

North American **CleanEnergy**

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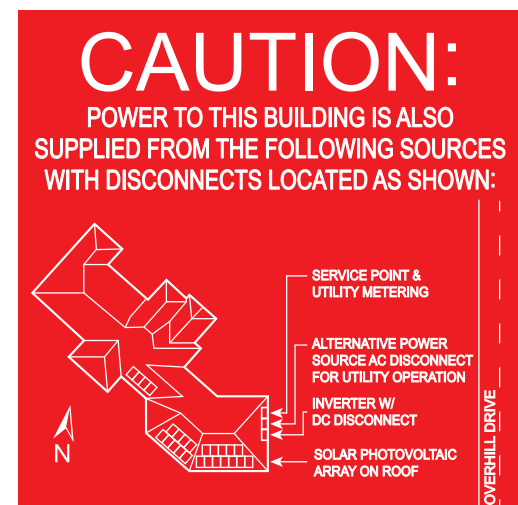
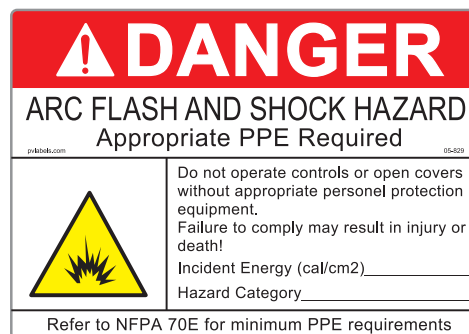
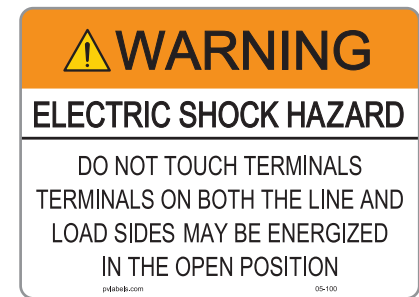
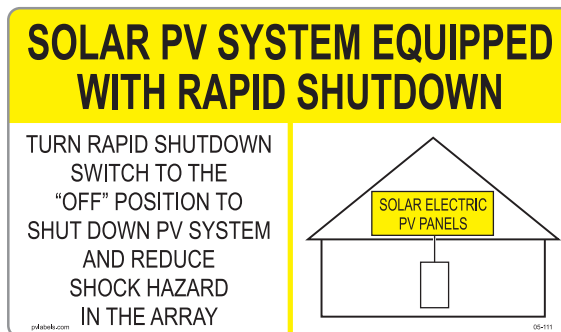
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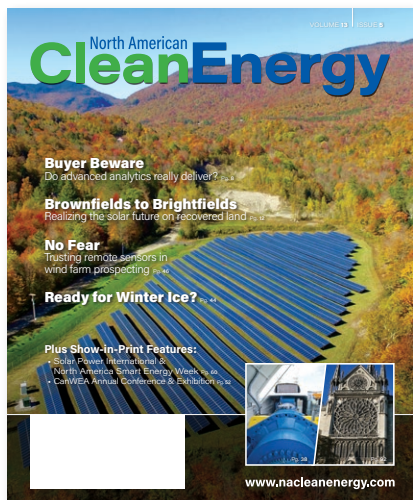
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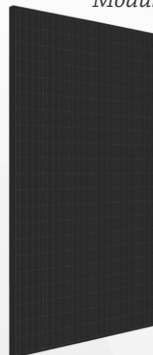
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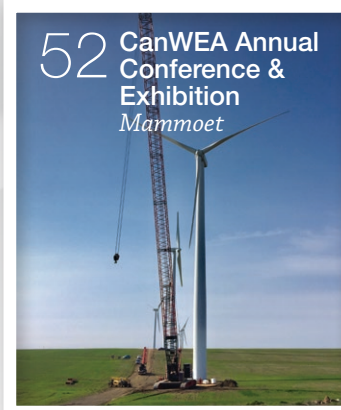
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Quest for Resilience

by Gary Liardon

Hello and welcome to North American (NA) Clean Energy News' 2019 SPI ESI North America Smart Energy Week special issue. Reflective of the US and global market for solar energy, this year's show promises to be the largest in the event's history as some 20,000 solar professionals from over 115 countries convene at the Salt Palace Convention Center in Salt Lake City, Utah September 23-26.

This year's conference and exhibition is shaping up to be a landmark industry event in what's been a breakthrough year for solar and renewable energy. From tariffs, trade wars, ITC extensions, record-setting heat waves and raging wildfires, to subsidy-free solar bifacial panels, perovskite PV, and the increasingly potent combination of solar plus storage, there will be no shortage of critical issues and important topics of interest. And, of course, everyone always enjoys exploring all of the new and innovative solar technologies on display.

Solar, energy resilience, and grid modernization

Resilience has emerged as one of the most sought after and potentially valuable attributes of the modern power grid. This has come about as the result of the convergence of several trends, including the increasing frequency and intensity of extreme weather events, the drive for universal and sustainable electrification, and consumer demand for high-quality power. For these and other reasons, it really is eye-opening, and very encouraging, to see "solar plus storage" systems not only competing with, but outpacing new natural gas and coal-fired power generation in a growing number of markets; all despite a playing field still skewed in favor of fossil fuels.

Innovative distributed solar, other renewables, battery energy storage, and clean energy technologies are providing us the tools and systems we need, but clear market mechanisms and regulatory frameworks which foster construction of more resilient power and energy grids are still emerging. If you are attending this year's SPI, don't miss Tuesday's panel discussion, "The Quest for Resilience: Who Wants It? Who Gets It? Who Pays for It?"*

A gathering of industry and enterprise

Reliable, high-quality, and affordable energy is the lifeblood of our economy and society. Joining with individuals and organizations spanning the length and breadth of our economy and society, industry participants are proving that distributed solar energy, in concert with battery-based energy storage, can enhance the resilience of our energy systems and meet our energy needs more securely, efficiently, and effectively than the current generation of power and energy technology and networks, even when the sun isn't shining.

US communities, cities, and states have been at the forefront of the drive to modernize power grids, enhance the resilience of our energy system, and combat climate change. As highlighted in SEIA's recently released Solar Means Business report, leading US corporations across an expanding range of industry sectors are turning to, and investing in, the combination of solar power generation and battery-based energy storage. Enhancing the resiliency of our power and energy systems stands out among them, as does the potential for solar-plus-storage systems to stem the tide of rising greenhouse gas (GHG) emissions, global mean temperatures, and enable us to mitigate and adapt to the effects of climate change.

This is just one of the many goals that SEIA has accomplished recently. As a SEIA board member, I've had the good fortune to work with president and CEO Abigail Ross Hopper, as well as SEIA staffers throughout the country. They've done a tremendous job organizing the drive to extend the solar ITC and launch the Defend the Solar ITC campaign. A bill to do just that, for five more years, has been introduced in Congress as a result. So have bills to set a national 100% renewable energy target and enact a carbon tax.

What better place to discuss these important industry issues? Salt Lake City, Utah is an excellent venue for this year's Smart Energy Week conference and exhibition. The state's solar energy capacity has surged in recent years, to the degree that Utah broke into SEIA's Top 10 Solar State ranks in 2016. As of year-end 2018, Utah ranked 10th in the nation in terms of installed solar power, having installed 1,661MW of capacity, enough emissions-free electricity to power some 321,620 homes. That is forecast to grow by 942MW over the next five years.

Utah's growing solar power capacity is boosting the economy as well. The state is home to 140 solar businesses: 21 manufacturers, 68 installation/development companies, and 51 other types of solar businesses employing some 6,045 residents. A total of \$2.65 billion has been invested in Utah's solar sector and 33,891 solar energy systems had been installed statewide as of 2018. That said, solar energy accounted for just 6.40% of the state's electricity generation. That leaves plenty of room for growth, especially in light of Utah's abundant solar energy resource and independently minded, enterprising citizenry.

The sun is certainly shining brightly on Utah and our industry. Have a great show everyone!



Gary Liardon is President and Chief Operating Officer at PetersenDean Roofing & Solar in the consumer division. He is on the board

of directors for SEIA (Solar Energy Industries Association). Founded in 1984 by Jim Petersen, PetersenDean specializes in new residential and commercial construction, working with some of the nation's largest builders and developers. With more than a million roofs under its belt, the Fremont, CA-based company employs 3,000 workers and operates in seven states: Arizona, California, Florida, Hawaii, Nevada, Oklahoma, and Texas.

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*This panel includes my colleagues: Dan Skopec, Vice President, Regulatory Affairs San Diego Gas & Electric and Anne Hoskins, Chief Policy Officer, Sunrun. It is being moderated by Rick Umoff, Regulatory Counsel & California Director, State Affairs Solar Energy Industries Association (SEIA). If you are interested in learning more about resilience, we're speaking on Tuesday, September 24 at 4pm in room 250A.

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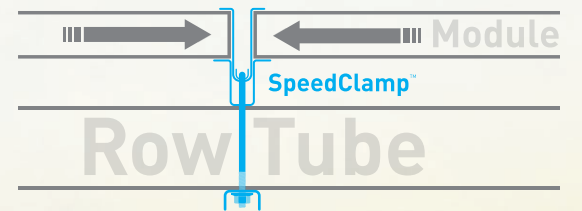
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Buyer Beware

Do advanced analytics really deliver?

by Steve Hanawalt

These days, you can't avoid the hype touting all the ways advanced analytics (AA) optimizes the performance of solar and wind power assets. "Advanced analytics" is a broad term for a range of techniques and tools that takes data and uses it to generate valuable business insights, and make predictions and recommendations. For the purposes of this article, the umbrella term "advanced analytics" refers to a range of techniques and tools, including artificial intelligence (AI) and machine learning (ML).

If the buzz about advanced analytics is to be believed, you simply plumb your operating data up to a shiny new web service and the insights pour forth—saving you millions! But is it really that easy? What kind of real-world results can you expect? What data infrastructure and pre-processing do you already need to have in place for these applications to deliver reliable ROI? Before moving into advanced analytics, what about making standard industry analytics work properly? Are you confident you're capturing all the asset performance improvement opportunities available?

Buyer beware—there are a lot of claims out there from software vendors and consultants looking to sell unproven or misapplied technology in the renewable energy space. On the other hand, some AA solutions generate significant opportunities for improvement in project returns—when properly applied. Therein lies the challenge: What is the right application of AA in the renewable energy space?

The Five Keys to Successful Implementation

To help find the answer, let's look at the five keys of successful AA implementation in solar and wind:

- 1. The right data platform:** Do you have a robust and scalable data platform with a fully integrated time-series, transactional, and metadata layer? If you don't, you won't be able to meet the requirements of the following two keys.
- 2. A robust data cleansing process:** Operating data from renewable energy plants is high in volume, frequency, and noise (meaning it's full of missing and bad or corrupted data). Many advanced analytics run just fine in a laboratory, but fail miserably when they encounter the mess of real-world operating data. A robust and automated data cleansing pre-process is mandatory. There is no direct flight from raw data to insights.

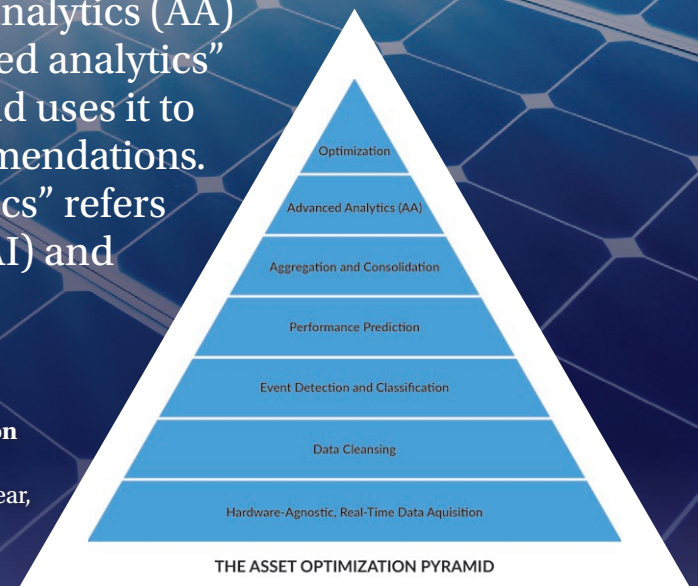
- 3. A powerful event detection and classification engine:** When you're pulling millions of data points from your plants over the course of a year, you need a reliable tool to help you separate worthless data from data you can use.

Manually classifying every event and failure type used in the analytic and anomaly detection process would require an army of data analysts - your data platform needs an industrial-strength, automated event detection and classification engine that's designed by experts in solar and wind power. General-purpose algorithms won't be able to associate events with renewable energy asset failure modes and effects. They might alert you to a problem, but that won't be much help when it comes to determining the cause, and prioritizing the issues that expose you to the most risk.

- 4. The right tools:** Make sure you're applying the right set of tools to your problem. AA relies on a diverse set of tools (models) to classify data and events or to find performance anomalies. It is not always necessary, and sometimes not even a good idea, to use an advanced algorithm when a linear regression will suffice.
- 5. Dedicated subject matter experts (SMEs):** Most often, generating corrective and preventive actions from the insights raised by AA is neither easy nor obvious. It requires solar and wind power operational SMEs to interpret. These technicians, analysts, and engineers know how the equipment really works, its failure modes and causes, and the proper actions for resolution. You won't reach your software ROI goals without a skilled team dedicated to the process of post-AA analysis and resolution.

When to Consider Advanced Analytics—and When Not To

Advanced analytics should be considered for anomalies that aren't or can't be detected using the plant SCADA or traditional monitoring applications. For example, you don't need AA to tell you your wind turbine or solar inverter is offline, and you shouldn't have to use AA to



tell you that a tracker has stopped tracking. However, if your plant SCADA system isn't pulling tracker control setpoint data, advanced analytics can detect that a tracker has stopped tracking. In other words, before you invest in moving up the asset optimization pyramid, make sure you have each of the five keys to a successful implementation.

Consider the typical utility-scale solar power plant: It has thousands, even millions of non-instrumented electric generators. Sensors well downstream of these generators don't have the sensitivity to detect performance issues associated with these generators. So how can we know if our solar generators are performing optimally? We have three choices:

- Manually inspect them—a very cost-prohibitive option.
- Use thermal imagery—a good, but periodic, option.
- Use advanced analytics—a good continuous option because the typical solar power plant does not have sensors located close enough to the generation equipment to detect subtle shifts in operating performance.

Advanced analytics solves other problems specific to our industry as well, such as using machine learning to detect subtle changes in a turbine's power curve, or to catch the temperature derating of a solar inverter. Additionally, automated workflows incorporating AA can generate a work order with all details about failure mode, failure cause, and repair code recorded by the software. By integrating the event detection, insight, and action steps into an automated workflow, we can reap the benefits of advanced analytics.

To Buy or Not to Buy?

That's the big question. Is advanced analytics worth the investment? It can be. But if you're trying to solve the wrong problem, or if you don't have the right data platform, business processes, and subject matter experts in place, you're far better off investing your money getting the basics done right first.

Steve Hanawalt is co-founder and executive vice president of Power Factors. Power Factors consolidates multiple operational data sources, asset hierarchies, and metadata frameworks to create a single cloud-based remote asset management platform that works with today's large-scale portfolios.

Power Factors /// pfdrive.com





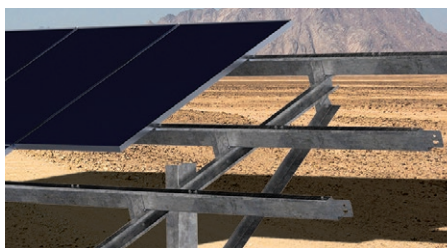
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Up On The Roof

Is ballasting really safer than anchoring?

by Alexandre Vanasse

WHEN ROOFTOP SOLAR BECAME MORE

commercially widespread in the early 2000's, Building Codes around the world simply did not have any instructions on how to calculate wind effects on tilted panels on a flat roof. As time passed, and PV racking manufacturers started testing their products in wind tunnels, the industry started to define several unknowns, some of which are still in discussion today. What portion of the structure acts like a single structural element (called "tributary area" by specialists)? What is the effect of a wind deflector?

Almost two decades later, and after installing collectively gigawatts of flat commercial rooftop solar, our industry now has a more thorough understanding of how wind affects a solar system. But ballasted systems still move, and sometimes (albeit rarely) fly off the roof and cause considerable equipment damages.

While any other industry attaches their equipment's to a building's structure with bolts and screws, our industry still loads our high tech, space-age solar cells panels with... rocks to hold them in place!

It is generally assumed by PV project developers that roof penetration carries a risk of leaking. As technology and knowledge about wind physics evolve, however, experts are starting to consider direct attachment much more seriously.

According to experts, ballasted systems with wind deflectors require very thorough analysis of the racking structure and its location and shape on a given roof, and some risks are too easily overlooked. For instance, wind deflectors that can bend under wind pressure may not be as efficient to limit uplifts as theoretically thought. Also, as PV racking manufacturers had their system wind tunnel tested, they found that their results did not always scale well on large or tall buildings of different shapes. It became clear that PV system's wind engineering had to consider the size of the system relative to the size of the roof.

A select group of building experts collaborated with the Structural Engineers Association of California (SEAOC) to help write sections of new Building Codes in North-America (ASCE 7-16 and NBCC 2016) and papers' that brought a new, deeper understanding of how the

size of a building can affect wind forces applied on a racking structure. Today, when this science is applied (namely the A_n and L_b factors for scaling wind tunnel results), ballasting a PV array on a large, tall flat buildings become extremely complicated - dead loads can be huge, especially on tall roofs, making some projects impossible to complete with concrete ballasts only.

Where it was usual to see ballasted systems around or even under 5 lbf/ft², most large flat buildings, when these new rules are used, will now see up to (and sometimes more than) 10 lbf/ft² at standard tilts, no matter if wind deflectors are used; ballasting systems above 15-degree tilt will become very complicated.

Point loads are also quite complicated to manage. Some higher tilt systems can have several hundred pounds of blocks required at one location, which causes issues with roof insulation compression and general point loading on specific roof joists. Since most solar flat roof anchors can usually take up to 750 lbf of factored force, which is equivalent to over 40 gallons of concrete (155 liters), anchoring can solve many of these problems. Even adding just a few anchors in the corners of the array (where the vortices effects are the strongest) reduces point loads, and prevents lateral drift and seismic events.

Now that bifacial PV panels are cheaper than

standard panels in the USA, thanks to easing trade restrictions, ballasting is even more questionable. Such technology largely benefits from the absence of a wind deflector, higher tilts and higher heights from the roof. All of these elements increase the ballasting load necessary to hold an array in place, further complicating the ballasting of bifacial PV systems. Ballasting bifacial PV systems is not recommended, since the ballast blocks will most likely shade the backside of the panels, and limit bifacial gains. Instead, developers should discuss roof penetrations with their clients on any white roof that is appropriate for bifacial PV.

Roofing anchors have been used to tie down roof assemblies and roof equipment for decades; they generally don't leak when installed properly because they integrate with the roofing membrane, and become part of the roof system.

A number of unknowns can be countered with anchoring. One in particular is friction: when a system is ballasted, and a wind deflector is used, lateral drift has to be compensated by friction of the system on the roof. Unfortunately, friction can only be determined with testing that is partial at best. After a few years, when the roof is soiled and worn out, what are the chances the friction coefficient is still the same?

In terms of engineering, anchors may experience failure when there is a plastic deformation (i.e. the anchor's metal plate or bolt start to bend permanently). Even a bent anchor will still have some retaining force. Ballasts, on the other hand, will fail when the wind force is stronger than gravity - at which point the system may fly anywhere,





This unpredictability is a fundamental unknown associated with ballasted systems. On slightly sloped roofs, thermal dilatation and contraction can make the PV array shift slightly over time; adding a few anchors to make sure the array doesn't crawl can be seen as a good practice.

When a racking starts to lift up under extreme wind events, it starts to react to wind in an entirely different way than when it was flat on the roof. Different racking manufacturers will have different tolerance to such lifting and bending of their racks, so the project developer should inquire about maximum lifting that is allowed for a given product. More lifting means more unknowns.

Also, concrete blocks can degrade over time, especially if poor quality concrete is used. If blocks lose part of their weight, or break apart and fall of their ballast trays, the integrity of the solar array can be compromised.

Even anchors are not always fully understood. It's important to consider eccentricity on anchors when engineering a solar array. For instance, if the loads are not applied directly over the central axis of the anchor, forces applied on a metal rail beside the anchor can become a sort of lever. That will make the anchors weaker than their maximum rated forces.



Rail-based racking systems that can be mounted directly over the anchors, with very little surface touching the roof, will also reduce roof wear and tear, which is usually safer over time.

Manufacturers must also understand anchor placement, and how the racking system distributes the forces on the anchors. Done properly, this allows the installer to place fewer than one anchor per panel (which is more typical of "rack" or "tray" based racking systems that can use up to 2 anchors per panel).

As climate change provokes harsher weather events, hurricanes and more frequent stronger winds, project developers should thoroughly consider the advantages of anchors. To limit damages and risks associated with anchored systems, ask professional roofers (ideally the same team that installed the original roof) to integrate the anchors into the roof. Offering a single

warranty on the entire roof system, including anchors, will help bring peace of mind to building owners.

In summary, because wind deflectors may bend and ballast blocks may degrade over time, PV array lifting can change the aerodynamics of a racking system, rare strong wind events will be more frequent in the next decades, and new knowledge, science and Building Codes are bringing better understanding of the effect of building size and shape on a solar array, anchors are a compelling choice. Solar developers should take time to investigate the option of anchoring their solar system, instead of burying their investment under a pile of rocks.

Alexandre Vanasse is VP Business Development at Opsun. Opsun engineers, designs, and manufactures custom mounting systems for PV installations, for both rooftop and ground mount.

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¹SEAOC, "STRUCTURAL SEISMIC REQUIREMENTS AND COMMENTARY FOR ROOFTOP SOLAR PV ARRAYS PV1-2012" and "WIND DESIGN FOR SOLAR ARRAYS PV2-2017"

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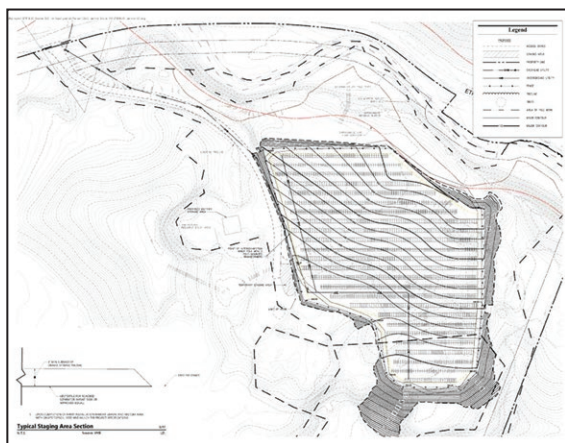
by Chad Farrell



Rhode Island is currently in the process of creating an inventory of every brownfield, landfill, and parking lot in the state in their search for new locations to harness solar power. Even here, in America's smallest state, the intersection of favorable economics and demand for carbon reducing solutions to address climate change makes scaling the number of solar installations in the U.S. inevitable. Meanwhile, finding suitable sites for greenfield development that don't involve environmental, aesthetic, or interconnection constraints has become increasingly difficult.

In Vermont, practically the only way to build a larger net metering project is by utilizing what the legislation refers to as "preferred sites"; these are primarily landfills, brownfields, or other previously developed land such as parking lots, rooftops, and abandoned gravel pits. Maine recently enacted legislation that provides incentives for renewable energy projects located on preferred sites. This is to encourage the development of distributed generation projects in locations that are more preferable (out of the public eye), are on properties that may not have a higher or better use for local tax revenue, and utilize locations that are closer to where electricity is being consumed, thus better suited from an interconnection/grid stability standpoint.

The reuse of brownfields and landfills as host sites for larger solar arrays is a relatively recent phenomenon. As solar markets have matured, state policies have evolved – instead of encouraging renewable energy development everywhere, the industry now needs forward-thinking policies that focus on where to best site solar projects over the next several decades. This is a significant pivot, and not one without challenges.



While brownfields and landfills can offer more preferable locations for solar arrays than typical greenfield land (from environmental, aesthetic, and grid quality standpoints), the nature of working on and around environmentally impaired soil and groundwater presents additional complexity and risk. As a result, the development and construction of these projects are generally more expensive than a similarly sized project on previously undeveloped land.

Increasing numbers of elected and regulatory officials are recognizing the value of more solar built closer to areas with greater population density. One of the best solutions is by turning brownfields to brightfields. As an example, the 2.2-megawatt South Burlington, Vermont landfill solar project produces over 2,600,000 kWh of clean electricity per year in one of the heavier load zones; that's the equivalent of nearly 400 typical New England homes. In signing onto a long-term contract, the City is also saving

money on its municipal electrical costs, with projections for up to \$5M in savings over the 25-year contract period. These savings are being rolled into additional energy efficiency and renewable energy generation projects for the City, under a revolving loan fund construct.

The 5.7-megawatt array installed last year on a Brattleboro, Vermont landfill is now generating nearly 7,000,000 kWh of clean electricity per year, \$100,000 in annual lease revenue for the Windham County Solid Waste Management District, and significant savings on the electric bills for 20 schools, municipalities, and other public institutions in the area – all through a group net metering arrangement. The total value to the community from this project is estimated to exceed \$10M over the 20-year contract term. It's currently the largest landfill solar project in Vermont, and there will be more.

Conservative estimates predict a massive increase in the amount of solar installed in the U.S. by 2030. This will undoubtedly unlock the potential of underutilized sites such as brownfields and landfills; this land will be critical to realizing these ambitious but achievable projections. These sites will also be integral for meeting the increasing demand for electricity as we move toward electrifying the transportation and thermal energy sectors, while at the same time transitioning our energy supply system to a distributed generation model powered by renewable energy.

According to the Environmental Protection Agency, there are an estimated 450,000 brownfields in the United States. The National Renewable Energy Laboratory estimates that landfills and other contaminated sites cover 15 million acres across America, an estimated 80,000 of those acres of

which have already been prescreened for renewable energy development.

As we embark on what some are referring to as "the Solar Decade," with plans to produce 20 percent of our domestic energy supply from solar by 2030, we can't afford to leave viable project sites empty. Turning brownfields into brightfields currently remains a relatively underutilized segment of the market. Although evolving technology drives down installation prices, and rapid innovation in the energy storage market helps to increase solar deployment, it's still not enough. Establishing local and state-level policies is critical to streamlining the development of these more complicated, yet often preferable projects.

Many of us in the solar industry are working hard to overcome these challenges by continuing to develop and construct brownfield and landfill projects; not just in Vermont, but across the entire country. Converting brownfields into brightfields creates opportunities for investors, the grid, and local communities by reclaiming unused land for clean energy generation where it is needed most, while offering savings to both taxpayers and ratepayers. And in our view, that is a win-win-win.

Chad Farrell is founder and chief executive officer of Encore Renewable Energy. Encore works to blend natural and built environments in creating commercial, industrial, and community-scale solar PV systems. They focus on undervalued and underutilized properties such as landfills, brownfields, parking lots, and rooftops.

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“Heliostat” combines the Greek words for sun (“helios”) and stationary (“stat”)—in other words, a device that tracks the sun from a stationary point.

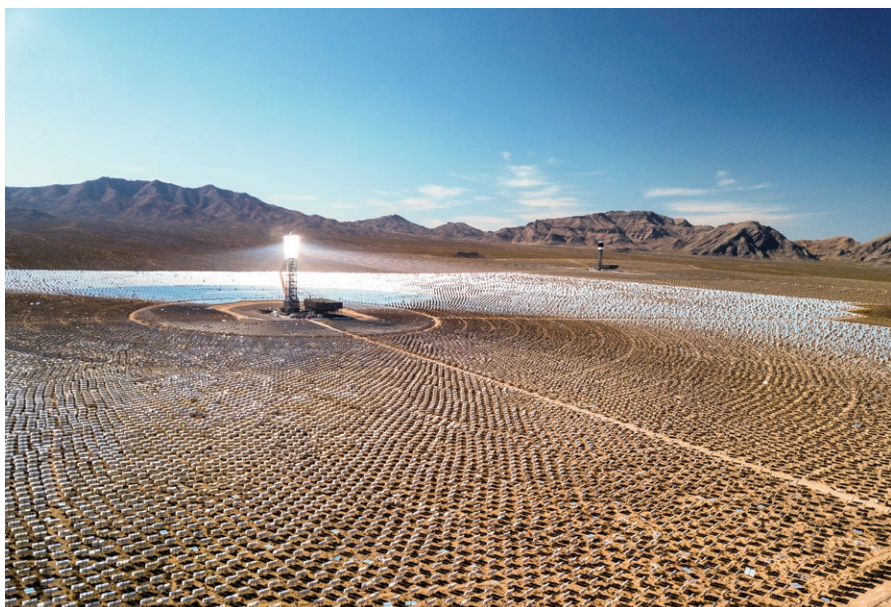
Gear Set Reset

How double-enveloping worm technology is driving heliostat dependability

by Jacob Randall

The Ivanpah project in the Mojave Desert uses 173,000 heliostats and is the world’s largest concentrated solar power facility, generating an estimated 940,000 megawatt-hours of clean energy a year.

When the average person thinks about solar power, it is likely they will picture a classic photovoltaic (PV) solar panel installation. While less familiar, concentrated solar power (CSP) also has an important role, as countries embrace alternative energy production as a means to address emerging challenges. While building a CSP facility requires far more time and expense than constructing a PV array, CSP facilities can produce a tremendous amount of energy and, most importantly, can store it far more efficiently than PV systems. As a result, CSP facilities tend to offer distinct advantages over classic PV, especially in locations close to the equator with high solar radiation.



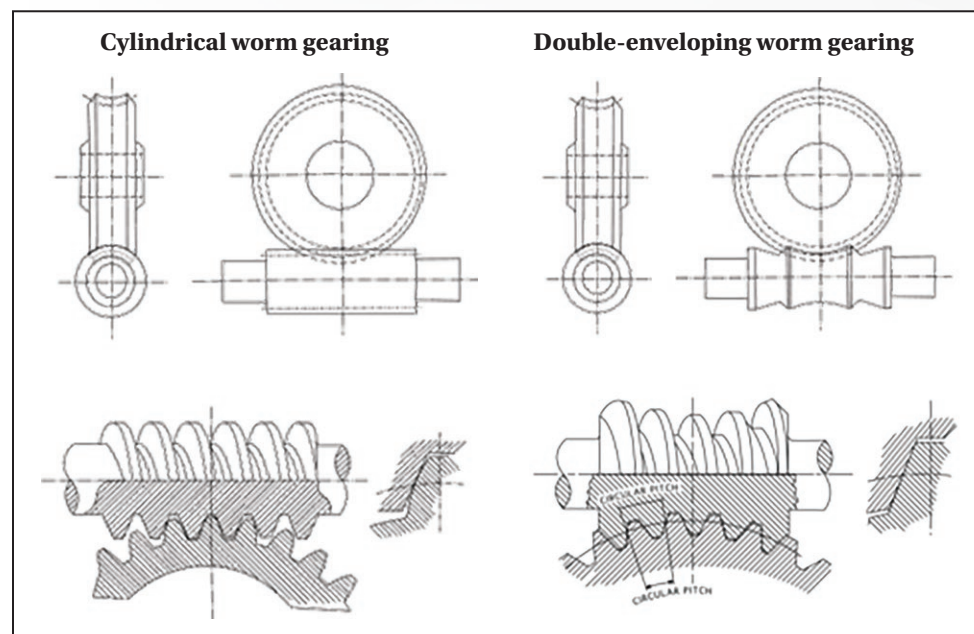
The efficient operation of a CSP facility goes beyond the collection tower. A successful CSP installation requires well-constructed heliostats that precisely track the sun throughout the day and reflect its rays onto the heat exchanger atop the tower. While heliostats may appear as little more than large mirrors affixed to support poles, they are actually complex devices that require careful engineering to function effectively over a 30-plus-year life span. Precise movement of each heliostat is essential. They key to this precision? The gear set.

Aiming for Extreme Accuracy

Two types of drive systems are used to position heliostats for optimal reflection throughout the day: an azimuth drive that allows for east to west rotation, and an actuator for the vertical elevation of the mirror. Heliostats rotate 270 degrees or more a day along the azimuth drive. These movements—with rotation speeds as slow as .009 RPMs—must be extremely precise to maintain proper alignment. To achieve a proper angle of incidence (where the light rays strike the mirror exactly so) a robust gear design is required, one that employs the same type of technology used to point and position satellite systems and surgical tables.

For azimuth drives, many heliostat makers have come to favor a double-enveloping worm gear design, where the worm and gear wrap around each other. This design offers greater contact between the worm thread and the gear teeth than a standard cylindrical worm gearing. In a double-enveloping design, the curved profiles of the gear teeth match the circular profile of the worm thread, allowing full engagement between the thread and the teeth. Single enveloping worm gear designs can only achieve partial engagement between the thread and the teeth.

Figure 1: The mesh of common cylindrical worm gearing (left) provides one to 1 ½ gear teeth in contact with the worm while the double-enveloping design (right) provides greater tooth contact—up to eight times more than cylindrical worms.



This superior mesh contact translates to higher torque capacity and greater shock load resistance. Double-enveloping gear sets can optionally be spring loaded to be self-adjusting, which helps to compensate for wear and maintain zero backlash integrity (where there is no clearance or lost motion caused by gaps between the teeth and the thread). This is crucial for accurate positioning. As a result, the double-enveloping worm gear set has become a preferred solution for maintaining the ultraprecision required for efficient CSP operations. Across the globe, double-enveloping worm gearing technology can be found in virtually all manner of modern heliostat designs.

Added Structural Stability

The high gear-to-worm contact ratio of double-enveloping worm gear sets also helps to provide stability for heliostats, which are frequently subject to extreme environmental forces. Because heliostats often measure 25 square meters or greater in size, they can act as large sails when strong winds kick up across wide open expanses. Desert windstorms can pack peak gusts up to 190 miles per hour - heliostats must possess excellent structural rigidity to continuously withstand these forces, while holding their position to within fractions of an inch. They must also effectively resist any sand or debris carried along by these potentially damaging winds.

This requires high torsional stiffness, which is an inherent feature of double-enveloping worm gear sets, and mission critical to keep heliostats exceptionally stable. And while gear set designs with less inherent contact between the thread and the teeth can sometimes be sized up to withstand higher loads and stresses, this is not ideal for several reasons. More weight means more material costs, as well as extra transportation and installation expense, and may also require design modifications to heliostats (to accommodate the larger gear set and added weight).

Additional Considerations

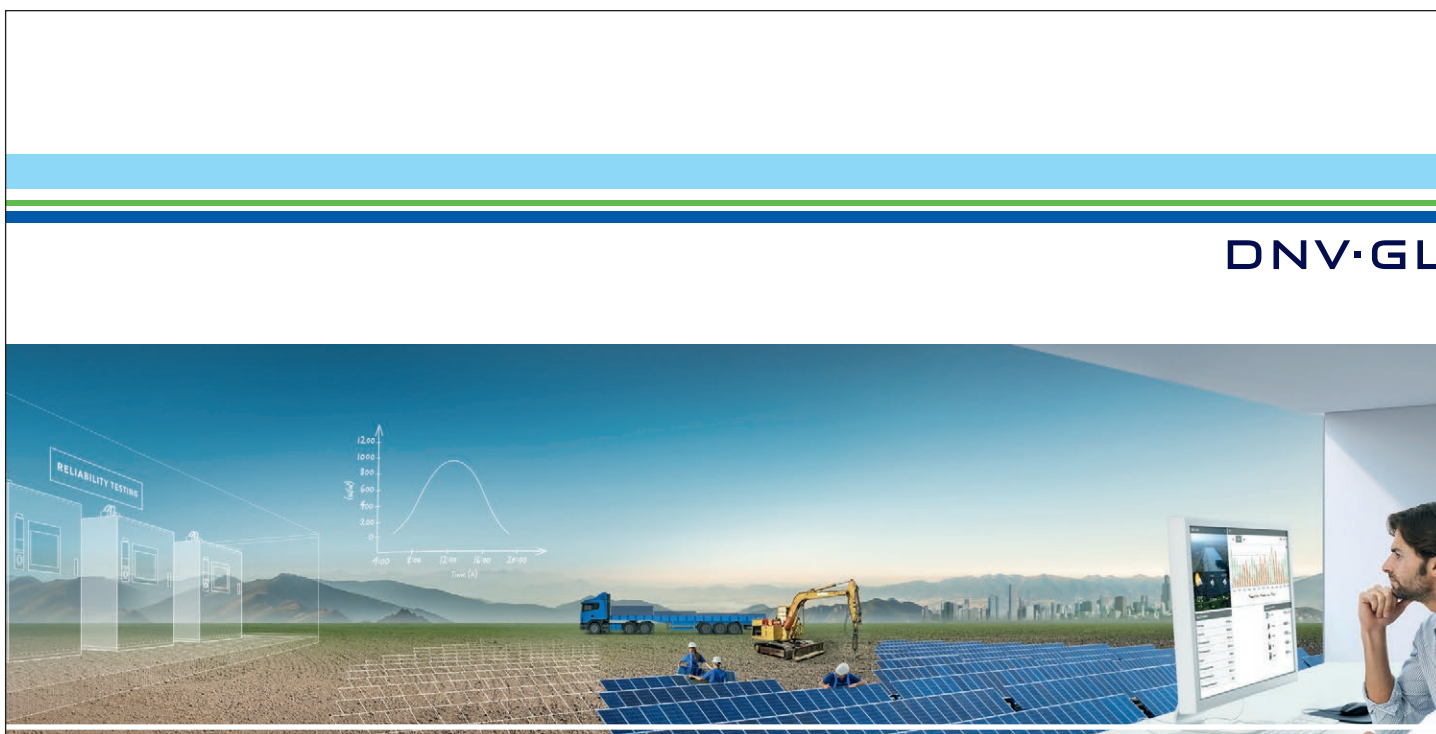
Regardless of the gear set design, it is important for CSP operators to ensure that heliostat gearboxes are properly sealed. Depending on the location of the facility, moisture or salt spray infiltration can pose a threat to reliable heliostat operation. This is in addition to sand, dirt, and debris. Heliostat gearboxes should be designed for zero maintenance - lubricated internally, and sealed up for the life of the device. Some gearboxes must be greased every three to five years, which can quickly amount to a major maintenance headache when it comes to regularly relubricating tens of thousands of units operating in harsh conditions.

There is no such thing as a simple CSP installation; power producers must lean on trusted suppliers to overcome major obstacles. The right technology for the job is one requirement, while the ability to coordinate large-scale deployments across continents is another critical consideration for keeping CSP projects on schedule. Take time to identify suppliers with a proven track record for completing large projects on schedule. After all, the sooner power generation starts, the better. Working with a partner that offers extensive CSP market expertise and a collaborative engineering approach can be invaluable to achieving the best results.



Jacob Randall is Director of Strategic Markets at Cone Drive, a leader in precision motion control technology for diverse markets including solar, automation, aerial platforms, and food and beverage. In the renewables market Cone Drive produces gear sets for trackers that position solar panels.

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Solar vs the California Drought

by Chris Greenmyer



IT WAS SPRING 2017. THE WORST DROUGHT IN

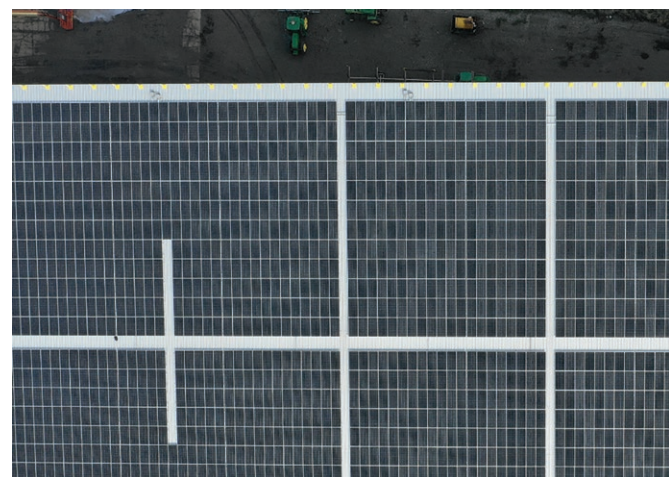
California's history had just shown signs of letting up. Even though supplies were replenishing, water was still in high demand; valley farmers were desperately looking for ways to cut costs while trying to stay afloat with diminished crops. On top of that, utility prices were at an all-time high, and discussions of tariffs were making their way through the industry, striking fear into the eyes of every developer, builder, and end user in the country. No better time to start an AG-driven, large scale solar project in the middle of the California valley, right?

For one project contractor, it was the perfect time, and the project was given the green light. As 2018 rolled in, 22 trucks rolled towards Stockton, California. Carrying over 230,000 pounds of pre-fabricated gray steel, the fleet delivered their load to Sousa Farms Inc., which was getting ready for the construction of an 85,000 sq. ft solar canopy.

Construction started with the columns. Each column is supported by spread footings that measure a minimum of 10' in length, by 10' in width, and 3' in depth. Yards and yards of concrete flooded the site, topping off all 28 rebar caged footings. Then came the steel canopy, erected by a crew of hard-working individuals responsible for making sure that each bolt, nut, and washer was installed according to plan, and torqued to correct specifications.

After the drought had ended, the rain arrived. The structure was in jeopardy of delays due to what the weather report was showing on the horizon. In order to avoid costly delays, the contractor needed all hands on deck, and as many resources as possible to overcome the challenges of a potentially historic wet winter. Even as numerous storms bore down on the site, the team did not give up.

To help push through winter muck, truckloads of crushed rock were installed on site; this allowed work to continue in the wet conditions. The crew rode the wave through the harsh winter, and into the foggy, dew-filled spring mornings. By summer, the structure was a skeleton of gray, soaking up the UV rays that would soon be used to harness energy.



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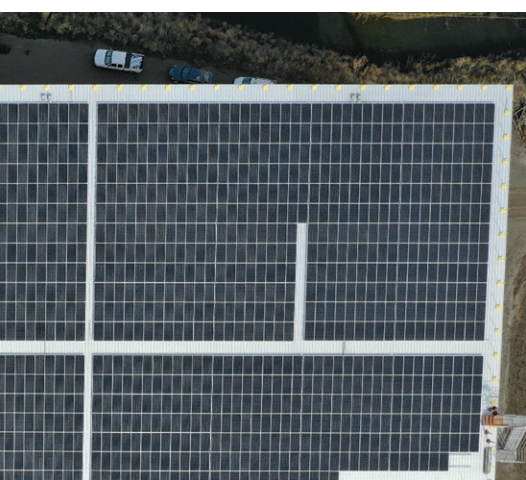
A project of 1.16MW wouldn't normally grab anyone's attention, but when you take a close look, you'll see that it's the structure that makes this system truly unique, and a great asset to the Sousa family and their business operation. Months later, into the early summer of 2019, it was finally time to flip the switch; the Permission to Operate was issued by PG&E on June 4th, 2019, and the solar system went live. Not only are they reducing their carbon footprint and providing clean energy to the grid, Sousa Farms has grown into a forward-thinking business, driving the local economy and putting food on the table.

At completion, the south eave of the structure measured at 32 ft, while the north end was a mere 50ft in height. This massive steel structure spanned a total 510 ft, which ended up creating a masterful design for shade, even spanning across the existing Sousa Farms Inc. office and warehouse. Mr. Sousa wasn't exactly after shade, however. Instead, his goal was the 85,000 sq. ft rooftop footprint which would become home to Sousa Farms Inc's 1.16MW DC PV system.

The Photovoltaic Grid Tied system is comprised of (3,335) 335w 72 cell panels and (18) 50kw and (2) 30kw String Inverters. The PV system is monitored through a web-based monitoring portal. Choosing a monitoring service involved finding a platform with as much detailed information as possible. Mr. Sousa is very detail oriented when it comes to his farming processes, so it only makes sense that he would decide on a web-based monitoring program that would allow him to dissect the inverter's analytics (watts, voltage, amps and kwh production). A master of numbers and American ingenuity, Mr. Sousa prides himself on engineering, data spreadsheets, and a work-smarter-not-harder mentality.

The contractor used their engineering experience to apply this same premise to the system design: trapezoidal roof mounts were the base of the racking system, which included over 20,000 ft of aluminum rail attached across 5,900 aluminum cube mounts, and multiple walkways that were designed to allow access for maintenance and cleaning.

The system has an anticipated energy production of over 1.5 million kWh in year one - enough power to fully charge 30,000 Tesla Model 3's. In Mr. Sousa's case, the energy will be diverted in a different direction: the system will be able to offset multiple irrigation pumps that feed acres of walnuts and cucumbers across the Sousa Farms ranch, which included three homes and a main office.



Chris Greenmyer is Project Manager at Lenzi Incorporated, a California-based construction company with 40 years' experience in general contracting and development. Since starting a solar division in 2010, Lenzi has constructed and developed a combined 135MW of PV throughout the country.

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Saving an Industry's Reputation

Opinions of a solar inspector

by Christopher Beauchamp

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MY GRANDMOTHER, TRYING TO INSTILL

good values in me when I was young, would say, "It takes years to build a good reputation and only minutes to kill it." This didn't resonate with me until I was an adult and running my own business. In those 10 years, this statement was my motto - it kept me very busy with business flowing in from word-of-mouth advertising. I have since changed careers to solar inspecting, but my motto remains the same. Unfortunately, not everyone holds themselves to the same high standard. Over the six years I've been working as an inspector, I have been astounded by what I have seen in the field. Based on my firsthand experience, I can tell you that the reputation of the solar industry is at risk.

Some of the more memorable offenses include the times I've caught installers grounding to gas pipes, mounting an entire roof array without one piece of flashing, and even gluing modules to rails when they ran out of clamps. One experience that stands out is the installer who argued with me to avoid a poor score on his inspection. He should have had a grounding rod reaching eight-feet into the ground. Instead, he chose to use three different three-foot grounding rods. He informed me it was actually nine feet in the ground and had passed all local inspections - when I called him on it, he was not happy. After that, I couldn't help but wonder, who is overseeing these installations? Who is making sure that the installer has followed code and best industry practices? There appears to be a lack of consistent oversight on quality, or adherence to code being

enforced by local government (or the installer themselves). We, in the industry, all know that the city inspector references a quick checklist and rarely gets on the roof. The homeowner may have a false sense of security after the local AHJ visit, so when problems arise later it becomes a matter of bad customer experience, which fosters a lack of trust.

When a homeowner has a roof system that is not performing as the sales representative promised, they can get frustrated. When leaks appear because flashings were not installed correctly, the homeowner gets even more frustrated and angry. When the installation company doesn't return their calls, the homeowner becomes livid. By the time that homeowner finds out the installer is no longer in business (which is happening far too often) they've reached the breaking point. From then on, most of their conversations with friends will be about how terrible solar is, how it wrecked their house, how they were deceived, and how no one in their right mind should get solar on their home. This is the worst kind of word of mouth - and it hurts all of us.

Just as every consumer should do research when choosing a good auto mechanic, restaurant, or even doctor, so too should they put in the time to research before choosing a solar installer. All solar installers operate differently; consistency can vary from crew to crew even within the same company. Homeowners need to be more curious about the company they are hiring, and not just gloss over the details when the salesman is at their door. They need to read the small-print





The solar industry is still relatively new, with plenty of untapped potential. We owe it to ourselves to play a part in learning from past mistakes and ensuring quality installations are the norm. Inspections and training are the easiest way to disseminate vital criteria for solid installations. Solid installations lead to happier customers. Happy customers will tell everyone they know about how much they love their system and encourage others to be part of the solar community. The reputation of solar is in our hands.

Christopher Beauchamp has been a solar inspector with Burnham Nationwide for the last six years. He is currently head of development for the BurnhamEYE Documentation & Inspection Application. His attention to detail and enhancement of this inspection tool has enabled accurate remote inspecting of solar installations across the nation and beyond.

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in the contract and ask questions so that they really understand what kind of a deal they are getting into. A well-informed consumer can help drive the industry towards a better customer experience.

By running a tight ship and making training paramount, solar installers can help boost our reputation industry wide. Too often, the "quantity over quality" mentality is stressed - this ends up costing everyone in the long run. Installers should have regular meetings, encourage collaboration between installation crews to share tribal knowledge, and turn a scrupulous eye on their team's workmanship. The smarter installers take inspection reports and use them as an opportunity for improvement. Well-trained installers will pass on the knowledge and adhere to higher standards in the right environment. On the other side are the installers that push back on their inspection results, oftentimes because they were not aware they were breaking code or doing anything incorrectly. It's rarely a matter of malicious neglect. More often, it's just the result of basic ignorance or lack of experience.

Users of third-party installers (TPI) should start out new relationships with a strong inspection protocol. Failures do not need to eliminate the new installers; a simple plan for corrections can change the outcome and future trajectory. Good installations result in fewer phone calls, better social media, and less headaches in trying to rectify legal escalations. After all, it is better - and less expensive - to do a job right in the first place than to spend man hours fixing a mess.



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Unlocking Solar Diversity

NYC's community solar option is driving heliostat dependability

by Manish Nayar

Community solar has experienced enormous growth across the country over the past few years. From 2016 to 2019, the total capacity leapt from roughly 300 to 1400 megawatts (MW), more than quadrupling the supply. By 2020, community solar could reach between a third and a half of the total distributed PV market, according to the National Renewable Energy Laboratory (NREL). Most of that capacity and growth is in rural areas, but increasingly, urban rooftops offer an opportunity for solar development - and could be the key to its diversification.

New York is a leader in the growth and development of the community solar market thanks to the NY-Sun Initiative, which gave the sector a \$1bn boost. Enough community solar to supply an additional 120,000 homes is slated for development in the State. Governor Cuomo also recently increased the size cap on community solar projects from 2 to 5 MW, increasing the number of available household subscriptions from roughly 360 to 900, so individual projects can expand their reach.

With all of this new solar power available, policy leaders are concerned that not all income groups benefit from it equally. Over forty percent of households in the U.S. classify as low-income (according to the U.S. Department of Housing and Urban Development definition of falling at or below 80 percent of the local median income). This market accounts for 49.8 million households, but half of these cannot support PV panels. Just under a quarter of the below-median income households in New York state have access to solar energy.

Community solar presents an important solution, particularly for New York City residents, because it allows residents to access renewable energy without owning,

building, or installing PV panels. And thanks to the offsite location of the shared solar array, users can subscribe regardless of their building unit type or home ownership status. In New York City, the breakdown of renters is 87 percent very low income, 77 percent low income, and 70 percent moderate income residents. At least 85 percent of all three income category groups live in multi-family units, according to the New York State Low- to Moderate-Income (LMI) Census. Renters and residents of multi-family units often lack the decision-making power to determine the energy source of their household. Regardless of these barriers, LMI households in New York City still deserve opportunities to get in on the community solar action.

With community solar, multiple users draw from the energy generated by a large array of solar panels (PV) located offsite. This requires coordination between the solar project and its owner, the utility company, and the users. Participants either subscribe to the solar energy source, or become partial owners (some utilities offer premium subscriptions for this "boutique" service). Alternately, the savings on the cost of energy can be captured via virtual net metering (VNM) that tracks the off-site energy output, and

adjusts users' electricity bills according to the net value of energy they have consumed. So far, sixteen states, including New York, have passed VNM legislation.

For participating VNM subscribers, not only can community solar lower their cost of energy (by 10 percent or more), but it enables tenants to access renewable energy without a large upfront expense. Tenants can also bring their subscription with them if they move - a great opportunity to bring renewable energy to LMI communities in large cities. In practice, however, not all users can easily access VNM community solar due to financing and policy-making difficulties. This is why state and local governments seek strategies to improve LMI access, and shrink the solar socio-economic divide.

The two most popular policy objectives include lowering energy costs for low- and moderate-income residents, and supporting a thriving local workforce. On average, low-income households spend 8.2 percent of their income on energy costs. Cities developing net cost reduction programs with VNM community solar could extend their efforts to curb those costs. Add in training and hiring from local communities, and the result is a win/win situation for the LMI community.

So far, LMI users still account for a very small percentage of community solar users. Most users are larger organizations like businesses, universities, government agencies, and upper income households. Only around five percent of the projects that supply LMI users exceed ten percent inclusion. Because community solar is often financed through premium pricing, high enrollment fees, or long payback periods when the solar array is partially owned, LMI participants don't see any immediate cost savings advantages. This



obviously disincentivizes them from joining. Developers also lack incentives to attract low income customers.

A number of innovative approaches to achieving greater inclusion have been implemented across the states offering community solar. Most of these involve mandating a percentage of LMI participation, or making programs that cover the costs of LMI participants through alternate payment or credit rating structures. A recent initiative in New York state plans to cover the community solar enrollment fees and other costs for 7,000 low-income households. Another project, by the New York State Energy Research and Development Authority ("NYSERDA"), aims to benefit LMI communities by offering a third of the subscriptions for community solar contracts (amounting to 26.4 megawatts of capacity) free of cost.

Apart from mandated inclusion, LMI households wishing to seek approval to a community solar program may be denied if their credit score is low or non-existent. To address this, the Green Jobs--Green New York program offers alternate qualification tiers for solar power and energy efficiency loans, where the focus is more on mortgage payment history and an added sliding debt-to-income ratio requirement. In Massachusetts, a test program qualifies LMI users for community solar based on a more comprehensive set of criteria including income data, FICO score, and repayment history on household expenses (utilities, rent and cellphone).

Community institutions may play the role of an anchor subscriber to absorb the fluctuating costs of participation, enabling even more LMI subscribers to join. Local NGOs or government agencies can also help find LMI subscribers, as well as carry the administrative burden of signing up participants for developers. Additionally, by keeping a waiting list of subscribers ready to join when other participants leave, community solar can reduce the likelihood of price variation.

Through well-planned policies, community solar has the potential to tackle a number of socio-economic disparities that LMI households face. Inclusive solar programs can reduce any stigmas that solar only benefits wealthy individuals. At the same time, it can reduce the long-term costs of

energy while providing jobs for those most in need, reducing financial strain. Lastly, and most importantly, including LMI participants in community solar programs pushes solar forward as a viable mainstream option that reduces the consumer's cost of energy while accelerating widespread adoption.



Manish Nayar is the founder and Managing Partner of OYA Solar. Manish has led the growth of the company and its resulting 1000MW+ North American development pipeline. Manish has developed, constructed or transacted on over 500MW of solar assets in the last 10 years.

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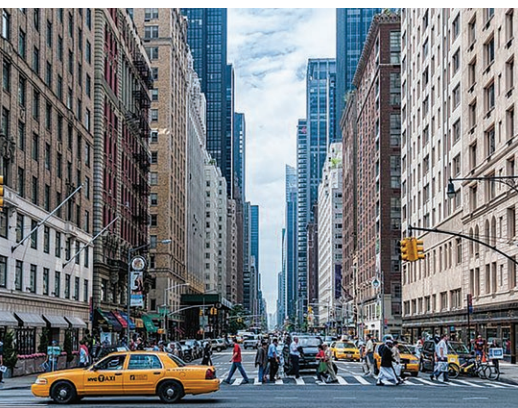
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Following “Tradition”

How a well-known operating lease makes a compelling financing alternative for commercial solar

by Stanley S. Fishbein, JD, LL.M. (Tax)

THE “TRADITIONAL” OPERATING LEASE HAS BEEN USED

for decades by equipment salespeople to sell all types of commercial equipment, from office equipment to factory machinery - even big-ticket items like aircraft. Unfortunately, in the solar industry, sales opportunities are being missed because the “traditional” operating lease is not well known, and even less understood.

It’s time to demystify this “de facto” financing method. This concept offers many features and benefits that not only differentiate it from alternative financing choices, but also make it an ideal choice for certain potential customer profiles.

Many companies, when they recognize the affordability and investment value over the life of a system, will actually prefer to invest in owning a long-lived solar system.

The value through ownership of a solar system is very attractive, especially when energy savings is combined with tax benefits, renewable energy credits, and any other incentives. Because there are other needs for cash in a business, however, discovering the right financing is key to making ownership affordable within a company’s operating and capital budgets. This is where the lease becomes a compelling financing alternative.

Leases are pretty well understood and tend to follow a similar pattern across industries. In the solar industry, a “traditional” operating lease (also known as a true lease) is a usage agreement between two parties, whereby the owner of the equipment (Lessor) gives to another (Lessee) the right to use the equipment for a period of time (Term) in return for some form of consideration (typically monthly payments). If a purchase option is not exercised, the Lessee is required to return the equipment to the Lessor.

By replacing upfront capital investment with 100 percent tax-deductible, fixed monthly payments (no escalator) that have been subsidized by the monetized value of the lessor’s tax benefits (investment tax credit and depreciation), the “traditional” operating lease serves as a quick, affordable path to ownership.

Fixed monthly payments, followed by a purchase option price, will typically total less than the original solar system price; there is no interest paid, and the cost to own will be further reduced by the tax-deductibility of these payments. Just looking at the numbers, this “traditional” operating lease should be considered the de facto method of financing for companies seeking ownership.

Compared to a loan, the “traditional” operating lease (with its lower, fully tax-deductible payments) will provide a company with all the same energy savings and non-tax incentives, while also conserving cash in the company for working capital and other uses. This has the added benefit of increasing a company’s profitability. What’s striking is that companies will obtain a similar or lower after-tax cost of ownership using the “traditional” operating lease versus a loan!

This similarity of after-tax cost of ownership is due to the different set of tax benefits under each method. Using a loan, a company obtains the investment tax credit and tax deductions for interest and depreciation. Using the lease, that company obtains lower monthly payments (subsidized by the lessor’s monetization of the ITC and depreciation) that are 100 percent tax-deductible as rental expense, as well as a tax-depreciable purchase option price.





Anyone involved in solar sales should make a point to ask a lot of questions about a company's situation. Only after you're armed with the information you need can you offer financing choices that you can be confident will address your customer's broader needs and objectives.



Stanley S. Fishbein, JD, LLM (Tax) is Managing Partner and Co-founder at CleanView Capital, an equipment finance company specializing in making ownership of solar and other clean energy systems affordable and profitable for commercial and industrial companies nationwide. Stanley has more than 35 years' experience in all aspects of the equipment finance industry, including origination, structuring, and syndication.

CleanView Capital /// www.cleanviewcapital.com

The comparison assumes that a company can obtain full value from the assigned tax benefits. Any limitation of the company's ability to use the tax credit or deductions for interest or depreciation within the company makes the operating lease the unquestionable preferred alternative.

An operating lease is particularly attractive for the following types of entities:

- **Pass-through entities**, such as S Corporations, LLCs, and partnerships, where taxable income and tax credits pass through to the entity owners. Allocating a tax credit among multiple individual owners in a family-owned business or professional company (doctors, architects, engineers, etc.) could diminish the attractiveness of an income tax credit; in any event, it does not conserve cash within the business. Some pass-through entity owners, such as employee stock ownership plans (ESOPs) are tax exempt and cannot use a tax credit.
- **Regular "C" Corporations** where the business already has ample depreciation, tax credits, and/or net operating loss carryovers that minimize its current tax liability, or has reached a limitation on tax-deductible interest.
- **Any entity with capital budget constraints**, and the desire to utilize its operating budget, where the energy savings will be realized.
- **Any entity that wants to conserve cash in the business**, and keep its bank lines available for working capital and re-investment purposes.

Other financing alternatives include a finance (capital) lease, which is a loan documented as a lease, and the Commercial Property Assessed Clean Energy Program (C-PACE) where loan payments are documented as property tax. The Power Purchase Agreement ("PPA") and its first cousin, the Solar Operating Lease (based upon the same economic model as the PPA), emphasize energy savings rather than ownership.

In comparing these alternatives to the "traditional" operating lease, it is important to look at the after-tax as well as before-tax value of the offering to a customer over the estimated life of the asset, and not simply an analysis over the term of the financing.

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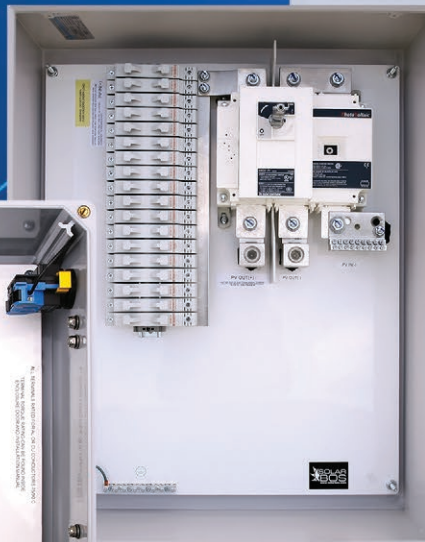
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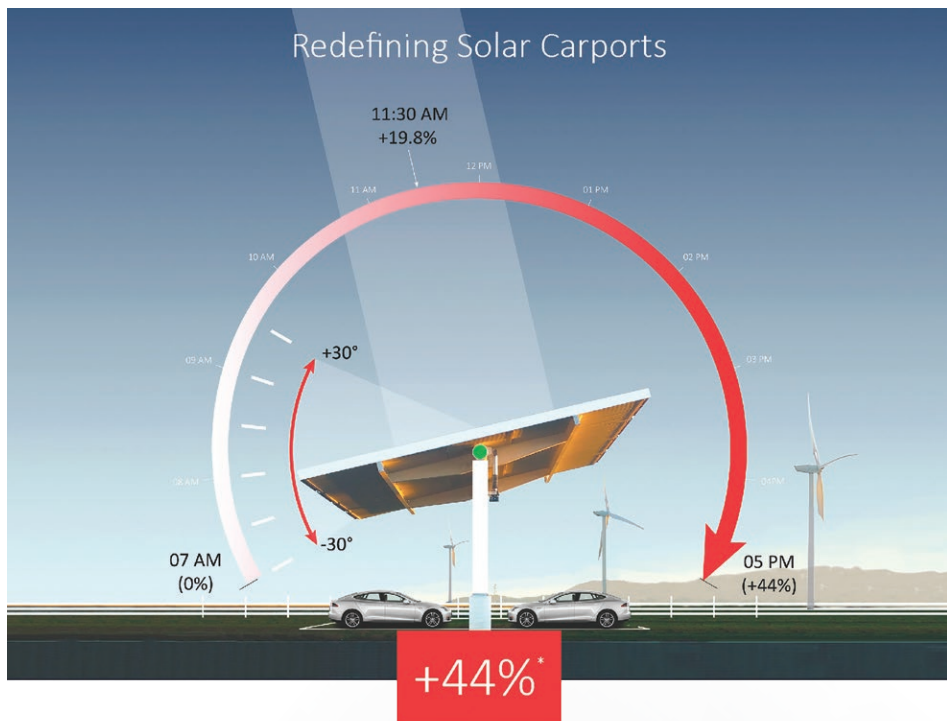
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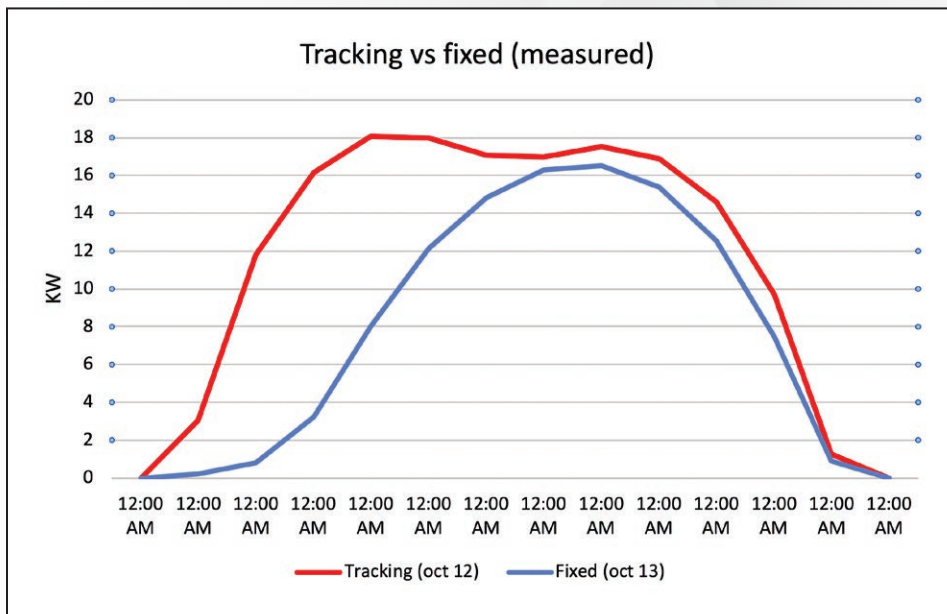
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The Revolution of Sun Tracking Carports

by Alain Poivet

Commercial size carports are often the easiest solution to deploy large areas of solar collectors in an urban area or on corporate sites, but these fixed carports have a major flaw; because they usually follow the drive lanes azimuth, they are often sub-optimally oriented and, therefore, less than efficient.

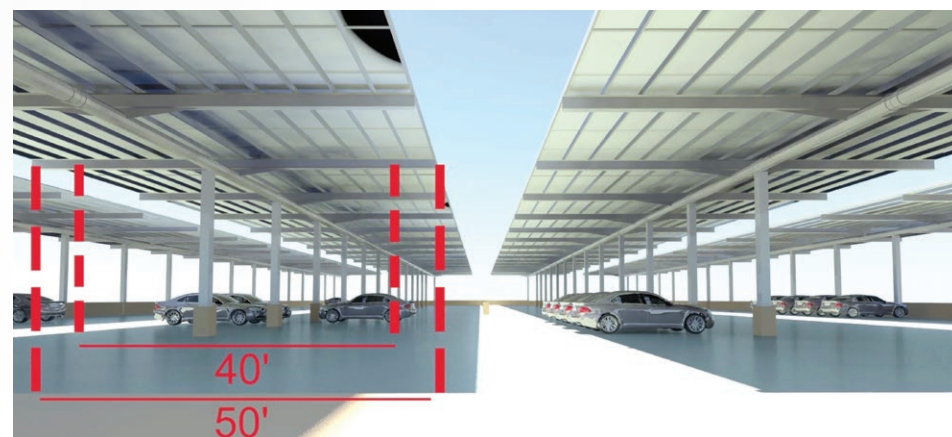


Keep an eye out for the latest standard: Sun-tracking carports. This new technology is about to reshape the industry.

Parking areas are perfect applications for solar deployment. They are large areas with little shading and no building integration issues. The solar panels installed on canopies above the parking spots shade the cars, which protects them and reduces the need for air conditioning. Solar carports or canopies are now widely used in sunnier parts of the world, but these are usually fixed and can rarely be ideally oriented. Additionally, in order to remain economically feasible, they must follow the parking lot's layout, which means that their orientation is usually controlled by the drive lanes azimuth - often less than optimal.

Fixed carports are often built with a 5 to 10-degree pitch. This may be acceptable when facing south (although the ideal pitch would be 20-25 degree), but few parking lots have a perfect southern orientation. Most of the time, the panels are going to face an awkward azimuth, severely reducing efficiency. Plus, if the panel faces the sun at 2pm (at a 30-degree tilt), it is 15 degrees off at 1pm, 30 degrees off at noon, and 90 degrees off at 8am. At 8am, no direct sun ray hits the solar collector surface; it collects no energy except for some reflected glare, although most of the year the sun is already powerful at 8am. At 3pm it is 15 degrees off, and at 6pm it is 60 degrees off. Designers try their best to set this fixed angle so their panels are tilted towards the south in the northern hemisphere and north in the southern hemisphere, but these other tilt angles all have the same problem: the losses are enormous.

Fixed carport designers look for a compromise between pitch, clearance, cost, and efficiency. Ideally, if they could use a carport technology that allowed the





Ready-made shade structure

PLP carports are engineered and optimized to site-specific applications and PV solar installations. The modular structures feature a simplified design and integrated PV module mounting system designed to provide fast assembly rates and labor savings on every project. These solar support structures feature tilt angles that offer 0°, 5°, and 10° positions and an optional gasket sealing solution. PLP's unique module clamping system offers 50% fewer components than traditional systems and has built-in ¾" spacing. This system offers 4-high or 7-high in portrait module mounting for single row or double row car parking with built-in wire management channels.

Preformed Line Products /// www.preformed.com

panels to track the sun on one axis, the peak angle would last all day, greatly boosting the energy collected.

Sun tracking carports can solve the wind load issues, with more resilience to less than ideal azimuth. For example, a 30 KWp sun tracking modular carport can tilt 30 degrees east and 30 degrees west, with a 60-degree range, making the best of both the morning and the evening light. This can increase its energy production by up to 44 percent. Its ideal orientation is azimuth 0 degree, meaning its axis of rotation is horizontal with a north/south orientation. When the azimuth is not 0, the performance changes slightly: up to azimuth 40 degrees, the performance decrease is below 3 percent, with a maximum loss of 10 percent at 90 degrees.

How can such a large array be efficiently tilted and controlled regarding safety and code compliance?

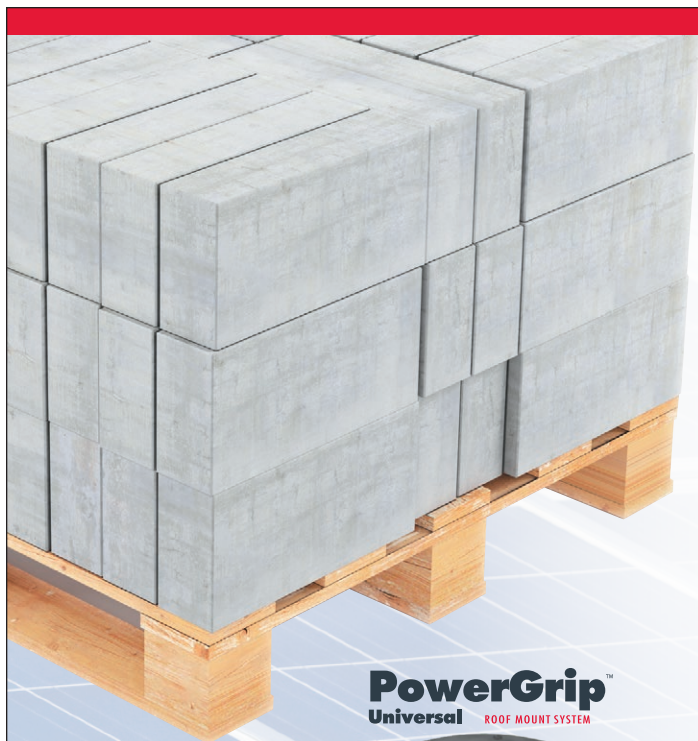
Ingeniously designed frame and drive systems sustain the code compliant wind load in any position. A built-in intelligence can also automatically adjust tilt angles in various conditions to reduce stress on the panels and carports. Systems may also be controlled remotely, which facilitates maintenance, cleaning, and snow removing operations.

Current fixed panel carports add value to any parking lot and have been implemented nationwide with good results. The next logical evolution of this technology is a leap forward that drastically increases power output on fixed surfaces. Sun-tracking carports give solar designers the flexibility they need to create a living building that takes full advantage of the sun, while also charging the bottom line.

Alain Poivet is CEO at SCARLET Solar, which has developed and manufactures a sun-tracking tilting modular solar carport.

SCARLET Solar

/// www.scarlet.red



Get Out of the Stone Age!

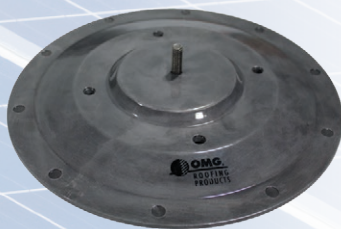
Most rooftop solar racks are designed around ballast blocks or cement pavers. But ballasted rack systems can move around on the roof, grind broken pieces of ballast into the roofing membrane, and leave the building vulnerable to leaks and other roof problems. More important, many buildings cannot accommodate the dead load weight that ballasted systems require.

Move beyond the Stone Age with PowerGrip!

The OMG PowerGrip family of products was designed to reduce ballast from commercial solar racking systems by providing a secure connection directly to the roof deck or structural members. Once secured in place, properly installed PowerGrips minimize rack movement and remain watertight.

Let us show you how a PowerGrip from OMG Roofing Products can help bring your next solar project out of the Stone Age.

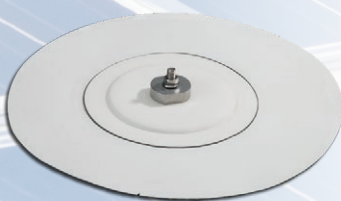
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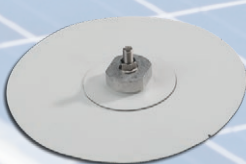
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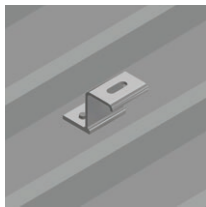
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Easy and cost-effective valley attachment solution

The Z-Bracket from Solar Connections International is a solution for valley attachments providing an ease-of-installation and includes pre-applied EPDM which creates a watertight seal. The single piece design simplifies installation and reduces cost and is compatible with rail or rail-less systems.

Solar Connections International

/// www.solarconnections.com



Deep technical support

altE Store, a Boxborough-based distributor of solar energy products and systems, now offers deep technical support for all Schneider Electric Solar Business products purchased from altE. As part of this new service, altE built a technical support lab at its Boxborough headquarters. The lab allows specialists to create a mockup of the customer's system, to replicate and solve complex technical issues. Over time the lab will expand to allow deep technical support for more brands, and R&D for new products.

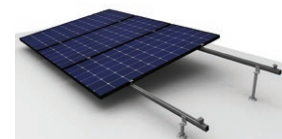
altE Store /// www.altestore.com



Upgraded inverter solution

SMA's new Sunny Boy offers the ability to integrate SMA's new TS4-R-F module-level retrofit device, a SunSpec compatible solution that increases safety and delivers cost-effective, module-level shutdown. The SunSpec transmitter is factory integrated. It represents a fast and easy way to comply with NEC 2017 680.12, which is now being enforced. Additional safety and reliability are afforded with SMA's advanced AFCI technology. The company has certified to the new UL Standard 1699B-2008 allowing integrators and system owners to benefit from increased uptime and production as well as confidence that AFCI lab results will match field performance. Power production is maximized with OptiTrac Global Peak maximum power point tracking technology, providing string-level optimization and greater overall system value. Granular string-level reporting including voltage, current, power, and DC energy also give system owners a new level of insight. Coupled with the Sunny Boy's integrated wall mount bracket that accelerates installation, the new inverter represents a fast and effective solution for shade mitigation. In addition to compliance with NEC 2017, the new inverters are compliant with California Rule 21 Phase 2 and UL 1741. The new Sunny Boy-US also offers simple, selectable country codes for region-specific smart inverter functionality in areas such as Hawaii, California, and the Northeast. SMA offers an optional cellular modem and revenue grade meter along with their Secure Power Supply function. Homeowners can access up to 2000W of daytime opportunity power. Secure Power Supply is easily installed, and works with the company's TS4-R-S and TS4-R-O module-level technologies.

SMA America /// www.sma-america.com

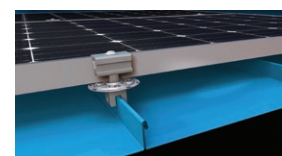


Mounting system for flat and low-slope roofs

Quick Mount PV has launched their new QRail Tilt System which allows installation of the QRail Racking System on a variety of low slope commercial and residential roof types. In addition, The QRail Tilt system allows access to the roof for maintenance and repairs without removing the array, enables installation over roof obstructions, and prevents roof degradation. The QRail Tilt System utilizes the QBase Deck Mount, which can be attached directly to the deck or a structural member based on site-specific requirements. Especially for buildings that have structural load constraints, QRail Tilt can make a solar project possible. The system can be installed at a 5° or 10° tilt with a large assortment of height options. Design assistance is available through Quick Mount PV's technical team. The new system adds to Quick Mount PV's solar mounting and racking systems. All Quick Mount PV products are manufactured at their California manufacturing facility. The company provides both virtual and in-person trainings for solar installers all across the country. Quick Mount's Elevated Water Seal Technology has allowed the company to install over fourteen million roof attachments over ten-plus years with zero leaks.

Quick Mount PV

/// www.quickmountpv.com



Low cost, quick installation PV flush mounting kit

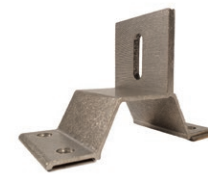
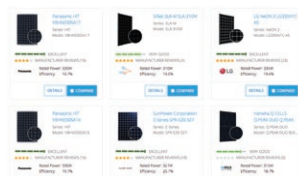
S-5! now introduces a new and improved PVKIT 2.0, with low installation time and low cost for PV flush-mounting. The kit comes preassembled with MidGrab or EdgeGrab for easy and efficient installation. A single tool drives the top bolt, eliminating several installation steps. The PVKIT 2.0 features aggressive bonding teeth for solid grounding. Fewer lugs and ground wires are required.

S-5! /// www.s-5.com

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Triple option loan for rooftop solar projects

EnerBank USA's new Triple Option Loan is for contractors to offer homeowners who are installing solar panels and expect to receive income tax incentives, rebates, and/or other significant payments. The new loan features a 12- or 18-month no-payment period and three re-amortizations of principal and interest over the life of the loan, providing homeowners flexibility in choosing how they want to pay for their projects. During the 12- or 18-month no-payment period, customers are not required to make payments on the loan. If the entire principal amount is paid off before the expiration of the no-payment period, all accrued interest is waived. After the no-payment period, the loan is re-amortized, followed by two more re-amortization events each May of the following years. This allows homeowners the option to apply rebates, bonuses, or tax refunds to reduce the amount of their monthly loan payment. With the new Triple Option Loan, contractors have an additional choice in financing options they can offer their customers, helping them grow their businesses in the process.

EnerBank USA
 /// www.enerbank.com

Consumer Reports-style buyers guide

The Buyer's Guide from EnergySage is a Consumer Reports-style tool for researching, comparing, and evaluating solar equipment. Built with data and analysis from National Renewable Energy Laboratory (NREL), this new tool empowers consumers and the industry to easily compare solar panels, inverters, and batteries based on quality, performance, and price. The Buyer's Guide can be used in two key ways by consumers: as the starting point to their solar shopping journey by finding and evaluating equipment, narrowing down their options and then proactively seeking quotes for a specific equipment package, and as a way to better understand the value of the equipment they've been quoted by installers both on and off EnergySage so that they can make confident, well-informed purchase decisions. The Buyer's Guide will help the industry differentiate their products, build brand awareness, and gain valuable insight into consumer preferences.

EnergySage
 /// www.energysage.com

Versatile hybrid inverter

The GEN24 Plus hybrid inverters complete the Fronius product range. The devices are available in single-phase and three-phase versions and are suitable for global use. They provide all the benefits of the SnapINverter and include additional features, such as being quick to commission using an app and offer a fast service plan. The PV Point provides a basic emergency power supply, even without an energy storage system. This enables users to charge their phone or laptop, ensuring they remain contactable and up-to-date with the latest information, even during longer power outages. If the inverter is combined with a battery, it can provide a full back-up system supplying the whole household with electricity. The Primo GEN24 Plus was awarded the Plus X Award 2019 for High Quality, Ease of Use, Functionality, and Ecology.

Fronius Solar Energy
 /// www.fronius.com

Compatible and economical metal roof mount

Kinetic Solar introduces an economical new mount for commercial metal roof projects. With commercial installations in mind, the design has been optimized to reduce the required number of components, while maximizing compatibility with the majority of metal roof profiles. It features an integrated L-Bracket and pre-installed butyl gaskets. By allowing the rail to run perpendicular to the eaves, the mount enables landscape mounting at portrait pricing. It is able to attach to either the roof strapping or steel girts. Initially developed for SkyFire Energy, a solar contractor in Western Canada, it joins the family of Kinetic products that are designed with installers in mind.

Kinetic Solar
 /// www.kineticsolar.com/skyfiremount

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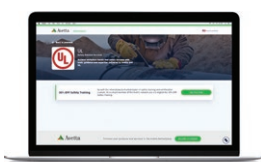
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Discounted safety products, insurance and safety-related services

Avetta launched Marketplace, an online resource for suppliers to obtain exclusive discounts on safety products, insurance, and safety-related services essential to their business operations. Marketplace enhances the value of membership in the worldwide Avetta network and reduces costs, saves time, improves performance, and grows businesses of the 90,000+ participating contractors and suppliers. As an Avetta member, contractors and suppliers connect online to receive offerings and exclusive discounts from companies such as BLR, DISA Global Solutions, FleetSharp by Agilis Systems, HUB International, SafetyCulture, Safety Resourcing, UL, Universal Specialty Group, USA Telecom Insurance Services, and others. Some of the services include industry certifications, safety training, workplace auditing, drug testing, insurance, cybersecurity, travel, car rental, and IT products and services.

Avetta /// www.avetta.com



Quality, safety, risk, and compliance management software

Ideagen has launched a new and improved version of its Q-Pulse application to coincide with the 25th anniversary of the software. Q-Pulse is used across the energy industry to help organizations comply with a variety of quality and risk standards including ISO 9001, 14001, 45001 (OHSAS 18001), ISO/TS 29001:2010, ISO 27001 and ISO 31000. As well as maintaining the software's existing functionality, the browser-based Q-Pulse 7 comes with powerful dashboards for increased business intelligence and an intuitive user experience.

Ideagen /// www.ideagen.com



600V three-phase gate driver with smart shutdown

The STMicroelectronics STDRIVE601 3-phase gate driver for 600V N-channel power MOSFETs and IGBTs provides ruggedness against negative voltage spikes down to -100V and responds to logic inputs in 85ns. Featuring smart-shutdown circuitry for fast-acting protection, the STDRIVE601 turns off the gate-driver outputs immediately after detecting overload or short-circuit, for a period determined using an external capacitor and resistor. Designers can set the required duration, using large C-R values if needed, without affecting the shutdown reaction time. An active-low fault indicator pin is provided. The STDRIVE601 replaces three half-bridge drivers to ease PCB layout and optimize the performance of 3-phase motor drives. All outputs can sink 350mA and source 200mA, with gate-driving voltage range of 9V-20V, for driving N-channel power MOSFETs or IGBTs. Matched delays between the low-side and high-side sections eliminate cycle distortion and allow high-frequency operation, while interlocking and deadtime insertion are featured to prevent cross conduction. Fabricated in ST's BCD6S offline process, the STDRIVE601 operates from a logic supply voltage up to 21V and high-side bootstrap voltage up to 600V. Bootstrap diodes are integrated, saving the bill of materials, and under-voltage lockout (UVLO) on each of the low-side and high-side driving sections prevents the power switches operating in low-efficiency or dangerous conditions. An evaluation board, EVALSTDRIVE601, is available to help users explore the features of the STDRIVE601 and quickly get first prototypes up and running.

STMicroelectronics
/// www.st.com/stdrive601-pr



Rugged, low voltage capacitors

TDK Corporation introduced DeltaCap X Black Premium, a new series of EPCOS MKD capacitors for power factor correction (PFC). Capacitors in the series have rated voltages of between 440VAC and 850VAC. With an internal delta connection, the capacitors are designed for power factor correction and filtering of harmonics at the low-voltage level. With capacitance values of 3 x 51 µF to 3 x 165 µF, power correction performances ranging from 20 kvar to 44 kvar (50/60 Hz) per capacitor are achieved. The special black coating improves the dissipation of heat, thereby achieving a very long service life of up to 300,000 hours in accordance with temperature class -40°. Thanks to the extremely rugged construction, the capacitors of the B32305A* series can withstand a maximum inrush current of 500 x IR, temperatures of up to 149°F (65°C) and perform up to 62,000 operating cycles per year. The DeltaCap X Black Premium types are self-healing and equipped with an overpressure disconnecter which isolates all three phases from the grid in the event of damage. The impregnation, based on biodegradable soft resin, has an additional positive effect on the heat dissipation. The capacitors are suitable for use with or without reactors in both conventional and dynamic PFC systems and also for use in tuned resonant circuits in industrial power grids and harmonic filters.

TDK Corporation
/// www.tdk.com



Windsor Solar

SOLAR ENERGY IS A BUSINESS WITHOUT BORDERS.

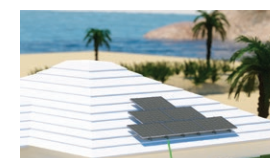


PCL's Solar Center of Excellence is built upon over a decade of experience delivering optimized solar projects with practical solutions for our clients. Backed by the strength of one of the industry's strongest balance sheets and the depth of PCL's proven results to our clients, we have consistently delivered all projects on time and on budget. Together with PCL's internal engineering team and internally-developed software, we strive to lower our clients' Levelized Cost of Energy – providing them with the best solution for their site.

Whatever you need – be it planning, design, engineering, construction or commissioning – PCL's solar experts are focused on your business priorities, guiding you seamlessly through all phases of project delivery.

Contact Andrew Moles at amoles@pcl.com or Patrick Malone at pmalone@pcl.com for more information.

TOGETHER WE BUILD SUCCESS
Watch us build at PCL.com



Racking system for island style roofs

AceClamp announces their newest solar mounting solution for island-style roofs. Their ISR Racking System for PV arrays is designed for high-velocity hurricane zone (HVHZ) applications and has been designed to meet the same high wind requirements as the building and the roof. All AceClamp products are fast and easy to install.

AceClamp /// www.aceclamp.com



Piston soldering module

With the Sensitive Wire Feeder (SWF), Eutect GmbH's intelligent wire feeder can be used in combination with a laser (LL), piston (KL), or induction (IL) system for the soldering of assemblies. In combination with the SWF, the new KL module is a force, wire quantity, and speed-controlled piston soldering system with 100% traceability. Furthermore, the new module is equipped with fully automated changing of the soldering tip and an integrated nitrogen gas supply. With the help of intelligent sensors, the operator is informed when the wire is tending towards the end in the feeder. Here, the system has another 40mm of solder wire in reserve after the signal, in order to be able to complete both the current solder and the process. In addition, the SWF can also be freely integrated into the machine room in its latest stage of development. The SWF KL system adapter, which can be adjusted for optimal soldering results, allows for almost completely free, solid, and reproducible arrangement of the wire feeders and the soldering piston kinematics. The new SWF-KL module can also optionally be equipped with an extraction system. Depending on the overall automation solution, the product to be soldered and the process flow, the extraction system is integrated and minimizes contamination in the system and in the installed components. Thanks to this, service and maintenance periods can be optimized. The freely adjustable speeds and wait and dwell times in the SWF module and in the motorized and spring-loaded piston infeed allows for a maximized process window. The piston soldering itself can also be adjusted for the production conditions and specifications. The piston soldering service life can be maximized through selecting the standby temperature and the functions, depending on the specific soldering process. Alongside the SWF module and the piston soldering application, a new soldering tip changing system was developed. Changing of the soldering tip is done according to the process task or at defined intervals.

EUTECT GmbH /// www.eutect.de



Industrial networking infrastructure series

Antaira Technologies' LMP-1802G-SFP and LMX-1802G-SFP series are industrial-grade equipment that is Ethernet ready to fulfill various markets' edge-level networking applications in harsh and outdoor environments. These devices support high density Ethernet port connectivity, wide bandwidth, long distance data transmission, and are highly reliable. The LMX-1802G-SFP Series is a suitable choice for campus ring solutions with its two fiber optic ports supporting an open standard ring technology (ERPS). These outdoor devices are able to communicate and send critical information back to an enterprise switch at a datacenter. Antaira's LMP-1802G-SFP Series can not only provide a large number of PoE ports (30W) for high density security applications, but also fiber optic interfaces for long range connectivity that is 3ft to over 60 miles (1m to 100km). The SFP port will not only allow connectivity beyond the 300ft (100m) limitation of copper cable but also permits connectivity through areas where electromagnetic interference may cause issues such as on a factory floor. The Antaira management software on these switches helps monitor, react, and troubleshoot applications to reduce the cost of maintenance and downtime. Features such as SNMP Traps, Syslog, and port mirroring can assist when maintaining a system and reducing issues causing outages.

Antaira Technologies /// www.antaira.com



Safe, durable, and easy to install fuse holders

Mersen announced the launch of the globally certified HP15FHM32B 1500VDC HelioProtection fuse holders for photovoltaic applications. Designed to global standards, the HP15FHM32B fuse holders are IP20 ingress protection rated, featuring a finger-safe rotating fuse carrier that accepts 10/14 x 85mm gPV fuses, introducing the next level of safety for utility-scale photovoltaic applications. The body of the fuse holder is engineered with leading UL94-V0 material, providing superior flammability rating and exceptional durability. The fuse holders also include a lock out/tag out feature as well as DMM probe access. The HP15FHM32 series fuse holders are offered in two variations. The HP15FHM32B features a tool-less CAGE CLAMP, while the previously introduced HP15FHM32A features a screw clamp. Both accommodate front loading of fuses and accept standard PV rated wires with DIN rail mounting, providing added flexibility and versatility for end-use installations.

Mersen /// ep.mersen.com







High voltage DC contactors ideal for solar and energy storage applications

Introducing the HX Series

-) Developed for use in combiner boxes, inverters and energy storage systems
-) The smallest UL508 recognized contactors rated for high current switching
-) UL recognized contactors for 1,000vdc and 1,500vdc
-) Featuring GIGAVAC's EPIC® sealed switching technology for superior protection against harsh environments
-) GIGAVAC's dual coil design means low coil power consumption and no EMI emission or crosstalk

For complete specs, visit us online or call +1.805.684.4801
sensata.us/gigavac-hx



New training modules

Mersen Knowledge Center - Electrical Power is Mersen Electrical Power North America's official online self-registering E-learning portal for electrical distributors, engineers, and end users. Their newest training module, "Application Basics: Photovoltaic Fuses in Solar Applications- M307E," will help users learn about the main components of a typical photovoltaic installation, understand the different segmentations of solar market, and identify Mersen fuses and fuses holders designed for use in photovoltaic installations. Visitors to the portal will find a broad library of 23 different training modules to choose from, all in video presentation format. The modules introduce students to basics of electricity, fuses, and surge protection products and provide an overview of how these products are applied in various applications. Training modules typically take ten minutes or less to complete and contain a short quiz at the end. Upon the successful completion of the each training module quiz, students have the option of printing out their Certificate of Completion.

Mersen /// ep.mersen.com



Switched-mode power supplies

Weidmuller has launched its new INSTA-POWER product series. The single phased, primary switching power supplies are characterized by a wide power spectrum, compact construction, and high value for money. The INSTA-POWER series has nine (9) variants with power outputs of 15W, 30W, 60W, and 96W (5V, 12V, 24V, 48V). Thanks to a wide range of voltage inputs of 85-264V and international approvals, they can be used worldwide resulting in an advantage for export-oriented plant engineering. All devices in the series can be operated in the temperature range -13°F to 158°F (-25°C to 70°C). High efficiency of up to 91% and extremely low no-load power loss of max 0.5W ensure minimal energy costs. Together with the MTBF value in excess of 750,000 hours, INSTA-POWER switch-mode power supplies are an extremely economical investment over the entire service life of the device. With an installation depth of just 60mm, INSTA-POWER switch-mode power supplies can be found on the smallest of panels. This makes it suitable for DIN cutouts in various distribution boxes. The INSTA-POWER series can be snapped into the terminal rail or screwed onto the panel. The PUSH IN connection on the INSTA-POWER series makes installation, maintenance, and measurements, under even the most unfavorable conditions, convenient.

Weidmuller
/// www.weidmuller.com



Manage multiple energy sources on-grid or off-grid

Phocos' Any-Grid Hybrid Inverter Series with built-in 80A MPPT PV charge controller is now available in 5kW-230/48V and 3kW-230/24V versions, and a brand new 120VAC version is expected to ship Q4 2019. The Any-Grid Hybrid Inverter Series is designed for flexible energy access to support a broad range of conditions including on-grid, edge-of-grid, and off-grid applications. This new product offers the reliability of a true sine wave inverter with the efficiency of an 80A MPPT solar charge controller to manage multiple energy sources, offering customers a cost-effective, all-in-one solution. Phocos designed the Any-Grid Hybrid Inverter Series based on customer feedback to create a scalable and robust product line appropriate for homes, businesses, and industry globally, regardless of their unique energy access challenges. This product offers a real solution for edge-of-grid applications where access to power may be unreliable, in transition, or subject to change in the future. The Any-Grid Hybrid Inverter solution provides options for multiple energy sources such as grid power, generators, and solar power systems to be used together seamlessly. This flexibility helps end users maximize the optimum mix of energy resources available today and provides long-term value by having the ability to adapt to both their changing energy needs and their access to resources over time.

Phocos Americas
/// www.phocos.com



Flexible automatic bussing

The Automatic Bussing Machine from Ecoprogetti solders the interconnections of solar panels with extreme flexibility, providing a reliable and easy-to-use soldering solution. The upgraded Automatic Bussing Machine performs at high speed with great efficiency, and also improves the module quality. The achieved speed is under 30 seconds, and depending on the design of the solar panel, the cycle time can go down to 25 seconds/module. With its high-speed cycle times, Ecoprogetti's Automatic Bussing can manage a production line of up to 300MW/year, increasing time and quality efficiency in a small footprint. The new Automatic Bussing can work with 5-6-9-12 busbars or wires, and with panels 60- or 72-cells, half-cut cells provision is available as optional.

Ecoprogetti srl
/// www.ecoprogetti.com



25-year plastic cable tie

HellermannTyton's PVDF Solar Tie delivers all-weather performance and longevity in a familiar-looking fastener design. The cable tie's material is responsible for its extended lifespan, making it a commercial-scale, plastic solar tie designed to last more than 25 years. Manufactured from polyvinylidene fluoride, or PVDF, this outdoor tie exhibits high UV, chemical, and thermal resistance. With a maximum operating temperature of 284°F, this easy-to-install polymer-based cable tie boasts the longevity of metal. The gray color indicates PVDF, which provides inspectors visual confirmation a solar-specific wire management product was used on the installation and can speed site approval.

HellermannTyton
/// www.hellermann.tyton.com

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- Flat roof pitched roof and ground mount

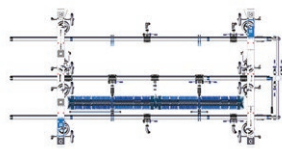
www.kineticsolar.com



Low profile microflashing technology

QuickBOLT with Microflashing has passed 2 waterproof tests at IntertekLLabs on TPO roofs. The QuickBOLT with Microflashing has been installed on Asphalt Shingle Roofs all over the country and can now be used as a new solution for installers to work on residential or commercial TPO roofs. The QuickBOLT with Microflashing is UL Certified and can be installed in under 60 seconds. It has passed the following third-party tests for TPO roofs with no leakage: ASTM E331 - 120 min @ 15.0psf, and ASTM E2124 - 6" water column for 7 days. The QuickBOLT with Microflashing is available online now along with all test documents for TPO and Asphalt Shingle Roofs.

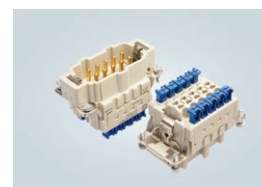
QuickBOLT /// www.quickbolt.com



High-speed ground mounted cleaning system

The SOLA-TECS F system was developed for cleaning PV modules on ground mounted systems. With the F system horizontal oriented brush movement, it is possible to clean from 80" (2000mm) to the height of a mounted system up to 13ft (4000mm) with a high rate of speed not achieved by other manual methods, from 3300 to 6600 sq. ft. per hour. The SOLA-TECS F is rugged and uncomplicated, with no batteries or electrical system, and is made entirely of mechanical components which can be adjusted on-site. The F system was designed as a modular construction kit for full flexibility by adding or removing carriages. High pressurized water powers the rollers spinning action which gently but effectively cleans the panels with little effort. The SOLA-TECS F system is hand operated by two workers and its brush bar can be swiveled at the end of the row, producing a thorough cleaning end to end. It can also jump gaps up to 12". Furthermore, water is distributed throughout the entire width of the brush ensuring even cleaning from frame to frame. Cleantecs GmbH in Germany has been producing high quality cleaning products for over 30 years and is constantly adapting the process of solar panel cleaning. ProSolarClean, LLC, professional solar panel cleaners in California, represents the Sola-Tecs products in the United States, Canada, Mexico, Central, and South America.

SOLA-TECS /// www.sola-tecs.com



Flexible production and simplified installation

With its Han ES Press HMC series, HARTING has developed an interface that can be installed quickly without tools and is robust enough to be connected and disconnected ten-thousand times. This quick-connect technology is the Han ES Press HMC, with the suffix 'HMC' standing for High Mating Cycles. The contact inserts are equipped with a pre-tensioned cage clamp that is triggered by an actuator. If the actuator is pushed into the contact chamber, the cage clamp returns to its original position and secures the conductor. Only a screwdriver is needed to release the connection. The Han ES Press HMC fits with Han standard housing sizes 6 B to 24 B. The standard housings are already available in versions with locks and seals optimized for high mating cycles. Complementing this, contacts and grounding elements are now used that are extremely resistant to abrasion due to a special surface coating. The Han ES Press series is reliable in all types of harsh environments, including high vibration environments. This is due to how tight the conductor sits as a result of the constant pressure of the cage clamp. Installation and connection times are reduced when compared to conventional cage clamps, screw connections or hard wiring techniques. As a result, on-site installation time is reduced, and fast detachability facilitates servicing.

HARTING, Inc. of North America
/// www.harting-usa.com



Precise, burr-free cuts

Emerson expands the Greenlee Shear 30T with seven new die sets and a new bare kit configuration option, giving professionals the ability to choose dies specific to their needs and utilize compatible pumps they currently own. Mounted on a mobile work station, the transportable Shear 30T is designed to increase productivity, improve precision, and eliminate the need for rework while cutting strut, threaded rod, DIN rail and Legrand 3000 Series Raceway. The Shear 30T uses interchangeable dies made from durable, long-lasting material and can be rotated to extend die life. The die profile design offers compatibility with multiple brands and sizes of strut, providing versatility for the operator. The quick die change system allows the user to easily swap out dies with no tools or loose parts. For increased efficiency, the dies automatically retract after each cut so that they are in position for repeated use. In addition, the use of dies improves safety by eliminating sharp exposed blades when cutting various types of material such as strut and threaded rod.

Greenlee /// www.greenlee.com

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Mounting system for asphalt shingle roofs

The new and improved PowerPlate and L-Foot features dual EPDM gaskets that interlock and create an impenetrable elevated watertight seal. Available in black and mil finish.

Solar Connections International

/// www.solarconnections.com



Bifacial racking solution

TerraSmart has unveiled GLIDE, its latest ground screw-based racking design for utility-scale solar projects. GLIDE is infused with bifacial module compatibility allowing complete exposure of the module to maximize potential backside power yield. Carrying forward TerraSmart's tradition of accommodating slope tolerances up to 36%, GLIDE's intuitive design pulls forward 10 years of direct field experience to improve install velocity with simplified connections, agile parts, and a significant reduction in hardware. With the combination of an installer-friendly design and value engineered steel members, TerraSmart has significantly reduced the price per watt.

TerraSmart /// www.terrasmart.com

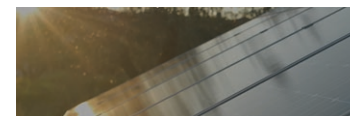


eBook for community solar projects

Community solar allows solar consumers, including residences, businesses, schools, and towns to join the Solar Revolution. As community solar increases in popularity so does the need for funding of these projects. But, as an emerging segment of the industry, community solar has been one of the least understood, so Standard Solar has launched a new eBook Community Solar: What You Need to Know. This free, comprehensive guide to community solar answers questions about community solar and addresses how community solar deals get done and how they get funded. The eBook arms readers with the knowledge they need to make sure a solar project can come to fruition, secure in knowing that it's the best deal possible. Between 50% and 75% of potential solar consumers can't put solar on their own roofs so community solar is the answer. According to GTM's recent report, Commercial Solar Consumer Finance Trends, third-party ownership in commercial solar has been increasing since 2015, driven primarily by the intense growth in community solar. Community solar accounted for almost 20% of commercial installations in 2017, 99% of which were third-party owned.

Standard Solar, Inc.

/// www.standardsolar.com



Supporting new renewable energy in Oregon

Portland General Electric recently launched Green Future Impact, a new solution that helps large commercial and industrial customers source 100% of their electricity from new wind or solar renewable energy facilities. Green Future Impact gives customers another way to meet aggressive sustainability and climate goals. Subscribers to Green Future Impact help accelerate a cleaner energy supply in the region. Their subscriptions to a dedicated power purchase agreement will bring a new wind or solar facility online. The first facility will be located in Oregon and operational by the end of 2021. As a bundled green product, customers will receive energy from that facility, along with the associated renewable energy credits. Approved by the Oregon Public Utility Commission earlier this year after a collaborative process, customers qualify if they have more than a 30kW annual aggregate peak demand or a 10MW average load. Green Future Impact may add up to 300MW of new renewable resources to PGE's system. Subscriptions are for 10- or 15-year terms, and pricing reflects the actual cost of producing and delivering the energy from a specific facility. The product is self-supporting, ensuring no costs are shifted to non-participating customers.

Portland General Electric Company

/// www.portlandgeneral.com

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TUV certified DC to DC converter

Dynapower announces that its DPS-500 DC to DC converter for solar plus storage has been certified for IEC 62109 from TÜV Rheinland. It is the first DC to DC converter designed for utility-scale solar plus storage applications to receive this important safety designation. In addition to being certified to IEC 62109, Dynapower's DPS-500 is also certified to UL 1741 and UL 62109. The DPS-500 has also been tested by TÜV Rheinland and passed compliance for emission standards and immunity standards.

Dynapower Company

/// www.dynapower.com

Modules

Efficient design and a high-yield performance are key factors in any solar energy project. Regardless of the project size - whether for a residential project, commercial building, or utility-scale application - selecting the right module is extremely important. To help you find the right choice for your solar project, we've highlighted some of the top contenders in the industry.

SEE AD ON PAGE 3



Panasonic

Panasonic

Product: Panasonic HIT AC Module N330E

Application: Residential

Maximum Power (Pmax): 330W

Maximum Continuous Output Current:
1.31A @ 240VAC / 1.51A @ 208VAC

Maximum Units per 20 A (L-L) branch circuit: 12 @ 240VAC / 10 @ 208VAC

AC Short Circuit Fault Current Over 3 Cycles: 5.8Arms

AC Port Backfeed Current: 0A

Module Efficiency: 19.7%

Operating Temperature Range: -22°F to 185°F (-30°C to 85°C)

Power Tolerance: +10%/-0%

Weight: 42.99lbs. (19.5kg)

Dimensions: 62.6" x 41.5" x 1.6" (1590mm x 1053mm x 40mm)

Warranty: 25-year workmanship, materials, and linear power output warranty (module and microinverter)

Key Features:

- TripleGuard covers the solar panel system's performance, workmanship, parts, and labor for 25 years;
- High efficiency of 19.7% enables higher power output and greater energy yields;
- Panasonic's vertical integration provides extreme quality assurance;
- HITR continues to perform at high levels due to the temperature coefficient of -0.258% /°C.

na.panasonic.com/us/solar

SEE AD ON PAGE 36

www.axitecsolar.us
AXITEC®
 high quality german solar brand



Axitec, LLC

Product: AXIpremium HC

Application: Commercial

Maximum Power (Pmax): 370Wp

Maximum Power Point Voltage (Vmpp):
39.6V

Maximum Power Point Current (Imp):
9.35A

Open Circuit Voltage (Voc): 47.40V

Short-Circuit Current (Isc): 9.85A

Module Efficiency: 18.65%

Operating Temperature: -40°F to 185°F (-40°C to 85°C)

Max. System Voltage: 1000V

Cell Type: 144 mono crystalline high efficiency cells

Glass: 0.13" (3.2mm) hardened, low reflection white glass

Frame: 1.57" (40mm) silver aluminum

Weight: 49.82lbs (22.6kg)

Dimensions: 78.74" x 39.06" x 1.57" (2000mm x 992mm x 40mm)

Max Load: 50PSF

Tests/Certifications: UL 1703, IEC 61730

Warranty: 15-year manufacturer's warranty on 90% nominal performance, 25-year manufacturer's warranty on 85% nominal performance

Key Features:

- Micro crack and hotspot free modules;
- High module performance through half-cut technology and tested materials;
- Positive power tolerance from 0-5Wp;
- Snow load up to 50PSF;
- High quality junction box and connector system for a long lifetime.

www.axitecsolar.us



GCL System Integration Technology Co., Ltd.

Product: Bifacial Monocrystalline Module (GCL-M3/72DH)

Application: Residential, commercial, utility-scale

Maximum Power (Pmax): 405W

Module Efficiency: 20.1%

Normal Operating Cell Temperature (NOCT): 45°C +/-2°

Max. System Voltage: 1500VDC

Frame: 1.37" (35mm)

Weight: 51lbs (23.1kg)

Dimensions: 79" x 39" x 1.38" (2010mm x 1000mm x 35mm)

Tests/Certifications: TUV, CE, ISO, SA

Warranty: 10-year product warranty, 25-year linear power warranty

www.gclsi.com



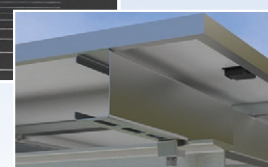
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SOLAR CARPORT



Ready-Made Shade Structure

- Modular design – common components
- Shared PV module clamps – up to 50% fewer clamps
- 0, 5, and 10-degree tilt options – positive or negative
- Purlin extensions adjust to any width module



Purlin Extension



Shared Module Clamp

800.260.3792
preformed.com



SEE AD ON PAGE 36



www.axitecsolar.us
AXITEC[®]
 high quality german solar brand

Axitec, LLC

Product: AXIblackpremium HC

Application: Residential

Maximum Power (Pmax): 310Wp

Maximum Power Point Voltage (Vmpp): 32.74V

Maximum Power Point Current (Impp): 9.47A

Open Circuit Voltage (Voc): 40.01V

Short-Circuit Current (Isc): 9.96A

Module Efficiency: 18.66%

Operating Temperature: -40°F to 185°F (-40°C to 85°C)

Max. System Voltage: 1000V

Cell Type: 120 monocrystalline high efficiency cells

Glass: 0.13" (3.2mm) hardened, low reflection white glass (frontside), composite film (backside)

Frame: 1.38" (35mm) black aluminum frame

Weight: 40.79lbs (18.5kg) with frame

Dimensions: 65.94" x 39.06" x 1.38" (1675mm x 992mm x 35mm)

Max Load: 113PSF

Tests/Certifications: UL 1703, IEC 61730

Warranty: 15-year manufacturer's warranty on 90% nominal performance, 25-year manufacturer's warranty on 85% nominal performance

Key Features:

- TPositive power tolerance from 0-5Wp;
- Stable module for a long life in extreme conditions;
- 100% electroluminescence inspection;
- Axitec-Soft-Grip-Seam aluminum frame;
- High quality junction box and connector system for a long lifetime.

www.axitecsolar.us

SEE AD ON PAGE 3

Panasonic



Panasonic

Product: N325K Photovoltaic Module HIT BLACK

Application: Residential

Maximum Power (Pmax): 325W

Maximum Power Point Voltage (Vmpp): 59.2V

Maximum Power Point Current (Impp): 5.5A

Open Circuit Voltage (Voc): 70.9V

Short-Circuit Current (Isc): 5.94A

Module Efficiency: 19.4%

Operating Temperature: -40°F to 185°F (-40°C to 85°C)

Normal Operating Cell Temperature (NOCT): 111°F (44°C)

Max. System Voltage: 600V

Weight: 40.81lbs (18.5kg)

Dimensions: 65.3" x 43.7" x 48.5" (1658mm x 1110mm x 1232mm)

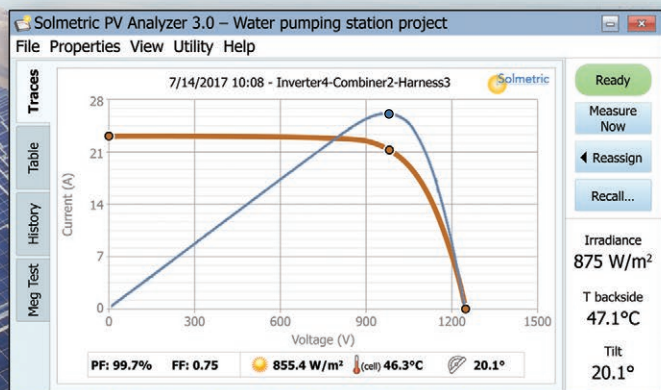
Warranty: 25-year workmanship and linear power output

Key Features:

- 19.4% module efficiency and sleek all black appearance;
- Pyramid cell structure design for optimal sunlight capture;
- Low temperature coefficient of -0.258% °C produces higher power output at high temperatures;
- Heterojunction technology with ultra-thin amorphous silicon layers reduce electron loss;
- Water drainage frame design prevents rain accumulation, eliminates water stains from panel surface.

na.panasonic.com/us/solar

1500 Volt 30 Amp I-V Curves



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Now shipping V2!

- Highest accuracy and throughput
- Largest display with best array troubleshooting features
- Database of 50,000 PV modules
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- 300ft wireless sensor range



www.solmetric.com



AIMS Power

Product: 130W Portable Foldable Solar Panel with Charge Controller & Built-in Carry Case

Application: Residential, commercial, recreation

Maximum Power (Pmax): 130W

Maximum Power Point Voltage (Vmpp): 22V

Maximum Power Point Current (Impp): 5.91A

Open Circuit Voltage (Voc): 26.4V

Short-Circuit Current (Isc): 6.35A

Module Efficiency: 22.3%

Operating Temperature Range: -40°F to 185°F (-40°C to 85°C)

Cell Type: Monocrystalline

Frame: Rugged, water resistant fabric

Weight: 6.5lbs (2.95kg)

Dimensions: 23.3" x 16.3" x 7.9" (592mm x 414mm x 200mm)

Tests/Certifications: CE, TUV

Warranty: 10-year warranty

www.aimscorp.net



Silfab Solar

Product: BC Series-SIL 330 BL

Application: Residential

Maximum Power (Pmax): 330W

Maximum Power Point Voltage (Vmpp): 34.2V

Maximum Power Point Current (Impp): 9.65A

Open Circuit Voltage (Voc): 42.1V

Short-Circuit Current (Isc): 9.98A

Module Efficiency: 19.4%

Operating Temperature Range: -40°F to 185°F (-40°C to 85°C)

Normal Operating Cell Temperature (NOCT): 105°F +/-2° (40.6°C +/-2°)

Max. System Voltage: 1000V

Power Tolerance: -0W / +10W

Cell Type: 126 half cut mono-PERC MWT c-Si

Glass: 3.2mm high transmittance, tempered, DSM antireflective coating

Frame: Black anodized aluminum

Weight: 43lbs (19.5kg)

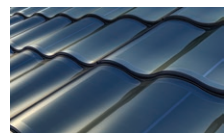
Dimensions: 66.9" x 39.4" x 1.5" (1700mm x 1000mm x 38mm)

Max Load: 4000Pa rear load / 5400Pa front load

Tests/Certifications: ULC ORD C1703, UL 1703, FSEC and CEC listed. Product durability proven up to 3 x IEC, climate chamber tests up to DH3000-TC600-HF30, UL Fire Rating Type 1, ISO9001:2015

Warranty: 25-year product workmanship warranty

www.silfabsolar.com



Hanergy Thin Film Power America

Product: HanTile Solar Roof Tile

BIPV Form: Solar roof tile

BIPV Type: Thin film

Power Density: 7.86W/sqft

Power: 30W

Open Circuit Voltage: 10.6V

Short-Circuit Current: 4A

Max Power Voltage: 8.6V

Max Power Current: 3.5A

Max Length: 27.91 (709mm)

Max Width: 19.69 (500mm)

Max Thickness: 1.61 (41mm)

Weight: 22.05lbs (10kg)

Warranty: 25-year solar generation warranty

www.hanergyamerica.com



Trina Solar

Product: Trina Solar Residential Module

Application: Residential

Maximum Power (Pmax): 340W

Module Efficiency: 20.0% (front side)

Power Tolerance: 0 / +5W

Cell Type: 120 half-cell mono crystalline MBB

www.trinasolar.com



Sky Energy

Product: Lightray Solar Module

Application: Residential, commercial, industrial, utility-scale

www.sky-energy.com

WHY LEAVE ENERGY BEHIND?

Specialized racking for Bifacial PVs can increase your ROI

Bifacial PV Panels can collect energy from both sides, therefore an adapted racking solution must be used to maximize sunlight reaching the backside of the panels.

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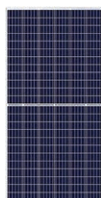
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CONTACT US FOR DETAILS: +1.419.334.7181 / commercial@crownbattery.com / www.crownbattery.com



SunWize Power & Battery

Product: SunWize SWPB-320W-C1D2 Solar Module
Application: Industrial
Maximum Power (Pmax): 320W
Maximum Power Point Voltage (Vmpp): 38.31V
Maximum Power Point Current (Impp): 8.36A
Open Circuit Voltage (Voc): 45.44V
Short-Circuit Current (Isc): 8.36A
Max. System Voltage: 600V
Power Tolerance: 0% / +3%
Cell Type: 72
Weight: 46.3lbs (21.6kg)
Dimensions: 38.9" x 77.01" x 1.97" (988mm x 50mm x 1956mm)
Tests/Certifications: UL 1703, Class 1 Division 2 Group A,B,C, and D
www.sunwize.com



Shenzhen Crystal Solar Co., Ltd.

Product: Bifacial (flexible) solar panel
Application: Utility-scale, recreation
Maximum Power (Pmax): 389W
Maximum Power Point Voltage (Vmpp): 39V
Maximum Power Point Current (Impp): 10A
Open Circuit Voltage (Voc): 46.8V
Short-Circuit Current (Isc): 11A
Module Efficiency: 21%
Operating Temperature Range: -22°F to 158°F (-30°C to 70°C)
Normal Operating Cell Temperature (NOCT): 25°C
Max. System Voltage: 200V
Power Tolerance: 5%
Cell Type: Bifacial solar cell
Frame: Aluminum
Weight: 66lbs (29.9kg)
Dimensions: 77" x 39" x 0.12" (1956mm x 992mm x 3mm)
Max Load: 500lbs (227kg)
Tests/Certifications: ROHS, CE, FCC
Warranty: 5-year warranty
www.crystal-solar.com



Vikram Solar, Ltd.

Product: Somera Duplex N-Type Bifacial
Application: Commercial, industrial, utility-scale, agro-industry, sound barriers
Maximum Power (Pmax): 395W
Maximum Power Point Voltage (Vmpp): 43V
Maximum Power Point Current (Impp): 9.18A
Open Circuit Voltage (Voc): 50.5V
Short-Circuit Current (Isc): 9.83A
Module Efficiency: 20.16%
Operating Temperature Range: -40°F to 185°F (-40°C to 85°C)
Normal Operating Cell Temperature (NOCT): 46°C
Max. System Voltage: 1500V
Power Tolerance: 3%
Cell Type: Monocrystalline N-type bifacial 5BB
Glass: 2.5mm (0.098") high transmission
Weight: 59.525lbs (27kg)
Dimensions: 77.76" x 39.05" x 0.23" (1975mm x 992mm x 6mm)
Max Load: 2400Pa
Tests/Certifications: UL 61703, IEC:61730:2016, IEC 61215:2016
Warranty: 30-year warranty
www.vikramsolar.com



Atlantic Clean Energy Supply, LLC (ACES)

Product: 260W bifacial
Application: Residential, commercial, industrial, utility-scale
Maximum Power (Pmax): 260W
Maximum Power Point Voltage (Vmpp): 38.91V
Maximum Power Point Current (Impp): 9.71A
Open Circuit Voltage (Voc): 47.55V
Short-Circuit Current (Isc): 9.25A
Module Efficiency: 18%
Operating Temperature Range: -40°F to 185°F (-40°C to 85°C)
Normal Operating Cell Temperature (NOCT): 45°C +/-2°
Max. System Voltage: 1500VDC (IEC)
Power Tolerance: 0 / +5V
Cell Type: Bifacial
Glass: Double glass
Frame: Aluminum
Weight: 65.7lbs (29.8kg) +/-3%
Dimensions: 78.9" x 39" x 1.18" (2004mm x 1000mm x 30mm)
Max Load: 2400Pa (front and back)
Tests/Certifications: ETL
Warranty: 12-year product warranty, 30-year linear power output warranty
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CertainTeed

Product: CT Series Module 120 half-cell
Application: Residential
Maximum Power (Pmax): 315W
Maximum Power Point Voltage (Vmpp): 32.8V
Maximum Power Point Current (Impp): 9.6A
Open Circuit Voltage (Voc): 39.7V
Short-Circuit Current (Isc): 10.0A
Module Efficiency: 19.0%
Operating Temperature Range: -40°F to 185°F (-40°C to 85°C)
Normal Operating Cell Temperature (NOCT): 45°C +/-2°C

Max. System Voltage: 1500V
Power Tolerance: -0/+3%
Cell Type: Monocrystalline PERC half-cut
Glass: 3.2mm
Frame: Aluminum anodized black
Weight: 40.8lbs (18.5kg)
Dimensions: 65.95" x 39.06" x 1.38" (1975mm x 992mm x 35mm)
Max Load: 5400Pa snow / 2400Pa wind
Tests/Certifications: UL1703, IEC61215
Warranty: 25-year warranty
www.certainteed.com/solar



Q CELLS

Product: Q.PEAK DUO BLK-G6+
Application: Residential
Maximum Power (Pmax): 345W
Maximum Power Point Voltage (Vmpp): 34.25V
Maximum Power Point Current (Impp): 10.07A
Open Circuit Voltage (Voc): 40.92V
Short-Circuit Current (Isc): 10.58A
Module Efficiency: Up to 19.5%
Normal Operating Cell Temperature (NOCT): 109°F +/- 5.4° (43°C +/-3°)
Max. System Voltage: 1000V IEC/UL
Power Tolerance: -0W / +5W
Cell Type: 6 x 20 monocrystalline Q.ANTUM solar half-cells
Glass: 0.13" (3.2mm) thermally pre-stressed glass with anti-reflection technology
Frame: Black anodized aluminum
Weight: 43.9lbs (19.9kg)
Dimensions: 68.5" x 40.6" x 1.26" (1740mm x 1030mm x 32mm)
Max Load: 5400Pa / 4000Pa (snow/wind loads)
Tests/Certifications: UL 1703, VDE quality tested, CE-compliant, IEC 61215:2016, IEC 61730:2016, Application Class II, U.S. Patent No. 9,893,215 (solar cells)
Warranty: 25-year product and linear performance warranty
www.q-cells.us



ET Solar, Inc.

Product: Elite PERC bifacial
Application: Utility-scale
Maximum Power (Pmax): 390W
Maximum Power Point Voltage (Vmpp): 41.3V
Maximum Power Point Current (Impp): 9.45A
Open Circuit Voltage (Voc): 49.1V
Short-Circuit Current (Isc): 9.96A
Module Efficiency: 19.09%
Normal Operating Cell Temperature (NOCT): 25°C
Max. System Voltage: 1500V
Power Tolerance: -0% / +4.99%
Cell Type: Mono PERC half cut
Weight: 52.9lbs (24kg)
Dimensions: 80" x 39.4" x 0.21" (2039mm x 1002mm x 5.5mm)
Max Load: 2400Pa
Warranty: 10-year product guarantee, 30-year linear power output guarantee
www.etintegration.com



Solaria Corporation

Product: Solaria PowerXT 370W
Application: Residential, commercial
Maximum Power (Pmax): 370W
Maximum Power Point Voltage (Vmpp): 40.2V
Maximum Power Point Current (Impp): 9.20A
Open Circuit Voltage (Voc): 48.3V
Short-Circuit Current (Isc): 9.60A
Module Efficiency: 20.5%
Operating Temperature Range: -40°F to 185°F (-40°C to 85°C)
Normal Operating Cell Temperature (NOCT): 45°C
Max. System Voltage: 1000V
Power Tolerance: -0% / +3%
Cell Type: Monocrystalline PERC
Glass: 3.2mm, tempered, AR coated
Frame: Black anodized aluminum
Weight: 46lbs (21kg)
Dimensions: 63.8" x 43.9" x 1.6" (1621mm x 1116mm x 40mm)
Max Load: 5400Pa (front), 3600Pa (rear)
Tests/Certifications: UL 1703, IEC 61215/61730, CAN/CSA-C22.2, Fire Type 1
Warranty: 25-year power and workmanship warranty
www.solaria.com



Merlin Solar Technologies

Product: FX36L 165W
Application: Residential, commercial
Maximum Power (Pmax): 165W
Maximum Power Point Voltage (Vmpp): 19.34V
Maximum Power Point Current (Impp): 8.54A
Open Circuit Voltage (Voc): 23.25V
Short-Circuit Current (Isc): 8.81A
Module Efficiency: 18.76%
Operating Temperature Range: -40°F to 185°F (-40°C to 85°C)
Normal Operating Cell Temperature (NOCT): 45°C +/-2°
Max. System Voltage: 1000V
Power Tolerance: +/- 3% @STC
Cell Type: Mono cSi
Weight: 10.4lbs (4.7kg)
Dimensions: 117" x 14.7" x 0.83" (2983mm x 372mm x 21mm)
Tests/Certifications: IEC 61215, IEC 61730
Warranty: 20-year power production warranty, 5-year M&W
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Wind Turbine Gear Oils Protect Against Wear

by Austin Guenther, P.E. and Eli Lester

Wind turbine gearboxes face severe operating conditions. In comparison to similarly-sized industrial gearboxes, wind turbine gearboxes have higher power densities, more variable loading, and experience wider operating temperature ranges. These conditions make selecting the right gear oil critical to maintaining wind farm availability and profitability.

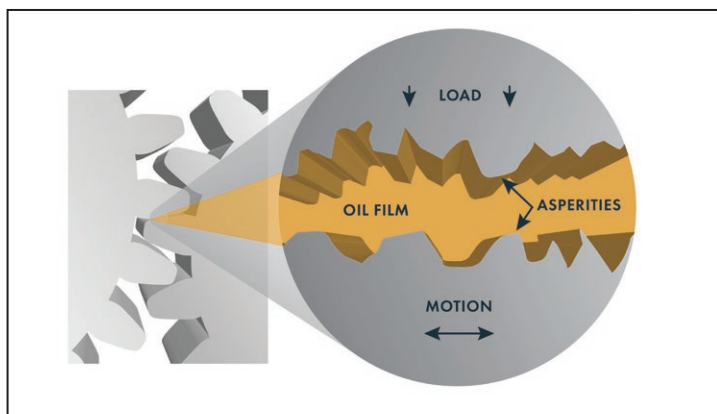


Figure 1: Hydrodynamic lubrication – asperities on opposing gear teeth are separated by a film of gear oil.

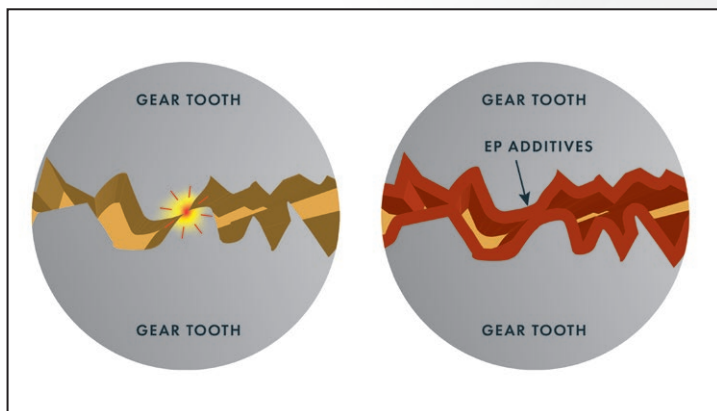


Figure 2: Mixed lubrication without (left) and with (right) extreme pressure additives.

The primary purpose of a gear oil is to protect against tooth wear. Without lubrication, the friction and highly concentrated loads on the gear teeth would quickly destroy tooth surfaces. A wind turbine gear oil protects in two ways: first, by preventing gear teeth from coming into direct contact; and second, by preventing wear when contact occurs.

Keeping Teeth from Contacting

While gear teeth appear smooth to the naked eye, when viewed through a microscope, peaks, or “asperities,” become visible. Under ideal conditions, the asperities on opposing gear teeth are separated by a film of gear oil that prevents contact and wear, as shown in Figure 1. This is known as hydrodynamic lubrication – it’s the same phenomenon responsible for cars “hydroplaning” on wet pavement. The oil film thickness is influenced by the gear speed, the pressure between the opposing gear teeth, and the gear oil viscosity. The gearbox design and operating conditions determine the speed and pressure. The last variable, gear oil viscosity, is the only one that can be easily changed by the operator.

Viscosity is a liquid’s resistance to flow. Higher viscosity oils create thicker films because they resist getting squeezed out from between the opposing gear teeth. However, an oil that is too viscous will cause excessive drag on components, resulting in lower system efficiency and higher operating temperatures. Since a single oil is used to lubricate the low- and high-speed stages of the gearbox and the bearings, the oil viscosity chosen must meet the requirements of all the gearbox components.

Gear oil viscosities are specified by ISO viscosity grade. The viscosity grade indicates the kinematic viscosity of the oil at 40° C (104° F) in centistokes (cSt). Each successive viscosity grade in the ISO

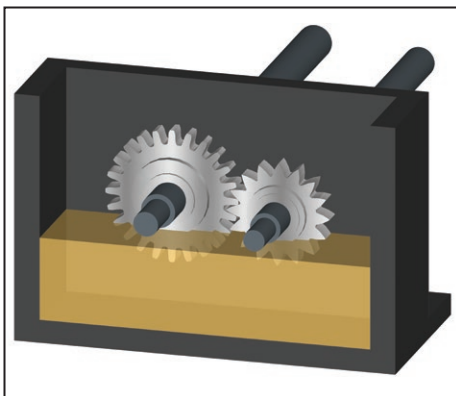
system is ~50% more viscous than the previous (i.e., ISO 100, 150, 220, 320, 460...). While not a standard ISO viscosity grade, 390 centistoke oil has been selected by some Operations and Maintenance (O&M) companies to achieve optimal lubricant film thickness in many common wind turbine gearboxes.

An oil’s viscosity changes with temperature. Gear oils thicken at lower temperatures and thin at higher temperatures. The viscosity index (VI) of a gear oil indicates how much the gear oil’s viscosity changes with temperature. The viscosity of an oil with a high viscosity index will change less with temperature than an oil with a lower viscosity index. A higher viscosity index is desirable because it provides more consistent lubrication at startup and year-round.

Preventing Wear from Contact

Ideal lubrication conditions don’t always exist, even in well-designed gearboxes. A sufficient oil film may not exist for several reasons; high torques, low speeds, and shock loads can squeeze out most of the oil film. Without an adequate oil film, the surfaces of the opposing gear teeth can come into direct contact with one another - this condition is known as “mixed lubrication” because the tooth load is shared between the remaining oil film and the asperities. The resulting localized high temperatures and pressures at the contact points can cause the asperities on one tooth to “weld” to the asperities on the opposing tooth. As the teeth rotate out of mesh, the welds break, transferring material from one surface to another, destroying the tooth surfaces. This process is called “scuffing” because it creates a characteristic streak pattern on the teeth.

Gear oils include extreme pressure (EP) additives to prevent scuffing. The extreme pressure additives may consist of a variety of phosphorus, boron, and



Other Considerations

While the primary purpose of a gear oil is to protect gear teeth, a good gear oil must also lubricate bearings, endure years of service, and protect against corrosion. Wind turbine operators seeking to maximize uptime should consider gear oils from several manufacturers to determine which product best meets their needs. Any differences in the initial product cost may easily be outweighed by the extended service intervals and better gearbox reliability offered by higher quality gear oils.

Figure 3: Cutaway view of the FZG test rig showing the sample gearset arrangement.

sulfur compounds that adsorb onto tooth surfaces to form a protective layer over asperities. This boundary layer prevents the asperities from welding to one another, protecting the gear teeth from scuffing, as shown in Figure 2.

One standard method for evaluating the effectiveness of the extreme pressure additives in a gear oil is the FZG scuffing test. FZG stands for the "Forschungsstelle für Zahnrad und Getriebebau", which is the German name for the Institute of Machine Elements at the Technical University of Munich, where the test method was developed. In this test, a standard sample gearset is lubricated with the gear oil, as shown in Figure 3. The gearset is then subjected to increasingly severe operating conditions in a series of stages. After each stage, the gearset is inspected; if the damage and wear are within acceptable limits, the next stage of the test is initiated with more severe operating conditions. The FZG fail stage for a gear oil corresponds to the stage in which the wear exceeded the acceptable limits.

There are several variations on the FZG test, so care must be taken to ensure the same test conditions were used when comparing gear oil datasheets against one another. FZG test descriptions and standards will be noted on the datasheets, along with a series of letters and numbers separated by "/" marks denoting the operating conditions. Most wind turbine gear oils will surpass the passing criteria of the final stage in the commonly used FZG A/16.6/90 scuffing test. Therefore, more severe tests, such as the FZG A10/16.6R/90 scuffing test, are required to differentiate wind turbine gear oil performance.

Side-by-side field test data can provide additional insight into wear and scuffing protection. A typical field trial involves selecting several similar turbines at a single wind farm and filling them with different gear oils. Over the course of several years, the turbine gearboxes are monitored (using oil sampling, instrumentation, and maintenance records) to determine the best performing oil. This approach has been employed by O&M companies seeking to maximize turbine availability.

Austin Guenther, P.E. is the Chief Marketing Officer of Hydrotex, a manufacturer and distributor of wind turbine gear oils, hydraulic fluids, and greases. He has a Bachelor of Science in Mechanical Engineering from Marquette University, and a Masters of Business Administration from Georgia Tech.

Eli Lester is the Wind Power Market Segment Leader for Hydrotex. He has over a decade of experience in the lubrication industry and has trained technicians from several O&M companies on wind turbine lubrication best practices.

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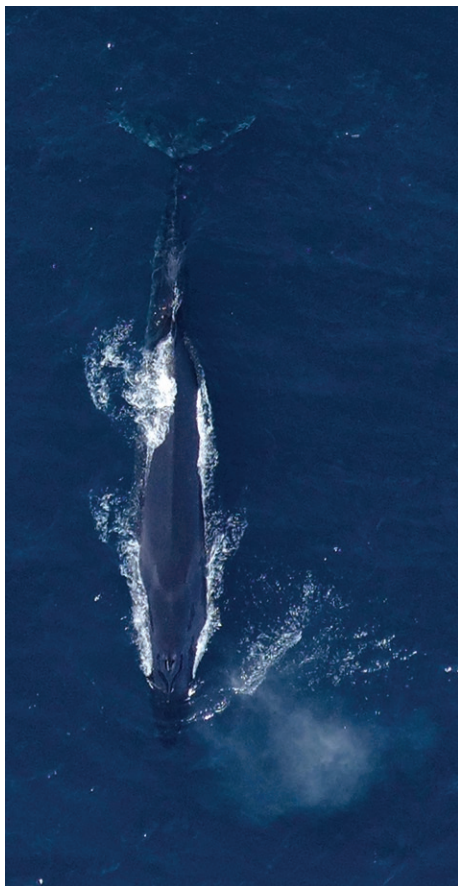
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New York's Predevelopment Activities Advance Offshore Wind

by Kate McClellan Press and Gregory Lampman



IN JULY 2019, GOVERNOR CUOMO

announced the winners of New York's first comprehensive offshore wind solicitation – the Empire Wind and Sunrise Wind projects – totaling nearly 1,700 megawatts. As the single largest renewable energy procurement made by a state in U.S. history, these two projects are expected to produce enough offshore wind energy to power more than one million homes, and support more than 1,600 jobs with a combined economic activity of \$3.2 billion statewide. This will help jump start progress towards New York's unprecedented offshore wind goal: 9,000 megawatts by 2035.

To accomplish this, the New York State Energy Research and Development Authority (NYSERDA) has been leading the coordination of offshore wind opportunities, seeking to advance New York State's goals in a way that is both responsible and cost-effective. As a result of this philosophy, the State is continuing its proactive approach to investing in predevelopment activities.

As part of the New York State Offshore Wind Master Plan¹ released in January 2018, the State invested in bringing together existing data, new research, and feedback from stakeholders to inform the federal Bureau of Ocean Energy Management (BOEM) in the identification of new lease areas in the New York Bight. New lease areas that are in proximity to New York City, the State's "load center," are critical in advancing the State's goals.

As BOEM reviews the draft Wind Energy Areas², the State is investing in predevelopment activities to gain a better understanding of the physical and environmental conditions in these areas. This will reduce developer risk, which will enable developers to submit more competitive bid prices into New York's offshore wind solicitations. These activities are expected to provide a starting point for project development, but not to displace the work developers will need to undertake to design, permit, and construct their projects.

Accurate meteorological and oceanographic — metocean — data is essential to understanding project productivity and profitability. It is used to inform optimal site layout, design, and, perhaps most importantly, to understand the wind resource and expected generation from an offshore wind project installed in the area.

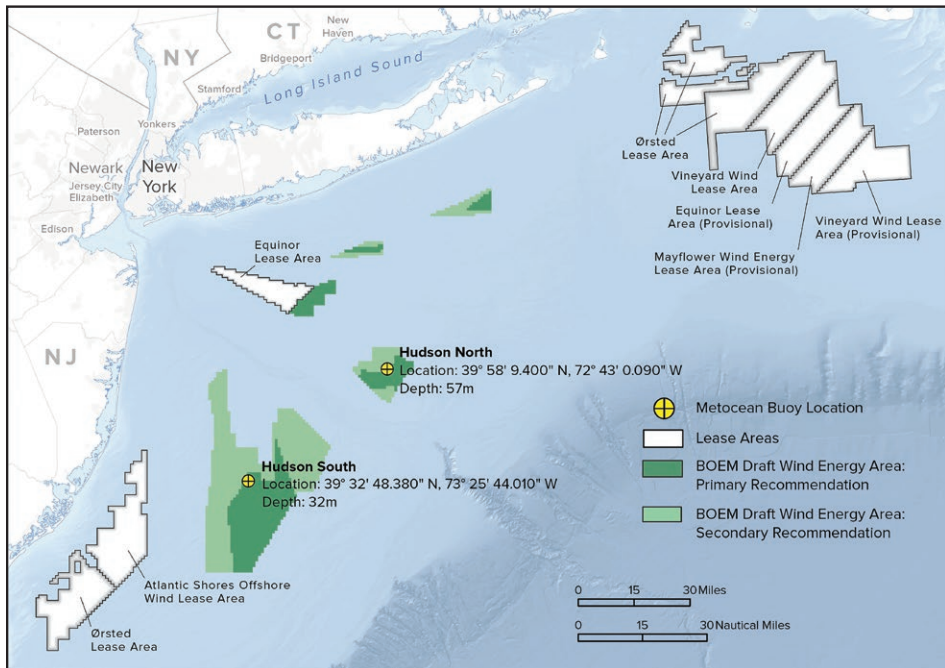
With this in mind, NYSERDA deployed two metocean buoys in

August. The buoys are located more than 20 miles off New York's coast (in BOEM's designated Draft Wind Energy Areas) and each buoy will collect data for two years. These (LiDAR) buoy systems are fitted with remote sensing equipment that uses pulsed laser light to determine wind speeds and direction at turbine height, along with wave and current measurements. The two made-to-order buoys were deployed in the North Sea for validation against a meteorological measurement tower – metmast – in accordance with Carbon Trust OWA Stage 2 standard and International Electrotechnical Commission (IEC) standard 61400-12-1 CDV. The buoys represent a \$4.5 million investment by New York that is expected to bring a nearly half billion dollar return on investment through lower offshore wind developer bids.

For example, an improvement in data quality sufficient to reduce a developer's uncertainty in modeled base-case wind speed for an 800-megawatt offshore wind project – from an annual average of 9.0 meters per second (m/s) to 9.1 m/s – could result in approximately \$130 million in additional energy production (over the 25-year life of the project). If this information was collected by the developer that submitted a bid into a State solicitation, the savings would accrue exclusively to the developer. If this data was available prior to a State's offshore wind solicitation, the savings accrued would be expected to be shared by both the State and developer, via lower developer bids. If we further assume that four 800 megawatt projects could benefit from similar data refinement, then the aggregate benefit would jump to almost \$530 million over 25 years.

In addition to collecting traditional Metocean data, the buoys will feature other environmental sensors that will collect information about birds, bats,





marine mammals, and fish. Above the water, passive acoustic receivers will detect and record bird vocalizations and bat sonar activity. The buoyed platforms will also host the first long-term deployment of radio antennas this far off the coast, for detecting the passage of tagged birds. With support from BOEM, U.S. Fish and Wildlife has tagged hundreds of red knots, terns, and other threatened and endangered bird species with radio transmitters. As the birds pass radio receivers, the nanotag signals will be recognized and recorded. Under the water, passive acoustic hydrophones on each buoy will detect marine mammal presence, while passive acoustic receivers will detect tagged fish for SUNY Stony Brook.

Similar to predevelopment benefits from metocean buoys, early stage investment in wildlife surveys is important due to interannual variability of wildlife migrations. Advancing this work early in the development process accelerates the development

timeline, while also protecting wildlife. In the summer of 2017, NYSERDA began to conduct a 3-year, 4-season planning level wildlife survey of the NY Bight using digital images from aircraft. The images are collected at a flight elevation of 1,360 feet, and then analyzed by taxonomists to identify all imaged wildlife, many to the species level. The project collected more than 3.5 million images, providing broad scale contemporary data about the seasonal, interannual, and spatial distributions of wildlife in the NY Bight, as well as supporting BOEM in the identification of new, responsibly-sited lease areas.

Metocean data will be made publicly available when data collection begins. Wildlife data is publicly available via a remote data server.

In addition to these activities, New York State is now advancing an approach to invest in planning level geophysical and geotechnical surveys of BOEM's new Wind Energy Areas. These surveys will provide developers the data they need, when they need it, to maximize its value and help advance the State's progressive goals efficiently, cost-effectively, and responsibly.

Kate McClellan Press is the Project Manager and Gregory Lampman is Program Manager of the Environmental Research Program at New York State Energy and Research Development Authority, which promotes energy efficiency and the use of renewable energy sources. Collectively, NYSERDA's efforts aim to reduce greenhouse gas emissions, accelerate economic growth, and reduce customer energy bills. Governed by a 13-member Board, NYSERDA has provided objective information and analysis, technical expertise, and support in New York State since 1975. LiDAR buoy systems developed by EOLOS, supplied by Ocean Tech Services, with data management and validation by DNV GL. This Metocean data will be made publicly available via their data server, Resource Panorama. High Resolution Digital Aerial Survey data collected by Normandeau Associates with APEM Inc. Public access to wildlife data courtesy of Normandeau Associates.

NYSERDA /// www.nysERDA.ny.gov

¹<https://www.nysERDA.ny.gov/All-Programs/Programs/Offshore-Wind/Offshore-Wind-in-New-York-State-Overview/NYS-Offshore-Wind-Master-Plan>

²<https://www.boem.gov/NY-Bight/>

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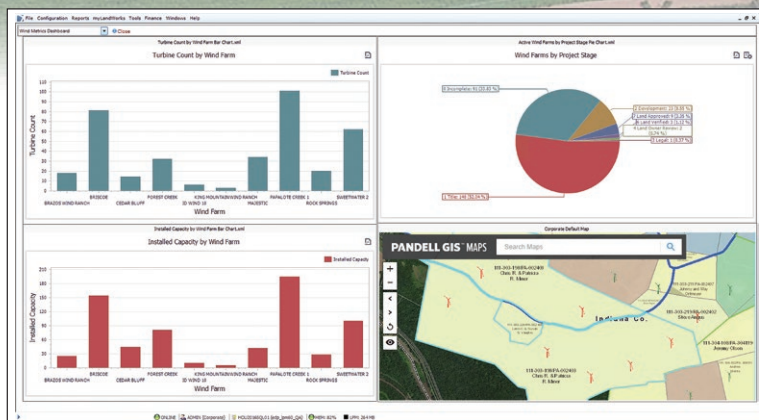
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Tips for Choosing and Using Land Management and GIS Software

by Laura Holt

As the federal Production Tax Credit (PTC) for wind and Investment Tax Credit (ITC) for solar subside, clean energy companies face increased pressure to boost profitability from their assets. Knowing what you own and managing operations efficiently remains critical to success, whether in wind or solar farm development, commercial operations, or asset management.



Global leaders in renewables harness technology to connect employees with real-time data and a common visual language, in order to simplify land asset management. The following five examples highlight how they make their organizations smarter, using land management and GIS (Geographic Information Systems) software to combine mapping and advanced analytics.

1. Use GIS to make better business decisions

Leading renewable companies democratize GIS data across their organizations; location-based analytics offer insights impossible to perceive via tabular data alone.

One renewable utility, with more than 500,000 electric customers, depends on GIS when setting up renewable projects. An acquisition project involves multiple workflows - often running in parallel - from appraisal and survey work, to environmental planning and contract negotiation. Each project has multiple tracts of land, each at a different stage in each workflow. That makes determining overall project status difficult.

Maps solve that challenge. They can show each workflow as a series of color-coded tasks, and allow each tract to display in the color of the last task completed in that workflow. Workflows can be toggled to instantly view where each tract is in the appraisal process, contract negotiation, etc. With map data live-linked to land records data, the company gets real-time project status maps.

2. Leverage the power of an integrated land management and GIS system

Integrating land management and GIS does more than keep maps real-time; it can reduce time setting up new wind farms.

Another renewables company, with over 30 years of experience and 15 GW in development, took the innovative approach of using GIS tax parcel information to create new records in the land system. A simple interface allows users to select tax parcels in the GIS. Users can then choose which tax parcel attributes to import and populate with optional data. Data entry time was reduced by a factor of nine. Now they can load multiple parcels to create new wind farm projects in minutes - complete with polygons, landowner details, and legal descriptions.

3. Maximize insights with more ways to view data

Organizations with hundreds of leases, easements, or power purchase agreements need a land records system that allows for extraction of meaningful data insights without investing in technical staff. At a minimum, land management software should have robust search capabilities to query and return a list of matching records that can export to a spreadsheet, using a command such as "Show me all the wind leases where I have the right to renew."

Beyond sorted and filtered spreadsheet lists, one of the world's largest wind power producers, with operations on three continents, uses first tier querying to drive both canned and custom reports so they can drill down to the data view they want. Dashboards roll up data from all levels of reporting and display it in lists, graphs,

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and charts, to answer timely questions like “What is the status of my assets today?” and “What tasks do I need to complete to maintain my land rights?”

4. Automate complex manual processes

Few aspects of land management are as complex as royalty clauses. Often based on multiple variables, these calculations typically escalate over time, and may include minimum amounts or true up payments. Many operators still use spreadsheets for these convoluted payment calculations. By using land management software, it just takes seconds for industry leaders to leverage those spreadsheets to create digital payment records in a repeatable process.

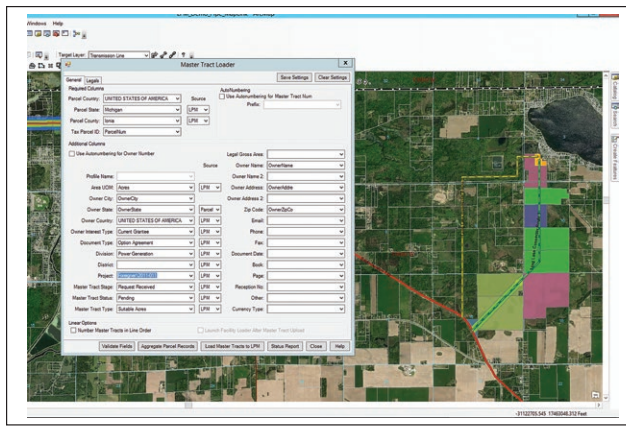
A major North American company, with about 30 GW of solar and wind projects, uses land management software to automatically import production and sales data to generate production royalties. The company runs the sales and production numbers through calculation spreadsheets attached to each lease to auto-calculate what each payee should receive. By incorporating spreadsheets into the land records database, payments are created automatically, with all payment variables available for reporting and inclusion in payee remittance letters.

5. Streamline landowner communications

Acquiring and maintaining land rights requires regular communication with landowners. Land management software should provide easy ways to record landowner communications, create letters, and let payees know how royalty payments are calculated.

One producer, with wind farms in six states, uses its land system to auto-generate payee remittance letters. For each wind farm, all the royalty payments for the quarter are processed with the click of a button. The system writes the payments to a history table, outputs a list of payment details that is consumed by accounting software, and automatically generates a letter to each payee that includes details about how the payment was calculated. These payment variables and their values are pulled directly from the database, and the letters are customized with the company logo and wind farm name.

The land management and GIS software you choose can affect how much time you spend inputting its data and extracting any actionable meaning from that data. The software should help you stay competitive by providing diverse ways to view and manipulate information about land rights and facilities, without requiring database expertise.



Laura Holt is Manager, U.S. Software Operations for Pandell, which delivers Software-as-a-Service (SaaS) products and services to 500+ energy companies worldwide. Pandell's cloud-hosted product suites help finance, land, and operations teams conduct business more effectively.

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Ready for Winter Ice?

by Marty McKewon



Ice accumulation from freezing fog event in Kansas

AFTER LAST WINTER, BRINGING UP A TOPIC SUCH AS ICE ACCUMULATION

to turbines may draw a few groans. If anything, it confirms just how significant the impact of extreme cold and icing can be on wind turbine performance and production. Of course, there is nothing you can do to actually stop the meteorological icing event from happening, but there are steps you can take to recognize - and prepare for - icing. There are additional steps you can take to mitigate the total impact of an icing event, and even position your site for a faster return to full production.

Understanding the Impacts

The impacts of icing to wind turbines are both safety- and production- based. Ice accumulation on blades can lead to ice throw, which can be dangerous to onsite employees and, potentially, the general public. Even stationary wind turbines can shed large chunks of ice. This not only creates a further safety hazard, but the accumulation of ice on blades increases component fatigue from load, and can increase noise levels. Perhaps most importantly, the production of the turbine will be reduced due to loss of aerodynamic properties, resulting in less power output. Continued ice accumulation and rising safety concerns may lead to total shutdown of the turbines, perhaps for days at a time. When that happens, the financial losses can be huge.

Recognizing the Threat

The threat of ice accumulation is not always obvious. The most well understood icing event is freezing rain. That may be because it is widely advertised by local weather sources, and rarely

sneaks up on anyone. However, it's often the less recognized events of freezing fog and heavy wet snow that cause bigger headaches. A wind driven, heavy, wet snow can stick to almost anything; due to high moisture content, the weight of accumulating snow piles up fast. A worst-case scenario is a heavy, wet snowfall lasting 3-6 hours, followed by a sharp drop in temperature in a short period of time. This can create a "flash freeze" that essentially bonds the accumulation to whatever it has fallen on - even a turbine blade. That ice will stay on the blades until the sun returns and temperatures warm.

Freezing fog, on the other hand, can form in several ways. One method that often sneaks up on renewable energy professionals is when a cold, shallow arctic airmass undercuts an existing moist airmass in place. Temperatures at the wind site might be in the upper 30s to near 40, and a couple of hours later it can be 25 and windy, with freezing mist and fog coating your blades, and you're suddenly blindsided by a major drop in production.



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Image shows missing piece of ice from turbine blade

allows the client to ingest the data in house for creating internal portal sites and dashboards that monitor production. Many commercial providers also have Meteorologists on staff that can support the client in collecting information and data that summarizes the severity of the event.

For these reasons, renewable energy professionals should rely on high resolution weather forecasts from commercial providers that focus on addressing the impact to your wind farm. By alerting you to ice accumulation days in advance, commercial providers enable you to adjust production forecasts, rearrange maintenance plans, and review safety protocols.

Don't forget about the post icing event weather! Once the icing is over, when does everything return to normal? Temperatures below 32 with cloudy conditions will do little to remove ice from the blades. If the accumulation is substantial, you may not be able to run the turbine at all. Rising temperatures and sunshine are a good sign, but also precede melting ice - that means crews returning to work too soon could face danger from ice falling off the wind turbine. Likewise, starting the turbines too soon could send ice missiles flying hundreds of yards, presenting another serious safety hazard. Paying close attention to post icing event weather is equally important as preparing in advance of the icing event.

A final icing event happens in locations near water (such as an ocean) and locations that are elevated. This event is called in-cloud icing. It's the king of icing because you can literally experience the characteristics of precipitation based icing and freezing fog at the same time. Because of that, in-cloud icing events can be extreme, and result in the most significant production losses. Locations such as New Brunswick, Nova Scotia, and the northwest United States, are more prone to this type of icing event. Even more challenging is that some of your turbines at lower elevation may not see any icing, while turbines at high elevations could be shut down.

Mitigating the Event

There are plenty of public and private commercial weather sources that predict icing. For the unique needs of a renewable energy professional, commercial sources may be the best option. One reason is that they can spend more time focusing on forecasting the freezing fog and heavy wet snow events that can exceed the impact of freezing rain events. They can also supply raw forecast data feeds, which

Preparing, Planning, Execution, and Recovery

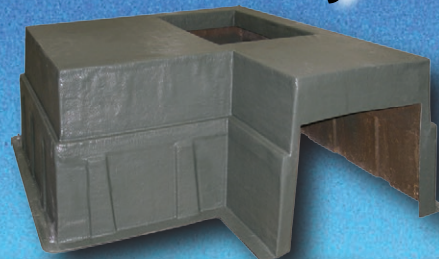
You can't stop the weather from happening, but you can prepare for it. Watch forecasts closely for all types of icing - not just the obvious events. Once you know an event is on the way, make sure you have a plan. Off-takers and power marketing teams should know how production could be impacted, and when. Look at the maintenance schedule for that day - does it need adjusted? Once your plan is formulated, make sure to execute it. Continue to check forecasts regularly to see if the event is getting worse or the threat is passing. As ice accumulates, monitor production closely, and stop turbines as needed. Once the icing event is over your work still isn't done. You still need to execute your plan as you head into the recovery stage. Knowing when the ice will begin to melt is important. When is it safe to return to outdoor work? When will production recover to normal levels?

Ice events may be one of the most challenging natural hazards you will face. Unlike lightning stand downs, which usually last hours, or high winds, which rarely exceed a day, an icing event can last days, a week, or more. Impact to production, maintenance, and safety can be unmatched by any other hazard. Learning to recognize these events in advance by using all sources available can lead to better preparation and mitigation. Ultimately, you will lessen the financial impact while maintaining a high level of safety.

Marty McKewon is Chief Meteorologist at Indji Systems, a provider of weather monitoring and alerting solutions to the Renewable Energy Industry. Marty has 30 years of weather industry experience, including roles as a Meteorologist, Product Manager, and Sales Professional.

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No Fear

Trusting remote sensors in wind farm prospecting

by Greg Shambo



OUR INDUSTRY IS PRETTY RISK-AVERSE.

Some of us like to take things very slowly when it comes to embracing change in the wind farm development sector. For others, it's all about change and innovation. Bigger and more efficient wind turbines added to our landscape every day harvest about 40 percent of the renewable energy used to create electricity in the U.S. However, when it comes to using remote sensors (e.g., lidar, which stands for light detection and ranging) to measure wind for future wind farms, we've been slow to adopt. We fear the lack of data quality, or that the assessment from financial institutions might not be bankable. When it comes down to it, we fear dealing with a devil we don't know. As the rest of the industry continues to grow, however, being comfortable with the status quo is no longer an option.

How is remote sensing used in prospecting?

An incredible amount of work goes into developing a wind farm before the first turbine starts to produce energy. Wind measurement, or "prospecting," is required for a minimum of one year before a development plan is approved. Developers must have accurate data from this process; it is the primary variable in their bankable wind resource assessment, which is required to attain project funding. Inaccurate wind measurement could limit the amount of revenue the wind farm produces. Based on Electric Power Research Institute (EPRI) data, a 1 percent annual production increase at a typical wind farm can increase revenue by up to \$500,000 per year. By reversing this EPRI data, one could surmise a similar decrease in revenue corresponding to the decrease in production.

For years, meteorological evaluation towers — commonly called met towers — have been the primary technology to conduct wind measurement. However, the Federal Aviation Administration (FAA) regulates tower height. When that height exceeds 60 meters, the lighting and permitting that's required significantly increases

met tower cost. As turbine rotor sweeps grow beyond 200 meters tall — larger than two football fields — met towers that don't grow with the turbine height are unable to deliver data with enough accuracy. Remote sensing using lidar is a proven technology that allows for more accurate and expansive measurements of wind in the prospecting phase.

Fears that stifle lidar adoption

Fear #1 — Bankability. Will banks consider data measured by lidar as reliable when financing a wind farm project?

Leading independent bank engineers (IE) are familiar with remote sensing. Some have written specific guidelines for the classification of remote sensors available today. For example, some sensors are classified to be used as a stand-alone device (no other met tower is required during the measurement campaign), while others must be put next to a met tower first for calibration.

No matter which measurement technology is used, the data must be considered. For example, if your met tower was poorly sited, wasn't maintained, or experienced extreme weather conditions, some (or all) of its data can't be used. Following these same considerations for lidar data makes it equally bankable to tower data. Work closely with your IE early in the process to



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understand the requirements for using lidar in a bankable wind resource assessment measurement campaign.

Fear #2 — Lidar Ownership Cost. Will it be more than the cost of a met tower?

Although lidar costs more than a standard 60-meter met tower, lidar is significantly less when compared to the cost of a hub-height met tower. And how much is your time worth? Lidar instrumentation rarely requires a permit, so you can quickly begin measurement on site. Plus, lidars have a long lifetime, and reusing lidar on various project sites quickly brings the cost benefit in favor of lidar.

Quieting fears with lidar's value

Lidar provides significant value to developers during wind prospecting.

Measuring with lidar is safer.

There are real safety concerns with met towers. They can be dangerous to install, maintain, and repair, plus heavy snow can weigh down a tower and cause it to collapse. Because small planes have been known to collide with met towers, the Federal Aviation Administration (FAA) had to provide guidance on marking and registering towers under 80 meters tall; the National Transportation Safety Board updated its safety guidelines in 2018 for pilots regarding met towers.

Alternatively, crews installing remote sensors don't have to climb a tower for setup. Instead, the device is delivered on site, set at a specific location, and powered up. It weighs less than 100 pounds and is no more than 3 to 4 feet off the ground. As for air traffic safety, the lidar does all the work taking measurements hundreds of meters in the air, with no disruption to pilots.

Small devices pack a massive, mobile punch.

Despite the compact nature of remote sensors in wind measurement, they keep pace with the growing size of wind turbines. Lidar technology in wind measurement sensing can reach up to 300 meters, and provides the accurate data required for a wind resource assessment measurement campaign.

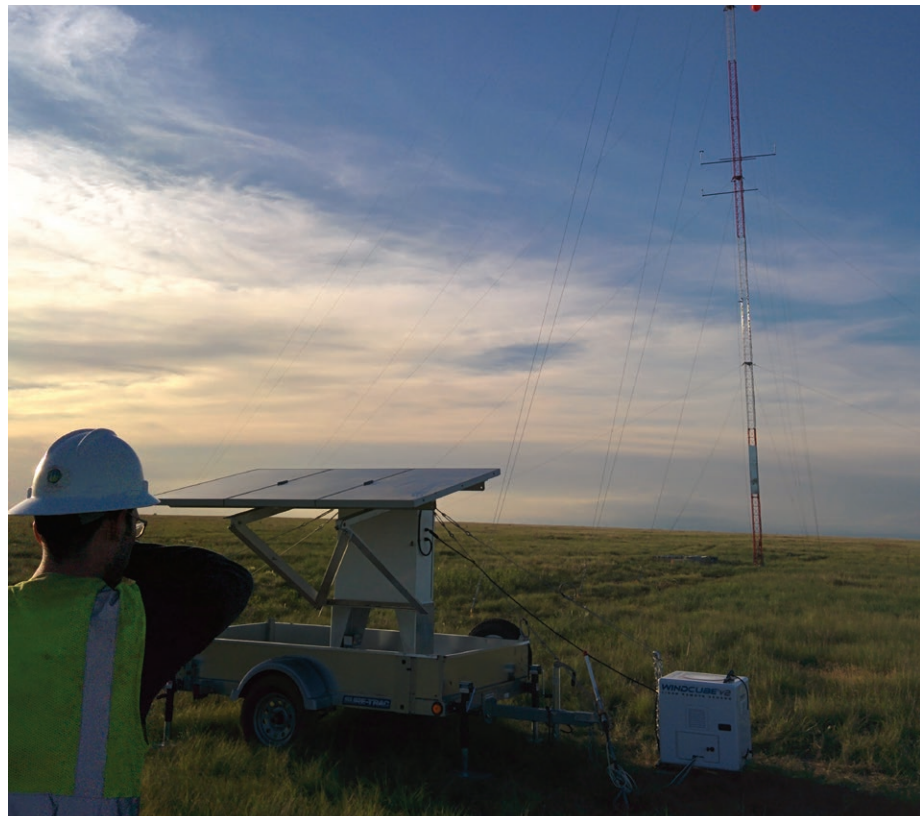
Time is money

Between permitting and installation, met towers take significant time to begin wind prospecting. Developers who use lidar sensing not only shave weeks or months off their development phase, but if they need to move the sensor for a more impactful measurement, they can do that in a matter of hours.

By openly sharing the value and successes of lidar's use in remote sensing for future wind prospecting, we can - more quickly and cost effectively - get to a place where wind energy is a sustainable and plentiful resource, keeping electricity flowing.

Greg Shambo is the North American regional director of Renewable Energy for Vaisala, Inc. He works with wind developers to adopt innovative solutions to help increase their competitiveness and profitability. He believes that renewable energy can be both a noble cause and a thriving business.

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New Class H rewind

IPS has introduced WindGuard, its first insulation system designed specifically for wind turbine generators. WindGuard has the dielectric and mechanical strength to prevent the problems that cause premature generator failures, including electrical, mechanical, thermal, and environmental stresses. IPS engineers addressed specific failure modes with this next generation insulation system including, inter-turn insulation failures associated with high dv/dt transients, ground wall failures associated with high cycle fatigue, thermal aging associated with rapid thermal cycling and harmonics, and mechanical failures associated with continuous-duty cycle ramps. WindGuard combines the dielectric strength of PowerSeal VPI Mica Tapes with the additional surge resistance of polyimide film, applied directly to the conductors using an advanced polymerization process for unsurpassed surge protection. The PowerSeal VPI Mica Tapes in WindGuard have a high dielectric rating, bonding with 100% solids elastomeric Class H VPI epoxy resin. This unique combination lets the rewind withstand the high-voltage transients and high-duty cycles associated with wind turbine generators. WindGuard has a Class H or 356°F (180°C) thermal class rating with unprecedented heat dissipation characteristics. Its ability to maintain flexibility with zero thermal aging during rapid thermal cycling makes it a robust insulation system. This new Class H rewind comes with a 5-year warranty.

Integrated Power Services /// www.ips.us



High port count switches

Antaira Technologies has expanded its industrial networking infrastructure family with the introduction of the LMP-1600G and LMX-1600G Series. The LMX-1600G Series is a solution when needing to increase the number of port counts in automation applications (UL Pending – 2020). The LMX-1600G series provides 16 one gig ports in a relatively small form factor providing a great deal of connectivity using only a fraction of the physical space previously required. This is a key feature when used in NEMA enclosures or any application with size constraints. The LMP-1600G Series, like the LMX-1600G series, also provides 16 one gig ports for high port density applications but also provides PoE power on all 16 ports. This configuration is suitable for surveillance applications where high-density PoE cameras are required in a small area. The wide temperature rating and rugged enclosure design allows this device series to be installed in environments without sacrificing the longevity of the switch.

Antaira Technologies

/// www.antaira.com



Connectors with quick push-in technology

LUTZE Inc. is expanding its industrial connector offering by adding a variety of straight and angled push-in M12 connectors to complement their existing product offering. The push-in technology delivers a quick and reliable termination without any tools required, providing a simple time saving solution while supplying reliable transmission for signal, data, or power cabling. These versatile M12 connectors provide a secure connection for solid, stranded, and ferruled wires per application requirements. Color coded and numbered terminals simplify termination to ensure proper connections. Ferruled and solid wires can be terminated using the quick push-in technology, and stranded wires use the easy-to-open tabs for termination. LUTZE's portfolio consists of 18 new M12 connectors, a combination of 2, 4, and 5 PIN options including straight or angled, male or female, and A, B, or D coded versions. These M12 connectors come either with a plastic housing or with a rugged zinc die cast housing for harsh industrial environments.

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Increased gripping capabilities

Emerson has expanded its Greenlee hand tool line to include new 9" High Leverage Pliers. These new plier offerings have a double-dipped grip for added comfort and control on the jobsite. The new Greenlee 9" High Leverage Pliers are forged from chrome vanadium steel for increased strength and longevity, ensuring the tool will withstand repeated use year after year. The new pliers are designed with a circular toothed pipe grip for a stronger hold on round material and provide greater cutting power than standard pliers.

Greenlee /// www.greenlee.com



Continuous rotation torque wrench

The new SpinTORQ 360 Continuous Rotation Torque Wrench from Snap-on Industrial is a continuously spinning, low profile torque wrench and is 80% faster than ratcheting hydraulic wrenches. The pneumatic-powered SpinTORQ 360 can access tight spaces, thanks to its low-profile head that continuously rotates 360° to provide maximum torque in both forward and reverse directions. With continuous rotation, the SpinTORQ 360 locks into position when energized and is securely in place until the tool stalls, increasing safety. The SpinTORQ 360's highly efficient epicyclical gearbox and double-enveloping worm gear design provides reliable, repeatable performance, and its automatic two-speed operation allows for fast rundown speeds, as well as precise final torque speeds. The SpinTORQ 360 is engineered and built for heavy duty bolting, heavy equipment maintenance, and designed to standard ANSI and API piping flange dimensions, so the tool rests against adjacent nuts during use. An assortment of stack sockets and inserts are available to cover a wide range of hex sizes.

Snap-on Industrial

/// www.snapon.com/industrial



Position control on a budget

POSITAL's new magnetic encoders provide absolute position feedback. With absolute measurement systems, complete position measurements are available whenever the control system queries the encoders. Production processes can be restarted directly with minimal loss of time and materials. POSITAL's absolute kit encoders are available with multi-turn measurement ranges, which can be very useful when a motor is connected to a screw shaft, cable drum, or gear reduction system. The multi-turn rotation counter is self-powered, using POSITAL's Wiegand energy harvesting technology. The rotation count is always up-to-date, even if the machine has moved while control system power was out. No backup batteries are required. POSITAL's encoders for stepper motors are "kit" or modular devices, designed to be integrated into a motor housing, measuring the rotary position directly from the drive shaft. Kit packages are available with the same mounting form factor as popular incremental encoders for NEMA-standard stepper motors, making these encoders convenient drop-in replacements for less advanced incremental encoders. The magnetic measurement module is compact (37mm diameter, 23mm deep) and highly resistant to dust, moisture, and shock/vibration loading. Shields are available to protect the measurement module from external magnetic fields. SSI and the more advanced "BiSS C" communication interfaces have been implemented. Both are open-source interfaces that are compatible with a wide range of PLC's and computers.

The FRABA Group /// www.fraba.com



SIL-2 certification for machinery protection system

Brüel & Kjær Vibro's VC-8000 SETPOINT Machinery Protection System has received SIL-2 certification, allowing it to be specified and used as part of SIL-rated functional safety applications. The VC-8000 is now compliant with the rigorous requirements of the American Petroleum Institute Standard 670 for Machinery Protection Systems, cybersecurity certification to standards such as IEC 62443, and SIL certification to ISO 61508 and 61511. With the ability to address both SIL-1 and SIL-2 functional safety applications, users can now avail themselves of not only the highly reliable machinery protective functions, but the other aspects of the VC-8000 platform that deliver both machinery protection and condition monitoring capabilities for turbomachinery and critical assets. Unique capabilities include a built-in flight recorder able to capture comprehensive, high-definition condition monitoring data for up to one full year on an embedded solid-state hard drive, native connectivity to the OSIsoft PI System, which eliminates the need for a separate condition monitoring software storage infrastructure while providing unrivaled process data correlation / integration, and simple architecture which relies on only three modules for machinery protection.

Brüel & Kjær Vibro (B&K Vibro)

/// www.bkvibro.com



Hydraulic cable and chain cutting tools

The CC-Series from Simplex consists of six models in three tool configurations ranging from the powerful handheld CCP model with integrated pump requiring no external power, to CCS and CCD models powered by an external pump for fast cutting on tough jobs. The CC-Series cutters easily and safely cut through chain and metal bar from 0.75" to 1.94" with capacity ranging from 15 to 125 tons at up to 10,125psi. The CC-Series offers models featuring integrated pumps, spring-return cylinders, or powerful double-acting cylinders.

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Powerful, portable cutting tools

Simplex's HCC-Series Cable Cutters consists of ten models in three tool configurations designed to quickly, cleanly, and reliably cut cable and wire rope from 0.71" to 4.72" diameter, including lead, underground, and telephone-grade cable, plus steel and aluminum wire rope. Capacity in the models ranges from 7.9 to 43.8 tons with a maximum pressure of 10,150psi. Each model offers advanced performance and productivity features such as spring-return cylinders or the increased cutting control of a double-acting cylinder on the 43.8 ton HCCD model. Two handheld HCCP models feature integrated pumps requiring no external pump or power supply.

Simplex /// www.tksimplex.com



Long reach, live line, cable cutter

BURNDY announced the release of the PATRIOT PATCUT954HS Long Reach, Insulated, Hydraulic Cable Cutting tools. The PATCUT954HS Hot Stick Cable Cutter (available in 82" and 94" lengths) provides users both increased flashover protection and extended reach for live line cutting. The large capacity C-Head is designed to hook onto conductors, stabilizing the tool for easy cutting, up to 954kcmil ACSR. Designed for safety, convenience, and function, the PATCUT954HS series of battery-operated tools perform cuts in less than 15 seconds, minimizing exertion and time required. The pistol grip and adjustable assist handle allow for extra control when operating overhead, while the rapid advance ram reduces time on live lines, adding to the overall ergonomics and safety of the system. Large on/off triggers and hand grip area also enhance user experience. The PATCUT954HS features protected electronic circuitry, the robust and reliable INFINITY DRIVE transmission, and a patented high-speed hydraulic pump system. Powered by Makita 18V, 3.0Ah or 5.0Ah lithium-ion batteries for long-lasting power, the PATCUT954HS is multi-Ah capable, accepting 2.0Ah through 6.0Ah sizes. A lifetime warranty on the INFINITY DRIVE is included, along with a 5-year limited warranty for the tool (excluding blades and the pole itself), and a 3-year limited warranty on the batteries and charger.

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Fall protection and rescue in confined spaces

Pure Safety Group (PSG) has introduced the Checkmate TR3 Tripod, used as Personal Protective Equipment to access workers and provide fall protection in confined space environments. The tripod features a new crown and foot design that makes it strong yet lightweight. The TR3 is the first Checkmate product to be launched in North America. The TR3 tripod legs lock in the open position automatically during use and easily disengage for folding, and are adjusted for proper height with captive pins. Detent pins secure them to the tripod using PVC-coated keeper wires. The tripod's pivoting spiked feet and rubber soles allow for its use on soft or hard surfaces. Its anti-splay webbing, which prevents the tripod legs from splaying under a load, can be neatly tucked into their own housing slot for storage. When used in conjunction with other Checkmate equipment, the TR3 can be used as an anchorage for suspended work and winch operations and as a secure fall arrest point. The tripod's maximum single-user weight for fall arrest, with one operator, is 310lbs (141kg). When used in assisted rescue, the maximum combined capacity load for workers is 620lbs (281kg) and, for carrying goods, is 550lbs (250kg). The tripod meets OSHA standards, exceeds ANSI standards, and will be CSA-certified.

Pure Safety Group (PSG)

/// www.puresafetygroup.com



Round slings with high-performance fibers and flex hose

The newly developed DoMega+ makes handling heavy-duty round slings easy. The round sling is made of ultra-high-molecular-weight polyethylene (UHMW-PE) and the new silver-grey cross-elastic round sling hose is made of polyester, which wraps tightly around the yarn core, thus ensuring a very low wrinkling, compact design. This means that DoMega+ round slings do not get crushed even in smaller crane hooks and attachment points. Due to the reduced internal pressure in the hose and a special fabric construction formulated for abrasion resistance, the DoMega+ demonstrates low wear and a long service life. The additional effect of the flexible hose is that the yarn core is able to expand better under load at the contact surface. The DoMega+ is currently available in the carrying capacities 10 to 50 t and is supplied as standard with an RFID transponder and a transparent extra protective hose for the standard label. The RFID transponder (HF, 13.56 MHz, I-Code SLL, ISO 15693) can be used to clearly assign tests, for example, and their digital documentation to the product. The transponder is easily readable and writeable with an NFC-enabled reader.

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www.mammoet.com/wind-power-and-renewables/

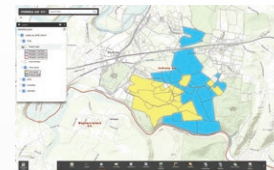


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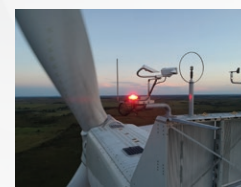


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marketintelligence.spglobal.com/energy-sector



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



Synthetic lubricant solutions

AMSOIL manufactures synthetic lubricants for all types of industrial gear, including wind turbines, filtration systems, and on-road and heavy-duty off-road applications. AMSOIL products use sophisticated additives to provide cost-effective choices for prolonging equipment life, reducing maintenance, and increasing performance.

AMSOIL INC.
www.amsoilwind.com



Wind energy solutions

Bachmann retrofits for SCADA, Controls, Condition Monitoring, and custom solutions 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 Monitoring
www.bachmann.info



Independent power producer and service provider

EDF Renewables North America is an independent power producer and service provider with over 30 years of experience. The Company delivers grid-scale power: wind (onshore and offshore), solar photovoltaic, and storage projects; distributed solutions: solar, solar+storage, EV charging and energy management; and asset optimization: technical, operational, and commercial skills to maximize performance of generating projects. EDF is about more than just producing clean, renewable energy for today's world. They're committed to providing future generations with the means to power their lives in economic, environmental, and socially responsible ways.

EDF Renewables North America
www.edf-re.ca



Smart components

EMA Electromechanics is the designer and manufacturer of the VDH/GSMI combined outdoor vacuum circuit breaker and high speed, mechanically interlocked grounding switch. 38kV class, 200kV BIL, 1200 A continuous current and 25, 31.5 & 40kA interrupting capability ratings, VDH/GSMI is a unique and patented system specifically designed for switching and grounding of wind and solar energy collection circuits, it replaces traditional use of oil insulated grounding transformers combined with conventional circuit breakers in every feeder of a wind or solar power substation, improving overvoltage mitigation and reducing costs.

EMA Electromechanics, Inc.
www.emaelectromechanics.com



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- Light** - Unsurpassed power-to-weight ratio
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With torque ranges up to 15,000 Nm, the E-RAD BLU uses a patented gearbox design and the precision of an electric AC Servo motor. These tools deliver smooth continuous torque and are capable of torque and angle sequence. They also feature enhanced traceability with data collection.

WIND INDUSTRY'S #1 TORQUE TOOL

WWW.RADTORQUE.COM

E-RAD BLU

1.800.983.0044

Transportation & Logistics

With all of the equipment, carriers, size, and specialized handling requirements, getting all of the right turbine components to the right project sites for construction can be a challenge in the wind industry. Safety and efficiency are important keys to ensuring projects and timelines run smoothly. Here we focus on some of the top Transportation & Logistics companies in the industry that provide the specialized services required for getting all of those wind power parts, components, and machinery where they need to be for a successful wind farm.

SEE AD ON PAGE 57



CN

Services: CN offers rail and transload services for dimensional loads and heavy equipment, supporting industries such as the wind industry, oil and gas, power generation, construction, and mining. Their network runs across North America from West to East, South from the Gulf coast into northern regions of Canada, and with direct access to strategic ports in the Great Lakes. They extend their reach by working with connecting carriers, partner shortlines, ports, and other parties to develop efficient routes, providing solutions for loading, offloading and marshalling their customers' freight.

Key Features:

- Solutions for distribution centers for projects in strategic locations, such as Western Canada and the US Midwest;
- Dedicated team with industry expertise to handle clearances, rail logistics, and commercial requirements;
- Access to strategic ports including the Great Lakes ports in Canada and the US, Gulf Coast, BC, and Atlantic Canada.

www.cn.ca

SEE AD ON PAGE 56



Transportation Partners & Logistics

Services: Logistic and transportation management for dimensional freight in North America

Location/Logistics: Kansas, North Dakota, Oklahoma, Wyoming, Colorado, Nebraska, and Texas

Key Features:

- Supporting rail, truck, crane, rigging and distribution centers, TP&L's team of in-house engineers are top-load certified and ready to take the lead when it comes to any logistical needs;
- From port to pad TP&L delivers economically, safely, and on time;
- Onsite services include: scheduled maintenance per OEM storage guidelines to maintain warranty, currently performing long term storage on over 800 complete turbines, additional shrink wrapping and product protection, storage of other windfarm related components such as cable reels, transformers, ladders, etc;
- Indoor storage available at all locations for element sensitive components such as DTA's, drivetrains, generators, and ship loose items.

www.tpandl.com



Port of Everett

Services: Port services, logistics, heavy lift, rail / road access

Min/Max Loads/Tonnage: 1MT-170MT

Location/Logistics: Everett, Washington USA

Qualifications/Certifications: CT-PAT, USCG, WPPA, APPA

www.portofeverett.com



Logisticus Group

Services: Turnkey transport, project management, route feasibility, offsite civil

Min/Max Loads/Tonnage: Unlimited

Location/Logistics: North America service territory

Qualifications/Certifications: Minority Business Enterprise (MBE) and Small Business

www.logisticusgroup.com



Totran Transportation Services

Services: Heavy haul transportation, project management, route feasibility study

Min/Max Loads/Tonnage: 150 Ust

Location/Logistics: Calgary, AB and Conroe, TX

Qualifications/Certifications: SC&RA, CANWEA, AMTA, Comply Works, IS Network

www.totran.ca



Port Saint John

Services: 3 Break Bulk Terminals with 4 warehouses (500,000 sq ft), 80acres of open area, 24,000 sq ft fabrication shop pierside, 3 stevedoring options

Min/Max Loads/Tonnage: Low water draft 35ft with 26ft tidal range twice per day. Load capacity of 1000 lbs/sq ft

Location/Logistics: Atlantic Canada in Southern New Brunswick, on the Bay of Fundy. Terminal names: DP World, Long Wharf, and Lower Cove.

www.sjport.com



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STORAGE OPTIONS & FOREIGN TRADE ZONE SPACE

BETTER

ON-DOCK RAIL & DUAL-SERVED BY BNSF & UP

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SEE AD ON PAGE 55



Port of Longview

Services: Breakbulk cargo handling port, secure indoor and outdoor storage, 9 marine terminals, and customized services.

Min/Max Loads/Tonnage: 140 MT tandem lift

Location/Logistics: The Port's strategic location as a full-service operating port on the Columbia River in Washington State, a program of unique cargo services, an outstanding workforce, and fully equipped marine facilities make it an efficient and reliable terminal-handling facility.

Key Features:

- Rail served by both BNSF and Union Pacific;
- On-dock rail;
- 70 acres of open laydown storage adjacent to breakbulk berths;
- Two Liebherr Mobile Harbor Cranes;
- Foreign Trade Zone and covered storage options.

www.portoflongview.com

SEE AD ON PAGE IBC



Port of Stockton
CALIFORNIA



Port of Stockton

Services: With 24/7 access to freight, the Port of Stockton is designed to quickly get cargo moving with flexible solutions for the renewable energy market. These include stevedoring, warehousing, inventory management, and transloading. Served by the UP and BNSF railways, the Port has 2.5 miles of on-dock rail with ample laydown area.

Min/Max Loads/Tonnage: The Port of Stockton has handled a wide variety of renewable energy shipments. It offers services for breakbulk and heavy lift shipments both large and small. With two mobile harbor cranes, around the clock security, and a 24/7 gate they offer unique and flexible results for critical logistical issues.

Location/Logistics: Located in the extended San Francisco Bay Area, the Port of Stockton provides instant access to less congested highways including I-5, CA-99, and CA-4, and is an hour away from I-80.

Qualifications/Certifications: The Port of Stockton has been in operation since 1933 and handles a variety of cargo for dozens of clients.

Key Features:

- 15 multi-purpose berths available upon demand;
- Around the clock security;
- 24/7 access to freight;
- Dockside rail loading.

www.portofstockton.com



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Your all-in-one resource for all transportation needs. We tediously manage logistics for all shipments, both domestic and foreign. Streamlining the entire supply chain process for your company so shipments arrive economically, safely, on time and to the quality standards set by the manufacturer.

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- O'Neill, NE
- Pueblo, CO
- Garden City, KS
- Enid, OK
- Levelland, TX
- Harlingen, TX

TPANDL.COM • (307) 337-7991



Port of Olympia

Services: Breakbulk, heavy lift, on-dock rail served by BN and UP, easy I5 access

Min/Max Loads/Tonnage: 140 ton mobile harbor crane, warehouse, and plenty of laydown area

Location/Logistics: Less than 1 mile from I5, central access to Columbia River Basin and Seattle markets, on-dock and warehouse rail served by both UP and BN

Qualifications/Certifications: Established in 1922, the Port of Olympia has handled wind energy components and heavy lift cargoes for a variety of customers

www.portolympia.com



C.H. Robinson Project Logistics

Services: C.H. Robinson Project Logistics has experience in developing and executing successful logistics plans for the transportation and management of heavy-lift and over-dimensional wind turbine equipment, from pick-up to final site. After a proactive analysis of all requirements, they help their clients develop solutions and contingency plans to help ensure shipping schedules are consistently met. They offer several services, including: detailed route planning; part/full charters; aircraft chartering and emergency rush air freight; accurate documentation; timely status reports; and consulting services for complex letters of credit and bid documents. Their experienced team of professionals is available onsite at global locations to manage the successful completion of technically demanding projects.

www.chrobinson.com



Port of Vancouver USA

Services: The Port of Vancouver USA specializes in handling wind energy cargo. It provides the equipment, facilities, space, and labor needed to safely and efficiently move projects of any size through the facility.

Min/Max loads/tonnage: The port's two Liebherr mobile harbor cranes can operate at any breakbulk berth and have a lifting capacity of 140 MT each, 210 MT together. Terminal 2 offers a Paceco crane with a 51 MT capacity and 115-foot outreach. Stevedoring equipment includes trailers and reach stackers to efficiently move cargo.

Location/Logistics: The port is 106 river miles from the Pacific Ocean on the Columbia River. The BNSF Railway, Union Pacific Railroad, Canadian National Railroad, and Canadian Pacific Railroad have direct unit train access from mainline corridors. Primary freight corridors of the U.S. Interstate Highway network run north, east, and south.

Qualifications/certifications: Port of Vancouver USA has handled wind energy components for over 17 years. Long-term relationships with customers have helped to develop port facilities and make investments in the right equipment and training to respond to the modern challenges of moving all wind energy components.

www.portvanusa.com



GT Wilmington USA

Services: Full service, deep water, wind project marine terminal

Min/Max Loads/Tonnage: 100 tons

Location/Logistics: Mid-Atlantic US

Qualifications: 360 Quality Certified, FSMA, HACCP Compliant

www.portofwilmington.com



Port Corpus Christi

Services: Port of Corpus Christi provides services for the movement of heavy lift cargo. Facilities include 6 near dock laydown yards; highway and rail accessible; a 47' deep ship channel; dockside rail; three Class-1 rail carriers and a short line railroad; available labor force; open, covered and dockside storage; and security/safety operations.

Min/Max Loads/Tonnage: Port of Corpus Christi moves more than 100 million tons of cargo per year and has developed and implemented efficient transportation and logistics solutions for the renewable energy industry including wind energy.

Location/Logistics: Located on the Texas Gulf Coast, Port of Corpus Christi has a straight and uncongested ship channel; limited low visibility days, and provides access via three Class-1 railroads and Interstate highways to the US, Canada, and Mexico.

Qualifications: Port of Corpus Christi is a modern Port with diverse cargo handling capabilities and home to more than 50 industrial companies. The Port attracts major investments from the US and foreign direct investments for construction of manufacturing facilities. The Port maintains an Environmental Management System, ISO 14001 certification, and is Green Marine certified.

portofcc.com



Premier Truck Rental

Services: Nationwide 4x4 crew cab pickup truck and work truck rentals

Min/Max Loads/Tonnage: 1/2 ton - 3 ton work trucks

Location/Logistics: Lower 48 US states

Qualifications/Certifications: AWEA, NTEA

www.rentptr.com



ATS

Services: ATS is an asset-based carrier for wind energy transportation, having transported over 200,000 wind loads.

Location/Logistics: Headquartered in St. Cloud, MN and providing transportation services throughout North America.

www.atsinc.com



MOVE BIG WITH US.

Seamless, single linehaul from overseas to destinations across North America.

When it comes to handling wind energy components, CN has the logistics team in place to get your cargo to its destination safely and damage-free. We work with connecting carriers throughout North America to design the most efficient route. And because our rail lines can handle more weight compared to the allowable highway limits, we save you time and money. Get the CN advantage - contact us today!

cn.ca/dimensional



Celebrating 100 years



Cranes, Heavy Lift, & Working at Heights

From rough terrains to great heights, the equipment needed to get the job done safely and efficiently at a wind power construction site must be tough and durable. Here are some of the latest cranes, heavy lift, & working at heights options available today.

SEE AD ON PAGE 59

LIEBHERR



Liebherr USA, Co. Mobile and Crawler Cranes

Brand: Liebherr

Model: LR11000

Max boom length: 735ft (224m)

Max capacity: 1200 USt

Available attachments:

- Variable boom systems for diverse requirements.

Additional features:

- Excellent capacities over the complete working range;
- Efficient application due to optimized transportation components;
- Comprehensive comfort and safety features;
- Worldwide customer support by manufacturer.

www.liebherr.com



Tadano

Brand: Demag

Model: CC 3800-1

Max boom length: 472ft (144m)

Max capacity: 715 USt, 650t

Available attachments:

- The Demag Boom Booster kit increases the main boom's stiffness, boosting the crane's lifting capacity by up to 30%;
- The optional Flex Frame solution replaces the usual tele-cylinder, allows easy setting of the Superlift counterweight radius from 13m to 21m with full counterweight on the tray;
- The Superlift Split Tray with quick coupling technology, used when setting up the main boom with or without the Boom Booster kit. Once the main boom is set up, the counterweight is no longer required, and can easily be uncoupled.

Additional features:

- With a lifting capacity of 650 t (715 USt) at a radius of 40ft (12m) and a maximum load moment of 9152 tonne-meters, the Demag CC 3800-1 is strong enough to erect wind turbines with a hub height of up to 384ft (117m) without the need for a Superlift system. As a result, it is a cost-effective choice for a broad range of assignments.

www.demagmobilecranes.com



Leavitt Cranes

Brand: Kroll

Model: K1650L

Max boom length: 226 ft (69m)

Max capacity: 135 ton

Available attachments:

- Variable boom systems for diverse requirements.

Available features:

- 589ft (179.5m) max HUH;
- No tying into the turbine tower;
- 15-20 m/s operating speed;
- 52ft x 52ft (16m x 16m) cross base;
- Eliminates anchor stools in turbine foundation.

www.leavittcranes.com



Bronto Skylift

Brand: Bronto Skylift

Model: Bronto S295HLA aerial work platform

Description: The HLA range ensures efficient and safe operations with challenging high rise installations including wind turbines. This range includes truck-mounted access platforms which offer maximum vertical and horizontal outreach.

Maximum height: 291ft (88.7m)

Maximum outreach: at Heights105ft (32m)

Maximum capacity: 1500lbs (680kg)

Rotation: 2 x 90°

Available options: Cage winch for material, (max load 880lbs); extendable (up to 12ft) working cage; wireless remote control for boom movements

www.brontoskylift.com



The Manitowoc Company, Inc.

Brand: Manitowoc

Model: MCL300

Max boom length: 11.48ft (3.5m)

www.manitowoc.com

Experience the Progress.



Liebherr cranes for wind power.

Liebherr offers optimized crane concepts for the most diverse situations and requirements for the erection of wind power generators for highest efficiency and economy.

- Top capacities in all lifting classes
- Long telescopic booms with variable working equipment
- High mobility and short assembly times
- Comprehensive comfort and safety features
- Worldwide customer support by manufacturer

Liebherr USA, Co.
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Newport News, VA 23607
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It's not just a solar show anymore. North America Smart Energy Week is the largest gathering of solar, smart energy, energy storage, and hydrogen fuel cell professionals in North America. Anchored by the flagship event, Solar Power International, North America Smart Energy Week brings together an extensive alliance of renewable energy leaders for four days of networking, education, and innovation that moves the industry forward. The event has diversified to include Energy Storage International (ESI), the Smart Energy Marketplace+Microgrid, Hydrogen+Fuel Cells International, and The Technical Symposium. Leading education with exceptional speakers, combined with a diversifying exhibit hall that represents a comprehensive view of the renewable energy industry shows the event continues grow with the evolving industry.

www.solarpowerinternational.com

show in print

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



New wide-range modbus energy meter

The new WattNode Wide-Range Modbus Meter offered by Continental Control Systems supports all world-wide utility services from 100 to 600Vac, offers remote current transformer and phase wiring correction for ease of installation and diagnostics.

Continental Control Systems

www.ctlsys.com

Booth 5168



Reliable PV connectors

Stäubli Electrical Connectors' North American headquarters is located in Windsor, California. Its product range includes interconnection systems for demanding applications in solar energy, medical, robotics, aerospace, general industry, and test and measurement including plugs and sockets designed for high performance, high mating cycles, low insertion and extraction forces, and those suited for low- and high-current applications.

Stäubli Electrical Connectors, Inc.

ec.staubli.com

Booth 2027



Quick and effective coating removal

The WILEY Telecom WEEB (Washer, Electrical Equipment Bond) Washer is a powder coat and paint penetrating contact enhancing washer used between connectors and equipment frames, cabinets, and other painted metallic surfaces to be bonded. The WEEB Washer teeth eliminate the need to remove non-conductive coatings (e.g. paint and powder coat) when making a bonding connection. The WEEB teeth pierce through most non-conductive coatings and embed into the underlying metal thus creating a bonding connection between the lug and the coated metal component that it is installed on (e.g. equipment racks, cabinets, enclosures, cable tray, etc.). WEEB Washers help eliminate unwanted rotation of the lug keeping connections secure and properly bonded. Not having to remove non-conductive coatings will save on installation time, create a clean work environment, and most importantly, prevent improper coating removal techniques that can lead to poor connections.

BURNDY

www.burndy.com

Booth A-3857



Maintenance-free AGM batteries

Crown Battery's maintenance-free AGM batteries are designed from the ground up for renewable energy. Built using robotic assembly, the industry's heaviest plates, and more active materials, they deliver enhanced performance and lifespan. Crown1 batteries are optimized for energy storage in off-grid applications and for uninterrupted power supply for grid-connected users, offering a wide array of configuration options, improved temperature management, and more. To ensure quality, Crown1 batteries are manufactured at the company's Fremont, Ohio headquarters. The plant includes environmentally-friendly, roof-mounted solar and wind arrays, and every battery incorporates recycled lead and plastic to help protect the environment. Proprietary cast-on-strap systems allow for 100X the precision of manual welding -- for improved battery life, reliability, and performance. Heat-sealing equipment, automated testing, and vision systems streamline production and ensure maximum precision, uniformity, and power.

Crown Battery

www.crownbattery.com

Booth 2601

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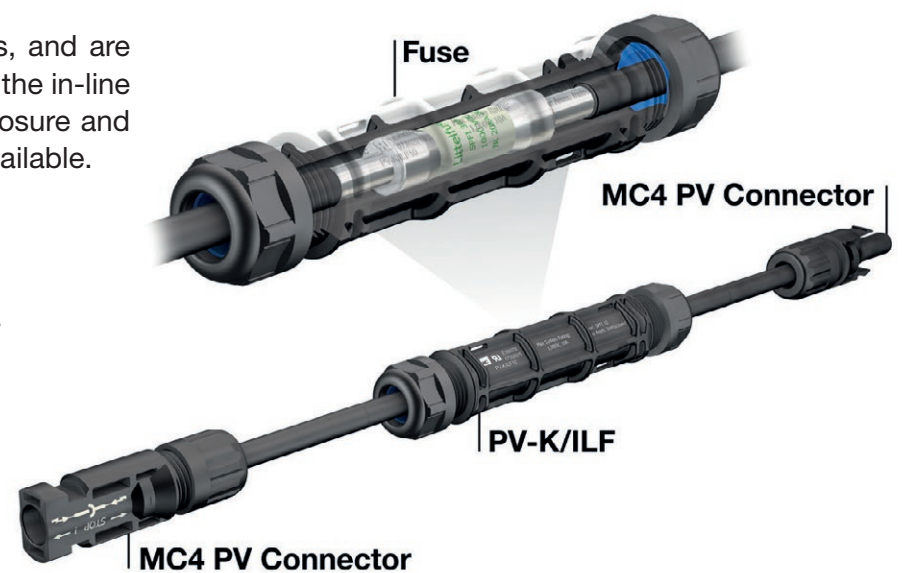
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Small Components. Big Impact!

Stäubli Electrical Connectors' (formerly Multi-Contact) MC4 photovoltaic connectors are the global industry standard and can be found on more PV modules than any other connector system in the world. Stäubli Electrical Connectors, with more than 1.5 billion installed PV connectors across the globe, is an integral part of more than 240 GW (over half) of the worldwide PV capacity.

The MC4 family of PV connectors are rated up to 1500 V UL, 70 Amps, and are available for 14 through 8 AWG cable configurations. We are also offering the in-line fuse PV-K/ILF: up to 1500V, up to 30A, and featuring a robust IP68 enclosure and crimped fuse connection for the most reliable and robust configuration available.



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Multi-Contact

MC

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Time saving enclosure series

Fibox's high impact resistance, watertight, UV resistant polycarbonate NEMA 4X ARCA - IEC enclosure series helps save time during assembly with a snap-in lockable inner front door, and an easy to mount DIN-Rail frame solution kit. The lockable door was designed to fit without the use of tools or hardware. The DIN-Rail kit allows installers to populate the rail outside the enclosure, then simply slide the rail assembly into the enclosure base, and connect any wiring. The ARCA - IEC cabinet is an effective enclosing alternative to steel boxes.

Fibox

www.fiboxusa.com

Booth 3757



Heavy-duty, long-lasting batteries

Constructed with heavy-duty thick lead-antimony plates and a durable dual-container design, Rolls Series 5000 2-volt 2 KS 33P offers reliability and high Amp-Hour capacity for small to large-scale energy storage applications. Delivering long-term cycle life with industrial-grade components, Rolls Series 5000 Renewable Energy battery lineup provides dependable high-capacity energy storage in a range of voltage and capacity options, backed by a 5-year full replacement warranty.

Rolls Battery Engineering

www.rollsbattery.com

Booth 2728



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www.electricalconsultantsinc.com



Commercial solar mounting system

The POWER PEAK mounting system is designed for larger scale ground mount installations requiring fast build rates. Optimized to site-specific conditions, POWER PEAK mounting structures assemble over pile driven galvanized "H" beams or C channels. The single row, vertical post design reduces the number of ground penetrations while providing increased ground clearance options. Also available in distributor kits with pre-assembled components, the POWER PEAK system provides a fast and secure mounting structure for most PV modules. POWER PEAK structures are assembled without lifting equipment and do not require field modifications, including drilling or welding. Pre-assembled components, including the patent pending module clamps, significantly reduce installation time and labor. Structures are designed and manufactured to match module string counts to reduce wiring time and materials. The unique module rails feature built-in wire channels for a professional appearance.

Preformed Line Products

www.preformed.com

Booth 4029



Energy storage fuses

SIBA Fuses 450VDC - 1500VDC (UL) ES fuses have a high breaking capacity for devices requiring protection. Careful system analysis is required to provide proper fusing. SIBA's ES fuses are specifically designed and tested for the stringent requirements of ES applications.

SIBA Fuses

www.siballc.net

Booth 2319



DC/DC power converter for photovoltaic applications

The Phoenix Contact family of Array Power DC-to-DC converters connect directly to a solar array. Array Power converts high-voltage DC from PV strings to 24VDC, eliminating the cost and hassle of trenching to power combiner monitoring and inverter control for anti-islanding applications. Array Power DC-to-DC converters have wide DC voltage input ranges, and some models are suitable for 1000V and 1500V PV nominal solar arrays. Outputs are electrically isolated 24VDC with currents up to 8A. Array Power can be wired in parallel with the use of a decoupling diode for higher current applications or with a DC UPS for back-up power. The Array Power has a compact housing and high efficiency of more than 90%, so it can also be used in small control boxes. The LED monitoring simplifies startup. Array power is certified to UL 1741/62109, facilitating the approval of the overall system. When used with the recommended surge protection, Array Power is covered by the Phoenix Contact Limited Lifetime Warranty, assuring the operational reliability of the array.

Phoenix Contact

www.phoenixcontact.com

Booth 5163



Low profile solar mounting with microflashing

The patented Low Profile QuickBOLT with Microflashing is a solution for mounting solar on Asphalt Shingle Roofs. It can be installed without lifting shingles or removing nails and staples, saving installers time and money. The QuickBOLT with Microflashing has multiple layers of protection that create a watertight seal. The Microflashing has passed standing and pressurized water tests and has been installed over 800,000 times with zero reported leaks. The QuickBOLT with Microflashing is now also tested and approved for TPO roofs.

QuickBOLT

www.quickbolt.com

Booth 4232

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Booth #328

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Quick and simple solar racking solution

Sollega announces the introduction of their new universal slide on clamp. Designed to fit all framed modules, the slide on clamp ships on the FastRack 510 allowing quick and simple installation. Installation consists of positioning the module on the mounted clamps, pulling the clamp until it seats on the flange, and tightening the nut down. The no assembly FR510 is now even fewer parts, speeding up commercial flat roof installs.

Sollega, Inc.
www.sollega.com
Booth 5306



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
Booth 1401



Solar ground-mount earth anchors

American Earth Anchors manufactures earth anchors for commercial, military, and residential markets and are used across a variety of industries to secure and stabilize everything from tents, sheds, retaining walls, portable shelters, erosion control matting, and most recently ground mount solar arrays. Their PE46-Hex8 Penetrators have been field tested to 9000lbs of downward pressure and up to 14,000lbs of pullout strength, and was designed to fit a 2" schedule 40 pipe making it an option for solar panel ground mount racking. The Hex8 can save time and money by replacing concrete footings providing the advantage of no digging, no forms, no pouring, no waiting, and easy leveling by screwing up or down. AEA can also make custom brackets for any pipe size.

American Earth Anchors
www.americanea.com
Booth 4628



Bifacial single-axis tracker

SF7 is a solar tracker with a high yield-per-acre performance and flexible land-use options, suitable for large-scale PV projects. The SF7 Bifacial single-axis tracker collects energy on front and rear sides of modules, capturing reflected irradiance from the ground, around the tracker, and from other modules. Depending on site conditions, bifacial yield-gain can reach +30%. Results obtained by the Bifacial Tracker Evaluation Center (BiTEC) show that individual bifacial PV modules on a SF7 bifacial tracker have 2.4% higher Bifacial Gain than a one-in-portrait module. In conditions of high albedo, bifacial modules on these Soltec bifacial trackers have up to 19.2% of Bifacial Gain and 11.9% in medium albedo.

Soltec
www.soltec.com
Booth 1827



Touchless, hydraulic snow removal

Buffalo Turbine has been manufacturing turbine style blowers since 1945, which are made using high-precision machined components, resulting in long-lasting dependable products. These turbine units are being used worldwide in a variety of applications. The diverse product line provides its customers with the ability to choose a product that best suits their application and various budgets. The newest of all the applications is touchless snow removal with its stacked hydraulic unit that quick attaches to most skid steers.

Buffalo Turbine
www.buffaloturbine.com
Booth 3228



High power producing and fast installing solar tracker system

The GameChange Solar single axis Genius Tracker offers several benefits to the owner and the installer. Owner benefits include higher power production with low O & M costs combined with fast installation utilizing pre-assembled driving arms and SpeedClamps for quick module mounting. The team at GameChange Solar will also share information about their fixed tilt structure, MaxSpan, and the ballasted ground Pour-In-Place with self leveling technology.

GameChange Solar
www.gamechangesolar.com
Booth 1237

Accuracy, Under All Conditions.

- Lowest Measurement Uncertainty
- Lowest Cost of Ownership
(Standard 5 Years Warranty and Recalibration Interval)
- ISO 9060:2018 Spectrally Flat & Fast Response Class A Pyranometer
- IEC 61724-1 Class A Compliant

www.eko-usa.com



Pre-fabricated solar support systems

Baja Carports supplies and installs pre-fabricated steel framing systems. Their services include; property and canopy feasibility, in-house engineering and design, project management, installation crews, and logistics/FOB. Baja resolves engineering challenges and can customize carport configurations to meet specific design criterion. A Baja carport can be engineered for live-loads up to 60psf and windspeeds to 160mph. Though typical parking spaces are 9ft x 18ft and have a minimum height clearance of 8ft6" with a roof array tilt of 5°, all Baja configurations can be customized to meet customer specifications. Their engineers and project management teams are experts in structural and seismic design, soil composition, elevations, and solar. Baja's bolted connection configurations: full cantilever, braced single post, and double post canopies require no field welding; making for fast on-site assembly.

Baja Carports

www.bajacarports.com
Booth L75 Main Lobby



Versatile fixed-mount system

APA's recently released TITAN series, is a 3-rail system featuring an asymmetrical clamping design. The TITAN includes installer-friendly features such as, 20% less total components, a low part count per MW, and low man-hours per MW for installation. Other solutions include the: Geoballast, Ground Screws, Helical Anchors, and Ready Rack Kit.

AP Alternatives

www.apalternatives.com
Booth 4155



Increasing the ground coverage ratio (GCR) on PV projects

The low tilt and clearance design of the Dahlia system is engineered to maximize PV coverage on a given; creating a high financial return for project owners and integrators. With the simplified engineering of a fixed-tilt system, Dahlia requires fewer connections to be made in the field, making installation easy.

RBI Solar

www.rbisolar.com
Booth 837

PREMIUM DEEP CYCLE BATTERIES

SERIES 4500 & 5000 MODELS

now with **ADVANCED NAM** carbon additive

- Quicker & More Efficient Charging
- Enhanced PSOC Performance
- Higher Capacity
- Improved Cycle Life

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Solar rack anchors

The PowerGrip line of roof mounts from OMG Roofing Products now includes the new PowerGrip V, a smaller version of the PowerGrip Universal roof mount. All PowerGrip products are watertight, easy-to-install, and provide a secure connection directly to the roof deck, thereby taking the wind load off of the membrane and onto the structural deck where it belongs. Once secured in place, properly installed PowerGrip units can help to eliminate ballast and rack movement that can damage commercial roofing systems.

OMG Roofing Products

www.outofthestoneage.com

Booth 4653



Aircraft grade solar wire management

Heyco Products continues to support solar installers with a variety of unique wire management solutions, including the Heyco SunBundler. Great for tidying up wires either along the top rail, panel-to-panel, or along purlins, the SunBundler provides up to 100lbs of tensile strength and is available in 5 different lengths to accommodate varying bundle diameters. Made in the USA from aircraft grade 302/304 stainless wire with a UV protected vinyl jacket and includes a 20-year warranty.

Heyco

www.heyco.com

Booth 3513



R-panel metal roof attachment

Solar Connections International is introducing their latest product which solves the complicated issues that arise when attaching solar panels to an R-Panel metal roof. The New PowerMount Adjust for R-Panel metal roof profiles makes installation hassle-free. Featuring the ability to adapt to ribbed panels that range in widths of .75" - 3.00" and PowerWings with pre-applied EPDM - The PowerMount Adjust takes the guess work out of R-Panel installations.

Solar Connections International

www.solarconnections.com

Booth 4437



All-in-one residential power and storage

One-Box, an all-in-one residential energy storage solution, combines solar power and battery energy to self-power the home, all the time. Delta's One-Box Residential Storage Solution can store excess solar energy and make it available at a later time, on-demand. Through their mobile app (IOS/Android), customers gain full visibility into the energy storage, self-powered home. The storage system can detect a grid outage, disconnect from the grid, and automatically restore power to the home in a few seconds time. In addition, the system can form its own stand-alone grid to utilize PV generation during daytime grid outages. The energy storage system is easy to install and run through the mobile app. Integrated with the IoT, the system operates with the Delta cloud, allowing for high performance. The storage system can be used for multiple applications, TOU, self-consumption, back-up power, and zero export applications.

Delta Electronics (Americas) Ltd.

www.delta-americas.com

Booth 2325



Utility-scale DC-to-DC converter

The UL 1741-listed DPS-500 is a 500kW DC-DC converter designed for utility-scale solar plus storage applications and has received the IEC 62109 certification from TUV. Up to 8 DPS units can be paralleled together and it works with all central inverters. The DPS-500 is also available as part of a fully integrated energy storage system from Dynapower, complete with battery enclosure, thermal management, site controls, and batteries. Multiple integrated systems can be paralleled together.

Dynapower

www.dynapower.com

Booth 3431



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 550MWs of PV projects and manages 600MWs 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

Booth 3655






20kW Surge

12K HYBRID

No-Glitch Technology

120/240/208V **STACKABLE**

10 Year Standard Warranty

Two 500V MPPTs **BUILT-IN**

Easy Plug 'n Play Design

Engineered, Assembled and Tested in USA

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Made-in-the-USA solar batteries

Trillium is designed and engineered in the USA and is available in 3 popular sizes that can be used in all solar applications. From its quality cell and battery design to its intelligent, built-in diagnostics, Trillium offers a range of advanced safety, environmental, and electronic features. With life expectancy over 5,000 cycles, Trillium will deliver outstanding return on investment over time. Trojan's Lithium batteries can be used in a variety of stationary and motive power applications. It's waterproof and dust proof, with an IP67 environmental rating. Trillium is designed to be a true replacement for deep-cycle lead-acid batteries and can be used with existing lead-acid chargers with AGM/GEL settings (I-E profile). Trillium offers unique, advanced electronic features such as a visual SOC (state of charge) gauge on the top of the battery.

Trojan Battery Company

www.trojanbattery.com/trillium

Booth 7047



Metal roof solar mounting

Celebrating one gigawatt of installed racking, Ecolibrium Solar unveils MetalX Racking to eliminate headaches and costs from corrugated, standing seam, and R-panel metal roofs. MetalX delivers a low cost per watt, 73% less aluminum, no long rails, low weight, fewer attachments, shortened install time, and small components to fit 30-50mm modules. MetalX is easy: Experienced project managers select the correct roof mount, do project calculations, layout, and bill of materials, and provide details for permitting and inspection.

Ecolibrium Solar

www.ecolibriumsolar.com

Booth 127



Power delivery engineering services

Electrical Consultants Inc. (ECI) was incorporated in 1985. For over 30 years, 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 500kV to their clients.

Electrical Consultants, Inc. (ECI)

www.electricalconsultantsinc.com

Booth 4645



Powered by the array

Array power eliminates the cost and hassle of trenching to power combiner and other array monitoring.

The Phoenix Contact family of array power DC/DC converters connects directly to a solar array, converting high-voltage DC to 24 V. Models suitable for 1000 V and 1500 V array voltages with currents up to 8 A are available. When used with the recommended surge protection, array power is covered by the Phoenix Contact Limited Lifetime Warranty, assuring the operational reliability of your array.



Come see us at **Booth #5163** September 24-26, 2019, at Solar Power International in Anaheim, CA!



© PHOENIX CONTACT 2019



Custom solar mounting structures

In 2017, OMCO Solar launched its proprietary Field-Fast solar mounting solution, with a manufacturing footprint in Ohio, Arizona, Alabama, and Indiana. In 2019, OMCO Solar launched its second Fixed-Tilt solution, the CHOICE Direct-Bolt Mounting System, a Fixed-Tilt racking structure designed specifically for large utility-scale projects.

OMCO Solar

www.omcosolar.com

Booth 3345



Outdoor NEMA3R 10/20/40ft container BESS

The pre-engineered containerized battery energy storage solution, driven by Sinexcel, is not limited to battery technologies, and can support most batteries including lead-acid, lithium-ion, flow battery, and super capacitor. The standard electric room benefit from modular and ETL/CPUC/HECO listed PCS offers maximum space for battery and flexible configuration in AC power and voltage. The built-in transformer, switches, fire suppression, and local controls reduce many complications and cost of installation. There are NEMA 3R rating cabinets and 10/20/40ft containers for different power and energy requirements in community, commercial, and industrial applications. Built-in DC coupled solution with PV support is also available.

Sinexcel

www.sinexcel.us

Booth 3327



Energy efficient, low voltage floor heating

Electro Plastics is the manufacturer of STEP Warmfloor, a low-voltage heater based on self-regulating PTC Nano Polycarbon technology. Because the heating element is self-regulating and acts as a floor sensor, it cannot overheat; as the material warms up, it consumes less electricity. The system is very energy efficient, operates on extra-low voltage, AC or DC, and can be connected directly to renewable energy, like solar or wind. Maintaining an even low temperature is more efficient than an on/off system and requires less solar panels, which makes this a solution for Net Zero Energy buildings. The installation is simple, and the thin and flat heaters can go under most flooring. Used for primary heating and floor warming; it is also available for snowmelt and roof deicing. All products are manufactured in USA with sustainable, non-hazardous and recyclable materials.

Electro Plastics, Inc.

www.warmfloor.com

Booth 5538



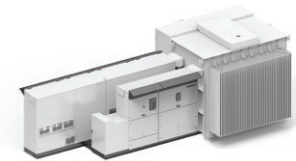
Modular and stackable PV inverter and ESS

TMEIC introduces the Solar Ware Ninja, a photovoltaic inverter and energy storage system. The advanced PV inverter is modular and stackable for multiple PCS power blocks. The system is configurable into multiple solutions, including PV only, stand-alone energy storage, or as a PV+ESS independent solution. Application flexibility is built-in, with multiple ratings allowing customization for small, 2MW projects up to large-scale projects.

TMEIC

www.tmeic.com

Booth 744



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/in³, 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 Power B Series is certified in compliance with UL 1741 SA, IEEE 1547.1, NEC 2017, CSA22.2 No107 and pairs well with INGECON SUN STORAGE Power three-phase bidirectional battery inverters.

Ingeteam

www.ingeteam.com

Booth 2225



Online platform to buy and sell solar equipment

EnergyBin.com is a B2B, members-only online community and marketplace where solar providers gain access to competitively priced components, including panels, inverters, racking, and batteries. EnergyBin facilitates the brokering, movement, and commerce of new, excess, used, refurbished, and legacy solar equipment and provides critical supply-chain intelligence. As a U.S. Department of Energy SunShot Initiative awardee, EnergyBin has lowered residential and commercial project capital costs by 20-70% on equipment.

EnergyBin

www.energybin.com

Booth 5137

SOLA-TECS

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- Adjustable lengths
- Rugged & easy to maintain
- Hydraulic water-driven system

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www.sola-tecs.com

www.prosolarclean.com

Booth #5517



Independent power producer and service provider

EDF Renewables North America is an independent power producer and service provider with over 30 years of experience. The Company delivers grid-scale power: wind (onshore and offshore), solar photovoltaic, and storage projects; distributed solutions: solar, solar+storage, EV charging and energy management; and asset optimization: technical, operational, and commercial skills to maximize performance of generating projects. EDF is about more than just producing clean, renewable energy for today's world. They're committed to providing future generations with the means to power their lives in economic, environmental, and socially responsible ways.

EDF Renewables North America
www.edf-re.com
Booth 2438 Hall C



SunSpec certified inverter

The Fronius Symo Advanced three-phase inverter is a SunSpec Rapid Shutdown certified inverter. The integrated Power Line Communication (PLC) transmitter based on the SunSpec Communication Signal for Rapid Shutdown allows in principle for plug & play connection with SunSpec based modules or module electronics. This eliminates the need for any additional communication hardware and provides the most cost-effective option for code compliance. To better serve 208V three-phase applications, e.g. agricultural buildings, churches, or municipal buildings, the Symo product line also includes 208VAC versions.

Fronius
www.fronius-usa.com
Booth 2019



Safe and effective enclosure and equipment sealant

Polywater InstaGrout Sealant is a two-part urethane foam that seals out pad-mounted equipment openings to prevent outages and service disruptions. Safe and effective to use, InstaGrout will not collapse during change-outs and adheres to various pad-mounted materials. Keep snakes, rodents, and insects out of critical electrical equipment and increase electrical reliability.

American Polywater Corporation
www.polywater.com
Booth 3735



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Innovative tracker design

FTC Solar's Voyager single-axis tracker features low installed cost enabled by minimized steel content and simplified installation processes requiring under 250 Manhr/MW. Voyager's 2P configuration, optimized module rails and post heights, and integrated wire management system enable outstanding bi-facial performance. And Voyager's innovative row control system is self-powered and features 3 days of backup autonomy, for enhanced reliability.

FTC Solar, Inc.
www.ftcsolar.com
Booth 4745



Delivering tomorrow's energy transformation today

Rhombus Energy Solutions builds a complete line of charging solutions for medium and heavy duty EV fleets, including custom dispensers and multiple power conditioning systems (PCSS). Their charging solutions are fully bi-directional, and are vehicle-to-grid (V2G) ready. Their products support standards-based OCPP management, and are designed for high reliability and ease of maintenance. All systems are NEMA 3R rated and UL 2202/2231/1741SA rated.

Rhombus Energy Solutions
www.rhombusenergy.com
Booth 2912



Fast installing solar mounting kits

AceClamp manufactures precision-engineered, fully-assembled solar mounting systems, like their fast-installing Rackless Solar Mounting Kits or their L-Foot Kit for use with racking systems. Both kits utilize the patented "slide-pin," non-penetrating roofing clamps which help prevent roofing panel damage set screws can cause. Tough stainless steel serrated caps on top and bottom creates a reliable panel connection, and their clamp grounding slot allows for wire security. The kit is universal, designed to fit every PV panel size. AceClamp's made-in-the-USA parts are readily available and constructed of non-corrosive aluminum and stainless steel material.

AceClamp
www.aceclamp.com
Booth 4429

SOLAR CONNECTIONS INTERNATIONAL
THE FUTURE OF SOLAR ATTACHMENTS

PREMIERE SOLAR PANEL ATTACHMENT SOLUTIONS

SUITABLE FOR THESE ROOF TYPES

STANDING SEAM	CORRUGATED
R-PANEL	ASPHALT SHINGLE

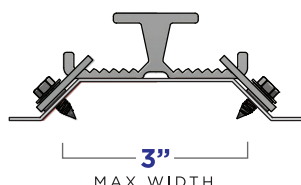
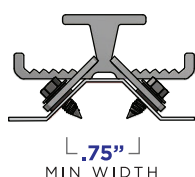
RAIL OR RAIL-LESS INSTALLATION METHODS

NEW!! FOR YOUR NEXT R-PANEL INSTALLATION



POWERMOUNT ADJUST FOR R-PANEL ROOFS

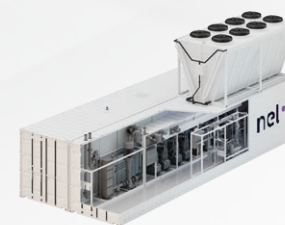
PowerMount™ Adjust adapts to ribbed panels that range in widths of .75" - 3.0". PowerWings include pre-applied EPDM.



A cleaning system to generate maximum yield

Uncleaned solar systems exhibit yield losses between 15-35%, and heavy soiling can be expected on systems installed on agricultural buildings with livestock, industrial plants, and on roads with heavy traffic. These systems generate less electricity, and therefore less remuneration for feed-in. The Sola-Tecs Solar Cleaning System is now available to the U.S. market from ProSolarClean, LLC. Sola-Tecs brushes are light, mobile, effective, and suitable for all system types, from residential roof mounts to large commercial ground mounts.

ProSolarClean, LLC
www.prosolarclean.com
Booth 5517



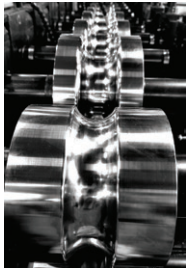
Large-scale hydrogen plants

Nel Hydrogen's electrolysers provide on-site hydrogen generation with compressor-less operation. The MC100, MC200, and MC400 containerized platforms enable flexible plant configurations and installations for medium to large scale hydrogen plants based on water electrolysis technology. The units provide fast response times and production flexibility making them suitable for hydrogen generation utilizing renewable power sources. The MC100, MC200, and MC400 with Proton PEM Technology make for reliable and turnkey solutions with minimal maintenance.

Nel Hydrogen
www.nelhydrogen.com
Booth 7318

SOLARPOWER INTERNATIONAL SEPTEMBER 23RD - 26TH SALT LAKE CITY, UTAH
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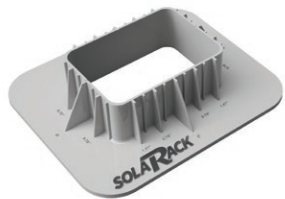
Custom fabrication of steel, aluminum, and alloys

RPM Rollformed Metal Products is a Canadian owned and operated custom fabricator of steel, aluminum, and alloys. RPM has been supporting North American requirements with quality products and client support for 30 years. RPM's product offerings are focused on galvanized structural steel members for various structural applications. All materials are sourced from Canadian or US Steel Mills and adhere to strict traceability. RPM is ISO9001:2015 CERTIFIED. RPM's depth of experience in custom roll forming includes Solar Racking, Industrial Racking, Pallet Conveyors, Heavy Transport, and many other industries. With 3 Facilities located in Southern Ontario, RPM can assist clients with custom roll forming, coordinating to site shipment and assembly.

RPM Rollformed Metal Products

www.rpmroll.com

Booth 4534



Standoff waterproofing base

SolaRack's SolaSeal is a standoff waterproofing base built specifically for the solar industry. Use when installing standoffs on flat roof applications such as torch-down, rolled asphalt shingles, and TPO. It's one piece, rectangular-shaped like a standoff base, and uses 18% less pourable sealant, which is a significant savings opportunity.

SolaRack, Inc.

www.solarackusa.com/solaseal

Booth 2043



Reliable solar racking products and new competitive pricing

Solar FlexRack offers their reliable TDP Solar Tracker Series, solar racking products, and complete project services with a new pricing model. The competitive pricing structure resulted from a re-vamp of their supply chain and internal operations, so they are now delivering cost-effective and thorough results through their custom-designed fixed tilt ground-mounts, single-axis tracker systems, and turn-key service packages.

Solar FlexRack

www.solarflexrack.com

Booth 425

Battery technology calls for the best protection there is



SIBA Fuses Energy Storage (ES) fuses are specifically designed and tested for the stringent requirements of ES applications and are utilized by large OEM's globally.

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GROUND MOUNT WIRE MANAGEMENT

NEW NFI-Hanger



- Most cost-effective ground mount wire management option on the market
- Holds 25+ PV wires in a single Hanger (tested using #8 PV wire, 7.95mm dia.)
- Opening/Closing function means NO NEED TO EVER REPLACE
- Round material = no sharp edges ever coming in contact with cables

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www.ninefasteners.com



ISO-17025 accredited pyranometer calibration services

ISO-CAL North America LLC is a full service ISO-17025 accredited calibration laboratory, specialized in solar radiometer (sensor) calibration services. Based in Phoenix AZ, services include indoor and outdoor WRR traceable pyranometer and pyrheliometer calibration in accordance with the latest ASTM and ISO calibration standards. The ASTM G207-11 indoor secondary transfer calibration method employed by ISO-CAL North America replicates the OEM production calibration of the leading pyranometer manufacturers, assuring continuity in sensitivity scale from one calibration interval to the next. In addition to instrument sensitivity, every ISO-CAL North America calibration report states the expanded calibration uncertainty with a 95% confidence interval (U95). Calibration turnaround times are 1 to 2 weeks typical. Expedited calibration services are also available on request. ISO-CAL North America supports numerous utility scale O&M services providers throughout the solar energy industry, while also tracking the calibration due dates and generating calibration notices to site asset managers via email.

ISO-CAL North America, LLC

www.isocalnorthamerica.com
Booth 4545



Transformer solution provider

WEG Transformers USA provides transformer products, services, and integrated solutions serving the North American T&D, commercial & industrial, and renewable markets for more than 35 years from four North American manufacturing plants. Their product offerings include distribution, substation and power transformers, multi-winding (3, 4, or 6) step-up transformers for solar applications, shunt reactors, generator step-up, auto, voltage regulating, and arc furnace transformers. WEG Transformers USA has an installed base of more than 12,000 transformers (24MW) and provides consistent quality and on-time delivery.

WEG Transformers USA

www.weg.net
Booth 5429



High performing data availability

The SR30-D1 Spectrally Flat Class-A digital pyranometer features an internal maintenance-free heated ventilation system. The circulation of heated air flow between the inner and outer domes suppresses the formation of dew and frost on the pyranometer optic. With < 2.3W max power consumption, SR30 delivers a high level of performance and data availability. Critical sensor data, including irradiance, sensor serial number, and calibration data are all available via RS485 RTU / Modbus connection. The sealed desiccant cartridge design with internal ventilation translates into reduced sensor maintenance and cost of ownership.

Hukseflux USA, Inc.

www.huksefluxusa.com
Booth 4545



Solar PV mounting system provider

TerraGen Solar is a solar PV mounting system solutions provider with a focus on upfront engineering, ease of construction, and quality manufacturing. TerraGen offers a variety of mounting systems including, but not limited to, flush mount racking systems, tilted pitched roof systems (south facing modules on an east/west pitched roof), flat roof ballasted systems, and ground mount systems. In addition to their standard product offerings, they provide solutions for engineering and construction challenges relating to solar PV systems.

TerraGen Solar

www.terragensolar.ca
Booth 4752



Hybrid lead-acid battery

MK Battery's Deka Solar line includes sealed lead acid GEL and AGM batteries and select flooded products. The new UltraBattery is a hybrid device - a chemical combination of a lead-acid battery and an ultracapacitor, achieving higher-rate, partial-state-of-charge operation with extended longevity and high efficiency. Its unique chemistry not only increases power handling but vastly reduces hard sulfation, facilitating excellent longevity, and allowing it to run for long durations between refresh charges. The UltraBattery is a solution for low voltage home and commercial use, as well as high-voltage grid applications. It's extremely efficient; up to 90-95% of every unit of energy stored is available for re-use when used in partial-state-of-charge. Like all batteries in the lead-acid family, UltraBattery is fully sustainable with its closed loop recycling.

MK Battery - Deka Solar

www.mkbattery.com

Booth 3419



Aerial intelligence to optimize energy production

Measure is an aerial intelligence company specialized in collecting, analyzing, and delivering information that transforms how solar owners and operators keep assets at peak performance. Through thousands of commercial drone flights, a specialized data engineering team, and a portfolio of inspection solutions, they deliver the benefits of drone technology to clients across the energy sector. Save time, reduce costs, and optimize energy production with turnkey drone services or an in-house drone program toolkit from Measure UAS.

Measure UAS, Inc.

www.measure.com

Booth 4651



Low voltage transformers

The HPS Sentinel Series transformer provides a blend of performance and reliability while meeting high levels of efficiency. The HPS Sentinel Series transformer is packed with pre-installed features for ease of install. HPS carries a complete inventory throughout North America to quickly meet their customers' needs.

Hammond Power Solutions (HPS)

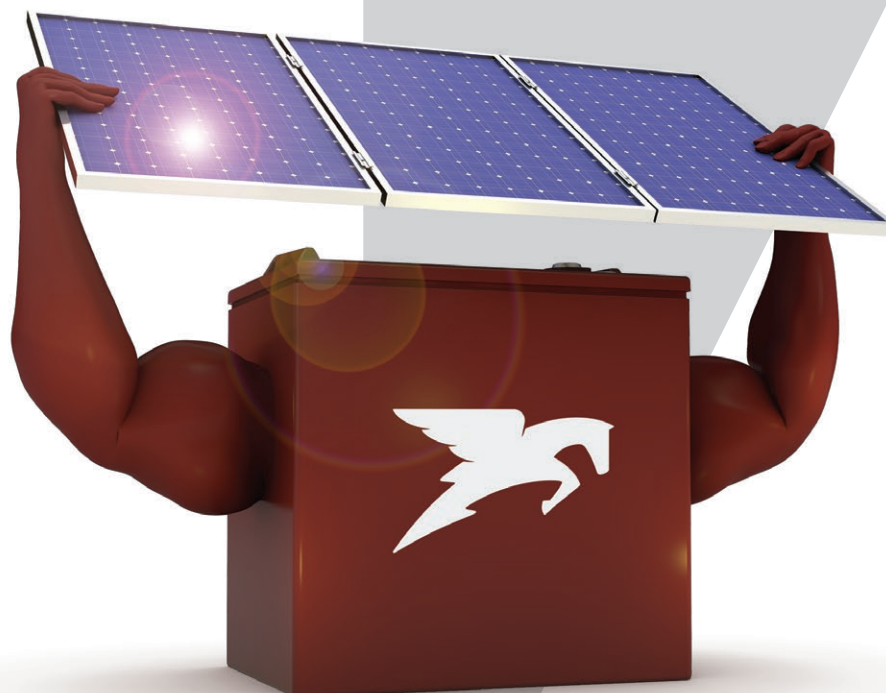
www.hammondpowersolutions.com

Booth 4720



ENERGIZING

THE SOLAR STORAGE NEEDS OF TOMORROW.



We don't just manufacture batteries - we innovate, engineer and develop energy solutions. We provide extraordinary life, quality, and performance for all your off-grid and mini-grid applications. At Trojan Battery Company, we're charging forward.



Learn more about Trojan's products including our new Lithium Ion solutions for renewable energy applications.

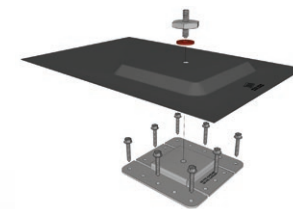
trojanbattery.com



Integrated energy storage systems

Energport, Inc. is a Silicon Valley based supplier of integrated energy storage systems leveraging automotive grade, lithium-iron phosphate battery cells. Aside from cell technology, Energport emphasizes on safety and performance while designing the systems. The fully integrated systems optimize compatibility and coordination among components, which ensures batteries, inverters, and control units work seamlessly with each other and perform safely and effectively as a whole. The Energport energy management system is another core competency supporting multiple applications. This is where the control algorithms sit and can be configured to meet various customer requirements. Energport's offering ranges from residential energy storage systems to large-scale, containerized systems for businesses and utilities.

Energport, Inc.
www.energport.com
Booth 7240



Solar mounting sheathing attachment

Zilla's patented Double Stud XL Flashing Assembly attaches directly to sheathing while also providing the option for structural members if necessary. Without having to locate structure, the Zilla Double Stud XL eliminates the need for installation prep work, standardizes design and installation processes, achieves greater speed and flexibility in the field, and makes it possible to complete more projects in less time at less cost. Zilla Double Stud XL is compatible with Zilla flush mount systems or any solar mounting system to help drive better bottom line results.

Zilla Corporation
www.zillarac.com
Booth 3834



Flexible, versatile inverter charger

The Phocos Any-Grid Hybrid Inverter Charger is loaded with features for common, real-world conditions, and is available in 5kW-48/230V, 3kW-24/230V, and 120V models. The flexible inverter charger supports various inputs with prioritization settings, along with multiple wiring configurations for off-grid and edge-of-grid applications. Phocos has integrated their high-voltage MPPT charge controller, an AC battery charger, along with a detachable display for convenience. This inverter grows with the customer. Nine inverters can be wired in parallel or 3-phase offering up to 45kW of synchronized AC power. Phocos has created a customized PhocosLink app to make monitoring and programming the Any-Grid product easy. The Any-Grid offers less SKU's to stock with opportunities to save time and money on design and installation.

Phocos
www.phocos.com
Booth 3337

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HVHZ compliant Solar Racking (up to 185 mph winds)
Works with ISR, SSMR, TPO & Asphalt
Learn more: www.aceclamp.com/solar-racking-systems

by **PMC Industries Inc.**

patent pending

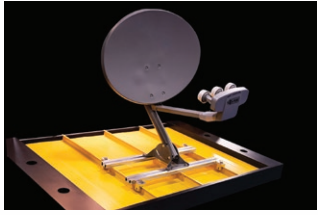
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 - DC Switches
 - Surge Protective Devices
- RECOMBINER BOX ON DC SIDE OF INVERTER
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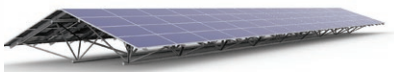


Cost-effective universal utility mounting system

S-5! introduces the universal GripperFix utility system for standing seam, exposed-fastened, and trapezoidal metal roof profiles. Mount almost anything with this safe and cost-effective system that uses only struts, S-5! clamps or brackets, and tabs. Install HVAC, satellite dishes, inverters, conduit, communication equipment, service walkways, light fixtures, and more. This all-aluminum and stainless system will last the life of the roof.

S-5!

www.s-5.com
Booth 3745



Solar canopy for high-wind environments

Quest Renewables will introduce the QuadPod Windmaster at SPI. Windmaster addresses potential racking failures in high wind environments mentioned in Rocky Mountain Institute's Solar Under Storm report published in June 2018. The Windmaster carport is designed, engineered, and tested for wind environments up to 180mph and requires just four foundations per truss pair. Unique to QuadPod solar canopies, 90% of construction takes place on the ground, inclusive of module attachment, inverter placement, and wiring. After ground level construction, the canopies are lifted by crane for final attachment to parking lot or garage, minimizing overhead work and optimizing work-site safety.

Quest Renewables

www.questrenewables.com
Booth 4854



Flexible and versatile residential PV solution

Growatt 8-10kMTLP-US is a solar PV solution for residential systems. It comes with wide input voltage range and maximum efficiency of 97.8%. It's of compact design and is easy to install. With its three MPPTs, the system configuration is easy and flexible to fit different roofs. It is compliant with UI1741 SA and CA Rule 21. Furthermore, with Growatt OSS (Online Smart Service) it is convenient for customers to monitor and maintain the PV system from their smart devices.

Growatt New Energy Technology

www.growatt-america.com
Booth 2619

C&I ESS & Micro-grid

Driven By **Sinexcel**

Introducing the turnkey and fully integrated Energy Storage Systems

by **Ep Energport** partnering with **Sinexcel**

The pre-engineered battery energy storage cabinet and container Driven By **Sinexcel** benefit from modular and ETL/CPUC/HECO listed PCS offers maximum space for battery and flexible configuration. The NEMA 3R rating cabinets and 10/20/40ft containers compliant with UL9540 is one of the best options for different power and energy requirements in community, commercial, and industrial applications.

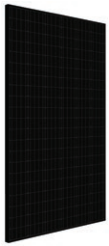
Built-in DC coupled solution with PV support is also available.

See us in SPI at Booth: 3372

www.sinexcel.us

www.energport.com

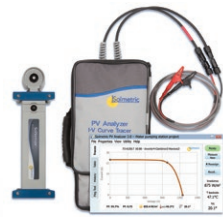
Sinexcel Inc. and Energport Inc. are two separate legal and business entities independently operated and managed by their respective owners.



Black-on-black residential solar panel

Silfab Solar's BC Series-SIL 330 BL is a 2019 PVEL/DNV GL top performer and Gold Stevie Award Winner, and is a back contact metal wrap through panel utilizing 126 half cut mono-PERC MWT c-Si cells combined with an electrically conductive back-sheet by DSM. Superior power is achieved through relocation of the tabbing ribbon to reduce shading on the front providing an aesthetically pleasing black on black panel suitable for residential installations. All backed by a 25-year product workmanship warranty.

Silfab Solar
www.silfabsolar.ca
Booth 2701



High throughput I-V curve commissioning

This next gen model ("V2") of the PVA-1500 line of I-V curve tracers for commissioning, auditing, and troubleshooting PV systems adds charging/charged LED indicators, in-the-field firmware upgrade capability so that future firmware features and patches won't require a return to factory, and more. The PVA-1500 V2 also includes all the features of its predecessor, including the ability to measure 1500V at 30A, high accuracy, high measurement throughput, wireless irradiance, and temperature sensor with 300ft range, and easy-to-use interface via WiFi to a tablet or laptop.

Solmetric Corporation
www.solmetric.com
Booth 5515



Residential and commercial solar panels

Achieving >20% efficiency, aesthetic PowerXT panels deliver power and performance, as well as project economics. With high shading performance and energy yield, PowerXT's provides value while generating clean electricity on space-constrained roofs. Leveraging patented cell design, module architecture, and assembly techniques, PowerXT has no visible circuitry. Its Pure Black design is attractive, with excellent curb appeal. Optimized and engineered for maximum energy output, PowerXT offers certified quality and a 25-year warranty. Optimized and engineered for maximum energy output, PowerXT consistently provides quality, reliability, and durability.

Solaria Corporation
www.solaria.com
Booth 4960



AC combiners

SolarBOS AC Combiners provide a safe and cost effective alternative to AC breaker panels. Individual fused inputs facilitate string inverter output aggregation. SolarBOS AC Combiners support all string inverters and they are highly configurable to fit any application. Key benefits include low installation cost, reduced PPE requirements, reduced maintenance, 100% operation and reliability upon fuse replacement (as opposed to breaker degradation), and better performance at elevated ambient temperatures. Optional custom output bussing allows for direct connection to a transformer. Other available options include integrated input or output disconnects, auxiliary breakers, integrated SCADA monitoring components, convenience receptacles, pre-terminated custom length input conductors, and surge protection.

SolarBOS
www.solarbos.com
Booth 837

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YouTube



Prefabricated roof flashings and accessories

FlashStrap Roof Flashings are prefabricated accessories furnished to secure rooftop racking systems. FlashCo's accessories provide a firm connection to the roof deck and buildings structure, requiring a minimal amount of anchors and straps. FlashStrap is attached directly to the roof deck creating a secure connection then fastened and heat welded or adhered to the roof. All fastening plates are approved by roofing material manufacturers and designed to be installed by a roofing contractor.

FlashCo Manufacturing, Inc.
www.flashcomfg.com/solar
Booth 5444



Smart residential battery system

The PowerPod is a smart home battery system designed to save on electricity costs and protect against blackouts. Ranging from 5.5 – 16.5kW on the inverter side to 13.5 – 100kWh of storage capacity.

Electriq Power

www.electriqpower.com

Booth 7431

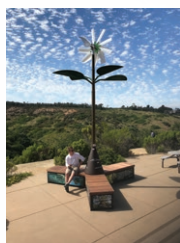
Globally certified PV fuse holders

Mersen is excited to announce the launch of the globally certified HP15FHM32B 1500VDC HelioProtection fuse holders for photovoltaic applications. Designed to global standards, the HP15FHM32B fuse holders are IP20 ingress protection rated, featuring a finger-safe rotating fuse carrier that accepts 10/14 x 85mm gPV fuses, introducing the next level of safety for utility-scale photovoltaic applications. The body of the fuse holder is engineered with UL94-V0 material, providing high flammability rating and durability. The fuse holders also include a lock out/tag out feature as well as DMM probe access. The HP15FHM32 series fuse holders are offered in two variations. The HP15FHM32B features a tool-less CAGE CLAMP, while the previously introduced HP15FHM32A features a screw clamp. Both accept standard PV rated wires with DIN rail mounting, providing added flexibility and versatility for end-use installations.

Mersen

ep.mersen.com

Booth 4346



Plug into nature

The EnergiPlant provides quiet reliable power as a free-standing wind, solar, and battery nanogrid. With 1000W of rated wind capacity and 360W of rated solar, they power WiFi connectivity, lighting, security cameras, mobile device charging, and more. There is no foundation required. Install at the beach, in a park, a concert venue, a school, university campus, or corporate campus. The cantilevered pole design makes for easy installation, servicing, and lowering in times of extreme weather.

Primo Energy

www.primoenergy.com

Booth 5653

ISO-CAL
north america



Calibrating to a higher standard

Solar Radiometer Calibration Services

ISO-CAL provides fast, reliable, ISO/IEC 17025 and ANSI/NC SL Z540 accredited solar radiometer calibration services: WRR, WISG and/or NIST traceable.

Equipped to calibrate any pyranometer or pyr heliometer model type, ISO-CAL offers both indoor and outdoor Primary or Secondary reference calibration services in accordance with all ISO and ASTM calibration standards.

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- ✓ Net Radiometers
- ✓ Pyr heliometers
- ✓ PAR Sensors
- ✓ Pyrgeometers
- ✓ LUX Sensors
- ✓ UV Sensors
- ✓ Spectroradiometers

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480-336-8133

info@isocalnorthamerica.com

www.isocalnorthamerica.com

SR30 | Digital Secondary Standard Pyranometer

Join the evolution...



ev·o·lu·tion
/ ,evə'looSH(ə)n/

noun

The gradual development of something, especially from a simple to a more complex form.

When it comes to superior performance, even Darwin would agree the latest SR30 pyranometer from Hukseflux is the natural selection.

SR30 pyranometer employs an internal, low power, maintenance-free ventilation system with heating, rendering larger higher power/ high-maintenance external ventilators obsolete. The SR30 is locally supported in the U.S. and backed by a 5-year warranty.

- Superior measurement accuracy
- Highest data availability
- Low cost of ownership
- Most value added features standard
- Performance validated (test data included)
- Compliant with latest ASTM & IEC standards



New

Low-power internal ventilation with heating via digital control over RS485 / Modbus (patent pending)

Internal ventilation port
Easy-view bubble level

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HuksefluxUSA™

631-251-6963

info@HuksefluxUSA.com | www.Hukseflux.com



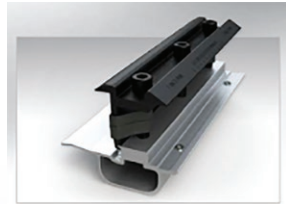
Rugged and accurate silicon-cell pyranometers

Apogee Instruments offers their new cost-effective thermopile pyranometers, as well as their new albedometer setup designed for monitoring bifacial panel performance. Apogee Instruments sensors come in multiple outputs and are priced competitively for integrators.

Apogee Instruments

www.apogeeinstruments.com

Booth 4050



Rooftop solar mounting solution

UNIRAC, Inc.'s SFM INFINITY is a rooftop solar PV mounting system that optimizes the solar installation process. SFM INFINITY impacts solar contractors' operations by reducing logistics costs, eliminating rough-in inspections, and enabling two installations per crew per day.

UNIRAC

www.unirac.com

Booth 4513



PV and storage energy management system

Trimark provides flexible, modular energy management solutions for coupled PV and storage systems (PV+S). These solutions are born from Trimark's expertise in managing a wide array of on-site energy applications, including battery and PV control systems. In addition, Trimark's integrated PV+S control solution allows for reliable, predictable energy generation, which leads to great payouts from site production. Moreover, this solution simplifies many tasks, including firming renewable production, controlling energy flow, optimizing asset operations, and stabilizing the grid. Trimark's PV+S control solution also ensures sites adhere to the guidelines of their respective Power Purchase Agreements (PPAs), resulting in significant revenue gains. As this solution enhances the PV-to-inverter loading ratio, developers are thus able to create affordable, efficient, and profitable systems.

Trimark Associates, Inc.

www.trimarkassoc.com

Booth 3218



Upgraded sensors, lower measuring uncertainty

This year, the MS-80, 60, and 40 sensors have received upgrades as EKO released the MS-80S, 60S, and 40S models. These new models have a new all-in-one converter with multiple outputs and diagnostic features. Selectable outputs include Modbus over RS-485, SDI-12, 4-20mA, or 0-1V. The digital output strings also provide diagnostic information such as tilt and inclination as well as internal humidity, temperature, and pressure data. Monitoring companies will find this new data beneficial as it will provide information about the installation quality and allow users to track any changes in the sensor over time. Each MS-80S meets the ISO9060:2018 Class A Fast Response and Spectrally Flat specifications as well as being suitable for IEC 61724-1:2017 class A monitoring systems. MS-80S are individually calibrated with ISO 17025 accreditation while having a 5-year warranty and recommended recalibration periods.

EKO USA

www.eko-usa.com

Booth 4724

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HIGHEST QUALITY
INDUSTRY FAVORITE

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Thick PVC Coated Steel Seats Firmly and Prevents Slippage

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Quick & Easy to Install
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CAB® Integrated Grounding System uses CAB® multi-carrier hangers together with specially designed copper composite messenger wire. This provides structural support for the cable system and at the same time provides sufficient ampacity for fault current duty, both EGC and GEC. Meets NEC, UL and IEEE standards. ETL Safety Listed by Intertek to UL 2703. Contact CAB® for Engineering Reports.

www.cabproducts.com Call: 814.472.5077

Cambria County Association for the Blind and Handicapped



Renewable energy made simple

SimpliGlobal develops energy storage products for both commercial and residential systems that eliminate installation headaches and optimizes a solar system's ability to generate savings. Their newest product, SimpliBox, is available for viewing at SPI this year. SimpliBox is an energy micro-storage unit that installs directly under the solar panel, reducing installation time from hours to minutes. SimpliBox has unlimited compatibility with all solar panels, contains highly-rated batteries for both safety and durability, and is scalable to any size system. Their proprietary software works in conjunction with SimpliBox to automatically register the system and programs it to optimize energy consumption for reduced demand shaving and time-of-use costs. Performance data is displayed in real time through their app.

SimpliGlobal

www.simpliglobal.com

Booth 7014



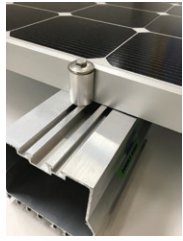
Dynamic energy management solutions

Racepoint Energy is focused on delivering dynamic solutions for residential and commercial energy with on-site microgrids to fit any budget or job size including solar, generator, and battery systems. Partnered with Savant, the companies deliver end-to-end solutions for climate, lighting, entertainment, and energy. Racepoint's solutions include mitigating the limitations encountered with home generation and consumption, including solar islanding, critical load panels, and time-of-use metering, all while using standard breaker architecture. Their technology allows users to monitor the energy used by each circuit (by room, appliance, etc), and manage energy storage systems.

Racepoint Energy

racepointenergy.com

Booth 4149



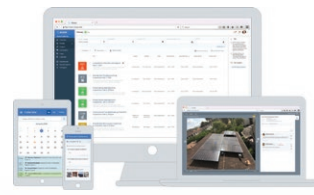
Rackless and robust mounting system

Solar Stack 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, Solar Stack is designed to meet 185mph winds. Certified Florida Product Approval including HVHZ (High Velocity Hurricane Zone). Solar Stack eliminates drilling holes, inserting screws, and locating structural connection points on the roof for positioning of the solar panel.

Solar Stack

www.solarstack.com

Booth 5333



Save on rework and repeat site visit costs

Scoop's elegant new web portal, now optimized for both tablets and widescreens, pairs with their mobile interface to provide seamless field communications, work order assignment, task & project tracking, and reporting. Field and office teams are kept in total sync with a real-time view of project status, photos, and activities, with an easy to use form builder that ensures technicians follow the exact steps required for each task, and collect all critical field data needed.

Scoop Solar

www.scoop.solar

Booth 3633



Optimizing residential energy storage systems

The Lumin Energy Management Platform brings intelligent control to any electrical distribution panel and makes ordinary circuits smart. Lumin's hardware/software system enables responsive load management that can adjust automatically to storage status, electricity pricing, and much more. The solution is valued by storage partners, solar installers, utilities, and homeowners alike.

Lumin

www.luminsmart.com

Booth 7334



THE DAYS OF A SIMPLY NEEDING AN INVERTER HAVE CHANGED



RIS 30/60



RIS 50



RIS 125



RIS 250



RIS 500



RIS 1000



RIS 2000

Rhombus complete Site Inverter Systems Deliver:

- Maximum flexibility with optional power stages that can be configured in multiple ways
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- Power converter for distributed energy resources in grid or island mode
- Resiliency designed multi-point communications to remote equipment
- Integrated isolation transformer
- Wide input voltage range
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VectorStat® Integrated Site Controller Includes:

- Feature rich, distributed architecture with industrial grade encryption
- Software platform and databases with industry proven open-source modules
- Persistent key value and time based database which runs on VectorStation™ hardware or VectorCloud™
- Open to customer-designed "applets" for customized applications
- Includes MODBUS, CAN, USB, RS-485 interfaces
- VectorStat® nodes can be connected to disparate equipment and included in network
- UL 1741 SA Certified and SunSpec® compliant



Large-scale energy storage projects

POWER Engineers, founded in 1976, is a nationally ranked consulting and engineering firm providing services for the generation, transmission, and distribution of electricity. POWER helps clients make sound BESS investments by applying decades of experience to clients' specific challenges.

POWER Engineers

www.powereng.com

Booth 2809



Complete solar plant monitoring and control

The all-new Solar-Log WEB Enerest 4.0 is a completely redesigned, power-packed energy monitoring and management platform. This enhanced platform provides intelligent, real-time error detection and intuitive controls for fast diagnostics and recovery. Streamlined analysis is possible through comprehensive data aggregation and future self-learning functionality. This will cut down the time it takes to analyze plant performance errors and make all fleet data visible at a glance. Fast and easy troubleshooting guarantees smooth plant operation. When combined with the recently released Solar-Log Base, Solar-Log WEB Enerest 4.0, will provide a complete solar plant monitoring and control solution.

Solar-Log America

www.solar-log-america.com

Booth L42



Augmented reality experiences

TerraSmart's bifacial racking solution, GLIDE, will be one of their latest innovations presented through an Augmented Reality (AR) experience at SPI 2019. GLIDE's intuitive design elements; bifacial module compatibility, simplified connections, agile parts, and notable reduction in hardware are just a few features that will be showcased at one of the three AR interaction areas. In addition, TerraSmart will display their turnkey construction phases beginning from civil work to the racking and module installation of an entire solar farm. The third AR experience will unveil TerraTrak, TerraSmart's first single-axis tracker that is optimized with an A-Frame design, built to fit their ground screw foundation. The interactive experience will highlight TerraTrak's stability potential, its simplified hardware, controls, weather station, and more.

TerraSmart

www.terrasmart.com

Booth 1227



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- Increase Profits & Minimize Labor
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Solar support structures

Kern Solar Structures manufactures and supplies a variety of premium solar support structures utilizing high-strength structural steel and proprietary technology to provide fast installation times while reducing costs for all involved parties by employing manufacturer-direct supply and management practices. Featuring products such as X-Piles and the Solar CarPorT System, Kern Solar Structures provides innovative, aesthetic, and cost-efficient solutions. The team at Kern Solar Structures brings along over 1.4GW of solar PV and CSP manufacturing expertise.

Kern Solar Structures

www.kernstructures.com

Booth 4929



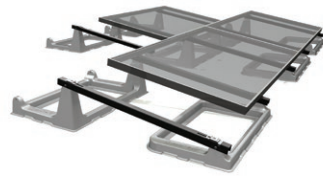
Adaptable solar tracker

The Sol-X tracker, designed and manufactured by Axsus, is a tracking system that utilizes roll formed sections and a simple drive system to handle both bending and torsional loads; eliminating excessive stress on the structure and modules. With a flexible drive system and row lengths of up to 180 modules, Sol-X has the ability to adapt to changing terrain up to +/- 10% and achieve a higher site density. Axsus is currently working on the next generation of solar structures with release dates in Q1 2020.

Axsus Solar

www.axsussolar.com

Booth 825



Tool-less ballasted racking system

DynoRaxx Evolution FR delivers a tool-less ballasted racking system for mounting PV solar panels on flat roofs and surfaces. The proprietary design of the DynoRaxx ballasted racking system has been created to simplify and speed installation without compromising quality or performance. DynoRaxx Evolution FR makes buying commercial and residential solar panel racking cost effective.

DynoRaxx

www.dynoraxx.com

Booth 3949

Versatile mounting system

SunModo introduces the Multi-Purpose System with SunTurf. The versatile system can be used as roof-mount, ground-mount, canopy, or multi-pole. The streamlined design combines the simplicity of a pipe-based system with next-level engineering. By spanning over roof obstructions, SunTurf Roof Mount takes full advantage of the available roof surface therefore maximizing the PV system size and increasing ROI. The system easily achieves 7ft leading edge height and provides convenient access to roof surface for maintenance and repair. Anchor SunTurf Ground Mount using one of SunModo's foundation types including ground-screw, auger, ballasted "Eco-block," or traditional post and concrete. The swivel pipe cap kit can accommodate terrains up to 27% slope east-west and 120% slope north-south. Optional bracing can provide additional structural rigidity for sites with high snow or wind load conditions. SunTurf is a solution for solar installers looking for a low-cost, high-performance system.

SunModo Corp.

www.sunmodo.com

Booth 3046



Cable management for utility-grade installations

Solar Snake Max maintains the proper cable separation required by NEC Article 310 electrical code and eliminates the need to de-rate cables which substantially saves on the cost of labor and materials. Easy to snap together components cuts the installation time by 50%. Quickly mounts to any style of vertical pilings or poles using messenger wire or aluminum rails. Made in the USA.

Snake Tray

www.snaketray.com

Booth 4234

SAFETY is priority one for our contractors and Ironworkers. The training is second to none.



These numbers can't be ignored:

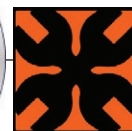
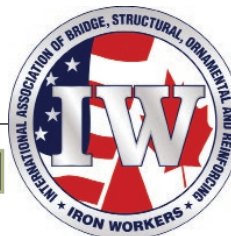
- **4,000** Contractors
- **157** Training Centers
- **6,941** Certifications in 2018
- **20,143** Certified Ironworker Welders
- **19,885** Apprentices and Trainees
- **6,000,000** dollars invested annually on SAFETY
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Reliable electromechanical equipment

EMA Electromechanics is the designer and manufacturer of the VDH/GSMI combined outdoor vacuum circuit breaker and high speed, mechanically interlocked grounding switch, a unique and patented system specifically designed for switching and grounding of wind and solar energy collection circuits, Concerning PRC-024-1 and PRC-024-2 Under Voltage Ride-Through Requirements, VDH/GSMI supports differentiation between internal and external faults to the power plants, providing designers and engineers the ability to set generators to trip if the fault is in the plant or ride through if the fault is outside the plant.

EMA Electromechanics
www.emaelectromechanics.com
Booth 5329



Solar wire hanger with open and close function

The NFI-Hanger is the newest addition to Nine Fasteners line of UL Listed solar wire management devices. The NFI-Hanger was designed in conjunction with First Solar for use with their Series 6 modules, but can be used with any modules within a ground mount installation. Constructed out of hard drawn galvanized steel, the NFI-Hanger will withstand any severe weather events it might encounter. An attractive feature of the NFI-Hanger to installers, is the opening and closing functionality it offers, which results in the ability to add or remove wires from the Hanger during maintenance without removing and replacing the Hanger itself. The NFI-Hanger is UL Listed to scope 1565 and is currently available for samples or purchase.

Nine Fasteners
www.ninefasteners.com
Booth 3956



Powerful solar charge controller

SS Power Technology's new charge controller, RapidSolar Charge Controller, is a patented electronic circuit that delivers 4X more electrical power to batteries, resulting in a significant reduction in cost. In addition, it greatly reduces the size and weight of the solar power system with batteries. RapidSolar Charge Controller eliminates the need for expensive electronics such as MPPTs, PWM-type charge controllers. The circuit performance has been verified by NREL for one type of load. The circuit makes it possible for the fully automated operation of the solar power system with storage by providing for automatic turn-off and restart functionality. The circuit implements a new constant power battery charging algorithm, which ensures all the power in the solar modules is delivered to the batteries all the time.

SS Power Technology
www.sspowertechnology.com
Booth 7032



Reimagining renewables

SkyBox makes smart solar simple with an advanced technology single-box design, representing new technology in the field of advanced power conversion, processing, and control. The fully integrated design of the SkyBox system eliminates external charge controllers and communication boxes, significantly cutting installation time and cost. SkyBox works with a wide variety of 48V battery technologies, managing energy based on time-of-use and demand charge rate structures to reduce total energy costs all with the simple use of an LCD touchscreen on the front of the system.

OutBack Power
www.outbackpower.com
Booth 3251

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Solar Panel Wash

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- Reduce water usage
- Approved by panel manufacturers
- Effective biodegradable cleaner
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American Polywater Corporation
www.polywater.com/solarpanelwash.html

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www.hammondpowersolutions.com

HPS Hammond Power Solutions



Residential energy storage solution

Fortress Power is a lithium battery manufacturer based outside of Philadelphia, PA that focuses on helping solar installers use safe and reliable energy storage for their projects. The 18.5 KWh Lithium Iron Phosphate energy storage system can be easily integrated into new or existing PV installation systems. From small residential to small commercial projects, this solution can stack 12 units in parallel and use local monitoring through their user-friendly LCD display to read the complete details of the storage system.

Fortress Power
www.fortresspower.com
Booth 7335



Solar warning labels

PV Labels has created two new items to help installers comply with code and finish off the install with a professional look. The new 05-218 and 05-219 labels have been designed to communicate the multiple messages required on DC and AC junction boxes. Based on the need to satisfy ANSI standards, these unique labels fulfill multiple code requirements while still fitting on these smaller components that have such limited space for labeling.

PV Labels

www.pvlabels.com

Booth 4555



Solar cable management

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 can act as the EGC and GEC. The new system uses grounding hardware on the L-brackets allowing 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

www.cabproducts.com

Booth 3856



Hydraulic crimping and cutting tools

TaskMaster Tools from ILSCO feature an extensive offering of manual, remote, and battery-powered hydraulic crimping and cutting tools, as well as hydraulic pumps. Battery-powered tools run on the M18 Milwaukee battery platform which offers cross functionality with tools an installer may already have in their possession. ILSCO offers connector, conductor, and compliance versatility with their 12-ton die taking and 6-ton dieless tools. Their tools are supported by the TaskMasterPRO service protection program which includes 5-year tool and 3-year battery warranties as well as a 5-day repair pledge.

ILSCO

www.taskmastertools.com

Booth 323



High density, high voltage energy storage solutions

KORE Power is a developer of high density, high voltage energy storage solutions for utility, industrial, and mission-critical markets. Designed to lower energy storage installation and operation costs while optimizing performance, the 1500Vdc Mark 1 energy storage system includes their proprietary NMC cells with added safety features and innovative modules, fully integrated with the Mark 1 BMS. With support from manufacturing partner, Do-Fluoride Chemicals, KORE Power enhances the quality control and visibility across the entire supply chain. The Company serves the growing demand for applications such as energy storage peaker plants, solar + storage projects, microgrids, front-of and behind-the-meter storage, mining energy solutions, and military applications. The 1500Vdc Mark 1 energy storage system has 6 GWh/year production capacity and availability starting Q1 2020.

KORE Power

www.korepower.com

Booth 7130



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Panasonic

na.panasonic.com/us/solar

Booth 1201

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Narada Power Source
www.mpinarada.com
Booth 2819



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.

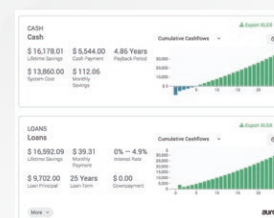
Opsun Systems, Inc.
www.opsun.com
Booth 5522



Reliable and robust fasteners

The Huck Self-Grounding BobTail offers all of the features of the standard Huck BobTail plus self-grounding capabilities. It eliminates the need for complex grounding assemblies and installs in less than 2 seconds. A simple visual inspection confirms it's installed properly. Huck fasteners provide a high level of security and vibration resistance, even withstanding over 100mph winds.

Arconic
www.afshuck.net/solar
Booth 328



Accessing commercial solar finance

For commercial solar designers and retailers, Aurora Solar and Sustainable Capital Finance have partnered to allow their customers to view live rates and apply for solar PPAs directly from Aurora. Instead of spending time rounding up all the documentation and production data required for a financing application, they can now automatically transfer all of their design information from Aurora to Sustainable Capital Finance hassle-free.

Aurora Solar
www.aurorasolar.com
Booth 3637



Solar equipment and systems protection

Littelfuse solar-rated fuses, relays, TVS diodes, varistors, power distribution blocks, surge protection devices, and other products protect equipment and systems subjected to faults common within PV installations. Littelfuse SPXV series fuses are designed to protect solar strings in 1500 V dc applications for 1 - 30A, 32A, and 35-50A. Littelfuse new Type 2 Surge Protection Devices are designed to protect solar string box and inverter applications in 1100 and 1500 V dc, 3+0 configuration. For arc-flash protection that anyone can afford, Littelfuse AF0100 arc-flash relays are a cost-effective, plug-and-play, easy to retrofit solution to mitigate the damaging effect of an arc-flash.

Littelfuse

www.littelfuse.com/solar

Booth 5228



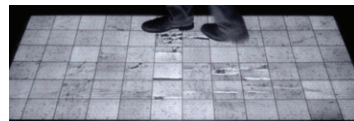
Sleek and powerful low-profile roofing system

CertainTeed reintroduces Apollo II and Apollo Tile II with upgraded output (from 63W to 70W per shingle/tile) as well as simplified flashing for its shingle systems, making installation quick and easy. New CertainTeed CT Series' 120 half-cell (formerly 60-cell) modules and updated 72-cell solar modules, available as part of CertainTeed's affordable and efficient Solstice Solar System, have been redesigned for more power output than ever before. Advanced 120 half-cell and 72-cell modules now produce up to 315W and 375W, respectively (up from 305W/360W).

CertainTeed

www.certainteed.com/solar

Booth 736



Cracked and defective solar panel detection

BrightSpot Automation has added an EL Video Camera to its line of electroluminescence systems for detecting cracked cells and other defects in solar panels. The video imaging enables fast testing of panels in the field or factory with the ability to move in real time to areas of interest. Still images can also be acquired. When combined with their LoadSpot mechanical load tester, videos show crack formation as a function of applied load.

BrightSpot Automation

www.brightspotautomation.com

Booth 341

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Axitec Solar
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Booth 4247



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Sol-Ark
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Booth 3421

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DNV GL is a global provider of independent renewables and energy advice. They work with investors, project developers, owners, and equipment manufacturers to help manage risk throughout the project life cycle to ensure the performance and safety of systems from residential solar rooftops to multi-megawatt power plants. DNV GL's services include: energy management and sustainability, grid integration, energy assessment; independent engineering; owner's engineering; technology reviews; pre-construction engineering, environmental, and permitting; asset management; solar grid integration; solar storage applications; certification testing; and PV module and inverter testing.

DNV GL
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California - Off the Grid

by Dr. George S. Cheng and Ray Martin

The solar industry in California is facing several challenges: (1) New California building codes require all newly built residential homes to incorporate rooftop PV solar beginning January 1, 2020. (2) Illustrated by the Duck Curve from California Independent System Operator (CA-ISO) in Figure 1, California's utility operators cannot accept much more on-grid solar power as it can create serious grid stability problems. A Duck Curve shows the grid capacity limitation for on-grid solar. (3) Battery storage can mitigate the Duck Curve problem, but batteries dramatically increase solar system costs and impact safety. (4) Utility companies may pay little for the solar power sent to the grid and may charge a monthly grid connection fee. (5) Uncertainties of on-grid solar economics may discourage homeowners to lock into a long-term on-grid solar purchasing or leasing program.

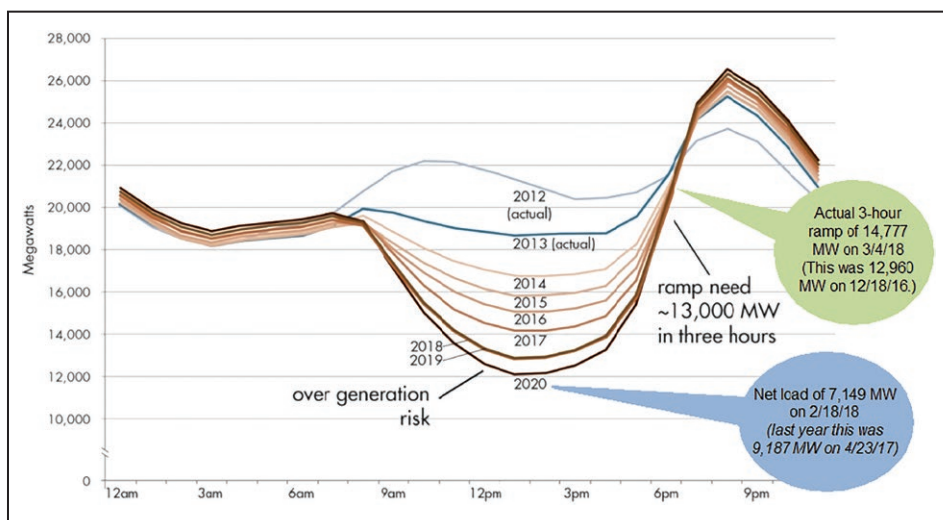


Figure 1

Battery-less off-grid solar

The optimal solution for new home builders to comply with the PV solar mandate is to go “off-grid”, with no batteries. When most people hear the term “off-grid solar system”, they may think of a remote cabin deep in the woods. However, a home with off-grid solar can still be connected to the electric grid. An off-grid solar PV system simply means that the electric power generated by the solar system never flows back to the grid. And the generated solar power is either consumed or stored, not in batteries, but in hot water or in the “coolth” of cooler air.

Off-grid PV water heating

Since running an electric water heater can consume a large portion of the electric bill, taking that load off the grid is a no brainer. As shown in Figure 2, an off-grid PV water heating system is actually quite simple. It includes multiple solar panels and an off-grid solar inverter designed for PV water heating. The inverter is connected to deliver solar energy to the lower heating element of the water heater. The temperature setpoint for the lower element can be purposely set much higher than the upper element; this way, the upper element that consumes grid power does not turn on unless a lot of hot water is used within a short period of time. Compared with thermal solar, PV water heating has many advantages: It is simple, clean, safe, cost-effective, and has no maintenance requirements – and packaged PV water heating systems are available on the market. What better way to save energy than in the form of hot water?

Off-grid solar for zone cooling and heating

Inverter-Air-Conditioners (IAC) or “mini-splits” are becoming more popular, because they are about 30 percent more efficient than a conventional air conditioning unit. Mini-splits can be started with small amounts of surge power, so they are well suited for being powered by battery-less off-grid solar systems, as shown in Figure 3. A digital timer can be programmed to run the system during the day when there is sufficient

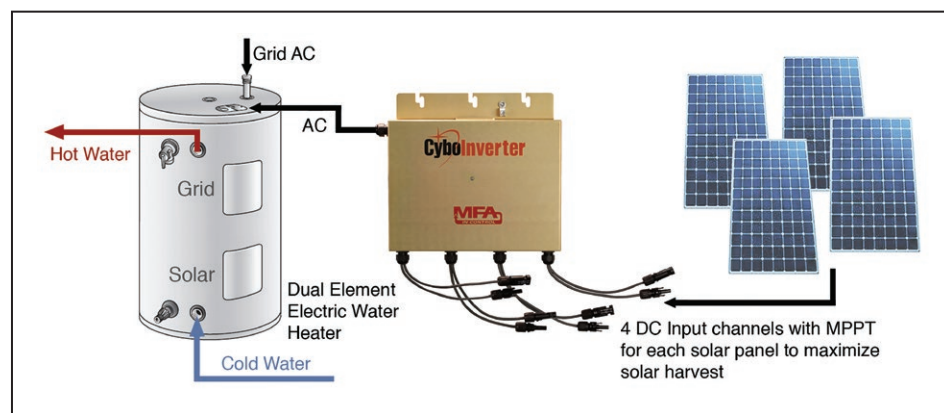


Figure 2

solar power. For homes with central A/C, it can still be economical to install one or more mini-splits in places such as the kitchen or living room to provide zone cooling or heating; the IAC can run during the day to cool or heat the zones, and save the energy in the form of air. After sunset, during the peak hours when the grid needs to ramp up power, the homeowner arrives home to a comfortable temperature - no need to turn on the central A/C. It's a great way to save electricity while help leveling the Duck Curve.

AC assisted off-grid solar system for heavy loads

Figure 4 shows an AC assisted off-grid solar system that can run 240V heavy loads, including central HVAC, IAC, swimming pool pumps, EV chargers, water pumps, clothes dryers, etc. With assisted AC input power, the system can run AC loads 24/7 with solar power, grid power, or combined power. It allows users to take major loads off the grid, and avoid the cost and potential curtailment of an on-grid solar system. By using a 30A dual-circuit or triple circuit timer, connected between the inverter output and the loads, you can schedule and run heavy AC loads individually.

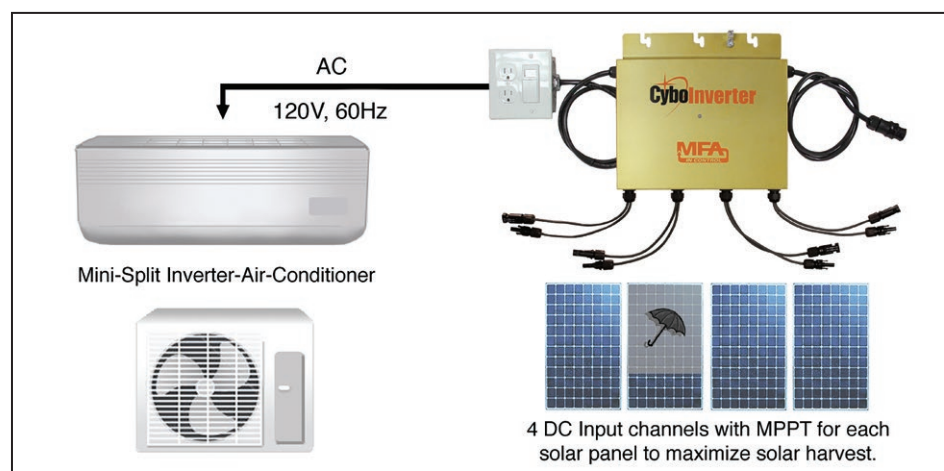


Figure 3

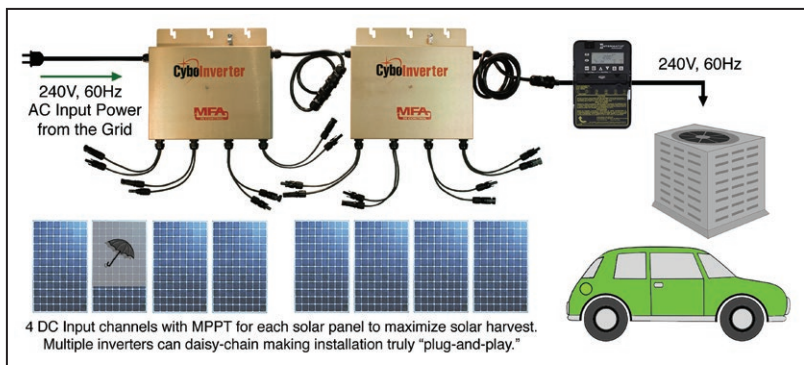


Figure 4

All-electric homes

Many home builders are choosing to offer all-electric homes, with no natural gas service. The builders' motivation is to reduce cost by eliminating the cost of running natural gas pipelines and exhaust systems. The utilities and municipalities are making the effort to make their communities greener by reducing emissions. For example, Sacramento Municipal Utility District (SMUD) now offers incentives up to \$13,750 to convert an existing gas home to all electric.

The trend is clear: the goal of net zero energy homes is now shifting to net zero emission homes. Since it can be costly to power water heaters and other heavy loads with electricity, it is even more compelling for home builders and owners to take these loads off the grid with off-grid PV solar systems.

Go solar for new homes

Today, only 10 to 15 percent of new California homes include solar PV systems. As of January 2020, 100 percent of new California residential construction will require solar PV; this will drive the market for an additional 96,000 to 102,000 residential solar systems in California per year. California homes are already expensive, so home builders are seeking solutions to comply with the solar mandate at the lowest cost possible.

The lowest cost solar system will not include batteries. Battery backup systems have advantages of lowering demand charges and can arbitrage power costs (storing power when rates are low, and consuming battery power when rates are high). However, the disadvantages of batteries are cost and safety. Battery fires, though rare, are hazardous because they involve both electricity and potentially hazardous chemicals that can produce noxious fumes when burning.

Faced with Duck Curve issues and other dilemmas, the goal for designing a solar system is no longer per watt price. In fact, for most new home builders and homeowners, the goal is how to meet solar mandates with minimum investment, quickest ROI, and freedom of choice. Going off-grid without batteries, taking major loads off the grid, and signing no long-term contracts, will allow you to achieve these goals.

Dr. George S. Cheng is the CTO of CyboEnergy, which focuses on the development, manufacturing, marketing, and servicing of the product lines in the energy and clean energy field.

CyboEnergy
/// www.cyboenergy.com

Ray Martin is Vice President of IDL Global, a corporate advisory firm that specializes in providing services to companies with an emphasis on technology and investment banking services for strategic acquisitions, divestitures, corporate finance, joint ventures as well as technology and IP management.

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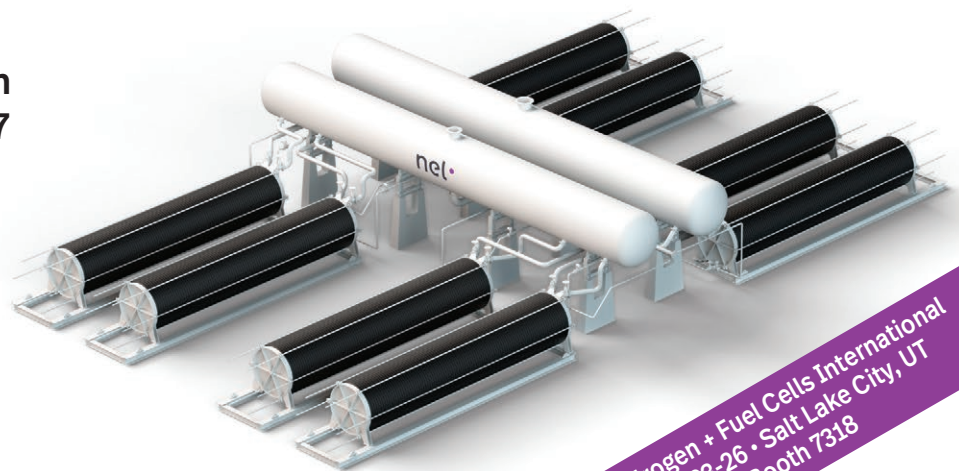


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The SMA Energy System Home delivers value to homeowners through backup power and energy management functionality, and simplicity to solar professionals with a complete, single-sourced solution for residential energy storage. The SMA Energy System Home includes a Sunny Boy 6.0-US battery inverter and a 10kWh battery from BYD. The system is available in two variants. The first includes the fully integrated Automatic Backup Unit, which simplifies installation for backup use cases. Whole-home backup can quickly and easily be achieved, or specific loads can be identified and protected. The second variant is for users exclusively focused on home energy management. This allows users to optimize rates and power consumption, as well as participate in unique markets with zero export grid requirements. Furthermore, even systems designed for energy management come with SMA's exclusive Backup Lite feature, which allows users to access 2000W of available power via a manual switch. Up to three high-voltage batteries can be connected to a single Sunny Boy Storage-US, simplifying installation, reducing labor, and cutting balance-of-system costs. The AC coupled architecture allows for new PV or retrofit installations. The system pairs with the Sunny Portal PV monitoring platform to monitor and control home energy usage. SMA Smart Connected is a proactive service solution provided with the SMA Energy System Home. Smart Connected ensures uptime is maximized for the homeowner while service truck rolls for installers can be cut in half.

SMA /// www.sma-america.com

Hybrid energy solutions

Darfon America Corp.'s energy storage products have improved features and functionality. Among the models upgraded are the H200 and H300 hybrid energy storage systems and the H5001 hybrid inverter. The H200 is an energy storage solution that integrates lithium batteries and the H5000 hybrid inverter into a 19" industrial enclosure. The H200 now offers Panasonic LNMC and Dragonfly LFP as battery options. The wiring terminals have been relocated to the backside of the H200 for easy access and speedy installation. The distribution panel was also redesigned with micro breakers thus making it more compact and increasing the battery bay space to allow up to 30kWh of battery storage. The H300 is a wall-mounted energy storage solution consisting of the H5001 hybrid inverter and a 5kWh LNMC battery. The H300 solution is now available in a 10kWh configuration using two battery packs and a master box. The H5001 hybrid inverter has undergone some physical changes including a lockable distribution box and lockable external PV disconnect for extra security. The conduit knockouts are laser-cut for easy removal and consistency in size. Also, the access cover is easier to remove for installers to program the AP registers. In all three models, the hybrid inverter fans have been upgraded for more precise temperature control. The hybrid inverters have also been improved to handle in-rush overload with 120V circuits. There is also an optional generator start-up kit, if needed.

Darfon Electronics Corp.
/// www.darfonsolar.com



Giga-scale cryogenic battery

Highview Power has developed, in partnership with Finland-based Citec, a modular cryogenic energy storage system, the CRYOBattery, that is scalable up to multiple gigawatts of energy storage and can be located anywhere. This technology reaches a new benchmark for a levelized cost of storage (LCOS) of \$140/MWh for a 10-hour, 200MW/2 GWh system. Highview Power's cryogenic energy storage system is equivalent in performance to, and could potentially replace, a fossil fuel power station. Highview Power's proprietary cryogenic energy storage technology, which uses liquid air as the storage medium, provides all the services essential for a robust grid including time shifting, synchronous voltage support, frequency regulation and reserves, synchronous inertia, and black start capabilities. Highview Power's CRYOBattery can be sited almost anywhere. The CRYOBattery has a small footprint, even at multiple gigawatt-levels, and does not use hazardous materials. Highview Power has developed and optimized its own proprietary BLU core controller system. The BLU controller enables a system to be configured to a particular application through the selection of individual operational modes. It also provides operation and performance monitoring feedback, ensuring a facility's optimal efficiency. The system's embedded flexibility further ensures that the controller has the built-in capacity to adapt as a facility's demand varies with market development. Highview Power recently won the 2019 Ashden Award for Energy Innovation with its proprietary CRYOBattery technology.

Highview Power

/// www.highviewpower.com



Large 48V lithium batteries

In addition to their newest 4LiFe series of LiFePO4 batteries, Iron Edison proudly assembles their high capacity 48 Volt Lithium Iron batteries for solar, battery backup, off-grid, and energy security. With capacities from 72kWh to nearly 300kWh, these batteries require zero maintenance, no watering, venting, equalizing or specific gravity readings and are suitable for new or existing 48V systems. They provide over 95% charge efficiency, 15-20 years of life with a daily 80% DoD, and can charge from solar, generator, or the grid. This solution incorporates Active BMS technology and up to 1,000 amps of peak charge / discharge current. Installation is simple.

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Financing program for energy storage projects

Dynapower, in partnership with LCA, is pleased to offer financing options for system integrators and buyers of Dynapower energy storage systems which provides valuable funding flexibility and potential tax advantages under IRS Section 179. The financing program includes the equipment cost as well as batteries, installation, and commissioning costs up to \$1 million dollars. The program is suited for behind the meter energy storage installations at commercial and industrial facilities with Dynapower's MPS-i125 EHV system. Benefits of the program include: conserves working capital; does not affect business credit; finance equipment purchase, installation, commissioning, and training in one lease; fixed monthly payments with \$1 purchase option at the conclusion of the lease; and potential tax savings under IRS Section 179, which allows businesses leasing equipment to fully deduct the cost of the equipment, up to \$1,000,000, in year one.

Dynapower Company, LLC /// www.dynapower.com



Easy to install and commission automatic transfer switches

ABB has introduced the next generation of automatic transfer switches (ATS), which increase system reliability, connectivity, and ease of use. Upgrades to the Zenith ZTX and ZTG series from Industrial Solutions will feature ABB's TruONE technology and incorporate both the switch and controller in one seamless, self-contained unit, which reduces the number of wires and connections, provides up to 25% more space for wire bending in the enclosure, and minimizes the potential for connection failures. The design also incorporates smart modular components which allow controller and operating mechanism replacement in less than 10 minutes. An optimized interface makes advanced control, connectivity, and energy management easy. With embedded connectivity, an auto-configure function, and a range of programming options, setting-up with the Zenith ZTX and ZTG series takes only minutes. With no wiring or calibration work required, the ZTX and ZTG provide ease of use. The new Zenith ZTG series can connect to the cloud-based ABB Ability Electrical Distribution Control System (EDCS), making Zenith transfer switches compatible with other ABB devices. A plug-in communication module range is offered in seven different protocols, ensuring easy installation and connectivity now and into the future. ABB Zenith ATS solutions bring a high level of convenience, efficiency, safety, and critical power security to residential and commercial facilities and industrial complexes. For facilities managers and consulting engineers, Zenith ATS is an enclosed solution for continuous power and time-saving innovations.

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Europe's Smart Energy Future

by Tibor Tarabek

A RISING TIDE OF COUNTRIES AROUND

the world have begun to craft sustainable energy systems designed to save energy users time and money while providing a cleaner energy future.

EU countries have developed different strategies towards reaching this goal of developing a smarter energy future. How are these companies utilizing the potential of smart energy management in their march towards a more efficient future of energy?

A history of smart energy management

Why is smart energy management important? While it is possible to save energy on your own (with energy-saving TVs, LED lights, converter energy, etc.) these can only save roughly 20 percent of an energy bill at most. As technology becomes more advanced, we have been able to develop systems specifically designed to manage energy much more intelligently, reducing cost for the user and promoting a cleaner energy future.

Present day has started to trend towards smaller grids, making energy more resilient as there is no longer a need to rely solely on one large grid. When combined, smaller microgrids act as a “swarm of bees” when everything is going smoothly; in case of a natural or manmade energy disaster, however, they can act independently. Most importantly, they allow for smarter energy management.

Regulation plays a major part in how countries approach energy. Energy management in Europe is horizontally divided and regulated, meaning they have different companies working together to produce, distribute, and provide user sales. This is in stark contrast to the United States, which largely manages its electricity vertically (with the same company in charge of all stages of energy, from its production to its user sales). This allows for a larger variation as to how each country approaches energy consumption within its borders.

The 2006 EU mandate requires each member country to convert 80 percent of its meters to smart meters by 2020. Some countries are on track, some are behind, and some are finding

innovative ways to adhere to the new policy. Even with many similarities in grids and regulations, combining the whole grid of the EU is not a simple task.

Germany

Germany recently unveiled an ambitious plan to fully transition into smarter, cleaner energy use throughout the nation. The plan, called *Energiewende*, aims to make a transition from carbon-emitting power plants to renewable energy, thereby reducing consumption, and phasing out nuclear power and carbon emissions. Specifically, Germany wants to completely halt all nuclear energy production.

Germany has instituted a program to move away from fossil fuel energy production by 2038, and all of the atomic power plants by 2022. This strategy, while bold and beneficial to the future of energy usage, has proven difficult to actually carry out. Along with monetary concerns, there is currently a debate within Germany on how to replace the thousands of jobs in the coal industry. Even so, Germany remains in danger of failing to meet its lofty goals of reducing carbon emissions by 40 percent by 2020. At the present moment, Germany remains one of the highest producers of carbon emissions in the world.

In order to adhere to EU regulations, Germany is instituting smart metering for those who use over 10,000 kilowatt hours (kWh) in annual energy consumption. These smart meters are designed to expand the German energy market - to benefit the digital world while ensuring a high standard for its users. The German Smart Meters Operation Act states that grid operators are to carry out the maintenance of the meters; third-party operators, however, will be able to do this once granted approval.

Germany is also pushing for smart energy storage; they hope to have 200,000 smart home batteries installed by 2020. This is not only important for the future of renewable energy (which is currently unreliable), but also the ability to hold surplus energy. This advantage is vital in allowing renewable energy to gain a major foothold in Germany and elsewhere.

France

France is still producing over 70 percent of its energy with atomic power - it is the most atomic energy dependent country in the world. In fact, France has recently pushed back its plan to reduce dependence on nuclear energy by ten years. Even with this dependence on nuclear energy that will continue into the near future, President Macron has repeatedly made it





clear that France will be committed to a clean, smart energy future.

France has taken the opposite approach to Germany in this regard – more nuclear energy but fewer carbon emissions. France ambitiously aims to reduce fossil fuels by 40 percent by 2030, including a legal framework to shut down coal-fired power plants by 2022.

France is on track to have its EU mandated 80 percent of its grid run by smart meters, currently on pace for a massive 95 percent by 2020. By using smart energy management, France aims to decrease wasteful energy consumption throughout its country.

The United Kingdom

The UK is arguably the best in the world at developing energy systems with integrated smart control systems. The UK Office of Gas and Electricity Markets (Ofgem) has done a great job in developing smart energy systems within the UK. Ofgem is not afraid of regulating smart systems and allowing them to be connected to the national grid. Thousands of people are currently connected to smart control systems, with the potential for much more.

The UK Research and Innovation (UKRI) recently launched a £30 million fund to promote local development of smart energy ideas. The goal of this initiative is to find innovation at the local level that can be scaled for use at the national level. The government is dedicated to providing citizens with the best technology in order to be more efficient with their energy consumption.

Across the EU, governments have been zealous in attacking climate change and increasing energy efficiency. While the strategies may differ, it's inspiring to see the leaders of the western world set an example for the rest of the world to follow.

Tibor Tarabek is Chief Data Officer at FUERGY, an AI-powered device that utilizes blockchain to help users optimize energy consumption, maximize energy efficiency & participate in the energy market.

FUERGY /// fuergy.com



Test wide range of motor sizes on a single system

SAKOR Technologies Inc. announces it has developed a series of dynamometer systems for customers required to test and verify the level of efficiency of electric motors in accordance with a variety of national and international standards. The SAKOR units can be used test from two to eight pole motors ranging from 10W to more than 3MW. The new line of SAKOR motor testing dynamometers offers high-accuracy testing for designers and manufacturers of electric motors of any size. They have been optimized so individual machines can test the widest possible range of motor sizes and still maintain necessary accuracy tolerances. SAKOR systems meet the standards' tight tolerances and exacting requirements regarding data precision and accuracy. Capable of precisely measuring motor efficiency, these dynamometers provide an essential tool to engineers seeking to reduce fossil fuel consumption and enhance energy efficiency to meet strict environmental standards and regulations.

SAKOR Technologies Inc. /// www.sakor.com



Energy efficiency infrastructure management service

energyOrbit has announced a new service to support customers using its existing cloud-based management platform. Through this service, called Application Management Services (AMS), energyOrbit utility customers are working directly with energyOrbit to manage key energy efficiency (EE) program areas, such as system maintenance, routine enhancements, real-time troubleshooting, and data manipulation. While utilities can still opt to fully manage the energyOrbit platform internally, AMS is ideal for utilities with resource constraints, or large deployments that may otherwise require additional staffing. Powered on the Salesforce platform, the energyOrbit cloud-based software solution provides an integrated user experience to streamline reporting and free up program administrators workloads, resulting in a higher focus on articulating and executing program strategy. Now, with the addition of AMS, utilities will have yet another layer of support on the personnel side to support staff, and ensure workflows are optimized.

energyOrbit /// www.energy-orbit.com



Evaporative and dry cooling solution

Baltimore Aircoil Company's (BAC) HXV Hybrid Cooler offers both evaporative and dry cooling in a water saving and energy-efficient solution. The HXV is suitable for maintaining peak performance for a variety of applications where water is scarce, water costs are high, uptime is critical, or plume is a concern. It is a solution for demanding projects, including data centers, industrial, manufacturing, and HVAC. The HXV Hybrid Cooler delivers energy-efficient cooling while maximizing water savings through the power of evaporative cooling. BAC's combined flow technology, which combines parallel air and water paths, ensures peak system energy efficiency. The HXV also offers up to 70% water savings with the ability to run with reduced water during the majority of the year. The HXV Hybrid Cooler also offers easy maintenance with immediate access to the cold water basin, prime surface coil, and the fan drive system. Operators can inspect the spray distribution system while the unit is in operation. Maintenance costs are further reduced by virtue of 70% chemical savings. When reliable year-round operation is critical, the HXV Hybrid Cooler offers trouble-free winter operation. Additional benefits of the HXV include uninterrupted operation with multiple fans and optional redundant pumps. Longevity and corrosion resistance are further increased with superior material options including EVERTOUGH Construction and TriArmor Corrosion Protection System. For projects requiring plume abatement, the HXV has no plume when operating dry, and the dry coil provides natural plume abatement when running wet.

Baltimore Aircoil Company /// www.baltimoreaircoil.com



Robust and reliable power supply

The STMicroelectronics VIPer26K high-voltage converter integrates a 1050V avalanche-rugged N-channel power MOSFET enabling offline power supplies to combine a wide input-voltage range with the advantages of a simplified design. The high voltage rating of the VIPer26K MOSFET eliminates the need for conventional stacked FETs and associated passive components to achieve similar voltage capability, and small external snubber components can be adopted. Drain current-limit protection is built-in and the MOSFET includes a senseFET connection for over-temperature protection. With high-voltage startup circuitry, a built-in error amplifier, and current-mode PWM controller all integrated on-chip, the VIPER26K can support all common switched-mode power supply topologies, including isolated flyback with secondary-side or primary-side regulation, non-isolated flyback with resistive feedback, buck, and buck-boost converters. The high MOSFET breakdown voltage, together with integrated features and minimal external circuitry lets designers save bill-of-materials costs and board space while boosting reliability in applications such as power supplies for 1-phase and 3-phase smart energy meters, 3-phase industrial systems, air-conditioners, and LED lighting. Additional benefits include internally fixed switching of frequency of 60kHz, jittered ± 4 kHz, combined with control of the MOSFET gate current during turn-on and turn-off to minimize switching-noise emissions. High power-conversion efficiency and no-load consumption less than 30mW help achieve high energy ratings and stringent eco-design approvals.

ST Microelectronics /// www.st.com/viper26k-pr

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 InfraCanada West Conference**
Banff Centre for Arts and Creativity – Banff, AB; www.infrcanada.ca
- 01-02 AWEA Wind Energy Finance & Investment Conference**
www.awea.org
- 05-06 2019 National Solar Tour**
USA; www.nationalsolartour.org
- 08-10 CANWEA Annual Conference & Exhibition**
BMO Centre – Calgary, AB; www.windenergyevent.ca
- 16-17 6th Annual Demand Response & Distributed Energy Resources World Forum**
San Diego, CA; www.drworldforum.com
- 16-18 5th Annual NY Energy Summit**
Hilton Albany – Albany, NY; www.infocastinc.com
- 22-23 AWEA Offshore WINDPOWER Conference and Exhibition**
Boston Park Plaza – Boston, MA; www.awea.org

NOVEMBER

- 01 InfraCanada Central Conference**
Niagara Falls Marriott Fallsview Hotel & Spa – Niagara Falls, ON; www.infrcanada.ca
- 05 3rd Annual California-Germany Bilateral Energy Conference (CGBEC)**
San Diego Convention Center – San Diego, CA; www.energy.ca.gov/cgbec.html
- 05-07 Energy Storage North America**
San Diego, CA; www.esnaexpo.com
- 05-07 2019 Fuel Cell Seminar & Energy Exposition**
Long Beach Convention Center – Long Beach, CA; www.fuelcellseminar.com
- 12-13 Clean Energy Means Business Buyer's Summit**
The Curtis Hotel – Denver, CO; www.cossa.co
- 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

DECEMBER

- 12-13 Solar Power New York**
Hilton Albany – Albany, NY; www.events.solar/newyork

JANUARY 2020

- 16-17 Solar, Storage and Smart Energy Expo Northern California**
Hilton Union Square – San Francisco, CA; www.events.solar/exponorth/

FEBRUARY 2020

- 04-06 Intersolar North America**
San Diego Convention Center – San Diego, CA; www.intersolar.us
- 10-13 GLOBE 2020**
Vancouver Convention Centre – Vancouver, BC; www.globeseries.com
- 12-13 The Energy Expo**
Miami Airport Convention Center (MACC) – Miami, FL; www.theenergyexpo.com
- 19-20 Solar and Energy Storage Northeast**
Westin Boston Waterfront Hotel – Boston, MA; www.events.solar/northeast/
- 26-27 AWEA Wind Project O&M and Safety Conference 2020**
Hotel Del Coronado – Coronado, CA; www.awea.org

Page	Company	Website
44	Abaris	www.abaris.com
74	AceClamp / PMC Industries	www.aceclamp.com/solar-racking-systems
76	American Earth Anchors	americanearthanchors.com
82	American Polywater Corporation	www.polywater.com/solarpanelwash.html
63	Arconic	afshuck.net/solar
87	AWEA - CleanPower	www.cleanpowerexpo.org
36	Axitec, LLC	www.axitecsolar.us
51	Bachmann Electronic Corp	www.bachmann.info
5	Baja Carports	www.bajacarports.com
27	Bitimec USA	wash-bots.com
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21	Burndy	www.burndy.com
78	CAB Products	www.cabproducts.com
16	CleanView Capital	cleanviewcapital.com
57	CN	cn.ca/dimensional
76	Continental Control Systems	www.ctlsys.com
35	Crown Battery	www.crownbattery.com
6	CyboEnergy	www.cyboenergy.com
15	DNV GL Energy USA, Inc.	www.dnvgl.com/energy
47	Doleco USA	www.doleco-usa.com
11	Dynapower	dynapower.com
52 & 85	EDF Renewable Energy	www.edf-re.ca
64	Eko Instruments (USA) Inc	www.eko-usa.com
62	Electrical Consultants, Inc.	www.electricalconsultantsinc.com
39	Elevator Industry Work Preservation Fund	www.eiwpf.org
48	EMA Electromechanics	www.emaelectronics.com
90	ESNA	www.esnaexpo.com
86	FIBOX	www.fiboxusa.com
7	GameChange Solar	gamechangesolar.com
29	Gigavac	sensata.us/gigavac-hx
82	Hammond Power Solutions	www.hammondpowersolutions.com
37	Heyco	www.heyco.com
77	HuksefluxUSA	www.hukseflux.com
81	IMPACT	www.ironworkers.org
42	Indji Systems	www.indjiwatch.com/wa
91	Intersolar North America	intersolar.us/nace
77	ISO-CAL	www.isocalnorthamerica.com
30	Kinetic Solar	www.kineticsolar.com
18	Lenzi Inc.	lenzicon.com
59	Liebherr Cranes Inc.	www.liebherr.com
84	Littelfuse, Inc	littelfuse.com/solar
50	Mankiewics Coatings	www.mankiewicz.com
74	MERSEN USA Newburyport-MA, LLC	ep.mersen.com
17	MK Battery	www.mkbattery.com
89	Nel Hydrogen	www.nelhydrogen.com
72	Nine Fasteners	www.ninefasteners.com
45	Nordic Fiberglass	www.nordicfiberglass.com
9	OMCO Solar	omcosolar.com
25	OMG Roofing Products	www.omgroofing.com
35	Opsun	opsun.com
84	Outback Power	www.outbackpower.com
3	Panasonic	na.panasonic.com/us/solarpanels
28	PCL Construction	pcl.com
67	Phoenix Contact	www.phoenixcontact.com
55	Port of Longview	portoflongview.com
IBC	Port of Stockton	portofstockton.com
33	Preformed Line Products	preformed.com
68	ProSolarClean / Sola-Tecs	www.prosolarclean.com
IFC	PV Label	pvlabels.com
19	QuickBOLT	quickbolt.com
53	RAD Torque Systems	www.radtorque.com
69	RBI Solar	rbisolar.com
79	Rhombus Energy Solutions	www.rhombusenergysolutions.com
65	Rolls Battery	rollsbattery.com
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85	S-5	www.s-5.com
OBC	Shoals	www.shoals.com
71	Siba Fuses	www.siballc.net
75	Sinexcel	www.sinexcel.us
43	SKYLOTEC North America LP	skylotec.com
32	SMARTTECH	smartechonline.com
70	Solar Connections International	solarconnections.com
83	Solar FlexRack	solarflexrack.com/competitive
23	SolarBos	www.solarbos.com
66	Sol-Ark	www.sol-ark.com
80	Sollega	www.sollega.com
34	Solmetric	www.solmetric.com
13	Soltec	soltec.com
46	Stahlwille Tools	stahlwille-americas.com
61	Staubli	www.ecs-ecart.com
49	Sterling Rope	sterlingrope.com/freedomtofocus
41	The Timken Company	timken.com/wind-energy
56	Transportation Partners and Logistics LLC	tpandl.com
73	Trojan Battery	trojanbattery.com
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