

# North American Clean Energy

[www.nacleanenergy.com](http://www.nacleanenergy.com)

## Wind Power Site Selection

A complex tapestry of factors

## Quality O&M Services Maximize Commercial Solar ROI

## New Technologies for Training

## Solar Plus Storage

The hottest energy trend in the club

## 2016 BIOPOWER Buyers Guide

### Plus Show-in-Print Features:

- Solar Power Southeast
- Solar Power Southwest
- WINDPOWER 2016





 **B**oT™ > **B**alance on **T**racker™ >

You bring the glass and labor...  
we'll provide the rest.



Shoals offers a complete Balance on Tracker solution, including:

- NiceTrack®
- Combiners
- Shoals Interconnect System®
- SnapShot® Monitoring



**shoals**®  
technologies group



# Experience. Manufacturing. Results.

Structural solar solutions, engineered to reduce cost and complexity for your project.

## PVcobra Fixed-Tilt

The PVcobra fixed-tilt system was designed to be durable, low maintenance, and rapidly deployed in the field. Engineered with structural light gauge steel and using only five components, this mounting system is one of the simplest structures to build on the market. The PVcobra has an extremely low material cost, while remaining incredibly robust to protect your solar investment.

## Sol Components

Our dedicated team of sales professionals, in-house engineering expertise, and over forty years of roll formed steel manufacturing deliver unparalleled project support at every level of the design, procurement, and delivery process. Sol Components has the expertise to provide turnkey project support from hardware optimization to complete power plant design.

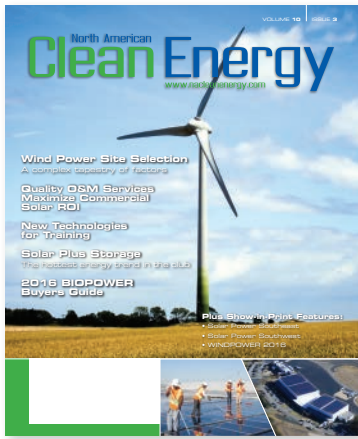


**SOLComponents**  
A CEMCO AFFILIATE

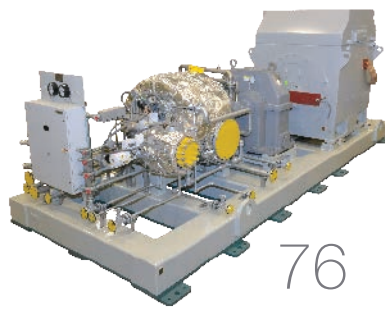
[www.solcomponents.com](http://www.solcomponents.com)

1-855-278-3444





# contents



## On our cover...

Maxwell Technologies' ultracapacitors are installed in more than 46,000 wind turbines around the world to provide energy storage and power delivery for wind turbine pitch control. The ultracapacitors also help stabilize short-term power output fluctuation in wind farms and cabling in large-scale deployments, such as the world's first megawatt-scale ultracapacitor-based wind farm energy storage system from China Guodian Corporation.

**Maxwell Technologies**  
www.maxwell.com

## departments

- 6 Newsbites
- 8 Top story
- 10 Wind power
- 22 Wind product spotlight - Safety & Fall Protection Equipment
- 24 Solar power
- 40 Solar product spotlight - Batteries
- 46 Solar Power Southeast
- 47 Solar Power Southwest
- 48 WINDPOWER 2016
- 64 Investing in clean energy
- 66 Energy storage
- 73 2016 Biopower Buyers Guide
- 78 Events Calendar

- 8 Solar on Landfills  
*The next frontier for sustainability*
- 10 Wind + Solar  
*A complex tapestry of factors*
- 14 Life Time Extension  
*How to maximize the return on investment*
- 16 Lidar  
*The key to improving wind farm drought tolerance*
- 18 Connecting Doubly Fed Inductions Generators to the Grid  
*Using an optimal crowbars solution*
- 22 Wind product spotlight:  
*Fall Protection & Safety*
- 24 Quality O&M Services Maximize Commercial Solar ROI

- 28 Bridging the Gap Between Solar Companies and Utilities  
*Lessons learned from the Japanese solar market*
- 30 Residential Solar Panels  
*To buy or not to buy*
- 32 New Technologies for Training
- 34 Solar Spring Break  
*Pairing college students with industry workforce training through tribal installations*
- 36 The Rise of Mainstream Residential Solar
- 40 Solar product spotlight:  
*Batteries*
- 46 Show-in-Print:  
*Solar Power Southeast*

- 47 Show-in-Print:  
*Solar Power Southwest*
- 48 Show-in-Print:  
*WINDPOWER 2016*
- 64 Solar in the Northeast  
*A new beginning*
- 66 The Key to a Successful Energy Storage Project  
*The proper selection of a system integrator*
- 68 Solar Plus Storage  
*The hottest energy trend in the club*
- 70 Will it Recycle?  
*What you need to know about battery recycling*
- 72 Beyond Batteries  
*Why software is the key to energy storage*
- 73 2016 Biopower Buyers Guide

North American  
**Clean Energy**  
www.nacleanenergy.com

MAY/JUNE 2016  
Volume 10, Issue 3

### EDITOR

Jill Walters  
editor@nacleanenergy.com

### ART DIRECTOR

Chris Van Boeyen  
production@nacleanenergy.com

### SALES MANAGER

Ian Stuart  
istuart@nacleanenergy.com

### SALES

Dave Benton  
dave@nacleanenergy.com

Don McIntosh  
dmcintosh@nacleanenergy.com

Quinn Stuart  
quinn@nacleanenergy.com

### CIRCULATION MANAGER

Kristy Vail  
circulation@nacleanenergy.com

### ACCOUNTING

Alison Bell  
abell@nacleanenergy.com

### PUBLISHER

Ian Stuart  
istuart@nacleanenergy.com

**255 NEWPORT DRIVE, SUITE 336**  
Port Moody, B.C. V3H 5H1  
Phone: (604) 461-6223

North American Clean Energy (USPS 1370) is publishing bi-monthly and distributed free by Action Media Ltd. Periodicals postage paid at Henry, IL. POSTMASTER: Send address changes to North American Clean Energy at 515 University Ave. Suite 1, Henry, IL 61537. Subscription updates can be made at circulation@nacleanenergy.com.

North American Clean Energy accepts no responsibility or liability for reported claims made by manufacturers and/or distributors of products of services; the views and opinions expressed are those of the authors and not necessarily those of North American Clean Energy. No portion of this publication may be reproduced without the permission of the publishers.

Editorial, Advertising, Production and Circulation are at 255 Newport Drive, Suite 336, Port Moody, B.C. V3H 5H1 (604) 461-6223. Subscriptions: \$48 per year outside North America. Email: circulation@nacleanenergy.com



Printed on paper with 90% recycled fiber.

**SIGN UP FOR YOUR  
FREE SUBSCRIPTION**

Go to website  
for new subscriptions,  
renewals, or  
change of address

**NACLEANENERGY.COM**

Information will remain strictly confidential.



*We've got you covered.*

**baja** CONSTRUCTION CO. INC.™



**Everything You Need for Success: High-Quality Results, Cost-effectiveness, & Power**

Baja Construction Co. Inc. specializes in designing, engineering, supplying, and installing high-tensile, light-gauge *Solar Support Structures*, an innovative and lucrative alternative to traditional rooftop applications.

Our custom-designed solar projects are tailored to optimize our clients' specific structural objectives for commercial, municipal, and residential developments, allowing our clients to provide highly versatile assets to their end users.

After 31 years in business and over 130 MW installations nationwide, our expertise in solar projects can include, but are not limited to, Solar Carports, Ground-Mounts, and RV/Boat Storage as well as Solar/EV Charging Stations and Mini Storage.

Executing a  
"Turnkey" Approach  
for all Projects

Customization with  
our In-House  
Team of Engineers

Over 130MW  
Installations  
Nationwide



**THIS PAST EARTH DAY, APRIL 22, MARKED A SIGNIFICANT MILESTONE** on our path to a more sustainable energy future. The leaders of 175 nations came together in New York City to sign the Paris Agreement at the United Nations headquarters, confirming their commitment to slow the rise of greenhouse gases and limit their countries' carbon emissions. While this is only a first step towards making the deal a reality, it is a step in the right direction.

On a more tangible level, renewable energy is hitting its stride as the one-millionth U.S. solar installation goes online in May. What took 40 years to achieve, is anticipated to double in the next two years, adding another one million solar installations, and growing more than 119 percent to add 16GW in 2016 alone.

And it doesn't stop with solar. The Office of Energy Projects, in their Energy Infrastructure Update reported installed capacity for both new build and expansion power generation achieved 29MW from hydropower, 33MW from biomass, 522MW from solar, and 707MW from wind in the first quarter of 2016. In contrast, new generating capacity for natural gas was only 18MW, and there has been no new in-service generation in coal, nuclear, or oil sectors so far this year.

Innovators in the renewable energy industry are using their creativity to come up with ways to breathe new life into some of the old dump sites and relics of our fossil fuel dependent society. For example, the Nanticoke Generating Station on the shores of Lake Erie, was once the largest coal-fired power plant in North America. At full capacity, it was capable of producing 4,000MW, but it was shut down in 2013. The site is now being redeveloped into a 44MW solar farm with construction beginning in 2017 and operation commencing in 2018-2019.

Out-of-the-box thinkers around the country are looking around them and seeing possibilities for renewable energy generation where before there was only waste. In Massachusetts, a 1.5MW solar array has been completed on a local landfill, (*see our article on page 8*). Moves like these provide a use for uninhabitable land and not only produce clean energy, but also help to diminish the environmental impacts of the sites.

These same types of thinkers are looking at business-as-usual and noticing it's not necessarily working for the new generation of industry professionals. They are developing opportunities for hands-on learning outside of the classroom (*see our article on page 34*), and training methods more suited to the way these individuals learn (*see our article on page 32*).

As we head into the season of conferences and exhibitions, we will have plenty of opportunities to hear from innovators, thought leaders, and industry professionals. I hope we will all contribute to the conversation. We will hear stories of where the industry was when it started, how far it has come, and how far it still has to go. It's already been one heck of a ride, and I, for one, am looking forward to where the road is taking us.

Enjoy the read!

*Jill Walters*



Photo by Ian C. Davis



©Solar Impulse

### Circumnavigating the globe without fuel

In silence, without using a drop of fuel, but with much wonder in the eyes of hundreds of enchanted supporters, Solar Impulse 2 (Si2) left Hawaii on 21 April at 6:15 am local time and landed at the Moffett Airfield on 23 April at 11:44 pm local time, completing the crossing of the Pacific Ocean with several world records. Using 17,248 solar cells to power its four lithium batteries which, in turn, power the aircraft's four motors and propellers, Si2 is the first solar airplane capable of flying day and night powered only by the energy of the sun. By attempting the first solar flight around the world, pushing back the boundaries of the possible, and taking on a project deemed impossible by industry experts, Bertrand Piccard and André Borschberg want to support concrete actions for sustainability and show that the world can be run on clean technologies.

**Solar Impulse** | [www.solarimpulse.com](http://www.solarimpulse.com)



### The endless ride

The concept of a drive that can turn any normal skateboard into an electric board is absolutely unique. Mellow's compact electric drive can be mounted on any skateboard within minutes. At the beginning it was just the search for the Endless Ride, that drove the team, all boardsport enthusiasts, forward. The possibility to enjoy the riding pleasure of surfing and snowboarding every day within the city. But quickly it became clear, that a compact electric vehicle, with such high quality standards has potential to change the way we think about urban mobility.

**Mellow** | [www.mellow.com](http://www.mellow.com)



### Magnetizing America's first offshore wind farm

Engineers at GE's Power Conversion business in Nancy, France, designed an innovative 6-megawatt direct-drive generator — one of the largest ever built — equipped with a permanent magnet rotor. The generator weighs 150 tons, measures 7.6 meters in diameter and sits hundreds of feet above the waves. It draws rotational energy from a giant GE wind turbine called the Haliade and converts it into electricity. The combo's very first commercial application will be at America's first offshore wind farm that's currently being built near Block Island, Rhode Island. Together they will produce enough electricity to power 5,000 American homes.

**GE Renewable Energy**  
[renewables.gepower.com](http://renewables.gepower.com)



highest module density  
fastest installation  
zero scheduled maintenance  
proven reliability

DuraTrack<sup>®</sup> HZ

best

LOWEST

LEVELIZED COST OF ELECTRICITY

period.

With more than three gigawatts of solar installed, Array's DuraTrack HZ trackers are field proven to be the fastest to install and the most reliable, resulting in the lowest levelized cost of electricity. Now the revolutionary DuraTrack HZ v3 design features zero scheduled maintenance and the highest module density of any system on the planet. Put the innovation and power of Array Technologies in your next installation.

sales@arraytechinc.com | 1.855.TRACKPV | arraytechinc.com







# Solar on Landfills

## The next frontier for sustainability

by Rob Jackson, PE

Imagine standing in a field. The sun is bright, and as far as the eye can see in every direction, there are hundreds, maybe even thousands of black, glossy panels standing upright in parallel rows, taking in the sun's rays. The subtle beauty of a solar field can be a breathtaking reminder of the clean energy being produced and our commitments to environmental sustainability.

Now, imagine below the grass lie mounds upon mounds of garbage. That's right, the solar field is on top of a landfill. Does the scene still seem as glorious? It should.

Though improvements in energy efficiency have made a significant impact, overall energy demand has continued to rise, and the need for new and innovative ways to generate power is higher than ever. At the same time, questions arise of where to install new generation facilities in densely populated areas, and what can be done with brownfields and landfills where residential and commercial construction is impractical?

In response to these growing needs, turning brownfields to brightfields by installing solar panels is a practical solution gaining popularity across North America.

According to the US EPA's Repowering America's Land Initiative, US solar installations on landfills and brownfields have increased from producing no MWs in 2006 to 173.2MW in 2015, and many more of these facilities are being considered every day as a potential solution to our energy challenges. According to the EPA's Repowering America website, there are currently at least 200MW of solar on landfill projects in the queue, although actual figures may be even higher.

### Site-specific questions to assess

When identifying a brownfield or landfill as a potential solar site, there are a number of key qualities developers should look for. First and foremost, the best candidates for such a project are closed, or capped, locations. From a logistical perspective, developers don't want to deal with additional remediation or closure efforts to the existing landfill site, as these will prolong the entire process and necessitate a greater amount of work, which can become costly.

Evaluating the topography of the proposed site is another key factor. Details such as the intensity of slopes on the landfill and level of undulation require a fair degree of consideration. Experts agree flatter land is always preferable, and makes these sites more attractive, allowing developers to fit a maximum quantity of solar panels in the area. In addition, flatter surfaces reduce the amount of shade between panels and between rows, optimizing energy production.

The age of the landfill is also a significant criterion, since settling can be a concern over time. If a site was filled primarily with construction debris and waste which doesn't decompose, age is not so much of a factor, as long as the underlying soil can support the weight of the solar structures on top. But in the case of municipal solid waste landfills, the grounds may still produce methane gas or other types of waste, which could be potentially harmful to anyone working on or surveying the surface of the installation. Newly closed landfills still have years before they settle, giving the waste enough time to fully decompose. While there's no universal standard, the rule of thumb in these cases, is the best candidates are those that have been closed for 20 years or more.

At the outset of every such project, it is crucial to develop a robust engineering analysis to evaluate any potential issues, such as the effects of stormwater on the land and other geotechnical considerations.

### Permitting challenges

Developing such a facility is not without its challenges, and there are a number of permitting and technical requirements which must be met prior to installation. No matter where a project is planned, permitting is not an easy task, and it is a best practice to have all documentation in place well before construction, while adhering to all record-keeping guidelines.

Ease of permitting can fluctuate depending on the region of the proposed installation. In regions with higher population densities, such as New England and the West Coast, the lack of open land for new projects adds greater pressure to re-purpose existing sites. There's also greater potential benefit, as many municipal utilities look to supplement generation rather than import it from hundreds or thousands of miles away. The review processes in these regions are often among the most stringent, and dual pressures and opportunities often lead to "first-of-their-kind" projects repurposing limited land resources. In these cases, significant documentation is typically required, and consultants with deep local relationships are mission critical to keep projects moving forward and on schedule.

However, even in areas where there are relatively short permitting forms for developers to complete, the process still entails numerous discussions and meetings with environmental regulators. It's never just as simple as a developer filling out an application, dropping it off, and moving forward without additional boundaries. Logistically, developers must leverage relationships and technical expertise to ensure the project comes to fruition in a timely and cost-effective way.

### The big brightfield picture

Hybrid projects such as these are extremely important to maintaining an adequate energy generation output, and they allow developers to reuse land that would have otherwise gone to waste. Repurposing these sites contributes to environmental sustainability efforts, and discourages the wasting of resources by offering solutions to maximize the value of a given location. In addition, these conversion sites create jobs and provide educational opportunities for all those involved. Most importantly, however, these sites generate significant financial savings, and provide clean energy to local communities.

*Rob Jackson, PE, is the national market director for solar power, TRC Companies, Inc.*

**TRC Companies, Inc.** | [www.trcsolutions.com](http://www.trcsolutions.com)





# WHEN WE SEE A GAP, WE FILL IT.

Maybe it's an Iowa thing, but instead of talking about America's skills gap, we work to fix it. That's why we've ramped up our STEM education. Why our universities prepare the engineers that are in such demand. Why our research institutions pump out advances that give advanced manufacturers an edge. And why Iowa has developed a network of community colleges that align curriculum to the specialized needs of our companies, and make Iowa workers more productive. Learn more at [iowaeconomicdevelopment.com](http://iowaeconomicdevelopment.com). And see how Iowa works for business.



[iowaeconomicdevelopment.com](http://iowaeconomicdevelopment.com)



[blog.iowaeconomicdevelopment.com](http://blog.iowaeconomicdevelopment.com)



[iowaeconomicdevelopment](https://www.facebook.com/iowaeconomicdevelopment)



[businessiowa](https://twitter.com/businessiowa)



# Wind + Solar

The benefits of using a hybrid system by Arjun Gupta



Despite a crash in the prices of conventional fuels, global investment in renewable energy hit a record high last year. According to a report from Bloomberg New Energy Finance, nearly \$329 billion was invested in clean energy technologies in 2015. Of that investment, \$67.4 billion went to small-scale and rooftop projects, proving that an increasing number of customers are using distributed generation (DG) as a way to meet their energy needs.

With the declining cost for both solar and wind technologies driving much of this change, prospective buyers are left to consider which system will perform best, solar or wind?

In a number of cases, however, a “hybrid” energy system combining both solar and wind can offer significant advantages over a system comprised of only a single technology. In deploying hybrid systems, consumers can overcome the intermittency challenges associated with renewables to ensure a more secure, and consistent power supply at their location.

## Wind vs. solar

A natural, inverse relationship exists between the sun and wind. When the sun is shining, the wind is often not blowing, and vice versa. The most obvious difference occurs in the daily cycle: it’s sunny during the day, while it tends to be windier during the evening. Depending on the location, solar and wind will peak in their power production at different times during a 24 hour cycle. However, this negative correlation also exists between seasons. In the winter, when shorter days reduce the production of solar PV panels, the production offered by a wind turbine can help keep a more reliable power supply. In short, the long days of summer are ideal for relying on production from a PV array, while the higher wind velocities during winter allow users to benefit from generation from a co-located wind turbine.

**CEC**  
Civil & Environmental Consultants, Inc.

CEC provides engineering, surveying, environmental, and ecological services for development or expansion projects. Let CEC coordinate with land owners, agents, utilities, and regulatory agencies, and help oversee completion of the design through implementation in the field.

Our federally approved bat surveyors and wildlife biologists maintain an excellent rapport with numerous U.S. Fish & Wildlife Service regions while always serving as advocates for clients.

Visit us at Booth #5114 during the AWEA WINDPOWER 2016 Conference!

Learn more: [www.cecinc.com](http://www.cecinc.com)

## The role of energy storage

For greater reliability, many developers are also incorporating advanced energy storage into hybrid systems. These “microgrid” solutions are ideal for clients who are looking to enhance their energy reliability beyond what’s available from the grid, or for clients who live in areas where the grid is simply not available. Adding storage increases the security of the renewable energy system because energy that is not used immediately can be stored for later use.

Currently, the majority of microgrids in North America are installed at universities, hospitals, military bases, and other areas requiring energy security for critical loads in the event of an outage. However, microgrids can be useful to a variety of customers, including:

- *Remote telecommunications sites:* These sites are one the largest markets cost savings through distributed microgrids. As the mobile and smartphone markets continue their robust growth, the demand for secure power for these sites is also increasing. Often located in remote, hard-to-access regions and relying almost exclusively on imported diesel fuel for energy, telecommunications towers make ideal candidates for the autonomous, clean, and reliable energy of distributed microgrids.
- *Commercial buildings:* For organizations requiring a constant and secure energy flow, hybrid microgrids reduce the costs associated with business interruption in the event of extreme weather or a utility grid outage. This is especially true for facilities like IT data centers, grocery stores, or manufacturing facilities. Using a combination of energy production and storage options, individual buildings can operate as their own power suppliers without a need for nonrenewable generation.
- *Remote Island Communities:* Similar to telecoms, many remote island communities rely on imported diesel and other fossil fuels. The inherent volatility in the price of this fuel can be make managing energy costs difficult. With hybrid microgrids, energy managers in these communities can lower cost their costs while increasing their independence.

What was once a niche market focused on off-grid or backup power supply has become one that provides benefits to an increasing number of customers. By incorporating generation from two sources, customers able to consistently consume the energy they use closer to where it is produced. With the maturity of storage technologies, their applications for use is increasing, and greater deployment of grid tied and off-grid hybrid wind and solar systems can be expected in the future.

*Arjun Gupta is an NABCEP Certified PV Installation Professional and senior system design engineer at UGE International.*

**UGE, Inc.** | [www.ugei.com](http://www.ugei.com)





# E-RAD BLU

SETTING THE STANDARDS... **HIGHER** 



visit TORKWORX



## simplifying **TORK**

### SOLUTIONS AVAILABLE

- DIGITAL TORQUE CONTROL**  
 The leading electronic torque control system in the Wind Industry assembled for your WTG.
- ONSITE BOLTING SERVICES**  
 Expertly trained controlled bolting technicians available for all your maintenance needs.
- WTG SPECIFIC TOOLING PACKAGES**  
 Our experience with all the major WTG OEM's delivers cost effective & efficient bolting systems.
- CALIBRATION AND REPAIR SERVICES**  
 Complete in-house facilities to handle all your tooling repair services no matter the make or model and calibration services to ISO17025 standards.

## THE FUTURE OF ELECTRONIC DIGITAL TORQUE CONTROL THAT WORX FOR YOU TODAY

The New ERAD BLU electronic torque control systems are engineered and manufactured for maximum durability and performance. The world's most advanced electronic pistol grip stall type torque tool ever produced. Designed to provide continued accuracy and repeatability using the RAD legendary gear box design and the precision of electronic motor. Capable of collecting torque data, measuring torque / angle in a single consistent cycle and accurate to +/- 3%.

Using advanced technology only available from the RAD torque system insures maintenances are done accurately and efficiently in the most cost effective method. Includes a touch screen interface for simplified usability along with pre-set torque and angle capability.

- 2" X 3" Touchscreen Interface
- Multiple Torque Guns per Controller
- Torque and Angle Feature Standard
- Bluetooth Calibration
- Advanced Data Collection
- Password Protection
- Preloaded WTG Specific Presets

Contact TORKWORX today for a complete detailed WTG specific bolting package for your maintenances.

Extreme Bolting Working Solutions can be found at [torkworx.com](http://torkworx.com) or at 888-502-WORX.

Visit TORKWORX at PowerGen 2015 in Las Vegas at Booth 1537!







# Wind Power Site Selection

## A complex tapestry of factors

by Timothy L. McMahan

**A CONVERGENCE OF PUBLIC POLICY, MARKET FORCES, ENVIRONMENTAL IMPERATIVES,** and technological innovation are transforming the nation's electrical grid. It's becoming increasingly clear that litigation over the Clean Power Plan, a proposed federal agency rule which would reduce carbon emissions from U.S. power plants, is a "side show" in a much bigger evolution of the energy industry. This is particularly true in the western states. In addition to the Clean Power Plan, embraced by Washington, Oregon, and California policymakers and utilities, both California and Oregon have now codified 50 percent renewable portfolio standards for major electrical utilities, and the expansion of the California ISO to include utilities throughout the western states in a regional energy imbalance market will likely spur strategic investments in new wind energy development.

These transformative forces indicate new utility scale wind energy site selection and development opportunities are on the march. Site selection involves a complex tapestry of factors that transcend purely commercial transactional imperatives. In fact, poor site selection and opposition can quickly become significant commercial impediments. Key among these factors is the potential for local project opposition. While often painted with the broad brush of "NIMBYism," project opposition is complex and potentially fatal, and should not be brushed aside by characterizing all opponents as obsessed with views from the backyard barbecue. With new opportunities for wind energy development, and commercial and policy drivers which may accelerate project siting, let's take a fresh look at siting best practices.

### The "easy" sites; new challenges

"Easy" wind energy sites are locations where there are few homes nearby (especially really nice homes, with territorial views), no sensitive habitat, or sensitive wildlife (including avian) species, few wetland areas or stream crossings, and preferably no significant conflicts with high value agricultural and other rural natural resource uses. And of course, minimal interference with air traffic, military training flights, or military radar. And very close proximity to major high voltage transmission substations. And no-to-minimal risks to Native American cultural resources or sites. And no major engineering or constructability impediments. Not to mention the development of federal lands has not quite panned out as promised.

Which is all to say, at least outside of the mythical Texas, there are fewer "easy" sites, and siting energy facilities almost anywhere involves trade-offs, negotiations, and balancing of legal risks and environmental impacts. In areas having experienced substantial wind energy development in recent years, such as the Columbia River Plateau and California wind generation areas, the list is a bit shorter. Moreover, in recent years, in addition to battling residential opposition, those of us in the trenches permitting wind facilities, and defending them in litigation, have encountered intense real and perceived natural resource conflicts between wind generation and natural resources. These include risks to golden eagles and other raptors, sage grouse, and even seasonal habitat ranges for highly managed big game species.

### The value of predictability

Energy facility developers are typically willing to pay for a predictable permitting climate. Few experiences are as unnerving as seeking a discretionary local land use permit from elected officials, who essentially act as judges in conducting hearings and making permit

decisions, and walking into a hearing room packed with opponents; local citizens who know the decision-makers. The traditional conditional use permit, typically devoid of objective criteria, essentially asks an applicant to demonstrate uses such as churches, schools, and home-based industries should be allowed as an exception to the zoning code, subject to conditions. A key, mandatory finding for most conditional uses is the use will be "compatible" with and "similar to" adjacent and surrounding uses, and will not unduly "interfere" with existing uses. Energy facilities, including wind energy facilities, are typically considered as a conditional use, using the clumsy tools typically used to consider much simpler proposals.

Such development codes are not a good fit for wind energy facilities, and invite opposition and obstruction. These codes are often at odds with the consideration of natural resource and environmental impacts. In other words, to avoid view shed-issue opposition, projects are often proposed in locations with potentially significant wildlife and habitat impacts. Depending on the perspective of local and regional state and federal wildlife agencies, rather than view shed opponents, agencies with environmental expertise may negatively comment or even oppose projects, posing risks of delay as well as commercial risks. It need not be so.

### Gaining predictability

Wind energy developers are skilled at pre-application due diligence. In states having applicable environmental regulations, such as CEQA in California and SEPA in Washington, as well as state siting councils, and where federal agency jurisdiction is triggered, pre-application biological surveys are standard, with well accepted and understood methodologies

### **Industry-sponsored land use plan and zoning amendments have established the following criteria-based approaches to permit compliance:**

- Advance, programmatic review of environmental and natural resource impacts, with acceptable, well understood frameworks for mitigation;
- Presumptive levels of non-significance for visual impacts, such as 1-mile turbine tower setbacks and/or 4X turbine height setbacks;
- Accounting for the presence of locally and regionally significant visual and scenic resources as bona fide issues for consideration (this focus diminishes the effect of "NIMBY" opposition and emphasizes issues of broader community concerns). Mitigation strategies may then be formulated;
- Presumptive findings of no impacts for issues such as shadow flicker and alleged health impacts;
- Acceptable operational noise thresholds, based on well-understood levels of substantial annoyance vs. specious claims of health impacts;
- Presumptive deferential findings of no significant impacts based on wildlife agency confirmation, and similar deferential findings based on tribal and state historical resource agency consultations.

*These and other criteria-based, objective codes are only adopted in an open, public legislative processes, and establish a clear, reliable permitting framework where compliance with criteria is presumptive for permit issuance.*



and parameters. These surveys are helpful in site selection as well as permitting facilities. Sometimes, they result in project modification and avoidance measures, and can even signal a site is too risky to develop. Newer natural resource issues, such as the potential impacts on critical winter range habitat for deer and elk, can usually be addressed through siting modifications and mitigation, such as habitat enhancement. In areas with a rich history of Native American occupation, prudent developers engage skilled cultural resource consultants.

Most cautious wind energy developers also cast a leery eye at residences with territorial views of the project site, mindful of potential opposition. What is surprising, however, is the level of opposition from those homeowners who may live miles from the site, and those who place high value on the ability to recreate in places that are often miles from the site. Out-of-town developers may be caught "flat footed" in perceiving these risks, and in developing strategies to address them.

Setting aside the quantifiable impacts of noise, the scientifically debunked theories of health impacts, and annoyance issues related to shadow flicker, the best strategy to address residential opposition to wind energy facilities is proactive engagement, including careful due diligence in investigating local attitudes about visual impacts. Visual impacts from individual residences should be considered separately from community-based concerns related to recreation areas and known scenic resources, such as viewpoints and historic monuments. This investigation should occur as a top-priority consideration in site selection, along with other high-priority issues.

In addition to identifying landowners needing a visit, early due diligence opportunities exist to seek and achieve amendments to locally adopted land use plans and zoning codes. Ideal local land use and environmental codes dictate accepted, objectively established levels of impacts, and clear, objective permit criteria. Compliance with criteria means presumptive permit issuance, with no room for political outcomes. There is no legal impediment to seeking and achieving code amendments establishing objective criteria and thresholds to address visual impacts (e.g. distances from development sites) within which facilities can achieve code-based findings of compliance. Moreover, focusing early on the sufficiency of the local permit process provides a valuable opportunity to engage in discussions with local land use planners and elected officials, where a developer can gain valuable knowledge of particular risks.



Absent substantial and inflexible commercial deadlines, putting these questions to the community in the form of land use plan and zoning code amendments prior to filing development permit applications is usually preferable to dealing with the strident opposition and political pressure that can arise in the traditional conditional use permit setting. In settings judged to be at high risk of visual impact opposition, various strategies and criteria can be fashioned to allow a predictable path to permitting. From the perspective of a criteria-based permit code approach, data available from "zone of visual impact" studies and visual simulations are on par

with biological surveys in aiding decision-makers in making objective findings of compatibility with surrounding land uses that balance impacts in a legally defensible process, leaving little room for litigation-based obstruction.



*Timothy L. McMahan is a partner at Stoel Rives, LLP where he practices in the areas of energy, land use, real estate development, environmental, and municipal law.*

**Stoel Rives, LLP** | [www.stoel.com](http://www.stoel.com)

## Perfect control for the maximum amount of energy generation



Bonfiglioli is a leading provider of complete packages for the wind industry that seamlessly control energy generation, from rotor blade positioning with a pitch drive to nacelle orientation with a yaw drive. Working closely with customers, Bonfiglioli designs and manufactures a series of specialized wind turbine gearboxes and inverters that deliver reliable, superior performance.

**Bonfiglioli USA**  
3541 Hargrave Drive Hebron, Kentucky 41048  
Tel. (+1) 859 334 3333 - Fax (+1) 859 334 8888  
[www.bonfiglioliusa.com/wind](http://www.bonfiglioliusa.com/wind)

 **Bonfiglioli**  
power, control and green solutions



## The most reliable satellite Internet value under the sun.

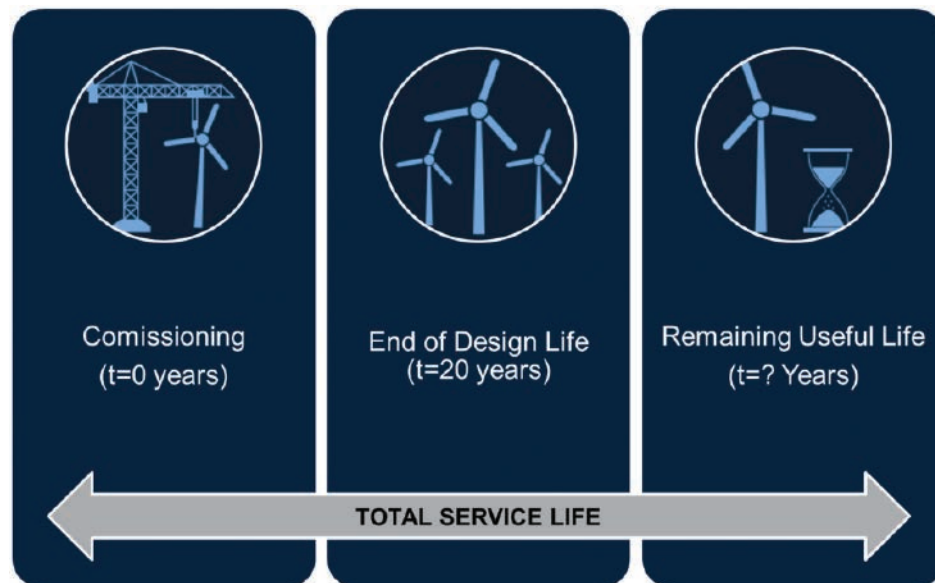


### Introducing affordable Internet data plans for the renewable energy industry.

Whoever said there's nothing new under the sun hasn't seen Skycasters lately. Our broadband satellite Internet plans for the renewable energy industry give you a better connection at a better price—so you save money from the get-go. You also save money by enjoying maximum uptime on the job. For 15 years, Skycasters has provided a premium, low-latency connection and guaranteed speeds that support all your data and communications needs—SCADA, VPN, VoIP, email, fax, streaming data and more. And it's all backed by service and support from a U.S. company that owns and operates its own infrastructure. **Call Skycasters today at 1-800-268-8653** for an Internet connection you can rely on in the field—no matter where that is.



[skycasters.com](http://skycasters.com) • 330.785.2100 • 800.268.8653 x127



## Life Time Extension

### How to maximize the return on investment

by Ing. Santiago Lopez

For a long time the wind industry has generated profit through manufacturing and project development. Once commissioning is achieved, the value must be kept or, if possible, increased. But what will happen to wind turbines soon reaching the end of their design life?

There are a large number of wind turbines operating globally. By the end of 2014, there was an installed capacity of approximately 370GW, compared to 159GW at the end of 2009. Thus, for at least 43 percent of the fleet, life time extension (LTE) will be applicable soon, with predicted strong growth as all wind turbines will eventually reach the end of their design life.

Extending the operation of a wind turbine equates to increased revenue, which is gaining significant importance in the established wind installation markets. LTE also incorporates potential challenges that may lead to higher O&M costs and an increased risk of structural failures, which are more likely associated with additional cost, also considering the corresponding safety risks. On the contrary, the alternative is to decommission the turbine at the end of its design life, which will not deliver additional financial returns.

Theoretically, any wind turbine can be operated for an unlimited period of time if adequate maintenance is provided, even beyond its assumed life time of 20 years. One example for extending the normal design life is to replace damaged components. Armed with the most expertise about “Remaining Useful Life” (RUL), engineers apply detailed cost modeling to develop and evaluate a range of different lifecycle strategies.

#### The immediate benefits include

- Optimize Asset IRR: detect site-specific turbine component lifecycle, identifying long-term value of the asset;
- Optimize Project Financing: reduce risk in the financing or re-financing process, allowing longer and more comfortable debt return periods with less risk for the financing entity;
- Identify Weak Components: detect the weak component and adjust maintenance, reducing the costs of O&M;
- Optimize Operation: evaluate if an investment in maintenance / retrofits / load optimized operations will have an adequate return, detecting the risk of failure for other main components;
- Extend Cash Flow: extend turbine life based on turbine and site-specific conditions, maximizing the long-term value of the asset.

Currently there are two methods applied within the industry to calculate the RUL: analytical and/or practical.

The analytical component is to calculate the RUL with the aid of mathematical models. This mathematical analysis can be based on completely new calculations or by updating





### Battery nut runner

A small and light battery nut runner with torque capabilities up to 4,000 Nm (2,950 ft\*lbs), the ADS-3 developed by ITH Bolting Technology, has the best power-to-weight ratio (Nm/kg) of its class coupled with a battery capacity of 5.2Ah. The ADS also features a brushless, and thereby wear-free, motor with automatic shut-off when the target torque value is reached. A high precision of  $\pm 4\%$  is possible due to the intelligent torque control system which automatically adjusts the rotations per minute (rpm) throughout the bolting process. After tightening, the Free-Run feature automatically frees the ADS of any torsional binding which can make removing torque tools difficult. This makes the ADS-3 safe, fast, and easy to move from bolt to bolt. The ITH type ADS is ideal for service jobs on bolted connections bigger than M16 (3/8").

**ITH Engineering** | [www.ith.com](http://www.ith.com)

an existing calculation done in the past. By applying this method the RUL of a wind turbine is calculated after the actual damage has been established. New or additional calculations for the wind turbine are made, taking into account site-specific boundary conditions, such as wind loads. The structural integrity of a certain turbine is verified for extreme and fatigue loads. The output of this approach will be an expert statement with a stipulation of RUL.

The practical component takes the form of on-site inspection of the relevant wind turbines. These inspections are recommended to be done by an accredited company according to ISO/IEC Standard 17020. The focus of these inspections is to verify the output from the analytical part and proofs on the basis of the actual conditions on the wind turbines under consideration.

Based on the results of the analytical and practical components, it is possible to make statements about any potential RUL and/or about the inspection interval to be complied with. However, this analysis needs to be conducted with regard to aspects of structural safety.



*Ing. Santiago Lopez is a senior staff engineer and project manager totaling more than 1GW built at UL/DEWI. He has more than 15 years of experience in wind, working both for OEMs and developers.*

**UL** | [www.ul.com/wind](http://www.ul.com/wind)



### Corrosion coupons

Q-Lab Corporation announced the launch of new Q-PANEL CX corrosion coupons (also known as mass loss coupons). The new coupons meet the requirements of GMW14872, ASTM B117, SAE J2334, SAE J2721, and ISO 9227 standards. Corrosion coupons are standardized steel panels that serve as reference specimens in corrosion testing. They help a user verify the rate of corrosion in corrosion chambers and serve as independent test monitoring devices. Q-Lab's CX-series of standard corrosion test coupons are suited for this application; they are consistent, clean, convenient, and cost-effective. In addition to the standard options, custom corrosion coupons in a variety of shapes, sizes, alloys, and finishes can be manufactured. All Q-PANEL CX-series corrosion coupons include a Certificate of Analysis, come pre-cleaned, and ready to use right out of the package.

**Q-Lab Corporation** | [www.q-lab.com](http://www.q-lab.com)

**SIEMENS**  
*Ingenuity for life*

# Made for American needs.

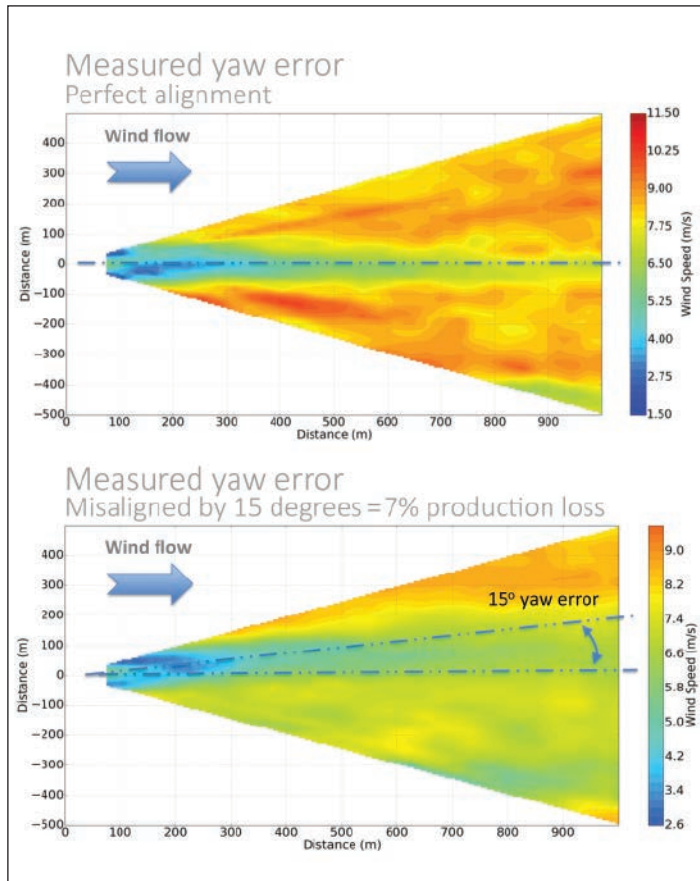
**The SWT-2.3-120**

Designed with the high capacity factor needs of the U.S. market in mind, the newest addition to the G2 platform extends the reach of one of the most robust and successful turbines of all time. The SWT-2.3-120 employs new 59-meter aeroelastic blades, resulting in a 120-meter rotor with substantial energy capture in medium to low wind conditions. An evolution of proven technologies, our SWT-2.3-120 delivers high energy production, resulting in excellent returns for years to come.

Meet us in New Orleans at AWEA 2016 booth #4238

[siemens.com/awea2016](http://siemens.com/awea2016)





**Figure 1.** Yaw error can significantly impair WTG production; in the above example, a 15° yaw error resulted in a 7% loss in WTG production.

# Lidar

## The key to improving wind farm wind drought tolerance

by Matthew Klippenstein



**2015 SAW BELOW AVERAGE WINDS ACROSS MUCH OF THE UNITED STATES**, with wind energy production down six percent, despite a nine percent increase in capacity. Worse still, this trend is persisting into 2016.

Fortunately, developments in remote sensing technology now allow for deeper, more detailed wind characterization at operational and pre-construction wind farms. Site-specific trends can be identified and corrective improvements introduced, mitigating the impact of so-called wind droughts, and improving yearly economic returns.

These improvements are made possible by the additional capabilities that lidar, a radar-like technology that uses laser light to measure the speed and direction of the wind, offers over historical industry methods.

A typical three-anemometer meteorological (met) mast provides wind speed data for three heights at one map coordinate. The wind energy industry has become proficient at extrapolating wind speeds vertically up to wind turbines' hub height, and laterally out to turbines' specific coordinates, but this extrapolated data can only ever be an approximation.

In contrast, directional lidar creates a dense mesh, offering precision spatial or temporal insight about wind micro regimes immediately surrounding a turbine. (Spatial/temporal trade-offs can be managed by budgeting time for both methods during lidar campaigns).

To use a medical analogy, if a met mast was an x-ray, lidar would be a PET scan, providing highly detailed information about narrowly targeted regions, leading to a more precise diagnosis and a more accurately prescribed solution.

As the same recurring factors tend to impair performance in onshore wind farms, it is important to integrate domain knowledge with data analytical techniques in order for the right solutions and improvements to be made.

### Turbine factors

Dynamic yaw errors can result when a wind turbine does not accurately rotate to align with incoming winds. Difficult to measure with nacelle-mounted wind vanes, these errors can be measured directly using lidar, allowing for control systems adjustments to be made, to keep the turbine properly realigned. This provides the dual benefit of increased energy production, up to 3 percent, along with reduced cyclic loadings on key components such as blades and gearboxes.

Particularly for older turbines, historical compromises in blade design, often for the sake of manufacturability, can lead to aerodynamic stall, reducing a turbine's annual energy production. Aerodynamic enhancements such as vortex generators can be deployed, but performance validation is key to ensure they are having the intended effect. Lidar measurement of air flow around the turbine establishes the optimum positioning of the devices, and then confirms the enhancements are working as intended.

### Terrain factors

Lidar data can be paired with computational fluid dynamics (CFD) software to accurately assess the effect of terrain and nearby forestry on wind energy yields, and devise optimum forestry restructuring plans in conjunction with local stakeholders. In highly-forested areas, improvements can be substantial, with owners increasing annual energy production by over 5 percent. As tree cover also increases air turbulence, restructuring can also reduce ongoing maintenance requirements and consequently, costs.

### Moving forward

Just as the map is not the territory, the software model is not the wind farm. It is subject to real world complexities ranging from microclimates to construction error and equipment limitations, among others.

Bird and bat collisions with wind turbines are recognized as a conservation concern both for power generators and the general public.

**Xpera Risk Mitigation & Investigation can reduce this environmental impact by using technology that detects and deters animals.**

**Our technology features:**

- HD cameras for species recognition and study
- High volume sound to deter flight patterns
- Ability to reject false thermal objects
- Operates in all environments and conditions
- Allows long range detection up to 2 km

**Windpower Deterrent**

**xpera**  
TECHNICAL SERVICES

ray.wilderma@xpera.ca

xpera.ca

1-866-497-0285





## Increased machine utilization for effective steel turning

For longitudinal and face turning, Sandvik Coromant introduces the new CoroTurn 300 for higher component quality, increased handling efficiency, and longer tool life in steel turning operations. The CoroTurn 300 features stable insert clamping, as well as eight-edged inserts for the high chip control, tool life, and surface finish. Stable insert clamping for the CoroTurn 300 is made possible through the patented iLock interface. This system securely locks the insert in place to prevent cutting forces from affecting the tool position. iLock provides tool accuracy within  $\pm 0.05$  mm (.002 inch) giving the operator indexing repeatability for a better surface finish and increased tool life. The eight-edged inserts for the CoroTurn 300 are available in grades GC4325 and GC4315 featuring Inveio coating, a uni-directional crystal orientation for high wear resistance, and long tool life. The unique insert design has excellent chip breaking capabilities and less carbide per edge, plus more edges allows for better inventory control. Another way the CoroTurn 300 offers chip breaking capabilities is through high-precision (HP) over and under coolant. Coolant from above controls the chip breaking for secure machining while under coolant controls the temperature for long and predictable tool life.

**Sandvik Coromant** | [www.sandvik.coromant.com](http://www.sandvik.coromant.com)



Although it has historically been difficult to compensate for these factors, lidar technology has increased the ability to diagnose the exact causes of wind farm underperformance. Specific corrective measures can then be prescribed to improve yield on both onshore and offshore wind farms based on real, comprehensive, accurate data. A combination of solutions could realistically provide yield improvements of between 5 and 12 percent.

By utilizing the insight afforded by remote sensing, and the application of measures to improve wind farm performance, in low-wind years, project economics should be able to tackle future wind droughts head on, and have better tolerance to the economic impacts of a low wind year.

While the benefits of site-optimized wind farms accrue annually in the form of higher energy yields, they will be most apparent during years of lower-than-expected winds, with the higher production baseline helping to offset the impacts of wind droughts. While a wind farm's economics will never be drought-proof, lidar offers a path for their becoming drought-resistant – a message SgurrEnergy believes will resonate with owners, operators, lenders, and vendors in coming years, as the American wind industry approaches its milestone 100th GW of installed capacity.

*Matthew Klippenstein is the renewable energy consultant for SgurrEnergy*

**SgurrEnergy** | [www.sgurrenergy.com](http://www.sgurrenergy.com)

# SUPERIOR LUBRICANTS IMPROVED RELIABILITY INCREASED PROFIT

## UPGRADE TO ROYAL PURPLE SYNFILM GT 320 WINDGEAR

- *Extended drain intervals*
- *Elimination of micro-pitting*
- *Superior foam control*

One of the primary factors that determines the reliability of rotating equipment is the quality of the lubricants. Royal Purple Industrial Lubricants gain their performance advantages over competing mineral and synthetic oils through the superior blend of synthetic base oils plus Royal Purple's proprietary Synerlec additive

technology. This unique additive technology is proven to make equipment run smoother, cooler, quieter as well as more reliably and efficiently. Royal Purple produces a complete range of high performance lubricants for nearly every industrial application.

To learn more, visit [RoyalPurpleIndustrial.com](http://RoyalPurpleIndustrial.com) or call 888.382.6300





# Connecting Doubly Fed Induction Generators to the Grid

## Using an optimal crowbarless solution

by Aritz Lorea

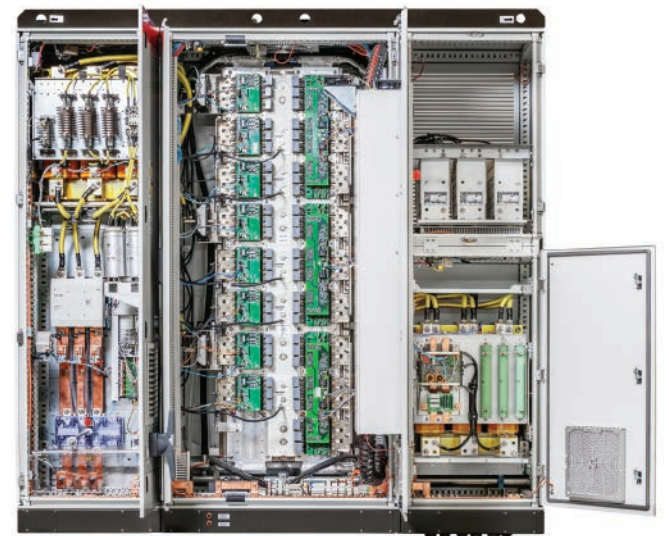


Figure 4. Ingeteam Crowbarless Power Converter

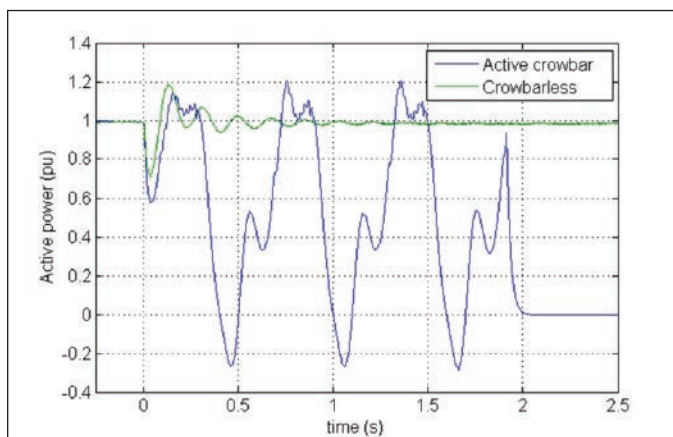


Figure 1. Active power during a SCR change from 5 to 2, with Active crowbar and with Crowbarless system

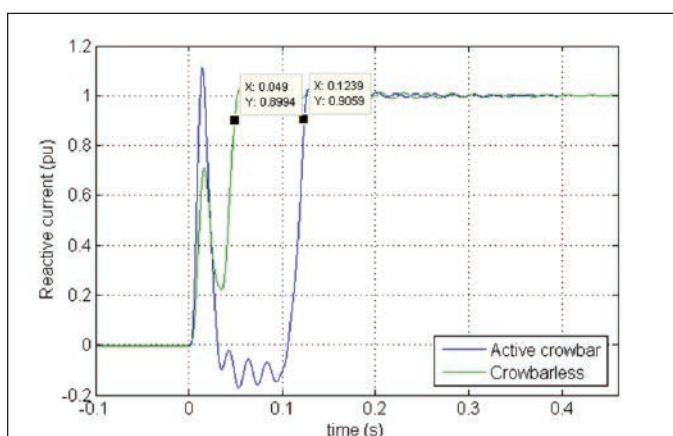


Figure 2. Current feed-in time for a Crowbarless and Active Crowbar system in a 3ph 20% voltage dip with a 3MW Wind Turbine

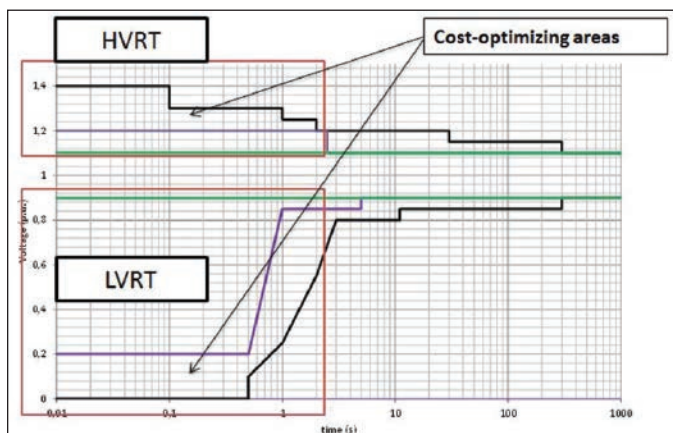


Figure 3. Cost optimizing areas for different grid codes requirements

Wind power penetration into the power generation system has substantially increased during the last twenty years, making the power quality and stability of this generation system increasingly important. Consequently, the grid codes, which establish the requirements all generation systems must fulfill in order to be allowed to connect to the grid, have been updated in order to guarantee the stability of the grid.

In recent years, wind turbines were allowed to disconnect from the grid when transients in grid voltage could jeopardize the integrity of their elements, especially the power converter. However, nowadays, due to the large amount of wind power installed in the generation system, this is no longer allowed. With such increase in installed power, the wind industry now faces the challenge of the suitable integration of the wind turbine into the grid, which main issues are the following:

- **Large distances between generation and load points**

In many occasions, the areas with suitable wind resources are not close to those areas where the energy is being consumed. Series and parallel compensation solutions are installed in order to increase the capacity of long transmission lines. These systems can present issues related to Sub-Synchronous Resonances (SSR) and Sub-Synchronous Control Interaction (SSCI), among others.

- **Low capacity of the transmission lines**

These grids are the so-called weak grids. They have a low Short Circuit Ratio (SCR) that in a wind farm is the relation between the short circuit capacity of the grid at the common coupling point and the rated power capacity of the wind farm.

Basically, these are grids in which the voltage fluctuates with Active and Reactive power flow.

- **Fault Ride Through events**

These events are usually caused by short circuits produced in the grid. Generation systems must be able to remain connected during these events in order to support the grid stability.

The Doubly Fed Induction Generator (DFIG) topology has proven to be an efficient and cost-competitive topology for wind turbines rated up to 3.5MW. Therefore, being currently the most installed topology.

However, its low grid integration capability jeopardizes the use of this type of conversion system, due to its high sensitivity to grid voltage transient, in which high voltages and currents appear in the rotor side of the generator, endangering the power converter connected to it. This is because the induction generator is directly connected to the grid, so any fluctuation in grid voltage produces a change in the generator flux, causing high rotor voltages and currents.

The most widely used system to protect the power converter under these events is the so-called active crowbar, a shunt circuit composed of actively controlled switches and dissipation elements which are connected in order to shunt the high currents, avoiding damages

to the converter. This system, however, presents the limitation that while the active crowbar is connected, the power converter is not in operation, the active and reactive power set points cannot be tracked, and therefore the wind turbine is not being controlled.

This power converter is designed to operate in DFIG topology, not including an active Crowbar, but a Modular FRT system instead. In addition, the Modular FRT system is an optimal solution, which means that depending on the grid code to be fulfilled and the electrical characteristics of the system, especially the stator configuration, the Modular FRT system is selected allowing for a cost-optimal power converter for each wind farm scenario.

The Crowbarless solution presents advantages in the behavior when compared to the active crowbar system solution, especially in issues related to weak grids and FRT events. Moreover, these two events may occur together, being a major problem of weak grids. This takes place when a short circuit is produced in the grid and the protection elements upstream the fault trips, isolating different generator systems from the transmission system. Thus, rapidly changing the SCR in the wind farm (high  $d(SCR)/dt$ ), making it difficult to control the voltage in the grid and therefore keeping the wind farm generators connected.

Voltage control in wind farms are usually tuned for strong grids, making the control dynamics not suitable for weak grids. The voltage control is not able to keep the grid voltage within the voltage range of the generation systems, as a weak grid presents high ratios of  $dV/dQ$ .

In DFIG topologies with converters including any kind of Active Crowbar





## High capacity wind turbine

The SWT-2.3-120 incorporates a variety of innovative technologies that have been scaled and streamlined to deliver a capacity factor for sites with medium to low average wind speeds. Together, these refinements have produced a turbine that is even more efficient under these wind conditions than its predecessor. The SWT-2.3-120 wind turbine employs a high-performance 120-meter rotor with 59-meter aeroelastically tailored blades allowing for enhanced energy capture. With a 23% increase in swept area and projected AEP over 9% higher than that of its predecessor for sites with average wind speeds around 7.5 meters per second, the SWT-2.3-120 is designed to help get the most out of medium to low wind sites. The nacelle is ergonomically optimized for maintenance through increased accessibility of components, and enclosed by a square steel canopy designed for maximum protection of internals. The NetConverter power conversion system allows generator operation at variable speed, frequency and voltage while supplying power at constant frequency and voltage to the MV transformer. The power conversion system is a modular arrangement for easy maintenance and is water-cooled. Via a standard Web browser, the Siemens WebWPS SCADA system provides a variety of status views of electrical, mechanical, meteorological, and grid station data as well as operation and fault status.

**Siemens** | [www.energy.siemens.com](http://www.energy.siemens.com)

system, this item is connected when the voltage transients in the grid causes rotor current or/and voltage values out the limit values of the converter. This can lead to instability of the Active and Reactive Power loops, and finally producing a disconnection of the wind turbine.

However, the Crowbarless solution, together with a suitable selection of grid filter and control loops tuning, is able to keep the control of the wind turbine during these transients, achieving the controllability required in order to operate in weak grids.

In addition, the modularity concept of the FRT system allows for a cost optimization for each application. The following figures show the behavior of the Crowbarless system under different grid events:

- **Figure 1** shows a comparison in the behavior of the Crowbarless system and the Active Crowbar system during a Short Circuit Ratio change from a value of 5 to a value of 2. It can be seen how the Active Crowbar is repeatedly activated leading to the instability of the system and finally getting tripped. However, the Crowbarless system is able to keep the control of the wind turbine, supporting the grid when required.
- **Figure 2** shows a comparison of the behavior of the Crowbarless system in a 20% 3-Phase Voltage Dip with a 3 MW Wind Turbine and rotor peak current of 11 kA in short circuit. The feed-in time of the required amount of reactive current is less than 50ms.
- **Figure 3** shows different grid codes voltage-time envelope requirements, highlighting the cost-optimizing areas for the Modular FRT system modular solution.
- **Figure 4** shows the Power Converter that includes the Crowbarless modular solution.

Aritz Lorea is the DFIG product manager for Ingeteam Power Technology's wind business. The expertise of Ingeteam on this matter has been recognized by the American Wind Energy Association (AWEA), the national trade association for the US wind industry.

**Ingeteam** | [www.ingeteam.com](http://www.ingeteam.com)



# On The Mark. We're Standing Behind It.

Doing a job right the first time saves money. There is no second-guessing with the BURNDY® Engineered System. Our coordinating dies, connectors and tools are designed to work together and meet stringent, accepted quality standards. Every BURNDY® HYDENT™ connector is clearly marked with the wire size, type, die index and color-coding for reliable electrical performance. Corresponding BURNDY® dies provide a permanent die index number embossment on each completed crimp for proper inspection.

*For a job well done, leave the BURNDY mark of quality conformance every time.*



Connecting Power to Your World®



[www.burndy.com](http://www.burndy.com)

© BURNDY LLC, 2016





### HMI-certified electric chain hoist

R&M Materials Handling, Inc. is pleased to announce the LK Electric Chain Hoist has been awarded the HMI-Certified License. The LK hoist has capacities ranging from 1/8 - 2 ton (125kg - 2000kg). The patented load wheel with five intermediate teeth delivers less chain wear and allows the LK to operate smoothly and quietly. All R&M hoists are statically and dynamically tested with a minimum of 125% rated load.

**R&M Materials Handling** | [www.rmhoist.com](http://www.rmhoist.com)



### Battery powered torque wrench

The new DB-RAD Series are battery powered torque wrenches with digital control for torque and angle operation. Available in various models with torque ranges up to 3,000 ft.lbs (4,000 Nm), drive sizes from 1/2" to 1", and a noise level of 80db. This patented product provides a portable and safe solution for any bolting needs. Each tool comes with two 18V batteries, capable of approximately 100 bolts between each quick charge. Also compatible with the RAD Smart Socket Series.

**RAD Torque** | [www.radtorque.com](http://www.radtorque.com)



### Offshore-certified connection system

The Connex dry-type, pluggable connection system can now be used for high voltages up to a maximum of 550 kV. The universal cable system can withstand the toughest weather conditions and possesses certification for offshore applications from the DNV GL classification society. As a high-capacity special HV solution, it connects the switchgear, transformers, etc. on the substation of the Global Tech I wind farm in the North Sea.

**Pfisterer** | [www.pfisterer.com](http://www.pfisterer.com)



### Single-ended impact socket

Hi-Line Utility Supply and Klein Tools present the Single-Ended Impact Socket for linemen and utility workers. All three sizes on one side saves time, reduces drops, and prevents loss of the adapter. Made in the USA, The Klein Impact Socket features an extendable and retractable head for easy access, includes a 7/16" hex quick change adapter, and its hollow shaft allows use on long threaded bolts.

**Hi-Line Utility Supply Co.** | [www.hilineco.com](http://www.hilineco.com)



### Weather sensor with lightning detection

Lufft's WS800-UMB Smart Weather Sensor is from the WS product family of professional intelligent measurement transducers with digital interface for environmental applications. It has an integrated design with ventilated radiation protection for measuring air temperature, relative humidity, precipitation intensity, precipitation type, precipitation quantity, solar radiation, lightning detection, air pressure, wind direction, and wind speed. One external temperature or rain sensor is connectable. WS800-UMB includes lightning detection by an integrated sensor analyzing the radio wave emission of lightnings. It delivers a count of recognized lightnings. The sensor analyses spectrum and wave form of the received signal to suppress the detection of man made electrical discharges.

**Lufft USA, Inc.** | [www.lufft.com](http://www.lufft.com)



### Protection for large AC and DC motors

By diverting harmful VFD-induced shaft voltages safely to ground, AEGIS PRO Series Rings protect large AC and DC motors from bearing damage, costly repairs, unplanned downtime, and lost revenue. Available for motor shafts to 30" in diameter, AEGIS PRO Series Rings are specially designed for high-current applications such as generators, turbines, and medium-voltage motors. Embedded securely in the AEGIS FiberLock channel along the inner circumference of the PRO Series Rings, six rows of conductive microfibers completely surround the motor shaft, providing millions of discharge points for harmful shaft currents and creating the path of least resistance that effectively diverts these currents away from bearings to ground. AEGIS PRO Series comes in solid- and split-ring versions. Solid rings are designed for installation on new or repaired motors prior to their installation. Split rings come in mating halves that simplify field installation around the shafts of in-service/coupled motors. Specially designed Universal Mounting Brackets allow fast, easy installation of AEGIS PRO Series Rings on large motors. These brackets attach to PRO Series Rings with screws and have slotted legs that allow mounting to the motor with a bolt circle of 2.64" to 7.79" greater than the shaft diameter. They are provided with 1/2", 1", and 1-1/2" standoff spacers to provide sufficient clearance for shaft shoulders, slingers, or other end bell protrusions. Mounting bolts, flat washers, and lock washers are also included.

**Electro Static Technology**

[www.est-aegis.com](http://www.est-aegis.com)

# Nordic Products Connect the Turbine to the Grid, One Product at a Time.



• 35kV 600Amp Sectionalizing Cabinets & 18" or 36" High Extensions.



• Chuted Box Pads in various sizes accommodate a variety of Pad-Mount Transformers



• MPP-141480-CB  
Cross Bonding Pedestal



• ND-362442-MG-TBS-WIE  
Splice Cabinet



**NORDIC FIBERGLASS, INC.**  
Quality Products for the Electric Utility Industry

P.O. Box 27 Warren, MN 56762 Tel: 218-745-5095 Fax: 218-745-4990 [www.nordicfiberglass.com](http://www.nordicfiberglass.com)

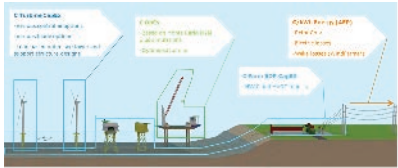




## Shaft voltage tester

The new AEGIS Shaft Voltage Tester Digital Oscilloscope makes it easy to check in-service motors for damaging VFD-induced shaft voltages, head off bearing damage, and costly unplanned equipment downtime. The AEGIS Shaft Voltage Tester Digital Oscilloscope is specially designed and configured to take and capture highly accurate voltage measurements from the spinning shafts of motors. The CAT II/III digital oscilloscope comes with a conductive microfiber tipped probe for exceptional shaft contact, a probe holder with magnetic base, and a compact carrying case. The 2-channel, full-function 100 MHz oscilloscope has a 5.7" TFT LCD color display, a multi-language user interface, and a 5-hour rechargeable/replaceable lithium-ion battery pack. The oscilloscope is capable of sampling rates of 1 GSa/s to 50 GSa/s and has a USB port for data transfer or flash drive storage. The AEGIS One-Touch screen capture feature simplifies data collection for reporting and analysis. With dual inputs, the AEGIS Shaft Voltage Tester combines oscilloscope, multimeter, and recorder functions in a single unit. Accessories include a 9V/4A power adapter, 1X/10X oscilloscope probes, test leads for the multimeter, a probe calibration tool, a rechargeable/replaceable 5-hour battery, and a USB flash drive with user manual. In addition to the standard 90-day warranty, an extended 2-year warranty is available.

**Electro Static Technology** | [www.est-aegis.com](http://www.est-aegis.com)



## Calculating LCOE

DNV GL, has unveiled Turbine.Architect, an in-house software tool enabling turbine engineers and component developers to quickly calculate the impact of their technology on Levelised Cost of Energy (LCOE) for a realistic wind project. Turbine.Architect supports turbine design and component technology development by quantification of the technical impact of design and component technology on both the turbine system as well as the entire wind farm, from the foundation to the electrical infrastructure. Turbine.Architect computes realistic values for the capital costs of turbine, Balance of Plant components, farm operational costs, availability, and farm annual energy production. The tool's engineering models produce concept-level technical specifications for turbine components and farm items, with up-to-date market intelligence translating these specifications into appropriate capital costs. Similarly, operational costs and availability are quantified using models for Operation & Maintenance that are benchmarked with real field data. Its method to estimate energy production includes losses from rotor aerodynamics, drive train components, and farm wakes, the latter by linking with DNV GL WindFarmer. Turbine.Architect also contains a discounted cash flow model where estimated costs and yield are escalated to LCOE and Net Present Value (NPV). As well as quick LCOE calculations at the early phases of a given project, the tool allows users to overwrite various components. The user may then do everything from high level screening of potential wind turbine design projects to detailed assessment of a specific system or component level technology innovation in the same tool, providing a unified way of presenting costs and calculating LCOE. The flexibility of the tool also allows the user to test various cost reduction opportunities and perform sensitivity analysis, with the overarching objective of supporting an LCOE-driven design process.

**DNV GL** | [www.dnvgl.com](http://www.dnvgl.com)



## WORKING AT HEIGHTS TRAINING COURSES



**If your workers face fall hazards,  
you're required to provide them  
with Fall-Protection training.**

**TEAM-1 Academy is the industry benchmark and gold standard when it comes to Fall-Protection training. All of our courses meet and exceed Ministry of Labour Standards and are customized to your location. Over 1000 courses were taught last year to Government Agencies, Fire Departments and Fortune 500 companies. With 98% customer retention you know you won't be disappointed.**

**Course content is delivered in an easy to understand manner and promotes "clip & go" systems.**

**Also ask us about our Inspection Services & Rescue Services.**

**LET THE KNOWLEDGEABLE STAFF AT  
TEAM-1 ACADEMY TRAIN YOUR TEAM**



**Visit [www.TEAM1Academy.com](http://www.TEAM1Academy.com) to purchase Professional Safety Equipment**



**No matter what your needs are, whether you are a large or small company,  
TEAM-1 Academy has a solution for you!**



**SIGN UP ONLINE AT [www.team1academy.com](http://www.team1academy.com)**

**OR GIVE US A CALL AT 905-827-0007**





# Safety & Fall Protection Equipment

According to the National Safety Council, falls are one of the leading causes of deaths in the workplace. Perhaps more than any other type of workers out there, those who erect and maintain wind turbines are exposed to some of the most serious, and potentially fatal, fall hazards. With many turbines reaching heights of well over 100 feet tall, wind farms are only growing upwards in many cases, and exposure to high winds can make work at high elevations even more hazardous. Here we highlight some of the latest in safety and fall protection equipment—a must for the growing industry.

SEE AD ON INSIDE BACK COVER



## Snap-on Industrial

**Product:** Hub Hatch Tool

**Applications:** GE 1.5MW Wind Turbine

**Description:** This tool is a solution for opening a GE 1.5 Hub Hatch. It combines a flex-head, ratcheting combination wrench, with a replaceable 14mm hex bit, and an engineered, tested, and certified Drop Prevention attachment point.

### Key Features:

- This custom solution replaces the “homemade” technician version, supplied by Snap-on Industrial and manufactured using industry best practices;
- Includes a “floating” attachment point which maintains complete tool functionality;
- The attachment point is tested and certified;
- Specifically for GE 1.5MW Wind Turbines with 14mm female hex fasteners on Hub Hatch doors;
- Serviced and warranted by Snap-on Industrial account managers.

[www.snapon.com/industrial](http://www.snapon.com/industrial)



## AKE Safety Equipment

**Product:** STOP-FYRE Fire Extinguisher

**Application:** Any area, situation, or equipment needing portable, clean, and fast fire suppression.

**Description:** STOP-FYRE is a multi-shot, clean agent extinguisher. The current design is taller, stronger, more accurate with a pressure gauge, and more reliable with a debris cap. The new STOP-FYRE still saves lives and property saving money, hassle, and tragedy and is backed by a Lifetime No-Hassle Guarantee.

[www.ake.com](http://www.ake.com)



## Gravitec Systems, Inc.

**Product:** G4 Rescue & Evacuation System

**Application:** Versatile in accommodating evacuation, lowering, lifting, and suspended or assisted rescue or evacuation

**Description:** The G4 Kit has been enhanced from a wind industry-specific rescue and evacuation system into a versatile rescue and evacuation kit meeting the demands of nearly every industry working at height. It is applicable to most industries, and can be customized for specialized work environments, including industry-specific belay kits.

[www.gravitec.com](http://www.gravitec.com)



## Hi-Line Utility Supply Co.

**Product:** Power Gripz

**Application:** Glove protectors and work gloves

**Description:** The Power Gripz glove protectors and work gloves offer an adjustable Velcro strap and proprietary grip pads from the palm to fingertips, maintaining its dexterity. Meeting and exceeding the ASTM F-696 Standards, these all-condition gloves provide ARC protection and heat penetration protection. Work Gloves come in Kevlar and Thinsulate for protection against the elements and come in sizes medium, large, and x-large. Glove Protectors are available in class 1 to 4, sizes 8-12.5. Bell Cuff and Mitten style protectors are also available.

[www.hilineco.com](http://www.hilineco.com)



## Power Climber Wind

**Product:** IBEX 1000P Climb Assist

**Application:** Intelligent climb assist for wind turbine technicians

**Description:** The IBEX 1000 climb assist system delivers personalized performance, increased safety, and better productivity. The IBEX 1000 allows user-adjustable support settings from 50 to 125lb (25 to 55kg), and provides constant load support, in both the up and down directions, regardless of climbing speed. These ride settings are stored in a load sensing EasyClimb Controller (ECC), attached between the climber and the belt, and can be changed at any time and anywhere. Motor power is controlled by signals from the ECC, which communicates climber behavior to adapt motor output for a consistent, comfortable climb. The motor responds to the climber rather than the climber responding to a constant speed and torque motor.

[www.powerclimberwind.com](http://www.powerclimberwind.com)





**Tech Safety Lines, Inc.**

**Product:** SRK-11

**Application:** Self-rescue kit

**Description:** The SRK-11 utilizes high heat rope with a tensile strength exceeding 6500lb and incorporates the Military Compact Descender (MCD). This controlled descent device, which features a dual braking system, provides a rapid means of escape from anywhere in or on the structure. Meeting or exceeding all OSHA & ANSI Standards, including Z359.4-2007, the SRK-11 is also certified by UL.

[www.techsafetylines.com](http://www.techsafetylines.com)



**Dakota Riggers & Tool Supply, Inc.**

**Product:** Petzl Vertex Best Hard Hat

**Application:** At height head protection

**Description:** With its strong chinstrap, the Vertex Best helmet has six-point textile suspension to ensure comfort for workers at height. Its unventilated shell protects against electrical hazards and molten metal splash. The Vertex Best helmet is designed for use with optional headlamps for work in low light environments.

[www.dakotariggers.com](http://www.dakotariggers.com)



**Ty-Flot, Inc.**

**Product:** Quick-Switch Tool Lanyard

**Application:** Tethering tools used at height

**Description:** Ty-Flot's switching tool lanyards, Quick-Switch tool lanyards are designed to keep tools connected at all times and stop tools from being dropped on people or property below. They provide the ability to switch the tool's connection from tool belts to wrists and between hands.

[www.ty-flot.com](http://www.ty-flot.com)



**Elk River**


**Product:** Premium Tool Lanyard

**Application:** Working at heights


**Description:** Elk River's premium tool lanyard is Hi Vis Orange/Yellow with a sewn in captive-eye carabiner with a screw gate for added safety. It is rated for 15lbs and is 31" long and extends to 56.5". The sliding loop lock allows attachment to different type tools and is easy to use.

[www.elkriver.com](http://www.elkriver.com)


B-RAD SELECT SERIES



THE WORLD'S MOST ADVANCED  
BATTERY POWERED TORQUE WRENCH



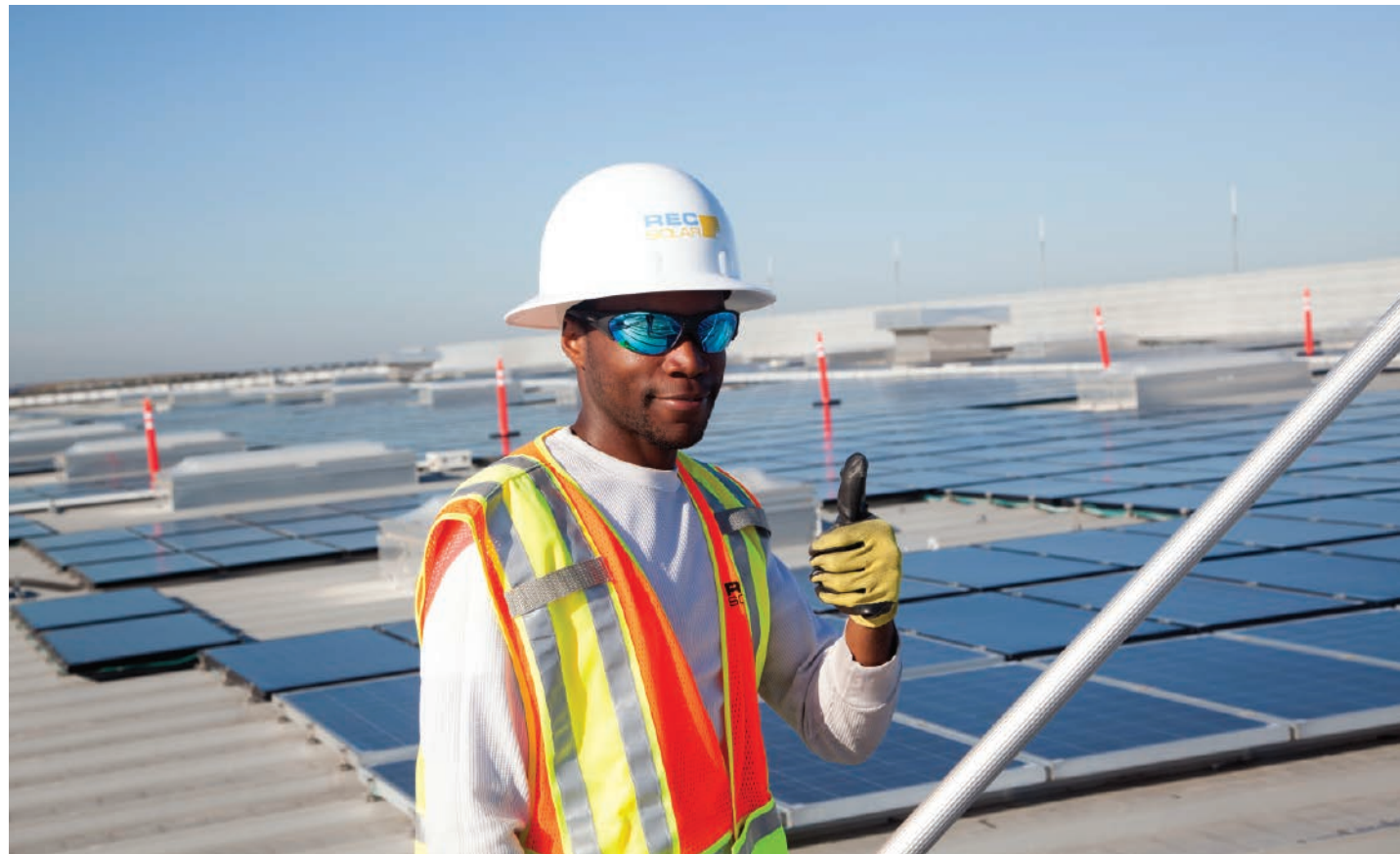
QUICK SELECT  
TORQUE SETTINGS



With over twenty years of dedicated gearbox design, RAD has the highest power-to-weight ratio of any tool on the market. Battery torque ranges up to 3,000 ft.lbs. **Patented Product.**

Please visit [www.radtorque.com](http://www.radtorque.com) for more information on the B-RAD Select Series





## Quality O&M Services Maximize Commercial Solar ROI

by Wayne Williford

The prodigious growth of solar power in the United States has turned what was once a boutique industry into a multibillion-dollar asset class. Cumulative installed solar photovoltaic (PV) capacity in the US has exceeded 20 gigawatts (GW), with thousands of projects scattered across the country.

With gigawatts now in play, this burgeoning stable of solar asset investments needs to be properly operated, maintained, and managed. Commercial solar system owners, building hosts, and other stakeholders require professional operations and maintenance (O&M) services for each solar project to realize its full value potential. PV systems without scheduled maintenance programs to support the product and power production do not typically provide the best ROI for the customer.

### From a cost-center to value-add

Until recently, the prevailing view of commercial solar O&M focused mostly on the more janitorial and repair sides of the service: keeping the vegetation trimmed, cleaning modules, replacing faulty inverters, and monitoring the performance of the PV array. O&M has been seen by some developers and EPC firms as an annoying cost center or “necessary evil,” one that could be downplayed (and under-budgeted) to make a project pencil out in the face of constant downward cost pressures. This compunction to cut construction—and services—costs to enhance short-term profits can have a negative impact on the longer-term operational health of the system.

The largest hidden cost to under-appreciating O&M is failed power production expectations. Customers plan, forecast, and budget based on the expected power estimated during design and construction. A PV developer’s future financing can be seriously affected by an underperforming project. Expensive material repair costs and additional resources to manage and repair the asset can add up quickly. Damage to the builder’s and the solar industry’s reputation to provide a cost-efficient energy alternative is also very costly.

A growing number of investors, EPCs, and asset owners now realize O&M and related services require a more holistic, value-oriented approach, one that is baked into the system design and procurement stages, and continues forward all the way through the life of the project. To get the maximum return on investment, the combination of a well-designed, well-built system, and a prudent O&M plan offer the best chance for success.

*Continued on page 26.*

## ALL HT PV Testers upgraded to 15A!



All HT Installation Testers and PV Curve Tracers now support up to 15 Amps. The 15Amp capability is keeping to our commitment to be the best supplier to the PV Industry.

- IV Curve tracers starting at \$3,495
- Installation Testers at \$1450
- Power Quality Analyzers starting at \$4,995
- ...adding more to the affordability promise

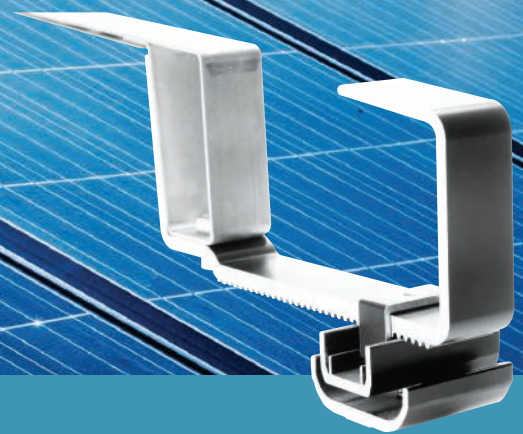


**HT Instruments America**  
sales@ht-instruments.us  
http://www.ht-instruments.com  
732-952-2111

**Premier Distribution Partner**  
**TEquipment**  
USA  
.NET  
An Interworld Highway, LLC Company



# SHAPING A GREENER FUTURE



## Innovative aluminum solutions for renewable energy

Sapa Extrusion is the world's largest aluminum extrusion company, with production in 40 countries. Our more than 23 locations across North and South America, plus the added resources of the global network, means that Sapa offers reliable, scalable, high-quality production of all your extruded aluminum product needs.

With decades of experience producing extruded aluminum for major industries worldwide, Sapa offers global expertise as a local resource.

- Aluminum Extrusion
- Fabrication
- Custom Alloy Development
- Profile Design

For more about Sapa and renewable energy:  
[NorthAmerica.Sales@sapagroup.com](mailto:NorthAmerica.Sales@sapagroup.com) • (877) 710-7272



## Quality O&M Services Maximize Commercial Solar ROI

...continued from page 24.

The operational success of a commercial solar power plant requires all of the parties involved—system owner, building host, O&M team, and monitoring firm—agree to clearly defined roles. There are many reasonable ways to slice responsibilities, and that's why all parties need to know their roles and expectations within the larger project maintenance strategy.

### From reactive to proactive

Developing a proactive, site-specific O&M schedule is the first step to maximizing the long-term value of a new solar project. An ounce of prevention can save a pound of maintenance costs. The key to doing this effectively is to determine exactly how much preventative service should be done to maximize long-term system value.

For example, one of the most important, and commonly missed, preventative maintenance services is inverter filter cleaning. Manufacturers typically require an annual preventative cleaning of filters to maintain warranty status. Just as dirty panels produce significantly less than clean panels, dirty inverter filters reduce the inverter's efficiency, and can ultimately suffocate the inverter. Failure to schedule regular inverter maintenance could lead to project downtime and significant rework expenses.

Half the battle is knowing what potential issues to look for and expect. Not every solar power system has been created equally, and over the years some patterns have emerged in the types of issues impacting system performance, especially among arrays built in the earlier part of the solar boom. An asset owner's approach to these issues will help determine the long-term profitability of the investment.

One of the more common issues appearing is ground faults; poor wire management often results in the inverter receiving a ground fault that shuts it down. In order to fix the problem, an electrician must be sent out to the site to find the ground fault and then replace the fuse on the inverter to get the system back online.



In some situations, bad wire management can lead to ground fault after ground fault, running up long-term bills and reducing the project's profitability. This is true for many other O&M issues, as well. If a project was not designed and built properly, the asset owners could spend years battling recurring O&M problems. Ultimately, the best way to avoid unnecessary O&M work is to ensure the system is built right the first time.

### The value of documentation

Reputable service providers will always provide reports upon completion of any maintenance service. This documentation is vital to the effective maintenance of the system. It details the system's unique scope, schedule, and service history. It can and will save the manager or owner time and money in the short and long run of the power systems service life.

Maintenance documentation can be an essential requirement when addressing warranty coverage and many warranty holders will not provide service without it. Though documentation may require more involvement on the owner or manager's side, it reduces risk and allows greater scrutiny and protection of a solar investment.



Wayne Williford is the director of O&M business development for REC Solar. Mr. Williford is a seasoned technical expert with qualifications across a range of industries and more than thirty years of experience in testing, deploying, and supporting advanced technologies and complex mechanical systems. For the last decade Mr. Williford has developed and managed teams of technicians and analysts responsible for servicing and maintaining more than 250 large-scale commercial solar photovoltaic systems. His skills were honed at Lockheed Martin where he held positions building, testing, and integrating satellite systems.

REC Solar | [www.recsolar.com](http://www.recsolar.com)

# GIGAVAC<sup>®</sup>

ADVANCED SWITCHING SOLUTIONS

## THE IDEAL CONTACTORS FOR SOLAR APPLICATIONS

### The P115 MiniTACTOR™

- Small, lightweight, and cost effective patented design
- Hermetic seal ensures clean consistent contact environment
- RoHS2 compliant
- Make / Break switching to 1200Vdc
- Can be installed in any position
- Capable of bi-directional switching
- UL Recognized

For complete specs, visit us online  
or call +1.805.684.8401

[www.gigavac.com](http://www.gigavac.com)



# TRACK & YIELD

- > Highest electricity yield per acre
- > Best GCR and fuller land use
- > Self-Powered tracking and Wireless communication
- > Low Installation & Maintenance Costs

## SF UTILITY Single Axis Tracker

 3703 certified

### Making Tracks

Soltec Renewable Energies is a leading solar tracking manufacturer headquartered in Spain. Soltec specializes in the manufacturing of single-axis solar trackers with more than 1GW in projects worldwide and a workforce of over 500 workers. The company has manufacturing facilities and offices in Spain, Brazil, Chile, China, Denmark, Israel, Italy, Mexico, Peru and the United States.

With a strong commitment to renewable energy and the environment, the company is highly dedicated to innovative research and product enhancement to offer the industry's premier technology.



**Soltec**

Contact us:  
3050 Osgood Ct, Fremont, CA  
+1 510 440 9200  
usa@soltec.com  
[soltec.com](http://soltec.com)



# Bridging the Gap Between Solar Companies and Utilities

## Lessons learned from the Japanese solar market

by Harumi McClure

It's no secret that United States utilities are feeling the growing pains of the breakneck growth of the solar market. As distributed solar floods the grid with power when the sun shines, utilities struggle to address the dual challenge of decreased revenue and greater fluctuation in demand for their conventionally generated power. Utilities have responded in a variety of ways, from adding fees for solar users to slowing solar interconnections.

### **Bridging the gap between utilities and solar, an example on a national scale**

In Japan, a "grid-friendly" approach has been pivotal to power solar growth. Enabling utilities to determine how much solar power can flow on and off the grid, and when, helps utilities gain confidence they can add solar and still maintain grid stability, and that utility support is vital to unlock a large-scale solar market. Japan has provided a perfect environment to observe what happens when utilities intelligently adapt to explosive growth.

### **Looking back at Japan's energy history**

Before the catastrophic earthquake and resulting Fukushima disaster on March 11, 2011, nuclear power generated about 30 percent of the nation's electricity. Just one year later, every nuclear reactor was shut down.<sup>1</sup> Japan worked to replace this major power deficit, in part, by attracting new solar investors with a lucrative feed-in tariff. In the blink of an eye, Japan became the world's hottest solar market.

This was terrific news for solar companies. Japanese utilities, however, were initially unable to cope with the rapid changes brought on by the swift transition to solar. The Japanese grid is decentralized and was not designed for a massive influx of solar power. This had a major impact on utility support for solar. Half of Japanese utilities announced programs to curtail and manage solar growth, while a Japan

Renewable Energy Foundation survey found 20 percent of solar companies were denied access by local Japanese utilities due to overcapacity. Without management or control, solar proved it could be more of a disruptive factor than a force for good.

Solar companies saw an important new market opportunity. They learned the utilities needed administrative abilities to guide how and when stored power came online to balance out demand surges and maintain resilience and drew on their expertise in the solar and technology industries to resolve these concerns.

To help Japanese utilities manage this solar surge, smart solar inverters were built which enabled the utility to control how solar interacted with the broader grid. This added "grid-friendliness" was critical to give utilities the peace of mind they needed to give solar the green light. Thanks to innovations like these, Japan remains a top solar market and utilities provide a stable grid for one of the most advanced technological societies on the planet.

Today's US market has many parallels. While a nuclear disaster has, fortunately, been avoided, the solar industry is growing quickly thanks to plummeting costs and pressure to go solar before the impending ITC step-down. Solar projects are coming online at an incredible pace; one project is installed every two minutes. As a result of this rapid growth, utilities and solar providers are seeing similar tensions here as were seen in Japan. Just like Japanese utilities hampered solar growth to ensure grid stability, American utilities are implementing surcharges and delays to manage this influx of solar power.

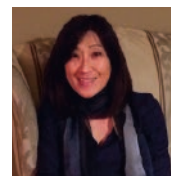
In Japan, solar companies and utilities bridged the gap between them, using smart inverters as part of the solution. Currently gaining considerable traction are newer solar-plus-storage solutions, which go even further to level out the grid, and enable greater adoption of solar energy.

This technology has seen a strong market reception, with the solar-plus-storage market projected to expand to \$3.1 billion in the next five years. That represents a twelvefold increase over today. As the rise of solar-plus-storage could add additional variability to the grid, it is anticipated, just like with solar, utilities will need confidence they can manage these technologies to ensure a stable grid. As a result, grid-friendly administrative tools are being incorporated into new solar-plus-storage offerings in North America and beyond. As with inverters, this technology promises to pave the way to strong solar market growth.

### **The US market can take lessons back to Japan**

American innovations in no-money-down financing have taken the industry into a whole new gear. New business models and software are playing a pivotal role in further driving costs and spreading solar, and Japanese solar companies would be wise to adopt these new mechanisms.

It works both ways. By sharing these valuable lessons between continents, and by bridging the gaps between parties in every grid, solar can continue its explosive growth all around the world.



Harumi McClure is the managing director for Tabuchi Electric.

**Tabuchi Electric** | [www.tabuchiamerica.com](http://www.tabuchiamerica.com)

<sup>1</sup> Fairly, P. (2014, December). *Can Japan Recapture Its Solar Power?*

Something very new under the sun.



MS-80 New Generation Pyranometer  
ISO 9060 Secondary Standard

More info and our complete range of products on:  
[www.eko.co.jp](http://www.eko.co.jp) • [www.eko-usa.com](http://www.eko-usa.com) • [www.eko-eu.com](http://www.eko-eu.com)





SNEC 2016 May 24-26  
Booth: E6-510 ShangHai China  
InterSolar Europe Jun. 22-24  
Booth: B2-530 Munich Germany

**ALWAYS AVAILABLE  
FOR HIGHEST YIELDS**

## FUSIONSOLAR SMART PV SOLUTION



SUN2000-33/40KTL-US

- ✓ Higher Yields
- ✓ Smart O & M
- ✓ Safe & Reliable







# Residential Solar Panels

## To buy or not to buy

by Mukesh Sethi

**THE RESIDENTIAL SOLAR MARKET HAS BEEN STEADILY GROWING** over the past few years, a trend that will continue in 2016. The solar industry, as a whole, saw the largest output of solar power to date in 2015, producing a 16 percent growth over 2014, according to the 2015 GreenTech Media report. The same report revealed that, for the fourth consecutive year, residential solar enjoyed over 50 percent annual growth. In years past, the residential solar industry was primarily driven by high-income states with favorable legislation regarding clean energy, states such as California and North Carolina. However, the number of states with annual solar

productions over 20MW has increased threefold over the past four years, pointing to the continued growth of residential solar across the country. One trend that is primed for a surge in popularity is the outright ownership of residential solar systems, as opposed to third party ownership and other leasing options.

There are several factors pointing to this movement, but this trend, like so many others, begins and ends with the consumer. The average solar customer today is much more educated on the solar business as a whole, as well as the particular type of solar system that they want for their home. Simply put, the customer is seeking to reduce their carbon footprint in a manner that makes the most financial sense for them.

More and more, residential solar customers are beginning to realize that owning the solar panels outright allows them to maximize their long-term savings despite the relatively high cost upfront. Also, loans for buying solar panels are easier to obtain and understand than they were in years past.

Last December, the Investment Tax Credit (ITC) was extended through 2021 which will result in more than 50 percent net growth in solar installations through 2016-2020. This new timeline will put worried consumers at ease, as legislation regarding the financials of the solar industry will remain constant at the federal level.

In the competitive residential solar business, there are several other important factors to consider when consumers purchase their own solar panels. Reliability is one of the main features that should appeal to consumers in their search for solar panels to install in their homes. People look for peace of mind with countless other long-term products, and that attitude should absolutely extend to their home solar system. Consumers don't want to have to worry about replacing these solar panels once they are installed.

Similarly, residential solar panels should be viewed in the same lens as any other full-scale investment. Solar panels can provide huge savings over a 25+ year period, and should be looked at with the same mindset when considering a real estate or other longstanding investment. Owning a solar system is incredibly beneficial, not only for the environmental impact, but for the cost of energy as well, so the process of purchasing such a system should be taken with the utmost care. In this same vein, people are more inclined to choose well-known brands with an established track record in the solar industry. Consumers want to be familiar with the brand and company they are buying this investment from, and will seek out brands with good referrals and a solid history in the business.

Manufacturers now have to be more transparent with consumers about the solar systems they are selling, partly because of the increased level of education amongst consumers and also the rise in competition within the industry.

**Japan Solar**

**Manufacturing  
The Highest  
Quality Japanese  
Solar Panels**

PANELS  
INVERTERS  
RACKING  
ENERGY STORAGE

Available for consignment

**Japan Solar US, Inc.**  
**650-571-5904**  
info@japansolarus.com | www.japansolarus.com

MADE IN JAPAN









### Stone coated steel roof hook

Stone Coated Steel roofs are a thin metal with a special, sprayed-on coating and are meant to look similar to asphalt shingle and tile roofs. In the past, most solar installers would outright reject working on this roof, but SolarRoofHook.com's 90° Stone Coated Steel Roof Hook for side mount rails with an adjustable height of 18mm compensates for irregular surfaces underneath the roof panels so the installer can mount the hook over remnants of the old roof. The batten bridge has a 9mm x 40mm slot and is 2-1/2" (63.50mm) wide. The 10mm x 38mm rail attachment slot accepts 5/16" or 3/8" bolts. Use their #14 or 5/16" Solar Mounting Screws in the 9mm mounting screw holes.

**Quick Screws International Corporation** | [www.solarroofhook.com](http://www.solarroofhook.com)

The increase in popularity of owning residential solar systems has also given rise to high-efficiency solar panels. These panels are more costly to purchase from the onset, but provide much greater savings over the long run. For consumers who may not have vast amounts of available roof space, these panels offer the best return on the dollar. High-efficiency panels often come with longer warranties as well, due to the importance placed on their longevity. These panels are built to perform in all kinds of weather conditions, and will make the most out of the limited space they are allotted. Purchasing solar panels from brands with a good, reputable track record and well-known technology are often safe choices.

In the constantly evolving renewable energy landscape, it is crucial consumers stay informed and aware of trends as new information hits the market. A solar system constantly reduces the energy bill of a home, without the interference of a third party, and is a huge boon to the homeowner's long-term savings. Staying abreast of these new developments is imperative when making the decision to buy residential solar panels.



*Mukesh Sethi is the group manager and head of solar products group for Panasonic Eco Solutions Company of North America (PESNA), a unit company of Panasonic North America marketing and selling Eco products such as Ventilation Fans, Indoor Air Quality products, Power Tools, and high efficiency Solar Panels. Mr. Sethi is charged with managing all aspects of Panasonic's Solar Products division and expand the high efficiency solar panel business to the U.S. market. He joined Panasonic in March 2010.*

*Prior to joining Panasonic, Mr. Sethi has worked in operations, planning and management for Avionics Company Thales Avionics and Sensient Technologies. Mr. Sethi holds a BS in Industrial Engineering and Masters in management from Rutgers University. He resides with his family in New Jersey.*

**Panasonic Eco Solutions**  
[www.panasonic.net/ecosolutions](http://www.panasonic.net/ecosolutions)

# FORWARD ENERGY

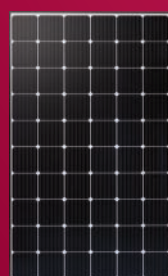
Forward energy is everywhere with world class manufacturing and best in class design.  
 Let's move forward.

Do you know how much detail does LG Solar concerned about?



LG Cell Production:  
 100 Pieces of Debris per 1ft<sup>3</sup>  
 Ambient Air:  
 350,000,000 Pieces of Debris per 1ft<sup>3</sup>  
 LG internal measurement

LG Solar production site achieved Class 100, which is close to a "dust-free" environment.



### LG NeON™ 2

 Cello Technology

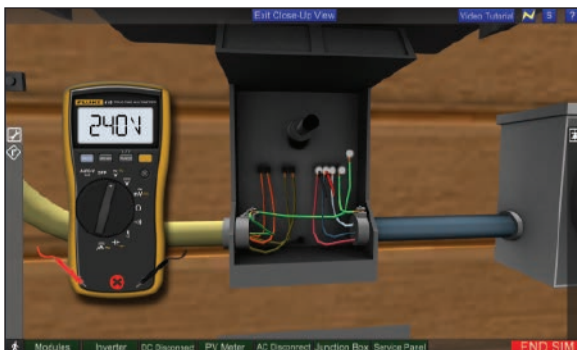
 Enhanced Warranty

 High Power Output

LG's new module, NeON™ 2, adopts Cello technology. Cello technology replaces 3 busbars with 12 thin wires to enhance power output and reliability. NeON™ 2 demonstrates LG's efforts to increase customer's values beyond efficiency. It features enhanced warranty, durability, performance under real environment, and aesthetic design suitable for roofs.







# New Technologies for Training

by Doug Donovan



**SEVERAL WEEKS AGO, THE OWNER OF A MIDSIZED SOLAR** contracting company in Texas said, “Our training is a complete goat rodeo.” Any non-native Texan may think that sounds fun; bucking goats, rag-dolling wannabe cowboys, and a corndog. But unfortunately, he was not describing a Sunday afternoon routine, but rather the dysfunctional training regimen at his solar company. This same commentary may have been heard many times before, although not as colorfully. The solar industry can brag of decades of continuous technical advancements, decades of market acceleration, decades of financial ingenuity, and yet the training of technicians and installers invites the comparison to a farm animal and meat on a stick. What’s going on here?

Investment in employee training and development are often the caboose of growing industries. The solar industry is no different. But, the realities of an emerging labor market are bringing more attention to the needs to advance training, not only in the community colleges and career schools, but more importantly at the contractor level. The industry is experiencing the greatest increase in on-boarding needs in the US economy. This has created a bottle neck for many companies, as all trades compete for a dwindling supply of laborers from career schools and apprenticeship programs. Deficiencies in training have led to slower growth for companies and to installation failure rates that cost the industry tens of millions of dollars annually. Further, the workforce’s new generation—millennials—have a different learning style and higher demands on short-term gratification. High employee turnover is not just a function of a difficult work environment, but also a function of less patient employees feeling they are not receiving the training they need to do their job properly or not having visibility into a promising career path.

The solar industry has begun to look for technological solutions for answers, and doesn’t have to look too far. Many adjacent industries, like HVAC and electrical, have adopted new technology platforms and delivery tools which have fundamentally changed the way employees are developed, engaged, educated, and inspired.

### Learning management systems

While not new to Fortune 500 companies or traditional education programs, Learning Management Systems (LMS) are beginning to be adopted by service contractors to manage their employees’ development. Many LMS’s use adaptive technology which can create individualized learning paths for each user. Some use gamification (often badges, levels, or leaderboards) for engagement, and provide a tracking system to help service managers and company owners quickly understand where employees need additional training or even use the data as a tool for performance evaluation.

### 3D simulation

The military, aviation, and medical industries have been using high quality video-game-like simulations to deliver skills training for decades. Lower development costs,

lower delivery costs, and a generation of gamers are making this a viable and scalable “hands on training” event which supports the real thing. Further, there is a litany of military studies proving its effectiveness. From improving in-the-field performance after using simulations, to lowering in-the-field errors after using game-based technologies, to accelerating acquisition of technical expertise after using a digital tutor system; none of this is drawn from uncharted waters. Companies are simply harnessing the best in educational technology and methodology and applying it to the solar industry.

### Mobile applications

We use our phones every day and all day to reference material: maps, Yelp reviews, and YouTube videos. We also know most everyone has quickly used YouTube or a Google search to reference info while in the field. Expect to see more advancements in how manufacturers are using mobile apps to quickly and easily disperse key, just-in-time training and procedure guides. This on-the-go resource center with picture capabilities will make a solar team and the manufacturer smarter and more responsive.

### Virtual and augmented reality

This is closer than people think. With Facebook’s purchase of a leading virtual reality (VR) company in 2015, and the launch of several rival companies’ headgear set for 2016, expect to see a lot more VR applications for learning. Medical manufacturers are leading the way with augmented reality (AR, the ability of a viewing tool, like a phone, to make intelligent overlays when pointed at a piece of equipment. Imagine pointing a phone at a power optimizer and immediately seeing all the critical specifications. We are just hitting the tip of of the iceberg here, but imagine standardizing code inspections using augmented reality Google Glass or phone applications.

### Blended learning

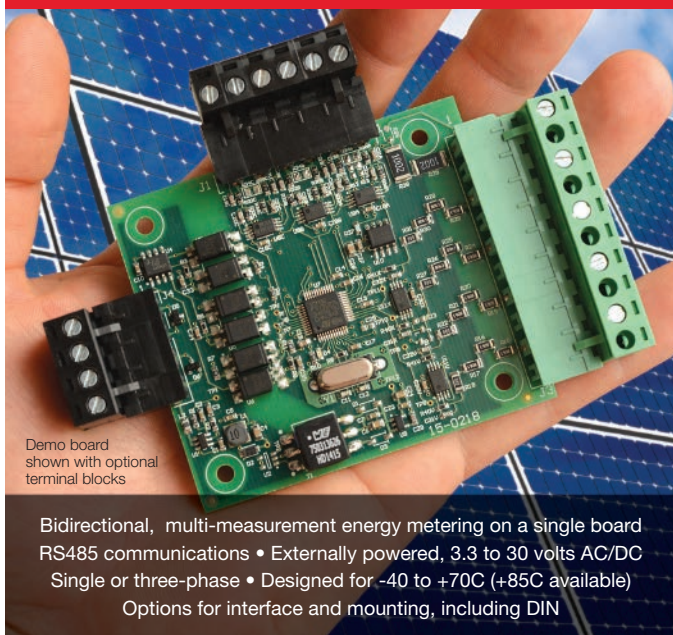
Over the last decade, learning institutions have begun to more effectively marry online and in-class education, providing a more time-efficient learning experience. Learners are required to view online lectures or complete online activities at home, and in-class time is spent focused on key needs like group discussion or hands-on-training.

### Training culture

In the end, all of the above advance training tools have no intrinsic value without deployment and use by companies and technicians. Companies will need to take a greater role in training their employees if they want to hit their growth goals as an organization. But, these new tools align perfectly with their new hires learning modalities; what 20-year-old doesn’t want to get paid to play a video game? The idea of developing a culture of learning around these games is a lot more realistic than the training tools of old. Further, these tools for the most part have been designed with business outcomes in mind, i.e. better field productivity, rather than traditional classroom learning outcomes, i.e. explain Ohms Law. And for those companies which adopt some or all of them, and build a sustainable system and culture of training and employee development, they will see more productivity and employment loyalty than ever before, without any of the heartburn caused by typical training methods or corndogs.

## Revenue-Grade PV Metering “In The Palm Of Your Hand”

Compact OEM module for revenue-grade metering



Demo board shown with optional terminal blocks

Bidirectional, multi-measurement energy metering on a single board  
RS485 communications • Externally powered, 3.3 to 30 volts AC/DC  
Single or three-phase • Designed for -40 to +70C (+85C available)  
Options for interface and mounting, including DIN

**Continental Control Systems, LLC**

1-888-WattNode (928-8663) • ccontrolsys.com

Doug Donovan is the CEO of  
Interplay Learning

**Interplay Learning**

www.interplay-learning.com





# WE'RE WITH YOU FROM CONCEPT TO CONSTRUCTION

Solar developers and EPC contractors face complex challenges: completing projects in a dynamic political and regulatory environment while adapting to compressed schedules and incorporating efficiencies to remain cost-competitive.

At Ecology and Environment, Inc., our renewable energy experts provide smart, practical solutions that help solar clients move projects from concept to reality through careful planning and a proactive approach. From initial siting studies through construction and mitigation monitoring, we draw from our extensive experience to anticipate potential project delays and resolve issues early to reduce risk and keep solar projects on track.



For help with your project, contact:

**Richard Stephens • (850) 523-0954 • [rstephens@ene.com](mailto:rstephens@ene.com)**



**ecology and  
environment, inc.**  
Global Environmental Specialists

[www.ene.com](http://www.ene.com)





# Solar Spring Break

## Pairing college students with industry workforce training through tribal installations

by Lia Papazoglou



Spring break usually means sunny beaches and parties, but for over 100 students from 10 colleges, this year it meant getting hands-on with solar by installing no-cost rooftop photovoltaics for low-income families.

“Solar Spring Break,” an alternative break program launched in 2014 by GRID Alternatives, provides a unique experience built around renewable energy and community service. This year students came from schools across America to install projects in California and Colorado.

The program has grown from six schools and teams in 2014 to ten schools and eleven teams in 2016, a sign of new interest in solar careers as the industry expands.

### Duke University's tribal installations stand out

While each team brought solar's benefits to underserved communities through lower utility bills and reduced emissions, the Duke University team's installations at the Chemehuevi Indian Reservation on the California-Arizona border stand out for their combination of homeowner impact and student initiative.

The eight-student team, all members of the Duke University Energy Club majoring in energy-related fields, spent four days installing rooftop solar systems on two tribal homes. With most of the team expecting to enter the clean energy industry after graduation, the installations provided valuable hands-on experience with solar technology and how it works in the field.

Professional staff provided on-site guidance and instruction, helping students complete every step of installation from cutting and installing rails to securing panels and setting up electrical system wiring.

“I always considered solar to be a distant, complex idea with numerous environmental benefits I was interested in,” said Duke student team member Emilia Chojkiewicz, “Installing solar as it turns out, is very easy and straightforward. Anyone can do it.”

Funding for the installations was primarily provided through California's Single-Family Affordable Solar Homes (SASH) program, with additional contributions from Southern California Edison, the San Manuel Band of Mission Indians, in-kind donations from the Chemehuevi Indian Tribe, and student fundraising.

Both systems used donated SunPower SPR panels with SMA 240V inverters. The first system features 10 SPR panels for a 3.27kW DC rating and \$760 in estimated annual utility bill savings, and the second system features 12 SPR panels for a 4.92kW DC rating and nearly \$940 in annual savings.

### Solar as economic opportunity

Tribal communities, especially rural ones, face some of the highest unemployment and poverty rates in America. Although reducing electricity costs is important for every low-income consumer, combining clean energy resources with solar's economic benefits are particularly salient for tribes developing resources consistent with their values.

Part of the Great Basin Culture Area, the Chemehuevi Indian Tribe is a branch of the Southern Paiute. Known to themselves as Nuwuvi (The People), they have been nomadic residents of the Mojave Desert and Colorado River shoreline for thousands of years. The Chemehuevi became a federally recognized tribe in 1970. Today, the reservation comprises 32,000 acres of trust land including thirty miles of Lake Havasu shoreline.

The tribe operates a small casino, restaurant, and other tourist-oriented businesses, but struggles to find economic opportunities for residents. Most Chemehuevi are on fixed incomes, and temperatures exceed 110 degrees in the summer, forcing them to choose between air conditioning and other expenses.

The solar systems installed by the Duke student team are expected to reduce household electricity bills at least 75 percent, saving homeowners up to \$21,000 over their 25-year expected lifespans. Since 2012, 85 systems have been installed on the Chemehuevi Reservation, with SASH program funding, representing \$1.7 million in investment. The savings to families are up to 90 percent on electricity costs.

Home solar installations are just the beginning for tribes like the Chemehuevi, looking to transition to renewable energy. In addition to their field work, the Solar Spring Break students met University of California Riverside (UCR) Professor Dr. Alfredo Martinez-

**SIBA FUSES** is proud to be the world leader in Energy Storage protection. We have a long-standing record for being first to lead the world in introducing & innovating new generations of PV fuses. SIBA Fuses was also the first to develop special wind farm SSK fuses for Switch-Fuse combination with low minimum breaking current at lower power dissipation, which can be used on transformers rated up to 3150KVA. Our Energy Storage fuses feature a high breaking capacity, specifically designed to meet the stringent requirements for energy storage applications, which we have perfected for the world's largest OEM's.

When you need true solutions, you will find that SIBA Fuses is the one stop you need to make to resolve all your Energy Storage protection requirements. Our product line includes, but is not limited to, the following fuses: capacitor, motor, transformers, PT, under-oil, traction, miniature and AC/DC semi-conductor fuses from 32VDC-5KVDC and 32VAC-40.5KVAC. Give us the opportunity to serve you. We're very confident you will appreciate our efficiency, product knowledge, and the superior technology and imaginative solutions that we can offer. We'd love to have you as one of our many satisfied SIBA FUSES customers.



**SIBA FUSES** [INFO@SIBAFUSE.COM](mailto:INFO@SIBAFUSE.COM)  
[WWW.SIBA-FUSES.US](http://WWW.SIBA-FUSES.US) IEEE BOOTH # 4341

**SIBA**  
FUSES



Morales, Managing Director of the Southern California Research Initiative for Solar Energy, to discuss a solar carport microgrid being planned for the Chemehuevi.

The system will manage energy use profiles and provide uninterrupted power at the Chemehuevi Community Center, which is currently prone to outages through a 90kW solar PV array with a 60kWh/30kW flow battery energy storage system. The design includes an advanced control system to take advantage of energy management strategies with expected benefits like lower energy costs, improved energy management, and increased grid stability for the whole community.

#### **Building a diverse and skilled solar workforce**

Beyond improving tribal family lives, Solar Spring Break is helping develop the next generation of solar industry workers and building a diverse workforce. America's solar industry needs qualified workers, the National Solar Jobs Census forecasts industry employment will grow 14 percent in 2016 but one in five solar employers already consider it "very difficult" to find qualified employees.

Most installers seek hands-on experience in new workers, so by combining classroom learning and passion for clean energy with actual work environment experience, Solar Spring Break participants graduate roof-ready.

"We were taught more in two days than we learned in months at school," said Abhishek Rao, a graduate student at Arizona State University who participated in 2015. "We put into practice all we studied from textbooks about residential solar systems, from surveying the site, to using tools to determine shading, designing the system, and actually installing it with our own hands. Solar Spring Break definitely added a much-needed real-world perspective to my experience studying solar energy engineering at school."

Solar Spring Break's student training benefits mirror training opportunities provided for tribal members through SASH-funded installations. To date, thirty-one Chemehuevi members have received a combined 1,500 hours of training, installing systems in the community, and learning skills they can use to start careers in solar.

As America's solar industry matures and installations expand, we're entering an incredible opportunity to build our own diverse, skilled workforce while extending the benefits of clean energy to all communities.



*Lia Papazoglou is the volunteerism and collegiate programs manager for GRID Alternatives. GRID Alternatives' vision is a successful transition to clean, renewable energy that includes everyone. Their mission is to make renewable energy technology and job training accessible to underserved communities. College students are encouraged to get involved with Solar Spring Break next year by visiting [www.solarspringbreak.org](http://www.solarspringbreak.org).*

**GRID Alternatives** | [www.gridalternatives.org](http://www.gridalternatives.org)



# SOLARROOFHOOK'S QuickBOLT

THE INDUSTRY'S FIRST CODE-COMPLIANT  
**FLASHING-FREE**  
MOUNTING SYSTEM

STAINLESS STEEL BACKED EPDM WASHER CHEMICALLY  
BONDS WITH THE COMPOSITE SHINGLE TO FORM A

**100%**  
**WATERPROOF**  
**SEAL**

**GUARANTEED TO PREVENT ANY LEAKS**

**FIND US AT INTERSOLAR BOOTH # 9345**



PE CERTIFIED TEST REPORTS AVAILABLE ONLINE

[www.solarroofhook.com](http://www.solarroofhook.com)





## The Rise of Mainstream Residential Solar Power

by Hayden Beck

Trends, like bell-bottom pants, catch on quickly, and just as quickly, they fade away. In contrast, smart, economical, earth-friendly decisions sometimes start out slowly, and then gain momentum as time goes on. Solar power is one of those earth-friendly decisions which began as an unattainable power source for the average consumer, but has quickly picked up speed over the last few years as more and more households make the change.

### Lower costs and tax credits

As the technology for solar energy has improved, the cost has gone down. In fact, prices for rooftop solar systems dropped by 29 percent from 2010 to 2013.

Federal and state tax credits and rebates have encouraged many people to go solar. Indeed, these credits and rebates can bring the total cost for a solar rooftop system to under \$10,000. However, the federal investment tax credit is set to decline from 30 percent to 10 percent during the second half of 2016. Taking that into consideration, as well as new available financing options, and growing networks of qualified solar installers, there has never been a better time to switch to solar power.

### Easy to maintain

Maintaining solar panels is as easy as hosing them down once a year. For the average homeowner bogged down by home maintenance, this is a huge benefit.

Easy maintenance aside, the fact that homes with solar power sell faster and for more money than homes without, should entice almost every homeowner to consider switching to solar power.

### Commercial businesses have jumped on the solar bandwagon

In addition to middle class homeowners, businesses have found that solar power can lower their operating costs. Not only that, but switching to solar allows companies to capitalize on improved environmental profiles.

### States are promoting storage development

California has set the example when it comes to energy storage. By passing Assembly Bill 2514, state utilities are now required to procure 1.3GW of storage by 2020. This has led the state's three largest

investor-owned utilities to install cost-effective power storage solutions.

And California isn't the only state getting involved. New York also budgeted \$25 million to go towards storage development.

### Energy storage helps in disasters

In an emergency, backup power is often run by diesel generators, which cause pollution. As solar energy moves forward, solar power systems combined with battery systems are providing a safer power alternative.

### Earth friendly

Solar power is more environmentally friendly than any other power system as it doesn't rely on water to make electricity. In addition, solar panels do not pollute the air as they generate electricity, and they produce no waste.

Solar power has no fuel costs, which means there is no gamble of fuel prices increasing. It's cleaner and more reliable than other sources of power.

### The future

Experts predict this is only the beginning of the surge of solar energy use. As people continue to recognize the benefits of solar power, its use will be even more widespread.

*Hayden Beck is a freelance writer who contributes content to multiple online publications. Recently, he has worked with Legend Solar. Hayden's focus includes writing about solar power and green industry trends. Hayden is committed to helping individuals learn more about renewable energy and new bio-technologies.*

**Legend Solar** | [www.legendssolar.com](http://www.legendssolar.com)

**MAGERACK**

**L-foot with Flashing**  
Absolute Waterproofing  
Easiest To Install  
Lowest Cost

**Tile Hook**  
Strongest Tile Hook  
Height Adjustable  
Optional Flashing

**Magerack Solar Mounting System**  
UL 2703 Certified, Class 'A' Fire Rating  
Built-In Integrated Bonding  
As Low As \$0.10 Per Watt

Scan for FREE Sample

**MAGERACK**  
[www.magerack.com](http://www.magerack.com)  
510-656-6661  
[info@magerack.com](mailto:info@magerack.com)

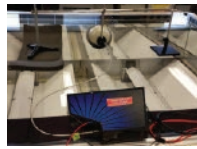




### Solar combiner nodes

ILSCO's solar nodes for combiner boxes up to 2000 volts for unfused PV source inputs are manufactured from high strength aluminum alloy for maximum conductivity and strength. Configurations include 18 to 42 string inputs and 4 outputs for application versatility. The conductor input side accepts a wire range of 4 – 14 Class B and C conductor, while the output side accepts 1000kcmil – 6 Class B, C, G, H, I, K, M, and DLO. This series can be used with mechanical or compression components, and a majority of the connectors have NEMA mounting hole configurations.

**ILSCO** | [www.ilsco.com](http://www.ilsco.com)



### Spectroradiometers for solar simulators

Spectral Evolution has spectroradiometers including the SR-3501 and SR-1901 to measure continuous simulators, and the SR-1901PT for pulsed simulators. Their instruments can test and measure a solar simulator for spectral match, uniformity, and temporal stability to ensure that the simulator is providing the promised light output consistently.

**Spectral Evolution** | [www.spectralevolution.com](http://www.spectralevolution.com)



### Safety-rated switcher ICs

Power Integrations announced the addition of a 900V device to its InnoSwitch-EP family of off-line CV/CC flyback switcher ICs. The new device targets power supplies operating from high-voltage DC and three-phase power sources found in industrial, motor-drive, metering, and renewable energy applications, and standard mains-voltage applications where continuous operation during line swells and surges is required. The 900V InnoSwitch-EP ICs are efficient, typically 85% for a dual output 18W design, eliminating heat sinks and enabling highly compact power supply implementations. The new 900V InnoSwitch-EP ICs feature an updated, integrated 900V power MOSFET which provides a significant operating margin for 450VAC industrial systems, increasing reliability, and operational life. Working continuously with an input voltage of up to 450VAC, an optional layer of protection, line UV/OV, prevents the IC from switching and protects the circuit up to 650VAC. 900V InnoSwitch-EP ICs enhance power-supply reliability by reducing BOM count to a minimum level and by eliminating optocouplers which degrade with time. Devices exceed all international energy-efficiency standards such as ENERGY STAR, California Energy Commission and European Union Code of Conduct (CoC), ErP Directive, and the US Department of Energy standards. Devices are UL1577 and TUV (EN60950) safety-approved and EN61000-4-8 (100 A/m) and EN61000-4-9 (1000 A/m) compliant.

**Power Integrations, Inc.** | [www.power.com](http://www.power.com)

## Minimal or No Site Grading Required.

**CONTOUR** is the most topographically adaptable ground mount racking system available and can be installed on up to a 20 percent grade resulting in a greater ROI.

**704-650-7474** | [info@dcesolar.com](mailto:info@dcesolar.com) | [www.dcesolar.com](http://www.dcesolar.com)







### Regenerative grid simulator

NH Research, Inc. (NHR) has released its new Model 9410 Regenerative Grid Simulator. This test instrument packs a full featured, 4-quadrant, regenerative, rack-mountable, 12-kW grid simulator in only 15 3/4" (9U). Standard models include three (3) fully programmable channels allowing for any combination of DC as well as 1Φ, 2Φ, 3Φ AC outputs. The modular design of this grid simulator permits power to be expanded in 12-kW increments, allowing improved sizing for testing micro-grids, grid-tied solar inverters, on-line critical power systems (UPS), grid-aware chargers, and similar AC grid-connected devices. This grid simulator simplifies IEEE 1547, UL 1741, CA Rule-21, and LVRT compliance testing by providing the highest level of integration and programming versatility in the smallest package. The new Model 9410 Regenerative Grid Simulator adds programmable AC to their regenerative bi-directional product line which includes the popular 9200 Series for DC testing and battery emulation. With the addition of this grid simulator, NHR is now able to offer combinations of AC and DC products specifically designed to simple testing of distributed energy resource (DER) and distributed generation (DG) products by simulating the AC area EPS as well as the DC battery or DC-Link capacitor.

**NH Research, Inc.** | [www.nhresearch.com](http://www.nhresearch.com)



#### SALES OFFICE

**Kipp & Zonen USA Inc.**  
125 Wilbur Place  
Bohemia NY 11716  
USA

**Rodney Esposito**  
T: +1 (0) 631 589 2065 ext. 338  
F: +1 (0) 631 589 2068  
M: +1 (0) 631 786 1558  
[rodney.esposito@kippzonen.com](mailto:rodney.esposito@kippzonen.com)  
[www.kippzonen.com](http://www.kippzonen.com)

Passion for Precision

### Accurately Monitoring the Performance of your Solar Energy System



To maximize the effectiveness of your solar energy system, you need to know how it is performing. A Kipp & Zonen pyranometer accurately measures the solar radiation available to your system in real time. Comparing this with the power generated allows you to calculate the efficiency of the system. A drop in efficiency indicates the need for cleaning, ageing or a fault, allowing you to schedule preventive maintenance and to monitor your return on investment.

Make that difference and contact Kipp & Zonen for the solutions available.



### Commercial PV inverters

Yaskawa - Solectria Solar announced the introduction of its PVI 50TL and PVI 60TL inverters adding to its three-phase, 1000 VDC, transformerless string inverter line. The PVI 50TL and PVI 60TL inverters have a flexible design, wide MPPT voltage range, 1.5 DC/AC ratio, -30°C to +60°C operating temperature range, remote diagnostics/firmware upgrades and are NEC 2014 compliant.

**Yaskawa - Solectria Solar**  
[www.solectria.com](http://www.solectria.com)



### N325 and N330 panels

Panasonic's new N325 and N330 panels produce 325 and 330 watts of power, respectively, and offer more solar output with fewer panels than traditional 260 watt solar panels. This increased output leads to 26% more free electricity and cost savings for homeowners over a 25-year lifecycle. The photovoltaic module HIT range of solar panels are easy to install and ideal for small roof areas. The HIT panels boast a 15-year warranty, and these panels can perform in extreme heat without jeopardizing quality or efficiency.

**Panasonic Corporation**  
[www.panasonic.com](http://www.panasonic.com)



### 1500VDC solutions

SolarBOS introduces 1500 VDC Combiners and Recombiners listed to UL-1741.

Key features of the disconnect combiners include: ETL Listed to UL-174; 100% continuous current rating up to 400 Amps; up to 36 input circuits; fuse sizes from 5 to 30 Amps; and optional 1500VDC surge protection. The recombiners are ETL Listed to UL-1741. They provide 100% continuous current rating up to 2560 Amps; up to 16 input circuits; fuse sizes from 50 to 400 Amps; optional load break or non-load break disconnect(s); optional 1500VDC surge protection; and optional zone level monitoring.

**SolarBOS** | [www.solarbos.com](http://www.solarbos.com)



### Retrofit MLPE solution

Tigo's TS4-R joins the family of the TS4 Platform which enables module manufacturers and installers to standardize on a single platform and utilize any of the cost effective Module Level Power Electronic (MLPE) functions currently available. The TS4-R is a Retrofit or Add-on base which supports the wide range of existing TS4 functional covers. The TS4-R addresses the need for a retrofit solution that can be mounted on any existing PV installation by connecting it to the existing PV module JBox. The TS4-R helps improve energy harvest, increases design flexibility, and adds visibility into an existing PV system. The offering for the retrofit product is composed of a two-piece solution: the TS4-R base, which is connected to the solar module, and the functional covers, plug-and-play MLPE which can be swapped in and out.

**Tigo** | [www.tigoenergy.com](http://www.tigoenergy.com)





### Specialized displays for community solar projects

AlsoEnergy announces their PowerPortal displays for community solar projects. PowerPortal was designed to provide flexible display options for today's community solar projects. PowerPortal provides community solar customers with a direct link to current information about their energy investment. This web-based end user display gives access to real-time production data and financial calculations for allocations within community solar projects. For end users and PPAs with multiple allocations, PowerPortal makes it possible to group designated allocations into single overview displays, rather than looking at each allocation individually. Versatile PowerPortal displays can even show complete balance sheets for grouped allocations with varying time-of-use rate sheet calculations, and can keep track of different contract start and end dates.

**AlsoEnergy** | [www.alsoenergy.com](http://www.alsoenergy.com)



### Wire management clip

WILEY's ACC-RBC15 wire management clip is made of corrosion resistant 304 stainless steel, which makes them a durable, long lasting, and reliable solution for all environments. The coined edges are designed to protect cable insulation from damage. The ACC-RBC15 is easy to install and can be snapped into rail channels of all designs. The ACC-RBC15 accommodates micro inverter trunk cables, AC module cables, and PV cables. The clip makes it possible to utilize the rail channel to run bundles of cables down the length of the rail.

**WILEY** | [www.burndy.com](http://www.burndy.com)



## Connect with us!

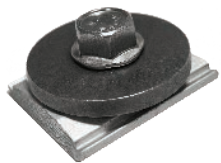
Did you know that nearly 25% of all solar electricity in North America flows through a SolarBOS product? Ever wonder why?

We believe it's due to our product quality, flexibility and manufacturing capabilities right here in the US. Not to mention our world-class customer service and wide product range, including everything from AFCI Combiners to Breaker Enclosures to PV Wire Harnesses. Add to this our 2-day shipping to most every jobsite in North America and it's easy to see why so many customers choose SolarBOS.

Solar Balance of Systems. It's what we do.



[www.solarbos.com](http://www.solarbos.com)   [sales@solarbos.com](mailto:sales@solarbos.com)   (925) 456-7744



### MLPE rail attachment kit

SnapNrack celebrates a joint UL 2703 listing with Enphase microinverters and SolarEdge optimizers. Under SnapNrack's UL 2703 listing, and with the launch of their MLPE Rail Attachment Kit, installers are no longer required to bond optimizers with ground lugs and bare copper. When using microinverters, ground lugs and bare copper are also not required to bond module rows. Installing a system using the MLPE Rail Attachment Kit will help further reduce labor and material cost. SnapNrack's MLPE Rail Attachment Kit has been designed, tested, and certified under the UL 2703 listing to work with Enphase microinverters and SolarEdge optimizers. The MLPE Rail Attachment Kit is an efficient solution for attaching microinverters and optimizers directly to SnapNrack rails. The microinverter and optimizer are bonded to the system through the kit and its attachment to the rail, removing the need for WEEBs. The kit comes pre-assembled and installs with a single 1/2" socket, utilizing standard channel nuts for Snap-In attachment to the rail.

**SnapNrack** | [www.snapnrack.com](http://www.snapnrack.com)



## A highly secure safety system



### Greeneye Smart PV Switch

- Failsafe safety system
- Individual shutdown feature per PV module
- Protection for firefighters or PV installers and electricians

[ep.mersen.com](http://ep.mersen.com)





# Batteries

A reliable battery is a key component to any efficient and sustainable solar energy system. Here are some of the more popular choices in the industry today...

SEE AD ON PAGE 45



## Rolls Battery Engineering

**Product:** Rolls 2 YS 62P

**Description:** Offering double the delivered Amp-Hour capacity of the Rolls 2 YS 31P, the new 2 Volt 2 YS 62P model offers 4860 AH in a single dual-container case design, offering significant storage capacity for large-scale off-grid and grid-tied applications.

**Capacity (Ah @ 20hr rate):** 4860 Ah

**Voltage:** 2 volts

**Cycle Life:** 3200 @ 50% Depth-of-Discharge; 5000 @ 20% Depth-of-Discharge

**Dimensions:** 27 3/8" x 9" x 31 5/8"

**Weight:** 570lbs (259kg)

**Key Features:**

- Durable, dual-container construction and industrial grade robotically welded cell formation;
- Included Rolls hydrogen R-cap reduces watering frequency, safeguarding against cell damage;
- Double the AH capacity of the popular 2 YS 31P model in a space saving single case design, reducing footprint for large-scale applications;
- 10-year manufacturer warranty, covering 3-year full replacement and 7-year pro-rated warranty.

[www.rollsbattery.com](http://www.rollsbattery.com)



SEE AD ON PAGE 43



## Crown Battery Manufacturing Company

**Product:** 2CRP3690 Power Module

**Description:** The 2-Volt 2CRP3690 Power Module combines massive ampere-hour capacity availability to renewable energy system users. The battery delivers application flexibility, while providing a better solution for temperature management and electrical isolation.

**Capacity (Ah @ 20hr rate):** 2550 Ah

**Voltage:** 2 volts

**Cycle Life:** 1500 cycles @ 100% Depth-of-Discharge; 4300 cycles @ 30% Depth-of-Discharge

**Dimensions:** 12.81" x 6.56" x 33.38"

**Weight:** 313lbs (141.9kg)

**Key Features:**

- Rugged internal construction with heavy-duty plate, cast-on strap, and terminal-post components, which deliver strong performance and durability;
- Posi-Wrap Plate Protection ensures active material retention, protecting from internal short-circuits to deliver proven ROI for customers;
- Low-maintenance design features reduced frequency of preventative maintenance to lower service costs and total cost of ownership; and
- High-capacity 2-Volt Power Module design includes fixed handles and the flexibility to be installed with or without battery racks.

[www.crownbattery.com/applications/renewable-energy-systems](http://www.crownbattery.com/applications/renewable-energy-systems)



## Microvast

**Product:** MPS-GEN01

**Description:** The battery module is used as the building block for the energy storage system. The battery module houses the individual cells in a protective enclosure. This enclosure provides a mechanical mounting system, power terminals, air passages for thermal management, and BMS connections. The module is designed to be used in a protected environment.

**Capacity (Ah @ 20hr rate):** 1080 Ah

**Voltage:** 3.6 volts

**Cycle Life:** 8,000 cycles @ 100% Depth-of-Discharge

**Dimensions:** 23.2" x 22.3" x 6.92"

**Weight:** 119lbs (54kg)

[www.microvast.com](http://www.microvast.com)



## BMZ USA, Inc.

**Product:** ESS 7.0

**Description:** Currently being delivered, the new 6.74kWh ESS 7.0 lithium energy storage unit offers high performance in a modern, aesthetically pleasing design intended for residential and small commercial solar PV installations and other types of renewable energy as well as on and off-grid configurations.

**Capacity (Ah @ 20hr rate):** 121.5 Ah

**Voltage:** 55.5 volts (48 nominal)

**Cycle Life:** 5000 cycle warranty

**Dimensions:** 25" x 18" x 18"

**Weight:** 209lbs (94.8kg)

[www.bmz-usa.com](http://www.bmz-usa.com)



is a U.S. subsidiary of 

# BATTERY ENERGY STORAGE SOLUTIONS

## 5,000 CYCLES

@ 70% DOD



### ADVANCED LEAD CARBON SEALED, MAINTENANCE FREE BATTERIES



**GS BATTERY (U.S.A.) INC.**  
[www.gsbattery.com](http://www.gsbattery.com) (800) 472-2879





SEE AD ON PAGE 42



## U.S. Battery

**Product:** US RE L-16XC

**Description:** Design optimized for maximum performance and life in stationary (non-vehicular) applications, including solar power and renewable energy installations, the OSP battery design and insulating DEFENDER "moss shields" increases life expectancy and performance.

**Capacity (Ah @ 20hr rate):** 401 Ah

**Voltage:** 6 volts

**Cycle Life:** 675 Cycles at 80% Depth-of-Discharge, and 1150 Cycles at 50% Depth-of-Discharge

**Dimensions:** 11-7/8" x 7-1/8" x 16-3/4"

**Weight:** 114lbs (51.7kg)

### Key Features:

- OSP outside positive plate;
- Higher peak capacity and increased initial capacity;
- Lower acquisition and per-cycle cost than lithium-ion, nickel metal hydride, or other rechargeable battery systems.

[www.usbattery.com](http://www.usbattery.com)



## Discover Energy Corp.

**Product:** 12VRE-3000TF

**Description:** Discover Tubular Flooded RE Series Batteries provide superior deep-cycling performance and reliability for demanding commercial, industrial, and residential renewable energy applications. Tubular Flooded RE Batteries utilize Advanced Tubular Plate Technology to deliver long service life with low maintenance requirements.

**Capacity (Ah @ 20hr rate):** 215 Ah

**Voltage:** 12 volts

**Cycle Life:** 2500 Cycles at 50% Depth-of-Discharge

**Dimensions:** 19.7" x 7.4" x 16.8"

**Weight:** 152lbs (69kg)

[www.discover-energy.com](http://www.discover-energy.com)



## GNB, Division of Exide Technologies

**Product:** Absolyte GP

**Description:** The Absolyte GP product line is a premium, valve-regulated, lead acid (VRLA), stationary battery for PV and energy storage projects. Made in the USA, Absolyte GP combines long duration and deep discharge performance in a modular, steel tray design for easy installation.

**Capacity (Ah @ 20hr rate):** 120 Ah to 5460 Ah

**Voltage:** 2 volts

**Cycle Life:** 1200 Cycles at 80% Depth-of-Discharge; 5000 Cycles @ 20% Depth-of-Discharge

**Dimensions:** Modular tray design provides for a variety of configurations

**Weight:** 30lbs to 275lbs (13.6kg to 125kg) / cell

[www.gnb.com](http://www.gnb.com)

# The Battery Matters



## The Difference Between Deka Solar and Other Batteries Is Like Night & Day

When it comes to solar power systems, don't settle for just any battery and be left in the dark. For energy storage and power when you need it, always choose Deka Solar, the long-life, reliable battery for on and off-grid power needs in even the harshest conditions.



Deka Solar Gel, AGM or flooded batteries are the proven choice for all your renewable energy applications.

- Competitive Warranty • Quality systems certified to ISO9001
- U.L. recognized components • Available through MK Battery distribution centers across North America, Europe and the Asia Pacific region.

### Deka Solar Saves The Day



Find your new Deka Solar battery

[mkbattery.com](http://mkbattery.com) © MK Battery 2016



MK Battery – An East Penn Manufacturing Co. Subsidiary MADE IN USA with U.S. and Imported Materials



SEE AD ON PAGE 41



### MK Battery

**Product:** 8L16

**Description:** The 8L16 is an industrial grade battery suited for off-grid solar applications. This battery provides several years of service with proper usage and maintenance. Stock is available nationwide reducing freight costs and transit time. Freight programs are available on pallet quantity shipments.

**Capacity (Ah @ 20hr rate):** 370 Ah

**Voltage:** 6 volts

**Cycle Life:** 1000 @ 50% Depth-of-Discharge @ 77°

**Dimensions:** 11.75" x 7" x 17.3"

**Weight:** 113lbs (51.25kg)

[www.mkbattery.com](http://www.mkbattery.com)

## CLEAN ENERGY STORAGE FOR A NEW GENERATION

**LITHIUM IRON**

**NICKEL IRON**

## THE LAST BATTERY YOU'LL EVER BUY.

Over a century ago, Thomas Edison found a battery design that he considered to be nearly perfect. Today, Iron Edison is proud to offer an updated version of this incredible design that is specifically manufactured for Renewable Energy systems.

- ⚡ Nickel Iron - 11,000 cycles or 30 years
- ⚡ Lithium Iron - 5,000 cycles or 14 years
- ⚡ Residential and Commercial Applications
- ⚡ Works with every major inverter and charge controller
- ⚡ 12, 24, and 48 Volts

info@ironedison.com  
**720-432-6433**  
[www.IronEdison.com](http://www.IronEdison.com)



### Fullriver Battery

**Product:** DC400-6

**Description:** Fullriver DC Series Deep-Cycle AGM batteries are specifically built for cyclic use in demanding solar applications. The thick plate design and AGM construction combine for a robust battery delivering optimal performance in both fair weather and extreme climate conditions, all in a spill-proof, non-hazardous, and maintenance-free package.

**Capacity (Ah @ 20hr rate):** 415 Ah

**Voltage:** 6 volts

**Cycle Life:** 500 cycles

**Dimensions:** 7.0" x 11.6" x 16.7"

**Weight:** 123lbs (55.8kg)

[www.fullriverbattery.com](http://www.fullriverbattery.com)

# Power You Can Depend On!

**WWW.USBATTERY.COM**



### OutBack Power

**Product:** EnergyCell 200NC

**Description:** VRLA AGM maintenance-free batteries with NanoCarbon technology for greatly improved cycle life even with partial state-of-charge; ideal for both cycling and back-up applications.

**Capacity (Ah @ 20hr rate):** 178 Ah

**Voltage:** 12 volts

**Cycle Life:** 2600 cycles at 50% Depth-of-Discharge in PSoC

**Dimensions:** 12.6" x 22.01" x 4.95"

**Weight:** 131lbs (60kg)

[www.outbackpower.com](http://www.outbackpower.com)



SEE AD ON PAGE 44



### Storage Battery Systems, LCC (SBS Battery)

**Product:** STT Series – STT2V600 / 6 OPzS 2-600

**Description:** The STT / OPzS series are 20-year, lead-selenium, flooded tubular plate batteries, manufactured in accordance with OPzS DIN40736 standards.

**Capacity (Ah @ 20hr rate):** 660 Ah

**Voltage:** 2 volts

**Cycle Life:** 1200+ Cycles at 80% Depth-of-Discharge

**Dimensions:** 5.71" x 8.11" x 27.6"

**Weight:** 100lbs (45kg)

**Key Features:**

- Offers a 20-year design life;
- The watering intervals are between one to three years;
- Has a leak-proof post seal;
- Can withstand high-temperature applications better than lead-calcium batteries.

[www.sbsbattery.com/stt-opzs](http://www.sbsbattery.com/stt-opzs) | [www.sbsbattery.com/stt2v600.html](http://www.sbsbattery.com/stt2v600.html)



### NEC Energy Solutions

**Product:** 12V Lithium Ion Battery / ALM 12V35

**Description:** NEC Energy Solutions ALM family of lithium-ion batteries offers high performance, a long operating life, and are safe batteries for tough, critical applications. The ALM 12V35 is available in standard (s), intelligent (i), and High Power (HP) series to match application requirements.

**Capacity (Ah @ 20hr rate):** 35 Ah

**Voltage:** 12 volts

**Cycle Life:** 10,000 cycles

**Dimensions:** 7.8" x 5.2" x 7.1"

**Weight:** 13.8lbs (6.3kg)

[www.neces.com](http://www.neces.com)



### Sun Xtender Battery

**Product:** PVX-3050T, Group GC2 Tall

**Description:** Since 1987, Sun Xtender has manufactured valve regulated lead acid batteries with AGM construction in the USA. The PVX3050T, Group GC2 Tall is the original AGM design adopted by the military. Non-spillable construction prohibits any electrolyte leaking or spewing, allowing the battery to be used upright or on its end or side with no water replenishment. Ship Hazmat Exempt.

**Capacity (Ah @ 20hr rate):** 305 Ah

**Voltage:** 6 volts

**Dimensions:** 10.28" x 7.06" x 12.94"

**Weight:** 91lbs (41.3kg)

[www.sunxtender.com](http://www.sunxtender.com)

## The Center of Your Solar System



This is where your investment in Solar & Wind Power Equipment pays off.



Crown Battery's proven array of Renewable Energy Deep Cycle Batteries. Unlike some deep cycle battery manufacturers who lump a few of their industrial products into a group and call it their RE line, Crown Battery evaluated the marketplace needs and re-engineered an entire line of 2-, 6- and 12-volt batteries to fit contemporary solar and wind power systems.

- ▶ The most complete, dedicated array of RE batteries with unmatched application flexibility and ease of handling
- ▶ Battery capacity ratings that range from 120 to 3690 ampere-hours (100 Hour Rate) and unmatched application flexibility
- ▶ Recognition of Crown Renewable Power Batteries as best-available and most-reliable by serious RE system owners

You've researched the renewable energy equipment you've bought. Now it's easy to select the storage batteries you need. Crown Batteries. Once you compare all the other renewable energy batteries in the world today, you'll find there's really no comparison. It's truly the best batteries for your solar system.

Contact us for more information: 419.334.7181  
[www.crownbattery.com](http://www.crownbattery.com)  
[sales@crownbattery.com](mailto:sales@crownbattery.com)





SEE AD ON PAGE 40



### GS Battery

**Product:** SLR1000-2

**Description:** The ECO R SLR1000-2 is part of the GS Battery "Pyramid of Power", a complete line of rechargeable batteries and energy storage systems. These batteries feature advanced lead and nano-carbon technology. These features allow the SLR1000-2 to deliver extraordinary performance and long service life.

**Capacity (Ah @ 20hr rate):** 1096 Ah

**Voltage:** 2 volts

**Cycle Life:** 5000 cycles @ 70% Depth-of-Discharge; 5500 cycles @ 50% Depth-of-Discharge

**Dimensions:** 11.3" x 6.5" x 19.41"

**Weight:** 147lbs (67kg)

**Key Features:**

- Rated for 5000 cycles at 70% Dod;
- Nano-carbon enhancement for excellent partial SOC performance;
- Sealed, virtually maintenance-free;
- Inherently safe and environmentally friendly.

[www.gsbattery.com](http://www.gsbattery.com)

SEE AD ON PAGE 42



### Iron Edison Battery Company

**Product:** Lithium Iron Battery System

**Description:** The Iron Edison brand Lithium Iron battery is innovative and maintenance-free. The Iron Edison battery is used for off-grid and utility backup applications as well as telecom and commercial peak load shaving. This next generation battery features longevity, durability, and ease of operation, without any complicated wiring.

**Capacity (Ah @ 20hr rate):** 180 Ah, 400 Ah, 700 Ah, 1000 Ah

**Voltage:** 12 volts, 24 volts, 48 volts

**Cycle Life:** 7000 cycles @ 30% Depth of Discharge

**Dimensions:** 28" x 16" up to 48" x 52"

**Weight:** 250lbs -1600lbs (113kg - 726kg)

**Key Features:**

- Lithium Iron Phosphate chemistry is inherently safer than all other lithium batteries; no thermal runaway;
- Battery Management System (BMS) actively monitors and protects the battery pack while allowing for maintenance-free operation;
- Durable steel enclosure with on-board fuel gauge provides the consumer with a simple interface;
- 12V, 24V, 48V options available in sizes of 180Ah, 400Ah, 700Ah, 1000Ah;
- High capacity, high voltage and other custom configurations available;
- Assembled in Colorado, USA.

[www.ironedison.com](http://www.ironedison.com)

**NEW!**  
**Battery Management System**  
[www.sbsbattery.com/EQUALINK](http://www.sbsbattery.com/EQUALINK)

**SBS**®  
 STORAGE BATTERY SYSTEMS, LLC.

Power Solutions™ since 1915  
[www.sbsbattery.com](http://www.sbsbattery.com)  
 800-554-2243

**Hydrogen Monitoring and Alarm System**  
[www.sbsbattery.com/SBS-H2](http://www.sbsbattery.com/SBS-H2)



### ViZn Energy

**Product:** GS200 Utility-Scale Solution

**Description:** 1MW-20MW blocks of 4-hour performance with safe and easy-to-permit chemistry. ISO 9001 manufacturing and made in the USA.

**Capacity (Ah @ 20hr rate):** 8000 Ah in MW configuration

**Voltage:** 1000 volts

**Cycle Life:** >2 Cycles/day with access to %100 SOC. 20 years life with negligible degradation

**Dimensions:** 53' x 8' x 9'

**Weight:** 700,000lbs (317,514kg)

[www.viznenergy.com](http://www.viznenergy.com)



### Energy Storage Systems, Inc. (ESS)

**Product:** 100kW/800kWh All-Iron Flow Battery (IFB)

**Description:** Earth-abundant iron, salt, and water for its electrolyte, and simple materials for battery components make the IFB from ESS, Inc. a cost effective, durable, environmentally-safe, long-duration storage solution. The IFB is ideally suited for time-shifting renewable energy on a daily basis, managing a facility's demand charges, and smoothing the intermittency of renewables on a constrained grid.

**Capacity (Ah @ 20hr rate):** 800 kWh

**Voltage:** 480 volts, 3 phase, 60 Hz

**Cycle Life:** >10,000 cycles

**Dimensions:** 40' x 8' x 8.5'

**Weight:** 4,000kg dry (ships dry), 54,000 wet

[www.energystoragesystems.com](http://www.energystoragesystems.com)



### sonnen, Inc.

**Product:** sonnenBatterie eco energy storage system

**Description:** The sonnenBatterie eco fully-integrated, intelligent energy storage system integrates with new and existing residential solar to provide backup power, solar self-consumption, off-grid power, and TOU rate arbitrage. The systems are AC-coupled and are currently available in 4kWh to 16kWh units.

**Capacity (Ah @ 20hr rate):** 39.5 Ah

**Voltage:** 120/240 volts

**Cycle Life:** 10,000 cycles / 10 year warranty; 100% Depth of Discharge

**Dimensions:** 26" x 51" x 14" (eco 4, 6 and 8) and 26" x 75" x 14" (eco 10, 12, 14 and 16)

**Weight:** 377lbs (171kg) (eco 4) up to 800 lbs (362kg) (eco 16)

[www.sonnen-batterie.com](http://www.sonnen-batterie.com)





## SimpliPhi Power

**Product:** PHI3.4 Smart Tech Battery

**Description:** The PHI3.4 Lithium Ferro Phosphate battery is optimized with proprietary cell architecture, power electronics, BMS, and assembly methods manufactured in USA. It is modular, lightweight, and scalable for installations ranging from kWh to MWh, providing seamless integration of renewable and traditional sources of energy in conjunction with, or independent of the grid.

**Capacity (Ah @ 20hr rate):** 67 Ah

**Voltage:** 48 volts

**Cycle Life:** 10,000+

**Dimensions:** 13.5" x 14" x 8"

**Weight:** 75.5lbs (34.8kg)

[www.simpliphipower.com](http://www.simpliphipower.com)



## PROINSO USA

**Product:** BMZ Energy Storage System 7.0

**Description:** The new 6.8kWh, ESS 7.0 lithium energy storage unit offers high performance in a modern, aesthetically pleasing design. Intended for residential and small commercial solar PV installations, it is also usable in other types of renewable energy as well as on/off-grid.

**Capacity (Ah @ 20hr rate):** 121.5 Ah

**Voltage:** 61.5 volts

**Cycle Life:** 5,000 cycles

**Dimensions:** 26.57" x 13.9" x 18.7"

**Weight:** 209.5lbs (95kg)

[www.proinosolar.com](http://www.proinosolar.com)



## Aquion Energy

**Product:** Aspen 48S-2.4

**Description:** Aquion Energy's Aspen battery is a building block for clean energy storage systems. Based on Aquion's safe, clean, and sustainable Aqueous Hybrid Ion (AHI) technology, the Aspen is the only Cradle to Cradle Certified battery. The Aspen battery provides years of hassle-free operation in residential, off-grid, and microgrid applications.

**Capacity (Ah @ 20hr rate):** 48.5 Ah

**Voltage:** 40-59.5 volts, 48 volts nominal

**Cycle Life:** 3,000 cycles to 70% retained capacity

**Dimensions:** 12.2" x 13" x 36.8"

**Weight:** 260lbs (118kg)

[www.aquionenergy.com](http://www.aquionenergy.com)



## Trojan Battery Co., LLC

**Product:** Trojan IND29-4V with Smart Carbon

**Description:** Smart Carbon is a standard feature in Trojan's Industrial flooded battery line to address the impact of Partial State of Charge (PSOC) on batteries in renewable energy (RE), inverter backup, and telecom applications. Trojan's Smart Carbon proprietary formula provides improved battery charge acceptance and faster recharge in PSOC applications.

**Capacity (Ah @ 20hr rate):** 1618 Ah

**Voltage:** 4 volts

**Cycle Life:** 1500 Cycles at 80% Depth-of-Discharge; 5000 Cycles @ 20% Depth-of-Discharge

**Dimensions:** 27.1" x 10.35" x 23.81"

**Weight:** 465lbs (211kg)

[www.trojanbattery.com](http://www.trojanbattery.com)

THERE'S A LOT OF LIFE IN ONE BATTERY

**Rolls**  
BATTERY ENGINEERING

The longest lasting battery for your off-grid home.

Learn more at [rollsbattery.com](http://rollsbattery.com)



## SOLAR POWER SOUTHEAST

May 25<sup>th</sup> to 26<sup>th</sup>, 2016

OMNI Atlanta Hotel at CNN Center—Atlanta, GA

Solar Power Southeast will bring 500 solar industry professionals who want to conduct business in the southeast United States solar market. Over 100 companies are registered to attend the event. This is a must-attend event for those wanting to grow their business in the region, or to keep up-to-date with the latest in the southeast solar market.

[www.events.solar/southeast](http://www.events.solar/southeast)

show in print

Features just some of the companies and technologies attendees will see at this year's show.

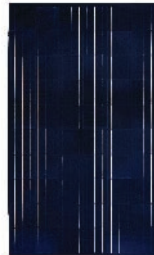


### Targeted turnkey ground screws and racking

TerraSmart's turnkey ground mount solution delivers an integrated foundation, racking, and installation. TerraSmart also provides the original, patented ground screw currently supporting over 500MW of installed capacity worldwide. The fixed-tilt racking (with wire-management) is fully integrated with the ground screw foundation, and has generous tolerances built-in to accommodate even the most difficult site conditions.

TerraSmart's exclusive rack also mitigates grading, cutting, fill, and permit fees during the site preparation process. With over 200,000 projects completed using TerraSmart people, products and equipment, TerraSmart's sizable construction fleet is able to ensure projects are completed on time and within budget.

**TerraSmart** | [www.terrasmart.com](http://www.terrasmart.com)



### Black backsheet PV modules

Whether residential, commercial, grid-tie, or off-grid, Kyocera Solar PV panels are solutions for a wide range of projects. Their KU modules can incorporate more modules per string, which reduces the cost of materials and labor by up to 20%. With a high average output, these crystalline modules come with a 25-year warranty, and are certified UL 1703, NEC2008 Compliant, IEC 61215/61730, ISO 14001, and IEC61701 Ed. 2 Severity 6.

**Kyocera Solar** | [www.kyocerasolar.com](http://www.kyocerasolar.com)



### Engineering services for utility-scale solar

Tropenas Company provides independent engineering to developers, owners, utilities, and solar OEMs by offering turnkey electrical and civil solar permit packages. With 3+GW of interconnection applications and designs, their multi-state local engineers will lead any portion of a solar project. Designed blending contractor field experience with value engineering, Tropenas' designs incorporate and clearly communicate lean solutions, enabling fast installation and long durability improving profitability. Example offerings: stamped electrical and civil permit drawings, independent engineering, medium voltage, and substation design.

**Tropenas Company** | [www.tropenas.com](http://www.tropenas.com)



### Aluminum frames for the solar industry

Sinobec supplies aluminum frames for solar panels, including customized design, clear, and black anodized frames from 10 micron to 20 micron, as well as powder coating AAMA2605.

**Sinobec** | [www.sinobecgroup.com](http://www.sinobecgroup.com)



### Solar inverter solutions

Fronius USA is showcasing their many solar solutions for high quality power inversion. Their Fronius SnapINverters are field serviceable string inverters built for the grid of tomorrow for both residential and commercial applications. Also now available, Fronius is introducing a highly cost effective Rapid Shutdown solution in multi and single string versions for optimum safety and code compliance.

**Fronius USA** | [www.fronius-usa.com](http://www.fronius-usa.com)



### Versatile mounting system

The Power Rail Family is a professional grade choice for mounting PV modules on residential and commercial roof structures. This mounting system has eight rail choices covering a wide range of span and cantilever requirements. In addition, every mounting rail features side channels for wire management and a broad selection of mounting attachments. The Power Rail system features a patented RAD lock-in-place bolt, an integrated grounding Amp Clamp, and patent pending pre-assembled module clamp that combine to offer the installer both labor and time savings.

**DPW Solar** | [www.dpwsolar.com](http://www.dpwsolar.com)



# SOLAR POWER SOUTHWEST

June 7<sup>th</sup> to 8<sup>th</sup>, 2016

Hyatt Regency Hill Country Resort and Spa—San Antonio, TX

The solar industry is coming on strong in 2016! SEIA and SEPA anticipate several hundred attendees from all cross-sections of the industry will convene in San Antonio this June for Solar Power Southwest. The program will center around trends and policies that impact the Southwest United States, with a particular focus on Arizona, Colorado, New Mexico, and Texas.

[www.events.solar/southwest](http://www.events.solar/southwest)



Features just some of the companies and technologies attendees will see at this year's show.

show in print



## Adaptable ground-mount system

Contour is a topographically adaptable ground mount racking system. Contour increases project ROI with less site grading required than typical ground mount products due to a single point purlin connection allowing the rack to pivot and seamlessly follow the topography up to a 20% grade. Installation options include driven beam or ground screw anchors that adapt to all soil types.

**DCE Solar** | [www.dcesolar.com](http://www.dcesolar.com)



## Ground mount solution

Polar Racking's PRU ground mount system includes a variety of foundation types and is best for the 200kW to 10MW ground mount market. Due to thicker gauges of material, the PRU uses 60% fewer connecting brackets and 50% fewer fasteners than industry standards. With less time needed for installation and lower labour costs, the PRU provides quality assurance and affordability hand in hand. The Polar Racking team supplies continuous product development, on-site technical support, and logistics coordination for on-time delivery. Polar maintains a four-week delivery time for complete foundation and racking orders.

**Polar Racking** | [www.polarracking.com](http://www.polarracking.com)



## Accelerated foundation method

TerraSmart's ground screw patented spiral thread system and pinpoint tip allow it to cut through the most arduous soil conditions imaginable. From bedrock to permafrost to coral, ground screws have an innate ability to penetrate the toughest soil conditions in minutes. Ground screws eliminate the need for concrete and allow foundations to be set within minutes, not hours. This accelerated foundation method has redefined installation times to 150 ground screws per day in medium dense soils. Imagine how fast a ground mount project will progress when you can set foundations in minutes and erect structure instantly.

**TerraSmart** | [www.terrasmart.com](http://www.terrasmart.com)



## Transition and combiner boxes

Soltection by Vynckier is a high quality, UL 1741 listed residential/commercial transition and combiner box for solar applications. The Soltection product line eliminates multiple sku's and utilizes high quality components, including Vynckier Enclosure Systems' FRP enclosures. Soltection by Vynckier guarantees 1-day delivery on all residential products and can meet aggressive shipping requirements for the commercial line. All products are American made and can be customized to fit individual job specifications in Vynckier's Houston, TX manufacturing facility.

**Vynckier** | [www.soltection.com](http://www.soltection.com)



## Rail-less PV mounting

RT-[E] Mount offers a unique approach to rail-less PV mounting systems. With its simple design, easy installation, and proven performance, RT-[E] Mount is a reliable solution. It can be attached directly into the roof sheathing, saving the solar contractor time up on the roof. Features include: integrated flexible flashing evaluated and certified by the ICC (International Code Council), fully waterproof, all-in-one design, P.E. Stamped letters ready, and ETL Classified to UL 2703.

**Roof-Tech** | [www.roof-tech.us](http://www.roof-tech.us)

**WE THRIVE IN THE TOUGHEST CONDITIONS**

More developers are reducing pre-construction costs, accelerating timelines and eliminating both risk and sub-surface unknowns with TerraSmart's new TF2 turnkey fixed-tilt racking solution.

Start Smart. Build Smart. TerraSmart.



TERRAS<sup>M</sup>ART.

VISIT [TERRAS<sup>M</sup>ART.COM](http://TERRAS<sup>M</sup>ART.COM) TO START BUILDING SMART!





## WINDPOWER 2016

May 23<sup>th</sup> to 26<sup>th</sup>, 2016

Ernest N. Memorial Convention Center—New Orleans, LA

WINDPOWER is the annual conference and exhibition for the US wind industry, hosted by the American Wind Energy Association (AWEA). It's the nexus between wind power professionals and industry experts, who converge to generate actionable ideas for expanding the wind energy economy through technology and collaboration.

[www.windpowerexpo.org](http://www.windpowerexpo.org)

show in print

Features just some of the companies and technologies attendees will see at this year's show.



### Narrow tongue expansion

The BURNDY narrow tongue lugs design permits the termination of conductors into confined spaces and applications including molded case circuit breakers, motor controllers, safety switches, and similar environments. Excellent for termination of larger cables used in applications to minimize voltage drop. The line expansion is a complement to their current line of narrow tongue offerings. All lugs are UL Listed to UL 486A/B and CSA Certified to C22.2.

**BURNDY** | [www.burndy.com](http://www.burndy.com)

**Booth 3124**



### Combined breaker & grounding switch

EMA Electromechanics' VDH/GSMI combined 34.5 kV outdoor vacuum circuit breaker and high-speed, mechanically interlocked grounding switch is specifically designed for application with wind energy collection units. This patented system for switching and grounding of wind collection circuits replaces traditional use of oil insulated grounding transformers combined with conventional circuit breakers in every feeder of a wind power substation, making green energy greener.

**EMA Electromechanics LLC**

[www.emaelectromechanics.com](http://www.emaelectromechanics.com)

**Booth 5129**



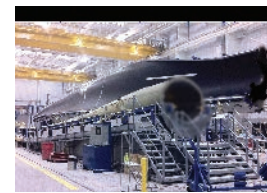
### Handheld printer for on-site marking

The handheld Thermofox printer from Phoenix Contact is lightweight and rugged, for easy marking on-the-go. Material cartridges hold an average of 25% more material than other printers on the market. The user can easily swap the cartridges for terminal block marking, shrink sleeves, self-laminating wire wraps, and indoor/outdoor vinyl tape in a variety of colors. The Thermofox also features barcode creation, a symbol library, automatic sequencing, and the ability to save files.

**Phoenix Contact**

[www.phoenixcontact.com/handheld](http://www.phoenixcontact.com/handheld)

**Booth 2139**



### Full-service wind engineering & manufacturing

Janicki Industries is a privately owned, full-service engineering and manufacturing company. Janicki specializes in manufacturing wind energy parts, patterns, and production tools made of advanced composite materials and metals. They are capable of tackling large-scale projects, utilizing high-precision five-axis mills, curing ovens, autoclave, and large annealing oven. Janicki also has extensive experience using many composite systems, such as: 71° C | 160° F machined syntactic putty; 121° C | 250° F carbon/fiberglass hybrid molds; 177° C | 350° F carbon molds; and 177° C | 350° F invar and steel molds. This 100% in-house capability for the total tooling and parts solution enables a one-stop shop for customers.

**Janicki Industries** | [www.janicki.com](http://www.janicki.com)

**Booth 2655**

# The world's leading expo for wind energy

27 – 30 SEPTEMBER 2016

Teaming up with **Wind EUROPE**

WindEnergy Hamburg is the global meeting point for onshore and offshore experts. The combination of the world's leading expo for wind energy in conjunction with WindEurope's leading industry conference represents a one-stop shop for business, networking, policymakers and the scientific community. Save the date!



The global on- & offshore expo

27 – 30 September 2016

[windenergyhamburg.com](http://windenergyhamburg.com)

**Hamburg Messe** in co-operation with **MESSE HUSUM & CONGRESS**



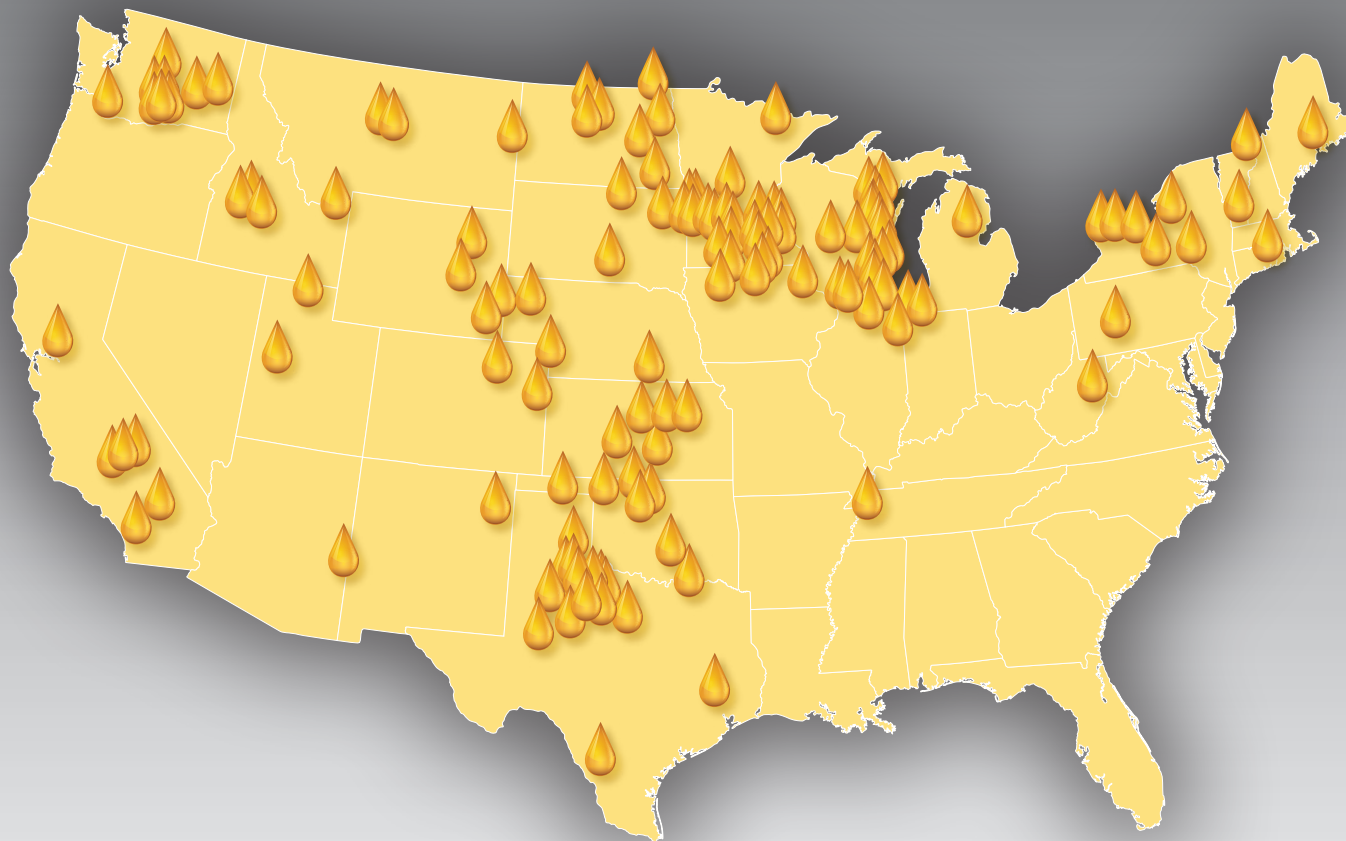
### Developer & operator

BayWa r.e. Wind, LLC is a turn-key developer and operator of renewable energy projects in North America. Headquartered in San Diego, CA, the company has been active in the U.S. since 2001. The company's business model is to develop, construct, own, and operate renewable energy projects. It seeks to complete the life-cycle by either divesting of or partnering on the operating assets. The company is actively seeking new renewable energy projects.

**BayWa r.e. Wind, LLC** | [www.baywa-re.us](http://www.baywa-re.us)

**Booth 4629**





## Maximizing Uptime Across North America

AMSOIL is protecting more than 10,000 MW-class turbines in North America alone. We have been delivering excellent protection and maximum uptime for more than seven years without reformulating our



product, preventing additional fluid changes and keeping turbines spinning. Find out why so many of the leading operators in the wind industry are switching to AMSOIL and why you should, too.

**DEVOTED TO PROTECTION.®**

Exceptional protection • Superior foam control • Proven water resistance • Minimized maintenance and downtime

Visit us at **Booth 4713** at **AWEA Windpower 2016**.



AMSOIL Wind Group | 715.399.6305 | [amsoilwind.com](http://amsoilwind.com)





### Operation and maintenance

EDF Renewable Services ensures ongoing project profitability for wind project owners and investors by providing a full range of operation and maintenance (O&M) services and expertise. These include: total project operations/balance of plant (BoP); asset management; warranty inspections; as well as engineering support and analysis. From the Operations Control Center, the company provides a full suite of standard and advanced services, including 24/7 remote monitoring, project performance evaluation, SCADA support, and remote resets and technician dispatch.

**EDF Renewable Services**  
www.edf-renewable-services.com  
**Booth 3139**



### Tools, safety & onsite consultation

Snap-on Industrial is a global innovator, manufacturer, and marketer of tools, equipment, safety, and productivity solutions for professional users performing critical tasks. During its more than 90 years in business, Snap-on Industrial has developed complete solutions for tool management including: torque calibration equipment; proprietary software for asset management and tool layout; lean kitting processes; custom kits for wind turbine maintenance and repair; a drop prevention program that includes engineered and tested attachment points on each tool; and a custom mobile tool container (Conex) program. In addition, Snap-on Industrial's 300+ industrial solutioneers provide onsite service, warranty, and consultation.

**Snap-on Industrial**  
www.snapon.com/industrial  
**Booth 3718**



### Portable condition monitoring

The Bachmann Portable Condition Monitoring System (CMS) delivers wind turbine diagnostics with complete coverage of the drivetrain from the main bearing to the generator, all from a single inspection. Vibration-based condition monitoring technology is a critical asset to the wind industry, providing a quick return on investment and placing extensive maintenance savings into the hands of wind site operators everywhere. Bachmann's Portable CMS allows wind site operators to assess the health of the major drivetrain components for each turbine, with minimal setup and no major investment. The use of a CMS helps to detect damage early, avoid unnecessary maintenance, identify issues prior to end of warranty, reduces risk of secondary damage, and extends total asset life.

**Bachmann electronic**  
www.bachmann.info  
**Booth 4813**



## TIME TO GET TO GRIPS WITH THINGS.

**MANOSKOP® 730 N** MANOSKOP® 730 N - at home in all weathers, such as in wind turbine maintenance. Accurate up to 1000 N·m. Quick & easy one-handed setting - proven to be reliable and robust - keeps downtimes to a minimum. Promised.

**Experience integrated tool solutions for maintaining wind turbines. Experience the »Made in Germany« difference.**



Tel.:(+1) 262-583-4060  
info@stahlwille-americas.com



### Blade coatings solution

ALEXIT BladeRep is an advanced blade coatings solution that maintains turbine blade surfaces for optimal performance and efficiency. For more than a decade, the BladeRep two-component, polyurethane-based system has proved to perform effectively in all conditions - ranging from challenging to harsh. These innovative coatings, GL certified for performance and reliability, meet the requirements of the cosmetic blade maintenance market, as well as the OEM small to medium blade specifications for high-quality, durable products.

**BladeRep (Mankiewicz Coatings)**  
www.bladerep.com  
**Booth 2949**



### Lubrication systems

BEKAwind offers 3 customizable lubrication systems for wind generators; The Single Line System is easy to install, operate, and maintain. It can be applied to main bearings, blade bearings and yaw bearings. The Progressive System offers a flexible lubrication system for oil and grease up to NLGI Class 2 and can be applied to main bearings, blade bearings, and yaw bearings. This system can be matched with a lubrication pinion for the pitch and yaw drives. BEKAwind Flow; a spray lubrication system, is selected for use with special lubricants with high solids content. This efficient non-contact technology offers a clean alternative for pitch and yaw drives.

**BEKAwind** | www.beka-lube.com  
**Booth 3049**



### Full service industrial contractor

Fagen, Inc. is a renewable energy design-build company, having constructed a variety of projects including wind power, biomass to power, conventional power, renewable fuels, and other industrial process facilities throughout the country and also internationally. Fagen, Inc. is consistently ranked among contractors and design-builders by Engineering News-Record (ENR) top 400. Utilizing their database of over 25,000 direct-hire employees, Fagen, Inc. is prepared to mobilize quickly and self-perform civil, structural, siding, insulation, piping, instrumentation, electrical, and start up services. They are fully prepared to meet industrial demand growth with a large inventory of cranes equipped specifically for the wind industry.

**Fagen, Inc.** | www.fageninc.com  
**Booth 1639**



## Complete LED wind tower lighting solution

Phoenix Contact provides LED wind tower lighting solutions, including purpose-built lights, UPS, and plug-and-play wiring – complete and from a single-source. LED lighting is maintenance-free and designed for optimal lighting of work surfaces and



escape routes in wind tower applications. A central UPS ensures lighting in case of power failure. Service technicians can conveniently read out the charge level and the battery expected service life. Preassembled cabling reduces installation time and eliminates the need for special tools. [www.phoenixcontact.com/tower\\_lighting](http://www.phoenixcontact.com/tower_lighting)

## Secure remote communication to wind farms



Phoenix Contact's new TC mGuard devices leverage cellular networks, such as Verizon and AT&T, to provide secure

remote communications wherever a wired connection is not possible. The TC mGuard meets the demand for remote maintenance and secure supervisory control and data acquisition (SCADA), two growing needs in today's connected wind farms.

For secure SCADA, the TC mGuard also offers a solution for customers that have a higher concern for security and availability of their sites. Features such as an active firewall, VPN technology, network redundancy, and support for multiple carriers under one part number ensure high availability and secure applications.

[www.phoenixcontact.com/mguard](http://www.phoenixcontact.com/mguard)

## Wind turbine blade lightning monitoring system



Due to their exposed locations, wind turbines have the highest risk of lightning strikes. Continuous monitoring of turbine blades for lightning effects has been challenging in the past, meaning that damage is often detected too late. The Phoenix Contact Lightning Monitoring System (LM-S) continuously detects and analyzes all

significant parameters of lightning surge currents, with real-time access and signaling. The LM-S allows for the planning for inspection and maintenance more efficiently, reducing downtime and improving turbine availability. [www.phoenixcontact.com/lm-s](http://www.phoenixcontact.com/lm-s)

new

### QUINT POWER - Preventive monitoring

Default settings	Out 1 digital	Out 2 digital	Out 2 analog	13 14 relays	Bargraph
Output Voltage	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Output Current	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Output Power	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Operating Hours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prewarning Derating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overvoltage Protection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Input Voltage OK	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Approaching failure?

Now you'll know. Application security, thanks to our new, fourth-generation QUINT POWER

Whether you're powering controls in the nacelle, the blade pitch, or the grid interface, the new technology in our QUINT POWER power supply delivers precise, real-time monitoring, NFC configurability, and a long list of application-worthy benefits. Get all the innovative details, drawings and specifications today!

Call 1-800-322-3225 or visit: [www.phoenixcontact.com/quintpower](http://www.phoenixcontact.com/quintpower)







### Project-specific ultracapacitor solutions

Maxwell's ultracapacitors provide burst power for electric wind pitch control systems to optimize turbine output and ensure rotor speed remains within a safe operating range. Maxwell ultracapacitors perform reliably within a wide temperature range and reduce significant maintenance costs associated with battery service and replacement. As an energy storage component, Maxwell ultracapacitors also provide fast-response for voltage stabilization and frequency regulation for the grid. Maxwell collaborates with utilities, wind asset owners, and systems integrators alike to design the most valuable, project-specific ultracapacitor solutions.

**Maxwell Technologies, Inc.**

[www.maxwell.com/wind](http://www.maxwell.com/wind)

**Booth 3354**



### Dual, vertical wind system

The BE-Wind product line is a dual vertical wind system with a Deflector (Diversion) shield. After wind tunnel testing and using flow analysis, a structure was developed to support the loads and allow the system to rotate smoothly into the wind, so the Deflector always maintains its position with constantly changing wind direction. Since the wind is diverted to both sides of the deflector, a second turbine is placed on the opposing side. The result is a high performance, low wind system for the small wind industry.

**Berdan-Tech, LLC** | [www.be-wind.com](http://www.be-wind.com)

**Booth 2451**



### Engineered flexible tray cable

Lapp Group components have been field-proven to withstand temperature extremes, hydraulic fluids, corrosive oils, and the vibration and torsion stress often found in wind turbines, helping to deliver high performance and revenue generating wind farms. Lapp is introducing ÖLFLEX TRAY VTC, a flexible tray cable with TC-ER for easier installations. Engineered with premium PVC insulation provides greater flexibility over PVC/nylon without sacrificing cable size.

**Lapp Group** | [www.lappusa.com](http://www.lappusa.com)

**Booth 2750**



### Blade protection coating

3M Wind Blade Protection Coating W4601 is designed to help protect the leading edge of wind blades from damage caused by sand and rain erosion and minor impact. 3M Wind Blade Protection Coating W4601 is a component polyurethane coating that provides excellent erosion protection in a single layer. The coating is designed for application in OEM facilities and can be easily applied via brush or casting.

**3M Wind Energy** | [www.3m.com/awea2016](http://www.3m.com/awea2016)

**Booth 5119**



### Surface solutions for wind turbines

Oerlikon Balzers and Oerlikon Metco surface solutions help to increase wear resistance, improve component performance, and extend maintenance cycles of gears, roller bearings, hydraulic and structural parts. They apply Nitriding, PVD/DLC coatings and thermal spray coatings to push the performance limits of components for wind craft turbines.

**Oerlikon Balzers**

[www.oerlikon.com/balzers](http://www.oerlikon.com/balzers)

[www.oerlikon.com/metco](http://www.oerlikon.com/metco)

**Booth 2449**



### Condition assessment solutions

Techimp has over 20 years experience in MV/HV condition assessment. Their comprehensive assessment program for wind farms includes advanced technology for sensors, acquisition units, SCADA, and dedicated software for any practical application on generators, inner cables, HV transformers, GIS, and MV/HV cables. They provide solutions for commissioning (factory quality control and on-site installation assessment), for monitoring (data analysis service and online SCADA monitoring), and for maintenance (QC inspections and ON/OFF line measurement).

**Techimp** | [www.techimp.com](http://www.techimp.com)

**Booth 2413**

**EMA ELECTRO MECHANICS**

**VDH/GSMI®**  
**34.5 kV Vacuum Circuit Breaker & High Speed Grounding Switch for Wind Power Substations**

Visit us at AWEA WINDPOWER 2016!  
**Booth #5129**

**EMA Electromechanics, LLC**  
 16 Industrial Drive, Sweetwater, TX 79556 • (325) 235-8000  
[www.emaelectromechanics.com](http://www.emaelectromechanics.com) • [contact@emaelectromechanics.com](mailto:contact@emaelectromechanics.com)



### Fire suppression system

The Firetrace automatic fire suppression system is a solution for the unique environment in a wind turbine unaffected by vibration, dust, airflow, and temperature. Their systems can protect the control panels, capacitor cabinets, braking system, transformer, and other at risk areas of the turbine, without requiring power or excessive space usage.

**Firetrace International** | [www.firetrace.com](http://www.firetrace.com)

**Booth 3547**



## *Foam, rubber and plastic solutions that seal, absorb and protect*

75 years' experience in the development, production and sale of foam, rubber and plastic solutions. DAFA's Wind solutions are developed using our experience within every field of business to your advantage in wind power.

### Our solutions for wind turbines include:

- Nacelle solutions
- Tower solutions
- Blade solutions
- Transport solutions

## DAFA CargoPro®

*- Safe transport and storage solutions for blades and equipment for the wind turbine*



- Prevent costly delays due to damages
- Optimal protection during transport, handling and storage of blades and equipment
- Increased visibility
- Universal solutions that fit all blade types



DAFA universal tip protector - a unique one-size-fits-all solution designed to protect the blade tip during transport, storage and installation of wind turbine blades.

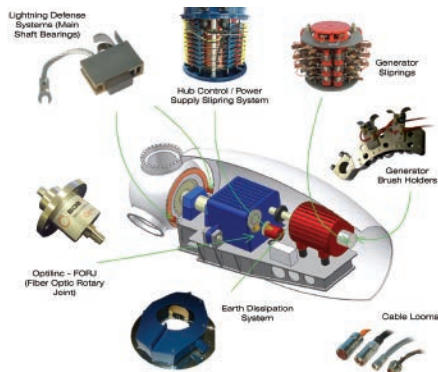




BGB Technology Inc. is a leading supplier in the development of slipring solutions for the wind turbine industry. BGB are at the forefront of turbine technology and work closely with major global wind turbine manufacturers.

**Expertise in:**

- > Hub control sliprings for both electrical and hydraulic pitch shift systems (main shaft)
- > Power supply systems (main shaft)
- > Generator / frequency converter sliprings and brush holders (generator high speed shaft)
- > Lightning defense brushes & static earth dissipation systems (main bearings and slewing rings)
- > Cable looms & harnesses for turbines
- > Brush holders
- > Fiber Optic Rotary Joints - FORJ (a fiber optic solution which is not influenced by vibration, humidity, heat, magnetism)



**T:** (+1) 804-451-5211 **E:** sales@bgbtechnology.com **W:** www.bgbtechnology.com  
 BGB Technology Inc. 1060 Port Walthall Drive, Colonial Heights, Virginia. 23834. USA

Visit us at booth 3826 at AWEA Windpower 2016 in New Orleans – May 23-26

## The Vanguard™ LED Series

Standing at the forefront of lighting innovation



### Vanguard™ FTS 370i LED Series

- Superior 200 kA Surge Suppression
- IR (NVG) Capable
- Integrated Design
- Rugged GPS Receiver
- Standard Radar Interface

With the ever growing wind energy market, the need for effective and efficient lighting systems has never been greater. The Flash Technology FTS 370i wind turbine FAA light was developed from years of experience in the obstruction lighting industry and through thousands of installations on wind farms around the world. New LED technology provides a robust and durable system with patented optics to reduce the effect of light scatter in the community. The FTS 370i offers an Infrared (IR) option for better visibility with night vision goggles (NVG) and NVIS. With an integrated design for simple installation, GPS synchronization, and a standard radar interface for ADLS requirements, the FTS 370i is the best choice for any FAA lighting system need.

Come see us at AWEA WindPower 2016 Booth # 2912

**FLASH TECHNOLOGY**

888.313.5274  
 flashtechnology.com



### Aerial work platform

The PALFINGER-built P 1000 is engineered for assembly and maintenance on wind turbines and other towering structures. With a working height of 337 feet (103 meters), the P 1000 provides access to tall, difficult-to-reach jobs. Equipped with a five-axel all-terrain mobile crane chassis and four different stabilizing configurations which allow the P 1000 to work in tight conditions, the working capabilities of the platform aren't hindered by its large size. Additionally, electronics and safety features, including telescopic stabilizers, guarantee stability and allow for safe operation in wind speeds up to 12.5 m/s.

**PALFINGER** | www.palfinger.com  
**Booth 1338**



### Durable industrial labeling

Etiflex Corp. manufactures a durable line of unique molded tags used in demanding environments and hazardous conditions. The newly patented data matrix tags keep a record of inspections displayed right on the item and can be updated in the field. Their permanent marking system never fades, even with UV exposure and abrasion. They are commonly used for recording inspections on slings, lifting gear, climbing gear, outdoor components, or for in-service dates, serial numbers, and capacity tags. All of the tags can be color coded and laser engraved. Etiflex also holds a patent for series of unique molded RFID labels.

**Etiflex Corp.** | www.etiflex.com  
**Booth 3212**



### Wind development region

Iowa is centrally located in the heart of a region that boasts some of the nation's most abundant wind resources, providing a strong economic environment for the wind energy industry. Companies can also benefit from a robust supply chain, with direct access to transmission lines that connect to regional transmission systems.

**Iowa Economic Development Authority**  
 www.iowaeconomicdevelopment.com  
**Booth 3512**



### Energy management consultants

Opportune, LLP is an international energy consulting firm specializing in assisting clients across the energy industry, including upstream, midstream, downstream, power and gas, commodities trading, and oilfield services. Opportune's practice areas include: chemical engineering, complex financial reporting, corporate finance, dispute resolution, enterprise risk, outsourcing, process and technology, reserve engineering and geosciences, restructuring, strategy and organization, and tax.

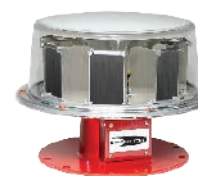
**Opportune, LLP** | www.opportune.com  
**Booth 2712**



### Project cargo services

Martin Bencher Group is a Scandinavian based shipping and freight forwarding company, transporting and specializing in the handling of projects and oversized/heavy cargo. Their expanded network and strategically located offices offer services to customers worldwide. Martin Bencher Group currently serves the following industries; oil and gas, shipbuilding, paper and pulp, power, mining, cargo handling equipment, yachts, and wind power.

**Martin Bencher Group**  
 www.martin-bencher.com  
**Booth 2050**



### Obstruction lighting solutions

Drake Lighting is a distributor of the Mallard Series complete line of FAA certified LED Tower Lighting. The LED Mallard Series has one two-conductor wire with no polarity. The one-size cable for Beacon, Markers, and Photocell and standard 13 1/4" bolt circle makes new installations and retrofits easy to install.

**Drake Lighting** | www.drakelighting.com  
**Booth 5315**



# FOR THE REALLY **LONG** HAUL

## 199 FOOT WINDMILL TRAILERS EXPAND LANDSTAR'S CAPACITY TO SERVE THE WIND INDUSTRY

Hauling windmill blades across the country is a big task, even for the most experienced owner-operator; it's a delicate practice of planning and patience. Just a decade ago, windmill blades were a lot smaller than they are today. Of course, even a small windmill blade can span dozens of feet and take days or even weeks to move from one place to another.

The art of hauling wind blades is ever changing. In October 2015, Landstar unveiled its newest capacity addition, a 199 foot windmill blade trailer. The new trailer allows Landstar BCOs to haul the longest wind blades ever built. The trailers weigh in at 49,000 pounds and are able to haul a 36,000 pound windmill blade.

"This gives Landstar greater flexibility in transporting longer windmill blades and enhances Landstar as a key player in wind energy transportation," said Landstar Vice President of Trailer Management Matt Miller.

The extendable trailers were specifically designed and built to meet the demands of the evolving wind energy industry, putting Landstar's new windmill blade trailers at the cutting edge in wind transportation, and Landstar among the premier blade haulers in the United States.

Visit us at  
AWEA Booth #1823







### Turbine lighting

Designed with the customer in mind, the Flash Technology Vanguard II is more user-friendly, robust, and easier to install than ever before. Tested by multiple lightning test laboratories, the Vanguard II has a surge-suppression rating of 25 kA. The Vanguard II provides many options for monitoring, whether performed by a company's NOC or by Flash Technology. Now, with Vanguard II, Flash Technology offers an Infrared (IR) version as an option for better visibility to night vision goggles (NVG) and NVIS. The FTS 370i NVG compatible design combines Red (620nm) and IR (850nm) LEDs to ensure the lighting system is visible to pilots in all circumstances. With an integrated design for simple installation, and a radar interface standard, the Flash Technology Vanguard II is a durable, capable, and functional choice for any lighting system needs.

**Flash Technology** | [www.flashtechology.com](http://www.flashtechology.com)  
**Booth 2912**



### Slip rings for wind turbine applications

BGB Technology provides custom designed and standard slip ring and fiber optic products covering all utility and small wind turbine requirements including: generator slip ring assemblies, hub and pitch control slip rings, yaw slip rings, lightning suppression, shaft grounding systems, and brush assemblies. Capabilities also include the incorporation of fiber optic rotary joints within pitch control slip rings to provide contactless signal transmission.

**BGB Technology, Inc.**  
[www.bgbtechnology.com](http://www.bgbtechnology.com)  
**Booth 3826**



### Transducerized closed-loop control system

AcraDyne's transducerized torque control system provides consistent, reliable torque values as well as the ability to monitor rotational angle during the tightening process. When combined with AcraDyne's controllers, customers experience a high torque, critical bolting system that can quickly handle tough and critical bolting applications. This high torque tool features five handle configurations, on-tool LEDs for accept/reject signals, and interchangeable tools, cables, and controls.

**Aimco Global** | [www.aimco-global.com](http://www.aimco-global.com)  
**Booth 2349**

## Customized Truck Rental

A Cost effective way to get you to your Next Job!

Providing towing and hauling solution to help meet your productivity goals, offering the newest vehicles equipped with comprehensive safety and security features



Order now for a timely delivery of quality trucks and service at competitive rates.

Contact us for a Free quote:

Call - 855.602.2777

E-mail - [sales@gocapps.com](mailto:sales@gocapps.com)

Visit - [www.gocapps.com](http://www.gocapps.com)

Please visit us at AWEA Windpower 2016, at booth 5429.



### Wind energy and turbine technology program

Since 2004, Iowa Lakes Community College has been preparing technicians for the wind energy industry, utilizing state-of-the-art technology and training assets to provide the realism top technicians deserve. Iowa Lakes has the nation's first AAS in Wind Energy & Turbine Technology and partnerships across the spectrum of the industry. Iowa Lakes provides courses including siting and analysis, operations and maintenance, drop prevention and working at height and rescue. Iowa Lakes Community College's program is AWEA-recognized for wind technicians.

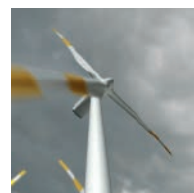
**Iowa Lakes Community College**  
[www.iowalakes.edu](http://www.iowalakes.edu)  
**Booth 5312**



### Structural bolting

Cooper & Turner provides a wide range of hot and cold formed threaded fasteners for the global wind power market, used in foundation construction, tower erection, nacelles, blade, and gearbox assembly. They operate their own production facilities in Europe and Asia, manufacturing high strength bolting up to 4" diameter (M100) in-house, adhering to international and customer specific standards. They also have licensed coating and lubrication processes on premises. The certified, in-house testing lab equipment includes tensile testing with 4,000 kN capacity, torque-tension testing up to M80, and grain and structural analysis equipment.

**Cooper & Turner Industries, Inc.**  
[www.cooperandturner-usa.com](http://www.cooperandturner-usa.com)  
**Booth 4748**



### Gear oil

Klüber synth GEM 4-320 N reaches a high level of wear resistance while providing a platform for achieving the ISO Cleanliness Codes desired for wind energy applications. Klüber synth GEM 4-320 N is compatible with hoses and sealing materials, and provides protection against corrosion.

**Klüber Lubrication NA LP**  
[www.klueber.com](http://www.klueber.com)  
**Booth 2429**



### Generator and motor repair

GlobalTech Motor & Controls, Inc., located in Houston, Texas, specializes in the repair of electrical rotating equipment including induction, synchronous, doubly fed induction (wound rotor), and permanent magnet generators. They repair, rewind, and test low and medium voltage generators and motors from 400KW to 5,000+KW.

**GlobalTech Motors & Controls, Inc.**  
[www.globaltechmotors.com](http://www.globaltechmotors.com)  
**Booth 3214**





### Professional tool solutions

STAHLWILLE's range of products includes torque wrenches, spanners, ratchets, torque multipliers, and many more. To ensure safety and productivity, both in the production environment and in the wind farms, STAHLWILLE's torque tools provide users with a high degree of convenience, accurate and quick setting, and an optimized ergonomic design. Controlled tightening is easy with their 730 Series torque wrenches, interchangeable inserts, 7707W Series Torque Testers, and complete calibration systems.

**STAHLWILLE** | [www.stahlwille-america.com](http://www.stahlwille-america.com)  
**Booth 3219**



### Transportation, distribution, and storage

The Port of Stockton is an inland port, strategically located in the heart of California's Central Valley. Served by both the UP and BNSF railways, the Port of Stockton has over 2.5 miles of on-dock rail and ample laydown area available for wind energy shipments. The Port is adjacent to I-5, CA-4, and CA-99, and less than an hour away from I-80. Their experienced workforce, two 144 M/T Liebherr Mobile Harbor Cranes, and around the clock security and gate offer a unique and flexible solution to critical logistical issues.

**Port of Stockton** | [www.portofstockton.com](http://www.portofstockton.com)  
**Booth 5212**



### Spare gear manufacturer

Founded in 1952, Ernst Schad is a privately owned gear wheels production company with experience in the production of gear wheels for wind turbine gearbox makers such as, Winergy, Bosch, Moventas, ZF Hansen, Eickhoff, Ja-Ke, Zollern, and others. Ernst Schad produces gear wheels per customer drawings, performs reverse engineering and production of new parts according to example, and offers repair by regrinding the flanks.

**Ernst Schad** | [www.ernst-schad.de](http://www.ernst-schad.de)  
**Booth 5539**



### Smart hydraulic power supply

With the Pintsch Bubenzer Smart HPU, oil level, temperature, pressure, moisture content, and contamination are continuously monitored against proper standards to provide advance warning of potentially damaging conditions. Preventive maintenance can be scheduled on a non-emergency basis, saving time and money, and keeping the turbine in production mode.

**Pintsch Bubenzer USA** | [www.pintschbubbenzerusa.com](http://www.pintschbubbenzerusa.com)  
**Booth 4038**

**3M** Science. Applied to Life.™

# Build. Protect. Enhance. Increasing efficiencies at every turn.

Offering  
**100+**  
Products and counting to  
help increase wind turbine  
efficiency

Your investment in wind power is substantial, make sure your return is as well. From manufacturing to maintenance and beyond, 3M is a trusted partner with technology to help maximize efficiencies at every turn. We provide a robust offering of tapes, coatings, fillers and vortex generators to fit your needs. As a global company you can rest assured that we will be with you wherever the wind blows.

**Come visit us at Booth 5119 to learn more.**

Visit [3m.com/AWEA2016](http://3m.com/AWEA2016)

© 3M 2016. All rights reserved. 3M is a trademark of 3M Company. Used under license by 3M subsidiaries and affiliates.

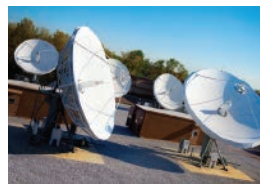




### Offshore wind subsea connectors

First Subsea is a developer of subsea connection technology, including the Ballgrab connector. Based on products designed for safety critical applications for hydro carbon flowline risers and station keeping mooring components used in the offshore oil and gas industry, First Subsea has developed a range of mechanical subsea connectors for applications in offshore wind projects. These include: cable protection systems for 11kV, 33kV, and 66kV array and export cables that connect into I tubes, J tubes, and directly into monopiles; automatic latching hang off connectors which permit cables to be pre-stripped or terminated; and diverless bend stiffener connectors for floating offshore wind platforms. They also develop mooring line connectors for floating offshore wind platforms used to reduce installation times, replace costly mooring capital equipment, and permit easy disconnection and disconnection, as well as single point lifting tools used to improve HSE and rigging requirements, speeding the installation and reducing vessel time.

**First Subsea** | [www.firstsubsea.com](http://www.firstsubsea.com)  
**Booth 2714**



### Broadband satellite internet service

Skycasters provides reliable data communications which keeps critical data flowing. The company serves all businesses needing a premium connection with maximum uptime, including those involved in renewable energy exploration and delivery. Their business-grade, high-speed satellite Internet solutions offer a low-latency connection with guaranteed speeds supporting all communications and data operations needed by the energy sector—SCADA, VoIP, email, fax, streaming data, and more. A direct and redundant connection to the U.S. Internet backbone provides Skycasters customers with reliable communications whenever and wherever they go. Fixed and mobile satellite Internet solutions all utilize business-grade equipment built to last and perform in the most rugged environments. Flexible and customized service plans are available to meet individual business needs, backed by a 24/7 Technical Support Group offering support based out of their company-owned and operated Ohio NOC/Teleport.

**Skycasters, LLC.** | [www.skycasters.com](http://www.skycasters.com)  
**Booth 3155**



### Forecasting software

Sentient Science uses materials science to build computational models of complex rotating machines in the wind, transportation, and industrial markets. Sentient's DigitalClone Live software provides always on computational testing of fielded wind turbine assets using actual operating conditions to provide a forecast into the predictive health of the major systems and components. Sentient provides life extension solutions to achieve optimal machine life and significantly lower O&M costs. Sentient's DigitalClone Live is used by different managers within owner and operator organizations. Operation managers use the software paired with SCADA to execute on the remaining useful life of assets already in failure. Asset managers use Sentient's rolling forecast to build multi-year O&M budgets and plan preventative maintenance schedules to achieve life extension. Financial stakeholders use the lifing data to assess financial risks and lower O&M costs. Sentient's DigitalClone Live is used by suppliers to gain global access to operators in need of replacement parts and services.

**Sentient Science** | [www.sentientscience.com](http://www.sentientscience.com)  
**Booth 3227**



Whether you need a system for wind blade production, or repairs, come by and learn how Mankiewicz can provide your complete coatings solutions.



**Booth #2949**



North America: +1 (843) 654 7755  
 Europe: +49 (0) 40 / 75 10 30

[www.mankiewicz.com](http://www.mankiewicz.com)



### Sealing, absorption, and protection solutions

DAFA is a global supplier of foam, rubber, and plastic solutions to wind turbine producers and sub-suppliers in the wind turbine industry. Their solutions for the foundation, tower, nacelle and blades include, DAFA RotaSeal; a new solution for sealing of rotating parts in the wind turbine, DAFA CargoPro; solutions for transport and storage of blades and equipment for the wind turbine, and DAFA Tower Foundation System; a foam solution concept for recessing in the foundation. Other solutions and materials in foam, rubber, and plastics, which seal, absorb, and protect, include gaskets, molded parts, sealing profiles, self-adhesive sealing strips, noise dampening, vibration insulation, and protection solutions.

**DAFA A/S** | [www.dafa-as.com](http://www.dafa-as.com)  
**Booth 4839**



### Energy development support services

Equitable Origin (EO) works with wind developers to plan and implement best social and environmental practices which reduce risks of community opposition and regulatory noncompliance. EO's support services are based on the EO100 Standard for Responsible Energy Development, a set of voluntary social and environmental performance standards developed with extensive stakeholder input integrating international reporting and performance standards including IFC reporting standards, UN guiding principles, and ISO 14001 environmental management standards. As a nonprofit organization devoted to environmental conservation and thriving communities, EO's verification of best practices by wind developers enhances positive perception and brand value.

**Equitable Origin** | [www.equitableorigin.org](http://www.equitableorigin.org)  
**Booth 4258**



### Conduit cable

PNA CableGuard provides cable in conduit for control and power cabling at both wind and solar farms. Long continuous run lengths of fiber optic cable in duct, up to 14000' on 1" IPS, minimize splicing. Fiber or cable installed in conduit at the factory ensures additional protection before, during, and after installation. CableGuard can be used in almost any underground application and provides significant lifetime cost savings compared to direct burial with less equipment, supplies, man hours, and damage to cable. CableGuard has the ability to withstand low temperatures and can adjust to ground movement and heaving. It is gopher resistant at 1 -1/2" OD and Nutria resistant at 2" OD. CableGuard fiber in duct is available in lengths up to 14,000' in 1", 11,000' in 1-1/4" and 8,000' in 1-1/2".

**Petroflex, N.A., Ltd.** | [www.petroflexna.com](http://www.petroflexna.com)  
**Booth 1300**





### Construction and EPC services

Wanzek Construction, Inc. is a heavy industrial contractor offering construction services to multiple industries including power, renewable energy, oil and gas, heavy/civil and industrial agriculture, as well as specialty services including crane services, O&M services, and oil field services. The company has established a strong portfolio of successful wind projects, with nearly 7000MW of wind generation capacity installed. Working with owners to balance organic growth with project requirements, Wanzek offers EPC services, consulting services, and project management. The company also provides comprehensive construction consulting services to ensure efficiency. A team of professional consultants, including the company's Six Sigma Master Black Belt Facilitator, offers consultation, at the onset of a job, to determine lean and efficient processes that increase project performance, productivity, and value.

**Wanzek Construction** | [www.wanzek.com](http://www.wanzek.com)  
**Booth 5239**



### Renewable energy wire and cable

Superior Essex is a U.S. manufacturer and supplier of energy wire and cable products serving the commercial, industrial, utility, and renewable energy markets. Low voltage 300V and 600V instrumentation cables for control systems, audio, intercoms, energy management, and alarm controls; low voltage 600V control and power cables for industrial or utility substation circuits; low voltage secondary URD for utility underground power distribution; medium voltage 5kV through 35kV power cables for primary power. Their MV Primary UD 35kV cables are suitable for underground collection systems designed for wind applications. These cables are offered with conductor strand filled, gauge sizes up to 1250kcmil, aluminum, TR-XLPE, or EPR insulation, multiple concentric neutral configurations, and LLDPE jacket, meeting the applicable ASTM, ICEA, and AEIC standards, and are RUS accepted.

**Superior Essex Energy Cables**  
[ce.superioressex.com](http://ce.superioressex.com)  
**Booth 4055**



### Van and truck rental

Capps Van & Truck Rental, established in 1972, is a Texas based company meeting the rental transportation needs of commercial businesses. Capps rents box truck and heavy duty pickup trucks as well as crew vans. Capps serves large and small businesses in the energy, construction, cartage, logistical, and service sectors throughout the continental United States, and maintains a large fleet of late model vehicles with comprehensive safety features. Their heavy duty pickup trucks are equipped for towing and hauling capabilities, receiver hitch and gooseneck. All pickup trucks are 4-wheel drive vehicles equipped with diesel engines and Allison automatic transmissions. A selection of ¾ ton, 1 ton, and 1 ½ ton crew cab vehicles with regular bed and flat beds are available and all rentals are covered with 24/7 road-side assistance.

**Capps Van & Truck Rental**  
[www.gocapps.com](http://www.gocapps.com)  
**Booth 5429**



### Aerial lift platforms

FairWind Renewable Energy Services, LLC is a North American aerial access truck service company offering a comprehensive service and maintenance portfolio of blade/composite repairs, blade and performance upgrades, turbine cleaning, inspections, and other lift access applications. FairWind owns and operates a fleet of Palfinger Truck Mounted High Lift Aerial Platforms and Suspended Baskets and can perform exterior up-tower services with both methods of access. Their 103-meter aerial lift platforms are safe and have a quick 15-minute rig up and down time, which reduces lost production time.

**FairWind Renewable Energy Services, LLC.**  
[www.fairwindres.com](http://www.fairwindres.com)  
**Booth 9000**

*construction company most admired by our customers*

*for our people, partnerships, performance, finished product,*

*ultimately building a better world for tomorrow.*

**YOUR SINGLE SOURCE  
BOP EPC CONTRACTOR**

**Fagen, Inc. has everything you need to complete your wind farm:**

- Experience building across the nation with a variety of wind turbine manufacturers.
- Skilled crews with recent wind experience.
- A fleet of main pick and support cranes.

**Call us today and ask what we can build for you!**

**FAGEN INC.**

320.564.3324  
[www.fageninc.com](http://www.fageninc.com)

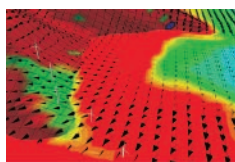




**HUB converter upgrades**

PSI Repair Services, Inc., provides product upgrades for H bridges (aka hub converters) to the wind energy industry. Their custom upgrades prevent failures from high heat loads and stripped ground screws. PSI's custom Switching Driver replaces the OEM part and efficiently translates into less heat, while reducing mean time between failures by 80%. Steel inserts are used to create more durable ground lug threads. PSI has field tested this upgrade on over 3,000 installations with successful results. PSI offers component repair and engineering services for GE, Vestas, Gamesa, Siemens, Suzlon, RePower, and Clipper wind turbines. They cover the critical electronic, hydraulic, and precision mechanical components driving the turbines' pitch and yaw systems, and down-town electronics.

**PSI Repair Services, Inc.** | [www.psi-repair.com](http://www.psi-repair.com)  
**Booth 2919**



**Wind assessment and forecasting services**

AL-PRO Wind Energy Consulting Canada, Inc. provides a broad suite of wind resource assessment and wind forecasting services to the wind industry in North America. A subsidiary of AL-PRO GmbH & Co. KG located in Germany, AL-PRO harnesses a wealth of wind experience from more than 900 projects located around the globe. AL-PRO provides pre-measurement advice to clients to select the most suitable measurement technology to ensure manageable uncertainties are kept low. In simple or complex terrain, AL-PRO has the expertise to complete thorough wind resource assessments and related services. AL-PRO also provides GMS PROFIWIND, an in-house mesoscale weather forecasting system specifically designed for the wind industry. GMS PROFIWIND provides turbine specific wind and yield forecasts at hourly or sub-hour resolution.

**AL-PRO Wind Energy Consulting Canada, Inc.** | [www.al-pro.ca](http://www.al-pro.ca)  
**Booth 3654**



**Power output upgrade**

Mersen's experience in the protection of electrical rotating machines enables them to offer unique solutions to protect frequency converters, turbines, controls, and other electrical equipment from the nacelle to the grid connection. The SR13-15 is an upgrade to one of the most common wind turbine generators in North America where the additional work load due to up-rating can sometimes exceed the capabilities of the existing unit. Requesting more power from existing machines requires an understanding of the technical implications and the exacting requirements of such demands. Mersen has responded by providing verifiable and workable solutions supported by intense R&D to the satisfaction of major OEM's and Power Utilities worldwide. Field tests have verified the designs which are based on sound technical expertise and a true working knowledge of the various applications.

**Mersen** | [www.mersen.com](http://www.mersen.com)  
**Booth 3319**

Tension and torque tools for wind turbines  
 FEATURING:  
**ITH Micro-MAX battery pump**

**Booth# 5339**

**ITH Bolting Technology**

[www.ith.com](http://www.ith.com)



**Coating systems**

Duromar has a full-line of high performance, zero VOC, color stable coating systems for the repair, resurfacing, and long-term protection of wind turbine blades, including the leading edge. Whether a blade is suffering from cracks, pits, or general wear, Duromar has a repair solution. OEMs may also apply these coatings for long-term blade protection starting at day one of operation. These products are easy to apply by hand or by spray.

**Duromar** | [www.duromar.com](http://www.duromar.com)  
**Booth 3149**

- Fiber or cable installed at factory
- Protection
- Lifetime cost savings

**PNA CableGuard™**  
 Cable in conduit for control and power cabling at wind & solar farms

**SOLUTIONS**  
**PNA-API**  
 CUSTOMER DRIVEN  
 IN PLASTIC

**Petroflex N.A., Ltd.**  
 P.O. Box 1356  
 Gainesville, TX 76241-1356  
 Ph: 800-433-5711  
 Fax: 940-668-6097  
[pnasales@petroflexna.com](mailto:pnasales@petroflexna.com)

[www.petroflexna.com](http://www.petroflexna.com) | [www.cableguard.com](http://www.cableguard.com)

Powering the **future** through **education** and **sustainability.**

DEGREE OPTIONS IN:

- Water Quality & Sustainable Aquatic Resources
- Heating, Ventilation & Air Conditioning
- Construction Technology
- Wind Energy & Turbine Technology
- Environmental Studies
- Electrical Technology
- Engineering Technology

+ Industry Training

**1-866-IA-LAKES • WWW.IOWALAKES.EDU**  
 EMMETSBURG • ESTHERVILLE • SPENCER • SPIRIT LAKE • ALGONA





### Synthetic motor oil

In 1972, AMSOIL, Inc. developed the first synthetic motor oil to meet American Petroleum Institute service requirements. Today, AMSOIL continues to formulate synthetic lubricants for the Industrial gearing needs of modern wind farms. With more than 7 years running the wind industry on the same formula, and reaching over 10,000 MW Class turbines in North America, AMSOIL Synthetic Power Transmission EP Gear Lube products and their line of hydraulic fluids are cost-effective choices for prolonging equipment life, reducing maintenance, and increasing gearbox performance and reliability. Anti-foam qualities preserve oil film thickness and optimize bearing life by controlling micro pitting and scuffing wear, increasing run times and reducing maintenance costs. AMSOIL's resistance to moisture extends filter life and eliminates additive depletion.

**AMSOIL, Inc.** | [www.amsoilwind.com](http://www.amsoilwind.com)  
**Booth 4713**



### Performance improvement services

SgurrEnergy is a renewable energy consultancy, with over 250 experts, providing engineering and technical advisory services for onshore and offshore wind projects. They deliver expert consultancy services at every phase of a project, from the early stages of site selection, feasibility, and design right through to project management of the construction phase, and operation and maintenance. SgurrOptimiser is a package of performance improvement measures and services available to wind farm owners, operators, developers, and investors, designed to increase production between 5% and 12% at existing wind farms. These measures will enhance wind farm production and performance, and asset return on investment.

**SgurrEnergy** | [www.sgurrenergy.com](http://www.sgurrenergy.com)  
**Booth 2822**



### Flat wire wave springs

TRUWAVE flat wire wave springs make it possible to decrease axial heights up to 50% in comparison to cylindrical round wire springs. This is possible because flat wire wave springs are made from a coiled, flat wire that has waves added to it which give it the spring effect. In contrast to spiral wound round wire springs the forces are transmitted only in axial direction into the contact surface, while in round wire springs torsional movement may cause long term problems in the application. The use of flat wire wave springs can effectively save installation space and prevent premature application failure. A positive side effect of the space saving attribute is that the total cost of the component can be reduced as well.

**Rotor Clip Company** | [www.rotorclip.com](http://www.rotorclip.com)  
**Booth 3019**



### Battery Torque Wrench

Torkworx introduces their new low-end torque ranges for the RAD Torque Systems B-RAD Select Series. Still with the same accuracy and repeatability, each B-RAD Select Series battery torque wrench comes complete with a reaction arm, two 18 volt batteries, battery charger, and a weather proof storage case. The digital display has buttons to adjust target torque, allowing unlimited torque settings and the system has the ability to 'lock-out' torque. To ensure the highest quality of measurement and accuracy, each B-RAD Series battery torque wrench comes individually calibrated traceable to ISO 17025 standards.

**Torkworx** | [www.torkworx.com](http://www.torkworx.com)  
**Booth 3023**

# FIRETRACE®

POWER TO INNOVATE. FLEXIBILITY TO ADAPT.

## FIRE PROTECTION ONE COMPONENT AT A TIME

### Modular Fire Suppression to select the areas you want to protect

Wind turbines present a unique challenge for fire suppression. Airflow, vibration, dust and temperature all work against traditional fire protection and suppression.

#### FIRETRACE ADVANTAGES



Protects multiple critical enclosures with one system



Eliminates concern for false alarm or false discharge



Requires no electricity offering uninterrupted service 24/7



Provides immediate detection and delivery of agent



Initiates shut down or sends an alert to your wind turbine



Allows for inexpensive installation, maintenance and recharge

**COME SEE US AT: AWEA – NEW ORLEANS – BOOTH 3547, WIND ENERGY HAMBURG – STAND A4.326**

CALL NOW: **(480) 607-1218** OR LEARN MORE AT: [www.firetrace.com](http://www.firetrace.com)





### Transportation management solutions

The Landstar network comprises more than 1,100 agents, 9,000 leased owner-operators, 14,000 trailers, and 44,000 other available capacity providers. Landstar's network of independent agents and transportation providers offers flexibility and a local presence with a global reach. Landstar's specialized and heavy haul services include: 199 foot windmill blade trailer, Schnabel trailers, 40-80 ton capacity lowboys, RGNs, double drops, multi-axles, steerables, vans, super-vans, and flatbeds, expedited ground and air, ocean freight forwarding, and border crossing. Landstar provides safe, reliable transportation logistics services and integrated transportation management solutions from a single point of contact with the resources to handle any event, planned or unplanned.

**Landstar** | [www.landstar.com](http://www.landstar.com)

**Booth 1823**



### Bolt tensioning cylinders

ITH bolt tensioning cylinders are designed for tightening large diameter bolts of all major OEM wind turbine applications from foundations to the nacelle. Foundations, towers, bearings, shafts, frames, mounts, any bolted connection bigger than M16 (5/8"). Lightweight and compact tensioner designs, with convenience and patented safety features from over 35 years of experience. Combine ITH tensioners with the standard-duty ITH Eco-MAX pump for installation jobs or the conveniently small Micro-MAX pump for maintenance and service jobs. ITH also offers advanced tensioning systems. Maintenance-free bolting was introduced by ITH using the ITH Stretch-System. This system combines ITH tensioner technology with IHF fastener technology to optimize the quality of a bolted joint. High accuracy and repeatability of the tensioning force improves joint efficiency which is integral to becoming maintenance-free.

**ITH Engineering** | [www.ith.com](http://www.ith.com)

**Booth 5339**



### Advanced data logger

Purpose-built for today's renewable energy professional, the SymphoniePRO data logger brings significant upgrades in capability and flexibility to Renewable NRG Systems' series of user-friendly loggers. Each of the 26 channels' statistical values are calculated from continuous 1-second data samples and averaged over a user-selectable interval (10-minute default). Collected data are stored efficiently as binary \*.RLD files on internal Flash memory with a redundant copy on an external SD card. Robust communications options include SMTP email data delivery, as well as remote, real-time connection capability over RNRG's MetLink protocol for tasks like automated or manual data download, firmware upgrades, live data viewing, or configuration changes. Included with purchase, the easy-to-use SymphoniePRO Desktop Application enables users to process raw data files, preview data files in time series format, and configure and communicate with both the SymphoniePRO logger and iPack communications devices.

**Renewable NRG Systems**

[www.renewablenrgsystems.com/symphoniePRO](http://www.renewablenrgsystems.com/symphoniePRO)

**Booth 2629**



### Engineering, surveying, environmental, and ecological services

Civil & Environmental Consultants, Inc. (CEC) provides design solutions and integrated expertise at all stages of a development or expansion project, from critical issues analyses, ecological surveys by federally approved bat surveyors and wildlife biologists, met tower and property surveys, inspections using small Un-manned Aerial Systems (sUAS or drones), right-of-way and drain commission permitting, and electrical design coordination, to civil engineering planning and logistics for lay-down, delivery, line drops, crane walks, and intersection improvements. CEC coordinates with land owners, agents, utilities, and regulatory agencies, and helps oversee completion of the design through implementation in the field. CEC provides biological monitoring services supporting 401/404 permit applications, reducing the need to hire additional consultants. CEC surveyors and biologists maintain a rapport with numerous U.S. Fish & Wildlife Service regions while always serving as advocates for clients.

**Civil & Environmental Consultants, Inc. (CEC)**

[www.cecinc.com](http://www.cecinc.com)

**Booth 5114**

**JANICKI INDUSTRIES**

- ▶ High Quality
- ▶ Price Competitive
- ▶ On-time Delivery

**Delivering Value with Wind Energy Tooling**

- ▶ Patterns • Molds • Blades
- ▶ Precision 5-Axis Machining
- ▶ Composite Fabrication
- ▶ Engineering Services

[www.janicki.com](http://www.janicki.com)  
360.856.5143

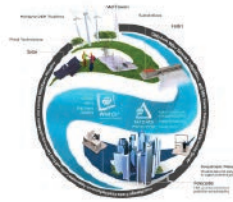
“Welcome to the Evolution of the Wind”  
“The World’s first Urban Vertical Dual Axis Wind Production Systems”

**BE-Wind**

214-649-4862  
[www.be-wind.com](http://www.be-wind.com)

Designed and Manufactured in the USA





### Smart energy asset manager

Envision Energy is a smart energy solutions provider whose offerings include smart wind turbines, smart energy management software, and technology services. Over 7.5GW of Envision's smart wind turbines are in operation, while Envision Wind OS and Apollo Solar OS help manage more than 30GW of renewable energy assets worldwide.

**Envision Energy** | [www.envision-energy.com](http://www.envision-energy.com)  
**Booth 1421**



### Turbine with 120-meter rotor

Siemens' new SWT- 2.3-120 builds on their G2 product platform. Designed with the demands of the Americas' market in mind, it is a product tailored to local conditions offering a safe investment with excellent returns for years to come. The SWT-2.3-120 employs a high-performance rotor and features IntegralBlade technology with 59-meter blades manufactured in Fort Madison, IA. The nacelles, assembled in Hutchinson, KS, are ergonomically optimized for maintenance through increased accessibility of components.

**Siemens** | [www.siemens.com/awea2016](http://www.siemens.com/awea2016)  
**Booth 4238**

### Wind energy insurance solutions

Travelers has more than 25 years of experience insuring clean energy and technology-related businesses, effectively delivering and implementing industry-specific insurance products and services. Travelers provides specialized coverages, risk management expertise, and early resolution claim strategies for businesses engaged at all stages of the wind energy lifecycle, from R&D and manufacturing to construction and permanent operations. Additionally, through Travelers Syndicate at Lloyd's, they offer first party coverage to businesses with global wind and solar exposures.

**Travelers** | [www.travelers.com/energy-practice](http://www.travelers.com/energy-practice)  
**Booth 1129**



### Field services

MAS Field Services performs land service work for renewable energy development projects throughout the United States. They are a service company with a focus on utility scale wind, solar, and transmission projects. They perform tasks such as site selection, land acquisition, title research, due diligence, GIS mapping, HSE oversight, field management, and gathering of surface waivers and crossing agreements to name a few.

**MAS Field Services**  
[www.masfieldservices.com](http://www.masfieldservices.com)  
**Booth 5448**



### Surety bonds

CSI Bonds is a Maryland based company which has been providing surety bonds exclusively for over 20 years. CSI Bonds serves commercial contractors and subcontractors of all sizes nationally. CSI concentrates in and understands the many facets of the wind and solar industries. They maintain relationships with a vast array of sureties enabling them to provide a high level of service to their contractors.

**CSI Bonds** | [www.csisuretybonds.com](http://www.csisuretybonds.com)  
**Booth 2242**

**BUILT ON PARTNERSHIPS**

- 6 Laydown Yards
- Highway & Rail Accessible
- Heavylift Capable
- Wind Ready!

**PORT CORPUS CHRISTI**  
 connect with us: [portofcc.com](http://portofcc.com)

**AIMCO** Delivers **Accuracy & Traceability to Critical Bolting**

**AcraDyne HT Series**  
**The TRUSTED LEADER for Critical Bolting**

AcraDyne's HT Series combines high torque and superior performance in an electric tool that beats the competition in accuracy, speed and safety. When combined with AcraDyne's Controller, customers have a high torque critical bolting system that can handle the toughest and most important bolting jobs.

**AcraDyne is Your Best Choice:**

- One of the most accurate high torque tools in the world today
- Up to **100 times faster** than hydraulic tools
- **The worlds ONLY traceable system** at the square drive for high torque bolting
- 1 Nm - 8,100 Nm
- **Over 300 models** to choose from
- **Built in integral transducer** for optimal monitoring and control.
- **Data Retrieval**
- Designed and **MADE IN THE USA**

**VISIT US:**  
**AWEA WINDPOWER**  
 NEW ORLEANS, LA • **BOOTH 2349**  
 May 23-26, 2016

**For More Information:**  
[www.AIMCO-GLOBAL.com](http://www.AIMCO-GLOBAL.com) / **1-800-852-1368**





# Solar in the Northeast

## A new beginning

by Graham Smith

**THE NORTHEASTERN UNITED STATES OFFERS AN ATTRACTIVE \$67.5 BILLION OPPORTUNITY** for commercial solar photovoltaic (PV) installations, according to a recent Wiser Capital report. Yet market penetration in the region is low. Innovative financing solutions reducing soft costs for developers and deliver investors with long-term, non-market correlated commercial project debt investments with strong risk-adjusted returns are crucial for growing the highly-underserved sector.

The Northeast is a particularly compelling commercial solar market primarily because of three market conditions: available roof space, high electricity prices, and state incentive programs. The region has close to 250,000 commercial buildings that could collectively produce 94,733 megawatts (MW) of renewable energy. With the Northeast's higher than average electricity rates and strong state incentives, such as Solar Renewable Energy Certificates (SRECs), commercial project owners could save almost \$1 million over a 25-year power purchase agreement (PPA) term.

Ensuring appropriate real estate is in place to meet the requirements necessary for solar (for example, rooftop area, structural layout, shading, and more) is the first step to installing commercial solar. If existing real estate meets the requirements without any need for architectural or structural modification, building owners are more likely to consider solar as an option. Favorable real estate conditions, however, are not enough to move the needle. Asset owners will not change business as usual until there is pressure to look for something new.

External pressures include high electricity rates, which would motivate building owners to change behavior. Electricity rates in the Northeast are over 35 percent higher than the national average. When compared to solar financing structures including leases, loans, and PPAs, which can hedge in the price of electricity for over 20 to 25 years, solar energy begins to look more appealing. Paired with state incentives rewarding clean energy generation, commercial real estate owners have become motivated to install solar. Each state in the Northeast has unique incentive structures, the most popular being SRECs, which provide monetary benefits to producers of electricity not emitting carbon dioxide emissions. These market conditions have created a significant opportunity for commercial solar; however, they are not enough to overcome the hurdles of the sector.

Throughout the United States, the cumbersome development process has derailed

many potential commercial and industrial projects. The current process of finding funding is complicated, costly, and time-consuming. Due to the lack of standardization of projects, transaction costs end up being high as financiers have to start from scratch for every deal. Streamlining the application process through automation and standardizing documentation are two simple ways to increase the flow of capital to the commercial market and ensure transparency and clarity between all parties involved.

Automating the application process can streamline loans by reducing the time and cost associated with continued email correspondence and numerous telephone calls. Having the information online gives the developer a good sense of how long the process will take, allowing them to better plan and budget the necessary time. Presenting the application online ensures transparency, as developers know exactly what information they need to provide from the beginning. Automation is also beneficial for finance companies, as it allows them to stay leaner and maximize the number of loans they can process.

Standardizing documentation for projects which are inherently different is the biggest hurdle that must be overcome within the commercial and industrial sector. One good place to start would be standardizing legal documentation. Legal costs can oftentimes amount up to 70 percent of the transaction soft costs in a project. By creating a standard template that can then be tailored according to the deal, transaction costs can significantly decrease.

Addressing some fundamental processes within the financing realm will increase access to capital in the commercial solar sector. The pieces have fallen together for the Northeast to thrive in the solar sector.

With available rooftop area, high electricity rates, compelling state incentives, as well as innovative, technology-enabled solutions simplifying the financing process, the commercial market in the Northeast can reach its full potential.

*Graham Smith is the CEO of Open Energy*

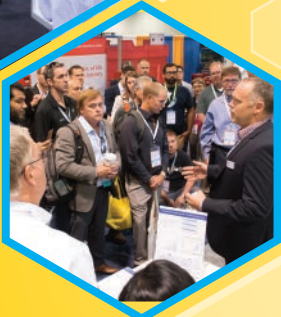


**Open Energy** | [www.openenergygroup.com](http://www.openenergygroup.com)



# INNOVATION AND COLLABORATION AT ITS CORE

Register and book your housing for  
the largest solar trade show in  
North America!



## NEW to SPI: Smart Energy Microgrid Pavilion

See how solar installations can power smart technology and reduce overall costs for consumers and businesses.

Whether you're an installer, manufacturer, or distributor, understanding how to incorporate smart technology into your business model will positively impact your bottom line.

A fully-functioning microgrid will also be featured within the pavilion!



**SOLARPOWER**  
INTERNATIONAL

Powered by:

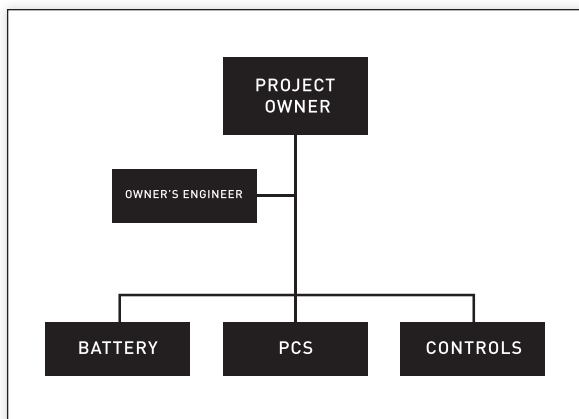
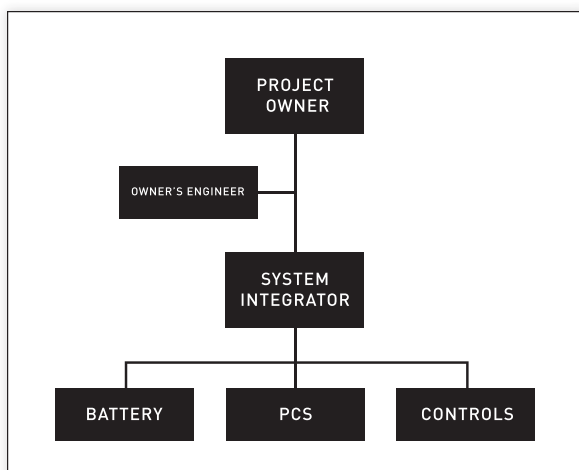


**SEPTEMBER 12-15, 2016**

LAS VEGAS CONVENTION CENTER - NORTH HALL & WESTGATE HOTEL

[WWW.SOLARPOWERINTERNATIONAL.COM](http://WWW.SOLARPOWERINTERNATIONAL.COM)



**Option A****Option B**

## The Key to a Successful Energy Storage Project

The proper selection of a system integrator

by Chip Palombini

Today's energy storage system integrators provide either a turnkey energy storage system, a system integration service or particular component in the system, or can be system owners themselves.

In the case of system integrators who produce a standardized turnkey product, the offering does not change project by project, but instead is a standardized copy and repeat approach. Other integrators optimize and develop custom solutions based upon specific project needs. These integrators often provide their own top level software for control of the entire project, but procure other companies' batteries and inverters (PCS) specific to the projects requirements.

System owners have several options for integration but need to make a wise choice of integrator to ensure the profitability of their projects.

With increasing price sensitivity, avoiding margin stacking by keeping the supply chain short while the system owner conducts their own system integration can be appealing. The challenge here beyond an efficient integration, is defining who owns the risk of integration issues if the supply chain is flat from owner to PCS suppliers (Option A). To truly appreciate the savings offered by Option A's approach, the system owner must not only have the in-house technical capacity and experience to self-perform, or directly procure, integration, but the ability and willingness to carry the associated integration risk.

System owners sometimes attempt to reduce cost by self-performing the integration role; only to be overwhelmed by the amount of work, and lacking the proper skill-set or knowledge base to perform integration. This commonly results in an attempt to shift integration risk to supply chain. This has been

much more prevalent in the commercial and industrial space than in the utility segment. ESS solutions require robust integration and controls in order for the owner to achieve maximum benefits of the system.

---

**When considering to self-perform the integration role, system owners must make honest assessment of their internal capabilities and appetite for risk.**

---

In Option B, the hired independent system integrator has responsibility for procurement and integration, and thereby the risk associated with the system's performance over its lifespan. Although the project owner is insulated from risk, they will pay a premium on project equipment as the integrator will mark-up components to cover any future costs incurred by downtime.

When examining outside candidate integrators, a project owner or developer must address the willingness and ability of the system integrator to provide a turnkey warranty or performance guarantee for the project. This may take different forms such



### Join the conversation to build a better grid



**ENERGY  
STORAGE**  
NORTH AMERICA

**OCTOBER 4-6, 2016  
SAN DIEGO, CA**

**LEARN MORE**  
[WWW.ESNAEXPO.COM](http://WWW.ESNAEXPO.COM)



as annual uptime guarantees, minimum annual energy availability, or a warranty.

Evaluation considerations should also include the integrator's experience with the project use case and components, as well as the candidate firm's history of delivering similar commissioned projects on time and on budget.

It is important to remember project installation skill-sets vary widely. Experience integrating grid tied systems for frequency regulation, or peak shifting applications, does not necessarily translate to the skill-set of properly and efficiently integrating a microgrid project.

Microgrid projects with multiple generating assets require specialized experience. Additionally, local weather conditions, dry/hot/dusty or wet/corrosive, call for an appropriate mechanical background as well. Having analogous system integration experience can be crucial to the successful commissioning of an energy storage project.

In the case of the pure system integrator who provides service only, questions should focus on depth of competency around the particular system component and familiarity with proposed vendors. In the case of component supplier as integrator, a principal concern will be a contract structure that ensures the 'integrator' is responsible for the proper operation of the components which they have not developed and manufactured.

#### Case-in-point

A system owner specs and purchases the three major components (battery, inverter, controls) and contracts one of the component suppliers to integrate the system. Now, the 'integrator' is putting products together that they may have not spec'd or ever worked with. If the controls vendor is integrating the system and there is an issue with battery performance, who bears the risk/responsibility in this situation, the 'integrator' or the system owner who originally spec'd the components? There needs to be a clear line of contractual responsibility to protect the interests of all parties.

As the energy storage market has matured, the current trend is the integrator role is evolving to be more well defined along two emerging models. The field of pure integrators whose value add is their expertise in providing the project design, scoping and selection of component vendors, as well as the warranty or performance wrap has matured. This model applies to both large utility-scale projects and microgrids where there is a required degree of project customization.

The other emergent model is the package/integrator. These are vendors who have developed fully integrated 'packaged' systems at fixed power and energy levels with pre-defined equipment vendors. This model is more commonly seen applied in the commercial and industrial markets. In addition to long term system accountability, part of the value of the package integrator is the speed of deployment and advantageous pricing based on volume relationships in their supply chain.

In either option, due to the proliferation of large, third party financed storage projects participating in merchant energy markets, the need for a bankable integrator to capture integration risk is becoming more important. Once satisfied with checking the firm's credentials and references, particular caution should be exercised when reviewing the financial stability of the company.

System integration firms come in all sizes, and an ideally sized firm must have enough financial and technical resource depth to support the lifespan of the project.

With project lifetimes running anywhere between 10 and 20 years it is crucial system owners ask themselves whether the candidate integration firm will still be there when they're needed, in order to mitigate risk. It is essential they persist and maintain operations for the lifespan of the project for the system owner to capture maximum profit.

In short, analogous experience, willingness to provide guarantees, and a bankable company are what system owners should look for when considering an outside system integrator.



Chip Palombini is the sales manager for the Dynapower Company Energy Storage Group. Dynapower is a supplier of bi-directional inverters for utility-scale and microgrid energy storage systems.

**Dynapower Company, LLC** | [www.dynapower.com](http://www.dynapower.com)

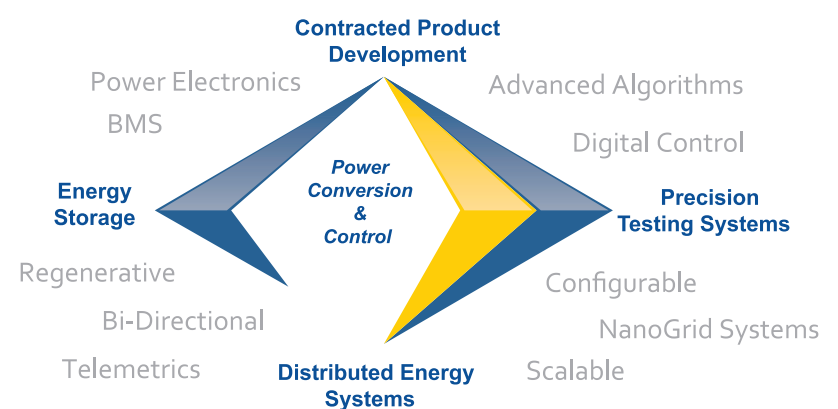


#### Current compensated chokes

SCHURTER expands its wide range of current compensated chokes with high current types for PCB mounting. The new DKIH series is now available with a nanocrystalline ring core, offering 8x higher inductance performance than ferrite core versions in the same compact dimension. The new product is designed for single and three phase applications with rated currents from 10 to 50 amperes. Due to its open design, the chokes are light weight and compact, ideally designed to suppress EMI noise caused by power applications on the PCB. The new DKIH-1 series is suitable for single phase AC or DC applications from 10 up to 50 amperes. Light weight and compact, the common mode chokes are easily placed on the PCB with through hole technology (THT). They are designed and approved according IEC 60938, UL 1283 and CSA 22.2 no. 8. The voltage rating is 300 VAC (IEC, UL) and 250 VAC (CSA) with an inductance range of 1.6 to 6.9 mH. The new DKIH-3 series is suitable for three phase AC applications from 10 up to 50 amperes. The common mode chokes are also designed according IEC 60938 and are rated 600 VAC with an inductance range of 0.7 to 10.8 mH, making them suitable for many applications such as UPS systems, switching power supplies, charge stations for electric vehicles and frequency converters for energy storage. The DKIH-1 and -3 have a wide temperature range of -40 to +100°C. They are available with a standard pin out or customer specific pin out. Variations in the winding are also available upon request.

**SCHURTER, Inc.** | [dkih.schurter.com](http://dkih.schurter.com)

## The Power to Change Our World

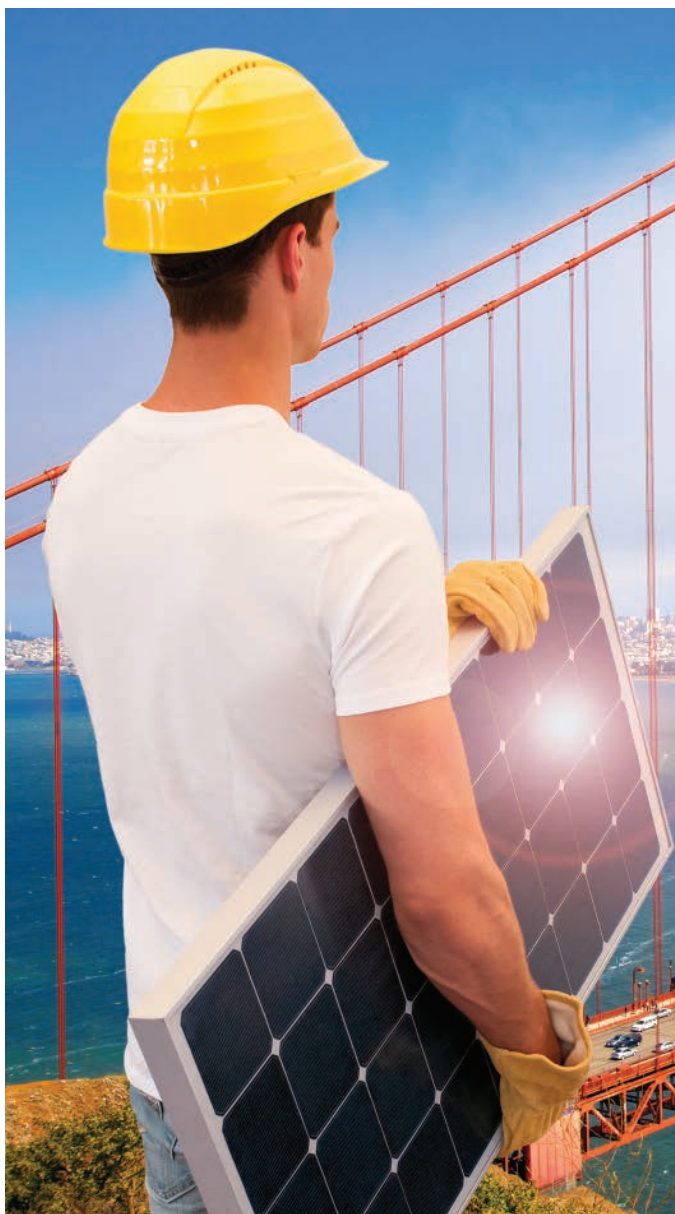


## Next Generation Power Conversion and Testing Systems

[www.RhombusEnergy.com](http://www.RhombusEnergy.com)

**Rhombus**  
Energy Solutions





# Solar Plus Storage

## The hottest energy trend in the club

by Florian Wessendorf

**CONSIDERED THE LYNCHPIN FOR GROWTH OF THE SKYROCKETING SOLAR INDUSTRY**, storage is one of the hottest trends in energy today. At the individual meter level, storage can give solar system owners the ability to store and use solar energy even when the sun isn't shining. On a larger scale, storage helps utilities even out the highs and lows that come with bringing more solar customers on to the grid; solar and storage really go hand-in-hand. The U.S. energy storage market grew 40 percent in 2014. And with the U.S. solar growth rate as high as 34 percent, it's no wonder solar-plus-storage is getting so much attention. But beyond the hype, what does solar-plus-storage outlook look like today, and where can it be expected to go?

Today, the U.S. solar-plus-storage market is just in the beginning stages of growth. While less than 0.1 percent of 2014 solar installations had storage installed in conjunction with them, solar-plus-storage is expected to see explosive growth this year. The annual U.S. solar-plus-storage market will reach 769 megawatts (MW) by 2020, with a \$3.1 billion valuation, according to GTM Research. Consumers are expected to be responsible for half of the total U.S. energy storage market by 2017, with utility- and commercial-scale installations accounting for the rest. California is expected to lead the way with 422 MW of storage by 2020, making up 54 percent of the total U.S. market.

Policy plays a major factor in the rate of growth of solar-plus storage. Due to the ITC's extension, solar is expected to continue its expansion, and bring storage along with it. Additionally, some states have incentive programs specifically for solar-plus-storage. Several states, including California, New York and Texas, have stand-alone storage or solar-plus-storage incentive programs. One of the largest of these is California's Self Generation Incentive Program (SGIP). It provides both upfront incentives, and performance-based incentives for behind-the-meter storage systems. The majority of participants in the program are linked with solar projects. The continuing debates in states across the country about net-metering and rate-design reform will impact the sector's growth from the top down, as well.

From the customer side, the ongoing advancement of innovative technologies in the solar-plus-storage space help spur continued interest in the industry. The costs of certain enabling technologies, namely lithium-ion batteries, continue to plummet, making storage an ever more affordable option. Since 2010, lithium-ion battery costs have decreased by about 23 percent every year. Other technologies such as flywheels, compressed air, liquid metal, lead acid, and others have different lengths of discharge duration and commercial maturity, but all are trending toward decreasing costs. Importantly, it is not just the storage technology itself that is contributing to decreasing costs in the sector. Other elements such as power conversion, hardware, management systems, and installation costs as a whole account for 40 to 60 percent of the total cost to the customer. As these costs decline, the benefits will continue to increase.

- NEM 2.0 no longer allows retail sell back for solar
- All residential customers will be on TOU
- Without batteries, no way to maximize savings from solar generation
- Power guard warranty

Visit us at Intersolar North America - Booth #8049  
 FOR MORE INFORMATION CONTACT US TODAY!

**CLEAN ENERGY STORAGE INC.**

800.889.7998 | sales@cleanenergystorage.net  
 www.cleanenergystorage.net



Storage's benefits to customers are already expanding: once almost exclusively used as a source of back-up power, storage now has multiple value streams to offer. When combined with software, storage can be a major boon to customers. It enables time-of-use shifting, reducing costs for consumers and particularly for businesses with high demand charges. Software-enabled solar-plus-storage can also take demand response to a new level by automating it without disrupting business-as-usual for customers.

From the utility side, the benefits of behind-the-meter solar-plus-storage continue to multiply as well. In aggregate, behind-the-meter storage can provide additional capacity and support ancillary services for utilities. Solar-plus-storage offers a lower-cost option to support operations compared to traditional grid capacity resources such as peaker plants.

Front-of-the-meter utility scale solar-plus-storage is also an effective means of supporting the grid. The storage mandates California has developed is helping spur the growth of this segment of the market, and some utilities are planning to build their own solar-plus-storage plants. Wholesale markets and utilities, are finding innovative ways to enable unconventional energy resources to meet growing energy needs.

Those watching the solar-plus-storage market should expect to see continued rapid growth in the coming years. In just four years, the annual U.S. solar-plus-storage market is expected to reach \$3.1 billion. With 660 MW, the behind-the-meter market is set to be the largest segment of the market, at 82 percent or \$2.6 million. And California will likely remain the leader, especially in the behind-the-meter segment. While still at a nascent stage, the future of the solar-plus-storage industry is looking very bright.

*Florian Wessendorf is the newly-appointed managing director of Solar Promotion International, one of Intersolar and ees North America's organizers. Florian takes also care of Intersolar South America, Intersolar India, and the global Intersolar conference program. Florian has deep expertise in the solar industry. He most recently served as managing director of photovoltaic equipment at the VDMA (Verband Deutscher Maschinen- und Anlagenbau, German Engineering Federation). In addition to strategy development, his work focused on identifying, evaluating, and promoting current market and technology trends as well as setting up and supporting industry networks. He was also responsible for political and technological advocacy as well as for exhibitions, marketing and PR.*

**Intersolar North America** | [www.intersolar.us](http://www.intersolar.us)  
**ees North America** | [www.ees-northamerica.com](http://www.ees-northamerica.com)



### Home energy storage system

Redflow has launched a residential energy storage solution, ZCell, a system that includes a battery made from easily recyclable or reusable components. ZCell can store 10 kilowatt hours (kWh) of energy, allowing people to 'timeshift' solar power from day to night, store off-peak power for peak demand periods and support off-grid systems. The core of ZCell is a Redflow ZBM2 flow battery. ZCell uses the Redflow ZBM2 in a custom-designed outdoor-rated enclosure that sits on the ground, connecting to a battery inverter/charger unit that delivers stored energy to the home. ZCell comprises a smart battery, managed and protected by an on-board computer control system, with an integrated ZCell Battery Management System (BMS) which enables easy on-site battery commissioning, monitoring and control using a smartphone-compatible WiFi interface. Overall, ZCell offers an attractive, easy-to-install, robust, and long-life energy storage system for home use. ZCell's innovative BMS lets the battery deliver benefits that may not be available to users of legacy battery types such as lead acid and lithium.

**Redflow Limited** | [www.zcell.com](http://www.zcell.com)



### All-electric medium duty work truck

EnerDel's Moxie+ advanced lithium ion energy storage system penetrates new market segment enabling an all electric medium duty truck line. EnerDel has been active supporting truck and bus customers with their advanced lithium ion technologies to achieve zero emission targets as well as improve operational performance for both hybrid and all-electric systems. Several preproduction vehicles have already passed one year long rigorous pilot program in real-world environments. The results of the trials prove that EnerDel's efficient and reliable lithium technology fully meets the demands of both world class OEMs and their end-customers.

**EnerDel** | [www.enerdel.com](http://www.enerdel.com)



### Complete battery management system

The Equalink system offers new and innovative diagnostic and monitoring features that are essential in maintaining critical operating parameters required by NERC and IEEE as part of a comprehensive battery maintenance program. Through its patented voltage balancing process, the Equalink system calibrates the charging voltage of all batteries with the charger's target value, keeping all batteries within the optimal voltage operating range. When used with its accompanying software, it becomes a complete battery management solution. Using a series of integrated modules and web-based management technology, the Equalink can accurately identify the three key parameters: temperature, internal resistance, and voltage of every individual battery in a given energy storage system. Equalink is ideal for lead-acid batteries (open/wet cell, maintenance free, gel, AGM) as well as Ni-Cad, NiMH, and most types of Li-Ion batteries.

**Storage Battery Systems, LLC (SBS)**  
[www.sbsbattery.com](http://www.sbsbattery.com)

# BE PART OF THE CHANGE

<b>SOLAR ONTARIO</b> May 16-17, 2016 Niagara Falls, Ontario <a href="http://SolarOntarioConference.ca">SolarOntarioConference.ca</a>	<b>SOLAR WEST</b> October 5-7, 2016 Edmonton, Alberta <a href="http://SolarWestConference.ca">SolarWestConference.ca</a>	<b>SOLAR CANADA</b> December 5-6, 2016 Toronto, Ontario <a href="http://SolarCanadaConference.ca">SolarCanadaConference.ca</a>
---	---	---

For show updates and more information, follow us on Twitter  
 @CanEnergyEvents  
 #SolarOntario #SolarWest #SolarCanada

Presented by



# Will It Recycle?

## What you need to know about battery recycling

by John Connell



**Crown1 AGM battery:** Absorbed glass mat and other lead-acid batteries are 99% recyclable and have the highest recycling rate in the USA. (Source: Environmental Protection Agency)


**canwea**  ANNUAL CONFERENCE AND EXHIBITION


**CALGARY, ALBERTA**  
BMO CENTRE  
NOVEMBER 1-3, 2016


[www.windenergyevent.ca](http://www.windenergyevent.ca)  
#CanWEA2016

**POWERING CONNECTIONS, HARNESSING CHANGE**

**REGISTRATION IS NOW OPEN!**



Organized by  **canwea**  
CANADIAN WIND ENERGY ASSOCIATION | ASSOCIATION CANADIENNE DE L'ÉNERGIE ÉOLIENNE

 **Deutsche Messe**

One of the best ways to protect the environment, conserve resources, and reduce our carbon footprint is battery recycling.

### How recyclable are batteries?

- **Lead-acid:** Lead-acid batteries are recycled at a rate of 99% of annual shipments within the United States – the highest recovery percentage of any product in the U.S., according to the EPA. Nearly all material (99%) is recycled to make more batteries. And the remaining 1% of material is inert.
- **Lithium primary:** Lithium primary batteries are partially recyclable, but only one company has the capability. The process, which involves cryogenically freezing batteries to -324°F before shredding, carries a significant fire risk due to battery volatility. Experts estimate that over 80% of these toxic batteries are landfilled.
- **Lithium-ion:** Where partial recycling is available, cobalt and nickel are the most-recycled metals because they're most valuable. When recycled, these materials are used in other products, but they are rarely used in the battery industry.

None of the lithium-ion recycling methods recovers all materials. At a flagship plant, for example, roughly 40% of material still goes to the landfill.

As Linda Gaines of the Argonne National Laboratory explained, "Recycling of aluminum or lithium from the slag [a common recycling byproduct] is neither economical nor energy efficient." It's six times cheaper to mine new lithium than to recycle existing material.

### How recycling works

**Lead-acid:** Battery recycling began with the introduction of the lead-acid starter battery in 1912. The lead-acid battery recycling system – now automated – remains cost-effective because lead is easy to extract and reuse.

Lead-acid battery cases are opened by machine or crushed into small pieces and separated. Lead is separated using simple systems, then re-smelted and purified under strict guidelines. Sulfuric acid electrolyte is cleaned and processed for use in other batteries or fertilizers. Connectors and plates are recycled or recovered whole. And finally, plastic covers and containers are made into new battery cases.

The entire process is computerized, automated, and tightly regulated by the EPA.

**Lithium-ion:** Large batteries often have over 100 individual cells connected into modules, and include control circuitry, anodes, cathodes, and multiple oxides, along with a thermal management system in most cases. Trained technicians must disassemble these units manually with extreme care because they can cause serious injury.

Batteries are sorted by chemistry, then shredded and separated by machine. Flammable electrolytes are burned; hazardous internal chemistry is neutralized following environmental guidelines; high-value materials often must go through the entire production chain again; and lithium, plastic, and aluminum are often unrecoverable.



### What happens to batteries at end of life?

**Lead-acid:** Lead-acid batteries must be recycled for sustainability and safety because they contain lead. Their higher material value, coupled with strong regulations, ease of recycling, and large recycling network mean lead-acid batteries are recycled 99% of the time – the highest of any consumer product in the USA.

Lead-acid battery manufacturers rely heavily on recycled lead, which can be reprocessed to extreme purity. The average battery contains 74% recycled materials, and the new materials are recycled after use. When mining does take place, it's primarily in Australia, the United States, and China.

**Lithium-ion:** Lithium-ion batteries contain nickel, cobalt, lithium, and other heavy metals that should be safely disposed. Because lithium-ion batteries maintain a high voltage after they're used up, there's a risk of electrocution or fire.

According to the U.S. Geological Survey, approximately 80% of lithium and lithium-ion batteries are sent to the landfill. And at least 40% of the material in many recycled batteries also ends up in landfills.

### Economics of recycling

Metal pricing and ease of recycling are key to recycling profitability.

**Lead-acid:** Lead comprises 60-70% of a lead-acid battery's mass, and only spent internal connectors and electrodes (or plates) are present inside. Because no separation of these components is required, recycling of lead-acid batteries is uncomplicated and safe. And lead's value means lead-acid battery recyclers often pay to recycle batteries, instead of relying on a single international source.

**Lithium-ion:** Some lithium-ion batteries contain valuable materials like cobalt and nickel. But as these materials are replaced, especially in phosphate- and manganese-based batteries, there's less economic incentive to partially recycle these batteries after use. Metal must go through the same long preparation and purification process as virgin material.

Because recycled materials cost more and don't often meet performance requirements, lithium-ion battery producers mine virgin lithium from ancient brine pools using water and chemicals to extract the material from the land.

According to a report by Recycling International, even with future technological breakthroughs, lithium-ion recycling would only recoup 20% of its cost via reselling recovered minerals and other materials.

And the complexity of recycling, along with ever-changing varieties of materials, complicates sorting and partial recycling. It also drives up recycling costs.

### Rethinking end of life

If batteries are fully or partially recyclable, check online to find the nearest authorized drop-off center, if one is available. Depending upon the energy storage technology, a refund or a credit toward the purchase of a new battery storage system may be given, or a fee may be charged to compensate for extraction costs and lower material value.

### Every battery technology has benefits and tradeoffs.

By selecting the right, eco-friendly batteries and taking care of them at end of life, we can close the loop and keep batteries out of landfills, so they'll deliver sustainable power for our homes, offices, and vehicles for generations to come.

*John Connell is the vice president of Crown Battery's SLI Products Group. Crown Battery manufactures all its advanced technology, lead-acid batteries at its ISO-9001:2008-certified plant in Fremont, Ohio.*

**Crown Battery** | [www.crownbattery.com](http://www.crownbattery.com)

# inter solar

connecting solar business | NORTH AMERICA

25  
1991-2016  
YEARS OF INTERSOLAR

## North America's Most-Attended Solar Event Moscone Center, San Francisco

- Hear it here first! Be part of the first major U.S. solar event in 2016
- Join 18,000 peers, visit 550 exhibitors, attend 60 sessions & workshops
- Gain insight: PV, energy storage, smart renewable energy & solar heating/cooling

JULY  
12-14  
2016  
[www.intersolar.us](http://www.intersolar.us)



co-located with



SEMICON  
WEST



Register now!





# Beyond Batteries

## Why software is the key to energy storage

by Karen Butterfield

### AFTER SEVERAL FITS AND STARTS, AND YEARS OF DEBATE ABOUT ITS POTENTIAL

to be renewable energy's 'holy grail,' there is now widespread agreement that storage is a crucial component of the modern smart grid. Driven by falling battery costs, new business models and software advancements, utilities and rate-payers are now experiencing the benefits of energy storage. Today, forward-thinking technology providers and grid stakeholders are working together to unlock new revenue streams which surface only when advanced software intelligence is applied to storage hardware.

The strongest case for intelligent energy storage today is being made at the commercial, industrial, and grid levels, where customer-sited systems offer immediate and long-term economic benefits across the board. As noted in the recent Rocky Mountain Institute report, *The Economics of Battery Storage*, when paired with sophisticated software, customer-sited storage assets can provide as many as 13 services across a variety of stakeholder groups: utilities, grid operators, and electricity users. Some compelling use-cases are highlighted below.

#### Mitigating demand charges

Commercial and industrial buildings in regions where demand charges are highest have been among the first to experience the benefits of energy storage. In California and New York, demand charges, which are based on 15-minute periods of high demand, can account for as much as 70 percent of businesses' monthly bills. Until now, little could be done to address demand peaks, which are largely impervious to traditional energy efficiency efforts. Hotels, for example, do not have the flexibility to stop running the elevators or turn off air conditioning during peak usage periods.

To combat demand charges without impacting guests' experience, hotel chain Extended Stay America installed intelligent energy storage systems in 68 of its California locations. The intelligent software embedded in the system learns and reacts to energy use to catch all cost-incurring peaks each month. Sophistication of the software is critical, as missing just one peak can erase all value provided by the system earlier in the month. Predicting and reacting to changes in energy usage is a tricky process depending on variable factors such as weather, production ebb and flow, and changing levels of generation from onsite production assets such as solar or fuel cells. Batteries alone cannot effectively predict or quickly react to this variability. They need to be paired with software that's embedded with real customer load and rate data, predictive analytics, real-time weather forecasts, and other feeds.

#### Opening new revenue streams

Beyond cost savings, commercial and industrial users of intelligent energy storage systems have the opportunity to leverage the battery for grid support, thus opening up an entirely new revenue stream.

Adobe is one of the first companies to demonstrate that commercial energy consumers can support the smart grid with energy storage, and get paid to do it. Adobe's San Francisco Campus participates in the day-ahead and real-time energy markets through the California Independent System Operator (CAISO)'s Supply-Side Pilot. In return for reducing their demand at critical moments for the grid, Adobe earns valuable revenue without expending any effort. The Supply-Side Pilot is a model for similar programs starting to come online across the nation. These programs, which allow businesses to participate directly in electricity markets, will become a core component of tomorrow's smart grid.

#### Enhancing the value of renewables

Another value stream software brings to energy storage is enhancing generation from onsite renewables. ShoEi Foods, a leader in the food processing industry, invested in a solar PV system as part of its plan to reduce energy spend. This move helped lower ShoEi's electricity usage, but the company captured the greatest value when pairing the solar with storage and software. During times of low solar production, such as on a cloudy day, the battery responds automatically as the first line of defense to reduce demand peaks. At the same time, the software component alerts the building operators of looming peaks so they can reduce usage if they choose. The results have been significant: ShoEi Foods qualified to switch to a lower rate tier, saving the company \$72,000 annually.

#### Restoring balance on the grid

Benefits for utilities that dovetail with end-user benefits include capacity, frequency regulation, renewable integration, voltage support, and enhanced grid visibility. Southern California Edison (SCE), the main electricity supply company for much of Southern California, plans to deploy 135 megawatts of customer-sited energy storage across the West LA Basin to support its local capacity and safeguard its customers from grid instability challenges. With the data it gathers from distributed sites, intelligent storage software can use predictive analytics to identify batteries in its fleet available to provide the grid extra energy when needed. Utilities can save on the costs they would otherwise need to spend on building peaker plants, while also reducing emissions and improving public health and safety.

For utilities, customer-sited intelligent energy storage can also support renewable integration and grid visibility. Hawaiian Electric Company (HECO) contracted to install one megawatt of distributed storage on Oahu to leverage these benefits. Straining under the influx of distributed solar, which causes extremes of high power generation when the sun is shining and lows when it is not, HECO turned to distributed storage to help store and dispatch excess energy when needed. The intelligent software coupled with its battery systems leverages the utility's existing renewable forecasting and monitoring capabilities, providing increased visibility into grid energy patterns and enabling the utility to better predict future energy needs.

#### Transforming our energy future

More energy users, utilities and grid operators are looking to intelligent energy storage as an invaluable solution. This is evidenced in the recent expansion of utility and ISO programs, including California's Demand Response Auction Mechanism (DRAM), SCE's procurement of energy storage beyond mandated levels, and recent requests for offers for energy storage programs from utilities in New York and Arizona. It's only a matter of time before businesses, municipalities, schools, utilities, and grid operators around the world shift their perception of intelligent energy storage from a "nice-to-have" to a crucial component of daily operations.



Karen Butterfield is the CCO of Stem, Inc.

Stem, Inc. | [www.stem.com](http://www.stem.com)





# 2016 BIOPOWER BUYERS GUIDE

## DIRECTORY

AIR POLLUTION CONTROL

BIOFUELS PRODUCTS & EQUIPMENT

BIOMASS PRODUCTS & EQUIPMENT

CONSTRUCTION & CONSULTING SERVICES

ENGINEERING & EQUIPMENT

FINANCIAL SERVICES

FOREST & WOOD PROCESSING

LARGE-SCALE POWER GENERATION

MATERIALS HANDLING SOLUTIONS

PLANT OPERATIONS

SOFTWARE

TESTING: QUALITY & CONTROL

WASTE TO ENERGY EQUIPMENT & PROCESSING

OTHER

Biogas/Anaerobic Digestion

Industrial Fans & Blowers

Revenue Metering/Data Telemetry



**AIR POLLUTION CONTROL**



**B&W MEGTEC**

B&W MEGTEC is a global supplier of turnkey clean air solutions to meet emissions regulations, improve process performance, and protect downstream equipment. Their wet electrostatic precipitator (ESP) provides high efficiency control of particulate, heavy metals, acid mists, and fumes. Its maintenance-free gas flow distribution system has large diameter perforations that prevent particulate buildup that could cause plugging. They also supply RTOs for VOC control, SCR/SNCR for NOx control, and more.

[www.megtec.com](http://www.megtec.com)



**FLSmith, Inc. - AFT Operations**

FLSmith AFT is a manufacturer and supplier of baghouse filter bags, APC replacement parts, and baghouse services to many industries. AFT's engineering and technical service team provides complete bag installations, changeouts, and dust collector rebuilds to ensure minimum downtime and long-term, trouble-free operation.

[www.flsmith.com/aft](http://www.flsmith.com/aft)



**Global Refractory**

Global Refractory has over 75 years of experience in installing, and servicing air pollution control equipment. They specialize in turnkey solutions including welding, millwrights, insulating, steel repair, equipment installation, HRSG relining, and media bed rebuilds from their two locations in Minnesota and Wisconsin.

[www.globalrefractory.com](http://www.globalrefractory.com)

**BIOFUELS PRODUCTS & EQUIPMENT**



**K&K Environmental, LLC**

K&K Environmental, LLC provides cost effective planning and equipment for biofuels. The K&K Wrapped Bale System allows biofuel to be baled and wrapped for efficient transport via truck, rail, or ship as well as outdoor storage in bale stacks. K&K automatic bale openers separate the biofuel from plastic before use. K&K also provides consulting and project design services.

[www.kkenvironmental.com](http://www.kkenvironmental.com)



**M-E-C Company**

M-E-C Company engineers, designs, manufactures, and services dryer systems along with other various product machinery and heavy-duty equipment. M-E-C Company's engineers, draftsmen, and shop personnel design and manufacture reliable dryer system islands to custom specifications.

[www.m-e-c.com](http://www.m-e-c.com)

**BIOMASS PRODUCTS & EQUIPMENT**



**Beltran Technologies, Inc.**

Beltran's biomass gasification technology converts carbon-based waste into bioenergy, biofuels, and co-products. Their biomass feedstock-flexible system can use low-value agricultural, animal, industrial, wood, or municipal waste. It produces clean-burning, multi-use synthesis gas, combined heat and power (CHP), biofuels, hydrogen, and marketable chemicals. The advanced gasification reactor, wet electrostatic precipitator, and engine-generator are closely integrated for optimum efficiency. This is a scalable, adaptable solution for harvesting safe, renewable energy, reducing pollution and CO2, and turning waste into profit.

[www.beltrantechnologies.com](http://www.beltrantechnologies.com)



**Continental Biomass Industries**

For over 25 years, CBI has designed and installed hundreds of purpose-built stationary machines, mobile machines, and systems for customers all over the world. This includes comprehensive systems featuring combinations of slow speed primary shredders, screeners, conveyors, picking stations, magnetic separators, water tanks, and secondary and tertiary grinders to assure specific product size.

[www.cbi-inc.com](http://www.cbi-inc.com)



**Jackson Lumber Harvester Company, Inc.**

Jackson Lumber Harvester Company, Inc. manufactures and sells biomass Webb Burners worldwide. These cyclonic suspension burners generate large quantities of heat for industrial processes, at substantially less cost-per-BTU than traditional oil or gas-fired systems. They may be fired with a variety of solid fuels including; sawdust, corn cobs, sunflower hulls, flax shives, pelletized wood, charcoal, peat, and coal dust. Moisture content must be less than 20% and maximum particle size is 1/2" (1.27cm).

[www.jacksonlbrharvester.com](http://www.jacksonlbrharvester.com)



**Martin Engineering**

Martin Transfer Point Solutions help achieve total material control. Specializing in belt support, belt alignment, belt sealing, and chute structure, Martin Transfer Point Products reduce equipment damage, reduce cleanup, control maintenance expenses, and improve overall plant safety. Through proper design and maintenance, bulk material handling operations can run cleaner, safer, and more efficiently.

[www.martin-eng.com](http://www.martin-eng.com)

**INDIANAPOLIS, IN**  
**2016**  
AUGUST 22 - 25, 2016

**SAVE 20%**  
On Full Conference or  
Training Package  
Registration!  
Use Promo code: **NACE**

[WASTECON.org/INDY](http://WASTECON.org/INDY)

New for 2016!  
Co-Located with  
**StormCon**  
The North American Surface Water Quality Conference & Exposition





### Robert White Industries, Inc.

Robert White Industries, Inc. specializes in equipment integration for raw biomass pretreatment to provide on specification raw material for the final process. They provide biomass handling, fuel preparation, and equipment for converting raw biomass into a finished raw material. RWI provides system design services, experience, and expertise for receiving, conveying, screening, grinding, metal removal, storing, unloading, and metering biomass.

[www.rwii.net](http://www.rwii.net)



### Turboden S.r.l.

Turboden, a Mitsubishi Heavy Industries company, designs, manufactures, and services Organic Rankine Cycle (ORC) turbogenerators which harness heat to generate electric and thermal power from renewable sources (biomass, geothermal, and solar energy) and waste heat from industrial processes, waste incinerators, engines, and gas turbines, suitable for distributed generation. Turboden offers turbogenerators from 200kW to 20MW electric per single shaft and currently counts about 320 plants in 33 countries.

[www.turboden.com](http://www.turboden.com)

# VIESSMANN



### Viessmann Manufacturing Company

Viessmann Vitoflex biomass boilers are robust, reliable, high efficiency, wood burning hot water boilers ranging from 500,000 to 4,200,000 Btuh. They are certified to ASME, CSA, and UL standards. Vitoflex boilers feature automatic ignition and automatic deashing, keeping operator involvement to a minimum. High-quality refractory brick reflects heat back into the fire for greater efficiency. Generous insulation of the heat exchanger keeps the energy in the water, not in the boiler room. Pneumatic tube cleaning preserves efficiency of heat transfer and cuts required cleaning in half. Viessmann's Vitoflex 300 UF burns a range of fuels up to 50% moisture forest chips. Unique flue gas recirculation option controls the primary combustion, automatically adjusting to varying moisture content fuels, drying, and gasifying the wood while preventing clinker formation.

[www.viessmann-us.com](http://www.viessmann-us.com)



### Warren & Baerg Manufacturing, Inc.

Warren & Baerg manufactures bale grinding systems for biomass including D-stringing, conveying and meter/surge bins. For densification, they offer complete cubing/densification systems for biomass, MSW, and industrial waste flows include metering/surge systems, conveying, densification/cubing machines, cube/material cooling, overhead conveyors for storage or truck load-out systems. They also manufacture individual equipment to provide solutions for cellulosic ethanol systems, gasifiers, pyrolysis, and boiler systems, including meter bins, meter/mixer bins, conveyors, top or bottom drag conveyors, belt conveyors, cube coolers, and material coolers.

[www.warrenbaerg.com](http://www.warrenbaerg.com)

### CONSTRUCTION & CONSULTING SERVICES

# FAGEN INC.



### Fagen, Inc.

Fagen, Inc. is a renewable energy design-build company. They have constructed a variety of projects including solar power, wind power, conventional power, renewable fuels, and other industrial process facilities throughout the country. Fagen, Inc. is ranked among contractors and design-builders by Engineering News-Record (ENR) top 400. Fagen, Inc. self-performs civil, structural, siding, insulation, piping, electrical, and start up services.

[www.fageninc.com](http://www.fageninc.com)



### RRS

RRS builds bankable biomass energy projects with an understanding of marketplace dynamics and costs. Whether a project involves more common feedstocks like woody biomass and food wastes, or less ubiquitous farm and agricultural processing wastes and residuals, RRS offers the knowledge base and due diligence to create favorable supply conditions for a successful financial investment in steam generation, anaerobic digester, and pellet manufacturing plants.

[www.recycle.com](http://www.recycle.com)

### ENGINEERING & EQUIPMENT

# BRUKS



### Bruks Rockwood

BRUKS provides mechanical-engineering and equipment supply for the bulk materials handling industries. Their services include project engineering, technical support, start-up training, and remote-monitoring/servicing of machine functions. From truck dumpers to ship loaders, and mobile chippers to stacker reclaimers, BRUKS product portfolio offers a wide variety of customizable solutions for the bulk materials handling industry.

[www.bruks.com](http://www.bruks.com)



### Evergreen Engineering, Inc.

Evergreen Engineering, Inc. specializes in mechanical, civil/structural, chemical/environmental, and electrical engineering. Established in 1985, Evergreen Engineering is a multi-discipline, full-service firm, providing industrial engineering, design, consulting, and construction solutions to the power generation, wood products, pulp and paper, chemical, and resin industries.

[www.evergreenengineering.com](http://www.evergreenengineering.com)



*Peterson 4710B Horizontal Grinder, 765hp, a land clearing favorite!*



*Peterson 4310B Drum Chipper, 765hp, 6 or 12-pocket configuration*



Scan with your smart phone to watch us grind!

For over 30 years, we've built our business around building the most productive mobile chipping and grinding machines in the industry. Day after day, we partner with our customers by giving them the best tools for the job and exceptional support when they need us.

Visit us at [www.petersoncorp.com](http://www.petersoncorp.com) today and see why Peterson is the industry leader for disc and drum chippers, horizontal grinders, blower trucks, screens and stacking conveyors.

Let us know how we can help you grow your business!

800-269-6520 • [www.petersoncorp.com](http://www.petersoncorp.com)  
PO BOX 40490 • Eugene, OR 97404







**IGRS**

Integrated Gas Recovery Services, Inc. (IGRS) is a full service solution provider for all landfill gas (LFG) related challenges. From gas collection and flaring systems to complex design, build, own, operate, and finance LFG utilization projects, IGRS serves both municipal and private clients across Canada. IGRS is a partnership between Comcor Environmental Limited (Comcor) and Walker Environmental Group specializing in Land-fill Gas to Energy (LFGTE) Systems, which utilize landfill gas for the generation of electricity; Landfill Gas Collection Systems, which mitigate odors from degrading landfill waste through installation of LFG collection systems; and Carbon Market Services, providing a full suite of carbon emission reduction credit (ERC) services including verification, registration, and sales. [www.igrs.com](http://www.igrs.com)



**Precision Energy Services**

Precision Energy Services supplies the biomass and wood products industry with consulting, engineering, procurement, construction, and O&M services for all types of combustion and gasification technology as well as steam, heat, and power generation from solid fuels. Their simultaneous multi-fueled systems provide a continuous source of reliable energy in the form of electrical power, steam, hot gas, and/or thermal fluids. [www.pes-world.com](http://www.pes-world.com)

**FINANCIAL SERVICES**



**Rodman CPAs**

The Green Team at Rodman CPAs provides expertise in renewable energy tax accounting, business structure, and management strategy. The team specializes in clean energy technologies, offering tax advisory, ongoing advisory for federal, state, and local tax incentives, ITC studies, grant qualification assistance and auditing, financial, and accounting services for companies involved with solar, wind, biomass, waste-to-energy, and energy efficiency projects. [www.rodmancpa.com](http://www.rodmancpa.com)

**FOREST & WOOD PROCESSING**



**Komptech Americas**

Komptech Americas provides screening and grinding equipment for processing wood waste into biofuels. The Komptech Multistar XXL-2 is a large star screen for screening compost, biomass, wood waste, etc. The star screen is very good at providing a consistent size output product at high volumes, regardless of moisture content. Biomass plants, Co-Gen plants, and anyone burning wood fuel could benefit from a starscreen on the front end of their system in order to provide their boiler with a clean and consistent size input product. The XXL-2 is one of many star screen models offered by Komptech. [www.komptechamericas.com](http://www.komptechamericas.com)



**Peterson**  
an Astec Industries Co.



**Peterson**

Peterson specializes in developing delivery and processing equipment that turns low-grade organic materials into high-value products for the biomass industry. The 4300B drum chipper is the latest in a long line of quality chipping and grinding machines produced by Peterson. The 4300B drum chipper is suited for high-volume biomass producers who have a wide variety of feed material, from logs up to 26" (61 cm) in diameter, to brush and small feedstock. [www.petersoncorp.com](http://www.petersoncorp.com)



**Terex Environmental Equipment**

Terex Environmental Equipment designs and manufactures wood processing, biomass, and recycling equipment. TEE offers a range of whole tree chippers, horizontal grinders, trommels, slow speed and medium speed waste shredders, waste handlers, windrow turners, and recycling screens with Spaleck technology. [www.terex.com/environmental-equipment](http://www.terex.com/environmental-equipment)

**LARGE-SCALE POWER GENERATION**



**Elliott Group**

Elliott Group designs and manufactures turbomachinery including steam turbine generator packages from 500kW to 50MW. Elliott steam turbine generators reliably, efficiently, and cost effectively produce on-site electrical power from energy sources such as biomass, geothermal, and fossil fuel-powered process and institutional steam systems. [www.elliott-turbo.com](http://www.elliott-turbo.com)



**Rawlings Wood Recovery Systems**

Rawlings provides size reduction equipment to assist their customers in utilizing renewable resources, while reducing and recycling a wide variety of wood waste into marketable products. They offer individual equipment delivery as well as complete customizable wood waste recovery systems including metal or magnet protection, product screening and separation. The Rawlings wood hog is designed for continuous operation while minimizing maintenance and horsepower. [www.wastewoodhogs.com](http://www.wastewoodhogs.com)



**SNC-LAVALIN**

Building what matters



**SNC-Lavalin**

SNC-Lavalin's Thermal division has EPC experience in all types of thermal power generation. They have completed 28 power generating facilities utilizing alternative energy fuels such as wood waste, tires, agricultural waste, and municipal solid waste. They provide a "one-stop-shop" for thermal power solutions, from planning, pre-feasibility and feasibility studies, to detailed engineering, procurement, construction, start-up, and commissioning of power facilities. [www.snclavalin.com](http://www.snclavalin.com)



**Rotochopper, Inc.**

Rotochopper manufactures high-speed grinders, slow-speed shredders, and hammermills for converting waste materials into alternative fuel products like wood pellets and boiler fuel. Available with diesel or electric power, Rotochopper fiber sizing equipment can process a wide range of raw materials, including whole trees, round and square bales, pallets, construction and demolition debris (C & D), wood chips, and much more. [www.rotochopper.com](http://www.rotochopper.com)

2016 ▶▶▶

3 X THE POWER OF BASELOAD RENEWABLES  
**3X THE VOICE**  
JUNE 7-8 | Reno, NV

**3X** FACT: 2/3 of US renewable electricity comes from baseloads-geothermal, hydropower, & biomass.

BRESx3	Topics	Register
<p>Often sidelined in the discussion of RE, the Baseload Renewable Energy Summit (BRESx3) will feature the combined voices of geothermal, hydropower, and biomass.</p>	<p>-Utilities Discuss Baseload Renewable Resources and the Value to their Power System -State Initiatives and Implementation Plans -Current Market Issues in the West -Energy, Tax, and Other Policies -New Technologies</p>	<p>Online registration is now open. Register on or before May 6th to claim a special early-bird discount.</p> <p>GEA/NHA/BPA/GRC/ACORE members receive an additional discount.</p>

[www.geo-energy.org](http://www.geo-energy.org) | [Rani@geo-energy.org](mailto:Rani@geo-energy.org)



## MATERIALS HANDLING SOLUTIONS



### Hallco Industries Inc.

Hallco Live Floors have been used in the biomass industry for years. Hallco has built a light, tough aluminum decking so chip trailers can carry more load with greater fuel efficiency. Their self-unloading floors work equally well in trailers and stationary bunkers or bins.

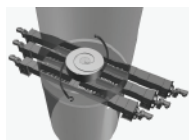
[www.hallcoindustries.com](http://www.hallcoindustries.com)



### KEITH Mfg. Co.

KEITH WALKING FLOOR conveyors provide a cost effective, low maintenance solution to fuel receiving/storage/handling requirements. Systems automate the feeding process, delivering material in a consistent manner, as well as storing it until needed. Live-bottom bins reliably handle a variety of fuel stock. Systems are custom engineered and designed to move tons, not pounds.

[www.keithwalkingfloor.com](http://www.keithwalkingfloor.com)



### SHW Storage & Handling Solutions, Inc.

For more than 45 years SHW Storage & Handling Solutions GmbH has delivered installations for processing, feeding, and storage of special bulk materials which are difficult to handle such as: wood chips, bark, paper waste, paper sludge, FGD-gypsum, RDF, secondary fuel, filter cake from industrial and municipal sludge, municipal waste, animal meal, etc. The design, production, and installation are carried out by SHW-SHS from one source.

[www.shw-shs.com](http://www.shw-shs.com)

## PLANT OPERATIONS



### EDF Renewable Services

EDF Renewable Services ensures ongoing project profitability for project owners and investors by providing a full range of expertise, operation and maintenance services, and enhanced management services such as asset administration and performance analytics. From their Operations Control Center, the company provides 24/7 remote monitoring and resets, evaluates project performance, and other advanced customized services.

[www.edf-renewable-services.com](http://www.edf-renewable-services.com)

## SOFTWARE



### ALDATA Software

ALDATA Software develops raw material supply chain management software for industries including virgin timber, residual fiber, recycled stock, and biomass. Their Boss Line suite of fiber supply management software can help streamline the fiber procurement process. ALDATA's systems assist pulp mills, paper mills, sawmills, wood yards, timber managers, biomass/biofuel, and pellet facilities manage suppliers, quantity, quality, and quotas, with real-time data available to support their management decisions.

[www.aldatasoftware.com](http://www.aldatasoftware.com)

## TESTING & QUALITY CONTROL



### Biomass Energy Lab

Biomass Energy Lab (BEL) is an ISO 17025 accredited lab dedicated to solid biomass fuel analysis. Along with quality testing services, BEL also provides EN Plus auditing, testing and consulting, as well as internal lab design and set-up. If exporting pellets or biomass, BEL can provide a Certificate of Analysis for the shipment. The testing can be performed with either ASTM or CEN/EN methods.

[www.biomassenergylab.com](http://www.biomassenergylab.com)



### Electromatic Equipment Co., Inc.

Electromatic Equipment offers a complete line of hand-held moisture meters for determination of moisture content in all forms of Biomass including wood chips, wood pellets, round timber, wood shavings, saw dust, miscanthus, elephant grass, and more.

[www.checkline.com](http://www.checkline.com)



### MoistTech, Corp.

MoistTech's IR-3000NIR is an online moisture sensor for instant, non-contact measurement of virtually any product and raw material in the harshest manufacturing environments. Providing performance, stability, reliability, maintainability, and cost of ownership, the IR-3000 is a solution to controlling a product's moisture. The online process moisture analyzer provides continuous, reliable readings. It's one-time calibration, maintenance free, and drift free optical design provides real-time measurements.

[www.moisttech.com](http://www.moisttech.com)

## WASTE TO ENERGY EQUIPMENT & PROCESSING



### ADI Systems Inc.

ADI Systems offers anaerobic technologies and biogas treatment to assist with waste-to-energy projects. They supply complete biogas handling, treatment, and utilization systems for the recovery of renewable energy from wastewater and organic waste.

[www.adisystemsinc.com](http://www.adisystemsinc.com)



### Ecomembrane

Ecomembrane designs and manufactures innovative biogas storage systems, utilizing proprietary polyester reinforced, PVC-coated membranes. Their constant pressure membrane gasholders serve as a standalone containment system, specially designed to store biogas generated from the anaerobic digestion of municipal wastewater treatment, agriculture waste, or industrial and/or urban waste. Ecomembrane offers tank-mounted digester covers and ground-mounted gasholders that are sized to meet a wide range of gas storage needs. Ecomembrane's goal is to help customers around the globe implement clean energy and emission reduction solutions, while reducing costs and maximizing the financial and environmental benefits.

[www.ecomembrane.com](http://www.ecomembrane.com)



### Geomembrane Technologies, Inc. (GTI)

Geomembrane Technologies Inc.(GTI) provides solutions which collect and store biogas from anaerobic digestion systems. GTI offers custom-designed biogas collection covers for tanks and lagoons of all sizes. They also offer biogas control systems to safely regulate biogas flow. They are the exclusive distributor of VSO Biogas Technologies double-membrane gasholders in the United States and Canada.

[www.gticons.com](http://www.gticons.com)



### Vecoplan, LLC

VECOPLAN designs, manufactures, and installs complete systems to prepare MSW for alternative fuel in production of heat and power, feedstock for conversion to syngas, methanol, cellulosic ethanol, biodiesel, and other biofuels. Capabilities include unloading of raw feedstocks, pre- and re-shredding, ferrous and non-ferrous separation, conveying, screening, air classification, testing stations, storage, and metered feeding to the boiler or conversion system.

[www.vecoplanllc.com](http://www.vecoplanllc.com)

## OTHER Biogas/Anaerobic Digestion



### Permastore, Ltd.

With over 55 years experience, Permastore is a manufacturer and supplier of glass-fused-to-steel and fusion bonded epoxy storage tanks, silos and supplies tanks, silos, roofs, and covers through their worldwide distributor network.

[www.permastore.com](http://www.permastore.com)

## Industrial Fans & Blowers



### AirPro Fan & Blower Company

AirPro designs and manufactures industrial-duty centrifugal fans and blowers for process and material-laden air. Their custom and pre-engineered product lines include air-foil, backward inclined, backward curved, radial tipped, exhaust handling, material handling, high pressure, high temperature, and API 673/560 rated fans and blowers. General operating capabilities include temperatures up to 1700°F, pressures up to 140" WGSP, and flows up to 350,000 CFM.

[www.airprofan.com](http://www.airprofan.com)

## Revenue Metering/Data Telemetry



### Trimark Associates, Inc.

Trimark assists in the successful completion of the Qualifying Facility (QF) conversion process including installation of revenue meters and secure data systems. As a new resource, a QF, or a resource in need of a replacement revenue meter, Trimark delivers end-to-end solutions. Trimark combines fully-functional, assembled, tested, and certified systems with guidance through regulatory and meter certification processes.

[www.trimarkassoc.com](http://www.trimarkassoc.com)



**MAY**

- 15-18 Strive for Sustainability**  
The Sagamore, Bolton Landing – New York, NY; [www.nyfederation.org](http://www.nyfederation.org)
- 16-17 Solar Ontario**  
Fallsview Casino Resort/Hilton – Niagara Falls, ON; [www.solarenergyevent.ca](http://www.solarenergyevent.ca)
- 17-19 Midwest Solar Expo & Energy Storage Symposium**  
Minneapolis, MN; [www.midwestsolarexpo.com](http://www.midwestsolarexpo.com)
- 23-26 WINDPOWER**  
Ernest Morial Convention Center – New Orleans, LA; [www.windpowerexpo.org](http://www.windpowerexpo.org)
- 25-26 Solar Power Southeast**  
OMNI Atlanta Hotel at CNN Center – Atlanta, GA; [www.events.solar/southeast](http://www.events.solar/southeast)
- 31-06 The Clean Energy Ministerial**  
San Francisco, CA; [www.cem7.org](http://www.cem7.org)

**JUNE**

- 01-03 Distributed Energy Development & Deployment Summit**  
Washington Plaza – Washington, DC;  
[www.informationforecastnet.com/events/distributed-energy](http://www.informationforecastnet.com/events/distributed-energy)
- 06-09 BIO International Convention**  
Moscone Center – San Francisco, CA; [www.convention.bio.org](http://www.convention.bio.org)
- 07-08 Baseload Renewable Energy Summit**  
Grand Sierra Resort and Casino – Reno, NV;  
[www.geo-energy.org/NationalGeothermalSummit/Main.aspx](http://www.geo-energy.org/NationalGeothermalSummit/Main.aspx)
- 08-10 2016 Modern Solutions Power Systems Conference (MSPSC)**  
The Drake Hotel – Chicago, IL; [www.selinc.com/mspsc-event](http://www.selinc.com/mspsc-event)
- 14-15 National Geothermal Summit**  
Reno, NV; [www.geo-energy.org/events.aspx](http://www.geo-energy.org/events.aspx)
- 21-22 REFF Wall Street Renewable Energy Finance Forum**  
The Grand Hyatt – New York, NY; [www.reffwallstreet.com](http://www.reffwallstreet.com)
- 21-23 Verge Hawaii**  
Hilton Hawaiian Village – Honolulu, HI; [www.greenbiz.com/events/verge/honolulu/2016](http://www.greenbiz.com/events/verge/honolulu/2016)
- 25-29 ASHRAE Annual Conference**  
Marriott St. Louis Grand Hotel – St. Louis, MO;  
[www.ashrae.org/membership--conferences/conferences/2016-ashrae-annual-conference](http://www.ashrae.org/membership--conferences/conferences/2016-ashrae-annual-conference)
- 26-29 50th US Rock Mechanics/Geomechanics Symposium**  
Houston, TX; [armasyposium.org](http://armasyposium.org)

**JULY**

- 11-13 A National Town Meeting on Demand Response and Smart Grid**  
Washington, DC; [www.demandresponsetownmeeting.com](http://www.demandresponsetownmeeting.com)
- 12-14 SEMICON West**  
Moscone Center – San Francisco, CA; [www.semiconwest.org](http://www.semiconwest.org)
- 12-14 Intersolar North America 2016**  
Moscone Center – San Francisco, CA; [www.intersolar.us](http://www.intersolar.us)

**AUGUST**

- 30-01 2016 Sandia Wind Turbine Blade Workshop**  
Embassy Suites – Albuquerque, NM; [windworkshops.sandia.gov](http://windworkshops.sandia.gov)

**SEPTEMBER**

- 12-15 PES ESMO Conference & Expo**  
Greater Columbus Convention Center – Columbus, OH; [www.ieee-pes.org](http://www.ieee-pes.org)
- 12-15 Solar Power International**  
Las Vegas Convention Center – Las Vegas, NV; [www.solarpowerinternational.com](http://www.solarpowerinternational.com)

**OCTOBER**

- 04-06 Energy Storage North America 2016**  
San Diego Convention Center – San Diego, CA; [www.esnaexpo.com](http://www.esnaexpo.com)
- 05-07 Solar West**  
Edmonton, AB; [www.solarwestconference.ca](http://www.solarwestconference.ca)
- 13-14 Decision 2016: Energy Choices!**  
Sheraton Burlington Hotel & Conference Center – Burlington, VT; [www.revconference.org](http://www.revconference.org)
- 23-26 GRC Annual Meeting & GEA Geothermal Energy Expo**  
Sacramento Convention Center – Sacramento, CA; [www.geothermal.org/meet-new.html](http://www.geothermal.org/meet-new.html)
- 25-26 AWEA Offshore Windpower**  
Crowne Plaza Providence – Warwick, RI; [www.offshorewindexpo.org](http://www.offshorewindexpo.org)

**NOVEMBER**

- 07-10 Grid Modernization Summit 2016**  
Capital Hilton – Washington, DC; [www.sgip.org](http://www.sgip.org)

**SEPTEMBER 2017**

- 19-21 tcbiomass 2017**  
Radisson Blu Aqua – Chicago, IL; [www.gastechnology.org/tcbiomass](http://www.gastechnology.org/tcbiomass)

Page	Company	Website
57	3M	3m.com/awea2016
76	3X Baseload Renewable Energy Summit	www.geo-energy.org
63	AIMCO	www.aimco-global.com
49	Amsoil	amsoilwind.com
7	Array Technologies	arraytechinc.com
5	Baja Construction	www.bajacarports.com
OBC	BayWa r.e. Wind, LLC	www.baywa-re.us
62	BE-Wind Products	www.be-wind.com
17	Bel Ray/Royal Purple	royalpurpleindustrial.com
54	BGB Technology Inc	www.bgbtechnology.com
13	Bonfiglioli	www.bonfiglioliusa.com/pv
19	Burndy	www.burndy.com
69	CanSIA	www.cansia.ca
70	CanWEA	www.windenergyevent.ca
56	Capps Rental	www.gocapps.com
10	Civil & Environmental Consultants	www.cecinc.com
68	Clean Energy Storage Inc.	www.cleanenergystorage.net
32	Continental Control Systems	ccontrols.com
43	Crown Battery	www.crownbattery.com
53	DAFA US	www.dafa-as.com
37	DCE Solar	www.dcesolar.com
33	Ecology and Environment, Inc.	www.ene.com
28	Eko Instruments (USA) Inc	www.eko-usa.com
52	EMA Electromechanics	www.emaelectromechanics.com
66	ESNA	www.esnaexpo.com
59	Fagen Inc	www.fageninc.com
61	Firetrace	www.firetrace.com
54	Flash Technology	flashtechology.com
26	Gigavac	www.gigavac.com
40	GS Battery	www.gsbattery.com
24	HT Instruments	www.ht-instruments.com
29	Huawei Technologies USA Inc.	www.huawei.com/solar
71	Intersolar North America	www.intersolar.us
9	Iowa Economic Development	www.iowaeconomicdevelopment.com
60	Iowa Lakes Community College	www.iowalakes.edu
42	Iron Edison	www.ironedison.com
60	ITH Engineering	www.ith.com
62	Janicki Industries, Inc.	www.janicki.com
30	Japan Solar US, Inc	www.japansolarus.com
38	Kipp & Zonen	www.kippzonen.com
55	Landstar	www.landstar.com
31	LG Electronics	www.lg.com
36	Magerack Corporation	www.magerack.com
58	Mankiewics Coatings	www.mankiewicz.com
39	Mersen	www.ep.mersen.com
41	MK Battery	mkbattery.com
23	New World Technologies Inc. - Rad Torque Systems	www.radtorque.com
20	Nordic Fiberglass	www.nordicfiberglass.com
75	Peterson	www.petersoncorp.com
60	Petroflex North America	www.petroflexna.com
51	Phoenix Contact	www.phoenixcontact.com/quintpower
63	Port of Corpus Christi	www.portofcc.com
3	PV Cobra	www.solcomponents.com
35	Quickscrews	www.solarroofhook.com
67	Rhombus Energy Solutions	www.rhombusenergy.com
25	Sapa Extrusions	www.sapagroup.com/NA
IFC	Shoals	www.shoals.com
34	Siba Fuses	siba-fuses.us
15	Siemens	siemens.com/awea2016
14	Skycasters LLC	skycasters.com
IBC	Snapon	www.snapon.com/industrial
65	Solar Power International	www.solarpowerinternational.com
39	SolarBos	www.solarbos.com
27	Soltec	soltec.com
50	Stahlwille Tools	stahlwilletools.com
44	Storage Battery Systems	www.sbsbattery.com
45	Surrette Battery	www.rollsbattery.com
21	Team1	www.team1academy.com
47	Terrasmart	terrasmart.com
11	Torkworx, LP	www.torkworx.com
42	U.S. Battery	www.usbattery.com
74	Wastecon	wastecon.org/indy
48	WindEnergy Hamburg	windenergyhamburg.com
16	Xpera	www.xpera.ca

Send us your clean energy show and event listings.  
Email information to the editor at [editor@naceanenergy.com](mailto:editor@naceanenergy.com)



# ENGINEERED DROP PREVENTION SOLUTIONS



Since inventing the socket and driver back in 1920, Snap-on has been driven by innovation. This GE 1.5 Hub Hatch Tool is an engineered solution that replaces the homemade version in many technician bags. It includes a floating, certified attachment point, ensuring functionality and drop prevention.



GE Hub Hatch Tool

Stainless Steel Safety Coil is designed to slide freely along the handle, so you can hold the wrench where you need to.

CUSTOM DESIGNED AND TESTED DROP PREVENTION TOOLKITS WITH INVENTORY MANAGEMENT SYSTEMS ARE ORDERED AS A SINGLE LINE ITEM.



Visit our display at  
Windpower Booth 3718

Contact Power Generation Manager John Tremblay  
413-519-3380 or [john.r.tremblay@snapon.com](mailto:john.r.tremblay@snapon.com)


[www.snapon.com/industrial](http://www.snapon.com/industrial)

**Snap-on**  
INDUSTRIAL



# r.e.sponsible for your success.

Wind Energy | Solar Energy | Bio Energy | Geothermal Energy



Over  
**700 MW**  
capacity designed  
and installed

Project Development  
Construction  
Asset Management