

North American **CleanEnergy**

EXTREME WEATHER EDITION

Blackouts in the Developing World

How microgrids are helping us cope Pg. 72

Maintaining America's Growing Offshore Wind Industry Pg. 8

Inverters that Optimize Production & LCOE in Extreme Weather & Terrain Pg. 26

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- Solar Canada Pg. 60
- Solar Power Southeast Pg. 61
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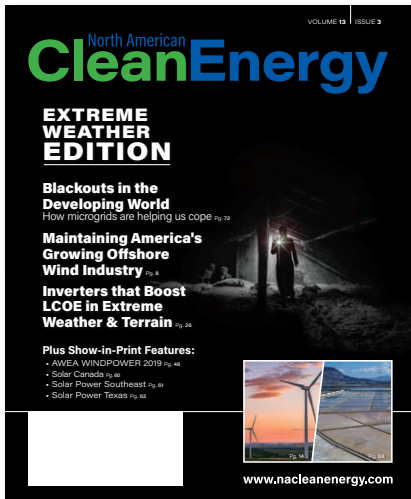
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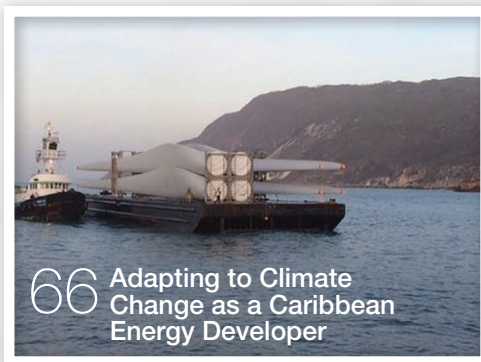
The devastation caused by Hurricane Maria left much of Puerto Rico in the dark for months. A number of island residents benefited from previously-installed solar plus storage systems. FUERGY's AI-powered virtual microgrid allows people who have the ability to store power to share their energy with others.

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MY CHILDREN'S SCHOOL SENT OUT AN EMAIL ALERTING

parents that they conducted yet another lockdown drill. The first few emails made me feel a little on edge, but now it's about as worrying as a fire drill. No big deal, right? We've all had to line up in the hall, our teachers warning us to keep quiet as they attempted to lead us out of the building in an orderly fashion. Fire drills could be a blessing in disguise if they were timed just right to help you avoid taking a test you hadn't studied for, or if you just wanted to talk to your friends (quietly) and get some fresh air. Lockdown drills are different. In the shadow of the recently acknowledged 20th anniversary of the Columbine school shooting, and the 18th anniversary of 9/11 coming up in just a few months, our attitude about preparedness has changed drastically.

In 2007, the Department of Education outlined security procedures that require most schools to conduct drills that "respond to an emergency situation including, but not limited to, a non-fire evacuation, lockdown, or active shooter situation and that is similar in duration to a fire drill."¹

Sadly, due to the frequency of these drills and subsequent emails, I've begun to feel a bit complacent about the whole thing.

At least I know my kids are getting practice at school. Considering the lack of disaster preparedness in my own home, I'm in no danger of being nominated for Mother of the Year. My house has fire detectors with working batteries (thanks to their piercing cry for attention that has us all scrambling around the house, waiting to hear which one is the culprit). My kids know how to crawl on the floor beneath the smoke, to avoid online strangers, and to dial 911.

But if there's a town wide major emergency, I'm embarrassed to admit that we don't have a plan of where to go or where to meet. I guess the assumption is that we'd all use our phones to either call each other, or wait for help from the powers that be. But what if the "powers that be" no longer had any power?

I had an up close and personal experience with the disruption caused by Hurricane Sandy when it hit us here on the east coast. Lives were lost, tempers flared, and people in the midst of the blackouts and power outages and fuel shortages quickly lost patience with how long it took for those in charge to get their acts together. Given the weeks we spent waiting for basic services to come back online, you'd have thought the utility companies had never considered the possibility of a big storm. It's easy to examine a disaster in retrospect, trying to dissect all that went wrong in the hopes of preventing a repeat. It's a lot harder to trust that we won't suffer the same problems in the future. No doubt emergencies have been averted thanks to past lessons learned and thoughtful preparation, but we so rarely hear about any positive news that I'd be surprised if those successes were widely reported.

Green power can benefit from the decades of experience conventional energy has had learning how to prepare for, and recover from Mother Nature's tantrums. After all, clean energy faces many of the same challenges from weather, unsuitable terrain, or hostile environments. While we have little control over the national grid, we have an obligation as an industry to take advantage of our remarkable talent to develop cutting edge technology that solves problems, and to disarm threats before they lead to catastrophe.

In our second annual Extreme Conditions issue, you'll read about the advancements your peers are making as they address some of the most punishing elements on earth. We're relative newcomers on the energy scene, rushing into the future while still trying to heed the warnings of our predecessors. Yet, we are all thoroughly connected, so - whether they are old or new - ensuring our regional power sources and national network are prepared for disaster is in everyone's interest.



*"With great power comes great responsibility."
- the late Stan Lee, creator of Spider-Man*

Meg

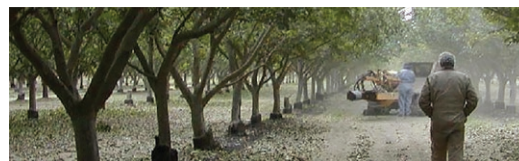
¹ <https://www.nj.gov/education/schools/security/drill/Guide.pdf>



Contest launches with \$500,000 prize

The NYC Curb-To-Market Challenge (CTMC) is a contest offering a \$500,000 prize for the best idea and business plan to repurpose New York City's recyclable waste and locally manufacture a product to sell in the New York City market. The winning entry will demonstrate the most efficient, sustainable, and environmentally aware way to implement the entire process of sourcing and converting the recycled waste for use, manufacture a product locally in New York City, and sell the product to the largest potential market. The winning business plan will receive a \$500,000 prize, split between a \$100,000 cash prize and a \$400,000 equity investment in the associated startup. The winning team or individual will also receive involved advising from the NYC CTMC founder Chris Graff, as well as access to a network of advisors and angel investors. The application period opened on February 1 and will remain open through June 1, accepting proposals from applicants from New York City and beyond. Finalists will be flown to New York City during the final two weeks of June to present in front of the judging panel. The winning business plan will be announced on July 1.

The NYC CTMC /// www.curbtomarket.com



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Dixon Ridge Farms, a handler of California organic walnuts, has reached complete energy self-sufficiency - with energy to spare, via the transformation of their walnut shells into renewable heat and power. This leadership in advancing sustainable climate change solutions in agriculture has led to the Farm's receipt of California's highest environmental honor, the Governor's Environmental and Economic Leadership Award (GEELA). Key to Dixon Ridge's sustainability is their use of SynTech Bioenergy's BioMax technology, which has led to the entire operation of 1400 acres and walnut processing being confirmed by UC Davis as greenhouse gas and carbon negative, producing about half of the emissions of comparable organic farm systems. By implementing SynTech's technology, Dixon Ridge Farms has demonstrated an advanced approach to clean energy in its farming practices and serves as an archetype for sustainable climate action in the agriculture industry.

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Maintaining America's Growing Offshore Wind Industry

by Eric Stanfield

OPERATION AND MAINTENANCE OF

America's growing offshore wind industry is a task that requires wind technicians to overcome obstacles not seen on land. Unique challenges on this job start with the need for experienced, land-based crews to undergo offshore marine safety training. Once training is finished, the workday starts early; boats leave at 6 in the morning, with days stretching 12-14 hours (including several hours of boat travel). "It takes a long time to get out there, so your sheer daylight hours are cut," said a crew member.

Downtime for swells can limit wind farm access depending on the distance of the turbines from shore. Once weather clears, techs must wait for space on the boat, which can be crowded with other workers also backed up on their jobs. Different contractors, each trying to optimize weather windows and shuttle boat access, need a little extra finesse to work together effectively.

When air or water temperatures are cold enough, workers are required to wear immersion suits, similar to what crab fishermen wear. These bulky outfits can be difficult to take on and off, not to mention uncomfortable. Most workers also find coping with seasickness to be a regular part of the job. Care needs to be taken in how to combat this, however, as some solutions can make them drowsy and less alert on the job. Even after reaching the site, vessels must still travel between individual turbines to onload or offload personnel. Pitching seas can complicate tie-off, as well as getting on and off the boat.

Efficiency is key - forget any tools or chemicals and your day can be shot. Getting them up and down from the platform to the blade, rigging, and rescue scenarios all differ depending on the pitch and yaw. "Considering what the machines are creating in revenue every day, we can't afford to make mistakes," said one worker. "From planning to packing and execution, we need to get it right the first time."

These turbines are very large, both in the size of the nacelle and the rotors. Workers notice this when on the blades (in the greater amount of movement) and when next to the towers (given the larger wind

shadows created by their increased diameter).

Workers use ropes to access the giant blades, and swing - suspended - out over the water. When the work is done, there's no dropping straight to the ground as they could on land; they must rely on a partner to pull them in.

Offshore turbine technicians must knock off work up to an hour early to be sure they're cleaned up, down-tower with their gear, and ready when the boat comes to get them. Vessel time is expensive, and communication is often difficult with the boat moving from turbine to turbine, encountering issues with docking, and waiting on workers who may be running late.

When the chance of lightning halts operations, it can take longer to resume work afterwards. "Terrestrially we have a lot more flexibility," said one worker. "It's easier for us to go down-tower if there's a lightning stand-down, and then go back up later. Where offshore, you can't come and go as you please."

If a safety incident were to require emergency medical response, it would probably take longer than at many land-based sites. Helicopter access times might compare to reaching a remote wind farm in Montana, for example. Even when conditions are otherwise normal, workers can be stuck at a turbine simply due to the shuttlecraft no longer being able to access it due to wave height. On the plus side, while the rotors can be quite large compared to those on land-based turbines, tower heights aren't correspondingly that much higher because they don't have to clear any obstacles or reach up as high to find clean wind. Winds in general aren't as turbulent in the ocean as they are on land, where obstructions impede airflow.

The technicians summoned to work on America's new offshore farms were drawn from a workforce that has succeeded in other challenging work environments, among several hundred jobs they did last year, involving thousands of turbines. They braved the weather to repair a massive blade in Nome, Alaska, saving a half-million dollars on

a replacement that would have taken months to install. They've encountered extreme heat on the job in Mexico and elsewhere in Latin America. Dust storms and crop spraying can be issues around fields. Due to their skill, and with rope access their primary approach (as opposed to cranes or platforms) they have worked on some of the most isolated wind farms on the planet.

These wind technicians takes full advantage of any spare time; team members have won international sailing races, gone caving deep in the earth in Tennessee, and taken a team of sled dogs in the Iditarod. These workers are hyperconscious of safety, and rigorously follow tried-and-true procedures based on 20 years in the business.

"Wind turbine service technician" is already the second-fastest growing job description in America. The offshore wind supply chain is now a \$70 billion revenue opportunity through 2030, with 1,700 turbines expected to be installed offshore of seven eastern states.

"We wanted to show what a U.S.-based team could do and be the tip of the spear, so to speak," said one of those working to service the first U.S. offshore turbines. "Successfully taking on new challenges is something we thrive on, and working out there again this year will enable us to keep sharpening that spear."

Eric Stanfield is the CEO of Rope Partner, provider of rope access maintenance, inspection, and performance enhancement services for the wind turbine operations and maintenance market.

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Multiphysics Protects Wind Turbines when Lightning Strikes

by Justin McKennon

As the world moves to reduce its dependence on fossil fuels, the global market for wind turbines is growing, projected to reach around \$70 billion dollars annually in the next few years. While wind power on such a scale is a great achievement, another powerful force of nature is preventing the industry from reaching its full potential: lightning.

Lightning strikes are the single largest cause of unplanned downtime in wind turbines, responsible not only for the loss of untold megawatts of power, but also for huge operation and maintenance costs.

Wind turbines are particularly susceptible to lightning strikes because of their great heights, exposed locations, and large rotating blades. Lightning can wreak havoc, both directly and indirectly, on virtually all wind turbine components, including blades, control systems, and other electrical components. Repair is not only expensive but also physically challenging, given the logistical constraints.



Figure 1. High-voltage generator.

Modeling and analytical engineers are actively involved in the committees that form the International Electrotechnical Commission (IEC), which defines the lightning levels and situations that blades must endure. Industry regulations, such as IEC 62305, require wind turbine manufacturers to incorporate lightning protection designs into their blades. For maximum protection, it's essential to know how much lightning current is likely to flow through a blade following a lightning strike, and precisely where it will flow. The problem is that simple assumptions about the behavior of lightning current often lead to inaccurate conclusions.

Deep Insights into Lightning Current

One of the most complete lightning simulation laboratories in the world is located in an 18,000-square-foot facility in Pittsfield, MA, USA. The space features 14- and 25-foot tall lightning generators capable of generating as much as 2.4 MV (Figure 1).

Traditional wind turbine protection schemes consist of a surface protection layer (SPL) covering the lightweight, high-strength carbon fiber composite blades. Often, the SPL consists of a conductive mesh meant to safely carry lightning current from the point where it "attached to" (e.g., hit) the blade, and then from the root to the ground.

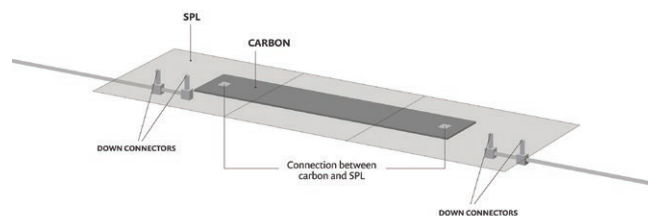


Figure 2. Geometry of the thin aluminum surface layer protection (SPL) placed on top of a carbon stack.

Understanding a carbon stack's ability to carry various amounts of current, along with other factors such as likely attachment points and puncture possibilities, is no small task. Given the cost to physically test these blades, some of which are 70 or more meters long, the numerical modeling of lightning effects has become a crucial part of the design process.

Given the complexity of the physics involved, it's easy to make the wrong assumptions, which can affect the accuracy of the models.

Simulation Reduces Overengineering

One common (but improper) assumption is that the carbon stack's conductivity is the same in all directions, when in reality there could be significant differences in carbon's conductivity along different directions.

Figure 2 shows the geometry of a carbon stack placed 5 mm below a 500- μm -thick SPL mesh made from an aluminum sheet, whose conductivity is set according to experimental measurements. The carbon's conductivity is also set according to experimental values; both its idealized isotropic and realistic anisotropic behavior have been considered in the simulation model.

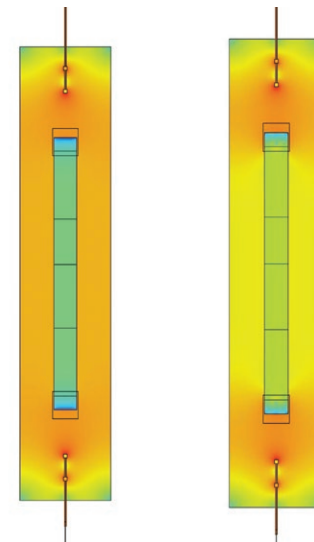
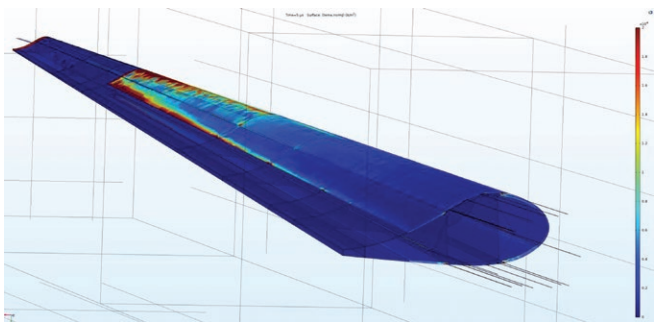


Figure 3. Simulation results showing that the amount of current in the SPL in the idealized isotropic case is significantly less than the realistic anisotropic case.

A time-domain wave equation for the magnetic vector potential was solved using multiphysics simulation. The results determined the associated currents, electric fields, and other values at those points, providing insight into the current's overall behavior throughout the entire structure.

The isotropic case underestimates the amount of current traveling through the SPL, implying that more current is traveling in the carbon and not in the SPL (Figure 3). Carbon is made up of many layers of individual fibers. It is very conductive in the fiber direction, but getting current into and out of the carbon is very challenging. If too much current has to pass through an interface between the carbon and something else, many of the individual fibers in the carbon can be burned away through heating and/or arcing (Figure 4). Carbon bears the primary structural



Justin McKennon is the Chief Engineer and Manager of Engineering and Simulation at NTS Lightning Technologies. Justin also is the chair of the SAE Commercial Space Committee. Justin has a Bachelor's and Master's Degree in Electrical Engineering from the University of Massachusetts Dartmouth. He has published dozens of papers on the use of simulation tools, and is widely regarded as an expert in electromagnetics and numerical analysis.

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Figure 4. Simulation results showing the current density on a sample wind turbine blade made of several carbon stacks.

loads, and damage here greatly reduces the lifetime of the blade and, in some cases, can lead to catastrophic blade loss. More current in the carbon is something engineers want to seriously avoid.

The isotropic case grossly overestimates the amount of current in the carbon because it ignores the very real orientation-dependent resistances in the carbon (Figure 5). Such an overestimate would introduce additional challenges that are not present, thus slowing down the development process, and leading to an overengineered product.

Reliable Results for Business Decisions

The ability to rapidly simulate and turn around models greatly reduces program risk, and allows for engineering level data to be obtained almost on-demand. In many cases, critical data simply cannot be measured on real test articles, which requires simulation and analysis to fill in these holes. Rather than spending considerable amounts of time and money fabricating complex test articles, simulation helps to analyze the physical phenomena, drastically reducing the problem scope for these projects.

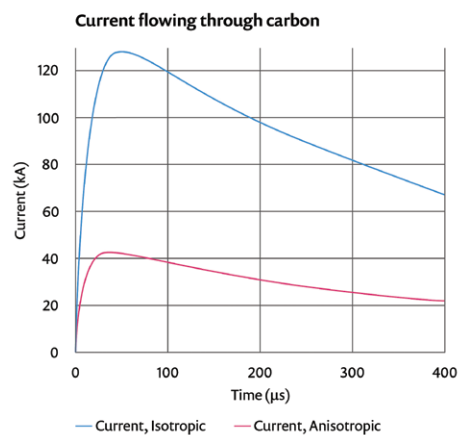


Figure 5. A plot demonstrating the current levels in the isotropic and anisotropic carbon cases.

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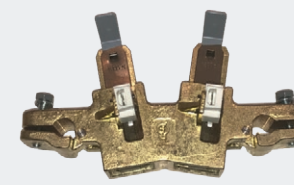
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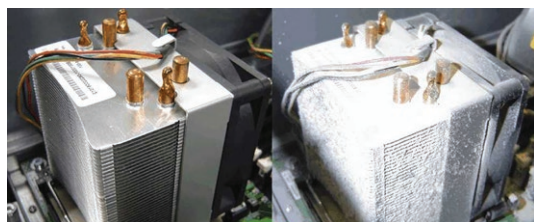
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Contingency Planning

The clever solution before serious incidents strike

by Hans Christian Sørensen



FOR MANY WIND ENERGY STAKEHOLDERS,

serious incidents involving fires, arc flashes, and lightning are not a part of everyday life. This would explain why many companies are not prepared for these situations when they rear their ugly heads. For energy companies and OEM's, these are sensitive matters that affect many aspects of business, including reputation, safety, and reliability. Evidence shows that being prepared for such crises will significantly speed up the recovery process.

Fire and Arc Flash

One of the most significant risks in the wind energy industry is an arc flash. An arc flash is the light and heat produced as part of an arc fault, a type of electrical discharge resulting from a low-impedance connection (through air to ground, or another voltage phase in an electrical system) which can exceed temperatures of 35,000°F. Fires resulting from arc flashes cause direct and secondary damage to a Wind Turbine Generator (WTG). A direct loss results when equipment is burned out to the point where metal surfaces are damaged beyond repair.

Secondary damage, otherwise known as contamination, is widespread damage in the WTG that is caused by residual chemicals after arc flashes incite fire, explosion, or other combustion events. Equipment may also have light to moderate melting damage on the cabling, plastic pipes, and insulation, yet still be restorable. In many cases concerning WTGs, the

secondary damage may be up to 10-15 times more severe than the direct damage when measured in replacement costs.

Soot that covers the surface is the most visible damage. It consists mostly of carbon, which is conductive. Note: It is important to not power up carbon contaminated equipment, as short circuits will more than likely occur, adding further damage to the equipment. What is not immediately visible on the surface of equipment is the acid that develops in the combustion of materials – this acid is the worst type of contamination after a fire or arc flash. Depending on the contamination and humidity levels, it will become visible in the form of corrosion.

During the combustion of various materials, several different acids may develop. Polyvinyl Chloride (PVC) is a material that is used in almost every installation. The most common corrosive acid that develops during the combustion of PVC is known as hydrochloric acid (HCl). This acid is part of the warm smoke, which condenses on cold surfaces.



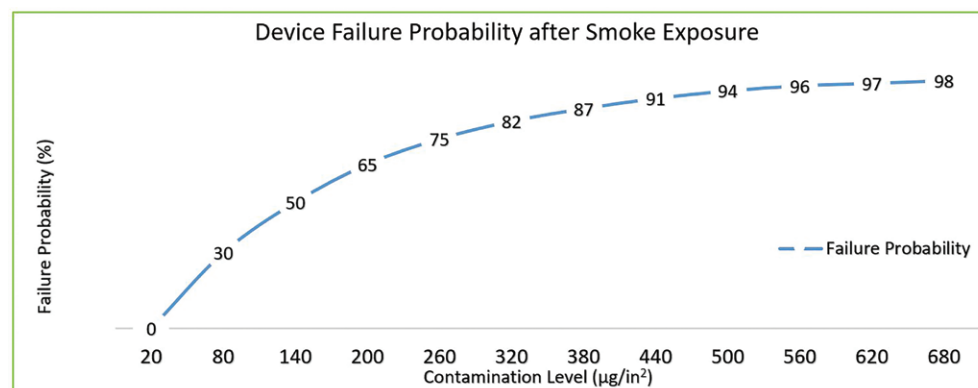
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Source: Hughes Associates, "DOE Fire Protection Handbook Volume II, Fire Effects and Electrical and Electronic Equipment," US Department of Commerce, 1996, pp. 41, 43.

Due to the pressure from the warm air, it can enter every unsealed area. It is easy to underestimate just how much HCl develops during a combustion: to put it in perspective, for every 1 kg PVC that is burned, 1.2 liters of acid develops.

Consequences for Technical Equipment and Installations

Corrosion erodes metals. The speed at which this occurs depends on the contamination level, humidity level, and type of metal. In 1996, the U.S. Department of Energy conducted a study that found that the failure rate of equipment increases dramatically as contamination levels increase. Even low levels of contamination will increase the failure probability to a critical level. If the contamination is not addressed, the failure rate continues to rise.

Contingency Plan Measures

Successfully building a well-functioning contingency plan for serious incidents requires identifying the appropriate internal stakeholders. While they may vary from company to company, they can include individuals from HSEQ, site-service, engineering, and risk management.

The next step should be to identify a specialized and trusted recovery partner. It is important to address impacted equipment as soon as possible after an incident, to allow for optimal probability of restoration. Your recovery partner will evaluate the secondary damage and conduct the proper chloride analyses to assess the contamination levels from HCl, as well as determine if the contamination has spread. For certain types of equipment, immediate and simple intervention can significantly reduce the cost for recovery or replacement. The recovery engineer on site will prepare a corrosion risk report that can then become a recovery plan, which will include not only your trusted partner, but often operators, service organization, suppliers, and OEM's.

Recovery of technical equipment is often times faster, less costly, and a more environmentally sustainable solution than the replacement of equipment. For more than 35 years, restoration methods have been proven to be extremely reliable; they are approved by several certification agencies.

As mentioned earlier, many corrosive substances develop during combustion of materials. It is therefore important that the recovery engineer be fully aware of this risk during the inspection of the WTG. To determine the need for further analysis of corrosion risk, the combusted materials and extinguished agents must be taken into consideration. If this is evaluated as a specific risk, the recovery engineer must take surface samples for lab analysis.

Replacement of certain components may be feasible - your trusted partner will be your primary source of information for the next steps. After a contamination event, the recovery percentage goal is to achieve 100 percent reliability of the equipment in question. Having a well-functioning contingency plan in place allows restoration specialists to be on site that much sooner after an incident, resulting in a higher likelihood of equipment being restored, reductions in down time, and lower overall costs.

Hans Christian Sørensen is a Sales Manager for AREPA in the Silkeborg, Denmark office. With nearly 15 years of experience in the recovery industry for technical equipment and installations, Hans Christian evaluates the value of preparedness and contingency planning, with a focus on the energy sector. AREPA's global team has over 35 years of experience providing comprehensive recovery solutions following property loss to critical equipment and systems.

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Accurate Forecasting During Severe Weather Season

Helping techs and turbines work better

by Ivan Gearhart

During severe weather season, the risks of lightning and high winds are top of mind both in terms of employee safety and potential equipment damage. Lightning is clearly a potential issue for turbine technicians, but it is also one of the biggest threats to wind turbines performance. And wind, even though it's at the heart of the industry, can be particularly dangerous to technicians working on turbines as well as the equipment itself.

With so many wind farms operating in the path of volatile and unpredictable weather patterns, it can make operations and maintenance challenging to manage. Using the most accurate weather forecasting and data available can help wind farm operators better protect their assets and employees from weather related risks.

Lightning Risks

Cloud-to-ground lightning bolts are a common phenomenon; there are about 100 strikes per second throughout the world. That's seven to eight million strikes per day that can put wind farms at risk. There's the obvious risk to technicians working during times of potential lightning strikes, but the direct and near-strike damage to wind turbines can result in downtime, which can impact ongoing and reliable turbine performance.

There are many options for monitoring lightning, but relying on someone to listen for thunder or watch local radar to ensure worker safety doesn't cut it when compared to the significant advances made in weather technology. There are weather services available that can detect and forecast lightning strikes, as well as provide high-quality, timely mobile alerts for technicians. When evaluating a weather source, here are some potential questions to ask to make sure the needed information is available: Does the system offer alerts based on a GPS location? Is there real-time, location-specific information on strikes? Do the alerts offer suggested actions?

Accurate weather information can also help determine the damage risks to turbines from both direct and near lightning strikes. By using accurate lightning strike information, operators can efficiently protect and repair specific turbines needing attention. Global lightning detection networks offer operational insight that can help establish an accurate, efficient approach to protecting turbines during severe weather. Knowing distance, amperage, polarity, time, and location of lightning strikes can help drive maintenance decisions, such as whether a turbine should be inspected first or just restarted after a fault. That information can also help determine if lightning damaged a blade or other equipment. If wind blade damage goes unnoticed, it could lead to further malfunctions, which commonly contributes to lower power generation.

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Ivan Gearhart is an Energy Regional Sales Manager with DTN. Ivan has been active in the wind power industry since 2006, consulting with wind plant operators and developers on both safety and wind plant optimization solutions. He's a graduate of Ohio University, Athens, Ohio, where he earned a Bachelor of Science in Communications. Ivan lives with his family in Lincoln, Nebraska.

DTN /// dtn.com

Extreme Wind Risks

In general, more is better - but not with wind. High winds can pose a safety factor for technicians working on turbines; when technicians can't safely work, the extreme winds also interrupt or delay turbine maintenance, threatening both the operation of equipment and safety of the maintenance crew.

To operate at peak efficiency, wind farms will benefit from using hub height wind forecasts to identify when each turbine will surpass normal operational thresholds. Understanding when turbines are most at risk from high winds allows operators and technicians to strategically schedule both internal and outside maintenance.

Winds at hub height can significantly differ from surface level winds. It can be a mistake to use forecasting tools that measure wind speed at ground level, leaving it to the wind farm operator to estimate how that translates to hub height. Additionally, forecasts should be gathered at the wind farm itself, where winds can be significantly higher than at the nearest weather station. Using hub height and gust forecasts can help turbines perform at optimal efficiency.

And, by choosing a weather forecasting tool that can predict wind speeds and gusts as early as a week in advance, operators can go ahead and hire expensive outside resources such as a crane, lift, or rope crews, without worrying if weather will delay their efforts.

With an understanding of available weather information that can accurately predict approaching storms, track lightning strikes in relation to turbines, forecast hub height wind speeds, and other specific information, operators can harness the information to safely and efficiently plan maintenance schedules around inclement weather, and help keep maintenance crews safe and the operation working without interruptions.



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US Offshore Wind

Development and technical challenges

by Bill Berger

THE RENEWABLE ENERGY PROGRAMS

have blossomed over recent years as a result of technology innovation, reduced installation and operational costs, and large support from the public. Wind energy installations have been maturely developed within the continental United States. The more recent advance is pointed to the offshore areas along the US coastline. As of April 2019, there has been a total of \$473 million in bids of nearly 1.7 million acres in federal waters. Currently, there are 15 active offshore wind leases with a capacity of 19 GW. This is just the beginning of very large renewal energy development.

European Offshore Wind

Statistics in Europe show 4,543 offshore turbines installed and grid-connected, making a cumulative total of 18,499 MW. Sites with partial grid-connected turbines now account for 105 offshore wind farms in 11 European countries. The UK has the largest amount of offshore wind capacity in Europe (with 44 percent of all installations in MW). Second is Germany (with 34 percent), followed by Denmark (7 percent), Belgium (6.4 percent) and the Netherlands (6 percent). Installations in 2018 added 2,649 MW of net offshore capacity. 15 wind farms were completed (fully grid-connected), and another 3 have partial grid connection and will continue to connect in 2019. Construction work started on another 6 wind farms, where no turbines have yet been grid-connected.

US Government Regulations

The Bureau of Ocean Energy Management (BOEM) is the US regulatory agency responsible for all activities in federal waters. Since 2005, the BOEM has been authorized to issue leases, easements, and right of ways for renewable energy development on the Outer Continental Shelf (OCS). The oversight is composed of four main categories including planning, leasing, site assessment, and construction and operations. Much of the process has been developed from similar energy development activities from the Oil & Gas Industry. Therefore, there is opportunity for operators and suppliers to adapt to this new environment by utilizing many skills from previous offshore projects.

In 2006, the BOEM issued the information requirements for a renewable energy Site Assessment Plan (SAP). The multi-part parameters of the SAP include topics of hazards, water quality, biological resources, threatened and endangered species, sensitive biological resources or habitats, archaeological resources, social and economic resources, coastal and marine uses, consistency certification, etc.

Technical Challenges

Government regulations typically set the stage as to what types of studies are to be conducted in order to address the aforementioned parameters. Industry stakeholders continually seek innovative methods and techniques to meet or exceed the government requirements. History has shown that proper planning and communication with regulators result in the development and use of alternative solutions for data collection.

A large challenge the industry faces in this environment is to identify programs that are cost efficient within the complex marine environment. There are many tools to select from including remote sensing, sampling, and visual inspections of various aspects within the project area. The technology improvements of the tools have blossomed within the past 20 years of operations in various industry related studies. Instrumentation and acquisition vehicles have evolved into

- Design and Operational Statistics
 - ISO Standard metocean analysis
 - Forecasts and weather window statistics
- Synergies with environmental and engineering assessments
 - Benthic habitat mapping
 - Water column measurements
 - Accoustic monitoring

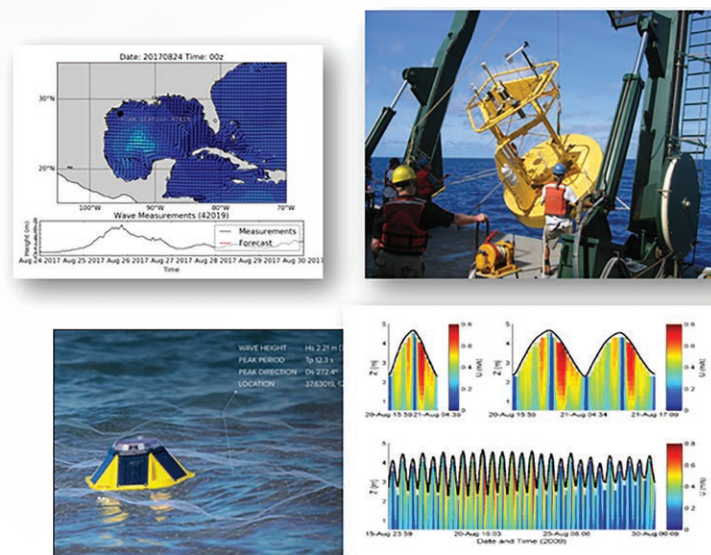


Figure 1. Showing metocean buoy system

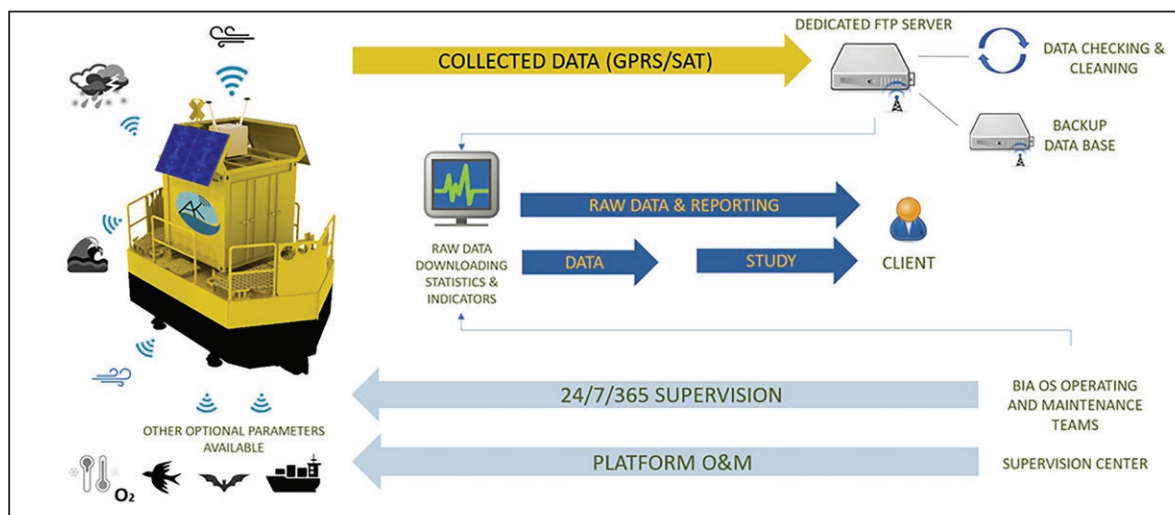


Figure 2. - Telemetry of data from buoy system

very efficient information gathering methods. For example, marine high-resolution geophysical surveys that were once conducted with a towed vehicle near the seafloor (with up to one mile of cable connecting the systems to the vessel) are now conducted with an Autonomous Underwater Vehicle (AUV) equipped with inertial navigation and various cutting-edge instrument technologies.

Data measurements of the atmosphere and metocean environments are conducted onboard floating buoy systems with solar, battery, or even wave motion for power. The buoy systems have the capacity for multiple sensors measuring wind and wave patterns, tracking marine life and bat/bird migration, etc. Each system is tuned to the specific need of the wind turbine project area (Figure 1).

In addition, modern systems are able to transmit data in real-time to a remote center for operational and preliminary analysis. These data are collected and analyzed for long periods of time (normally a minimum of one year), see Figure 2.

Companies are finding ways to bundle instruments and services to offer streamlined solutions for complex wind turbine project areas. There remains, however, a noticeable fragmentation of a single-source solution within the US. One alternative is to have companies partner together with a turn-key option for the operator/developer.

The conditions within the deep-water areas of the OCS change significantly between the Atlantic, Pacific, and Gulf of Mexico regions. Careful and detailed planning is key to a successful data collection campaign and answers to questions from government, academic, and industrial stakeholders.

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<https://www.boem.gov/Renewable-Energy/>

Bill Berger is a marine scientist with more than 25 years of experience in various offshore basins around the world. Expertise includes site investigations in complex deepwater environments for infrastructure placement within the energy and telecommunications industries. Extensive knowledge of oceanographic and geologic conditions is ideal for development of offshore wind energy programs. Similar techniques compared to the oil and gas industry can be used for proper site placement and transmission routing of wind energy.

Berger Geosciences

/// www.b-geo.com

BIA Offshore Studies

/// www.biaoffshore.com



Low-cost drone-based rotor blade inspections

Sulzer & Schmid Laboratories AG's new 3DX HD product has been developed as a cost-effective solution to cope with large volumes of high definition blade inspections. Based on the compact and flexible DJI M-210 drone, Sulzer Schmid's latest product delivers performance and fully autonomous drone inspections at a significantly lower cost compared to its existing 3DX™ Ultra-HD product based on the DJI's M-600 drone. The new 3DX HD product combines increased inspection capacity with improved ease of deployment. It offers all the key benefits of autonomous inspection flights, while improving inspection efficiency, handling and deployment during field operations. It is compact enough to be checked-in as regular luggage for air travel and can be deployed easily on CTV ships for Offshore Wind inspections.

Sulzer Schmid Laboratories AG

/// www.sulzerschmid.ch



Advanced analytics solution

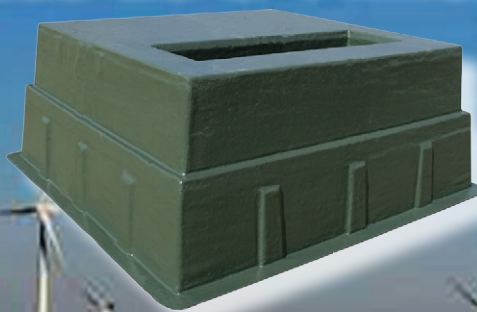
Seeq Corporation's R21 is an advanced analytics solution allowing organizations to rapidly analyze, predict, collaborate, and share insights to improve production outcomes. For publishing insights, Seeq has expanded "scorecards," a feature for the display of calculated tables in Seeq Workbench and Organizer. In addition to new scorecard and other features, R21 adds frequency analysis capabilities, often referred to as "FFT," to transform segments of a time-series signal into the frequency domain. R21 expands Seeq's recent focus on enabling larger deployments through scalability features and making the Seeq applications easier to use. R20 features include the ability to have live updates to Seeq Topics, which publish insights from Seeq to other users, expanded machine learning functionality for customers doing predictive analytics with Seeq, and an improved query model for customers accessing contextual data from SQL-based data sources to provide faster connections to big data sources.

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Small, compact, and functional blade monitoring system

The SHM.Blade and IDD.Blade systems from Wölfel Wind Systems allow structural damage and icing on the blade to be detected easily and efficiently. Structural Noise Sensors (SNS) are fiber-optically connected and measure vibrations and sound directly in the individual rotor blades. The storage and evaluation of the recorded sensor data is carried out in the Data Acquisition and Processing Unit (DAPU) in the hub. Taking into account the operating and environmental conditions provided by the wind turbine control system, the system automatically calculates condition indicators that provide information on the blade condition around the clock. By means of a warning and alarm setup, the control system is notified about critical deviations from the previously determined reference condition whereupon it can initiate countermeasures. Due to the small number of components and the compact sensors, SHM.Blade and IDD.Blade require very little installation space. Thanks to the robust hardware and the extended temperature range from -40°F to 140°F (-40°C to 60°C), they can also be used under almost all environmental and weather conditions. In addition, lightning protection has been optimized; metal-free cables with optical fibers make the system immune to electromagnetic radiation and there is no risk of flashover in the event of a lightning strike. In addition to optimizing the hardware, the revision also brings improvements in product functionality. The evaluation of the data can still be carried out via the external Monitoring Intelligence Center MIC.Wind. Via a web interface, the user can recognize the turbine's state at a glance.

Wölfel Wind Systems /// www.woelfel.de



High-performance UL 1077 supplementary protectors

ABB presents a new generation of miniature circuit breakers (MCBs) for electrical equipment that provides high levels of strength, performance, and savings, while remaining compliant with the UL 1077 standard. The new ST 200 M supplementary protectors are intended for use within industrial control panels, appliances, and other equipment to protect against overcurrent where branch-circuit protection already has been provided or is not required. The ST 200 M reduces the number of parts users need to order and makes it easier for distributors, OEMs, and consumers to do business with ABB. The new supplementary protectors are built with a thermoplastic housing which reduces the potential for transportation damages. Additionally, the ST 200 M offers an interrupt rating up to 10kA. The voltage ratings of the ST 200 M are 480Y/277 VAC and 60/125VDC, which eliminate the necessity of using two different product lines for AC and DC applications. The ST 200 M carries a short-circuit current classification of U2, which expands its range of applications. The ST 200 M features a red/green contact position indicator for increased safety by indicating the actual position of the contacts. Its calibration temperature of 104°F (40°C) reduces derating in industrial control panels at higher ambient temperatures. Installation of the ST 200 M is easy in part because it features ABB's patented twin terminals with captive screws for field wiring up to AWG 4. The new labeling of the ST 200 M is done with lasers, providing high resistance to fading, enabling easy identification of product type, rating, and approvals, even when it is installed on the panel.

ABB /// www.tnb.com



High torque for industrial applications

The new 14.4-volt Right Angle Cordless Screwdriver from Snap-on brings high torque, and easy-to-use one-handed bit insertion, to industrial applications. The 14.4-volt Right Angle Cordless Screwdriver delivers 150 inch-pounds of torque with up to 1550 RPM free speed, making it suitable for dash work, stripped fasteners, and removing/installing panels in select industrial, aerospace, and power generation applications. The new 14.4-volt Right Angle Cordless Screwdriver (part number CTSR761) features an oversized paddle trigger and easy access forward/reverse button. Other features and benefits include an ergonomic cushion grip, two-speed gearbox, variable speed extended trigger, nine position clutch, built in LED light, (2) 14.4-volt lithium batteries with a rapid 55-minute charge time, and accommodates most standard style screwdriver and power bits.

Snap-on Industrial

/// www.snapon.com



Small, tough, and portable videoscope

Olympus' IPLEX G Lite ultra-portable industrial videoscope offers fast, easy visual inspections of small or difficult-to-access locations. The lightweight, 2.5lb (1.15kg) videoscope features powerful imaging and measurement tools and is rugged enough to pass U.S. Department of Defense drop test standards (MIL-STD-810G). Easy, one-handed operation, a touch screen monitor, and electrically-operated tip articulation simplify inspections while interchangeable illumination options allow users to quickly and easily swap their LED for UV or IR illumination when working in dark environments. Smart Video Recording automatically records the last 30 minutes of video inspections to help eliminate accidental erasure. An oil-clearing adaptor uses capillary action to enabling users to get clear images without having to remove the insertion tube to clean the lens.

Olympus Scientific Solutions

/// www.olympus-ims.com



Industrial waterproof ethernet switch

Antaira Technologies' LNX-0500-M12-67 M12 IP67 Layer 2 series switches have been designed specifically for harsh industrial environments. Their 5-year warranty guarantees reliable operation in applications that are subject to high vibration and shock. The redundant power inputs of 12 to 48VDC through an M12 5-pin A-coded male connector ensures availability and uptime. The IP67 rating signifies these switches can withstand large volumes of water and submersion for up to 1 minute. These switches feature a wide operating temperature of -10° to 70°C in the standard model and -40° to 75°C in the extended temperature model which allows this device to be used in extreme climates. The LNX-0500-M12-67 M12 IP67 Layer 2 series switches are also easy to manage. The 5 port 10/100MB LAN M12 ports offer 148,800pps for fast packet switching with store and forward technology. The M12 4-pin D-coded, female connectors feature auto negotiation speeds, full/half duplex mode, and auto MDI/MDI-X connections.

Antaira Technologies

/// www.antaira.com



Enhanced customer experience in managing installed assets

Wärtsilä Online is a web-based customer platform aimed at providing a support service allowing customers to better manage their installed assets. The new platform replaces the company's current customer portal, Wärtsilä Online Services, which has been supporting customer installations since 2014. Wärtsilä Online is designed to enable mobile usage, and has enhanced and new features that create notable customer value in terms of smart maintenance management and real-time collaboration. This 24/7 service minimizes the time spent in manual steps, reduces human errors, and provides customers with readily available and up-to-date information regarding their installations.

Wärtsilä Corporation

/// www.wartsila.com

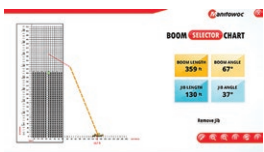


Full-range technology fuses

SIBA Fuses introduces True Full-Range Technology with their SIBA 7.2kV and 12kV fuses which are capable of operating at 100% full-range tested voltage and rated currents. Their 7.2kV fuses are available up to 180A in a single body and 12kV fuses up to 160A. For the increased levels of power used, such as in wind applications, SIBA developed high-voltage SSK type fuse-links that extend the range of usage for switch-fuse combinations up to larger transformers. In connection with the temperature limiting striker pin, which avoids switchgear damage caused by higher temperatures, this high-voltage fuse type allows proper and cost-effective fusing of distribution transformers by means of switch-fuse combinations with low power losses and high interrupt rating. These switch-fuse combinations can replace more expensive CB's, even in the case of transformer powers of up to 3,150kVA, and can limit the short-circuit power early in the process.

SIBA Fuses

/// www.siba-fuses.us

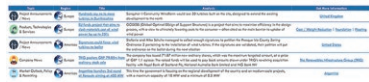


Free boom configurator app

Manitowoc Cranes has announced a new smartphone app for iOS and Android devices that will help crane operators and owners to quickly and easily determine the overall boom and jib length combination required for a lift. The Manitowoc Boom Length Selector App allows users to select specific boom and jib length combinations, building heights, boom radii, and other crane parameters using an easy sliding scale to determine the basic crane setup for a specific lift. The app is available now for free in both the App Store (Apple) and Google Play Store (Android) by searching for "Manitowoc Boom Length Selector."

The Manitowoc Company

/// www.manitowoc.com



Renewable energy data ecosystem

IntelStor is a renewable energy data platform built for decision support of project diligence and product development. Used by whole industry value chain, IntelStor's comprehensive database has catalogued more than 380,000 installed wind turbines as well as proposed projects in over 115 different countries covering both onshore and offshore wind. It also includes the specifications for more than 1,200 wind turbine makes and models, plus more than 52,000 globally filed patents detailing the technology usage of those turbine models. The company has plans to add solar market data during 2019 and energy storage market data by 2020. Originally created as a consulting tool, IntelStor has been spun off as a separate company specifically dedicated to online subscription access through a software as a service (SaaS)-based business model thanks to the advancement of IT systems technology. IntelStor is also a founding member of the Energy Data Alliance which was established to support asset owners, OEMs, and data analytics companies in monetizing the market intelligence value of asset performance and health monitoring data.

IntelStor, LLC

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Battery powered, portable ascent/descent device

The ACX Power Ascender is a portable ascent and descent device that operates on lithium-ion batteries and offers a versatile and efficient alternative to traditional rope access techniques. Some of the features include: Throttle Speed Control from 0 to 79 feet per minute; Long range battery - up to 667ft; Lightweight and easy to swap battery packs; Blue-tooth remote control reaches up to 492ft with three operating speeds; 440lb weight capacity.

SKYLOTEC /// www.skylotec.com



Craneless technology reaching new heights

The LT1200 Liftra Self-Hoisting Crane is Liftra's contribution to lower costs for owners and operators by enabling craneless replacement of major components. Getting the crane up to the nacelle is accomplished with a base system that is installed inside the nacelle, and a hoist block is lifted up, threading wires from the container to the base. The crane itself climbs the wires from the container and mounts onto the base. From there, no further assembly is required, and operation can begin. The new LT1200 Self-Hoisting Crane can lower and lift major components up to 78 tons, can be used on turbines with a hub height up to 170m, and is safe to operate in winds up to 18 m/s. LT1200 is delivered in a single 40ft container for easy mobilization, meaning no prior groundwork, and a minimal on-site footprint.

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Telescopic crawler crane

Maniotowoc's Grove Hydraulic Crawler (GHC) crane, GHC140, features a 171ft (52.1m) six-section, pinned boom with a maximum capacity of 127t (140USt). When configured with the 49.3ft (15m) offsettable bi-fold swingaway, it has a maximum tip height of 229.7ft (70m). Introducing new 1.5° load charts, the GHC140 offers the ability to pick-and-carry at 100% of its load chart on inclinations up to 4°, and can swing loads 360°. With its pin telescoping boom, operators can handle lifts at various radii. The GHC140's crawler tracks easily navigate tough job site conditions with its 57% gradeability track rating. The undercarriage is driven by powerful, two-speed hydrostatic drive motors. The track side frames can be hydraulically extended and retracted, providing three track spans with lifting capabilities at each span. This provides added versatility for the most suitable combination of crane width and lifting capacity. Additionally, the GHC140 can be transported to a job site in as little as four loads. Once it reaches the job site, it features a self-assembly counterweight and an undercarriage frame with jacks for easy self-assembly of the crawlers. In-cab amenities include a large air suspension heated seat, a climate control system for added comfort, a 7" (7178mm) screen for viewing the hoist, rear, and right side camera feeds, an intuitive graphical RCL system, and precise, electronic load-sensing joystick controls. A 20° tilting cab provides comfort when doing high-boom angle work. The crane can be outfitted with one of two engine options, which provide strong and reliable power, and meet all current EPA requirements. ECO and Auto Idle modes help maximize fuel efficiency, and the engine compartment is fitted with sound foam insulation to lessen engine noise and improve communication on the job site.

Maniotowoc /// www.maniotowoc.com



Comfortable, durable, and weightless head protection

The Ridgeline Full Brim Hard Hat is constructed of ABS material for strong and seemingly weightless protection. The helmet is easy to adjust with ratchet suspension allowing the wearer to modify the fit while wearing. A soft, replaceable brow pad and ratchet suspension provides a comfortable fit. The Ridgeline Cap Style Hard Hat is made of highly robust ABS material. The low profile design has a low center of gravity for balance and features a four-position harness allowing harness adjustments forward, backward, up, or down for a personalized fit. An easy to grasp knob to adjust the suspension from 6-1/2 to 8 as well as swinging hinge points that adjust to the most comfortable position on the back of the head. The Ridgeline Cap Style Hard Hat passes standards for reverse orientation, high temperature (HT), and low temperature (LT). Rear padded suspension and padded fabric and a polyurethane foam sweatband provides all-day comfort. A vented pressure pad keeps the head cool. The Ridgeline Full Brim and Cap Style non-vented head protection meets ANSI Z89.1, Type 1, Class E, G and C. Vented head protection meets ANSI Z89.1, Type 1, Class C. Hi-vis colors have been tested for the "HV" mark. Some options meet Canadian CSA Z94.1 - 2015 (•), Type 1, Class E, G and C standards - SEI third-party certification. Both hats are available in standard colors as well as Hydro Dipped patterns, which provides for a little extra style.

Pyramex Safety /// www.pyramexsafety.com



One drive, two tools

Enerpac's RSL Series Low Profile and Square Drive Torque Wrenches is a versatile, single-drive unit solution with interchangeable hex cassettes and square drive heads allowing users to quickly change tools during operations, enhancing productivity and lowering tool investment costs. Seven RSL Series drive units accommodate a wide range of hex cassette sizes from 7/8" to 6-1/8" (22mm to 155mm), with maximum output torque ranging from 1408ft/lbs to 28002ft/lbs at 10,000 PSI. The RSL Series feature a range of "Slimline" hex cassettes providing wide access to narrow spaces, like a blow-out-preventer, without compromising on tool durability or torque output. The RSL Series cassettes provide optimum strength-to-weight and torque-to-weight ratios, with rugged alloy steel design and just three moving parts for reduced maintenance. The design completely encloses all moving parts and minimizes pinch points. The RSL Series delivers accuracy to +/- 3%, with 30-35° of operating stroke to enhance productivity while avoiding "tool lock on". A minimum nose radius ensures trouble-free tool fit and the reaction arm has a simple dial lock for rapid changes. Robust handles are available for both sides and the tops of wrenches providing extra maneuverability. Back-Up Spanners and a number of optional accessories are available to provide maximum versatility. Enerpac offers a large selection of air and electric pumps that are system-matched to hydraulic torque wrenches.

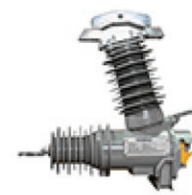
Enerpac /// www.enerpac.com



Pre-owned renewable energy equipment marketplace

RENewed Wind and Solar is an online marketplace for refurbished wind and solar equipment. RENewed Wind and Solar offers bargain prices on an array of high quality pre-owned, refurbished, and never-before-used wind and solar equipment. From recalibrated anemometers to second-life solar panels, RENewed Wind and Solar provides customers with an eco-conscious shopping experience by reusing underutilized renewable assets. A full inventory of the equipment currently available via RENewed Wind and Solar can be found on their website.

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Compact modular recloser

Siemens' Compact Modular Recloser (CMR) is a cost-effective, reduced-maintenance alternative to single-phase, oil-filled reclosers. Fully rated, lightweight, configurable, and compliant to IEEE C37.60, the CMR is rated for 630A continuous current with four shots to lockout. It integrates the switch unit, control, and voltage power source into a single-insulated epoxy housing, for reliability and easy installation. It has a 25-year pole-top life that is maintenance-free except for replacing rechargeable batteries. The CMR reduces operating costs since it doesn't require oil to be replaced or timing mechanisms to be adjusted. Its 630A continuous current capacity means it can be used for multiple applications and configured as needed. Alternatively, it can be ordered preconfigured and dropped in place without any set-up or configuration. The integrated GPS clock helps pinpoint the time of 10,000 events to within 10 milliseconds accuracy. The Siemens CMR has encrypted wireless data download, making reporting of network reliability easy, such as System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency (SAIFI), and Momentary Average Interruption Frequency Index (MAIFI) data. The wireless download capability allows operators to download data securely and safely from the ground. The Siemens CMR harvests power from line voltage instead of line current, so the device can be self-powered even if there is no current on the line. Weighing under 50lbs, the CMR can be crossarm- or pole-mounted. Two models, 15kV and 27kV, both with 12.5kA short circuit withstand, are currently available.

Siemens Corporation

/// www.usa.siemens.com



Artificial intelligence data processing

BladeEdge is pleased to announce the launch of EDDIE, an artificial intelligence (AI) image analysis engine designed specifically for the wind industry. EDDIE was created to enable automated condition assessments of blade inspection images, data analytic processing and report generation. EDDIE processes wind turbine inspection data and automatically generates easily-consumable reports. As AI, EDDIE has the capacity to work around the clock, processing data non-stop and delivering results with 98.8% confidence in data accuracy. EDDIE helps maximize the useable life of each asset reviewed, and tracks changes over time. With EDDIE, blade damage is caught sooner, making decisions regarding maintenance and repair easier than ever before. EDDIE was designed to process any type of wind turbine inspection data - from drone or ground scope capture images to legacy data. EDDIE automatically categorizes data and identifies anomalies, delivering reports that highlight blades requiring immediate attention and provides operators with a comprehensive understanding of all reviewed assets.

BladeEdge /// www.bladeedge.net



Quick, efficient turbine inspection solution

A turnkey blade maintenance solution offers a complete blade inspection to repair solution for the global wind power industry. The digital solution is efficient, reduces costs, and increases the speed of turbine inspections. With Clobotics smart wind solution, the Windspector, an autonomous drone flies around the turbine and blades, capturing high resolution images as it flies. Inspection is done in minutes, rather than hours. There is no longer dependency on highly trained human operators, which dramatically reduces the amount of labor involved and turbine down-time. Further images of the blades are then automatically analyzed, annotated, and reported on the cloud-based customer portal the very next day. Offering an autonomous AI-based inspection with Clobotics Windspector, backed by repair solutions and including GEV's all-weather Ventura Habitat, this brings turnkey fixed price solutions to wind farm O&M clients.

GEV Wind Power LLC
/// www.gevwindpower.com



Quality images for manufacturing and maintenance applications

Olympus new IPLEX GT/GX videoscopes provide manufacturing and maintenance inspectors with fast, easy visual inspections of difficult-to-access locations. The new videoscopes feature a high level of imaging performance to help shorten inspection times and boost efficiency by providing bright, crisp images. The videoscopes' white LED light source can easily be changed to ultraviolet (UV) or infrared (IR) light, making the scopes adaptable to a wide range of applications. The IPLEX GX and GT are comfortable to hold and operate thanks to an optimally-balanced controller, "light-touch" joystick, and intuitive touch panel controls. Live streaming is also available with a wireless adaptor, allowing others to view the inspection videos using the Olympus IPLEX Image Share App for iOS devices (up to two devices can be connected).

Olympus Scientific Solutions
/// www.olympus-ims.com



Leading edge safety, all-day comfort, and job site durability

FallTech's DuraTech Personal Leading Edge line of single and twin 9ft self-retracting lifelines provides an integrated dorsal connector offering a quick and straightforward push-button attachment and its energy absorber design and placement limit user back discomfort. This new family of SRL's is calibrated for typical walking speeds without the nuisance of unintended lock-ups. The constant-force main spring produces smooth lifeline payout and retraction operation while the lightweight and impact resistant nylon polymer housing ensures durability. It is designed for overhead anchorage and up to 5ft below the user's D-ring and has a 9ft working length for users weighing up to 310lbs. It is available in single and twin-leg configurations with steel and aluminum snap hook, rebar hook, and carabiner lifeline connector options.

FallTech /// www.falltech.com



Using science to decipher data and unlock value

Utopus Insights has launched its energy analytics platform and application suite, Scipher, a suite of products to monitor asset performance in real time, preempt critical component failure for proactive maintenance operations and planning, and to more accurately predict renewable generation. Scipher, a powerful, mature, scalable, and secure energy analytics platform, currently ingests data from 32,000+ turbines, 65GW of assets, curating 2.4TB and 55 billion signals daily. The Scipher software products suite is descriptive (historic data and real-time visualization), predictive (energy and weather forecasting), and prescriptive (asset health information for optimal maintenance and uptime).

Utopus Insights
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Small & Large Wind Turbines

Wind turbines convert the kinetic energy in the wind into mechanical power and are generally divided into categories based on their rated capacity. Large wind turbines range in size from 100 kilowatts to as large as several megawatts. Small turbines, below 100 kilowatts, are used for homes, telecommunications dishes, or water pumping. Here we focus on some of the small and large wind turbines available today.



Suzlon Wind Energy Corporation

Product: S111

Capacity: 2.1MW

Hub height: 90m, 120m, 140m (295ft, 393ft, 459ft)

Swept area: 9852m²

Nominal power: 2.1MW

Cut-in wind speed: 3.0 m/s

Nominal wind speed: 11.0 m/s

Cut-out wind speed: 21 m/s

www.suzlon.com



Goldwind Americas

Product: GW 155/4.2

Capacity: 4.2MW

Rotor diameter: 155m (~509ft)

Hub height: 110m (~361ft), project specific

Swept area: 18,772m²

Rated power: 4200kW

Cut-in wind speed: 2.5 m/s

Rated wind speed: 10.5 m/s

Cut-out wind speed: 22 m/s, can be extended based on project-specific wind data

www.goldwindamericas.com/gw4s



Nordex USA Inc.

Product: AW125/3000

Capacity: 3000kW

Blade length: 61.2m (200.78ft)

Hub height: 87.5m to 120m (287ft to 393.7ft)

Swept area: 12,305m²

Rotor speed: 86.5 m/s

Nominal power: 3000kW

Cut-in wind speed: 3.5 m/s

Nominal wind speed: 10.5 m/s

Cut-out wind speed: 25 m/s

www.nordex-online.com



Suzlon Wind Energy Corporation

Product: S128

Capacity: 2700kW

Blade length: 64m (210ft)

Hub height: 86m to 120m (282ft to 394ft)

Swept area: 13,000m²

Rotor speed: 7.3 rpm to 12.1 rpm

Nominal power: 2700kW

Cut-in wind speed: 3 m/s

Nominal wind speed: 9.5 m/s

Cut-out wind speed: 20 m/s

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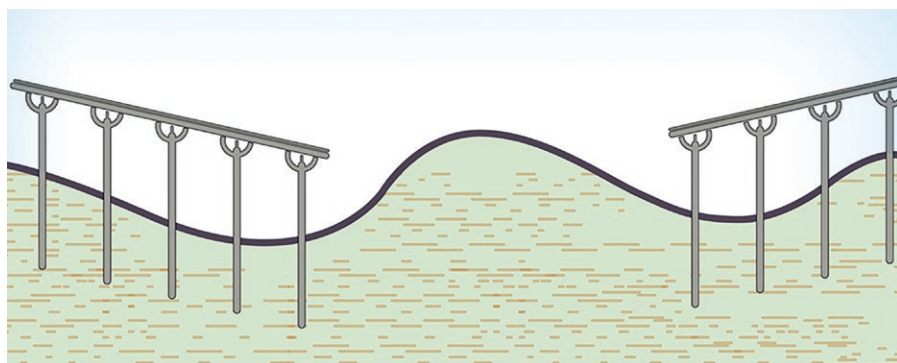
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4 Ways to Save Time on Solar Tracker Installations

by Matthew Schneider

Over the past decade, solar trackers have evolved to become less expensive, and easier to operate and maintain. These innovations, along with an increase in the scale of production, help explain how global tracker shipments topped 20 gigawatts in 2018 - accounting for over a quarter of ground-mount installations worldwide. That's more than 87 percent of utility-scale systems in the United States.



But most trackers in the field continue to use electric motors and gearboxes. These limit design flexibility, restrict the addressable market for solar tracking systems, and increase labor costs, making it unnecessarily difficult for many projects to pencil out on sites that are not simple rectangular parcels of land.

In 2018, the market started wide adoption of motor-free, air-driven tracker systems. These systems remove design constraints; they reduce the costs of civil work, labor, material handling, and site management, all of which will help the global market reach new heights in the years ahead.

Eliminate civil work

Site preparation time and expense vary from project to project. Cutting away slopes and filling in sections of land can undermine or ruin project economics. Additional unexpected costs are incurred when flood plains or wastewater runoff needs to be addressed, or if project designs need to accommodate habitats of native species. The keys to minimize these costs are to reduce or eliminate earthwork, and take full advantage of the layout flexibility available from motor-free tracking systems.

To reduce and eliminate time consuming and expensive earthwork, project developers and EPCs can use trackers with easily adjustable spans that can follow the grade, and typically eliminate the cost of civil work.

Adjustable-length spans have the added benefit of reducing post length and tracker height. A 90-module-long tracker on land with a 2 percent grade is 6 feet higher at one end than the other. This typically requires ladders to be used to complete module installation. On the other hand, a 30-module-long tracker on the same land has a height increase of only 2 feet.

Lay modules flat

Module attachment is typically the single most time-consuming step in the construction of a new project. It accounts for as much as 40 percent of time at the job site. Module installation crews spend most of their time fighting gravity - holding modules while waiting for other crew members to bolt them in place.

Two simple tracker system improvements dramatically reduce module installation time. The first eliminates torque tubes and replaces them with dual rails (purlins), so modules can lay flat across the top of the rails and crew members aren't spending time holding them in place. The second uses top mounting clamps that hold modules in place, allowing crews to finish tracking system installations without working underneath the modules.

These improvements reduce direct labor time and time spent on the construction site, so that trailers, forklifts, security personnel, portable toilets, and other general conditions-related budget line items can move to the next project sooner.

Reduce walking with fewer unique components

Each unique structural component delivered to a job site increases the time wasted walking through the project. Each person walking a project, up one row and down the next, adds 1.88 miles of walking per megawatt to their day.

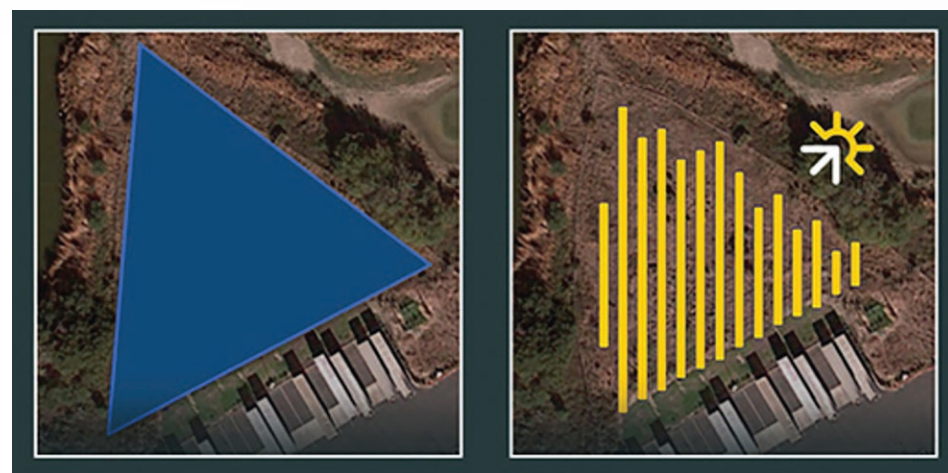
There are typically four types of crews, with about seven construction laborers overall. One crew distributes the components throughout the field. Another hand tightens components in place. A third tightens fasteners with a torque wrench. A fourth performs quality inspections. For every megawatt, each unique component adds 13 miles of walking.

The number of unique components in a tracking system can range from streamlined systems with three core components, to standard systems with 15 components or more. Streamlined systems can eliminate 156 miles of walking per megawatt - not including the work of removing components from pallets or collecting trash at the end of the day. Fewer unique components can eliminate a tremendous amount of wasted walking.

Use a single type of post

Traditional tracking systems use multiple types of posts (bearing posts and actuator posts) in each row. Streamlined systems eliminate this complexity, avoiding the need to distribute multiple post types to specific locations throughout the field. This reduces construction cost.

Streamlined systems also employ drives at every post. This enables the EPCs to use shorter, lighter piles, with as little as 4 feet of embedment. Smaller piles reduce post driving crew sizes, speed up driving times, and result in fewer post rejections.





Matthew Schneider, chief product officer at Sunfolding, has over 15 years of product development and product strategy experience. He also co-founded RayTracker, a producer of single-axis trackers that was acquired by First Solar in 2011. As First Solar's director of global product development for PV mounting systems, Schneider ran a team that delivered over 3 GW of trackers worldwide. In addition, Schneider has worked at Microsoft and NASA. He holds degrees from St. Olaf College and Stanford University.

Sunfolding /// www.sunfolding.com

DNV·GL



Innovation in action

A motor-free, air-driven tracker system was deployed at a wastewater treatment facility in Georgia, on a terraced property with five separate grades. The facility operator had buried some old settling tanks and other equipment, capped off with a foundation and layer of soil. The challenge was to leave much of the property undisturbed. Soil grading would have been a time-consuming and expensive proposition.

The solution involved subdividing the site into five distinct arrays. Some of the arrays tapered off down to a single string of modules. Shorter piles guaranteed that ground penetrations would not compromise the foundation beneath the soil. The shorter piles also reduced the cost of steel. By running air lines to the air-driven actuators (instead of running electrical conductors, as with motor-driven trackers) there was also less trenching.

Had the installer used motor-driven trackers, each terrace would have had separate motors, with trenching and electrical wire running up and down each slope. Instead, employing a motor-free system allowed for design flexibility that translated into a more efficient and economic installation.

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Inverters that Optimize Production & LCOE in Extreme Weather & Terrain

by Nohra Nasr

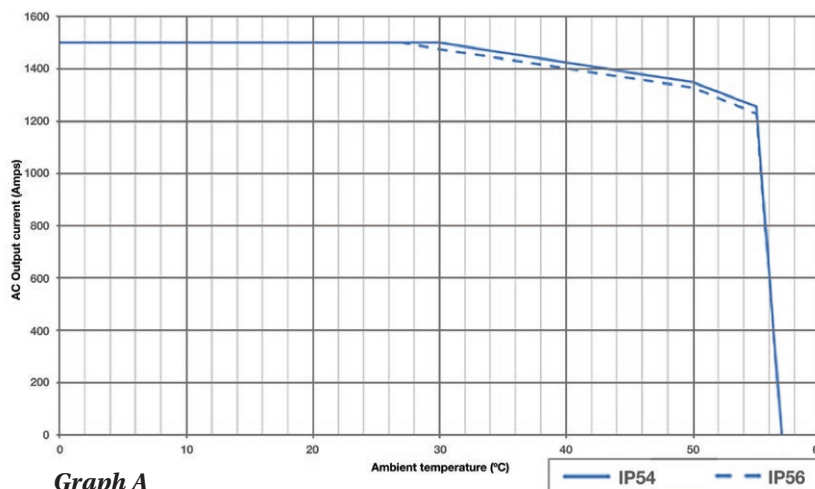
OWNERS OF PV SYSTEMS WANT

the flexibility to be able to build their projects in remote locations and harsh climates while still enjoying reliable, high performance production for the 35+ year life of their system. How these demands are met all comes down to the brains of any PV system - the inverter.

High performance under extremely high temperatures

One of the most important components for delivering solar power to the grid is the inverter. On hot summer days, when the temperature reaches the average high, cooling is required to maintain a certain level of power output. If the inverter is not converting that power to its full potential, that lost efficiency translates into lost energy production. Regular operations and maintenance work (to keep the air flow at an adequate level) is another major key to maintaining inverter power output at a high efficiency. Refer to Graph A for an inverter power derating curve versus temperature.

Inverters are designed with different cooling mechanisms. Some of the most innovative ones are dual channel ventilation systems, with air forced and temperature control to optimize the cooling process. An additional air-air exchanger guarantees IP66 / NEMA4 for the electronic components, with an adequate airflow inside the inverter. The power stacks and electronics' compartment are air cooled by a closed-loop heat exchange system (with no direct contact with the outside or with any other inverter cabinets - Image 1 and Image 2) This enhanced functionality makes it possible to increase the ambient operating temperature; thus, increasing the power output curve.



Graph A

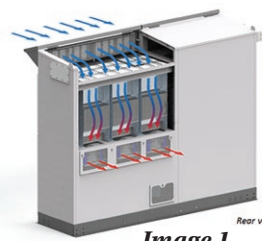


Image 1

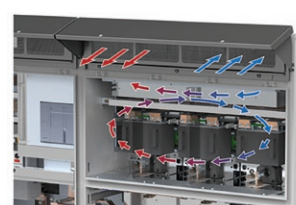


Image 2

Other effective cooling systems include two separate ventilation circuits; outside air is drawn in to cool heat-producing components, while circulating warm air is cooled down in an internal ventilation circuit, on the inside of the inverter. The heat exchanger used in this process is operated by fresh-air supply.

Another cooling mechanism worth mentioning is an advanced hybrid cooling system using heat-pipe cooling technology, where the inverter runs without fan operation up to 50 percent load. Heat-pipe cooling simplifies thermal management because it uses fewer parts, and only a slow-speed fan with a heat pipe heat sink.

Standing up to sandstorms

Over the last few years, there has been a dramatic increase in the number of PV installations in desert environments. The benefits include cheap land and excess sun, making it possible to generate solar energy for ~\$20 per MWh. Market-led reduction in PV system costs has led to the use of outdoor inverter solutions that dispose of external enclosures to protect the inverters and other equipment at the transformer substations (transformers, medium voltage cells, etc.). This has driven the need for designs that guarantee the

reliable operation of equipment in these extreme operating conditions without performance losses.

A "sand trap" system can completely seal the ventilation circuit, for maximum protection against the ingress of particles (which could cause serious technical problems in converters installed in the desert). They may also be certified to the IEC 60068-2-68 international standard by an independent, external laboratory. This standard establishes the conditions to be met by electronic equipment in order to effectively operate in environments with high concentrations of dust and sand.

In order to conduct the sand and dust test, a sealed chamber creates a controlled atmosphere with the humidity, wind velocity, and sand concentration conditions required by the IEC 60068-2-68 international standard. (Image 4)

In addition to the tests specified in the certification procedure, the equipment can be subjected to even more extreme conditions, such as those characteristic of a desert sandstorm - able to withstand situations with a high concentration of particles in the air (100 g/m³) and high wind speed (160 km/h). These dust storms, or "haboobs", have been witnessed in the southwestern states of the US, Abu Dhabi, UAE, and other desert environments around the world. (Image 6)

Enduring high humidity and corrosion

Other regions where solar energy makes incredible economic sense include islands and emerging countries in tropical environments. Many of these locations started out using high cost fossil fuels to generate electricity, which can cost over \$200 per MWh. To combat this, many locales have begun to deploy solar plus storage. These regions, as well as coastal cities, are marked by very high humidity and rain, which can shorten the life of the equipment.

Outdoor rated inverters, coupled with C5-M-H coating and stainless-steel hardware, help to overcome this environmental challenge and provide long operating lives. Many such inverters are already deployed worldwide, performing well on Islands like Hawaii, Puerto Rico, and Reunion Island.

Surviving arctic blasts

Solar photovoltaic cells convert sunlight into electricity. Cold winter temperatures do not impact production as long as they are within the actual operating temperature range of the inverters. In fact, colder temperatures increase module efficiency, and can help improve the output of solar cells. Most PV inverters in the market are designed to guarantee an operating temperature range of around -10°F to +140°F, with an option to add heating resistors kits for PV installations in cold regions. These heating resistors are designed to guarantee operating at an ambient temperature of down to around -25°F.



Image 4: Sand and dust test chamber



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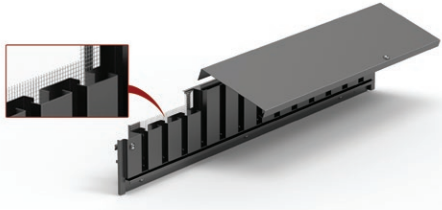


Image 5: Dust and sand trap

At the end of January of this year, a large part of the Midwest and the Northeast was hit with an intense Arctic air mass. Some areas fell below -30°F, with wind chills more than -50°F. Thanks to their heating resistors, several PV inverters were reported as active and able to convert power.

Accommodating uneven topography

For utility-scale PV power plants (20MW or higher), Central Inverters are still considered the preferred option due to their incredible CAPEX and OPEX value-proposition, whether the topography of the terrain is flat or not. Improved design has allowed inverters a high degree of versatility through scalable blocks of power. Inverters may be sized as 1.0MVA to 1.8MVA units, which can be combined as 2.0MVA to 3.6MVA in a dual-inverter configuration. These can be combined as skidless or integrated-skid stations of 1MVA, 2MVA, 3.6MVA, 5.4MVA, or 7.2MVA. Different sized stations are deployed to a site based on the specific topography of the location, and various sizes of sub-arrays in the field. These newer inverters also offer a suite of output voltages (e.g. a range between 450V to 690V) to optimize the medium voltage collection system architecture of each project.



Location: Sweihan, Abu Dhabi, UAE

Image 6: PV inverters in the desert



Location: Monticello, New York

Image 7: PV inverters in cold climate



Location: Ouarzazate - Atlas Mountains, Morocco

Image 8: PV inverters in snowy environment

As the PV industry has evolved to be one of the lowest cost sources of new energy generation, it has sparked a demand for PV systems in all corners of the world, including those with challenging locations featuring rugged terrain, drastic temperature variation, and extreme weather events. A robust inverter design that can operate anywhere is fundamental to a long, issue-free life for the PV system. Inverter suppliers continue to provide innovations that protect the inverter from harsh environmental conditions, while ensuring high performance, and reliable and durable operation for the lifetime of a project.

Nohra Nasr is Head of PV Sales & Business Development - USA at Ingeteam, a global market leader specialized in the design and manufacturing of power conversion and electrical equipment, mainly large inverters, frequency converters, motors, and generators for Wind, Solar PV, Energy Storage and Hydropower generation plants.

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How Temperature Affects PV Systems

by Susanna Cole

Many people believe that they need to live in an ideal climate in order to have a solar system installed. While installation and performance are affected by panel location and physical obstructions such as shady trees, ambient temperature is not a barrier to solar adoption.

Solar panels are rated for voltage and amperage output under what we refer to as “standard test conditions”, or 25°C/77°F with 1000w per square meter of light. Every panel is rated to produce a certain amount of wattage using these test parameters. While climate is not a deal breaker for installation, the output voltage of solar panels is affected by temperature. But it’s not the way the average person may think. In fact, in cold weather, the voltage will be higher than the panel’s rating, while in hot weather the voltage output will be lower. For example, a 300w panel with a VOC of 40v would be around 47v at -22°F, not an uncommon winter temperature in many states. It’s a simple concept, but how does that affect our system design, and what problems can it cause?

Pulse Width Modulation (PWM) charge controllers require you match your panel voltage to the battery voltage with little variation, so we’ll address Maximum Power Point Tracking (MPPT) charge controllers and their related voltage challenges. MPPT Charge Controllers can be paired with a higher voltage panel or panels, in which case you must be cautious not to exceed the manufacturer’s voltage rating.

Charge controllers have a maximum input voltage – go above that and they will sustain damage. It is critical to be aware of this maximum voltage, as well as what the ratings mean for each brand of controller as they vary significantly. For example, some controllers are rated at 200v, but stop producing power at just over 185v; damage will not occur until 200v. Other controllers, however, allow charging all the way to 200v, with an additional non-operational “Hyper VOC” above that voltage, which is still safe for the controller. Be careful though - in most cases, going above the charge controller’s rating will void the manufacturer’s warranty.

What does this mean? Many system designers will get as close to this voltage limit as possible to avoid the extra wiring and components needed to combine more strings of PV. This is also why 600v controllers are becoming more popular (although they will see compounded effects of cold weather voltage rise). You must compensate and design for the extreme possible cold temperatures or risk over-voltage damage to your charge controller.

Looking at the other temperature extreme, hot weather can cause lower voltage output from your solar panels. If you have designed them toward the higher voltage limit of the controller, this will not be a concern. On the other hand, if you designed the panels to remain close to battery bank



voltage (in an effort to minimize loss in conversion), you may see that your charge controller fails to come out of resting mode when it is hot outside. This happens because most MPPT controllers require 130 percent of the target battery charge voltage in order to come out of resting. For example, while an equalization charge for a 48v battery might be 62v, you would actually need 62x1.3 - or a minimum of 81 volts - from your panels to properly charge your batteries on a hot day.

How does climate affect batteries? The ideal situation would keep all batteries at a consistent temperature, in a climate-controlled environment. In the real world, however, that’s not always possible. With so many compositions available, it’s difficult to simplify any discussion of batteries. Suffice to say, most typical battery chemistries require a higher voltage charge when they are cold than they do when they are warm. This is generally accomplished by setting a temperature compensation in your charge controller. Lithium is an exception. Lithium batteries do not typically require temperature compensation for charging, but they do have difficulty operating in freezing temperatures. Case in point, some lithium manufacturers state that exposing their batteries to freezing temperatures will void the warranty on those batteries.

Explaining some of the reasoning behind design decisions and describing some of the technical requirements to customers can help them understand their system better. This involvement encourages them to take an active role in caring for their investment, which leads to higher satisfaction with their solar installation

Remember to note all of your manufacturer’s specifications and take care to design within them. Being aware of the effects of temperature on each element of the solar system allows you to create the most functional, efficient, and long-lasting system possible.

Susanna Cole is North American Sales Manager for MidNite Solar. MidNite Solar produces a wide range of alternative energy products, including charge controllers, battery-based systems, and combiner boxes.

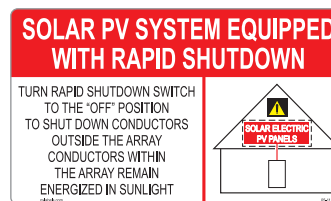
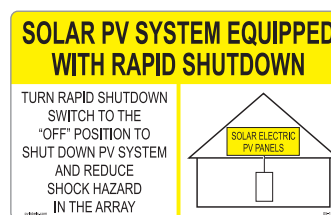
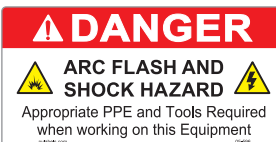
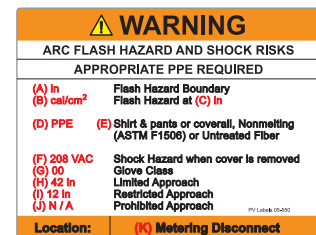
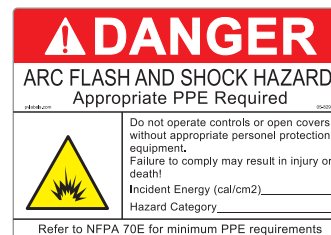
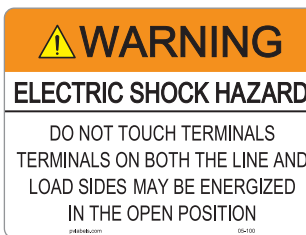
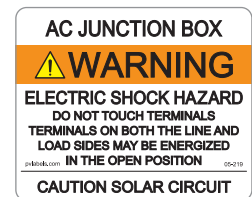
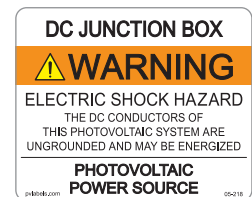
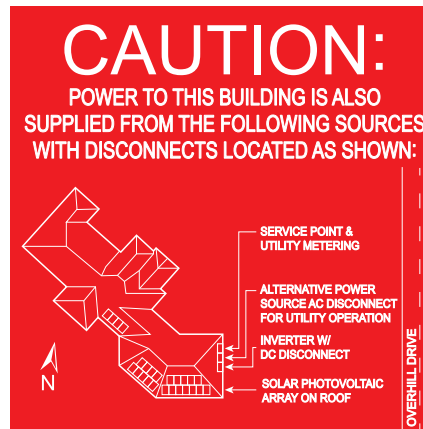
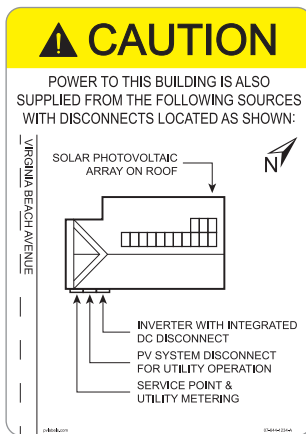
MidNite Solar /// www.midnitesolar.com

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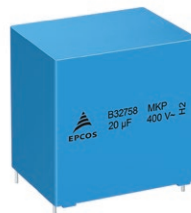
*Stock and Custom Orders will be shipped the same day if received and approved by 1:00 PM PST



Full range non-indicating time delay fuse

Mersen's Non-Indicating Class J Time Delay Fuse series offers a full range of ampere ratings between 8-600A in both indicating and non-indicating categories. Mersen's new Non-Indicating Class J Time Delay fuse series satisfies the National Electrical Code requirements for use in Class I Division 2 hazardous locations. Another key benefit of the Mersen Non-Indicating Class J Time Delay Fuse series is that they possess the same size, mounting terminals, and ratings as the Mersen SmartSpot Class J Fuses. The UL/CSA Listed Mersen Non-Indicating Class J Time Delay Fuse series is readily identifiable by suffixing the letter "N" to the Catalog Number of the equivalent Mersen SmartSpot Class J Time Delay Fuse and is available immediately.

Mersen /// ep.mersen.com



Rugged AC filter capacitors

TDK Corporation's EPCOS B32754* to B32758* series of AC filter capacitors cover a range of voltages from 250VAC to 400VAC and offer capacitances of between 1 μ F and 70 μ F. The capacitors comply with IEC 61071: 2007 and are robust, even at high humidity. This has been verified in a temperature, humidity, bias (THB) test at 60°C, 95% relative humidity and an applied rated voltage for 1344 hours, corresponding to 56 days, in accordance to IEC 60384 14:2013/AMD1:2016 Grade 3 Test A. The capacitors are designed for a maximum operating temperature of 105°C, and their epoxy resin-filled case conforms to UL 94 V-0. Depending on capacitance and rated voltage, the lead spacing is 27.7mm, 37.5mm, or 52.5mm. The capacitors are suitable for demanding applications in industrial electronics. These include, for example, output filtering for power supplies, frequency converters for drives, and renewable energy, or UPS systems.

TDK Corporation /// www.tdk-electronics.tdk.com

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IEC 61724-1 Class A Compliant

www.eko-usa.com



Hazardous location C1D2 solar panel with batteries

Larson Electronics has released a new hazardous location solar powered panel system with batteries that is rated for use in Class I Division 2 hazardous locations, where off-grid power is required or desired for continuing operations in remote or temporary environments. This solar powered control system features four, 190W solar panels and four 12V 250Ah 8D batteries. The HAL-SPSM-.75KW-12V-1000AH from Larson Electronics is a solar panel unit designed specifically for Class I Division 2 hazardous. This four solar panel unit includes four 12V 250Ah 8D batteries, which provide reliable power for connected equipment. Runtime for this system is 72 hours maximum (no sun is present) when powering one 190W 12V electrical device. A heavy-duty powder coated, corrosion resistant aluminum enclosure protects the valve regulated lead acid batteries and controls, and features pad-lockable hasps for defense against tampering. This unit is also included with circuit breakers offering short circuit protection. The solar panels are mounted via a skid mount frame for flat surfaces, and the battery enclosure can be mounted on poles or on the floor with rear-access U-bolts.

Larson Electronics LLC
/// www.larsonelectronics.com

1500 Volt 30 Amp I-V Curves

New!

Solmetric PV Analyzer

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- Measures up to 1500V at 30A
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www.solmetric.com



Handheld data logger

METEON 2.0 is compact, flexible, and battery powered; optimized for solar irradiance measurement in all types of solar energy applications. Users can check monitoring installations, visualize incoming radiation, and verify performance on the spot. METEON 2.0 can connect up to 5 Kipp & Zonen Modbus devices; SMP, RT1, and other types and allows users to power smart devices and configure their communication parameters. It allows connection to a Mencke & Tegtmeier Modbus PV module temperature sensor and includes a real-time clock.

Kipp & Zonen /// www.kippzonen.com

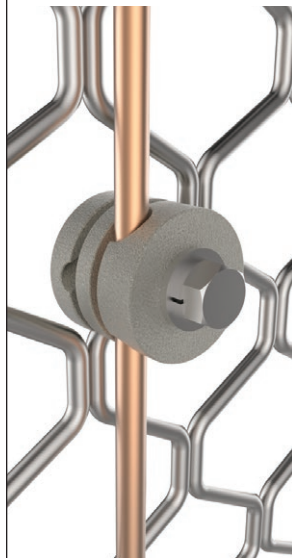


High power range inverter

The Fronius Tauro is a robust project inverter for use in unsheltered outdoor locations (IP 65), so that it is perfectly suited to large-scale systems ranging from 100kW to 5MW. The investment and operating costs of large-scale systems can be reduced to a minimum thanks to this inverter.

Fronius Solar Energy

/// www.fronius.com



CIGS-perovskite tandem cell

Scientists at Solliance, in collaboration with MiaSolé Hi-Tech Corp., fabricated a flexible solar cell with a power conversion efficiency of 21.5%. The solar cell combines two thin-film solar cell technologies into a 4 terminal tandem solar cell stack: a top flexible semi-transparent perovskite solar cell with a bottom flexible copper indium gallium selenide (CIGS) cell. CIGS technology has been successfully used to produce high efficiency flexible and lightweight cells and modules, which address markets where heavy and rigid panels cannot be used. Perovskite solar cells, despite being a relatively young technology, have already achieved high efficiencies, and promise low cost solar technology based on abundant materials. Combining both technologies in a flexible and lightweight package expands the horizon of high performance, flexible, and customizable solar technology.

MiaSolé Hi-Tech

/// www.miasole.com



Solar Farms: Critical Infrastructure Fencing

Grounding Solutions from BURNDY & Wiley

The Grounding Superstore™ has a full product offering to meet National Electrical Safety Code (NESC) or IEEE C2 codes for utility-owned solar farm perimeter fencing grounding and bonding requirements.

- **HYGROUND® Compression Grounding** – connects fencing and other metallic structures bonded together to the grounding grid
- **thermOweld® Exothermic Grounding** – utilizes a high temperature reaction of powdered copper oxide and aluminum resulting in an irreversible connection
- **Wiley WEEB® Bonding Washer** – allows painted or powder coated fencing to be electrically bonded without the need for removing surface coatings in the field
- **Type GAR Connector** – approved for direct burial, designed for copper cable connections and fence post grounding connections that are parallel or perpendicular
- **Rolling Gate Grounding** – ground moving components with a festoon system consisting of C-rail, coupler hangers, tow and intermediate trolleys, end stop, end caps and mounting clamps
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Rapid shutdown transmitter for integrated NEC 2017 compliance

Tigo's new RSS (Rapid Shutdown System) Transmitter completes its cost-effective rapid shutdown system architecture when paired with TS4-F (Fire Safety). Tigo's RSS Transmitter accompanies the UL-certified TS4-F (integrated) and TS4-R-F (retrofitted/add-on) solutions. The RSS Transmitter sends a signal to the TS4-F units to keep their PV modules connected while powered on and supplying energy. TS4-F units automatically enter rapid shutdown mode when the RSS Transmitter is switched off and resume energy production when power is restored to the RSS Transmitter. This solution complies with U.S. National Electric Code (NEC) article 690.12 specifications for 2014 and 2017 and supports the SunSpec-defined signaling for rapid shutdown with power-line communication (PLC). The TS4-F units and RSS Transmitter require no commissioning process.

Tigo Energy, Inc. /// www.tigoenergy.com



Wire management for First Solar modules

HellermannTyton's Series 6 RPC Hanger and Series 6 Fir Tree Fastener are specifically designed to fit the new Series 6 solar modules manufactured by First Solar. The parts' purpose-driven design makes them the only fasteners offering a complete wire management solution. The Series 6 RPC Hanger can be mounted with one hand. RPC stands for Ratchet P-Clamp, HellermannTyton's proprietary cable clamp that dynamically adjusts to different bundle sizes, which was released in 2016. A steel mounting hanger tolerates high torque and is treated to resist chemicals. The Series 6 Fir Tree Fastener combines an engineered fir tree with an offset and Solar Tie in a one-piece solution. Designed with single-axis trackers in mind, it demonstrates extraction resistance, even under movement. It can be pre-installed while modules are still on the pallet. Both products are made from high-impact modified, heat-resistant, UV-stabilized material that withstands UV exposure, chemicals, and temperature extremes. No metal comes in contact with wires, so there is no potential for electrical faults caused by sharp, metal fasteners.

HellermannTyton
/// www.hellermanntyton.us



Universal fault annunciator

EES delivers its universal fault annunciator series "USM" with the free of charge Modbus TCP implementation. For communication with superior or inferior third party systems in the control or process level, the annunciator provides one or two interface cards, while the latter is on surcharge providing also Modbus RTU, if needed. The device operates always as a Modbus slave (passive Modbus) with a Modbus address between 1 and 255. If Modbus TCP is used, the IP address of the communication partner (Modbus master) or for Modbus RTU the settings for the serial interface must be set in the parameterization which is accessible on the device through a webserver. Then data is accessible via Modbus-registers or -coils. To retrieve the respective information any 3rd party tool or device can be taken. EES offers a defined data structure as reports were e.g. various information about the inputs, collective reports, horn conditions or buttons pushed and all other options i.e. relay states can be read out. To round off the flexibility with the USM from EES, the protocols can be mixed together and by this form a gateway for maximum flexibility needs. Individual inputs can be set by Modbus TCP while forwarding the whole process image on IEC 61850.

ESS Elektra Elektronik GmbH & Co.
/// www.ess-online.de



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Standing seam mounting system

SeamRack 2.0 is a versatile standing seam solar mounting solution, featuring complete adaptability both fully-railed and shared-rail mounting configurations. The KB10 rail system uses non-penetrating seam clamps for mounting directly to standing seams, without jeopardizing the integrity of the roof. SeamRack 2.0's adaptable design is complimented by its simple installation and feature-rich mounting rails. The KB10 rails offer integrated wire management, side mounting, and common fasteners for simple and fast installation.

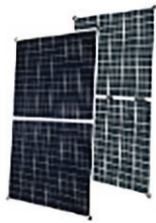
KB Racking
/// www.kbracking.com



Clamp meters meeting CAT IV 600V safety rating

Emerson is expanding its Greenlee test and measurement offering with four new meters and probes: the CMF Series, CMF-110 and CMF-118 Flexible Clamp Meters, and FC Series, FC-110 and FC-118, Flexible Clamp Current Probes. The flexible coils allow professionals to measure current in hard-to-reach cables and large conductors that hard-jaw clamp meters cannot clamp around. Flexible clamp meters allow professionals to measure current in tight spaces and on large conductors without breaking the circuit. The new flexible clamp meters are designed to be versatile and easy to use. They also have a manufacturer's limited lifetime warranty to ensure years of use.

Greenlee /// www.greenlee.com
Emerson /// www.emerson.com



400+ watt poly bifacial solar PV module

Canadian Solar Inc. unveiled BiHiKu, combining three solar PV technologies in one new 400+ watt module: black silicon, poly PERC, and bifacial cell technologies. Merging these technologies enables Canadian Solar to produce the BiHiKu module, a HiKu module with bifaciality up to 75%. This new poly solar module generates 400W or more on the front, plus up to 30% additional power generation from the back side, increasing system yield and reducing the Levelized Cost of Electricity (LCOE). BiHiKu is suitable for large commercial or utility-scale solar installations, particularly where a high reflection ground or surface under the module creates high albedo, contributing to high back side yield. The product will be available in 2019 and pre-production orders are being accepted now.

Canadian Solar Inc.
/// www.canadiansolar.com



Hydrogen as the energy source of the future

Hydrogen produced in an environmentally friendly manner has huge potential to revolutionize the energy supply as both an alternative to fossil fuels in the mobility sector and as a long-term storage medium for renewable energy. The Fronius SOLH2UB acts as a central hub for solar energy and enables the innovative integration of the electricity, mobility, and heating sectors. Hydrogen is thereby created, stored, distributed, and converted back into electricity using photovoltaics.

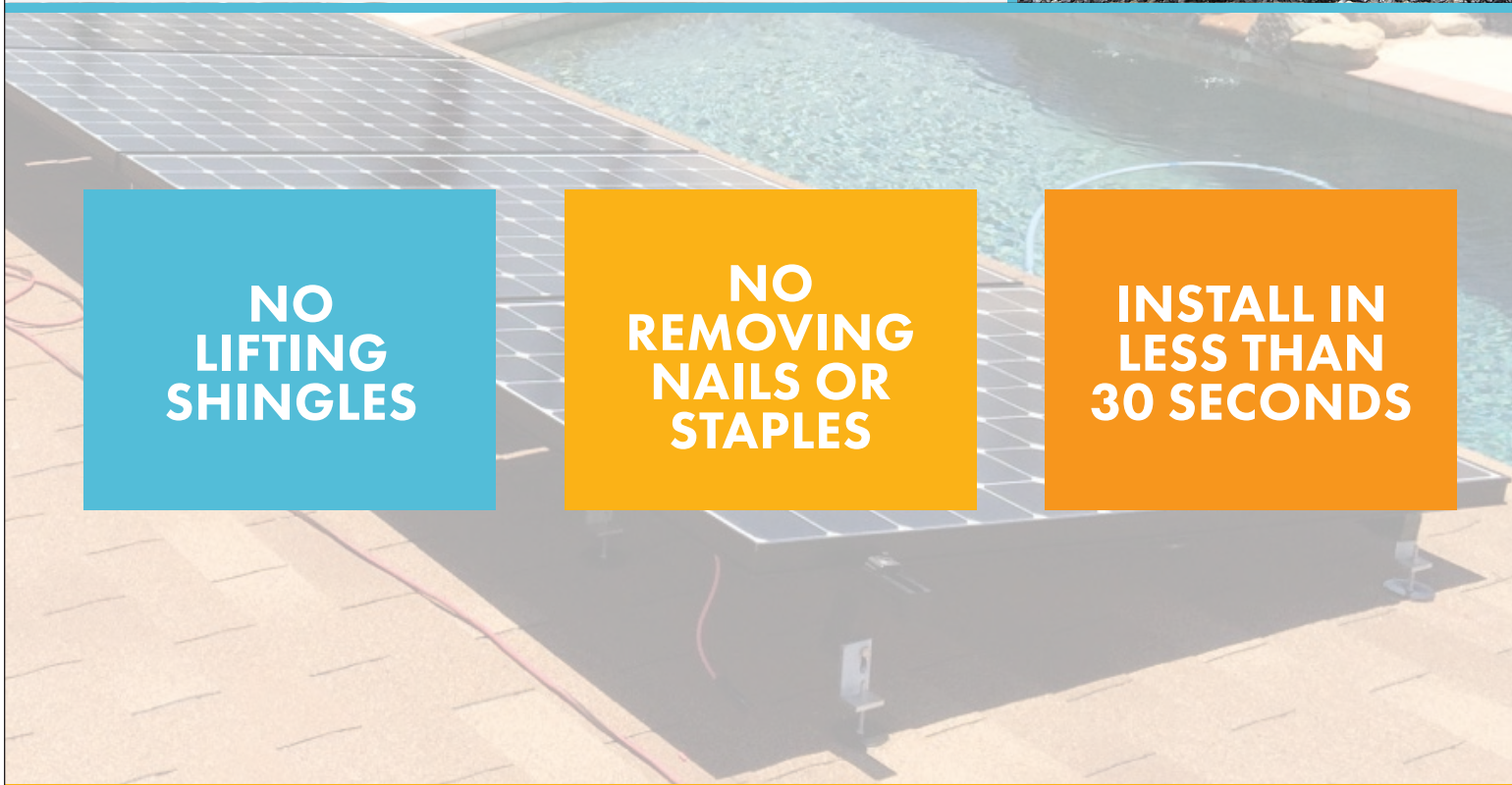
Fronius Solar Energy /// www.fronius.com

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That product name is: QuickBOLT.
The new name of our Solar Division is: QuickBOLT.



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New hybrid inverters

The new Fronius Primo GEN24 Plus and Fronius Symo GEN24 Plus hybrid inverters are easy to use and have many features; the individual emergency power variants ensure a very high degree of supply reliability in the home. The PV Point, provides a basic emergency power supply, even without a battery. For customers who already have a storage system, the devices offer a tried-and-tested full back-up solution that can supply the entire household with emergency power.

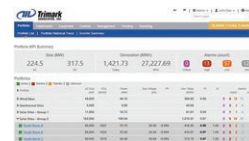
Fronius Solar Energy /// www.fronius.com



BIPV metal sheet solar roof

Swedish solar energy technology company, Midsummer, launched its new energy producing metal sheet roof, Midsummer solar roofs, a standing seam metal roof integrated with Midsummer's thin film solar panels offering high energy efficiency. The roofs are delivered pre-installed with solar panels for easy installation, similar to any standing seam metal roof without solar cells. Besides building integrated solar roofs, Midsummer's panels are suitable for a range of other roofs, corrugated, membrane, shingles, etc, as well as facades, vehicles, landfills, tents, etc. Midsummer's light, thin, and flexible solar panels can be walked upon like other metal roofs, and the weight, appearance, and cost is similar to a standard metal roof. Midsummer solar roofs have an expected lifetime of 25 years, with a guarantee of 15 years for the roof, a five-year warranty for the solar panels, and a guarantee that the roof delivers 90% of the installed peak power after ten years and 80% of the installed peak power after 25 years. The new model solar cell roof is narrow, which makes the roof aesthetically pleasing and increases the installed power per square meter. Midsummer solar roofs offer the option to connect the solar panels with each other for longer roofs, which means that Midsummer can supply its metal roof with integrated solar panels in lengths up to 39ft (12m).

Midsummer /// www.midsummersolarroofs.se



T1-S SCADA system for utility-scale solar sites

Trimark Associates, Inc. announces software updates for the T1-S SCADA system. With these enhancements, clients can improve their performance management analysis to optimize power generation and profits. The latest T1-S Vantage User Interface enhancements include simplified trending and analysis, portfolio-wide key performance indicators, production forecasting integration, control room / operations center dashboard displays, integrated external file repositories, and third-party gateway integration.

Trimark Associates, Inc.

/// www.trimarkassoc.com



Solar security tower

Larson Electronics' solar powered security tower can quickly deploy equipment to elevations of up to 20ft. This unit features a telescoping tower that folds and a rotating boom allowing for 360° rotation with a removable mast head. The SPLT-.53K-LM20-EW-TLR7-ACC-2XPTZ.23X-1XFE-4TB-W4G solar powered security tower comes equipped with a 120V battery charger and 25ft of 16/3 SOOW cord terminated with a 5-15P waterproof shore power cord cap. This unit is trailer mounted with a solar generator with a 12" x 12" x 6" junction box and 3 1080P full-HD outdoor cameras mounted to the top of the mast, which supports cameras for a 360° field of view. The cameras have 23x optical zoom levels and a 4.7-94mm varifocal lens that automatically adjusts. Larson Electronics' solar powered security tower features an 8-channel NVR that can be used with network cameras. The tower includes two 265W solar panels, solar charging system, 400Ah battery bank, and electric mast mounted on a trailer with outriggers. The three-stage mast is made of square steel tubing with a 12ft lower section, 8ft middle section and 6ft top section, each with a 2ft overlap. The mast is extended using an 850W, 600lb capacity electric winch with 3/16" galvanized steel cable. All electrical components are housed in a NEMA 3R job box bolted to the trailer.

Larson Electronics LLC

/// www.larsonelectronics.com



I-V curve tracers

The Solmetric line of PV Analyzer I-V curve tracers are used in Commissioning, Auditing, O&M, and Troubleshooting of PV systems. They offer high accuracy and measurement throughput (measurements per hour) with a large display and array troubleshooting features. They include a database of 50,000 PV modules, a 300ft wireless sensor range, and can measure up to 1500V at 30A.

Solmetric /// www.solmetric.com

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Heyco® Solar Products Warranty

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Heyco®-Tite Cordgrips for Enphase Q Cable

Two new cordgrips now accommodate the Enphase Q Cable. The 1/2" version provides liquid tight entry for one Enphase Q Cable; .24x.38" (6,1x9,7 mm). The 3/4" version provides liquid tight entry for up to two Enphase Q Cables; .24x.38" (6,1x9,7 mm) and an additional .130" (3,3 mm) dia. hole for a #8 solid grounding cable.



Heyco® HEYClip™ SunRunner® 4-2 & 4-2U

SunRunner 4-2 & 4-2U clips are compatible with the Enphase Q cable. SunRunner 4-2 works with Everest, SnapNRack, Solar Mount & similar rack profiles. SunRunner 4-2U works with Unirac, Ironridge & similar rack profiles.



Heyco® HEYClip™ SunRunner®

Double-compression design holds from (1) 12 gauge USE-2 to (2) 8 AWG cables up to 8,3 mm OD.



Heyco® HEYClip™

SunRunner® 90, 90-2 & 90-4

Double-compression, right angle design for use with PV modules mounted in "landscape" mode.



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Stainless Steel Wire Cable Ties

Aircraft grade 302/304 stainless wire w/UV protected vinyl jacket and stainless steel crimp sleeve, 8" (203 mm) to 20" (508 mm) lengths—Special lengths available upon request.



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Solar-powered mobile charging hubs

ChargeWheel's Energy Trailers are a combined solar power generation and energy storage solution for charging personal electric vehicles of all kinds. The Energy Trailer system is capable of simultaneously charging four electric vehicles or up to 400 e-bikes and e-scooters at DC fast charging (DCFC) speeds. ChargeWheel's Energy Trailers are equipped with solar panels, 550KWh of energy storage capacity, and DCFC. The Energy Trailer is capable of charging vehicles with 100% solar energy generated by roof-mounted solar panels, enabling micromobility fleets to utilize an unprecedented level of clean energy in their operations. Energy Trailers can operate in any parking lot, dramatically reducing space, permitting, and equipment requirements for the infrastructure necessary to recharge micromobility fleets at DCFC speeds. Energy Trailers don't require a connection to the grid, making them completely mobile and capable of generating renewable electricity onsite using solar panels. For EV drivers, ChargeWheel will introduce a yearly unlimited charging subscription plan, allowing drivers to charge their EVs at a fixed cost per year at any location. Micromobility or EV fleet operators can lease the trailers on yearly contracts, or for a monthly subscription fee, micromobility fleet operators who use independent contractors for charging of their fleets can direct their contractors to the nearest ChargeWheel Energy Trailer for charging.

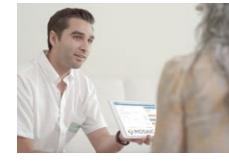
ChargeWheel /// www.chargewheel.com



Optimizing the assembly process

HARTING's new Han-Eco B series range now includes plastic housings that are fully compatible with the standard Han B. The rear mounting option for prefabricated cabinet harnesses simplifies the assembly process as the insert side of the wiring harnesses can be easily snapped into the bulkhead mounted housing from the inside of the switch cabinet - rearward, allowing assembly floor optimization. In addition to monoblock inserts from the Han B series, the Han-Modular range can also be used in plug-compatible fashion in the new Han-Eco B series. Hinged or holding frames allow the modules to be integrated into the plastic hoods or housings. Han-Eco B is available in the standard sizes 6B to 24B. Cable gland options include M20, M25, M32, and M40. The variety increases flexibility when it comes to the connection of new machine modules. Subject to cost and quality requirements, designers can choose either a plastic or metal housing. This ensures the downward compatibility of Han-Eco B hoods or housings in production systems. Plastic connectors are easy to install, are resistant to corrosion, and offer flexible assembly options. They are fire resistant to UL94 V0 and weigh about half as much as a connector made from die-cast aluminum.

HARTING /// www.harting.com



Next generation home solar loans

Mosaic announced the launch of PowerSwitch 6, the next generation of home solar loans. PowerSwitch 6 bundles together several new features designed to improve solar installers' cash flow, streamline processing, expand their markets, and lower their customer acquisition costs. The PowerSwitch 6 suite offers two loan structures—PowerSwitch CHOICE and PowerSwitch PLUS—which complement Mosaic's home improvement loan. The existing loan offering, renamed PowerSwitch CHOICE, is a solution for customers looking to add solar or solar and batteries to their home and take advantage of the 30% Federal tax credit to pay down their loan during the first 18 months. The new loan structure, PowerSwitch PLUS, provides a loan amortization schedule designed for customers who don't expect to receive a tax credit or who want to re-roof or make other energy efficiency improvements on their home at the same time as adding solar or solar and batteries, with payments reassessed at 18 months to reward any principal repayments.

Mosaic /// www.joinmosaic.com

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New reference tool helps improve performance and safety

Utilities and others in the electric power industry have a new tool to help them proactively reduce errors and performance gaps, the Human Performance Improvement (HPI) Pocket Guide, published by POWER Engineers Incorporated (POWER). The POWER HPI Pocket Guide is a compact, 60-page reference describing HPI philosophy and 23 of the most common error precursors such as Time Pressure or High Workload. It provides HPI tools that can be used immediately to reduce or mitigate potential errors. As the name suggests, the guide is intended to fit in a shirt pocket and is printed on all-weather paper to encourage its use in any environment.

POWER Engineers
 /// www.powereng.com



Wide range modbus meter

Continental Control Systems introduces the new WattNode Wide-Range Modbus meter with several features that simplify installation and reduce hardware costs. New features include a single meter model for services from 100 to 600Vac, remote correction of the current transformer (CT) polarity and phase, ANSI C12.20 class 0.5 accuracy, a 100-millisecond update rate, and the ability to detect disconnected CTs. The versatile power supply replaces seven models with one model. The new model operates from 85Vac to 690Vac on wye, delta, single-phase, and three-phase services. New settings will reduce installation time and hardware costs. Two CTs can be used instead of three CTs for delta circuits, and one CT can be used instead of two CTs for two-wire single-phase circuits. If CT wiring is incorrect, it can be fixed in software remotely after installation. The WattNode's FAST POWER feature measures and reports power, voltage, frequency, and current every 100 milliseconds for power export limiting and control applications. To support new tamper requirements, the WattNode can detect if a CT is disconnected. The WattNode supports potential transformers (PT) for services up to 36 kV and scales measurements based on the PT ratio. The WattNode Wide-Range Modbus uses the Modbus RTU protocol over RS-485 at up to 115,200 baud. It supports millivolt (0.333Vac) output CTs, flexible Rogowski coils, and has optional support for milliamp output CTs. It is available in UL 508A NEMA 4 steel or polycarbonate enclosures with optional fuses or circuit breakers.

Continental Control Systems /// www.ctlsys.com



Software as a service tool

Lumidyne Consulting LLC announced today the release of a new modeling Software as a Service (SaaS) tool that helps electric distribution utilities, cities and other organizations integrate distributed energy resources (DERs) into their planning processes. The modeling software, named SPIDER (Spatial Penetration and Integration of Distributed Energy Resources), is able to forecast spatial adoption and grid impacts of solar PV, electric vehicles (EVs), and battery storage; help grid planners minimize distribution system costs while ensuring system reliability; help city planners estimate EV charging station infrastructure requirements; rapidly update forecasts with new data through automated calibration; analyze different policy, technology or electric rate scenarios; and account for interactions among and uncertainty across DERs. The SPIDER model is built in Analytica, a powerful and flexible software platform. SPIDER model usage is dictated by each client's unique needs, with delivery options including: Desktop Application - maximum control for end user; Software as a Service (SaaS) - secure web interface hosted on scalable cloud computing; and Forecasting as a Service (Faas) - regularly updated by Lumidyne staff.


Lumidyne Consulting
 /// www.lumidyneconsulting.com

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QuickBOLT's Microflashing is now a registered trademark. Microflashing is a component of the QuickBOLT and Low Profile QuickBOLT Mounting Kits. The QuickBOLT is the world's first and only UL Certified Microflashing mounting system. The patented QuickBOLT with Microflashing technology seals roof penetrations and can be installed without lifting shingles or removing nails and staples. The QuickBOLT with Microflashing has been installed over 600,000 times with zero leaks.

QuickBOLT /// www.quickbolt.com

Batteries

The energy storage market is growing larger by the year and will soon enable renewables to become a mainstream source of power. A reliable battery is a key component to any efficient and sustainable renewable energy system. Here are some of the more popular choices in the industry today...

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MK Battery

Product: UltraFlex Energy Storage System

Description: The UltraFlex energy storage system brings the power to reduce diesel consumption, CO2 footprint, and maintenance costs. The system combines ultracapacitor and battery chemistries in a single electrolyte, creating a maintenance-free hybrid cell with high efficiency, performance, and long lifetime throughput.

Chemistry: Hybrid lead-acid/ ultracapacitor

Voltage: 48V

Energy: 17kWh

Peak Power: 25kWh

Operating temperature range: 32°F to 122°F (0°C to 50°C)

Warranty: 64MWh warranty

Key Features:

- Engineered for partial state-of-charge applications;
- Versatile for single and three phase operations;
- Adaptable to existing or new solar arrays;
- Recyclable with a positive end-of-life value.

www.mkbattery.com

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U.S. Battery

Product: US RE L-16XC2

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.

Chemistry: Flooded lead acid

Capacity (Ah @ 20hr rate): 401Ah

Voltage: 6V

Energy: 2.41kWh

Cycle life: 675 Cycles at 80% DoD, and 1150 Cycles at 50% DoD

Operating temperature range: 0°F to 120°F (-17°C to 49°C)

Dimensions: 11.875" x 7.125" x 16.75"

Weight: 114lbs (51.7kg)

Warranty: 5-year warranty

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



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Technologies



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sensata.us/gigavac-hx

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Dynapower

Product: MPS-i-125 EHV Energy Storage System

Description: The MPS-i-125 EHV is a fully integrated behind-the-meter energy storage system. The MPS-i-125 EHV couples Dynapower's efficient UL 1741 SA MPS-125 EHV inverter with Li-ion batteries in a temperature controlled battery NEMA-rated enclosure. The highly compact integrated system is easily deployed on a concrete pad, crushed stone, or on the ground with a forklift and minimal labor, reducing system installation costs for integrators and system owners. The system features Dynapower's Dynamic Transfer which, in the event of grid disturbance, seamlessly switches a facility from grid-tied to battery backup power. Multiple MPS-i-125 EHV systems can be paralleled together to meet the sizing needs of any behind-the-meter installation.



Chemistry: Lithium-ion
Voltage: 480 - 600 VAC 3 Phase
Peak power: 125kW @ 480V, 150kW @ 600V
Operating temperature range: -13°F to 122°F (-25°C to 50°C)
Certifications: Inverter: IEEE 1547, UL 1741 SA Listing
Key Features:

- Anti-islanding with UL Compliant trip points;
- Hardware over-current protection;
- Surge protection;
- Black Start;
- Autonomous Volt/VAR and Hz/Watt support.

www.dynapower.com

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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.
Chemistry: Lead-acid suspension (Absorbed glass mat)
Capacity (Ah @ 20hr rate): 415Ah
Voltage: 6V
Energy: 2.4kWh
Cycle life: 1700 cycles to 50% DoD



Operating temperature range: 5°F to 104°F (-15°C to 40°C) recommended, -40°F to 159.8°F (-40°C to 71°C) maximum
Dimensions: 7.0" x 11.6" x 16.7"
Weight: 123lbs (55.8kg)
Warranty: 7-year warranty in approved solar applications
Certifications: ISO9001, ISO14001, ISO18001, UL, CE, TUV
Key Features:

- Rugged construction inside and out;
- Over partition welded straps;
- Heavy-duty, pure lead plates;
- Sealed and maintenance-free, with little or no gassing.

www.fullriverbattery.com



Battery Systems, Inc.

Product: Centennial CB6-400 AGM Deep Cycle
Description: L16 group size, large valve regulated lead-acid AGM deep cycle battery
Chemistry: Lead-acid AGM (Absorbed glass matt)
Capacity (Ah @ 20hr rate): 416Ah
Voltage: 6V, nominal voltage
Energy: 2.49kWh
Peak power: 24kW
Cycle life: 500 cycles @ 80% DoD, 1200 cycles @ 50% DoD, 3000 cycles @ 20% DoD
Operating temperature range: 23°F to 77°F (-5°C to 25°C)
Dimensions: 11.61" x 7" x 15.91"
Weight: 126.76lbs (57.5kg)
Warranty: 7-year limited solar/RE warranty (2-years free + 5-years pro-rated)
www.batterysystems.net



LG Chem

Product: RESU10H Home Battery
Description: The RESU10H, compatible with SolarEdge7600, is LG Chem's first home battery in North America. RESU10H can be used for grid-tied backup and TOU applications.
Chemistry: Lithium-ion
Voltage: 400V
Energy: 9.8kWh
Peak power: 5kW
Operating temperature range: 14°F to 113°F (-10°C to 45°C)
Dimensions: 29.3" x 35.7" x 8.1"
Weight: 214lbs (97kg)
Warranty: 10-year warranty
Certifications: Cell UL1642 Battery Pack UL1973 / CE / RCM / TUV (IEC 62619) Emissions FCC Hazardous Materials Classification Class 9 Transportation UN38.3 (UNDOT) Ingress Rating IP55
www.lgesspartner.com



Darfon America Corp.

Product: Darfon B12LF
Description: The B12LF is a 12kWh LFP battery cabinet that is bundled with Darfon's H5001 hybrid inverter. Since the B12LF uses LiFePO4 chemistry, it has a long life span and is safe to use. Two B12LF battery cabinets can be stacked together to create a 24kWh energy storage solution.
Chemistry: Lithium-ion
Capacity (Ah @ 20hr rate): 250Ah
Voltage: 48V
Energy: 12Wh
Cycle life: 6000 cycles @ 80% DoD
Operating temperature range: -4°F to 140°F (-20°C to 60°C)
Dimensions: 23.6" x 43.3" x 23.6"
Weight: 485lbs (220kg)
Warranty: 5-year warranty
Certifications: UL1642, UN38.3, EN 61000 chapter 4.2, 4.3, 4.5, 4.6, EN55022, EMC (CE)
www.darfonsolar.com



Fortress Power

Product: eVault 16.5
Description: The eVault 16.5kWh lithium iron phosphate storage solution has 98% round-trip efficiency. Paralleling up to 8 units for 132kWh, the eVault comes with an LCD screen that monitors the battery's state of charge and power output. It is guaranteed up to 6000 cycles at a low cost per cycle.
Chemistry: Lithium iron phosphate
Capacity (Ah @ 20hr rate): 360Ah
Voltage: 48V
Energy: 16.5kWh
Peak power: 18.5kW
Cycle life: 6000
Operating temperature range: -4°F to 140°F (-20°C to 60°C)
Dimensions: 19.2" x 21.6" x 38.8"
Weight: 476lbs (20.9kg)
Warranty: 10-year warranty
Certifications: UL 1642
www.fortresspower.com



Trojan Battery Company

Product: Trillium TR 12.8-110 Li-Ion

Description: Trillium is designed and engineered in the USA and is available in 3 popular sizes for solar applications. From its cell and battery design to its built-in diagnostics, Trillium offers a range of advanced safety, environmental, and electronic features. With life expectancy over 5000 cycles, Trillium delivers return on investment to its customers.

Chemistry: Lithium-Ion

Voltage: 12.8V

Energy: 1.4kWh

Cycle life: >5000 cycles

Operating temperature range: -4°F to 140°F (-20°C to 60°C)

Dimensions: 12.1" x 6.6" x 8.7"

Weight: 30lbs (13.6kg)

Warranty: 8-year warranty

Certifications: UL2271/TUV; UN38.3; UL 1642; IEC 62133

www.trojanbattery.com



AIMS Power

Product: 200 AMP Lithium LiFEPO4 Battery 12V

Description: AIMS lithium battery is built with an advanced BMS and offers high charge cycles at a low weight. The full power of the battery is provided with every charge without harming the battery or worrying about memory problems. Made to last up to 10 years. Backed by a 10-year manufacturer defect warranty.

Chemistry: Lithium-ion

Capacity (Ah @ 20hr rate): 200Ah

Voltage: 12V

Energy: 2400kWh

Peak power: 350A

Cycle life: >4500

Operating temperature range: -4°F to 149°F (-20°C to 65°C)

Dimensions: 20.7" x 10.6" x 8.7"

Weight: 77lbs (33.9kg)

Warranty: 10-year warranty

www.aimscorp.net



Saft

Product: Intensium Max 20 High Energy

Description: The Intensium Max 20 High Energy is Saft's unmanned and ready to install Energy Storage System (ESS) in a 20-foot container, enabling utility-scale storage solutions for grids, renewables, and industries.

Chemistry: Lithium-ion

Voltage: 811V

Energy: 2.5MWh

Operating temperature range: -13°F to 131°F (-25°C to 55°C)

Dimensions: 22' x 7.8' x 9.5'

Weight: <30t

Certifications: UL 1642, IEC 62619, IEC 62093, IEC 62477, UL 1973, IEC 61000-6-4 / IEC 61000-6-2, IEC 62477 overvoltage cat II, IP 54, ISO 668, IEEE 693 high level, IEC 60721, UN 3536 - Class 9, UN 38.3, CE

www.saftbatteries.com

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Rolls

BATTERY ENGINEERING



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.

Chemistry: Flooded lead-acid

Capacity (Ah @ 20hr rate): 4860Ah

Voltage: 2V

Energy: 9.72kWh

Cycle life: 3200 @ 50% DoD; 5000 @ 20% DoD

Operating temperature range: -4°F to 110°F (-20°C to 43.33°C)

Dimensions: 27.375" x 9" x 31.625"

Weight: 570lbs (259kg)

Warranty: 5-year full replacement manufacturer warranty

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.

www.rollsbattery.com

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MPINarada

MPINarada

Product: NESP-Series Li-Ion (LFP)

Description: Narada NESP Li-ion (LFP) solutions are designed for a variety of applications and available in 2C, 1C, and 0.5C options to maximize life and performance. Narada can provide rack modules to fully configured container solutions.

Chemistry: Lithium-ion

Capacity (Ah @ 20hr rate): 250Ah

Voltage: 51.2V

Energy: 25.6kWh

Peak Power: 12.8kW

Cycle life: 10,000 cycles

Operating temperature range: -4°F to 140°F (-20°C to 60°C)

Dimensions: 16.3" x 23.6" x 10.4"

Weight: 205lbs (93kg)

Warranty: 10-year warranty

Certifications: CE, UL, IEC

Key Features:

- 0.5C to 2.0C options available (Frequency Regulation, Peak Shaving, Peak Shifting);
- Passive and active thermal ventilation;
- Designed for containerized solutions;
- High lifetime performance;
- Fully compliant with U.S. market codes and standards.

www.mpinarada.com



Storage Battery Systems, LCC

Product: Renewable Energy Storage Cell SBS-6PzS967

Description: Designed and developed with precision in mind, these bolt-on renewable energy cells provide high charge acceptance and long and durable service life. The design and use of high-quality raw materials guarantees the reliability and efficiency of this energy solution.

Chemistry: Lead-acid

Voltage: 2V

Cycle Life: 3250 cycles at 50% DoD

Dimensions: 7.80" x 4.69" x 28.31"

Weight: 114lbs (51.7kg)

Warranty: 120 months: 5-year full warranty with balance prorated based on prices at the time of replacement

www.sbsbattery.com/solar



Concorde Battery Corporation

Product: VRLA-AGM Batteries

Description: Concorde Battery Corporation has been manufacturing SunXtender deep cycle AGM batteries for the solar, photovoltaic, and renewable energy industry since 1987.

Chemistry: Lead-acid

Capacity: 1215Ah @ 24hr rate

Voltage: 2V

Energy: 2.4kWh

Peak power: >1.6kW

Cycle life: 1000 cycles @ 50% DoD

Operating temperature range: -40°F to 160°F (-40°C to 71°C)

Dimensions: 11.64" x 6.95" x 15.73"

Weight: 124lbs (56.2kg)

Certifications: UL 1989 (File Number MH-17983)

www.sunxtender.com



BMZ

Product: ESS 9.0

Description: A modular, lithium-ion based energy storage system, which stores the surplus of collected solar energy for later use. Energy can either be directed into the storage system or be fed into the public grid via an inverter.

Chemistry: Lithium-ion NCA

Capacity (Ah @ 20hr rate): 6.265A for 20 hours, total usable capacity 125.3Ah

Voltage: 54V Nominal

Energy: 8.5kWh Nominal, 6.8kWh Usable

Peak Power: 18kW

Cycle life: 5000 cycles

Operating temperature range: 35°F to 113°F (1°C to 45°C)

Dimensions: 19" x 25" x 17"

Weight: 214lbs (97kg)

Warranty: 10-year, 5000 cycle warranty

Certifications: CE, UN 38.3, IP21

www.bmz-group.com

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www.IronEdison.com



Discover Battery

Product: 42-48-6650 / 12-48-6650

Description: Discover Battery's Advanced Energy System (AES) LiFePO4 batteries offer a low cost of energy storage per kWh. Deep cycling, fast recharge, >95% round-trip efficiency, 1C continuous charge/discharge, 5C peak current, and a 10-year warranty combined with zero maintenance provide customers with bankable performance and total cost of ownership savings.

Chemistry: LiFePO4/LFP

Voltage: 48V nominal

Energy: 6.65kWh

Charge temperature: 32°F to 113°F (0°C to 45°C)

Discharge temperature: -4°F to 122°F (-20°C to 50°C)

Dimensions: 18.5" x 13.7" x 14.7"

Warranty: 10-year warranty

Certifications: IEC 62133, UL 1973, UN 38.3

www.discoveraes.com



GS Battery

Product: SLR Series

Description: The GS Battery SLR Series batteries are designed for high-cycle applications using advanced nano-carbon technology.

Chemistry: Advanced lead-acid

Capacity (Ah @ 10hr rate): 50Ah, 500Ah, 1000Ah

Voltage: 2V, 12V

Cycle life: 10,000 cycles @ 30% DoD, 5000 cycles @ 70% DoD

Operating temperature range: 5°F to 113°F (-15°C to 45°C)

Warranty: 10-year limited warranty

Certifications: UL1973 with BMS

www.gsuasa-es.com



ESS Inc.

Product: Energy Warehouse

Description: Utilizing earth-abundant iron, salt, and water for its electrolyte, and simple materials for battery components, the Energy Warehouse (EW) from ESS Inc. is a durable, environmentally safe, long-duration storage solution. The EW provides low levelized cost of storage (LCOS) and deep charge and discharge cycles.

Chemistry: Flow

Voltage: 600V to 850V

Energy: 400kWh

Peak power: 100kW (DC)

Cycle life: >20,000

Operating temperature range: 23°F to 122°F (-5°C to 50°C)

Dimensions: 320 sq. ft.

Weight: 34,612lbs (15,700kg) dry, 79,807lbs (36,200kg) wet

Warranty: Comprehensive 20-year warranty with continuous extended service agreement

Certifications: NRTL, UL, Intertek Field Labeling, IP54, IE60529

www.essinc.com

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fullriverbattery.com



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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.

Chemistry: Lead-acid

Capacity (Ah @ 20hr rate): 2550Ah

Voltage: 2V

Energy: 7.1586kWh (100hr), 4.9470kWh (20hr)

Cycle life: 1500 cycles @ 100% DoD; 4300 cycles @ 30% DoD

Operating temperature range: -40°F to 120°F (-40°C to 49°C)

Dimensions: 12.81" x 6.56" x 33.38"

Weight: 313lbs (141.9kg)

Warranty: 5-year full replacement limited warranty

Certifications: Conforms with BCI and IEC Test Standards

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;
- High-capacity 2-Volt Power Module design includes fixed handles and the flexibility to be installed with or without battery racks;
- Lead-acid batteries are 99% recyclable.

www.crownbattery.com

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Panasonic

Panasonic

Product: Harbor Smart Battery

Description: The Harbor Flex smart battery offers homeowners a high-performance energy storage system at an attractive installed price per kilowatt-hour. Featuring Panasonic DCB-105 lithium ion battery modules, the Harbor Flex can be expanded to make a Harbor Plus smart battery with even more energy and power capacity, making it simple for system owners to accommodate their changing energy needs. This scalable and flexible smart battery unit is designed for solar-plus-storage applications including self-supply, rate arbitrage, and clean backup power.

Chemistry: Lithium-ion

Voltage: 380VDC REbus Nanogrid

Energy: 10.3kWh total, 17.1kWh useable

Peak power: 12kW

Operating temperature range: 5°F to 45°F (-15°C to 7°C)

Dimensions: 10" x 22" x 68"

Weight: 445lbs (202kg)

Warranty: 10-year, 45.3kWh throughput warranty.

Certifications: UL 9540, UL 1973, UL 1642, CSA 22.2

Key Features:

- Powered by Panasonic Li-ion Battery Technology;
- Connect as many as four (4) Harbor smart batteries to a single Pika Islanding Inverter for up to 68.4kWh of useable storage;
- Long lasting battery backup power;
- Time-of-use (TOU) and zero-export ready;
- Residential and commercial application ready.

na.panasonic.com/us/solar



Sol-Ark

Product: PCC-250

Description: Cost effective alternative to lithium with similar cycles and partial SOC. Built for battery backup, time of use, and long term off-grid applications.

Chemistry: Carbon Absorbant Glass Mat (AGM)

Capacity (Ah @ 20hr rate): 250Ah

Voltage: 12V

Energy: 3.0kWh

Cycle life: 3000 @ 50% DoD, 5800 @ 20% DoD

Operating temperature range: -40°F to 160°F (-40°C to 60°C)

Dimensions: 12.7" x 22" x 6.1"

Weight: 180lbs (81.6kg)

Warranty: 3-year warranty

www.sol-ark.com



K2 Energy Solutions

Product: K2 Pro Series Battery

Description: The K2 Pro Series is safe, clean, and reliable with long cycle life. Lightweight, K2 batteries need less replacement and lose only 2% charged capacity per month.

Chemistry: Lithium-ion

Capacity (Ah @ 20hr rate): 111Ah

Voltage: 12.8V

Energy: 1420.8kWh

Peak power: 12kW for 3 seconds

Cycle life: Up to 3000+

Operating temperature range: -4°F to 149°F (-20°C to 65°C)

Dimensions: 12.1" x 6.6" x 8.3"

Weight: 30lbs (13.6kg)

Warranty: 90-day workmanship and quality warranty under normal use

Certifications: UN38.3 Test Compliant

www.k2battery.com



Lithium Werks

Product: U27-24XP Battery Module

Description: The U27-24XP is a high-performance, 24V battery, built on a patented Lithium Iron Phosphate chemistry platform in a Group 27 size case. The U27-24XP is suitable for material handling, stationary energy storage, and commercial EV or marine applications.

Chemistry: Lithium-ion

Capacity (Ah @ 20hr rate): 72Ah

Voltage: 25.6V

Energy: 1.84kWh

Cycle life: >4000 cycles @ 80% DoD

Operating temperature range: -14°F to 122°F (-10°C to 50°C)

Dimensions: 12.0" x 6.77" x 8.86"

Weight: 42.25lbs (19.2kg)

Warranty: 5-year warranty

Certifications: UL 2580, UL 1642 (cells), FCC Class B, CE, UN 38.3, DNV-GL, NMA

www.lithiumwerks.com



VRB Energy

Product: Vanadium Redox Battery Energy Storage System (VRB-ESS)

Description: VRB-ESS is scalable to any size from 250kW/1MWh to multi-megawatt size with four to eight hours of energy storage for utility-scale solar and wind time-shifting, peaking power applications, and microgrids. Components and electrolyte can be nearly 100% recycled at end-of-life, dramatically improving lifecycle economics and environmental benefits.

Chemistry: Flow

Voltage: 400/480VAC

Energy: 1000kWh

Peak Power: 250kW AC

Cycle life: >25,000 cycles

Operating temperature range: 32°F to 122°F (0°C to 50°C)

Dimensions: 80m²

Warranty: 10-year parts and labor warranty with zero capacity fade

www.vrbenergy.com



NantEnergy

Product: Energy Storage Solutions

Description: NantEnergy's proprietary Zinc-Air battery technology enables low cost solutions for long and short duration applications. The company's energy storage solution has been deployed at over 3000 sites worldwide, including at over 100 remote community micro-grids.

Chemistry: Zinc-air

Capacity (Ah @ 20hr rate): 525Ah

Voltage: ~1.1 to 1.2V

Energy: 575kWh

Peak power: 75kW

Cycle life: Based on discharge hours, life is not dependent on number of cycles

Operating temperature range: 32°F to 122°F (0°C to 50°C)

Dimensions: 18" x 14.5" x 5"

Weight: <40.7lbs (<18.5kg)

Warranty: 2-year standard warranty with 5- and 10-year extension options available

www.nantenergy.com



Nilar, Inc.

Product: Nilar EC Series

Description: Nilar offers a nickel metal hydride (NiMH) bi-polar design which provides safe, reliable, and cost efficient energy storage. The battery's compact high voltage design is made for industrial use.

Chemistry: NiMH

Capacity (Ah @ 20hr rate): 10Ah

Voltage: 144VDC

Energy: 1.44kWh

Cycle life: 2000

Operating temperature range: -4°F to 122°F (-20°C to 50°C)

Dimensions: 13.26" x 12" x 5"

Weight: 75lbs (34kg)

Certifications: IEC 62485-2, IEC 62675

www.nilar.com



Bringing the Power to you



Leoch Battery Corp.

Product: LRC Series

Description: The LRC Series utilizes Advanced Carbon technology for superior performance in partial-state-of-charge (PSOC) applications and a long deep cycle life of 4400 cycles @ 50% DoD. These robust, high capacity, VRLA AGM batteries are suitable for use in unstable grid conditions where the batteries are cycled regularly.

Chemistry: Valve Regulated Lead Acid (VRLA) AGM

Capacity (Ah @ 20hr rate): 1152Ah

Voltage: 2V

Energy: 2.304kWh

Cycle life: 4400 cycles @ 50% DoD

Operating temperature range: -4°F to 131°F (-20°C to 55°C)

Dimensions: 17.32" x 7.13" x 14.37"

Weight: 162.4lbs (73.6kg)

Warranty: Up to 5-year manufacturer warranty

Certifications: IEC 61427, UL 94V-0FR, OHSAS 18001, ISO 9001, ISO 14001

www.leoch.us

No other solution delivers the ultra-reliability and ultra-sustainability of the UltraFlex system and brings you the power to dramatically reduce diesel consumption, CO₂ footprint, and maintenance costs.

- Reliable and robust for the toughest off-grid locations and renewable applications
- Scalable and versatile for single and three phase operations
- Adaptable for existing or new solar arrays
- Recyclable product with a positive end-of-life value



MK Battery and Ecoult are East Penn Manufacturing Co. Subsidiaries
www.mkbattery.com | 800-372-9253



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Iron Edison Battery Company

Product: Lithium Iron Battery

Description: Iron Edison Lithium Iron Phosphate Batteries are suitable main power storage and backup for photovoltaic systems and UPS systems.

Chemistry: Lithium-ion (Lithium Iron Phosphate)

Capacity (Ah @ 20hr rate): 100Ah to 5600Ah

Voltage: 48V (nominal)

Energy: 5kWh to 291kWh

Peak power: 100W to 52kW

Cycle life: 4000 cycles - 14,000 cycles

Operating temperature range: 32°F to 113°F (0°C to 45°C)

Dimensions: Single 30" x 12" x 10" enclosure to eight 48" x 27" x 8" enclosures

Weight: 140lbs to 6720lbs (272kg to 3048kg)

Warranty: 10-year warranty

Certifications: CE, UL1642, IEC62113

Key Features:

- Iron Edison uses Lithium Iron Phosphate (LiFePO4) battery cells, which is a safe lithium-ion battery chemistry for home or commercial use;
- Iron Edison Lithium Iron batteries are compatible with all major brands of 48V battery inverters;
- An integrated Battery Management System (BMS) actively monitors each cell and optimizes pack performance while safeguarding against thermal runaway;
- Designed and assembled in Colorado using high quality components, Iron Edison Lithium Iron batteries are built to last for decades;
- Every Lithium Iron battery comes with a 10-year performance guarantee and lifetime technical support.

www.ironedison.com



SolaX Power USA, LLC

Product: Lithium-ion batteries and hybrid inverters

Description: The SolaX Power Triple Power Battery gives homeowners a compact and elegant design with a quick and easy installation, integrating the Battery Management Unit (BMS). The BMS enables customers to control their electric bill through self-consumption of solar and TOU rate smart scheduling, and includes an off-grid mode to protect the home in the event of a power outage.

Chemistry: Lithium-ion

Voltage: 100.8V

Energy: 6.3kWh

Peak power: 3kW

Cycle life: 6000 cycles @ 90%DoD

Operating temperature range: 32°F to 113°F (0°C to 45°C)

Dimensions: 18.3" x 7.6" x 23.1"

Weight: 148.8lbs (67.5kg)

Warranty: 10-year warranty

Certifications: UL1642, UL1741SA, IEC 62109, IEC 62619, UL1973

www.solaxpower.com



BAE Batteries USA

Product: Energy Storage Stationary Battery

Description: Low carbon, deep cycling, and high reliability advanced lead-acid batteries for demand response or frequency regulation for renewable and energy storage applications.

Chemistry: Lead-acid

Capacity (Ah @ 20hr rate): 67Ah to >4000Ah

Voltage: 2VDC to >1000VDC

Energy: Depends upon application

Peak power: Depends upon application

Cycle life: 2000 to >5000 depending upon discharge parameters

Operating temperature range: -4°F to 113°F (-20°C to 45°C)

Warranty: 5-year full warranty, 10-year warranty on post/post-seal

Certifications: ISO, IEEE 535 (Europe), IEC Testing Requirements

www.baebatteriesusa.com

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Canadian Energy

Product: MIXTECH

Description: MIXTECH prevents acid build up from killing batteries and can extend their life by up to 4x. It's 100% maintenance-free, provides sustained performance, and offers low total cost of ownership.

Chemistry: Lead-acid

Capacity (Ah @ 20hr rate): 115Ah

Voltage: 12V

Dimensions: 13" x 6.8" x 9.5"

Warranty: 36-month warranty

www.cdnrg.com



Lithium Power, Inc.

Product: Solar Energy Storage Battery Solution

Description: High energy density, slim rooftop design, solar energy storage with DC/AC and AC/DC conversion. Built-in over/under voltage, temperature, current, and short circuit protection. Battery conditions constantly monitored and available through various communication protocols or saved in history data log. Battery pack allows parallel connection. Safety regulations such as UL/IEC are available.

Chemistry: Lithium-ion

Capacity (Ah @ 20hr rate): 42Ah

Voltage: 48V

Energy: 2.016kWh

Cycle life: 2000+

Operating temperature range: -4°F to 131°F (-20°C to 55°C)

Dimensions: 21" x 16.07" x 3.28"

Weight: <55lbs (<25kg)

Warranty: 5-year warranty

Certifications: UL, IEC, UN

www.lithiumpowerinc.com



PBES

Product: Industrial and Marine NMC and LTO Batteries

Description: A high power marine lithium ion battery designed to perform in extreme conditions. The PBES battery provides thermal runaway prevention. PBES has patented CellSwap technology which allows cells to be replaced at end of life, saving replacement cost.

Chemistry: Lithium-ion

Capacity (Ah @ 20hr rate): 4500Ah (3C lithium)

Voltage: 100V

Energy: 6.5kWh

Peak Power: 450A

Cycle life: 15,000 cycles @ 80% DoD

Operating temperature range: -40°F to 140°F (-40°C to 60°C)

Dimensions: 22.8" x 14.9" x 12.6" (580mm x 380mm x 320mm)

Weight: 198lbs (90kg)

Certifications: Meets or exceeds all applicable certifications

www.pbess.com



EnerSys

Product: PowerSafe ESG Battery

Description: The PowerSafe ESG battery is designed to handle the challenging load profiles and service conditions of utility applications. The configuration of five multi-cell units reduces the footprint of the PowerSafe ESG battery to enable minimal occupation of floor space.

Chemistry: Lead-acid

Capacity (Ah @ 8hr rate): 187-935Ah to 1.75V/cell @ 77°F

Voltage: Five multi-cell 4-volt units

Cycle life: 20-year life expectancy in float service @ 77°F

Operating temperature range: 32°F to 104°F (0°C to 40°C), recommended temperature: 68°F to 86°F (20°C to 30°C)

Dimensions: 6.6" x 11.1" x 18.6" to 10.1" x 11.1" x 18.7"

Weight: 87lbs to 215lbs (39kg to 98kg)

Certifications: ISO 9001:2015, ISO 14001:2004

www.enersys.com



SCHMID

Product: EverFlow Storage Container

Description: Power and capacity of the EverFlow Storage Container are easily scalable, making the intrinsically safe VRFB attractive for various applications. All components and tanks are integrated in a single 20ft or 40ft container for fast and easy installation, safe operation, and controlled environmental conditions.

Chemistry: Vanadium Redox Flow

Capacity: 20ft container typically offers up to 50kW / 200kWh

Voltage: 400V/230V / 3-phase AC

Energy: Up to multiple MWh

Peak power: Up to multiple MW, usually in 25kW steps

Cycle life: Typically 10,000

Operating temperature range: -4°F to 014°F (-20°C to 40°C)

Dimensions: 20ft or 40ft containers

Warranty: 1-year warranty

www.schmid-group.com



Hybrid Energy Storage Solutions, S.L.

Product: SHAD solution

Description: The SHAD solution is HESStec's patented technology, defined as Hybrid Energy Storage Solution (HESS) based on a flexible hardware and software platform. This enables a combination of multiple types of storage technologies (batteries, ultracapacitors, flywheels, fuel cells, etc.) optimized for specific customer uses at different levels of the electrical network, covering a myriad of grid applications.

Chemistry: Saltwater batteries and ultracapacitors

Energy: 277kW@7.8kWh (ultracapacitors), 50kW@200kWh (batteries)

Dimensions: 40ft container

www.hesstec.net

DEFENDER™ Moss Shield

Heavy Duty Internal Connections & Extra Thick Bus Bar

XC2 High Density Paste Maximizes Runtime and Battery Life

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Extra Large Mud Rest

Tough Polypropylene Case Design

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WINDPOWER 2019

May 20th - 23rd, 2019; George R. Brown Convention Center – Houston, TX

www.windpowerexpo.org

2018 has been a historic year as wind power surpassed 90,000MW installed and the AWEA WINDPOWER Conference grew 10% making it the largest show in 5 years. The wind industry's powerful growth is poised to continue in 2019, with more than 37,700MW of wind capacity under construction or in advanced development. As we move toward the 2020s, wind energy will continue to thrive through collaboration with technology, other sources of clean and traditional energy, policy makers, innovators, farmers and ranchers, rural communities, big cities, and the list goes on. In May 2019, that future begins in Houston, the energy capital of world, where leaders from the wind industry and across energy sectors will gather at AWEA WINDPOWER 2019. In Houston, we will take the next steps forward to powering that future, together!

show in print

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



Wind energy solutions

Bachmann retrofits help increase lifespan, production and efficiency through new technologies, while meeting legal requirements through grid monitoring, voltage control, and safety. Bachmann ensures spare parts supply and updates to the latest technology and grid compliance.

Bachmann Electronic

www.bachmann.info

Booth 1345



Smart components

In Texas, EMA Electromechanics produces the VDH/GSMI, which combines a circuit breaker and a high-speed grounding switch. Concerning PRC-024-1/2, the VDH/GSMI supports differentiation between internal and external faults, signaling the WTG in a fraction of the 150ms required by the standard, and providing valuable information to take the decision to shut down.

EMA Electromechanics, Inc.

www.emaelectromechanics.com

Booth 3837



Developer & operator

BayWa r.e. Wind, LLC is a turn-key developer and operator of renewable energy projects in North America. Headquartered in Carlsbad, 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

Booth 3203



Preventive blade maintenance with lightning current monitoring

The Lightning Monitoring System (LMS) from Phoenix Contact detects and analyzes in real time the magnitude, duration, number, and other parameters of surge current events caused by lightning strikes. Detailed lightning analysis can be an effective input to asset management systems to optimize the inspection intervals for wind turbine blades, as well as appraise damage requiring immediate attention. This can result in performance improvements by reducing turbine downtime and increasing availability. This has important implications as wind turbines become larger and are located in more access remote areas such as offshore applications.

Phoenix Contact

www.phoenixcontact.com

Booth 2829


Trusted Leader in Operations & Maintenance.



10 GW operations & maintenance	8.6 GW under 24/7/365 monitoring	30+ years of experience
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Let's talk energy. 

Meet us at **Booth #1821**


EDF Renewables
858.521.3575
OMSales@edf-re.com
www.edf-re.com/ao



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

Booth 1212

Transportation, distribution, and storage

The Port of Stockton is an inland facility located in the extended San Francisco Bay Area that has handled breakbulk cargo since 1933. It has 2.5 miles of on-dock rail connecting to the UP and BNSF that offer service throughout the United States. The Port is adjacent to less congested highways, I-5, CA-4, and CA-99, and is an hour from I-80. It has handled shipments of clean energy cargo of all shapes and sizes. The Port of Stockton has around the clock security and uniquely offers customers 24/7 access to their freight.

Port of Stockton

www.portofstockton.com

Booth 4046



Versatile and durable torque tester

SmartCheck is a newly launched small sized, versatile, and easy-to-use torque tester suitable for any workshop and service vehicle. Its compact dimensions coupled with its rotatable display and the ability to mount it horizontally or vertically, provides versatility in any location. With a splash-proof display and keypad, it can be operated through power supply or battery. SmartCheck quickly provides information on whether or not a torque wrench is within the prescribed tolerances or if it requires adjustment. The integrated visual and audible overload protection mechanism and impact resistant plastic housing ensure the durability associated with STAHLWILLE products.

STAHLWILLE

www.stahlwille-americas.com

Booth 3336



Bolt tensioning cylinders

ITH bolt tensioning cylinders are designed for tightening large diameter bolts on all major OEM wind turbine applications including: foundation rods, tower bolts, bearing bolts, and more. They offer compact and lightweight designs, including patented safety features. A full catalogue of standard designs, and a large scope of modified and custom designs are available to meet specific customer needs.

ITH Engineering

www.ith.com

Booth 2045



Wind farm inspection services

Measure offers full wind farm drone inspections which include comprehensive visual inspection for turbines, a full site overview with easy access to raw images and custom reports, and portfolio analytics to track the performance of wind turbines over time. Measure's drone solution improves inspection efficiency and turbine productivity, reducing man-hours for maintenance checks by 75% and requiring less downtime for expensive repairs.

Measure | www.measure.com/wind

Booth 3032



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Wind blade coatings products

Mankiewicz announces two new advanced coatings products that maintain turbine blade surfaces for optimal performance and efficiency. BladeRep Profile Filler 5 advantages include a short time to sand, fast pot life to drying ratio, and a wide application window allowing all-season repairs. BladeRep LEP 10 is designed to provide single-layer protection for the leading edge areas of turbine blades from damages caused by rain and particle erosion. These coatings meet the requirements of the cosmetic blade maintenance market, as well as OEM blade specifications for high quality and durable products.

Mankiewicz Coatings

www.bladerep.com

Booth 3503



Synthetic lubricant solutions

AMSOIL specializes in developing synthetic lubricants backed by a long-term warranty. AMSOIL PTN 320 is formulated with extreme-pressure additives, providing high resistance to scuffing wear and micropitting fatigue on gear surfaces operating under extreme pressures and shock loads. The next-generation additive technology delivers outstanding overall performance in areas critical to wind applications, including water resistance, filterability, long-term foam control, rapid air release, rust and corrosion inhibition, and paint and seal compatibility. PTN 320 has earned approvals from wind turbine, gearbox, and bearing manufacturers including GE, Siemens Gamesa, Vestas, ZF, Winergy, Moventas, NGC, SKF, Timken, Envision, Eickhoff, FAG, Flender, and more.

AMSOIL, Inc.

www.amsoilwind.com

Booth 1945



Wind development region

Kansas is ranked No. 2 in wind potential and is among the top five states for operating wind farms, with 5653MW of wind farms currently in operation and 1900MW in new projects announced. Kansas wind is cost effective due to high capacity factors, and has therefore been attractive to corporate and out-of-state off-takers, which are purchasing a significant percentage of the wind energy produced in Kansas. Centrally located in the heart of the wind corridor, Kansas offers access to the key regions for wind farm development and an advantageous operating environment for developers, wind turbine component manufacturers, logistics, and other service providers. The Kansas Department of Commerce is the primary point of contact to assist companies in learning about the state's wind industry and finding the ideal site for their operations.

The Kansas Department of Commerce

www.kansascommerce.gov

Booth 3235



Blade inspection and repair

Wind generation asset owners want to maximize power production over the project's lifespan, but many owners don't prioritize blade inspections and repairs until it's too late and they experience a costly failure. Damaged blades are a major cause of wind farm under-performance, and replacing even a single blade can be very expensive. Regular blade inspections are essential to catch problems early, thereby minimizing downtime and the cost of repairs. EDF Renewables' Blade Maintenance Program uses robotic drone automation and AI analytics to ensure accuracy and cost effectiveness. High-resolution photographic inspections of each blade yield data that is standardized and quantifiable, and can be used to optimize blade life cycle management. In addition, their inspection reports grade any damage and provide operating guidelines and customized recommendations to prioritize repairs and bring blades back to peak performance.

EDF Renewables

www.edf-re.com

Booth 1821

A complete portfolio of comprehensive engineering, procurement, construction management & testing services for project development

Interconnect Assistance & Electrical Studies
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Engineering with Distinction

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www.electricalconsultantsinc.com

No More Climbing

The Climb Auto System by 3S Lift allows technicians to focus on the job and not on the climb. It eliminates the need for climbing completely, improving AEP, Health & Safety and employee retention.

The single technician ladder mounted lift is easily retrofitted into any modern wind turbine - often in 8 hours or less! It provides the ease-of-use of a service lift with the low cost, low maintenance and reliability of a climb assist.

Find out more at:
3SLift.com/ClimbAuto

3S Lift Safe · Simple · Specialized
Access Equipment



Suite of O&M solutions

SkySpecs offers a suite of products developed with expediency, accuracy, and automation in mind. AI-powered inspections and Horizon, SkySpecs' blade asset management software, helps their customers be proactive in their O&M decision making.

SkySpecs

www.skyspccs.com

Booth 3821



Precision pitch control

Parker D*FC hydraulic proportional valves are designed to meet the tough demands pitch control systems demand. The D*FC valve is a direct drive design with precision spool feedback. The electronics are mounted in a ruggedized enclosure that has been shock tested for long life in the high vibration environment. The valve is available in both the NG6 (D03) and NG10 (D05) sizes. Mounting and wiring are compatible with all existing on-board electronic models. Both current and voltage input signals are available. The high dynamic electronics delivers precise smooth control the turbine pitch actuator.

Parker Hannifin - Energy
solutions.parker.com
Booth 1245



Fall arrest cable sleeve

The new SKYLOTEC CLAW Vertical Fall Arrest Cable Sleeve is designed to fit a wide variety of wire ropes and travel along the vertical system while providing fall arrest when needed. Engineered to fit 3/8 and 5/16-inch wire rope, this high quality, lightweight stainless-steel device travels smoothly up and down the vertical system without hanging up. The redundant safety features reduce the risk of improper installation and unsafe situations. The CLAW is independently tested to meets ANSI A14.3-08, CSA Z259.2.5-17 and OSHA requirements.

SKYLOTEC
www.skylotec.com
Booth 1930



Battery torque wrench

Torkworx introduces the new Digital BRAD, up to 2x faster than their previous version. The DBRAD powered torque wrench is a digital cordless 18V lithium-ion battery tool with advanced patented technology containing digital display and single increment torque settings. With programmable preset torque and angle settings, this torque wrench has an accuracy of +/-5%. It offers an automatic 2-speed gearbox and available gear turning accessories.

Torkworx
www.torkworx.com
Booth 3528



Carbon brushes and brush holders

Helwig Carbon is a manufacturer of carbon brushes and brush holders used on wind turbine generators. American made ISO certified. Their products are designed to provide long life and low maintenance costs.

Helwig Carbon Products, Inc.
www.helwigcarbon.com
Booth 4330

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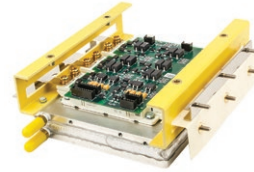
timken.com/wind-energy



Tools

Dakota Riggers is a stocking distributor for Tuff Bucket products. These high-quality lifting buckets feature the innovative roll-down closure system. This closure system allows for the bucket to fully load, rated both right side up and upside down. Tuff Buckets are available in a variety of different sizes, in either heavy-duty canvas or vinyl-coated polyester material.

Dakota Riggers | www.dakotariggers.com
Booth 3136



Rotor and line assemblies

Ludlum Wind provides new upgraded ESS and non-ESS rotor and line IGBT assemblies for the GE 1.5 series turbines. They have been providing parts to the wind industry since 2010, featuring short delivery times (typically 3 days) with products maintained in stock. Ludlum has over 400 employees and is a vertically integrated manufacturer that began in 1962. Upgraded components and Ludlum's custom AEBM board are integrated to provide improved operation at high temperatures and a longer operating life. Reusable packaging with custom cut high-density foam and custom reusable steel shipping plates protect the fiberglass standoffs and the bus connections during shipment to the customer ensuring products arrive safely every time. Ludlum's highly integrated manufacturing allows them to have control over product quality, delivery time, costs, and allows them the capability to offer long-term support.

Ludlum Wind

www.ludlumwind.com
Booth 1302



Anchor bolts and fastening systems

Cooper & Turner is a manufacturer of high quality, high strength, safety critical, large diameter (M16 to M100) hex bolts, double ended studs, and thread rod. Employing automation (including in process NDT inspection) and robotics results in high quality and consistent products, having full lot traceability, for supplying the global wind turbine market, OEM's, and major tiers as well. Recently opening an anchor bolt manufacturing plant in Pueblo, CO., they use 100% USA material and manufacturing, producing anchor bolts to ASTM A615 Grade 75 and Grade 90, plus ASTM A722 Grade 150, with all accessories (nuts, washers, and PVC sleeves), with bolt caps and grease optional. All assemblies are tested in a USA independent lab.

Cooper & Turner

www.cooperandturner.com
Booth 3845

Optimize the value of your wind project.

Start with the people who can plan, design, permit and construct them as well as make the necessary interconnections. Discover the benefits of an inclusive team with customized services at burnsmcd.com/AllForWind.

BURNS MCDONNELL

CREATE AMAZING.



The challenge

*Harvesting energy
safely and efficiently*

From filtration and condition monitoring to custom hydraulic power units and advanced accumulators and cooling solutions, Parker has the precision-engineered products and turnkey systems to help the most sophisticated wind power plants generate energy more efficiently, while improving reliability and uptime.
 See us at AWEA WINDPOWER - Booth #1245



ENGINEERING YOUR SUCCESS.
solutions.parker.com/AWEA2019



Composite wind blade manufacturer

TPI is a global independent manufacturer of composite wind blades for the high-growth wind energy market supporting global wind turbine manufacturers. TPI's products provide high strength, light weight, and durability. TPI has over five decades experience manufacturing quality large-scale composite structures at a competitive total delivered cost. Its advanced composites manufacturing technology allows TPI to build near aerospace grade parts at industrial prices.

TPI Composites

www.tpicomposites.com
Booth 2845



Offshore wind site assessment

Berger Geosciences has experience in marine site assessments including areas of archaeology, biology, oceanography, meteorology, and geology. Their team can provide a turn-key solution for acquisition of site assessment data and information to meet or exceed government and industry requirements.

Berger Geosciences

www.b-geo.com
Booth 4353



Full service engineering and design

Electrical Consultants Inc. (ECI) was incorporated in 1985. Their in-house portfolio of services, including overhead and underground transmission engineering, substation and switchyard design, industrial power systems design, land survey and construction staking, right-of-way services, environmental planning, project management, construction management, and procurement services have provided a key resource for hundreds of utilities. ECI brings extensive experience in power delivery services through 500 kV to their clients.

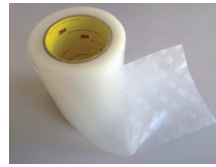
Electrical Consultants, Inc.
www.electricalconsultantsinc.com
Booth 2945



Heavy and specialized transportation

Landstar provides specialized and heavy haul transportation services. Whether hauling a single machine or managing a complex project, Landstar has the experience, capacity, and equipment to move any heavy/specialized freight. Their vast array of specialized equipment includes flatbeds, stepdecks, double drops, extendables, multi-axes, steerables, lowboys with 40-80 ton capacity, RGN units, beam, perimeter, and more. Landstar provides safe, secure, claim-free deliveries of over-dimensional, heavy weight freight.

Landstar
www.landstar.com
Booth 1402



Protecting AEP by protecting leading edges

AEP losses from blade erosion are not inevitable. 3M Wind Protection Tapes shield leading edges and surfaces from pitting, wear, and water ingress. Proven successful in aerospace for 40 years, these tapes are made from tough, abrasion-resistant polyurethane elastomers which resist puncture, tearing, erosion, and weathering. They are UV stable, solvent-free, and conform to complex shapes. 3M Wind Protection Tapes have shown they help maintain turbine efficiency, help reduce downtime and maintenance, and can help extend the useful life of blades.

3M
www.3M.com/wind
Booth 2531



Transportation and logistics

TP&L's services can be introduced anywhere along the supply chain. They serve OEM's, project developers, and transportation companies. TP&L is also available to help plan rail load outs from port to pad. Their in-house engineer is open top loading certified and available every step of the way. TP&L's partners bring with them over 40 years of combined transportation experience in all sectors-port, truck, rail, and distribution services.

Transportation Partners and Logistics
www.tpandl.com
Booth 3515

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Accurate and reliable sodar systems

REMTECH manufactures DOPPLER SODAR(s). Their SODAR systems remotely measure a vertical profile of thermal stratification, horizontal and vertical wind speeds, horizontal wind direction, and turbulence parameters. The vertical range is well over the largest wind mills highest level (250m). They are accurate, very low power, and extremely reliable.

REMTECH Inc. | www.remtechinc.com
Booth 4537



Offshore wind developer

For 25+ years, Ørsted has been developing, constructing, and operating offshore wind farms and is responsible for more than a quarter of the world's installed offshore wind capacity. In the U.S., Ørsted can deliver clean energy to the seven states on the East Coast that have committed to build more than 10GW of offshore wind capacity by 2030. They operate the Block Island Wind Farm, America's first offshore wind farm, and have a comprehensive geographic coverage with a large pipeline of development capacity. Ørsted is committed to bringing the benefits of offshore wind to the U.S., including cost competitive, clean, reliable energy along with economic growth and job creation.

Ørsted U.S. Offshore Wind
us.orsted.com
Booth 3603



Project development and planning

With more than a century of experience building power infrastructure throughout North America, Burns & McDonnell has provided engineering and consulting services on more than 60,000MW of renewable wind capacity. Their team can support every aspect of a wind farm's life cycle. From siting to detailed design, environmental permitting to technology selection, grid planning to due diligence, owner's engineer services, and much more. They also have the engineering perspective to model and design necessary interconnections with the high-voltage grid. The in-house team of Burns & McDonnell engineers, environmental specialists, and consultants can develop a customized set of services to help their clients optimize the value of their wind projects.

Burns & McDonnell
www.burnsmcd.com
Booth 1415



SAFETY CRITICAL WIND ENERGY FASTENERS

- Over 150 years of manufacturing experience and 25 years providing safety critical fasteners to the wind energy industry.
- Proven partner for OEMs and construction companies.
- ISO 9001, 14001, and OHSAS 18001 accredited.
- Hot and cold form bolt and stud production
- Distribution facilities in the US, Europe, and Asia

We currently support all aspects of the wind turbine market, providing a range of fasteners, both standard and customer specifics:

- Nacelles
- Blade to Hub
- Foundation Hardware
- Tower Flange Assembly
- Off-shore Transition Bolts & Studs



Cooper & Turner | www.cooperandturner.com
Booth 3845

HEICO FASTENING SYSTEMS

The best value to secure bolts.

HEICO-LOCK® WEDGE LOCKING SYSTEMS

The **HEICO-LOCK® wedge locking system** is the reliable solution to the problem of **securing bolted joints** in high vibration assemblies against self-loosening by rotation!

HEICO

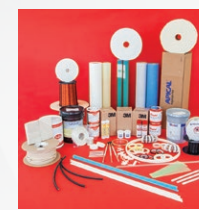
WWW.HEICO-GROUP.COM



Engineered synthetic lifting slings for wind energy installations

Samson's patented high-performance HMPE multi-loop lifting sling, Agile Lifting System, has an optimized design with a smart configuration that allows for shorter slings in wind installations, which translates into headroom savings and the ability to utilize a shorter boom. Synthetics are also 80% lighter in weight than their steel-wire counterparts. The shorter, lighter sling allows a smaller crane to be contracted and therefore reduces installation costs. Synthetic slings are cost effective for wind installations, and also offer the benefits of easy handling and high lifting capacity.

Samson Rope
www.samsonrope.com
Booth 3342



Manufacturer, converter, and distribution operations

Pittsburgh Electrical Insulation's (PEI) North American locations have the ability to slit, punch, block, sheet, and laminate both rigid and flexible electrical insulation materials - their HSP Tape, Dacron Felts, Armature Banding Tape, surge rope, and edging tapes are manufactured in-house to customer specifications. PEI is also a global distributor for producers of commutators, lugs, cables, fiberglass tapes, mica tapes and sheets, shrink and non-polyester films, Teflon and Teflon glass, silicone rubber tapes, slot liners and wedges, heat shrinkable products, laminates, resin kits, insulating paint, conductive tapes, foam tapes, slot fillers, specialty coatings, adhesives, and greases.

Pittsburgh Electrical Insulation
www.peipittsburgh.com
Booth 3103



Noise and shadow flicker analyses

Epsilon has analyzed noise impacts at more than 150 wind farms throughout the United States as well as Canada. They provide noise analyses for pre-construction energy projects as well as post-construction to ensure project compliance once completed. Epsilon's noise experts serve as witnesses on noise control issues before regulatory agencies and local siting boards, and participate in public hearings and community meetings to help explain noise effects potentially created by a project. To address community concerns and regulatory requirements, Epsilon has performed analyses for proposed wind energy projects across the United States calculating the expected duration of shadow flicker at sensitive receptors. They can prepare comprehensive reports illustrating the areas near the project where shadow flicker is likely to occur as well as provide expert testimony.

Epsilon Associates

www.epsilonassociates.com
Booth 3239



Remote sensing services

ZX300 deployment, commissioning, and data services from Campbell Scientific include long and short-term rental, deployment and commissioning, operations and maintenance, relocation, and decommissioning. Campbell Scientific provides a full commissioning report, and ensures all measurement, power equipment, and communications are online and functioning throughout the measurement campaign. They also ensure the relocation and recommissioning of the measurement equipment, power supply, and communications are properly executed with comprehensive documentation and after the campaign is complete, they decommission and efficiently remove the equipment.

Campbell Scientific

www.campbellsci.com
Booth 3345



Increase annual energy production

Clir Renewables is a renewable energy AI software company whose cloud-based tools help asset managers and owners maximize production, and give owners clarity on performance. With solutions created by renewable energy engineers and developed by software experts, Clir brings together all aspects of renewable energy engineering including data integrity, data analytics, modeling, turbine/panel engineering, control engineering, asset management, financial planning, and reporting in a high-value low-cost application. Founded in early 2017, Clir Renewables now supports 4GW of assets globally.

Clir Renewables

www.clir.eco
Booth 3914



Free standing tower cranes

Krøll provides large capacity, free standing tower cranes which are an effective solution for wind turbine erection. Where there is restricted and limited access, small hardstands, high erection height levels, and large nacelle weights Krøll cranes have provided effective alternate solutions in conditions where crawler and mobile crane could not be applied. Leavitt Cranes is the North American Agent for Krøll Cranes A/S and is capable of working with wind turbine manufacturers, developers, owners, and erectors.

Leavitt Cranes

www.leavittcranes.com
Booth 3927



Torque and tensioning tools

McCann Equipment, Ltd. is a multi-branch Canadian industrial tool distributor, specializing in the sale, service, and rental of torque and tensioning products. Services include the repair, calibration, and certification of torque tools (manual, electric, pneumatic, hydraulic), transducers, and testers. Additionally, McCann Equipment certifies air pressure gauges and hydraulic gauges as well as tension calibration testers (Skidmore). ISO 17025 accredited.

McCann Equipment, Ltd.

www.torque-tools.com
Booth 3429

AREPA

Restoring Confidence in Your Equipment

Our global equipment restoration experts provide turnkey rapid response throughout the wind energy industry – no matter where in the world restoration may be required.

For more information, visit www.arepa.com.

Wind service teams

BARR Field Services is an international wind service team, solving service issues for over 13 years. BARR holds multiple patents on tooling and processes and offers a variety of services to the industry including up-tower and down-tower dent removal, bolt extractions, flange pushes, up-tower and down-tower welding repairs, paint repairs, tower remediation, and more. With locations in Texas, Iowa, and Kansas, they can respond quickly to any urgent request.

BARR Field Services, LLC | www.barrfabrication.com
Booth 3537



Low frequency vibration monitor

America AllNumeric's low frequency vibration monitors have built-in vibration sensors which can be configured in up to 3 perpendicular directions and can receive the signal up to four external channels. This product implements the ISO 13894-1 authentication standard, PL_d, and contains a Shock Safety Detection (SSD) function certified by DNV GL. With this function, the monitor can efficiently prevent shock damage to the wind turbine. There are different output interfaces, such as CANopen, Profibus, RS485, and RS232. An online monitoring system is compatible with this product, and can record and analyze the computer's data.

American AllNumeric
www.americanallnumeric.com
Booth 4233



Highly engineered fastener products

Heico-Lock Wedge Locking Systems prevent self-loosening of critical bolted joints, which greatly improves application integrity, mitigating costly and dangerous fatigue failures, and operational downtimes. Incorporating angle geometry and axial tension rather than friction, the Heico Wedge Lock Washer effectively maintains a bolted joint's high preload requirement. Heico's Wedge Lock Washers reliably support functional elements even under extreme operating conditions like high vibration environments, dynamic loads, intense thermal cycling, and potential low preload conditions. Heico's Wedge Lock Washers and new Heico-Tec Tension Nuts for large diameter bolted joints are manufactured in Germany to ISO 16949 quality standards and are stocked in North Carolina to serve the clean energy market.

Heico Lock
www.heico-lock.us
Booth 4249



Multi-brand expertise, service quality, and flexibility

Deutsche Windtechnik, with its 1100 employees, provides independent full scope O&M services for wind turbines technologies. The services include the planning and implementation of maintenance, inspections and repairs for all components, repowering, QHSE, expertise and consulting, and much more. One key component of Deutsche Windtechnik's business model is that it provides service for turbines from Vestas/NEG Micon, Siemens/AN Bonus, Nordex, Senvion, Fuhrlander, and Gamesa. This means it can service almost all common turbine types, including most of the turbines installed in the US. On the other hand, the flexible maintenance contracts offered by Deutsche Windtechnik give operators decisive influence over the profitability of a project.

Deutsche Windtechnik
www.deutsche-windtechnik.com/home
Booth 4221



Environmentally acceptable lubricants for open gears

Klüberbio LG 39-701 N is a high-performance grease which utilizes latest types of base oil and additive packages. The product achieves eco-friendliness along with protection from high loads, good resistance to corrosion, and excellent adhesion to gear teeth. The oil from Klüberbio LG 39-701 N features high viscosity and comes from 100 % renewable resources. The behavior at low temperatures promotes utilization in automatic lubrication systems down to -22°F (-30°C). The performance is in line with traditional lubricants with the added value of environmental protection.

KLÜBER LUBRICATION NA LP
www.klueber.com
Booth 3509



Tension & Torque Kit

Minimalist
 Compact
 Lightweight

The simple solution for bolt checks

www.ith.com



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2019 AWEA WindPower Show | Kansas Department of Commerce

Kansas Wind Rankings

- **#1** in Wind Share of In-State Electricity Generation (**36.4%**)
- **#4** in Wind Generation (**19,295 GWh**)
- **#5** in Installed Wind Capacity (**5,653 MW**)
- **#5** in Cumulative Wind Investment (**\$10.5 billion**)
- **#6** in Wind Capacity Additions in 2018 (**543 MW**)
- **Top 3** in Wind Turbine Nacelle Production



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 @KansasCommerce



Cold shrink termination components

TE Connectivity (TE)'s Raychem Class 1 A cold shrink terminations (CST) are a one-piece solution for high performance in cold applied terminations for polymeric cables up to 35kV. The CST offer a reliable, fast, and easy-to-install system to ensure trouble-free service. TE's components are pre-expanded on an easy-to-remove spiral holdout, allowing installation in compact environments on prepared cable. The silicone body is formulated for tracking and erosion resistance. The extra-long stress cone aids in correct positioning and integrated void-filling mastic eliminates the need for silicone grease. Sealing mastic for the lug end is built into the expanded termination, eliminating the need for additional sealing tapes. Shear bolt and compression style terminals and pin connectors are available to provide reliable connection to a variety of conductors. The CST components have full traceability to raw materials and are in compliance with IEEE-48, CENELEC HD 629.1.S2 (includes IEC, BS, VDE, and other international specifications).

TE Connectivity
www.te.com/energy
Booth 3915



Leakproof screw-in connectors

Eisele offers screw-in connectors of the LIQUIDLINE 5500 series made of saltwater-resistant aluminum. They fulfill the special requirements for tube holding power and can be used together with aluminum heat sinks. The patented screw-in technology ensures tubes remain connected with no leaks, even in the event of frequent vibrations or movements of the tube and extreme temperature changes. To provide solutions for different application scenarios, Eisele offers the same series in both stainless steel and dezincification-resistant brass. For maximum cooling performance in power electronics applications Eisele offers its time-proven solid metal plug connectors with pivoting 90° or 45° elbows as the middle element. The elbow threaded fittings achieve more than 50% better flow rates than conventional elbow fittings.

Eisele Connectors | www.eisele-connectors.com
Booth 4227

METEODYN WT

The CFD software for wind resource assessment



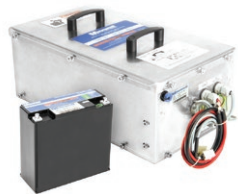
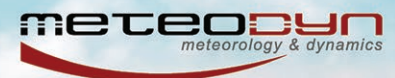
Accurate in complex terrain



Atmospheric stability contemplated



Import mesoscale data or met mast data



High power backup storage for pitch control

Maxwell assists wind farm operators and owners with achieving increased wind turbine uptime with its ultracapacitor-based energy storage for reliable emergency pitch control. Wind farms often face multiple replacement cycles and high maintenance costs for traditional lead-acid battery systems. Maxwell's ultracapacitor storage solutions for new-build turbines and retrofit solutions for existing turbines offer long life, resiliency in hot and cold environments, and efficient, high power delivery for reliable blade pitch control.

Maxwell Technologies
www.maxwell.com/wind
Booth 3327

VDH/GSMI®

34.5 kV Vacuum Circuit Breaker and High Speed Grounding Switch for Wind and Solar Power Substations



Ema Electromechanics is the designer and manufacturer of model VDH/GSMI® combined 34.5 kV vacuum circuit breaker and high speed, mechanically interlocked grounding switch (aka "grounding breaker"), a unique and patented system specifically designed for switching and grounding of wind and solar feeder circuits.



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 Tel: 325 235 8000
 Email: contact@emaelectromechanics.com
www.emaelectromechanics.com



Whether you need a system for wind blade production or repairs, contact us today to learn how Mankiewicz can provide your complete coatings solutions.



Booth # 3503



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

www.mankiewicz.com



Self-rescue and evacuation kit

The SRK-11 is used for the self-rescue and evacuation of a worker at height. This ANSI compliant self-rescue kit has been field tested for over a decade and is used in multiple industries globally. The SRK-11 assures an independent, immediate, and adaptable evacuation and self-rescue capability. This rescue kit can also be inverted and used in an assisted rescue to lower a person. This micro rescue kit is easy to use, compact, and lightweight; the 300ft. kit weighs 7.4 lbs. Custom rope lengths up to 600ft. are available. The adaptable SRK-11 can also be paired with a StepWise Lanyard to perform a self-rescue after a fall. The SRK-11 is 3rd party certified by UL as meeting ANSI Z359.4-2013. Tech Safety Lines also offers the SRK-15 that is 3rd party certified by TÜV SÜD as being CE compliant for EN341: 2011/2D.

Tech Safety Lines

www.techsafetylines.com
Booth 2345



Service lifecycle solutions for complex technologies

As an AWEA Green Team Member, DEX, a repair, parts, and manufacturing solutions provider with 35+ years of experience, will have physical IGBTs on display to demonstrate the parts before and after repair. This illustrates the advantage of repair and refurbishment as a "GREEN solution" through decreased waste and increased reliability. An informational video of the DEX facility, including operations and engineering, will be displayed throughout the show.

DEX

www.dex.com
Booth 3427



Wind turbine slip rings

United Equipment Accessories manufactures low-maintenance, high-quality slip rings for OEM and aftermarket clients. These slip rings feature a new brush technology designed to provide long life in harsh environments. UEA's design engineers work with their customers to custom build slip rings that meet a wind turbine's specifications. UEA can take current slip ring specs to design an interchangeable slip ring for any wind turbine. Single brushes can be replaced at any time, removing the need to replace entire units or sets of brushes. UEA products maintain functionality in a wide range of electrical and electronic circuits, environmental conditions, and rotational speeds.

United Equipment Accessories

www.uea-inc.com
Booth 2744



Wind turbine obstruction lighting

Compliant to FAA and international lighting standards, Flash Technology's obstruction lights mark more than 17,000 wind turbines and MET towers around the world. The integrated FTS 370i features surge protection against 99% of lightning strikes, a 360° light collector, rugged GPS receiver, a 5-year warranty, and more. Their OL800 solar obstruction light requires minimal maintenance and is suitable for temporary installations like MET towers and during wind farm construction. Standard and compact options are available.

Flash Technology

www.flashtechology.com
Booth 1831



Solutions to power electronics

AmePower is an ISO9001 certified engineering company specialized on delivering customized solutions to improve the efficiency and reliability of high-power electronics systems found in wind turbines, PV inverters, EVs, marine propulsion, and many other applications. Their area of expertise includes GTO to IGBT technology conversion, IGBT system upgrades, and form/fit/function custom converters. Their equipment is manufactured in USA, complying with buy America. Their services include repair and overhaul of old/obsolete high-power converters, contract manufacturing, retrofit/technology upgrade, pre-designed inverters, in-house testing, and engineering capabilities.

AmePower

www.amepower.com/wind-power
Booth 2915

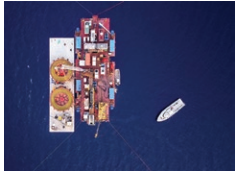


Design, assembly, and service of hydraulic accumulators

SFP provides design, assembly, and service of hydraulic accumulators used in various industries including the wind power industry. In collaboration with their customers, they provide value added solutions reducing costs, ensuring safety, and improving performance for all integrated hydraulic systems. SFP offers full service and repair of bladder accumulators both on-site and at their plant in Katy, TX. Their products are offered with wide range of approvals to suit the global requirements including ASME, CE, AS1210, CRN, and TR-CU.

SFP, Inc.

www.sfphyd.com
Booth 3450



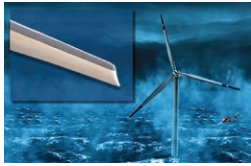
Submarine utility operations

Caldwell Marine International, LLC is a marine construction contractor specializing in submarine utility operations. CMI's main focus is marine construction, submarine power cables, fiber optic submarine cables, and systems worldwide. In operation for over 65 years, CMI has successfully carried out the installation and repair of hundreds of submarine power and telecommunications cables. CMI has built and rehabilitated many piers and docks, as well as installed many unique marine structures that require advanced installation techniques. Caldwell Marine is a part of JAG Companies Inc. which includes Northeast Remsco Construction, Huxted Tunneling, and ECI Drilling International. This working partnership provides strength, commitment, and a common goal focused on delivering "Excellence of Service" to its customers, from start to finish, on time and on budget.

Caldwell Marine International, LLC

www.caldwellmarine.com

Booth 4036



High performance blade edge protection

Resodyn Engineered Polymeric Systems (REPS), developers and manufacturers of Polymer Thermal Spray (PTS) and ResoCoat technologies, will introduce, display, and present results from a Phase II SBIR development of breakthrough blade edge protection systems. Responding to a DOE call for advanced performance protection systems, REPS developed a coating candidate showing promise against an array of benchmark technologies in rain erosion and sand erosion tests. Based on a proprietary formulation, the coating has withstood up to 16 hours of rain erosion testing at ORE Catapult (UK) at a tip speed of 125m/s, and most recently was tested at tip speeds in excess 140m/s. REPS' results are expected to be of interest to blade manufacturers as an OEM added value feature and to field operators for repair, maintenance, and preventive application.

Resodyn Engineered Polymeric Systems

www.resodyncoratings.com

Booth 4532



Ladder mounted technician lift for wind turbine generators

The Climb Auto System is wind's new climb assist, improving health and safety, and reducing the cost of ownership. The Climb Auto System is a single technician (rated at 310lbs) ladder-mounted lift that completely eliminates the physical and mental strain of climbing. It features safety control switches on both handles, a remote mode for the easy transport of tools, and collapsible pedals for rapid evacuations in the event of an emergency. It offers an independent fall arrest systems for personnel and the Climb Auto System. The Climb Auto System can be easily retrofitted to any new or existing wind turbine ladder, often in only 8 hours. It has certifications from CE, UL, ANSI, OSHA, and more and has been installed in over 30,000 towers worldwide. The Climb Auto System is a safe and cost-effective way to ascend a tower and lets technicians keep their minds on the job and not on the climb.

3S Lift | www.3SLift.com

Booth 4421



Automatic obstruction lighting

DeTect developed the HARRIER Aircraft Detection Lighting Systems (ADLS) for automatic obstruction lighting activation for aviation obstructions such as wind farm turbines, high voltage transmission lines, and communication towers. The HARRIER ADLS provides reliable, continuous 360° radar surveillance of the airspace around wind farms, power lines, and other installations that require aircraft obstruction lighting from the ground level to above aircraft flight altitudes, automatically issuing signals to activate lighting when aircraft are detected at a defined outer perimeter. ADSB integration minimizes lighting activation from high altitude commercial aircraft. The HARRIER ADLS is also multi-function capable and can provide site security for aircraft, ultra lights, and drones as well as bird detection for environmental monitoring and risk mitigation. HARRIER is also fully compatible with all SCADA systems and turbines.

DeTect | www.detect-inc.com

Booth 4420



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ECONOMICAL,
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1300R MkII Oil Filter Element

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Dirt holding capacity: 296.6g

***"R005" with 5μm media also available
Exceeds GE 1.5 OEM Spec*

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High performing gearbox oil

Shell's engineers have created a wind turbine gearbox oil that delivers exceptional oil life, tested using the ASTM D2893 method. ASTM D 2893 exposes the lubricant to heat and oxygen (in the form of air) for prolonged periods to accelerate aging. A measure of the viscosity increase at the end of the test is used to gauge the resistance to ageing. The less the lubricant thickens, the higher its resistance to ageing. Shell's new wind turbine gearbox oil, Shell Omala S5 Wind, was tested against the standard test, and subjected to a four-fold increase in the test duration. Shell Omala S5 Wind offers an oil life of ten years in the field, giving wind turbine owners and operators peace of mind of its longevity and performance in today's challenging conditions.

Shell

www.shell.us/power

Booth 2921



Secure bolting solutions

Nord-Lock Group provides secure bolting solutions, creating a safer world by focusing on the integrity of mechanical solutions that are critical to our way of life. The Group offers four key technologies: Nord-Lock original wedge-locking washers with wedge locking technology that makes unintentional loosening impossible, even when exposed to severe vibration and dynamic loads. Superbolt mechanical tensioners that can accurately and safely achieve high preloads while using only hand tools. Expander System pivot pin replacements that provide a permanent solution to lug wear eliminating the need for expensive welding and line boring, and Boltight hydraulic tensioning tools which can provide a low profile solution for space-restricted applications demanding high and accurate preloads, such as wind turbines. Together Nord-Lock Group is providing safe and innovative solutions to safeguard human lives and customer investments.

Nord-Lock Group

www.nord-lock.com

Booth 3403



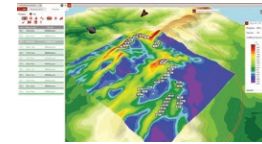
High performance filtration systems

Wahne Filtration's low cost and high performance gearbox and hydraulic filters exceed OEM requirements. Veteran owned and operated.

Wahne Filtration

www.whfilter.com

Booth 4137



Wind engineering and climatology software

Meteodyn computes the wind through computational fluid dynamics (CFD) to accurately assess the wind at the local scale. They provide software solutions for the design and operation of wind farms. Meteodyn WT is a software which provides an accurate assessment of the wind resource. It can compute the wind on any terrain, including forests, mountains, lakes, etc. It helps determine the best location for wind turbines to maximize production. Meteodyn SPA is a software for wind farm monitoring and maintenance optimization. It processes and analyses SCADA data to detect if a wind turbine is underperforming.

Meteodyn

www.meteodyn.com

Booth 3437



Renewable energy infrastructures

CONSERTEK USA provides complete EPC products and services in the renewable energy sector for all meteorological analysis projects, including engineering, procurement, construction, instrumentation, and commissioning of met towers. In addition, CONSERTEK USA provides inspection and maintenance services on any MET Towers as per TIA-222 standards. CONSERTEK USA also provides support booms and accessories, instrumentation cabinets, and ancillary services for wind farms. The cabinets are designed, assembled, and installed by CONSERTEK USA's technicians. The logger program is in lab pre-tested. The support booms are compliant with the latest edition of IEC 61400.

CONSERTEK

www.consertek.ca

Booth 3352



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Specialized safety products

Einpart, LLC has 20 years of experience in parts, tools and special equipment. They supply and support the North and South American wind market from their headquarters located in Plano, TX. Their main product lines for the onshore and offshore wind industry are FAA approved obstruction lights, torque and tension tools with a wide range of hydraulic, electrical, and mechanical tools. Personal protection equipment, certified lifting bags, WTG components, offline oil filtration, heat products, sensors, hydraulic parts, and consumables.

Einpart LLC

www.einpart.com
Booth 2225



Tower lighting solutions

TWR is a manufacturer of obstruction lighting, visibility sensor, and radar detection systems for wind turbines and tall structures that present a hazard to aviation. With thousands of systems installed around the globe, TWR provides FAA and ICAO compliant systems. TWR showcases their latest FAA L-810 temporary light, as well as their standard L-864 lighting system, visibility sensor and controller, and can provide information about their system compatibility with radar technology.

TWR Lighting

www.twrlighting.com
Booth 2009



Community acceptance and security around wind farms

Technostrobe present LIDS (Lighting Intensity Dimming Solution), a new solution that helps wind energy developers gain a greater level of community acceptance for their projects by reducing the intensity of the lights on wind farms. LIDS technology can effectively and safely adjust the intensity of the light to the surrounding visibility present at wind farms. Light intensity can now be dimmed by 90% under clear skies conditions (10km or more of visibility). When the intensity of the lights is adjusted according to the surrounding visibility, pilot safety is maintained when they are flying near wind farms, and it significantly mitigates the impact of the beacons on local communities.

Technostrobe

www.lidsinfo.com
Booth 2914



Precision metal stampings, stator, and rotor assemblies

With 35 years of experience, Sotek stamps and laser cuts wind power stator and rotor laminations from in-house designed and manufactured tooling. Sotek manufactures vent plates, end plates, stator bars, and related components to meet client specifications. Their team of manufacturing and assembly technicians perform lamination stacking, pressing, welding, thermal fit shaft insertion, final machining, and value added services in their Buffalo, NY facility. They support purchased items, logistics, offer exceptional supply chain value, and are a seamless part of a wind power manufacturing team.

Sotek

www.sotek.com
Booth 4521



High yield wind turbines

The Nordex Group has installed more than 25GW of wind power capacity in over 40 markets and generated sales of around EUR 2.5 billion in 2018. The company currently has more than 5500 employees. The product portfolio is focused on onshore turbines in the 2.4 to 5.XMW class, which are designed to meet the market requirements of countries with limited available space and regions with limited grid capacity.

Nordex USA Inc.

www.nordex-online.com
Booth 2521

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SOLAR CANADA

May 8th - 9th, 2019; BMO Centre – Calgary, Alberta, Canada

www.solarcanadainformation.ca

The Canadian solar energy market is growing rapidly. Provincial governments and consumers are focusing more on renewable energy in an effort to lower greenhouse gases and utilize more affordable sources of energy. This has created a tremendous opportunity for companies to expand their market presence in Canada. Solar Canada Conference & Exposition provides an excellent platform to connect with industry professionals and enter this growing market.

Take advantage of this unique opportunity to network with thousands of attendees and hundreds of exhibitors representing the entire industry: solar integration, development, engineering and EPC, equipment manufacturers, utilities, consultants, federal, provincial and municipal governments, communities, and students.

show in print

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



Bifacial PV racking

Opsun is a manufacturer of Bifacial PV Racking. Their team of specialists can design, optimize, engineer, and manufacture a racking system adapted to any project's requirements. They can tailor a system for any bifacial PV application (rooftop, ground mount, wall mount), and work with flat roof systems, anchored or ballasted, with tilt angles from 5° to 30°, with panels elevation from the roof ranging from 8" to 24". Recommended applications for bifacial PV includes 15° tilt, 16" from the roof (at the front), with no rails or obstruction behind the panels, no wind deflector, 100% aluminum, 20-year warranty, fully engineered for the application at a competitive price.

Opsun

www.opsun.com



Easy-to-install racking and mounting solutions

SunModo's EZ standing seam clamps make solar PV installations on metal roofs easy. Featuring rust-free aluminum alloy and roof-safe oval end set screws, the clamps work on a wide variety of seam profiles. The set screw of the 1" EZ Standing Seam Clamp can be installed on either the vertical leg of the clamp or on the 10-degree leg of the clamp. The 2" EZ Standing Seam Clamp installs in situ at the desired seam attachment location. No more sliding the clamp up the roof line with this two-part assembly. They offer four different standing seam clamps for specific project needs. Available in 50mm width standard version with 2 set screws or 30mm width mini version with 1 set screw.

SunModo Corp.

www.sunmodo.com



Integrated PV solution for harsh conditions

GP JOULE is a global renewable energy company developing, engineering, constructing, operating, and financing commercial and utility-scale renewable projects. Globally, GP JOULE has installed over 550MW of PV projects and manages 600MW of assets across Europe and North America. Their full range of PV products and services is focused on delivering low installed cost in tough environments. Combining turnkey EPC expertise with its proprietary PHLEGON single axis tracker, GP JOULE offers a bankable solution with engineering, installation, and commissioning services. Designed specifically for harsh climates and challenging sites, the PHLEGON tracker uses heavy-duty linear actuators that intelligently integrate German-engineered control systems. This technology contends with heavy snow and high winds to ensure production 365 days a year. Cost-effective PHLEGON utilizes up to 50% fewer piles, has a low fastener count, and offers easy ground maintenance access.

GP JOULE

www.gp-joule.com



O&M services

EDF Renewables provides a full suite of O&M services to more than 10GW of renewable energy projects across North America, and is experienced at working with technology from all major solar OEMs. The company offers total-project solar O&M services that include balance-of-plant management, as well as maintenance and repair of inverters, trackers, modules, and combiner boxes. Additional service offerings include functional checks, testing and maintenance of backup batteries, sampling MV transformer oil, and infrared (IR) scans of collection components including MV and substation transformers and substation overhead infrastructure. Their Operations Control Center provides 24/7/365 remote monitoring, SCADA, and regulatory and compliance support, as well as a spectrum of availability guarantees. Through its Performance and Reliability Engineering group, the company offers engineering support in addition to performance reporting and analysis.

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Wire management with integrated grounding

CAB Solar Cable Management has a new, patented Integrated Grounding system. It utilizes copper composite messenger wire in place of the standard system's galvanized, and it can act as the EGC and GEC. The new system uses grounding hardware on the L-brackets that allows them to bond the messenger wire to the pier and eliminate jumpers at each pier. This system saves both labor time and product cost. It is safety listed by Intertek to UL 2703 and the L-brackets are UL 467 compliant. Engineering reports on the system and installation best practices are available.

CAB Solar Products

www.cabproducts.com/solar-power



Self-powered solar tracker

Solar FlexRack TDP 2.0 Solar Tracker with BalanceTrac is now available with a self-powered option for crystalline and thin film solar modules. Solar FlexRack's latest tracker technology bundles an advanced tracker design with full project support services. Features include: up to 90 modules per row, rotational range of 110° (± 55°), optimized for 1000V and 1500V modules, and low per-unit fixed costs for BOS savings and more.

Solar FlexRack

www.solarflexrack.com

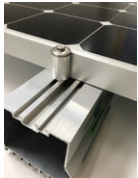
May 29th - 30th, 2019
Georgia World Congress Center
Atlanta, GA

www.events.solar/southeast

Solar Power Southeast event features prominent executives, including an opening general session anchored by leaders from Radiance Solar, Cypress Creek Renewables, Game Change Solar, Recurrent Energy Group and SEIA and SEPA. This event will showcase products like solar attachment systems, Roof Clamps, rubber molding, snow guards, snow rail systems, and much more.

show in print

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



Rackless and robust mounting system

SolarStack is a mounting system designed to eliminate racking and rails by using a code approved foam adhesive instead of roof penetrations, keeping the roof warranties intact. This method of solar mounting is cost effective and reduces labor costs and installation time by 50%. Patented and meeting stringent wind codes, SolarStack is designed to meet 185mph winds. Certified Florida Product Approval including HVHZ (High Velocity Hurricane Zone). SolarStack eliminates drilling holes, inserting screws, and locating structural connection points on the roof for positioning of the solar panel.

SolarStack

www.solarstack.com



More power from every roof

Panasonic HIT AC Series Module combines the efficiency of HIT solar modules with the intelligence of Enphase microinverters to deliver maximum power production from every roof size and shape. An Enphase IQ 7X microinverter with Individual MPPT tracking is integrated with HIT high efficiency solar technology, offering extreme efficiency and high power output for residential solar systems. The all-in-one smart panel enables more power, easy installations, low costs and high ROI. Panasonic's HIT X-Phase AC Module's low temperature coefficient of $-0.258\%/^{\circ}$ generates more solar power on the warmest days.

Panasonic

na.panasonic.com/us/solar

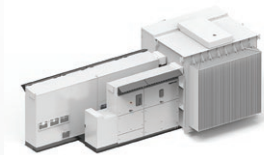


Fully ballasted, non-penetrating system

Preformed Line Products introduces the POWER MAX Ballasted Roof Mounting System. The POWER MAX solar mounting system is engineered to maximize energy output on commercial flat roofs. Developed with the professional installer in mind, this system offers adjustable inter-row spacing in the field of up to 11". It features 50% fewer components and a simplified design resulting in fast assembly rates and labor savings on every project. Available in a flush mount, 5° or 10° tilt, or higher density dual tilt design, the POWER MAX base arrives stacked on pallets providing easier transport to the roof. Engineered as a fully ballasted, non-penetrating system, it accepts standard concrete blocks and is qualified by wind tunnel testing.

Preformed Line Products

www.preformed.com



Versatile plug & play inverter solution

Ingeteam's Medium Voltage Inverter Station is a compact, customizable, and versatile plug & play solution that can be configured to suit each customer's requirements. This medium voltage solution integrates all the devices required for a multi-megawatt system, customized up to 5.4MVA. With high adaptability and power density of $5.2W/in^3$, not only does Ingeteam's Inverter Station offer low CAPEX, but also low OPEX, thanks to its long-lasting design, ease of access and serviceability, and maximum protection. The high-performance design uses electronic conversion topologies capable of achieving efficiency values of up to 98.9%. Its dual channel air cooling system makes it possible to increase the ambient operating temperature for enhanced functionality, thus maximizing return on investment. The INGECON SUN PowerMax B Series is certified in compliance with UL 1741 SA and pairs well with INGECON SUN STORAGE PowerMax three-phase bidirectional battery inverters.

Ingeteam

www.ingeteam.com



Solar field wiring

The BLA (Big Lead Assembly) takes all the guesswork out of wiring a solar field. Using Shoals' latest in-line fuse and wire manufacturing technology, they offer a site free of DC string combiners. The entire load is combined into a single pair of aluminum conductors running from the string combiner to the inverter. There's no need to trench for DC feeders or hang string combiner boxes. And when terminated with the BAC connector, the whole array is plug-&-play. Plug in the panel strings, plug into the inverter, and just walk away.

Shoals Technologies Group

www.shoals.com



Solar mounting structures

OMCO Holdings renewable division, OMCO Solar, was launched in 2007 and produces custom solar mounting structures for the solar industry. OMCO has 8GW of installed product in the industry. In 2017, OMCO Solar launched its proprietary Field-Fast solar mounting solution, benefiting from a nationwide manufacturing footprint (Ohio, Arizona, Alabama, Indiana) and leveraging steel procurement expertise to scale manufacturing in the US.

OMCO Solar

www.omcosolar.com



Covering all of the ground

The Dahlia fixed-tilt ground mount system is designed to have a high Ground Coverage Ratio (GCR). The low tilt and clearance of the system allows for the maximum amount of PV modules to be deployed on a given project site. The simplified design can be installed at a fast rate, making this system a cost effective fixed-tilt solution.

RBI Solar, Inc.

www.rbisolar.com



Architecturally aesthetic solar canopies

Quest Renewables' QuadPod solar canopies maximize commercial solar carport projects by offering safe installation, efficient construction, and low project costs. Quest's scope of work includes design, engineering, manufacturing, and site training and support.

Quest Renewables

www.questrenewables.com

June 24th - 25th, 2019
JW Marriott Austin
Austin, TX

www.events.solar/texas

Solar Power Texas provides energy professionals the opportunity to gain exclusive updates from local policy drivers and learn from leading businesses in the region. With over 400 attendees, 48 exhibitors, and a robust schedule highlighting solar, energy storage, policy, and trends impacting the Lone Star State, the event has grown to become the premier location to connect with other professionals looking to tap into this growing market.

show in print

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



High current combiner

The Shoals high current combiner uses the wire harness to combine more strings per circuit, with high power at each connection. This means a 50% reduction in return cables, up to 67% fewer torqued connections, and greatly lowered preventative maintenance costs.

Shoals Technologies Group

www.shoals.com



Mounting system for asphalt shingle roofs

Attaching solar panels to an asphalt shingle roof is easy with the Shingle PowerFoot from Solar Connections International. Starting from the base, the PowerPlate is made from durable 0.032" aluminum and includes reference and center marks for easy alignment. The 6061-T6 L-Foot features a fully pre-applied EPDM Gasketed base which provides an additional layer of water protection.

Solar Connections

www.solarconnections.com

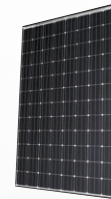


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OMCO Solar

www.omcosolar.com



Home solar and battery storage

Panasonic HIT offers an efficient solar module, providing homeowners with decades of reliable sustainable power. Add their intelligent battery storage solutions and deliver a complete solar + storage system. Homeowners can improve grid independence and save money with a fully integrated energy ecosystem that keeps their family powered up during outages and peak rate periods. With full support from Panasonic, installers can offer a 25-year warranty on HIT solar panels which covers product, performance, parts, and labor.

Panasonic

na.panasonic.com/us/solar



Black mono modules

Axitec's AXIblack premium solar modules are suited for installations where the black exterior design must match performance. These high performance monocrystalline solar modules reach efficiencies up to 19.55%, guarantee high power output, and a spinning meter.

Axitec Solar

www.axitecsolar.us



Easy-to-install racking and mounting solutions

SunModo's EZ standing seam clamps make solar PV installations on metal roofs easy. Featuring rust-free aluminum alloy and roof-safe oval end set screws, the clamps work on a wide variety of seam profiles. The set screw of the 1" EZ Standing Seam Clamp can be installed on either the vertical leg of the clamp or on the 10-degree leg of the clamp. The 2" EZ Standing Seam Clamp installs in situ at the desired seam attachment location. No more sliding the clamp up the roof line with this two-part assembly. They offer four different standing seam clamps for specific project needs. Available in 50mm width standard version with 2 set screws or 30mm width mini version with 1 set screw.

SunModo Corp.

www.sunmodo.com

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Critical Conditions

The desperate need for fail-proof backup power in medical facilities

by Alex Saucedo

As our world becomes increasingly connected, we become ever more reliant on power. Most of us view a temporary loss of power as a nuisance, an interruption to the way we live with our gadgets and electronics. But when we or a loved one needs it the most - in a medical facility - a power cut is a thoroughly frightening prospect. While it may not be something we often think about, the consequences of such an incident can be devastating.

In 1987, New York Hospital suffered a 22-minute power outage. During this outage, the electric respirator of a prematurely born, 40-day-old infant stopped. Aware of the infant's reliance on this respirator, staff were prepared for this complication and began efforts to help him breathe with the use of a manual air pump. Sadly, these attempts were insufficient, and the baby died.

Of course, this was decades ago. Policies, procedures and backup power technologies have greatly evolved since then. Yet in 2005, during Hurricane Katrina, 45 patients at Memorial Medical Center in New Orleans, died - a direct result of a power outage.

Code red

The 1987 outage at New York Hospital was caused by backup generators failing during a scheduled repair of the main power plant. This problem has continued to overshadow hospitals.

During a New York City-wide blackout in 2003, not only did multiple backup generators fail in hospitals, but it was also reported that fuel supplies for those generators fell to critically low levels as fuel trucks struggled to maneuver across the city. Fuel shortages were a problem again during Hurricane Rita in 2005, and again in 2012, when Hurricane Sandy hit New York and New Jersey. During these incidents, two major hospitals required bucket brigades to haul diesel up to the floors where the generators were located. Despite this effort, the generators in both hospitals failed - hundreds of patients had to be evacuated.

Hospitals suffered backup power failure again after both the Christchurch earthquake of 2011, and the 2012 earthquake and tsunami in Japan. In addition, a 2015 flood in the Tamil Nadu state of India resulted in the deaths of 18 patients.

An uphill battle

The issues facing hospitals regarding their power supplies are complicated. An aging power grid infrastructure, combined with an ever-increasing demand for power and a deluge of extreme weather events, has led to precarious circumstances in which power outages are becoming more regular. According to Eaton's Blackout Tracker Annual Report, in 2017, the United States alone suffered 3,526 power outages lasting an average of 81 minutes each.

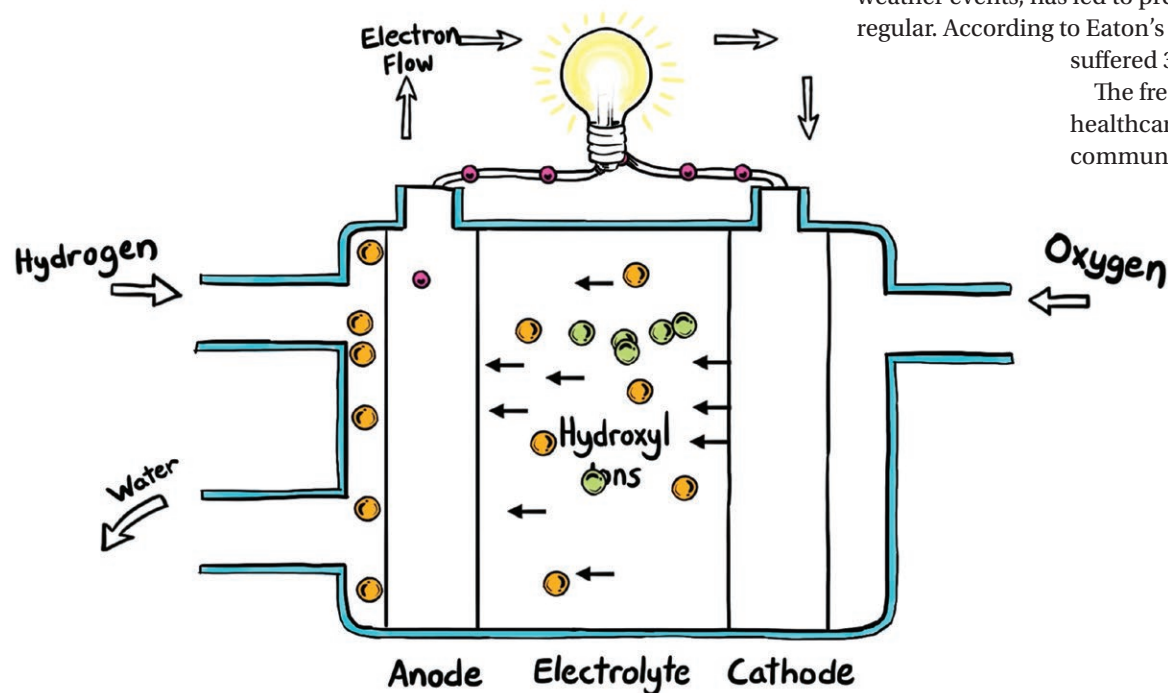
The frequency and impact these outages can have on all aspects of healthcare services (acute care and emergency response, life support devices, communications and file retrieval, medication storage, air quality, temperature control, sewage disposal, and water purification systems) underscores the need for fail-proof backup power.

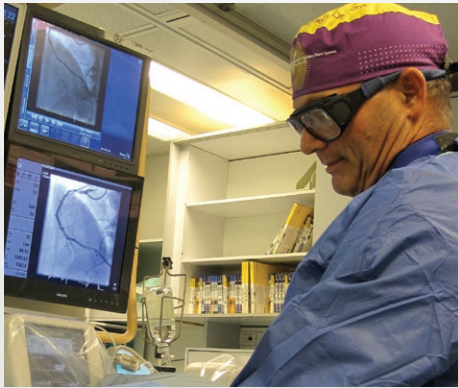
The National Fire Protection Association and the National Electrical Code both require US healthcare facilities to have emergency power restored within 10 seconds of an outage. Facilities are also required to have 96 hours' worth of emergency power fuel. It's clear, however, that these failproof measures aren't failproof enough.

Code green

Backup diesel generators have proven inadequate time and again, and yet, even at the cost of human lives, they continue to be used. This has to change.

Renewable energy alternatives like wind and solar offer a source of clean energy, but they don't always deliver the power we need when we need it. Fuel cells can address this problem. They meet the specific power requirements crucial in fast-paced and critical settings





Alex Saucedo is GenCell Director of Sales North America. GenCell's G5 system is a long-duration UPS (uninterruptible power supply), hydrogen-based fuel cell solution that supports off-grid and rural electrification. Since its founding in 2011, GenCell has grown to more than 80 employees, including many veterans of the Apollo & Mir projects. The company is headquartered in Israel with a worldwide distribution and support network.

GenCell Energy /// www.gencellenergy.com

such as hospitals. Unlike renewables, they are not weather dependent but weather resilient, providing a perpetual source of reliable power.

The answer to long-duration, uninterrupted power supply lies with fuel cells. Hydrogen based fuel cells are completely clean, and add an extra layer of protection and redundancy for mission critical equipment, ensuring 100 percent functionality in case diesel generators fail. With a smaller footprint and with no CO2 emissions, they can be stored both indoors and outdoors, where they can also be better protected from severe weather conditions including floods.

Advanced hydrogen fuel cell backup power solutions are designed with remote IoT monitoring capability, providing visibility into system health at all times. This ability to control and maintain the fuel cell remotely offers the assurance that, as soon as it's needed, this back-up power supply will kick in to maintain full functionality. Unlike diesel generators, they do not require maintenance checks; any potential issues will be identified long before the system can reach the point of failure.

In addition to providing lifesaving power during outages, hydrogen fuel cells and their dynamic load capacity also provide a backup power solution that easily absorbs the high load demands created by imaging devices and other sophisticated equipment. Indeed, to prevent any interruption to power flow, the Hillel Yaffe Medical Center in Israel recently installed a hydrogen-based fuel cell within its cardiac catheterization unit. They have now eliminated the possibility of damage to their delicate equipment, and crucially, they've avoided equipment downtime and interruptions to surgical procedures, further reducing risk to life.

Unfortunately, the situation with aging power grids isn't going to improve any time soon. What's more, as we head towards a world of increased electrification, the demand on these energy suppliers is going to climb. Add ongoing extreme weather events, and these medical facilities face a multitude of challenges. However, there are solutions designed to help mitigate these issues. The onus is now on our hospitals and other critical care facilities to invest in a more reliable emergency power solution - one that won't fail when it's needed most.

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Adapting to Climate Change as a Caribbean Energy Developer

by Bruce Levy

SINCE HURRICANES IRMA AND MARIA TORE

through the Caribbean in 2017, energy resilience has been at the forefront of industry conversations, as communities restore damaged infrastructure and debate future systems. The storms not only ramped up the urgency to decarbonize energy systems to combat climate change, but also served as a harsh reminder to do so in a way that will withstand increasingly extreme conditions. In response to this call for resilience, some Caribbean islands have passed renewable energy resolutions and attracted developers to the region hungry for new investment in wind and solar energy. But within the fresh opportunities, these new players also have intensifying climate conditions to consider at every stage of the development process.

Raising the stakes for energy

Building resilient energy infrastructure is part of a larger narrative in the Caribbean. Islands stand at the literal frontlines of devastating hurricanes, rising sea levels, and more frequent and severe heat waves. By taking measures to diversify and distribute energy sources, islands will strengthen their grid and enjoy less disruption when the next storm strikes. Most islands today are fueled primarily by oil-based and imported fuels. The cost of these imports can take electric rates hostage and create economic instability with fluctuating oil prices. Islands that move to even 30 percent renewable energy can reduce the impact of high oil prices significantly. By bolstering energy self-reliance with robust, durable renewable energy technology, islands are adapting both structurally and economically for catastrophic climate change events—and developers can help them get there.

Hitting the resilience mark, right off the bat

Developers have a chance to build resiliency into new energy infrastructure as early in the process as site selection. Subject to intensifying and increasingly frequent tropical storms, Caribbean island nations require a facility that's capable of withstanding high wind speeds and storm surges. On islands, the flattest land tends to be located around the shoreline, but so too is the highest threat of storm symptoms. These criteria can eliminate large portions of the best land from consideration, but proper site evaluations are often overlooked in favor of speeding up the process, or simply because flat land is hard to find. Developers should be cautious when proposing sites for renewable energy facilities, making sure the location of their site aligns with worsening storm scenarios.

Once a site is selected, thorough geotechnical testing can be the difference between costly post-storm system reconstruction and a broken panel here or there. It's unnervingly common for new contractors to conduct all geotechnical tests in just one location—even for a multi-acre facility—sometimes on the perimeters of the site

or near the main access road, away from where the bulk of the system will be installed. Geotechnical testing in the exact soil where piles will be driven will either confirm that the ground is solid enough for development, or signal the need for longer piles and deeper anchors for racking. This is key to laying a foundation that will stay upright in the face of intensifying storms, and keep the lights on in critical conditions.

Designing for the elements, down to the nuts and bolts

After selecting a site, developers in the Caribbean need to design and develop the system with the worst-case scenario in mind. Designing for worst-case scenarios means procuring equipment that's appropriate for intensifying weather conditions like high speed winds and flooding, regardless of minimum requirements. For example, although proposal specs often only call for turbines rated to withstand Class 3 hurricanes, resilience-savvy developers understand that wind speeds are projected to increase over the lifetime of the equipment, and procure turbines rated for Class 4 or 5 hurricanes.

The extra dollars spent on storm-rated panels, inverters, racking and turbines are lost without the same attention to the system's nuts and bolts. It's often just an insignificant component that fails under strong winds or heavy rain, and brings down the entire facility. A 4-megawatt, fixed ground-mount solar facility in Spanish Town, St. Croix was directly in the path of Hurricane Maria in 2017. The costliest repairs included



damage to electrical equipment inside a seemingly safe concrete building. While the building itself withstood Category 5 hurricane force winds, the roof ventilation fan did not. Winds removed the fan, and heavy, continuous rain flooded the inverters inside, leaving the facility inoperable. To avoid costly system upgrades, developers should design and construct every part of their project to withstand worst case scenarios, down to the storage building's ventilation fan.

Aiming for calm, after the storm

After a system is built, developers and owners should expect that hurricanes and severe storms will pass their facilities regularly. Operations and maintenance strategies that include storm mitigation techniques can help prepare for the effects they leave behind. Building a proactive and trustworthy relationship with the local utility will help institute hurricane preparedness programs in the days leading up to the storm. Preparedness programs can help arrange backup power systems to combat outages, develop post-storm repair plans to ensure timely system maintenance, and spread outreach campaigns to keep customers informed. These mitigate long-term impacts from damage to the facility, saving developers and local communities time and money.

Designing, developing, and operating renewable energy projects to withstand worsening climate conditions has a ripple effect. As islands strive to decarbonize their energy systems, and new industry players flood the region, decisionmakers will look for trustworthy and long-term development partners for their projects. These extra measures not only make stronger energy systems, but also boost reputations in communities. Above all, as the effects of climate change continue to threaten economies and lives in the Caribbean, developers have an obligation to do their part and build clean, cost-effective, resilient energy infrastructure. In the wake of a devastating storm, reliable power should be last on a community's list of concerns.



Bruce Levy is CEO and President at BMR Energy (part of the Virgin Group) which develops, finances, constructs and manages clean, renewable energy projects in the Caribbean and Latin America.

BMR Energy /// bmrenergy.com



Charging solution provides reliability and charge quality

Delta-Q Technologies (Delta-Q) announced the addition of a 1000W, 24V battery charger to its RC Series. The RC1000 is a high frequency charging solution capable of charging both lead-acid and lithium-ion batteries. The new charger also offers Controller Area Network (CAN bus) communications for seamless machine integration. The RC1000 is suitable for use in battery-powered scrubbers, sweepers, and burnishers. Similar to its family series, the RC1000 has an IP66-rated ingress protection to seal out dirt and fluids, while its mechanical design and component selection resists vibration, shock, and temperature extremes.

Delta-Q Technologies /// www.delta-q.com



Intelligent lithium ion batteries

Trojan Battery Co., LLC announces the Trillium line of Trojan Intelligent Lithium batteries. With life expectancy over 5,000 cycles, Trillium maximizes total energy throughput and lowers lifetime operating costs. Trillium is suitable for meeting demanding deep-cycling requirements across a wide range of stationary and motive power applications. Trillium is designed and engineered in the USA and is initially available in 3 popular sizes that can be used in a variety of applications. Trillium offers a range of advanced safety, environmental, and electronic features including an intelligent built-in diagnostic as well as a superior cell and battery design. Trillium is designed to be a replacement for existing lead acid batteries. The built-in battery protection system guards the battery from the extreme demands of various motive and stationary applications. Aftermarket customers without Lithium battery experience are now able to switch to this advanced energy technology without the need for sophisticated expertise in Lithium Ion technology or system integration. In addition, OEM customers can quickly add the Trillium range of products into equipment without significant investments in custom pack design and development. Trillium features automotive-grade safety components, CAN-bus communication, and an integrated state-of-charge indicator. The electronic controls allow for voltage compatibility for all 12V, 24V, 36V, and 48V applications including the ability to use most existing lead-acid chargers.

Trojan Battery Company

/// www.trojanbattery.com



Bi-directional DC-DC optimizer

The Alencon BOSS is a solution for both improving and bringing down the cost of DC-Coupled Solar + Storage deployments while extending useful life of the batteries and improving battery rack utilization. The BOSS controls the charge and discharge of individual battery racks in both DC and AC coupled deployments. The BOSS supports the integration of energy storage with 600V, 1000V or 1500V PV strings. The BOSS features Alencon's Galvanically Isolated DC-DC conversion topology. This architecture offers users a number of benefits not available from other non-isolated DC-DC converters, including the ability to incorporate grounded PV systems with floating batteries on the same DC-bus as well as the ability to pair high voltage 1500V PV with lower voltage battery chemistries. Additionally, because the BOSS is a rack level DC-DC converter it assures the most optimal utilization of each battery rack in the cabinet. By addressing each battery rack individually, the BOSS also improves system safety by limiting the fault currents in the case of a sudden short to ground thus potentially reducing system cost by eliminating the need for additional safety devices. Additionally, the BOSS makes battery rack augmentation over the life of a storage project much easier and cost effective by allowing battery racks with different charge-discharge voltages to be installed onto the same DC-bus. The BOSS also makes it easy to deploy DC-coupled Solar + Storage projects with string inverters.

Alencon Systems

/// www.alenconsystems.com



An interface between inverters and a monitoring solution

Trimark Associates, Inc. has launched the Trimark SMA Gateway product. Designed around the Trimark Data Gateway (TDG), the SMA Gateway is a drop-in replacement for the discontinued SMA Sunny WebBox. The TDG is an industrial gateway loaded with a derivative of Trimark's SCADA software. This platform provides a robust and resilient solution that will provide many years of reliable non-stop service in the demanding environments of photovoltaic power plants. The Trimark SMA Gateway ships with easy-to-understand instructions on how to remove the old unit and install the new one. Once the unit is energized and connected to the inverter and a laptop computer, the technician will use a web browser to trigger the Trimark SMA Gateway to scan each serial port to find all connected SMA inverters and map the data into the Trimark SMA Gateway.

Trimark Associates, Inc. /// www.trimarkassoc.com

Fighting Water Scarcity & Climate Change with Sustainable Mining Technology

by Jared Lazerson

This piece is a follow-up to Jared Lazerson's 2017 byline for North American Clean Energy.

2018 WAS A WATERSHED YEAR FOR THE ENERGY STORAGE

and electric vehicle sectors. The cost of solar and wind continued to decrease, while adoption of energy storage and electric vehicles reached new highs. From California's SB100, to federal electric vehicle mandates in France and China, the continuing growth and consumer demand for these technologies – and the lithium batteries that power them – has only become more certain. Similarly, the most recent National Climate Assessment clarified the scientific imperative for decarbonization. The industry has yet to reach a consensus on the ability of lithium supply to meet the growing demand. Yet, even the most bearish estimates project scarcity and supply bottlenecks within the next decade, which threaten to hinder wider adoption of clean energy and technology for price-sensitive consumers.

Technologies that can open up new sources of lithium are an important step towards achieving a more stable lithium market – but change at the periphery of the industry won't be enough. Now, it seems the largest mining companies may not have a choice in the matter. As regulators in South America (where over half of the world's lithium reserves can be found) begin to crack down on water usage, it's both economically and environmentally imperative that we bring cleantech innovation to the heart of the lithium industry. In doing so, we can address the environmental, social, and market concerns facing the lithium industry.

The shortcomings of legacy extraction methods in South America

The most common method of extracting lithium in South America is a process called solar evaporation, thanks to the plentiful and highly concentrated saltwater flats, or salars, famously found in Chile, Argentina, and Bolivia. The solar evaporation process uses the sun to evaporate water from these underground salars in ponds that take up hundreds of acres of land.

However, the process of solar evaporation is highly capital and water-intensive. Extracting a single ton of lithium using solar evaporation can require as much as 500,000 gallons of water. At one plant in Argentina, wells pump at a rate of more than 2 million gallons of water per day. In addition to their large environmental footprints, these ponds cost tens of millions of dollars, and take several years to bring online. Once active, the ponds can take up to 18 months to produce any usable lithium, an inefficient pace which has led to ongoing market concerns about the viability of the lithium supply chain. Given the environmental and market imperatives to create a stable lithium supply chain, it is clear that there must be a paradigm shift in the industry that moves us away from relying on solar evaporation, particularly with vulnerable peoples facing the brunt of this growing global demand.

The case for a paradigm shift in lithium mining

The issue of water scarcity in areas where lithium is mined is not a new problem. One such lithium hotspot, the lithium-rich Salar de Atacama in Chile, is already one of the driest places on Earth, receiving an average of less than four millimeters of rain per year. Due to the growing demand for lithium, the water shortage has become so severe for several communities in the area that they now must truck in potable water from elsewhere in the country to survive. With predictions of skyrocketing lithium demand, the communities in the Atacama, and others like it across the lithium triangle cannot sustain the industry without a change from the status quo.

Fortunately, policymakers in the region are making moves to address the water shortages. As policies incentivizing electric vehicles and clean energy have ramped up over the past year, so have policies attempting to address the environmental concerns behind lithium mining. In October of 2018, Chile began a first-of-its-kind legislative effort to restrict water usage by lithium miners, citing the intense freshwater needs for the evaporation ponds used in solar evaporation. The government blocked Albemarle, the one of the largest lithium producers in both the region and world, from building a plant to process 42,500 tons of lithium carbonate. According to the Chilean government, Albemarle “had failed to provide requested details about how it plans to triple lithium production from Chile's Salar de Atacama without using more water.” Though Albemarle is challenging the government's ruling, they also face investors and industry analysts who question how the industry will be able to meet growing demand without the ability to increase lithium production in the region.

The solution: new technology, new lithium supplies

Over the past two years, new technological advances have begun to open up new sources of lithium – for example, extracting petrolithium from industrial wastewater – in order to both meet demand, and help avoid the impacts of mining facing the indigenous communities. Many companies, both from within and outside of the mining industry, are driving technology to extract lithium from these lithium-rich salars without using freshwater evaporation ponds.

Advanced nanofiltration technology, which can extract lithium and purify toxic oil sands wastewater, is also able to extract lithium from the lithium-rich salars. This technology, currently operating in oil and gas operations in North America, has the potential to completely change the way lithium is extracted in South America. Advanced nanofiltration extracts lithium from brine more rapidly than solar evaporation, producing lithium in less than 12 hours, compared to the 12 to 18 months required by traditional methods. Advanced nanofiltration also requires less capital to bring online, and is less damaging to the local environment than solar



evaporation. By applying this technology and others like it, brine previously containing lithium can also be safely recycled or returned to the environment.

As lithium demand continues to grow with the increased adoption of clean energy, reliance upon traditional extraction methods threatens not only the mining industry and the local communities it impacts, but everyone with a stake in a clean energy future. It's time for industry and policymakers to work together to build the sustainable energy supply chain needed to power a truly sustainable future.

Jared Lazerson is President, CEO and Director of MGX Minerals, a developer of lithium, magnesium and silicon projects using innovative processes to supply the new energy economy. Mr. Lazerson has worked in the mining and technology industries since 1994, with companies including Osprey Systems (GPS and Digital Mapping), United Helicopters, Copper Island Mines and Manto Resources. He holds a BA in International Relations from the University of Pennsylvania.

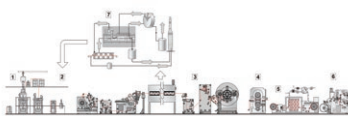
MGX Minerals /// www.mgxminerals.com



Clean, reliable, and intelligent backup power

The Electriq PowerPod is a fully-integrated energy storage, management, and monitoring system that includes safe lithium-ion batteries and a hybrid solar/battery inverter controlled by intelligent software. The attractive design minimizes wiring and space requirements while enabling battery capacity to scale up to meet almost any home or light commercial need.

Electriq Power /// www.electriqpower.com



Lithium-ion battery electrode manufacturing line

Dürr MEGTEC has launched a complete lithium-ion battery electrode manufacturing line in an operating layout that improves flexibility, quality, cost-effectiveness, and speed-to-market. Matched to meet application-specific production requirements, each line configuration is a complete manufacturing operation, encompassing every stage in the electrode production process, including powder handling, slurry mixing, coating and drying, calendaring/roll pressing, secondary drying, slitting, and n-methyl pyrrolidone (NMP) recovery and purification.

Dürr MEGTEC
/// www.megtec.com



Cloud solution for monitoring and reporting EV charging points

Circontrol's Cosmos is a cloud-based platform that collects and stores data from a specific set of EV chargers for monitoring and reporting. This platform has an intuitive and user-friendly dashboard that allows making customizable reports by user, charger, consumption, and tariffs, including invoice's simulation. Cosmos is specially focused on fleet managers, condominium administrators, and car park operators who want, for example, un(subscribe) users, remotely controlling the chargers, and making reporting processes simpler and automatic. Cosmos has been designed to ease some of the tasks related with the management of a set of EV chargers. The dashboard is intuitive and user-friendly and allows obtaining a general overview of the most significant data about an installation or a group of installations. It also includes a charging network map to locate and check the charger's status easily and quickly. Cosmos is compatible with EV chargers from other brands, apart from Circontrol's, as long as they comply with OCPP 1.6 protocol.

Circontrol /// www.circontrol.com



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Safe, eco-friendly battery technology

The engineers at Fortress Power announce the New Generation of its eVault battery (G2LFP-15kWh). Fortress eVault series uses Lithium-Ferro-Phosphate technology instead of Lithium-Nickel-Manganese-Cobalt (LNMC), which is a safe, eco-friendly technology offering better operating temperature, significantly more life cycles, and a high peak power output. The new battery is user friendly with a front display showing the State of Charge (SoC) and the battery voltage. The battery is compact and can be stacked 5 in parallel, to achieve 75kWh. Each battery communicates with each other via RS-485 cable to balance the charging capacity when they are connected in parallel. These new units will be available in November. All Fortress batteries have a 10-year warranty with 6000 cycles. The batteries are designed to work with commonly used 48V chargers/inverters such as Schneider, Outback, Magnum, Darfon, and SMA among others. The long cycles enable Fortress batteries to support backup, time-of-use, self-use, and off-grid applications. Currently Fortress offers 10 and 15kWh in North America, which are scalable to 20 and 30kWh.

Fortress Power /// www.fortresspower.com



Maximize charging options for drivers while reducing operational costs

eMotorWerks' JuiceNet Enterprise solution simplifies management of electric vehicle charging stations across multiple sites. By deploying both smart-charging EV supply equipment (EVSE) and cloud software solutions on a commercial scale, electric vehicle fleet owners and facility managers are able to remotely manage fleets of chargers at various locations from a single cloud dashboard and maximize EV charging capabilities on their properties. Through the dynamic load balancing control of the JuiceNet Enterprise solution, EV owners can install more stations on their property without costly electrical upgrades to their building infrastructure, balancing the charging load in real-time to match site electrical capacity. In addition, JuiceNet Enterprise enables EV drivers and building managers to optimize renewable energy use by aligning charging when solar and wind generation are most abundant on the grid. The solution allows customers to reduce onsite peak electricity demand charges by sharing loads between chargers throughout the day, while ensuring vehicles are charged when needed. The system also empowers drivers to locate available stations within their network on the JuiceNet mobile app. JuiceNet Enterprise allows deployed stations to automatically shift power use to nighttime hours, when prices are low, or curtail charging during peak afternoon times. Through JuiceNet Enterprise, fleet operators gain flexible configuration, reporting, and notifications, such as the ability to configure charger settings across the network, by customer account, location, or individual station. The benefits of JuiceNet Enterprise also extend to a regional utility level, allowing fleets of JuiceNet-enabled EV chargers to aggregate charging loads and respond to demand response programs, helping to bring greater stability to the grid during peak load times.

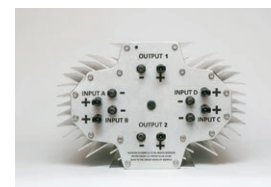
eMotorWerks /// www.emotorwerks.com



Advanced nano-carbon deep cycle battery

GS Battery newly developed their "SLR" Advanced Deep cycle VRLA battery with Nano-Carbon technology. It is designed for the high cycle life requirement of energy storage systems and manufactured in Japan according to rigorous Japanese quality control standards in order to deliver high performance and long service life. SLR500-2 was released on July 2018 and is designed for PV use. 2V, 500Ah/10hr, 5000 cycle@DOD70%, PSOC, 10-year limited warranty.

GS Battery /// www.gsbattery.com



DC coupled solar + energy storage solution

Alencon Systems LLC's SPOT (String Power Optimizer and Transmitter) is a string level DC-DC optimizer which optimizes the power from PV string inputs with voltages ranging from 600V to 1500V. The SPOT-ES family of products has been specifically designed for the needs of DC-coupled Solar + Storage deployments. The SPOT-ES V5 includes a true 1500V input based on 1700V rated Silicon Carbide (SiC) rated mosfets, an ability to map a wide battery charge/discharge voltage range, reliability enhancements developed in concert with Solar + Storage technology providers and integrators, as well as flexible communications options for better integration with Solar + Storage and Microgrid control systems. The SPOT-ES's galvanic isolation concept isolates the PV input from the output by attaching isolation transformers to each PV input. This technique provides a unique benefit in the DC-coupling of Solar + Storage because the integral magnetics to the SPOT can be easily configured from one deployment to another to easily support a broad battery charge/discharge DC-bus voltage, where the voltage range could vary by as much 20% from complete discharge to full charge. The SPOT-ES V5 includes an ultra-fast circuit to protect it from sudden system power output overloads. The SPOT-ES V5 features enhanced communications features to allow it to be interfaced with third party system controllers via either Modbus TCP, for communicating to the SPOTs wirelessly, or Modbus RTU, which allows for hardwire communication to each SPOT directly. The enhanced communication functionality offered in the SPOT-ES V5 allows for granular control over the PV, including the ability to curtail production at the string level.

Alencon Systems, LLC /// www.alenconsystems.com



EV mobile charging station

LAPP's Mode 2 mobile charging station is for use with both domestic and CEE sockets, as well as other innovative technologies for electric and hybrid vehicles. LAPP's mobile charging station optimizes power and design flexibility, and includes a range of technical innovations, including higher charging currents and advanced electrical protection. Using an interchangeable power cable, it enables vehicle charging from domestic or CEE sockets and includes power up to 11kW, temperature monitoring, and automatic detection of the maximum charging current.

LAPP /// www.lappgroup.com

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Ultra-low-power micro controller

The STM8L001 ultra-low-power microcontroller from STMicroelectronics targets cost-conscious applications, by combining ST's efficient 8-bit STM8 core with essential and effective peripherals, in the compact, low-pin-count SO-8 outline. The microcontroller provides essential features for basic sensing, communication, and control, including two comparators, SPI, I2C, and UART interfaces, and one 8- and two 16-bit timers. 8Kbytes of Flash memory and 1.5Kbytes of RAM provide cost-effective code and data storage, and up to 2Kbytes of the Flash memory can be assigned to act as data EEPROM. A flexible internal clock system, adjustable from 32kHz to 16MHz, saves component count and simplifies board design. The STM8L001 delivers a competitively priced device with high performance for applications such as industrial sensors, lighting equipment, battery chargers, toys, e-Bikes, access cards, PC accessories, printer cartridges, and other cost- and power-sensitive smart products. The up to six user I/Os allow engineers to take full advantage of the STM8L001's optimized specification. ST's ultra-low-power technologies ensure frugal operation in all modes, cutting current to as little as 300nA in halt mode to maximize the lifetime of battery-powered devices. The STM8L001 is also flexible, operating from 1.8V to 3.6V, and fully specified from -40°C to 125°C to ensure reliability even in harsh conditions.

STMicroelectronics

/// www.st.com/stm8lvl



Universal deployable battery pack

EnerDel's Universal Deployable Battery Pack (UDBP) is ready to help solve military related energy storage issues. The UDBP is an intelligent system of lithium-ion battery technology and electronic controls designed to provide 10kWh of stored energy with a nominal 350VDC output. The system is also capable of driving power conversion systems. The rugged design of this pack is man-portable and will be used in military field operations.

EnerDel /// www.enerdel.com



Residential electric vehicle charging station

SolarEdge Technologies, Inc.'s residential electric vehicle charging station is a standalone EV charger offering system design flexibility specifically for sites where the inverter and EV charger cannot be installed at the same location. The new EV charger will be integrated into SolarEdge's smart energy suite to support increased energy independence. With the EV charger offering management in SolarEdge's monitoring platform, EV charging can be easily controlled and programmed.

SolarEdge /// www.solaredge.com

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Blackouts in the Developing World

How microgrids are helping us cope

by Tomas Demcak



For residents of Maracaibo, March 7 to March 12 represented hell on earth. Power blackouts crippled the second largest city in Venezuela and left its residents struggling to find ways to survive. With the sun beating down overhead, basic amenities disappeared overnight. Food spoiled in refrigerators, restaurants, and supermarkets, causing widespread hunger. Water became undrinkable without access to water filtration, causing its citizens to pay abhorrently steep fees for bottled water on the black market. Looting and riots marred the streets with violence, leading to hundreds of people seeking access to hospitals that couldn't treat them. In just five days, a power crisis effectively crippled all semblance of a functioning society.

For well-developed cities in the West, a blackout typically means a couple hours of minor inconvenience - smart phones will go uncharged, WIFI networks will go unconnected, and televisions will go unwatched. But in the developing world, when disaster strikes (be it natural or manmade) a power outage can quickly devolve into a humanitarian crisis. In the 21st century, however, we've designed a catastrophe-saving solution: the strategic implementation of microgrids.

Independent energy operation makes sense

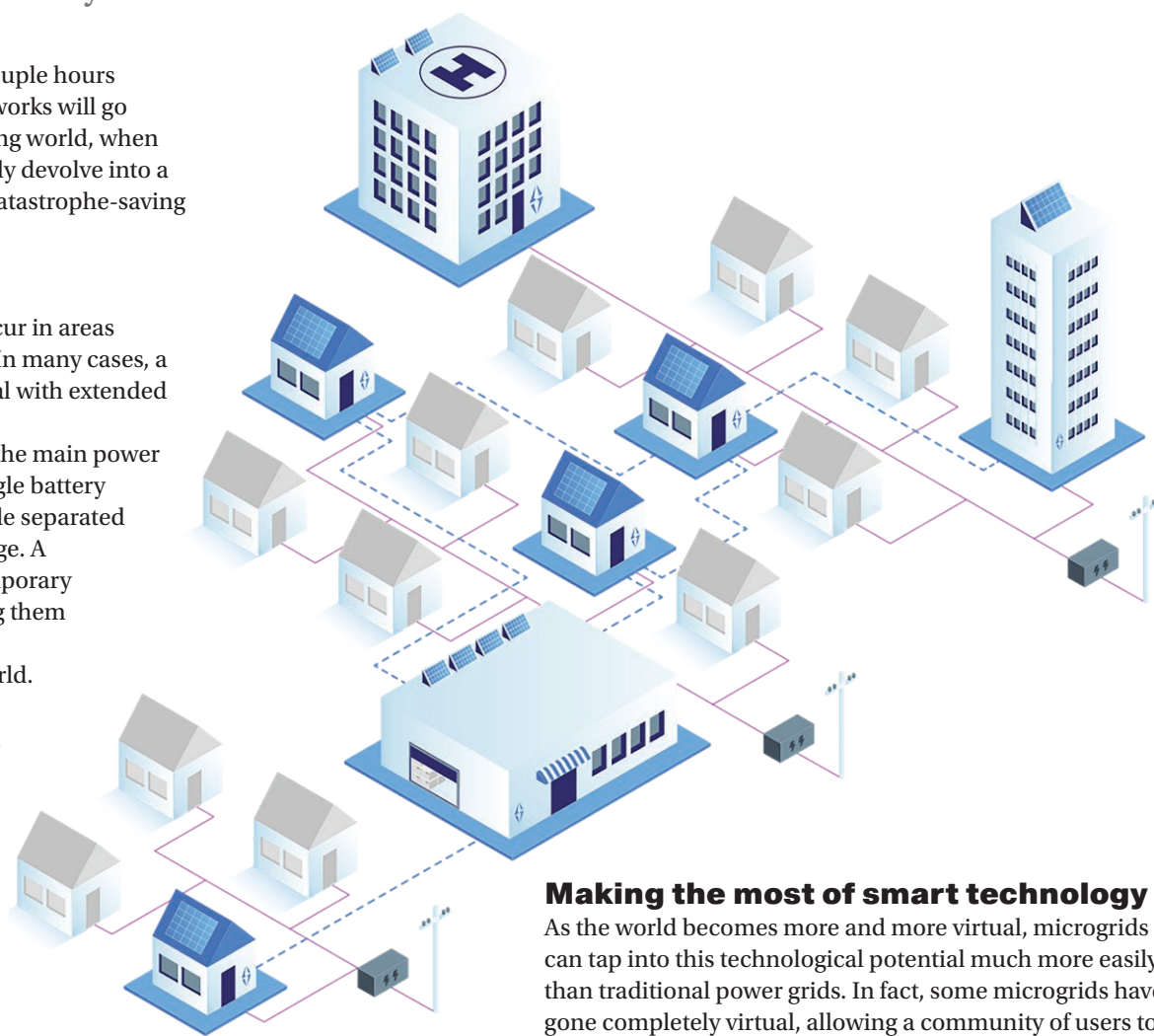
Natural and manmade disasters are on the rise. Worse, they often occur in areas where populations are generally ill prepared to deal with the fallout. In many cases, a poor main power grid exacerbates the problem, forcing people to deal with extended blackouts in a time of extreme need.

A microgrid acts as a small, freestanding power source apart from the main power grid. Microgrids can range in size from a few small buildings, to a single battery pack connected with a smartphone. The ability to provide power while separated from the grid is essential when a region is experiencing a power outage. A process known as "islanding" allows buildings to provide at least temporary power for essential services in case of an emergency, while still giving them access to the main grid under normal conditions.

Microgrids are already installed in many places throughout the world. In the United States, microgrid technology allowed for the continued running of hospitals, grocery stores, and gas stations in the aftermath of Hurricane Harvey, saving the lives of countless Texans.

Rural communities, often hit hard by disasters, could see the most benefit from microgrid implementation. The ability to detach from faulty central grids and power themselves is essential when dealing with underfunded power companies or natural disasters.

If a conscious effort is made to get communities to implement microgrids, it could prove to be game-changing. Take the Venezuelan blackouts for example: Strategic microgrids could have prevented the cataclysmic chain of events from occurring.



Making the most of smart technology

As the world becomes more and more virtual, microgrids can tap into this technological potential much more easily than traditional power grids. In fact, some microgrids have gone completely virtual, allowing a community of users to share energy without the need for a physical connection.

Using AI technology, microgrids are able to virtually analyze the data from all connected devices, interpreting trends such as weather, the device owner's behavior, and the behavior of all other devices on the grid. Using a machine learning algorithm, the virtual network allows each member to connect to each other's power devices. This results in smarter and more adaptable energy allocation, and ensures that power is spent and bought in the most efficient way.

Peer-to-peer (P2P) energy trading is another perk microgrids can facilitate through virtual marketplaces. Users can buy energy when they are deficient, sell when they produce too much, or give to family or loved ones in case of a crisis. Blockchain plays a vital role in this, as it helps verify transactions in the energy market. As of February, 150 companies worldwide are developing virtual microgrids using blockchain technology.

It's easy to see how this would benefit those in a crisis: When disaster hits, users have access to a trustworthy energy network, rather than having to rely on the state-provided power. In Puerto Rico, companies are already providing virtual microgrids to turn entire city blocks into virtual power plants, in preparation for the next Hurricane Maria.

Microgrids for smarter, more sustainable energy

Amidst the wreckage, in the aftermath of Hurricane Maria, one house shined bright as a beacon to all. The only place with power for miles, Casa Pueblo, an ecology center, provided power and acted as a makeshift hospital for hundreds of people in the weeks after the hurricane. What made Casa Pueblo special was its installation of solar powered microgrids. Taking advantage of the natural sunlight that Puerto Rico enjoys, Casa Pueblo was able to bypass the power outage by using sustainable renewable energy. While solar power isn't yet efficient enough to be the sole source of power throughout the year, it allows for buildings to retain resiliency in the midst of a crisis.

With their high compatibility with renewable energy, microgrids may be the final catalyst to pave the way to a 100 percent renewable energy future. A major benefit of solar-powered microgrids is their ability to store energy for later use. This is especially important when it comes to solar power, as energy can be stored during the day and used at night. This is the kind of flexibility that developing countries with unreliable energy supplies simply can't pass up. Renewable energy will not only benefit the planet in the long run, but it will allow countries to increase their resiliency in the face of adversity.

As of this writing, sustained blackouts have returned to Maracaibo, causing further misery to its inhabitants. When it comes to protection against these kinds of crises, the only defense is preparation. Microgrids not only offer the power to avoid extensive disaster zones, but they are also the best way to get smart about energy in the 21st century.



Tomas Demcak is Co-founder and Chief Compliance Officer at FUERGY, an AI-powered device that utilizes blockchain to help users optimize energy consumption, maximize energy efficiency, and participate in the energy market.

FUERGY /// <https://fuergy.com>



Advanced LED lighting system

Xylem Lighting introduces its Phaeton Parking Garage fixture, a high efficiency outdoor/indoor IP65 wet location rated LED luminaire featuring fully integrated wireless lighting controls, including occupancy sensing and true daylight harvesting, in a 14" square fixture which provides uniform illumination and low glare photometrics. It's designed specifically for applications where moisture or dust is an issue and as a replacement for fluorescent and high intensity discharge fixtures in existing installations. It complies with DLC Parking Garage Photometric and 4.2 Premium technical requirements and is also suited for applications such as tunnels, canopies, building entrances, and food facilities. The Phaeton achieves its uniform illumination and low glare through use of proprietary hybrid diffuser/lens optics with up-light prisms to eliminate hot spots and spreads light evenly throughout the surrounding ceiling and floor areas. Integrated into each Phaeton Fixture is Xylem's Xi-Fi Wireless Control System, a powerful and easy to commission network capability which can reduce energy usage by as much as 90%. It features an intuitive user interface and enables users to create groups of fixtures, adjust light levels, control illumination, and manage time-out settings, without having to make any physical adjustments at the fixtures. This architecturally attractive luminaire, available in 40W and 75W models, features fast pay-back with efficiency of up to 140 lumens per watt; greater safety and comfort with brighter, more uniform illumination; full compliance with IESNA requirements; optional external emergency power module, and easy one-person installation.

Xylem /// www.xylem.com



Solar powered explosion proof LED light

Larson Electronics announced the release of a solar powered explosion proof LED indicator light for remote areas and standalone applications where power is impractical or unavailable. This 7W unit offers 360° of illumination and is ATEX rated for Zone 1 and 21 with a Class I, Division 2 solar panel. The ATEX-EPSLED-80-STB-SOL-20C-C1D2-24V explosion proof solar powered LED indicator light operates on 24VDC, a Class I, Division 2 rated solar panel, and eight 24VAC 18Ah sealed lead acid batteries. When exposed to direct sunlight, the battery bank charges in five hours. The batteries are housed in a NEMA 4X remote enclosure and charged by the solar panel with a 20ft 12/2 SOOW cord connecting the light fixture to the solar panel. Made of aluminum with a temperature-resistant pressed glass lens, this 7W lamp is rated for flammable environments and work sites where combustible gas, vapor, or mist may be present. This saltwater-resistant unit's control box features either a day/night sensor and motion sensor, or an on/off switch. This LED indicator light offers 1,235 candela and is compatible with wall, pendant, or trunnion mount configurations.

Larson Electronics LLC /// www.larsonelectronics.com



Smart-grid ready medium voltage switchgear

Schneider Electric's Premset, is a compact and modular vacuum, medium voltage (MV) switchgear providing reliability, safety, and ease of use. The Premset switchgear was designed as a response to meet the new challenges of electrical distribution networks. Built using a Shielded Solid Insulation System (2SIS), it allows MV network operators to increase safety and efficiency while minimizing downtime and meeting the needs of the smart grid. 2SIS protects all the switchgear's live parts with earth-screened solid insulation, reducing the risk of internal arcing and facilitating top performance in practically any environment. Premset MV distribution switchgear brings 2SIS technology to the market in a compact, highly modular form. This performance is achieved through the use of 2SIS combined with a patented universal flat power connection system and an original mechanical design. As an added benefit, the use of solid insulation increases life expectancy and enables high efficiency through advanced monitoring and control. It helps ensure peak network performance in several ways, including feeder automation with built-in communication and local intelligence, load management with integrated smart metering, asset management with advanced monitoring of switchgear, and the use of standard communication protocols. Premset Smart Grid embedded features are improving the management of today's networks and can anticipate future requirements of evolving grid-management regulations.

Schneider Electric
/// www.schneider-electric.ca

MAY

- 01-02 Midwest Solar Expo**
Radisson Blu Aqua – Minneapolis, MN; www.midwestsolarexpo.com
- 07-09 Oregon Solar Energy Conference**
Portland Crowne Plaza – Portland, OR; oregonsolarenergyconference.com
- 08-09 Solar Canada**
BMO Centre – Calgary, AB; www.solarcanadaconference.ca
- 15-16 International Solar Power & Technology Summit**
San Francisco, CA; <http://usa.solartech.global>
- 19-22 Strive for Sustainability Solid Waste & Recycling Conference**
The Sagamore, Bolton Landing – Bolton Landing, NY; nyfederation.org
- 20-23 AWEA WINDPOWER 2019 Conference & Exhibition**
George R. Brown Convention Center – Houston, TX; www.awea.org
- 29-30 Solar Power Southeast**
Georgia World Congress Center – Atlanta, GA; www.events.solar/southeast

JUNE

- 05-06 37th West Coast Energy Management Congress (EMC)**
Santa Clara Convention Center – Santa Clara, CA; www.energyevent.com
- 11-13 International OpenADR Symposium**
PG&E's Pacific Energy Center – San Francisco, CA; www.openadr.org/symposium
- 21-23 The 30th Anniversary Energy Fair**
Custer, WI; www.midwestrenew.org
- 24-25 Solar Power Texas**
JW Marriott Austin – Austin, TX; www.events.solar/texas

JULY

- 16-18 July 2019 Battery Seminar**
The Inn at St. John's – Plymouth, MI; www.batteryseminars.com
- 17-18 5th National Grid-Scale Energy Storage Conference**
Albany, NY; www.wplgroup.com/aci
- 18-19 Community Solar Power Summit**
Sheraton Philadelphia Society Hill Hotel – Philadelphia, PA; www.events.solar/community-solar
- 29-01 SEPA Grid Evolution Summit**
Washington, DC; www.sepapower.org

SEPTEMBER

- 10-11 Wind Resource & Project Energy Assessment Conference**
Hyatt Regency Lake Washington – Renton, WA; www.awea.org
- 15-18 GRC Annual Meeting & Expo**
Palm Springs, CA; www.geothermal.org/meet-new.html
- 18-20 Horizon 19**
Boston Convention and Exhibition Center – Boston, MA; www.horizon19.org
- 23-26 Solar Power International 2019**
Salt Palace Convention Center – Salt Lake City, UT; www.solarpowerinternational.com
- 23-26 Energy Storage International**
Salt Palace Convention Center – Salt Lake City, UT; www.solarpowerinternational.com

OCTOBER

- 01-02 AWEA Wind Energy Finance & Investment Conference**
www.awea.org
- 08-10 CANWEA Annual Conference & Exhibition**
BMO Centre – Calgary, AB; www.windenergyevent.ca
- 22-23 AWEA Offshore WINDPOWER Conference and Exhibition**
Boston Park Plaza – Boston, MA; www.awea.org

NOVEMBER

- 05-07 Energy Storage North America**
San Diego, CA; www.esnaexpo.com
- 14-15 Solar Power Midwest**
Palmer House Hilton – Chicago, IL; www.events.solar/midwest
- 19-21 AWEA Clean Energy Executive Summit**
Omni La Costa Resort & Spa – Carlsbad, CA; www.awea.org

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27	Dynapower	www.dynapower.com/ESG
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48	Electrical Consultants, Inc.	www.electricalconsultantsinc.com
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43	MK Battery	mkbattery.com
65	Narada	www.mpinarada.com
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50	Parker Hannifin Corporation -Parker Energy Business Unit	solutions.parker.com/awea2019
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IFC	Shoals	www.shoals.com
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