular soils into a cemented mass, by permeation with a low viscosity cement grout. The grout is injected under pressure through previously installed pipes. The grouted soil has increased strength and stiffness, and reduced permeability. Common cement grouting applications are to underpin existing foundations, create excavation support walls, create water cutoff walls, and fill cracks in rock formations, particularly to cut off water flow paths below dams. Cement grouting is available as a design-build service by specialty contractors. A thorough geotechnical investigation should be performed prior to design of a cement grouting program to help to ensure proper injection hole geometry and grout selection. Cement grouts can consist of standard Portland cement or materials known as microfine cements which consist of finely ground slag and Portland cement that is mixed with water and a dispersant to aid permeation. Standard cement particles can permeate coarse sand and microfine cements are necessary to permeate medium and fine sand. The equipment is relatively small, and therefore is suitable for use on sites with restricted access.

Cement grout can either be injected through a pipe drilled into the soil or, when grouting rock formations, through an open hole drilled in rock. Packers are often used to isolate sections of the

drilled hole to help assure proper grout distribution. When treating sand, injection pipes known as Tube-a-manchette (TAM) pipes are used to carefully control the injection location. TAM pipes are typically two-inch diameter steel pipes with injection ports every few feet along the length of the pipe. Rubber sleeves (manchettes) cover each injection port and serve as one-way valves that open during injection and collapse onto the ports after injection. The TAM pipes are installed in boreholes in a designed pattern beneath a foundation to allow injection beneath the entire foundation footprint. Depending on site access, TAM pipe inclinations can range from vertical to horizontal to create a treatment zone. Once the TAM pipes have been inserted into the borehole, the space between the TAM pipe and borehole wall (annulus) is filled with a weak but stiff grout that seals and stabilizes the borehole and holds the TAM pipe in position. A pneumatic packer is then pushed into the TAM to a specified injection point. Rubber seals at each end of the packer are hydraulically inflated to isolate the injection port. The initial pressure of the cement grout breaks through the annulus, permitting it access to the soil.



The volume of cement grout needed to solidify a zone of granular soil is calculated by predicting the shape of the grout flow from the injection point determined by the subsurface conditions. In uniform granular soils, the grout typically flows radially from each port to create a spherical grouted shape. Based on a spherical flow model and the soil void ratio, the required maximum design volume can be calculated.

An effective quality control program requires that all stages be monitored and fully documented. Installation of the sleeve port pipes is monitored to ensure proper alignment. An experienced grout technician should monitor the grout flow meters and pressure gauges during grout injection and record the injection data for each location: pipe number, date, sleeve number and elevation, grout volume, and pressure and flow readings. A geotechnical engineer should review the data to verify the formation and stability of the grouted mass. In use since the late 1800s, wind tower construction can take advantage of this effective alternative to complete reconstruction of the foundation system. ↪

James Hussin is a director for Hayward Baker, Inc., the leading specialty foundation and ground improvement contractor. He can be reached at jdhussin@haywardbaker.com. Go online to www.haywardbaker.com.

Proper lubrication and contaminant control are critical in order to attain long gearbox service life, both during and after the warranty period.

IN CONDUCTING END OF WARRANTY inspections, we typically find a number of turbine gearboxes with internal gear damage that occurred over a relatively short period of time. While these issues have materialized largely unnoticed by the project owner up to the final turnover inspection, the affect of such irreversible conditions will gravely impact the performance of the gearbox through future years. Proper lubrication and control of contaminants has never been more important, both during and after the warranty period.

Although many gearbox failures resulting from manufacturing issues have been widely reported lately, damage to gear teeth caused by poor lubrication and maintenance practices continues to be a problem. Improvements in gear materials and gearbox designs unfortunately can't eliminate contamination that enters gearboxes in a number of ways: metal remnants from the manufacturing process and from internally produced gear and bearing wear, airborne particles through breathers and seals, and particulates that are unintentionally added during maintenance. You can be assured that whenever the gearbox is opened for inspection, top-off, or repair, a significant opportunity exists for contaminant ingress.

While some get away with describing it as normal wear and tear, the scuffing and micropitting issues found after just five years of turbine operation might be more aptly described as abuse and neglect. Normal wear will occur as a result of degradation of the lubricant over time and is expected to occur slowly over the life of the gearbox, given well-filtered oil with no suspended or abrasive particles. Scuffing and pitting, on the other hand, is damage caused directly from contamination of the oil, and from an industry perspective is not generally considered wear at all. Often stated, contamination of the oil is a critical factor in gearbox longevity, and discovering evidence of scuffing or micropitting after just a few years of operation is a smoking gun for establishing responsibility at the end of warranty.

With today's gearbox designs calling for new surface hardening techniques and metallurgy, the products have led to more aggressive surface loading and ultra-thin surface material. These harder surfaces are more resistant to sliding wear, but they are highly susceptible to contaminant-induced rolling wear. Additionally, the mating

surfaces of gear teeth are not perfectly smooth and are full of small imperfections such as machining marks and dents. If the proper viscosity of oil is used, the oil film will be thick enough and the imperfections of the gear teeth will not contact one another. If contamination is introduced, however, hard particles in the oil can fatigue the hardened material in different but easily identifiable ways.

Scuffing is damage to a gear tooth surface due to intense frictional heat generated by a combination of high sliding velocity and high contact stress. Metal particles detach and transfer from the meshing teeth. During successive rotations these particles can scratch the teeth and will continue to do so until the particles are removed from the oil. Micropitting is a form of rolling contact fatigue that can occur anywhere along the tooth surface, typically starting in the bottom or the top of the tooth profile where contact is made. Identified by a gray stain color, micropitting is surface fatigue that results in micro-cracking, formation of micropits, and loss of material. The small pits can be difficult to see, but the condition may lead to macropitting and eventual gear tooth breakage. In either case lubricant and lubricating conditions, not material strength, are responsible for scuffing damage and micropitting. The risk of both increases as lubricating oil degrades or becomes contaminated with particles or water.

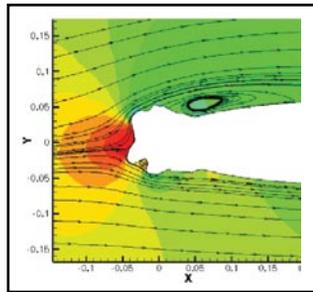
Because their moving parts are in contact with each other, all gearboxes essentially require lubrication. Contaminants not only reduce the lubricant's ability to do its job, but will also interfere with the moving surfaces to cause wear and ultimately lead to component failure. Abrasive deterioration evidenced by scuffing or micropitting will result not only from oil contamination but also by poorly specified lubricants. We all recognize that replacing filters on a regular basis is good maintenance. Refitting gearbox vents with breathers that restrict the ingestion of airborne dirt and debris will help control contamination from entering the unit. Proper care during top-off and inspections will reduce the introduction of particles into the unit. Also keep in mind that overfilling a gearbox can be just as damaging as under-filling, as it can cause air entrainment, overheated oil, and leakage. ↵

Turbine icing is an increasing challenge to the economics of wind energy in cold climates. Read on to learn how it happens, what it causes, and how it can be addressed.

THE NORTHEASTERN AND MID-ATLANTIC U.S. is an attractive region for future wind park developments due to good wind resources, state incentives, and ease to grid connection in the vicinity of major populated areas. The associated colder climate conditions sound promising at first sight because of possibly strong winds and higher air density, e.g. air at -30°C is 26.7 percent denser than air at $+35^{\circ}\text{C}$. However, a colder region may be subject to a number of meteorological icing conditions that have the following adverse effects on wind energy production:

loss of energy production due to turbine shutdown during/after icing events; reduced energy production due to disrupted aerodynamics; overloading due to delayed stall; increased fatigue due to imbalance in the ice loads, and; safety concerns caused by uncontrolled ice shedding. The cost of energy (COE) of wind-produced energy is driven by O&M and availability. It is critical to ensure that wind turbine icing does not affect these two important COE factors to an extent that would endanger the profitability of energy produced by wind in colder climates. We therefore need to enhance our understanding of the nature and prediction of meteorological icing conditions, the physics of ice accretion and its effect on blade aerodynamics and power production, the safety concerns, and to develop strategies to mitigate those adverse effects by developing anti-icing and operational strategies.

The “ice type” that accretes on a structure is mainly governed by the ambient air temperature (T), the Liquid Water Content (LWC), and the Median Volumetric Droplet Diameter (MVD). The accreted ice mass is then proportional to the duration of the icing event (t) and the wind speed (V). The two main ice types are rime ice, and glaze ice. Rime ice occurs at low T and low LWC. Droplets freeze immediately upon surface impact resulting in low density ice growth upstream of the airfoil. It is the primary ice type concerning aircraft icing during flight. Glaze ice occurs at higher T (close to freezing temperatures) and higher LWC than rime ice. Here the droplets do not freeze immediately, but run along the airfoil. This leads to high density “horn-shape” ice growth along the airfoil (see figure). Glaze ice is significantly more



CFD simulation around a glaze ice shape (Airfoil: NACA0012)

difficult to predict and is the primary ice type that occurs on wind turbine blades.

Available ice accretion models are oftentimes only validated for two-dimensional flow under rime ice conditions. Model validation for three-dimensional glaze ice accretion is inherently difficult. Particularly, no validation data are available for run-back effects along the blade airfoil section and in the radial direction due to centrifugal effects. Only a few field data sets of actually accreted wind turbine ice shapes are available. However, their quantitative correlation to

the actual meteorological icing event conditions is never entirely conclusive. The Adverse Environment Rotor Test Stand (AERTS) of the Vertical Lift Research Center of Excellence (VLRCE) at the Pennsylvania State University is a unique facility that enables scaled tests of meteorological icing events for rotating wind turbine blades. The accompanying figure shows a Computational Fluid Dynamics (CFD) simulation around an AERTS accreted ice shape that is helpful in understanding the aerodynamics of iced wind turbine

blades. Further research is being conducted.

At present wind turbines subject to meteorological icing conditions are being shut down as soon as a vibratory load threshold is reached, generally caused by load imbalances. This is necessary in order to mitigate effects on machine life and safety concerns. Research is needed to provide insights into the physics of ice accretion on wind turbine blades, leading to improved designs and operational conditions—including tip-speed-ratio, blade pitch, and novel airfoil designs—that minimize ice accretion during icing events. The main objective must always be not to lose availability, and not to increase O&M requirements.

Possible strategies for anti-icing include blade heating, hydrophobic surface coatings, spray coatings, and ultrasound, with all having downsides in terms of energy requirement, weight, durability, O&M, and availability. We need to think more about this problem. Wind turbine icing is too important to be ignored by manufacturers, operators, and academia. There is a lot to do, and a lot can be done. Every percent in capacity factor counts toward the competitiveness of wind energy. 

Sven Schmitz, Ph.D., is an assistant professor in the Department of Aerospace Engineering at The Pennsylvania State University and a member of its Wind Energy program. Call (814) 863-0778, e-mail sus52@enr.psu.edu, or go to www.wind.psu.edu.

Why should a developer assess strategic logistics considerations before final OEM selection? Because you need to know what you're paying for!

FOR MOST WIND FARM PROJECTS, site developers outsource the delivery of components to the OEM. The price structure and delivery terms for this service vary by project, but contractually it is the responsibility of the OEM to resolve the many complex considerations involving wind component transportation. So why is it critical for the developer to understand transportation logistics early in the assessment cycle? The short answer is: the developer always pays, so it's important to know what you are buying.

COST DRIVERS

With wind farm developments expanding to new areas around the globe, traditional financial budget placeholders for logistics costs do not necessarily apply. In relatively new development areas such as South America, Africa, and parts of Asia the prospective development region may not have adequate ports, sufficient local labor, expertise, or proper transport equipment. While these issues can be overcome through capital investment or importing resources, the additional costs must be part of the project budget. To help drive overall transportation costs down, developers should understand the concept of multimodal solutions that may include any combination of truck, rail, and potentially water options. Having these options increases the developers leverage to negotiate transportation rates. Even so there is usually a final road component to the delivery.

In some regions older road infrastructure creates substantial challenges. For instance, in some parts of the Northeast U.S. low overpasses, narrow sharply curved roads, and insufficient bridge load capacities may require circuitous routing and public infrastructure upgrades. In less developed parts of the world road conditions may create a challenge. The developer may need to build extensive private roads just to gain access to the development area. Site geographical terrain can also influence costs. Steep grades to the turbine pad site may require specialized power and assist equipment or increased capital investment in site roads to reduce grades. Transportation permit fees vary widely by region. In the U.S. alone each state has different permit fee structure for oversized loads that range from a nominal fee to thousands of dollars for each component. The costs typically increase based on the component's dimensions and weight. As turbine sizes become larger, it is important that the developer understands the ef-

fect of turbine class size has on the cost to transport the components to site. In some cases it is possible that total transportation costs could "tip" the project budget to unfavorable.

NECESSARY NEGOTIATIONS

Acquiring knowledge of logistical issues early prepares the developer for negotiations with potential OEMs. Not all OEMs have the same logistics capabilities and expertise, and more difficult development sites may severely stress some OEM capabilities. Given prior knowledge of the potential issues, developers are better positioned to speak candidly with the OEMs. A good understanding of costs means the developer can better assess the terms offered. Developers are also better positioned to judge the OEM's understanding of the logistical issues and their ability to provide solutions. Knowing what the potential logistical risks are helps the developer balance them against rewards in the proposed delivery framework agreements. All delivery agreements should include measures and goals for the overall project success.

REGULATORY ENVIRONMENT

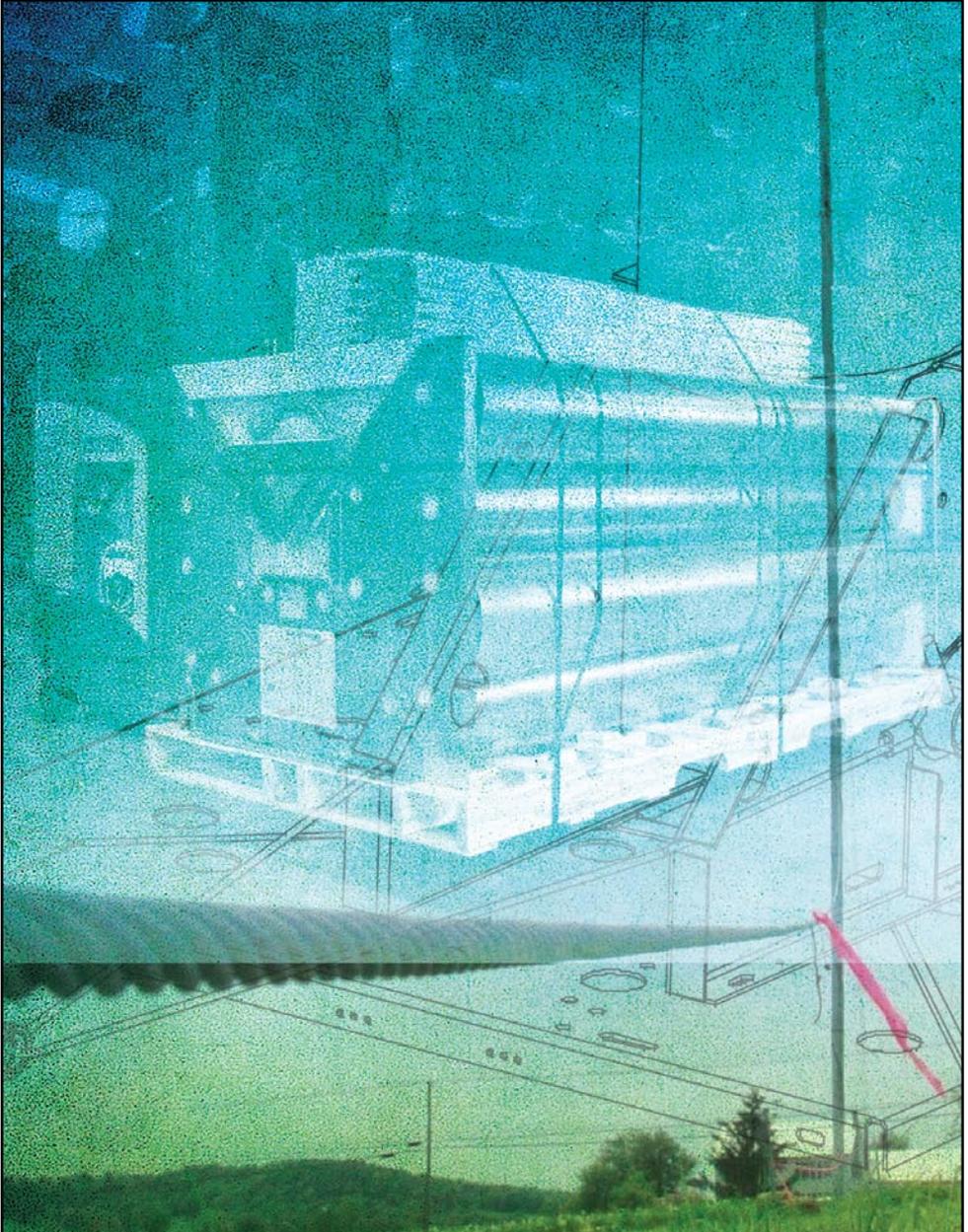
There are no unified global regulations for transportation logistics. Typically there are multiple layers of governance that vary by local, state/provincial, and national authorities. The maze of regulations can be daunting, and since many wind components travel across multiple lines of jurisdiction it is critical that developers understand the key issues which can impact the project's success. Regulations can often restrict delivery times and days, which can directly impact the construction schedule and cost if components are not pre-staged. The developer needs to be sensitive to the local concerns. One of many areas of local opposition may be focused on public road disruption including potential traffic slowdowns or shutdowns and progressive wear and tear of the road surface. While some traffic concerns can be mitigated by moving components en masse via rail or potentially water, most will travel at least some distance over the road. Building relationships with local and state/provincial authorities is key to positive and constructive communication. Although the developers may not ultimately acquire permits, it is important that they are well informed and can react to potential concerns. Developing early plans to address these issues will help support a foundation of public support and trust. ↙

Anne Puhlovich is project manager with Professional Logistics Group. For more information go online to www.prologisticsgroup.com.

PROFILE

NRG SYSTEMS, INC.

By Russ Willcutt



You can't just talk the talk, you've got to walk it as well, especially when you're in the wind energy business. This company sets an example for others to follow.

IT'S ONE THING TO TALK ABOUT being a good environmental steward, but one Vermont-based manufacturer of wind measurement systems and turbine controls provides proof of that commitment in its products, actions, and even the facility in which it is housed. "We are a values-based company," according to Barton Merle-Smith, director of marketing and sales for NRG Systems, Inc., "and that's directly connected to our founders. Those values guide every decision we make whether that involves product design, our environmental footprint, and how we conduct ourselves as an enterprise. And I think that's one of the reasons our customers enjoy doing business with us."

Founded in 1982, NRG Systems has grown in leaps and bounds into one of the most progressive companies to be found. Employing more than 110 people, the first phase of its 75,000 square-foot headquarters and manufacturing facility was built in 2004 using the greenest materials and technologies available. This resulted in the building—which is 100-percent powered by renewable energy—being one of only five industrial facilities in the world at that time to receive gold LEED certification from the U.S. Green Building Council. This dedication to efficiency is also reflected in its embrace of lean manufacturing techniques, which has resulted in a remarkable three-day lead time, on average. And this is not achieved by manufacturing equipment in advance to be stocked in a warehouse, Merle-Smith explains.

"Since we design and build everything ourselves—sensors, towers, data loggers, and we even write our own software—and have worked extensively with our vendors to streamline the supply chain, we're able to get our products out the door extremely quickly," he says. "If you order 15 60-meter towers today, or one of the new 80-meter towers we've just introduced [see press release in this issue], they will typically ship in no more than three days. Achieving that requires thinking strategically, staying abreast of market demand, and developing production processes that are incredibly efficient."

And when those products do ship, if sent by surface freight there is no charge, which

allows the company to choose the best method themselves. Orders are shipped by rail whenever possible, for instance, to minimize fuel usage, and overseas shipments can be bundled in containers for additional savings. Another remarkable breakthrough is known as the Envirocrate®, in which the product forms its own packaging.

"We pioneered the development of the tilt-up tubular tower over 25 years ago and they became such a success that we were shipping more and more of them to locations all around the world, so we started thinking about the cardboard that was being wasted," Merle-Smith says. "The question we asked ourselves was 'why can't the towers be their own packaging?' So that's what we've done. The tower bases form the ends of the shipping unit, and there's practically nothing to throw away on the receiving end. We also donate the lumber that's used to pack some of our raw materials to Habitat for Humanity, so there are houses around here that have been built with wood that we've provided!"

This spirit of innovation is especially apparent in the company's products, which are designed for ease of use, reliability, and manufacturability. Knowing that its wind measurement systems—complete system packages, tilt-up towers, and a wide variety of data loggers and sensors, including lidar—are often used at remote locations, quick setup and easy operation are at a premium, and both have been engineered into NRG's entire product line. In addition to these measurement systems the company also offers the IceFree Hybrid line of turbine control sensors, widely utilized by OEMs around the world. Two years ago the company entered into a relationship with Leosphere, a specialist in lidar for atmospheric observations, to develop and market the WINDCUBE® v2, which is the lightest and most-compact lidar remote sensor available.

"Our niche is in designing mainstream products specifically for the wind industry, and I believe our commitment to sustainability is evident in everything we do," Merle-Smith says. "That's a philosophy that was instilled in us from the very beginning by our founders, and it will continue to guide all aspects of our operation in the future." ✎

SCALING THE HEIGHTS SAFELY

Avanti Wind Systems is dedicated to designing and manufacturing the safest work cages and fall-protection equipment available, but testing and training are critical to their successful use.

By Kent Pedersen



Kent Pedersen is general manager of business development at Avanti Wind Systems, Inc. Call (262) 641-9101 or go to www.avanti-online.com.

AT AVANTI WIND SYSTEMS WE WORK to design and manufacture the best work cages and fall protection systems currently available on the market, but technicians still must be trained and the systems inspected and maintained at least once each year. This is not only a legal requirement, but also a necessary safety precaution for technicians working in towers. Although there are some variations between states, U.S. law requires owners to perform annual inspections and to keep a certification journal including dates and detailed descriptions of the testing methods utilized. This journal must be present whenever the authorities perform a check. A description of these safety devices will not only make their

utility clear, but will aid the owner in conducting these inspections.

DESIGNING FOR WIND

An Avanti work cage allows technicians to avoid climbing up and down the ladder mounted inside of the tower. The cage will carry employees and their tools quickly and safely to the turbine nacelle. The system has also been designed so that it can be used during the construction phase, which means that equipment can be transported within the tower and to a platform close to the nacelle inside of the cage. It can be stopped at any point along its path, and when the doors are opened the drive mechanism is disabled and the technicians



Fig. 1: Avanti climb assistance device.

can work safely from the cage or climb out onto the ladder. Most Avanti work cages can carry two technicians and their equipment, and they can be used in most types of turbine towers that have been prepared for them. Avanti engineers are constantly developing new work cage systems to meet all industry needs.

Avanti Wind Systems has also developed a ladder system with a pre-mounted fall protection system. It is a statutory requirement that all ladders in wind turbine towers should be equipped with a fall protection system that prevents service technicians falling from the ladders if, for instance, they lose their footing or suddenly become ill. The fall protec-

tion system stops the service technician after falling a few centimeters, and it remains locked until either the technician can continue alone or can be helped by colleagues. The system is based on a rail in the middle of the ladder. The service engineer's harness is fitted with a click-on runner that then attaches to the rail. The runner is fastened to the engineer's harness with a carabiner of the same type as used by rock climbers. The runner can be clicked onto the fall protection system anywhere on the ladder.

As the Avanti fall protection system is designed with a fixed rail on the ladder, several technicians can use the system simultaneously. When using wire-based systems, a technician



Fig. 2: The work cage can carry two technicians and their gear.

must wait until his colleague has reached the nacelle before he can use the system himself. The Avanti system has been approved so that one technician can climb onto the system every six meters. In other words, as soon as one technician is six meters up the ladder, the next one can start climbing.

Avanti has also designed a system that makes it easier for technicians to climb towers. In simple terms, Avanti's climb assistance is an endless rope that runs from the bottom to the top of towers. It is connected to a motor at the base of the tower, and here the engineer can set the system to a pull force between 30 and 40 kilos. When the technician links to climb assistance with a rope grab and gently pulls the rope, the system takes up the selected bodyweight in kilos during the entire ascent and descent. If the technician stops climbing the system stops as well, and then starts again after a gentle pull of the rope. The system reduces the risk of injuries to engineers' knees, arms, shoulders, and feet.

Avanti's climb assistance can be installed in both new and existing towers. In fact, Avanti has installed many climb assistance systems in older towers throughout the world. Older turbines must be serviced more frequently, and this means many hard climbs for technicians on ladders. This is why many owners of older towers decide to install the new system. Climb assistance is not an anti-fall protection system, however. It is merely an aid for engineers, and it must always be used together with an approved anti-fall system. The independent, international test institute Force Technology has approved the simultaneous use of the two systems, as they function perfectly together. This is an additional guarantee of safety.

PASSING THE TEST

Our warranty for work cages, ladders, and climb assistance also requires test and inspection at least once each year by Avanti or personnel that we have trained. Turbine owners naturally accept that all the equipment in towers has to be correctly installed by authorized personnel. But a wind turbine tower is also a place of work, and in contrast to most other workplaces owners sometimes forget that safety equipment has to be tested regularly.

As important as this testing is, proper training is also critical. Every year Avanti Wind Systems trains several thousand wind turbine industry employees throughout the world, either at the Avanti training centers or onsite at wind farms where the employees are working. It also provides closed courses for employees of the same company, or open courses in which anyone can participate. Not many people doubt the impor-



BRONTO SKYLIFT

Work Safer

Model S150 XDT
150' Working Height

Model S200 XDT
200' Working Height

Model S230 XDT
230' Working Height

Model S295 HLA
295' Working Height

Model S330 HLA
330' Working Height

Nothing beats a Bronto aerial for safety when inspecting, cleaning and servicing wind turbines. And, they do it faster and more productively, so you save time and money!

They're available in a wide range of sizes and offer optional features like integrated washers and generators to meet your specific needs.

Working heights to 330 feet!

For more information, call or visit us on the web
352/895-1109 • www.bronto.fi

Above all

A subsidiary of Federal Signal Corporation



Fig. 3: Rescue operation from outside of the tower.

tance of having effective safety equipment, but it is equally important that technicians working with the equipment are trained to work with it, and to deal with both dangerous situations and accidents.

During the courses, which can run over several days, technicians learn everything about safety in relation to fire, evacuation, and rescue from towers. The courses include theory, but also rely heavily on practical exercises in towers. For example, one compulsory part of the course consists of a course member acting as if he is unconscious while his colleagues fasten him to the safety equipment from the rescue and evacuation unit, which must be in the nacelle, and then lowering first the unconscious subject and then themselves outside of the nacelle.

This is a situation we hope will never occur in the real world, of course, but one that requires special training for any employee who may encounter such a challenge. It's also important for owner's to keep in mind that they are responsible for providing this training to anyone who will be relying on this safety equipment, and that the training must be kept current as well.

THE AVANTI ADVANTAGE

Founded in 1885 as the Avanti Ladder Factory in Denmark, scaling heights safely has been the company's primary concern for more than a century. Avanti Wind Systems has designed work cages, ladder systems, and fall-protection devices specifically for wind technicians for the past 26 years. Today it is the world's leading pro-

ducer of work cages and other personal safety systems for use in wind turbines, having supplied more than 12,000 such devices all around the world, totaling more than half of all those installed.

Avanti Wind Systems has recently begun production of ladder systems for wind turbines in the United States. Today the manufacturing of aluminium ladders is taking place near the company's North American headquarters in New Berlin, which is close to Milwaukee, Wisconsin. The factory is intended to supply the North American wind market. Until now Avanti has manufactured its ladder systems in China and Germany, and these factories will continue manufacturing for the rest of the world.

Avanti Wind Systems has also become a strategic distributor and service partner for Cresto ResQ products in the wind energy industry. Cresto—previously named ResQ—has sold more than 25,000 sets of evacuation and rescue equipment for wind turbine towers around the world. The agreement between Avanti Wind Systems and Cresto means that Avanti has established training and service centers for Cresto equipment in the United States, Germany, Great Britain, Spain, India, Australia, and China, where Avanti already has offices and factories.

As with everything related to wind turbine tower safety, the evacuation equipment must be inspected and tested at least once each year. But Cresto has developed approved packaging that makes it possible to test the safety equipment just once in 10 years. The safety equipment is vacuum packed—that is, put into a foil bag from which all the air is pumped out. When the rescue device, ropes, and other accessories are not in

contact with oxygen and humidity they last longer, since the materials cannot wear down. The vacuum packing also safeguards the equipment against the wind turbine tower vibrations. What must still be tested each year in this instance is the integrity of the vacuum seal, in order to make sure that no equipment or material degradation has occurred. If the packing is soft, it's a sign of a hole in the bag, at which point everything will have to be inspected, tested, and vacuum-packed again.

The Avanti-Cresto partnership also means that the two companies will jointly launch new series of harnesses and other personal protection equipment for technicians working on wind turbine towers. Safety has always been the top priority for Avanti Wind Systems, and the goal is clear: Safe work in wind turbines, anywhere in the world. 



GEAREXPO
The Worldwide Gear Industry Event
2011

transform
POWER INTO PROFITS

NOVEMBER 1-3, 2011 DUKE ENERGY CONVENTION CENTER CINCINNATI, OHIO

The countdown begins for GEAR EXPO 2011!

DON'T WAIT - BOOTH SPACE IS GOING FAST.

Gear Expo is...

-  **Where your buyers come...**
Thousands of gear industry professionals attend the expo looking for the latest technologies and manufacturing solutions.
-  **Located in a new city with a modern venue...**
Cincinnati is conveniently located near many potential customers.
-  **Offering excellent benefits and amenities for exhibitors...**
Take advantage of the free Solutions Center, additional attendees from the ASM Heat Treat Expo, and many opportunities to promote your company.

Visit www.gearexpo.com or call 800-687-7469 to reserve your space.

MARK YOUR CALENDAR FOR NOVEMBER 1-3, 2011
AND RESERVE YOUR BOOTH TODAY!

UPTOWER TOOL MANAGEMENT

The last place you need to lose a tool is when you're working atop a wind tower. Snap-on Industrial provides solutions that keep your tooling together.

By Pat McDevitt



Pat McDevitt is business development manager at Snap-on Industrial. Go online to www.snapon.com/industrial.

WHEN IT COMES TO GETTING A JOB done right, having the right tools at hand can make all the difference. Whether that job is performing routine maintenance at a nearby jobsite or an emergency repair on a wind tower 250 feet in the air, technicians need to be able to get their hands on the necessary tools fast.

And it's not just about getting tools to the jobsite, it's about getting the right combination of tools without leaving any crucial pieces behind.

Using mobile tool cribs that come with tool-control technology, as well as devising specialized tool kits for specific jobs, can help technicians work more effectively and productively to get the job done quickly.

MAKING TOOLS MOBILE

Sometimes getting the tools to the jobsite itself is half the battle, especially if it's located halfway across the world. A mobile tool crib can be an efficient and economical solution by allowing tools to travel from one site to another, instead of incurring the high cost of supplying both sites with the same set of tools. When managed properly the mobile tool crib is an integral component of a jobsite, especially at larger wind farms or sites in remote locations.

The idea and practice of a tool crib is nothing new, of course. What is new, however, are well organized tool cribs that offer a totally controlled environment, increasing jobsite productivity while reducing costs. Next-gen-



Fig. 1: It's common for technicians to carry a bag with more than 100 tools going from turbine to turbine. The last thing you want is to find one missing.

systems. Some suppliers even provide trained tool crib attendants to manage the mobile tool crib on site.

Mobile tool cribs house all tools and equipment, typically in conex-type containers of 20 to 40 feet in length. To aid in tool organization, mobile tool cribs come with custom-built cabinetry and shelving, detailed with foam inserts to keep even small tools in place. All tools housed in the mobile tool crib have been specified by the customer. This allows the user to avoid paying for unneeded additional tools, and ensures that the requested tools will be integrated into the organization system before the crib arrives.

KEEPING INVENTORY

Once the mobile tool crib is operational on the jobsite, keeping track of it allows workers to quickly access tools when needed. Traditional tool cribs are notoriously difficult to navigate, with a take-it-when-needed tool checkout policy that can lead to wasted time and lost tools. To alleviate this problem, mobile tool cribs use asset management software to help increase tool accountability.

Asset management software keeps track of the tools and also enables the tool room attendant to track usage trends, output valuable management reports, and provide a clear indication of what truly is available in inventory. When new tools are added, the tool crib attendant assigns them a bar code and updates the system to reflect an accurate count.

Security also can be an issue at job sites. Newer tool cribs use ID cards instead of keys, so that managers know who accesses the crib and when. The same key-card is used in connection with the tool control system to identify who is checking out which tools. This way lost tools can be traced back to the worker that last accessed them, whether or not they were returned to the crib, reducing misplaced tools and costs. When the job is finished, mobile tool cribs can be loaded onto a tractor trailer for delivery to the next jobsite. The company also receives a printout of what tools need to be replaced, recalibrated, or recertified before the mobile tool crib moves on.

CUSTOM KITTING

Nothing is more frustrating to a technician than when that one crucial tool to get a job done has been forgotten, even if it's simply back at the tool crib. Consider the technician working 300 feet in the air on a wind turbine. It's common for

eration mobile tool cribs from Snap-on Industrial offer the latest technical advances including asset management software that reduces tool replacement costs while increasing jobsite efficiency.

Mobile tool cribs are also becoming more mobile. Instead of having technicians go back and forth to a tool crib, which is often in an existing facility a distance from the actual jobsite, tool cribs are now coming to the workers. Mobile tool cribs can be customized and set up directly on a jobsite. Modular in design, mobile tool cribs include storage and control systems, cabinets, and shelving, plus electrical components that include lighting, air conditioning, and electronic keyless entry



Fig. 2: Modular in design, mobile tool cribs include storage and control systems, cabinets and shelving, plus electrical components that include lighting, air conditioning and electronic keyless entry systems.



Fig. 3: A custom kit can be developed to house all the necessary tools required to perform preventive maintenance on specific components.

technicians to carry a bag with more than 100 tools from turbine to turbine, but what happens if he forgets a tool on one turbine after scaling another? That last thing he wants to do is scale that other turbine just to retrieve a tool. Whether the technician is up in the air or on the ground nothing wastes time, productivity, and money more than needlessly walking back and forth from the job to the turbine or tool crib to retrieve a forgotten tool. However, one way to make sure that the tools needed for specific jobs make it there is by creating a custom tool kit.

Here's a common application for how a custom kit works. For example, a piece of machinery that undergoes routine preventive maintenance every three months would have a kit created and ready to check out from the

tool crib with all the necessary tools needed to complete maintenance on that job. By kitting those tools in the crib, a technician needing to do that repair doesn't have to check out the 10 tools individually. Rather, he simply checks out the kit, knowing he has all the tools to complete the job.

An ideal use for a custom kit is preventive maintenance. That's because many facilities have equipment, machinery, and systems that require regular ongoing preventive maintenance as part of their operation. A custom kit can be developed to house all the necessary tools required to perform preventive maintenance on specific components. All the technician has to do is check out the kit from the tool crib to know that he has all the necessary tools to complete the job.

GETTING STARTED

The first step for a customer in creating a custom kit is to work with a Snap-on Industrial representative to identify the tools needed for the particular job, and in the process look for efficiencies in the way maintenance is performed. A larger customer may have up to 15 different applications requiring kits of various sizes. The key is identifying those needs and developing kitting solutions that improve efficiencies and ultimately save time and money.

Just as organization and accountability are important aspects of the mobile tool crib, these attributes are also sought after in custom tool kits. All kits come with cutout foam placements for tools, which provide a higher level of organization and accountability. This added level of organization offers inventory control for safety and theft prevention advantages and ensures the technician can account for every tool in the kit at a glance.

The days of lost tools are quickly becoming a thing of the past. Every day mobile tool cribs and custom kits are saving technicians time and money. As companies look to continually improve efficiencies, today's tooling solutions offer the combination of good asset management processes and high tool security. It's a winning combination. ✈



Fig. 4: Mobile tool cribs house all tools and equipment, typically in conex-type containers of 20 to 40 feet in length. All tools housed inside have been specified by the customer.

INCREASING GENERATOR LIFESPAN

Not only can upgrades drastically increase the service life of wind turbine generators, they can also prevent serious damage and high repair costs. Availon provides pointers.

By Olaf Kleesch

Olaf Kleesch is director of global technical support and engineering for Availon. Visit online at www.availon.com.

"HE WHO STOPS BEING BETTER stops being good." What is the relevance of this quote from Oliver Cromwell, founder of the English Republic, to the wind industry? Fully developed upgrades are a performance booster for any wind turbine generator (WTG) since the optimization of turbine components leads to significant improvements, such as the reduction of recurring faults and the increase in availability and performance. Upgrades can also prevent serious damage and help to avoid high repair costs.

The development of WTG upgrades should be an integral part of every independent service provider's (ISP) portfolio. By changing only a few parameters of a WTG control system, a turbine can often be optimized quickly and easily. The ca-

pabilities of ISPs can be measured by their ability to master the challenges faced in the development and introduction of WTG upgrades. Turbine owners and operators should check whether their ISP has proven processes in place for developing and implementing optimizations.

OPTIMIZATION APPROACHES

It is necessary to recognize and describe a problem at the beginning of the upgrade development process. The catalyst for such an analysis can come from many directions including the ISP, as a result of fault analyses, from on-site installers reporting about recurring irregularities within certain turbine components, or from operators suggesting possible optimizations.



The first step is to determine the cause of the problem. Neither evident nor obvious, problem analysis is typically one of the greatest challenges in the upgrade development process. ISPs that provide continuous fault analyses on contracted turbines are the most knowledgeable and have access to key data necessary to identify and analyze problems. A detailed cost/benefit analysis can determine whether the development of a turbine upgrade makes economic sense for the owner. To develop a concrete solution, an ISP should have in-house mechanical and electrical engineering knowledge. They also need access to very specific competencies from partners during the development process as well.

A continuous documentation process is essen-

tial to seamlessly retrace every development step of an upgrade. This is important even when carrying out simple design changes, particularly if a solution unexpectedly fails to produce the desired on-site improvements. A risk assessment is also recommended, since an upgrade may lead to design changes that could affect a turbine's operational safety.

Finally, the prototype of an upgrade must demonstrate that it is actually beneficial. This sometimes requires longer on-site testing and evaluation to ensure practical suitability, as well as sustainability.

DEFINING DMAIC

The path to an upgrade can be reduced to a simple formula known as "DMAIC"—or Define, Measure, Analyze, Improve, Control—which is a core process of Six Sigma. Since the 1970s Six Sigma has a proven track record in the industry as a statistical quality management system and is a recognized and successful method for defining DMAIC processes. The systematic use of such methods as part of the development of WTG upgrades is a reliable way to realize measurable improvements in turbines. Decision makers should not only check whether ISPs use such systems for development processes, but also whether or not they support them with further quality assurance measures.

CRITICAL SITUATIONS

Turbines containing three-point bearings provide an excellent upgrade example. With the traditional bearing configuration, grave consequences may result if the main bearing fails and the damage is not detected in time. The damage produced by the failure allows the main shaft, including the rotor, to move toward the back of the nacelle. The wind pressure acting on the rotor pushes the entire gearbox up to nine millimeters backwards until the displacement of the drivetrain is finally halted by a steel block. As the gearbox rests against the steel block, the pressure of the drivetrain is transferred to the planetary carrier bearings. The result is the complete destruction of the planetary carrier bearings and, therefore, the gearbox.

Continuously monitoring the gearbox's position prevents any serious or costly damage from occurring. Availon developed a new upgrade, mainly consisting of two inductive proximity switches, to solve this problem. Using control system error messaging, along with the remote monitoring system, they constantly monitor the position of the gearbox. If the drivetrain deviates from its original position, a fault message is transmitted to the remote monitoring system. To prevent any further damage to the gearbox and main bearing, the turbine is then immediately shut down by the control system. The turbine can then only be restarted on-site once the position of the gearbox has been inspected.

An on-site inspection can evaluate the degree of damage to a main bearing. Replacing the main bearing is usually inevitable, and already represents a

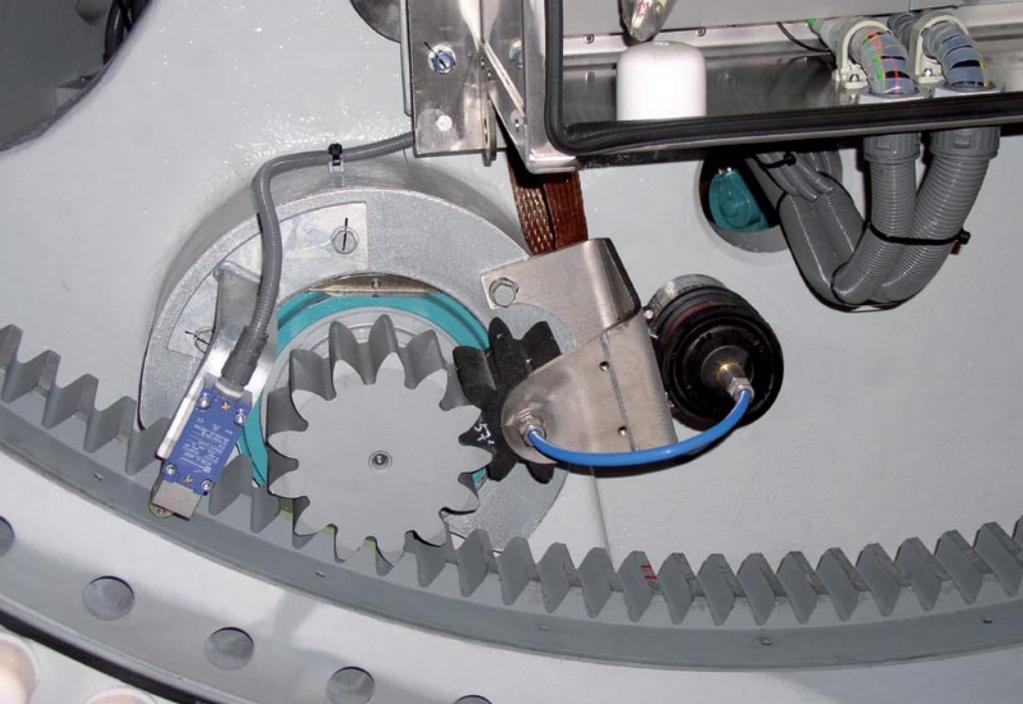


Fig. 1: Permanent lubrication systems facilitate the reliable automatic and constant supply of lubricants to components, increasing the operational reliability of turbines (GE).



Fig. 2: The grid coupling contactor, handling the switching processes of the main switch, can generally prevent damage and increase turbine availability (GE).

considerable investment, but it is less than the cost incurred from a complete gearbox replacement. To prevent such situations from becoming critical, this upgrade is readily available.

REPLACEMENT PROBLEMS

During maintenance, replacing carbon brushes in Vestas' V80 and V90-2 megawatt turbine generators is time consuming because of issues that arise from the original attachment of the brushes. When removing the brush attachment, other components may fall into the slip ring compartment. Due to the arrangement of the generators, the fallen components are difficult to reach without dismantling the slip ring even further. The added work contributes to lost time and higher service costs.

A new attachment solution significantly decreases the time needed to replace carbon brushes. It also prevents parts from falling into the slip ring compartment during maintenance and repairs. In addition, the new upgrade increases the service life of

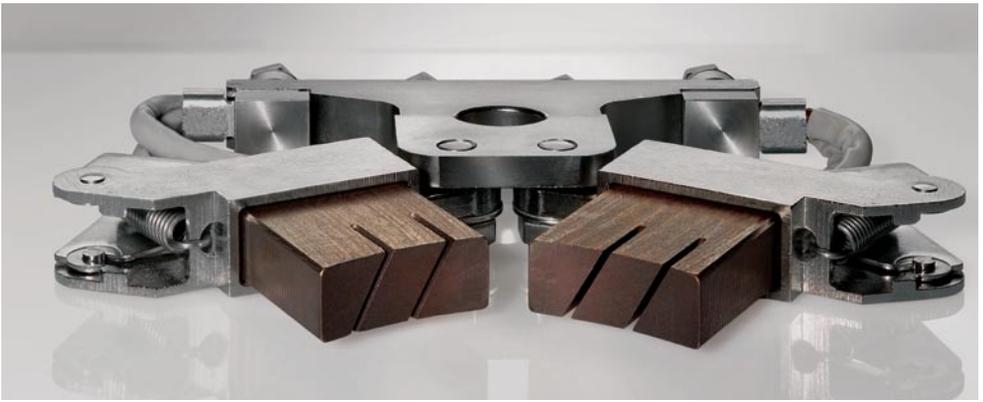


Fig. 3: Availon has developed a new mounting process for carbon brushes that ensures a quicker and easy brush replacement (Vestas).

the carbon brushes. The original mounting system consists of only one spring, causing the brush sides to wear unevenly during operation. As a result the brushes have a limited service life of approximately 12 months. The new mounting upgrade, coupled with a configuration change, prevents this irregular wear of the carbon brushes. Availon field trials have

shown that the upgrade increases service life from 12 to 18 months, on average.

IMPROVED VENTILATION

Availon developed a ventilation management improvement for the transformer used in the Vestas 2 MW turbines. The upgrade applies to turbines installed in extreme weather locations, such as along coastal areas where transformers fail and need replacement every two years. Such frequent replacement represents a substantial investment, but is necessary because of unfavorable air circulation and contamination due to the salt in the air. The salt accumulates on the

When precision, reliability and quality are your expectations... **TURN TO SOTEK/BELRIX**

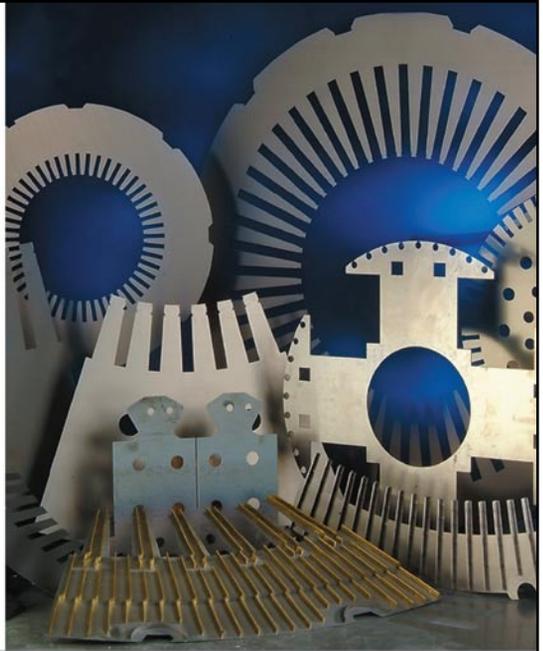
A leader in the manufacturing of precision metal stampings. We supply custom stamped laminations and assemblies to a variety of customers – large and small.

Whether your need is for immediate turn around or delivery of production quantities on a regular basis, we are equipped to meet your needs.

- Stator, Rotor, and Pole Laminations
- Stator, Rotor, and Pole Assemblies
- Vent and Finger Plates
- Stamping and Laser Capabilities
- Complete In-House Tooling Capabilities



established in 1984



Sotek, Inc. and Belrix Industries, Inc. • 3590 Jeffrey Boulevard • Buffalo, NY 14219
716-821-5961 • fax: 716-821-5965 • www.sotek.com • info@sotek.com • ISO REGISTERED

SERVING MEDIUM TO HEAVY INDUSTRIAL MOTOR AND POWER GENERATION INDUSTRIES

transformers and leads to corrosion of other components.

The upgrade uses special deflectors to direct the air through the nacelle so less enters the transformer room. Using a specially controlled fan, only 20 percent of the cooling air is channeled into the transformer, which is sufficient for cooling. The new air conditioning system for the Vestas 2 MW turbines aims to fully prevent the development of salt deposits in the transformers in the future, thereby increasing service life considerably.

PORTABLE CONTROL BOX

Maintenance or other work performed in the nacelle of Vestas turbines has repeatedly been a problem for operators. In the past, one person had to operate the WTG control system from the tower base so that work could be carried out in the nacelle. With the new control box Availon has developed, this procedure is no longer required. The control box is a portable operating console connected by the Opto interface in the nacelle and can control the turbine directly from the nacelle.

EXTENDING BLADE BEARINGS

The life of rotor blades mainly depends on their seals. Due to constantly changing weather conditions, seals must meet specific requirements. If they don't, it won't be long before the blade bearing suffers damage.

Generally, a distinction is made between contact and non-contact seals. Depending on the type of relative movement of the components being sealed against each other, a distinction can be made between static (no movement), translational (linear movement), and rotary (rotating movement) seals. A blade bearing seal is a contact-sealing element with a rotational relative displacement caused by the displacement of the blades. Located on the stationary outer surface of the pitch bearing, the seal should prevent water intake and grease



Fig. 4: With a control box maintenance is quicker and easier because the wind turbines can be controlled directly from the powerhouse by a portable control panel (Vestas).

leakage onto the moveable inner race of the pitch bearing.

But what happens if a seal does not work correctly and doesn't prevent unwanted substance transfer? A damaged seal often allows a discharge of bearing grease and contaminates the equipment or ground with grease residue or dripping grease. As a result, grease must be replenished often.

A greater hazard is presented if rain enters the rotor blade bearing and mixes with the lubricant. This will shorten the life of the bearing, partially due to corrosion. Water that penetrates the seal can also cause an increase in error messages from the pitch controller and failure of pitch drives or pitch bearings. Replacing sealing profiles is nearly impossible due to their installation positions, so it is incredibly costly to fix the issue. To avoid such problems, a rotor blade bearing seal must be protected against environmental influences. The solution is a cover, or sealing hood, that meets the following special requirements:

- Protects the bearing against water intake;
- Is resistance to oil and grease;
- Has excellent aging resistance;
- Offers easy installation;
- Has an extra-secure seal, despite significant centrifugal forces;
- Compensates for large tolerances, and;
- Is easy to service.

The hood upgrade consists of several half shells that are glued and bolted together at the joints and positioned around the rotor blade. A tension strap positions and secures the hood profile of the cover on the rotor blade. The sealing hood is made from shapeable chloroprene with special auxiliary tools and tempering furnaces required to achieve reliable shaping.

Dichtomatik GmbH and Availon partnered to create the hood upgrade. Headquartered in Hamburg, Germany, Dichtomatik has many years of experience in the field of sealing systems for the wind industry. Through the development of upgrades to various turbine systems, the service life of the turbines can be extended and unplanned maintenance costs reduced. The greater reliability of wind turbines will allow for continued implementation of this renewable resource in the coming years. ↵

We strive to create and deliver educational events that capture the energy of the rapidly expanding wind market and offer necessary opportunities for organizations to learn and network with fellow wind professionals.

The revenue generated from AWEA events is used to advance the wind industry through policy analysis and promotion, to ensure wind industry interests are addressed in renewable energy legislation, to communicate the benefits of wind energy to all. ONLY AWEA puts your dollars to work advancing the wind energy industry. **Join us at our upcoming events!**

AWEA Wind & Transmission Workshop

February 9 – 10, 2011 ▶ Omaha, NE

AWEA Wind Power on Capitol Hill

February 15 – 16, 2011 ▶ Washington, DC

AWEA Wind Power Project Siting Workshop

March 1 – 2, 2011 ▶ Kansas City, MO

AWEA Wind Power Supply Chain Workshop

March 24, 2011 ▶ Little Rock, AR

AWEA Wind Power Finance & Investment Workshop

April 7 – 8, 2011 ▶ New York, NY

For More Information: www.awea.org/events



INTERNATIONAL TURBINE ADAPTATION



The North American wind industry can benefit from the more-mature European market, harnessing existing—and proven—designs to forge ahead.

By Troy Hewitt

Troy Hewitt is global wind energy business leader at Intertek. Visit online at www.intertek.com.

THE NORTH AMERICAN WIND TURBINE market has experienced rapid growth in the last six years. Support for wind energy at the federal level in both the United States and Canada has fluctuated, but many states and provinces have responded with their own incentive programs and renewable energy standards. These initiatives, coupled with comparatively stable federal support, have been recent major drivers of the boom in wind turbine installations across North America.

But what does this mean? Simply put: Adaptation. Most wind turbines installed in North America and Canada are actually designed by European companies or based on European designs. These designs were typically performed to IEC standards and European electrical requirements,

which are often not compatible with the requirements of U.S. and Canadian electrical code and product standards. Unlike utility-owned power plants, most wind turbine installations in the U.S. and Canada are owned by Independent Power Producers (IPPs) and fall under the requirements of the National Electric Code (NEC) or Canadian Electric Code (CEC). Historically, though, many jurisdictions have not enforced the requirement of the NEC or CEC, which means wind turbine designs have not been adapted to North American requirements.

DESIGNING TO COMPLY

Wind park installations are more prevalent than ever. As a result, the enforcement of existing elec-



trical codes and development of wind turbine specific standards is becoming more stringent across all markets. Wind turbine manufacturers face the daunting task of redesigning their products to meet an evolving set of requirements. The challenge for manufacturers is to adapt their designs without compromising key design features and differentiators. Additionally, manufacturers need to distinguish between aspects of the design that must be modified to comply with North American regulations and where they can avoid making changes so as to minimize the time and cost of the redesign effort.

There are many aspects of the wind turbine electrical system that require evaluation to determine the consistent elements and differences

between IEC requirements and the corresponding U.S. and/or Canadian requirements. One key area is the requirements for the major critical components of the system. These critical electrical components include switchgear, control systems, power conversion equipment, pitch and yaw drives, power distribution, cooling systems, and most importantly, the generator.

The generator is the most critical element of the wind turbine design. Why? The generator is not only more expensive, but it is the single piece of a turbine that is the most difficult to replace, or redesign, to achieve North American compliance. While there are significant differences between the standards for generators with the same design across markets, an understanding of the differences—as well as the similarities—can enable compliance for the European Union, the U.S., and Canada.

MAINTAINING STANDARDS ACROSS MARKETS

The main IEC standard for generators is IEC 60034-1 [1], along with other parts of the IEC 60034 series that cover specific aspects of construction and performance. In addition, there are standards for component parts of the generator, such as the insulating materials and overall electrical insulation system. The full list of applicable standards will depend on the type and construction of the generator, but the following are typical:

- IEC 60034-5 [2] covering Ingress Protection (IP) classification;
- IEC 60085 [3] for thermal evaluation of electrical insulation systems;
- IEC 60034-18-1 which provides general guidelines for the functional evaluation of insulation systems, and;
- IEC 60204-1 [4] for general electrical safety.

In the U.S. the corresponding standards are UL 1004-1 for rotating equipment and UL 1004-4 with specific generator requirements. Other related standards include:

- UL 1446 [5] for electrical insulation systems (random wound generators);
- IEEE 1776 [6] for electrical insulation systems (form wound generators, more common for large wind turbines);
- UL 50E [7] for enclosure requirements, and;
- UL 746C [8] for properties of polymeric materials supporting live parts.

In Canada, CAN/CSA C22.2 No 100 is the standard for motors and generators. Rather than a separate standard for the generator electrical insulation system, C22.2 No 100 includes testing to qualify electrical insulation systems. Other applicable Canadian standards include:



In the E.U. manufacturers are required to comply with E.U. directives, but the use of standards is optional and manufacturers are able to self-certify without a third party's involvement. Self-certifying manufacturers must document compliance with the essential requirements of the directives and, assuming standards are used as the means to determine compliance, the manufacturer will perform tests as defined in the normative standards and document the results to demonstrate compliance. Since standards are optional and manufacturers are free to make their own judgments about methodology, applicability and results of testing, this information often cannot be used for demonstrating North American compliance even where the testing or constructional requirements overlap. When third-party testing data from an accredited source is available, equivalencies may be drawn between the IEC test results and the U.S. or Canadian standards that would allow use of the IEC results to satisfy the North American requirements.

GENERATOR CONSTRUCTION

The principle of third-party qualification applies not only to the overall generator assembly, but also to the components that comprise the generator. Certain components are deemed "critical" when the generator is evaluated for compliance. A critical component is one that must satisfy requirements mandated by the product standards in order for the generator to be considered compliant. This can include aspects of the component such as dimensions, materials used, material properties, electrical ratings, and even the shape or the color. The generator manufacturer cannot rely solely on ratings and data from the component manufacturer to demonstrate compliance. Instead, components used in the generator should either be certified, indicated by the CO or NRTL mark on the component. If not indicated by either mark, then the component will have to

- CAN/CSA C22.2 No 0.17 [9] for polymeric materials properties;
- CAN/CSA C22.2 No 0.4 [10] for grounding and bonding, and;
- CAN/CSA C22.2 No. 0 providing general guidelines related to the Canadian Electrical Code.

Apart from the differences in specific constructional or testing requirements, there is a conceptual difference between compliance in the E.U. and in North America that can affect the steps that need to be taken to demonstrate compliance with North American standards. In both the U.S. and Canada, equipment such as generators is certified by third-party companies that must verify and document complete compliance of the equipment to all the applicable requirements from the relevant standards.

These third parties are called Certification Organizations (CO) and Testing Organizations (TO) in Canada, and Nationally Recognized Testing Laboratories (NRTL) in the U.S. These companies, such as Intertek, are accredited to perform testing and issue certification. Any equipment bearing a certification mark from one of these third parties has been fully evaluated and there is documented evidence of compliance.

be qualified for use by the CO or NRTL evaluating the generator.

Another key difference between most European and North American standards with respect to wind turbines is that European standards are more performance-based. Simply put, this means there are certain performance criteria that must be met in order for the product to be considered acceptable, while North America standards are more prescriptive, providing specific constructional requirements. For example, both the U.S. and Canadian generator standards have specific minimum thicknesses for cast metal, sheet metal, and polymeric enclosures. They also specify minimum design criteria for the grounding, ventilation openings, corrosion protection, wiring connections, and wiring types. The European standards applied to generators do not provide this level of specifics, but they do rely on the performance of the product in the intended use to drive the specification of the construction and the components, materials, or equipment that goes into the generator. The term suitable is used throughout the IEC



Fire Protection: The Right Choice for your Wind Turbine

Wind turbines present a unique challenge for fire suppression. Air flow, vibration and dust all work against traditional fire detection.

Firetrace is different, utilizing our linear pneumatic heat detection tubing:

- Protects multiple critical enclosures with one system
- Requires no electricity offering uninterrupted service 24/7
- Allows for inexpensive installation, maintenance and recharge
- Initiates shut down or sends an alert to your monitoring system
- Eliminates false alarm
- Provides immediate detection and delivery of agent at the heart of the fire

Call today and learn why Firetrace is the right choice for your wind turbine.

Visit us at: EWEA Brussels – Stand 11406 • AWEA Anaheim – Booth 3819

FIRETRACE[®]
AUTOMATIC FIRE SUPPRESSION SYSTEMS

Tel: +1 (480) 607-1218
E-mail: firetrace@firetrace.com
www.firetrace.com



standards for electrical equipment with suitability left up to the manufacturer.

A key component of any generator is the electrical insulation system (EIS) or systems employed in the stator—and depending on the type of generator—in the rotor. The EIS of the rotor and stator can be different. The EIS consists of various electrical insulation materials (EIMs) in conjunction with con-

ductors, which form the windings that are inserted into the stator and/or rotor core. The EIS provides ground-wall, phase-to-phase, and turn-to-turn insulation. Failure of the EIS can result in a phase-to-phase or phase-to-ground short circuit resulting in shock or fire hazards. The EIS between manufacturers vary greatly and can be a simple assembly of a few materials or a complex arrangement of many lay-

ers of differing types of materials. These EIMs are chosen for both mechanical and chemical properties. The combination of EIMs that comprise the entire EIS can behave very differently than individual materials would in isolation.

The EIS is subjected to various stresses in application including electrical (continually varying voltages), mechanical (vibration, abrasion, expansion/contraction), environmental (humidity, contaminants) and thermal (heating and cooling cycles during operation). In the U.S., the standards for EISs (UL 1446 and IEEE 1776) emphasize thermal stress as the primary stress factor. The test methodologies of the U.S. standards are designed to provide a thermal class rating, which is a measure of the maximum operating temperature that the EIS can be utilized at on a continuous basis and still maintain its electrical properties over the expected lifetime of the generator. The testing specified in the Canadian standard (C22.2 No. 100) also emphasizes thermal stress but does not necessarily include all of the materials comprising the EIS.

In the E.U. the evaluation of the acceptability of an EIS may be based on either thermal, electrical, or a combination of both as the primary stress factors and is referred to as a functional evaluation. There are several IEC standards that provide test procedures that may be used. Also, there are options for waiving certain environmental and mechanical stress tests during the functional evaluation based on the end product application. The basic methodology for conducting the thermal aging tests for both U.S. and IEC standards is not dissimilar and share a common basis. The methods for determining the thermal classification of an EIS are based on analyzing the failure profiles using the method of Arrhenius for both schemes. Therefore, it is not unreasonable that a similar result would be obtained regardless of which thermal aging scheme was utilized. The challenge in bringing an IEC design to North America lies in documenting the methodology, decisions and test

results used to qualify the EIS per IEC requirements so that equivalency with the North American requirements can be determined.

MAKING THE GRADE

The list of required tests for generators specified in North America and European standards is very similar. In both cases they require testing of the entire product for temperature (thermal) performance: testing to demonstrate the prevention of electrical breakdown of equipment, and thus the prevention of electrical shock or fire caused by such breakdown; tests for the ability of personnel to access both moving parts and electrically live parts; and tests for abnormal conditions such as “over speed” or short circuit. Due to the difference in electric grid frequency between North American and Europe (60Hz versus 50Hz) some testing done for European compliance may have to be repeated at 60Hz. For generators such as permanent magnet generators (PMG) where the full output of the generator goes through a power converter the genera-



tor output frequency does not change for a 60Hz application so test results can likely be re-used for North American compliance.

While both the E.U. and North American standards contain over-speed testing, there is a distinct difference in the test methods. The U.S. standards require that the testing be conducted with the generator operating at 100 percent rated output at 120 percent of the rated speed. The E.U. standard allows waiving of the over speed test when agreed to between the manufacturer and the user. When performed, the E.U. over-speed test does not require the generator to be producing 100 percent rated output. Both the E.U. and North American standards require testing to verify the rating of enclosures but the methodologies differ significantly. The E.U. testing is based on the concept of International Protection (IP) rating (see IEC 60529). This is typically a two-digit code that indicates the capability of the enclosure to prevent the ingress of objects such as tools, wires, and fingers, and contaminants such as dust or liquids.

A specific IP rating is not specified for generators, but is left to the discretion of the manufacturer and the intended use of the generator. In North America enclosures are rated according to an enclosure type designation using a number between 1 and 13. These ratings are mainly for applicability of the enclosure to various environmental conditions. Some enclosure type ratings are considered suitable for outdoor use and some are only for indoor use. Each rating has specific tests designed to determine the level of resistance of the enclosure to dust, ice, water or vapors. In order to verify performance under North American requirements, materials such as the gasket, seal, or other material from property performance are required for the enclosure to meet its rating. IP ratings do not require this type of testing so where these materials are employed additional testing may be required for North American compliance. While there is not a one-to-one correlation between IP rating and enclosure type rating, it is possible for IP rated enclosures to be qualified for use in North America. Similar to other components, the key is the availability of third party test data from an accredited source.

North American standards specify some tests that are not required by EU standards. These include tests to demonstrate that the generator output power is within 5 percent of the ratings of the nameplate for generator, specific testing for the ability of generator enclosures to withstand physical abuse, mechanical stresses and impacts during use, and tests to verify the capacity of generator lifting lugs.

CONCLUSION

While North American and European generator standards differ both in their concepts of compliance and in specific requirements, there still

remains a significant similarity that enables the adaptation of European designed generators to the North American market. The adaptation can often be made without significant physical changes to the generator. The keys elements to accomplish this include thorough documentation of the components used in the generator construction particularly third-party test data, emphasis on the key constructional and testing differences between the standards such as qualification of the Electrical Insulation System(s), component certifications/qualifications, enclosure ratings, and testing such as over-speed and output power rating. A detailed analysis of the generator construction and documentation will determine which North American construction and test requirements can be satisfied with existing documentation and where additional information, analysis, or testing is required. ✨

REFERENCES:

- 1) IEC 60034-1 is a standard and is applicable to all rotating electrical machines except those covered by other IEC standards, for example, IEC 60349.
- 2) IEC 60034-5 is Part 5 of IEC 60034. It is a standard for rotating electrical machines. Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code)-Classification.
- 3) IEC 60085 distinguishes between thermal classes for electrical insulation systems and electrical insulating materials.
- 4) IEC 60204-1:2005+A1:2008 is applicable to the electrical equipment or parts of the electrical equipment that commences at the point of connection of the supply to the electrical equipment of the machine and operate with nominal supply voltages not exceeding 1 000 V for alternating current (a.c.) and not exceeding 1 500 V for direct current (d.c.), and with nominal supply frequencies not exceeding 200 Hz.
- 5) UL 1446, Standard of Safety for Systems of Insulating Materials-General, outlines the test procedures required for the thermal evaluation of electrical insulation systems (EIS).
- 6) IEEE 1776 is a test procedure for comparing two or more insulation systems in accordance with their expected life at rated temperature.
- 7) This standard applies to enclosures for electrical equipment intended to be installed and used in non-hazardous locations in accordance with the Canadian Electrical Code.
- 8) These requirements cover parts made of polymeric materials that are used in electrical equipment and describe the various test procedures and their use in the testing of such parts and equipment.
- 9) This is the standard for evaluating the properties of polymeric materials.
- 10) This is the standard used for the bonding of electrical equipment



RETOOL YOUR THINKING



MARCH 22-26
LAS VEGAS USA

Register now for CONEXPO-CON/AGG 2011, the most information-packed show in construction. Get close and size up the newest equipment, technologies and strategies for profitability. See how construction has gotten greener, safer and more efficient since you last walked the warm pavement of Vegas. Be there to take it all in—so you can take it all back with you.

Go to www.retoolandwin.com for details on how to register and full sweepstakes rules.



RETOOL AND WIN

Get entered automatically for a \$250 PREPAID CARD simply by completing your registration.

Two winners will be drawn every week from July 12, 2010, through March 14, 2011. You could be one of them!



SWEEPSTAKES TERMS AND CONDITIONS

NO PURCHASE NECESSARY. Must be a professional in the construction industry and legal U.S. or D.C. resident 21 or older. To enter: Complete your registration at: www.retoolandwin.com. Sweepstakes starts July 12, 2010, and ends March 14, 2011. Void where prohibited. Odds of winning depend on the number of eligible entries received. Official Rules and alternate method of entry details at www.retoolandwin.com.

Sponsor: Association of Equipment Manufacturers, Milwaukee, WI.

AVOIDING GROUND-FAULT ARCING

Grounding transformers are essential for large wind farms, where the substation transformer often provides the sole ground source. Pacific Crest Transformers explains.

By Curt Collins

Curt Collins is director of sales at Pacific Crest Transformers. Visit online at www.pacificcresttrans.com

THE GROUNDING TRANSFORMER is an often-neglected component of the wind farm, shunted off to a sidebar issue. However, those who neglect to adequately plan for grounding transformers do so at their peril. In reality, millions of dollars in liability and loss can be attributed to ground-fault arcing, so grounding-related issues should top the checklists of any electrical contractor developing a wind farm.

Proper construction to meet the specific needs of wind farms is absolutely essential. In addition, be sure your grounding transformer considers such essential parameters as primary voltage, the size needed to carry the rated continuous primary phase current without exceeding temperature limits, and fault current and duration. Finally, se-

lect from among the variety of options available based on the application's site-specific needs.

WHAT IS A GROUNDING TRANSFORMER?

Simply put, a grounding transformer is used to provide a ground path to either an ungrounded Wye or a delta-connected system. Grounding transformers are typically used to provide a relatively low impedance path to the ground, thereby maintaining the system neutral at or near ground potential; to limit the magnitude of transient over-voltages when re-striking ground faults occur; to provide a source of ground fault current during line-to-ground faults; and to permit the connection of phase to neutral loads when desired.

If a single line-to-ground fault occurs on an un-



grounded or isolated system, no return path exists for the fault current, so no current flows. The system will continue to operate, but the other two unfaulted lines will rise in voltage by the square root of three, resulting in overstressing of the transformer insulation and other associated components on the system by 173 percent. Metal Oxide Varistors (MOVs)—solid state devices used to suppress voltage surges/spikes (lightning arresters)—are particularly susceptible to damage from heating by leakage across the blocks, even if the voltage increase is not sufficient to flash over. A grounding transformer provides a ground path to prevent this.

Grounding transformers are essential for large multi-turbine wind farms, where the substation transformer frequently provides the sole ground

source for the distribution system. A grounding transformer placed on the turbine string provides a ground path in the event the string becomes isolated from the system ground.

When a ground fault on a collector cable causes the substation circuit breaker for that cable to open, the wind turbine string becomes isolated from the ground source. The turbines do not always detect this fault or the fact that the string is isolated and ungrounded. The generators continue to energize the collector cable, and the voltages between the un-faulted cables and the ground rise far above the normal voltage magnitude. The resulting costs can be staggering. The loss of revenue alone for a string of 10 turbines can exceed \$10,000 per day. Considering removal and replacement, costs of equipment could approach an additional \$40,000 per transformer.

For example, a typical wind farm configuration is somewhat analogous to a carriage wheel with a ring, hub, and spokes. The wheel's outer ring is like the fence around the wind farm and the hub in the center is where the collector is located, which connects to the grid. The spokes are radial lines where each wind turbine sits. Typically each radial string of turbines will connect to a grounding transformer. Figure 1 provides a generalized diagram of this layout.

CONSTRUCTION CONFIGURATIONS

Grounding transformers are normally constructed with one of two configurations: a Zig-Zag (Z_n)-connected winding with or without an auxiliary winding, or a Wye (Y_{nd})-connected winding with a delta-connected secondary that may or may not be used to supply auxiliary power. Figure 2 shows these two possible configurations. The current trend in wind farm designs is toward the Wye-connected primary with a delta secondary (Figure 2b). There are several reasons why the two-winding Wye-connected grounding transformers are seemingly more popular than Zig-Zag designs:

- Though not actually the case, two-winding transformers are perceived to be more readily available for replacement or upgrade;
- Lack of familiarity with the design basics required for the Zig-Zag configuration means designers tend to fall back on the more familiar configuration;
- The Wye-connected two-winding design allows for secondary loading and metering while Zig-Zag designs do not;
- Not all manufacturers provide Zig-Zag grounding options to potential customers, even those for whom that configuration might be most appropriate.

The Zig-Zag connection's geometry (Figure 2a) is useful to limit circulation of third harmonics and can be used without a delta-connected winding or the four- or five-leg core design normally used for this purpose in distribution and power transformers. Eliminating the need for a secondary winding can make this option both less expensive and smaller than a comparable two-winding grounding transformer. Furthermore,

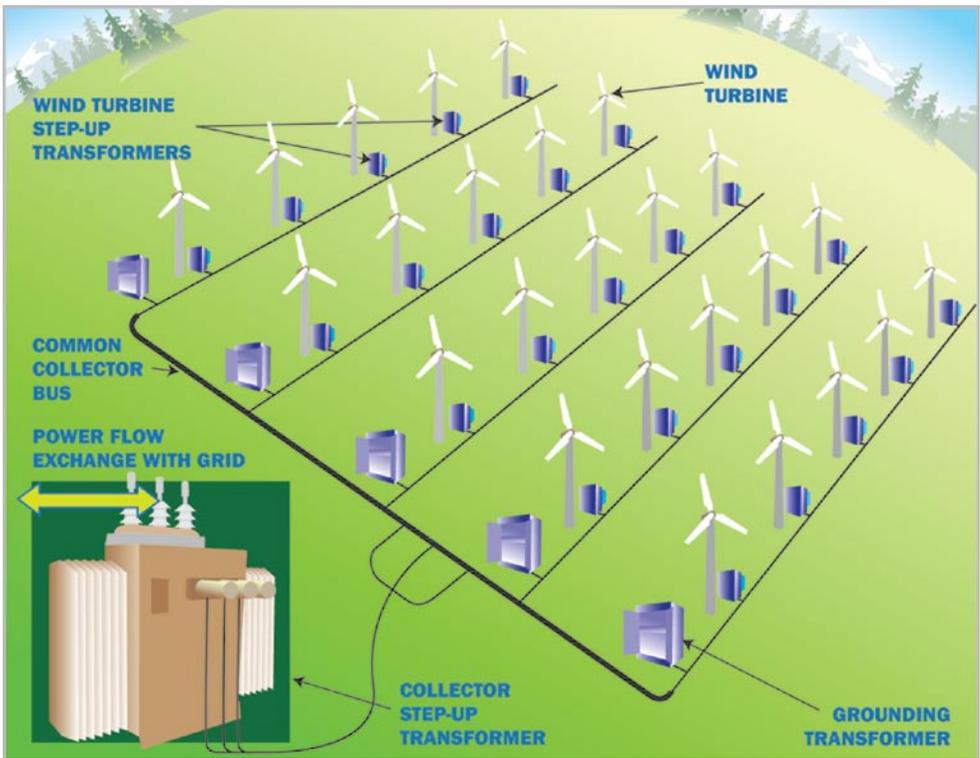


Fig. 1: Typical wind farm configuration.

use of a Zig-Zag transformer provides grounding with a smaller unit than a two-winding Wye-Delta transformer providing the same zero sequence impedance.

Wye-connected grounding transformers, on the other hand, require either a Delta-connected secondary or the application of four- or five-leg core construction to provide a return flux path for unbalanced loading associated with this primary connection. Since it is often desirable to provide auxiliary power from the grounding transformer secondary winding, this benefit may make it preferable to use a two-winding grounding transformer instead of a Zig-Zag connection. Both Zig-Zag and two-winding grounding transformers can be constructed with auxiliary power capabilities, and this can be either a Wye- or Delta-connected load.

A solidly grounded system using a grounding transformer offers many safety improvements over an ungrounded system. However, the ground transformer alone lacks the current limiting ability of a resistive grounding system. For this reason neutral ground resistors are often used in conjunction with the grounding transformer to limit neutral ground fault current magnitude. Their ohm values should be specified to allow high enough ground fault current flow to permit reliable operation of the protective relaying equipment, but low enough to limit thermal damage.

ESSENTIAL PARAMETERS

When selecting and specifying a grounding transformer for your wind farm, be sure to consider the following key parameters.

Primary voltage—This is the system voltage to which the grounded winding is to be connected. Don't forget to specify the transformer's basic impulse level (BIL), which measures its ability to withstand lightning surges. In some cases the BIL will be dictated by equipment

considerations, such as 150 kilo-volt (kV) BIL ratings on 34500 volt wind farms, because of the limitation on dead front connectors.

Rated kilo-volt amperes (kVA)—Because the grounding transformer is normally a short time device, its size and cost are less compared to a continuous duty transformer of equal kVA rating. For this reason grounding transformers are often not sized by kVA, but by their continuous and short time current ratings. Regardless of how you rate it, the grounding transformer must be sized to carry the rated continuous primary phase current without exceeding its temperature limit. This load includes the magnetizing current of the core, the capacitive charging current for the cables, and any auxiliary load, if applicable. The higher this value, the larger and more costly the transformer will be. Typical continuous current values can be as low as 5 amps to as high as a few hundred. Be sure to

include any auxiliary loading requirements.

Continuous neutral current—The continuous neutral current is defined as three times the phase to current. Or, in other words, the zero sequence current. This is usually considered to be zero if the system is balanced. However, for the purposes of designing a grounding transformer, it is a value that is expected to flow in the neutral circuit without tripping protective circuits (which would force the current to be zero) or the leakage current to ground that is not a symmetrical function. Again this value is needed to design for thermal capacity of the grounding transformer.

Fault current and duration—This value is needed to calculate the short time heating that results from a fault on the system and should be determined from an engineered system study. Typical values range from a few hundred amps to a few thousand amps, with duration times expressed in seconds and not cycles. For instance, a value of 400 amps for 10 seconds is typical. The fault duration is a critical parameter for the transformer designer. Where protection schemes use the grounding transformer for tripping functions, a relatively short time duration is specified (5-10 seconds). On the other hand, a continuous or extended neutral fault current duration would be required when the grounding

transformer is used in a ground fault alarm scheme.

Impedance—The impedance can be expressed as a percentage or as an ohm value per phase. In either case it should be chosen so that the unfaulted phase voltages during a ground fault are within the temporary over-voltage capability of the transformer and associated equipment, such as arresters and terminal connectors. Values, which can vary from as low as 2.5 percent to almost 10 percent, must be provided by the system designer.

Primary winding connection—Be sure to specify the type of primary connection, either Zig-Zag or grounded Wye. Consider the factors discussed above concerning situations for which a particular configuration might be most appropriate before making the decision. Secondary connection – specify the secondary voltage and connection when applicable. Also be sure to consider the size of auxiliary loading to be connected for either Zn- or Wye-connected primary windings. If the option is to have a two-winding transformer with no secondary load, determine if the delta winding can be “buried” (that is, not brought out) or if only one bushing is to be brought out for grounding to the tank or testing.

FEATURES AND OPTIONS

In addition to the design characteristics discussed, there are a number of other considerations or desirable features you should consider when building your wind farm grounding transformers.

First, advise the supplier whether you need a compartmental pad-mount transformer with integral tamper-proof compartment or substation design. Also consider whether the grounding transformer will be located outdoors or indoors, since even outdoor units need special attention when placed near other structures. Select the proper fluid type for the particular application—options include mineral oil, silicone, and Envirotemp® FR3™ fluid, a natural ester-based fluid with exceptional fire-resistant properties and favorable environmental attributes. Consider connectivity choices, and select the best one for the site. Options vary from dead front, live front, and spade terminals. Terminal location can be under a cover or on a sidewall, exposed or enclosed. In addition, temperature rise is assumed to be 65°C, so adjust design if necessary.

Consider site elevation or any special environmental concerns, and use special paint as required. Last, consider neutral ground resistors. The rated voltage of the NGR should be equal to the grounding transformer’s line to ground voltage. The current rating and duration should match the grounding transformer ratings. Remember to set the current rating high enough to be above the cable charging current and grounding transformer magnetizing current. ⚡

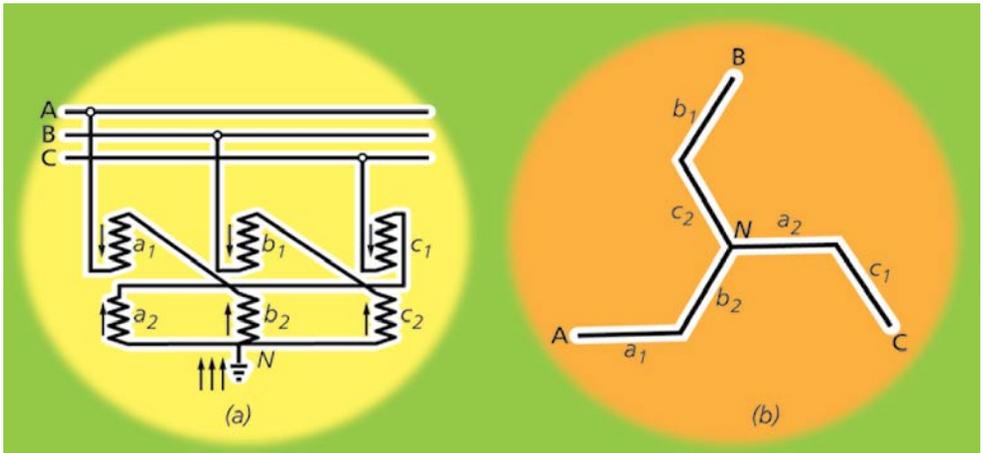


Fig. 2: Grounding transformer configurations.

MANAGING WIND STATION WARRANTIES

When a warranty expires, responsibility for future repairs transfers to the owner, who should be proactive in conducting in-depth inspections, as NAES makes clear.

By Glenn McCombs



Glenn McCombs is wind business development manager for NAES Corporation and can be reached at (856) 351-6320 or glenn.mccombs@naes.com. Go online to www.naes.com.

WIND TURBINE GENERATOR OEMS, as well as suppliers of other plant equipment, generally offer a warranty for their products. In the wind industry it has become common to offer a warranty of one to two years after installation. Owners need to address how to manage those warranties, both for the wind turbine generators as well as for Balance of Plant (BOP) equipment. The reason why may be obvious regarding a wind turbine generator that has an installed cost of several million dollars, but BOP equipment is also warranted by its manufacturer. Because wind stations contain multiple repetitions of the same equipment, any single failure may be the precursor to many others.

During the warranty period repairs are usually performed by the OEM or a competent service

provider, and almost always performed at zero cost to the owner. For example, output breakers, wind turbine generator pad-mounted transformers, and energy collection cables can all be visually inspected, and tower foundations can be inspected using an optical transit to detect settling, especially in regions with non-homogeneous geological strata.

Before the expiration of the wind turbine generator warranty period, owners need to prepare for accepting the OEM-supplied equipment. Ideally the equipment is turned over in the best condition possible. The owner needs to consider which of the following approaches best suits their needs.

First, the owner can simply accept the OEM



report of the current wind turbine generator status, and receive the equipment “as is” at the end of the warranty period. This option is generally inadvisable, for a number of obvious reasons. Second, the owner can conduct an end-of-warranty (EoW) inspection just prior to the expiration of the warranty. This will establish the “as is” condition of the OEM-supplied equipment before the OEM leaves the site. For a fairly small investment of \$3,000-\$5,000 per wind turbine generator the status of each wind turbine generator is established by conducting a full inspection, an NDE (nondestructive evaluation), an NDT (non-destructive testing), or all three.

Third, in addition to the EoW inspection the owner can conduct periodic “benchmark”

inspections, or spot checks, on select turbines throughout the warranty period to establish wind turbine generator and component status independently of any OEM reports. A benchmark inspection includes the same aspects of an EoW inspection.

INSPECTION IMPORTANT

The EoW inspection is best performed three to six months before the warranty period expires. This way the owner can present results to the OEM and reach agreement on who is responsible for resolving material condition issues before the OEM leaves the site.

A two-man crew requires about five hours per wind turbine generator to conduct the necessary EoW inspections, evaluations, and testing. The cost and duration of these activities depends on which components are inspected and at what level of detail. Those decisions can be made based on a “cost versus benefit” analysis, the maintenance history of each wind turbine generator at the wind station, or both. The ideal inspection team consists of one technician with an electrical background and one with a mechanical background to ensure that all areas are covered by knowledgeable personnel. Prior planning and scheduling minimizes the impact on the wind station and its availability. The EoW inspection typically includes the physical inspection of all the items listed in the sidebar accompanying this article.

The resulting EoW inspection report should include: the factual conditions found; when and exactly where the sample, reading, or photographs were taken; and acceptance specifications. For findings that are not acceptable, describe any requirement(s) that may have been violated. Along with presenting the facts it is best if the inspector includes an opinion of the cause of deficiencies, as well as providing information regarding any additional inspection or maintenance that should be performed prior to acceptance by the owner.

PROACTIVE PREPARATION

The most proactive approach is to periodically perform benchmark inspections or spot checks on select wind turbine generators throughout the entire warranty period. Performing annual or bi-annual benchmark inspections to supplement routine planned maintenance activities and establish component material conditions over time provides the owner with the status of each wind turbine generator. This way, when the warranty expires the owner can more easily predict when each major wind turbine generator component may degrade to the point of requiring major repair or replacement.

Conducting benchmark inspections also provides the opportunity to gather all maintenance and inspection activity in a Computerized Maintenance Management System (CMMS) to create a database of information that shows maintenance

trends over time. This information can be used to show trends in wind turbine generator performance, repairs, and ROI (return on investment). If an EoW inspection is also performed, that adds one more data point for such trending data.

Performing Benchmark Inspections: It is best to supplement the recommended OEM preventive maintenance activities with other benchmark inspections on select wind turbine generators such as non-destructive generator windings impedance tests, foundation settlement measurements, and energy collection system (underground) impedance readings.

Such inspections should be performed at least twice prior to the EoW inspection to provide, at minimum, three inspection data points to create a suitable trending graph that is fairly equally

spread across the years of the warranty period. These trends are used to clearly demonstrate both the historical condition and performance of a component or system during the warranty period, as well as providing the rate of any degradation. This way the owner is not saddled with an expensive repair of a failed component immediately upon expiration of the warranty.

Trending with a CMMS: Trending the multiple criteria and systems of multiple wind turbine generators is feasible only when performed by computer analysis. Typically, a work order is used to record material condition information each time a planned or corrective maintenance activity is performed. Work orders are best originated, worked, and stored in a CMMS system, as maintaining paper copies of work orders such as





End of Warranty Checklist

The EoW inspection typically includes the physical inspection of the following items:

- Main power breaker
- Electrical cabinets
- Hub slip ring system, which conveys control signals to the pitch system—general condition, resistance reading within tolerances
- Converter system
- Generator—check bearings for noise and test grease samples for contaminant levels from both the drive and non-drive ends, windings resistance tests and impedance to ground, alignment
- Cooling systems
- Main bearing, which is one of the most expensive parts to replace—visual inspection of the raceways and rollers, grease condition
- Gearbox, which is one of the most-stressed components in a wind turbine generator—visual inspection by borescope of the planetary gears and shafts and bearings, vibration readings, lubrication oil sample analysis
- Yaw system—adequate grease on the yaw ring, oil samples from each motor gear box
- Lubrication and hydraulic systems—identify leaks, inspect hoses and fittings, conduct sample analyses
- Tower—bolts, cables, ladders, paint, oil spills, safety equipment and cables, man lifts
- Brake system
- Blade—internal and external inspection
- Blade bearings—inspection, grease sample analysis
- Lifting equipment
- General cleanliness, a strong indicator of the level of care the wind turbine generator has received

PAMPA TEXAS



**WHERE THE WHEAT GROWS,
THE OIL FLOWS, AND
THE WIND BLOWS!**



Clay Rice, Executive Director
pampaedc@sbcglobal.net

P.O. Box 2398
Pampa, TX 79066-2398
806-665-0800
www.pampaedc.com

in a three-ring binder located in the O&M building or inside the door of each tower are almost useless, especially for trending.

“AS FOUND” INFORMATION

Periodically during operations, and as part of the EoW material condition report, “as found” conditions should be trended in addition to the results of special NDE or other inspections. For example, hydraulic and lubrication oil sample results, filter loading differential pressures, alignment readings, torque readings, running temperatures, and results of visual inspections can and should be trended.

ROOT CAUSE ANALYSIS

Parts replacement can and should be trended to identify which wind turbine generators show excessive wear and tear that has not been resolved. For example, if the yaw motors or gears have been repeatedly replaced in a wind turbine generator, the condition of that wind turbine generator at EoW turnover may appear acceptable. But until the root cause of the continued replacements has been identified and corrected, the need for replacements will continue.

ALARMS AND RESETS

Alarms and resets can and should be trended in a similar manner, with the goal of early identification of any pending failure or substandard wind turbine generator performance. This is an area requiring more work than is typically performed. The goal is to gather and analyze the data on multiple alarms and resets to determine their cause, and so that the mean time between failures can be understood. This statistical information can be used to drive down the alarm/reset incident rate for each wind turbine generator. Lower levels of “mean time between failures” translates into more reliable wind turbine generator performance over time.

RETAINING OEM DATA

Some OEMs separate SCADA-monitored data points into two categories: owner information, and information that is proprietary to the OEM. The proprietary data may be deleted when the OEM departs, or it may be made available at an additional cost. During the EoW inspection, the owner can “mine” or analyze all of the data held in the SCADA system. In addition to performing this analysis, it is an opportune time for the owner to review exactly what historical information is contained in the SCADA system and to learn whether that information will remain available after the warranty expires. The proprietary SCADA data may be removed coincidentally with the end of the service and maintenance contract, and when the OEM departs the wind station.

Being armed with the facts—that is, all of the material conditions, maintenance history, and trends of every aspect of each wind turbine generator and its components—places the owner in a strong position for negotiating with the OEM when the warranty period ends. This ensures that the wind turbine generators are turned over to the owner in the best condition possible and minimizes the risk of major repair expenses immediately after expiration of the warranty. ✦



the Power Wave AC/DC 1000 SD can be connected anywhere in the world, making equipment deployment easier for global companies. The digital inverter-based power source features Lincoln Electric's software-driven Waveform Control Technology, resulting in unprecedented control of DC positive, DC negative, balanced AC, and variable AC submerged arc processes without cumbersome mechanical cable swapping. Subtle waveform changes can be made for precise control of the submerged arc deposition rate and penetration. The result over conventional power sources is increased weld speeds, consistently higher quality welds and improved efficiencies in single or multi-arc environment. The new Power Wave machine features new iArc digital controls, delivering processing speeds up to 90 times faster than the previous generation. The result is faster arc response and greater arc stability.

Lincoln Electric Automation also integrated smart technology into solutions featuring remote weld process monitoring that allows welding operational efficiency analysis. Using Lincoln Electric's Production Monitoring™ 2 Web-based software, managers can track equipment usage, gather and store data by weld, station, shift or date, configure welding process limits and generate e-mail alerts. The system also features Lincoln's True Energy capability, which provides customers with an easy and accurate method for measuring and displaying energy for critical heat input calculations. Additional capabilities can be added to the robotic system, such as Touch Sensing, automated path follow and vision-based systems for tracking, guidance and error proofing. When appropriate for the application, these technologies can extend the precision and quality of the robotic submerged arc welding supplied by Lincoln Electric Automation.

The Lincoln Electric Company, headquartered in Cleveland, Ohio, is the world leader in the design, development, and manufacture of arc welding products, robotic arc welding systems, fume extraction equipment, and plasma and oxyfuel cutting equipment. The company holds a leading global position in the brazing and soldering alloys market. For more information call (216) 383-2667 or e-mail automation@lincolnelectric.com. Also visit www.lincolnelectric.com/automated-solutions.

ELECTRONIC FIXED RATCHETING HEAD TORQUE WRENCHES FROM STANLEY PROTO
Stanley Proto has added to its line of electronic torque wrenches three new fixed ratcheting

head models. The new wrenches accept standard Proto sockets, and come in ¼", 3/8", and ½" drive versions with torque ranges from 25 in-lb (2.8 Nm) to 250 ft-lb (339 Nm).

Stanley Proto fixed ratcheting head torque wrenches are accurate to within +/- 2 percent of indicated value in BOTH directions (compared to 4 percent clockwise and 6 percent counter clockwise on mechanical models). This broad accuracy range extends from 10 percent to 100 percent of full scale. In addition, 99 "onboard" memory storage locations help improve efficiency when taking multiple torque readings. The fixed ratcheting head features a robust 24-tooth design with a 15° arc swing, an alloy steel drive gear for strength and durability, a low profile design for easy access, and a reversing lever design to ease one-handed operation. The torque wrenches come with many of the same features and benefits as Proto's existing electronic torque wrenches. These include:

- An easy to read LCD Display with large digits;
- Three units of measure available (ft-lb, in-lb, and Nm);
- A rotating head for easy viewing of the LCD display from any position.
- A fast sampling rate that ensures the wrench will measure peak torque the moment it's reached;
- Track and Peak Hold modes as a standard feature. (In Track Mode the wrench displays real-time torque; in Peak mode it holds the highest measured torque until released);
- Helpful visual and audible indicators: a green light appears and buzzer sounds when the target is reached—a red light appears with intermittent buzzer when it is over-torqued; an audible buzzer helps identify when desired torque target zones are approaching and met. These features are a benefit when working in low light conditions.

The new wrenches are ergonomically designed for user comfort and operate on standard nine-volt batteries. They are manufactured to meet or exceed ASME B107.28. Users also have the option of purchasing Proto Software that allows for full two-way communication between the torque wrench and a personal computer. The software lets users download all data captured by the torque wrench directly into a spreadsheet, either all at once from on-board memory. It also allows for users to control all settings on the torque wrench either from the wrench or computer. The software comes on a CD, and includes a cable for connecting the torque wrench to the computer's USB port. To learn more visit www.stanleyproto.com.

Excel Gears... *Important!*

And Much More!

Precision gears, high-speed spindles, CNC gimbal heads, wind turbines, even gearbox assemblies for battleship gun turrets. That's the breadth of design, build and testing capabilities Excel brings to your company for high speed and high power, with smooth and quiet operation. Gear grinding to AGMA 15 (DIN 2) at 60" external diameters, gear hobbing to 70" maximum pitch diameter. All with our personalized service and guaranteed performance.



Excel seeks wind turbine gearbox builders looking to source in USA



EXCEL GEAR, INC.
A TOTAL SERVICE COMPANY

excelgear.com | 815.623.3414

Seamless Rolled Ring Technology

Our Technology
Used by some of the world's most innovative companies.



AJAX supplies quality rolled rings used in the manufacturing processes of some of the world's most innovative companies.

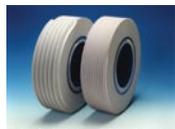
See how Ajax seamless rolled rings drive innovation at ajaxring.com.

AJAX
ROLLED RING AND MACHINE

803.684.3133 | www.ajaxring.com | sales@ajaxring.com

Technical Solutions

Aerospace and Automotive Applications



g Wheels

- Lower grinding forces
- New abrasive blends & bonds
- Lower grinding temperatures
- Increased porosity for higher stock removal



Gear Honing Benefits

- Flank correction
- Reduced operating noise
- Longer service life
- Correction for distortion from hardening process



Hermes Abrasives, Ltd.

524 Viking Drive • Virginia Beach, VA 23452
Toll free phone: 800.464.8314
PO Box 2389 • Virginia Beach, VA 23450
Toll free fax: 800.243.7637



Stahlwille Tools is the ONLY tool company with dimensionally accurate hand tools!



TORQUE WRENCHES

- Super accurate scale designed for industrial applications
- Can be used as a breaker bar with no damage
- Designed to ISO 12 month calibration cycle
- Does not need to be "zero'd" after use
- Interchangeable insert heads



MOBILE TORQUE TESTERS

STAHLWILLE TOOLS NA, SARASOTA FL, 877-548-1617
WWW.STAHLWILLETOOLS.COM

Dealer Inquiries Invited



Professional Tools made in Germany
877-548-1617

Need to improve your windmill production?

Invite a yellow coat.



SANDVIK
Coromant

Your success in focus

www.sandvik.coromant.com/us

THE Gear Works

Ingenuity in Motion™



Wind Turbine Gearbox Repair

Gearbox Repair
Gear Metrology
Gear Grinding to 2600 mm
Industrial Gears
Custom Gearboxes
Turbo Compressor Gears
Machining
Emergency Service
ISO 9001 Certified

Seattle, WA | 206.762.3333
www.thegearworks.com

Converteam, suitable for wind turbines up to 7 MW, presents numerous benefits:

- Best in class power density for a low voltage converter;
- Increases efficiency of the whole system compared to a 690V solution;
- Three level drive, optimises the wave form and dynamic control;
- Ability to keep low voltage while pushing the boundary of low voltage to its maximum capability.

The permanent magnet generator is an integral design including the mechanical drivetrain from Schuler. Converteam's Technology Director Derek Grieve says "The direct drive technology removes the requirement for a gearbox, increasing overall reliability of the wind turbines, especially important for offshore installations. With this new drive train, we demonstrate again the benefits of our full system approach, which in this case has led us to the introduction of the 900V voltage level to the renewables industry."

Converteam delivered its first permanent magnet generators for the Multibrid 5MW wind turbine, now the Areva M5000, in 2004. As a leading direct drive PMG manufacturer Converteam delivered one of the largest direct drive PMG ever built (3.7 MW) to Siemens Wind Power in 2008. With more than 20GW of wind power converters delivered so far, Converteam is the world leader amongst non vertically integrated manufacturers.

Building on over a century of experience, Converteam Group is firmly placed at the leading edge of technology and innovation with a global reputation for excellence in the conversion of electrical energy. Converteam develops and provides solutions built around three core components: rotating machines, drives, and process automation. As the technological and global market leader in metalforming, Schuler supplies machines, production lines, dies, process know-how, and services for the entire metal-working industry. For more information go to www.converteam.com.

NEW VEST-FIBER FACILITY IN MISSOURI

The Missouri Department of Economic Development (DED) announces that Vest-Fiber—a supplier of fiberglass products and services primarily to the wind turbine industry headquartered in Denmark—has chosen Moberly to be the location of a new manufacturing facility. The company's capital investment of \$2 million will create 50 new local jobs.

"The decision by an international company like Vest-Fiber to invest \$2 million and create 50

new jobs is excellent news for the economy of Moberly and Randolph County," says Governor Jay Nixon. "From day one as governor my administration has been focused on creating jobs and moving our economy forward, and I am pleased that we were able to provide the economic tools to help make this project possible. This significant investment by a European company is more clear evidence that Missouri's economy is on the move."

The state of Missouri's incentive package consisted of \$128,318 in Missouri Quality Jobs program incentives, which provides tax credits to companies that create a predetermined number of jobs, among other qualifications, as well as recruitment and referral assistance.

"Having Vest-Fiber select Moberly as the site for its newest fiberglass manufacturing facility is exciting news for the state," says David Kerr, director of the Missouri Department of Economic Development. "This project that involves bringing a company from overseas to north-central Missouri further demonstrates Missouri's commitment to being one of the top states in the nation in which to do business."

Founded in 2000, Vest-Fiber produces fiberglass and materials to the composite industry mainly to applications as wind turbine blades. The company specializes in cutting and kitting multi-axial reinforcement fabrics in glass and carbon fiber; structural foams/core material used in sandwich constructions; non-woven, plastic materials and vacuum bagging consumables; and "ready-to-use" resin infusion net-set kits. The company operates state-of-the-art cutting units that process more than 7,000 tons of fabrics and convert more than 600,000 square meters of core material on a yearly basis.

"In our search for the ideal location, we found Missouri to be the strategic center of all wind-related production facilities in the United States," says Hans Leerskov Hansen, business development manager of Vest-Fiber, adding that the company plans to have the new facility operational by February 2011. "We were also pleased to find the right skills and work ethic available."

Since 2007, the nonprofit The Missouri Partnership has worked in concert with state, regional, and local economic development groups, as well as private industry, to attract new companies to Missouri by marketing the state's business advantages. Through effective branding, advertising, earned media, trade show attendance, and targeted relationship-building, the partnership's team of seasoned economic development and marketing professionals seek to promote Missouri as a top destination for new capital investment and job creation. For more information visit www.missouripartnership.com. ✍

ADINDEX

AJAX Rolled Ring and Machine	61
Availon	BC
AWEA	41
Bronto Skylift	29
CON EXPO-CON/AGG 2011	49
Dow Wire & Cable	7
Excel Gear, Inc	61
Elk River, Inc.	63
Firetrace International	45
Gear Expo 2011	31
Gleason Corporation	IFC
Global Finishing Solutions	17
Hermes Abrasives	61
Pampa EDC	57
Reid Supply Co	1
Rud Chain	11
Sandvik Coromant	IBC, 61
Sotek/Beltrix Industries, Inc.	39
Stahlville Tools NA	2,61
Stor-Loc	4,63
The Gear Works-Seattle, Inc.	61
Trachte	13
windssystemsmag.com	47

Elk River, Inc.
Personal Fall Protection

Soar to new heights with our...

**NEW WindEagle™ LE Harness 62450,
Aluminum TX-12 Flex-NoPac®
Rescue Ring (CSA E6),
Energy-Absorbing
Lanyard 35689, and
*EZE-Man™ Auto Descent
Rescue Device with Hub**

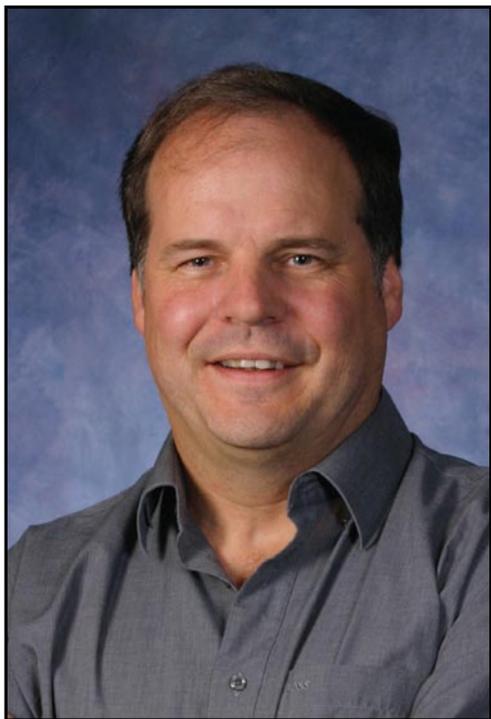
**Professional Training Required*

elkriver.com 800.633.3954

**MAXIMUM STORAGE
in minimum
space**

Stor-Loc
Modular Drawer System

STOR-LOC MODULAR DRAWER SYSTEM
880 N. Washington Ave. Kankakee, IL 60901
Toll Free: 1800.786.7562 • Fax: 1800.315.8769
email: sales@storloc.com
www.storloc.com



HOW DID YOU COME TO CO-FOUND SOUTHWEST WINDPOWER?

Well, I was living on a ranch that was pretty remote, and I was looking for an energy source. I met this guy named David Calley who'd designed a really interesting small wind turbine, and I was impressed with it. So we joined forces and founded the company in 1987 because we saw a need for a small battery charging wind generator that complements photovoltaics in supplying energy to rural areas. At first we were just thinking about remote locations here in the United States, but as I learned more about both wind power and energy resources we quickly realized how helpful this technology would be to communities in need of clean, sustainable energy around the world. In order to grow the company and continue developing our turbine designs we began working with the U.S. Small Business Administration (SBA), which has some great resources for smaller companies that don't have a lot of money to spend in the early stages. With their assistance we were able to develop our Skystream turbine, which really is an amazing piece of equipment. We also joined the American Wind Energy Association (AWEA) and became pretty active in supporting the industry and helping spread the word about wind power. I became something of an advocate, in fact, and was eventually named chair of AWEA's Small Wind Committee. I be-

gan traveling a lot, too, and so far I've visited more than 70 countries helping educate people about the benefits of harnessing the wind, at the same time identifying distributors to make this technology available at the local level.

DID THIS WORK PAVE THE WAY TO YOUR RECENT APPOINTMENT TO THE U.S. DEPARTMENT OF COMMERCE'S RENEWABLE ENERGY AND ENERGY EFFICIENCY ADVISORY COMMITTEE (RE&EEAC)?

I'm sure it played a role, especially since I'm such a fan of the SBA and benefited from my involvement with them and other governmental agencies. But I saw it as an opportunity to help achieve a number of goals that will benefit the wind industry at large. As I see it our mission on the committee is twofold. Back in the eighties, before the standards we have today had been established, there were a lot of products on the market that didn't quite live up to their claims or meet the needs of the end user. Not to cast aspersions on anybody, but manufacturers need to have benchmarks in place to level the playing field, and also to protect customers. So the continued development of standards for the turbines developed for small and community wind is one of our priorities. The other is directly connected to this standardization of the products we're manufacturing here in the U.S. but it has more of an economic thrust. We want to continue educating people around the world about the benefits of utilizing renewable energy sources such as wind, so we need to make sure that the products we're providing to them actually work. They've got to be reliable, simple to set up, operate, and maintain, and also to produce the expected energy volume. I don't think a lot of people here in the States realize that a vast number of countries use fossil fuel to generate the electricity they need, so they're victims of the highly variable prices associated with those sources. Helping them break that grip will lead to more stable economies and a whole host of related benefits that don't have a negative impact on their surrounding environment. We also want to make sure that the types of wind turbines we design are suited to the location in which they'll be operating. So we'll be focusing on education, quality, safety, and building on our U.S. export capacity. I'm really honored to have this opportunity to share what I've learned about wind energy over the past 25 years to the benefit of the industry both here and abroad, and also to be able to work with such an accomplished and knowledgeable group of individuals. There are 29 people on the committee representing U.S.-based companies, trade associations, and private-sector organizations, so I'm looking forward to learning from them as well. ✌

Southwest Windpower's Web site is www.windenergy.com. Visit the DOC at www.commerce.gov.

Capture the full potential!



Invite a yellow coat.

The wind power business is growing rapidly leading to new metal cutting challenges. As a Sandvik Coromant partner, you can always rely on a specialist nearby, focused on your success. Smart solutions for every component; from the base of the tower to the blade.

24-hour delivery of premium tools to almost every corner of the world is only one promise. Measurable results on the bottom line is another. Let's optimize your potential together!

Call 1-800-SANDVIK (1-800-726-3845) to talk to a Sandvik Coromant representative near you.

Think smart | Work smart | Earn smart



Your success in focus



**SAME SERVICE
NEW NAME**

*SSB Service
is now Avilon.*

Finding a team of experts to which you can entrust your turbines is vital. By listening to your issues and concerns, Avilon understands that availability and efficiency are key drivers of your financial success, and that having a partner is preferable to simply having a vendor.

We understand because we listen.

CONTACT US: partsUSA@avilon.com | 515-986-9101 | avilon.com



AVILON
UNITED WIND SERVICE

WE LISTEN.