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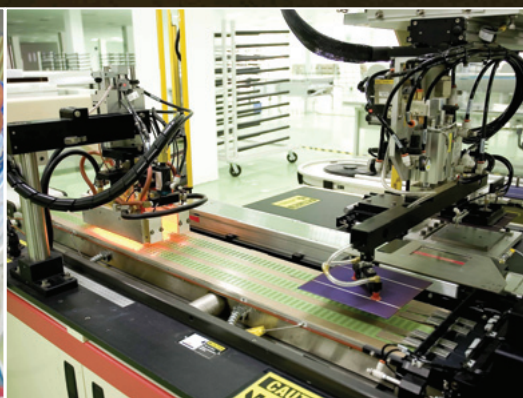
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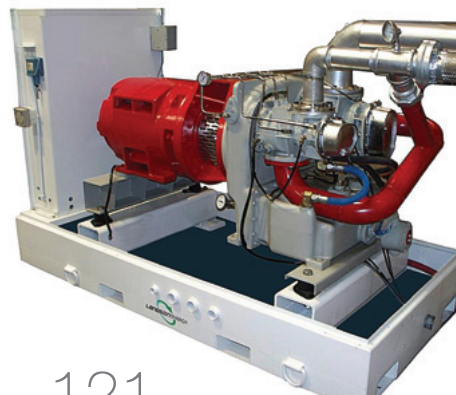
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EDITOR

Michelle Froese
mfroese@nacleanenergy.com

ART DIRECTOR

Rommel Ramirez
production@nacleanenergy.com

SALES MANAGER

Ian Stuart
istuart@nacleanenergy.com

SALES

Ian Stuart
istuart@nacleanenergy.com

Jake Fidler
jake@nacleanenergy.com

Dave Benton
dave@nacleanenergy.com

CIRCULATION MANAGER

Kristy Vail
circulation@nacleanenergy.com

ACCOUNTING

Alison Bell
abell@nacleanenergy.com

PUBLISHER

Ian Stuart
istuart@nacleanenergy.com

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

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Photo by Michelle Moore

SIR ARTHUR C CLARKE ONCE SAID, “Any sufficiently advanced technology is indistinguishable from magic.” Perhaps, the fact Clarke was a science fiction writer (he wrote the novel, “2001: A Space Odyssey,” developed concurrently with Stanley Kubrick’s film version) should be kept in mind; however, I’ve always thought that statement quite fitting in terms of renewable energy technology.

That we can derive usable energy from such everyday sources as the sun, wind, water, and even waste, seems not only fitting (at least, in terms of making the most of natural, renewable resources)—but also somewhat magical. Sun hits a reflective surface and we capture it to provide electricity. Wind or waves propel a turbine and, from it, we

create power. Of course, it’s not quite that simple, but technology makes it seem so.

In this industry, I’m always interested in what will make the next missing or “magical” ingredient to streamline energy production. Case in point: for researchers at the University of California, gold has been the missing link in solar panels. Along with their colleagues from China and Japan, those at UCLA demonstrated that by incorporating gold nanoparticles into organic photovoltaics, they could significantly improve a cell’s power conversion. Accordingly, the gold nanoparticles create a strong electromagnetic field inside the thin, organic PV layers by what’s known as the plasmonic effect—which essentially uses metal to enhance the absorption of sunlight (www1.cnsi.ucla.edu/index).

For another team of researchers at the Department of Energy’s BioEnergy Science Center (BESC), the magical ingredient may be a single gene. They’ve pinpointed the exact gene that controls ethanol production capacity in a micro-organism found in many types of biomass crops—a discovery that could turn out to be the missing link in developing biomass crops that produce higher concentrations of ethanol. Currently, expensive enzymes are used to break down a plant’s barrier to access the plant’s sugars for ethanol creation. But, as per the findings, “identifying this gene is a key step toward making the first tailor-made micro-organism that produces more ethanol” (<http://energy.gov> | <http://science.energy.gov>).

This issue, we bring you other technologies to consider as well, including an article on a hybrid solution that extends the options available for solar power at water agencies and wastewater facilities. This solution means in addition to solar on ground and rooftops, solar can now float on water, producing otherwise lost power and saving costly land (see page 12).

Sometimes the right technology is found in a completely different industry. Page 46 looks at the automotive sector to find the missing “low-noise” ingredient for wind turbines. And, page 116 discusses PEXa (crosslinked polyethylene) ground loops, an alternative to traditionally used HDPE (high-density polyethylene) piping systems in commercial and residential geothermal systems. With five show-in-print features (from CanWEA to Solar Power International, and others), we also showcase a variety of new products and services.

You never know, herein may lay a little piece of magic that will transform some technology of your own. Enjoy the read!

Michelle Froese

news bites

Renewable energy grows despite recession

The newly released REN21 “Renewables 2011 Global Status Report” shows that the renewable energy sector continues to perform well despite continuing economic recession, incentive cuts, and low natural gas prices.

Authored by Worldwatch Institute Senior Fellow Janet Sawin, in collaboration with a global network of research partners, the report shows that in 2010, renewable energy supplied an estimated 16% of global final energy consumption and delivered close to 20% of global electricity production. Renewable capacity now comprises about a quarter of total global power-generating capacity. Including large and small hydropower (an estimated 30 GW added in 2010), renewable energy accounted for approximately 50% of total added power-generating capacity in 2010. In 2010, existing solar water and space heating capacity increased by an estimated 25 gigawatts-thermal (GWth), or about 16%.

A full copy of the report can be downloaded at www.ren21.net.



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DOE supports development of drop-in biofuels

In support of the Obama Administration’s comprehensive efforts to strengthen US energy security, US Energy Secretary Steven Chu recently announced up to \$12 million to fund three small-scale projects in Illinois, Wisconsin, and North Carolina that aim to commercialize novel conversion technologies to accelerate the development of advanced, drop-in biofuels, and other valuable bio-based chemicals.

Drop-in biofuels are fuels that can serve as direct replacements or supplements to existing gasoline, diesel, and jet fuels, without any changes to existing fuel distribution networks or engines—and have the potential to significantly reduce US reliance on oil imports. The projects, funded through DOE’s Office of Energy Efficiency and Renewable Energy, seek to accelerate research and development that will lead the way toward affordable, clean alternatives to fossil fuels and diversify our nation’s energy portfolio.

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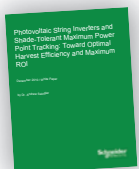
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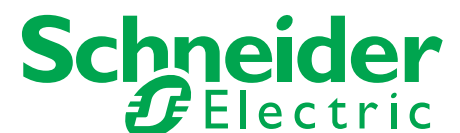
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Strategic Solar M&A Transactions

A look at Chinese dominance of the global PV market

By John D Franchini (*left*) & Rachel A Fink (*right*)



Recent statistics in the solar photovoltaic (PV) market reveal the greatest challenge facing manufacturers is the recent emergence and dominance of Chinese PV manufacturers in the global market. Last year, Chinese PV manufacturers increased their share of worldwide market sales to 45% from 36% in 2009. By contrast, US manufacturers experienced a drop in their worldwide market share from 58% in 2009 to only 17% in 2010. Similarly, German firms experienced a market share drop from 18% to 8% during the same period. One approach by which non-Chinese manufacturers can quickly regain their competitive position is to engage in strategic M&A transactions—specifically joint ventures (JVs) and acquisitions.

History of the PV market

China's recent overtaking of the PV market demonstrates a departure from the historical trend where high demand for PV products in a specific country translated into increased market power for the manufacturers of that country. Starting in the early 2000s, Japan led the demand for PV products and, accordingly, Japanese producers led the market in sales. By 2004, Germany had become the biggest demand market for PV products. Not surprisingly, by 2006, three of the top four producers were German. This model, however, no longer proves to be true.

Currently, over 90% of all newly produced PV products worldwide are being exported by China to the rest of the world. For example, in 2010, Asian producers supplied approximately 40% of the German market and Chinese producers supplied approximately 37% of the US market. Contributing factors to this recent globalization and saturation of the market include the global financial crisis in 2009, the corresponding decrease in the price of silicon and subsequent oversupply of silicon in the market, and low barriers to entry.

In addition to these factors, conditions specific to China have enabled Chinese manufacturers to penetrate the worldwide PV market more effectively. First, the low production and labor costs allow Chinese manufacturers to have lower cost margins, which has allowed them to fare better even in the face of falling sales prices. Second, the Chinese government has provided support for its domestic manufacturers with over \$30 billion in low-interest loans from state banks. These loans put Chinese manufacturing companies in an advantageous position *vis-à-vis* new and existing non-Chinese competitors.

Overcoming obstacles

For non-Chinese manufacturers to compete in the current marketplace, some may need to re-evaluate their current business models and cost structures. One possible solution for non-Chinese manufacturers is to engage in M&A activity, including JVs and acquisitions. Capitalizing on M&A opportunities can provide manufacturers with three important tools needed to excel in this increasingly competitive field: economies-of-scale, geographic diversification, and technology acquisition.

• Economies-of-scale

Given the increased numbers of lower-cost PV manufacturers that have entered the market in the past several years, one thing remains clear: manufacturers require more promising cost trajectories to remain profitable. Economies-of-scale can enable manufacturers to increase production efficiency, while reducing costs. This traditional M&A rationale is particularly relevant today given cost pressures. Manufacturing costs in China are relatively low compared to the US, Europe, and other Asian nations due to reduced labor and raw materials costs. For example, in 2010, the solar crystalline module average price was almost US\$0.50 per watt less in China than in the US and Canada, and more than US\$1 per watt less in China than in Japan and Germany.

Due to the increased price sensitivity of the PV market, this cost advantage has given Chinese companies a distinct edge in the global marketplace, resulting in a year-over-year increase in 2009 to 2010 of total cell production of 152%, and a 9% increase in worldwide market share. Not only has this advantage allowed Chinese companies to benefit from

stronger margins, but it has also enabled them to increase their production facilities to be better poised for today and future growth. For non-Chinese manufacturers to vie with their Chinese counterparts, they need to form strategic partnerships to build economies-of-scale necessary to reduce product development and supply chain costs.

• **Geographic diversification**

China’s ability to outpace other manufacturers has been greatly facilitated by the financial assistance and support they have received from the Chinese government. Currently, major differences exist among countries with respect to the types and duration of governmental support for solar energy. While the US, many European, and non-Chinese Asian nations provide feed-in-tariffs (FIT) for solar energy, tax credits or investment allowances, the rates for FITs differ. However, a great deal of uncertainty exists regarding the future of these programs in the US and Europe, in large part due to the debt crisis of these nations. Already, recent FIT rate cuts in European nations, such as Germany and Italy, have been the catalyst for drastic reductions in the size of those markets over the past two years.

As a mechanism to hedge risk, non-Chinese manufacturers should consider forming partnerships or other strategic relationships with companies based in different countries to avail themselves of as many government incentive programs as possible. Also, to ensure they will continue to be able to take advantage of government assistance and support, which are vital to remaining competitive given the developing and expensive nature of the industry.

• **Technology acquisition**

Technological development remains a key component to enabling manufacturers to remain viable by:

1. Leading future development with new forms of technology;
2. Hedging risk by diversifying among different forms of technology; and
3. Reducing manufacturing costs and increasing efficiency levels.

While US and European companies have been successful in utilizing technological development to create new forms of technology and lower costs, it has come at a high R&D cost, particularly compared to Chinese counterparts. In 2009, the percentage of R&D costs against total revenues was above 2% for all major US and European producers; whereas, among the top five Chinese manufacturers, only one had R&D costs above 2%.

It will be increasingly difficult for US and European-based firms to remain competitive if they continue to invest higher percentages of their revenues in new technologies vis-à-vis their Chinese

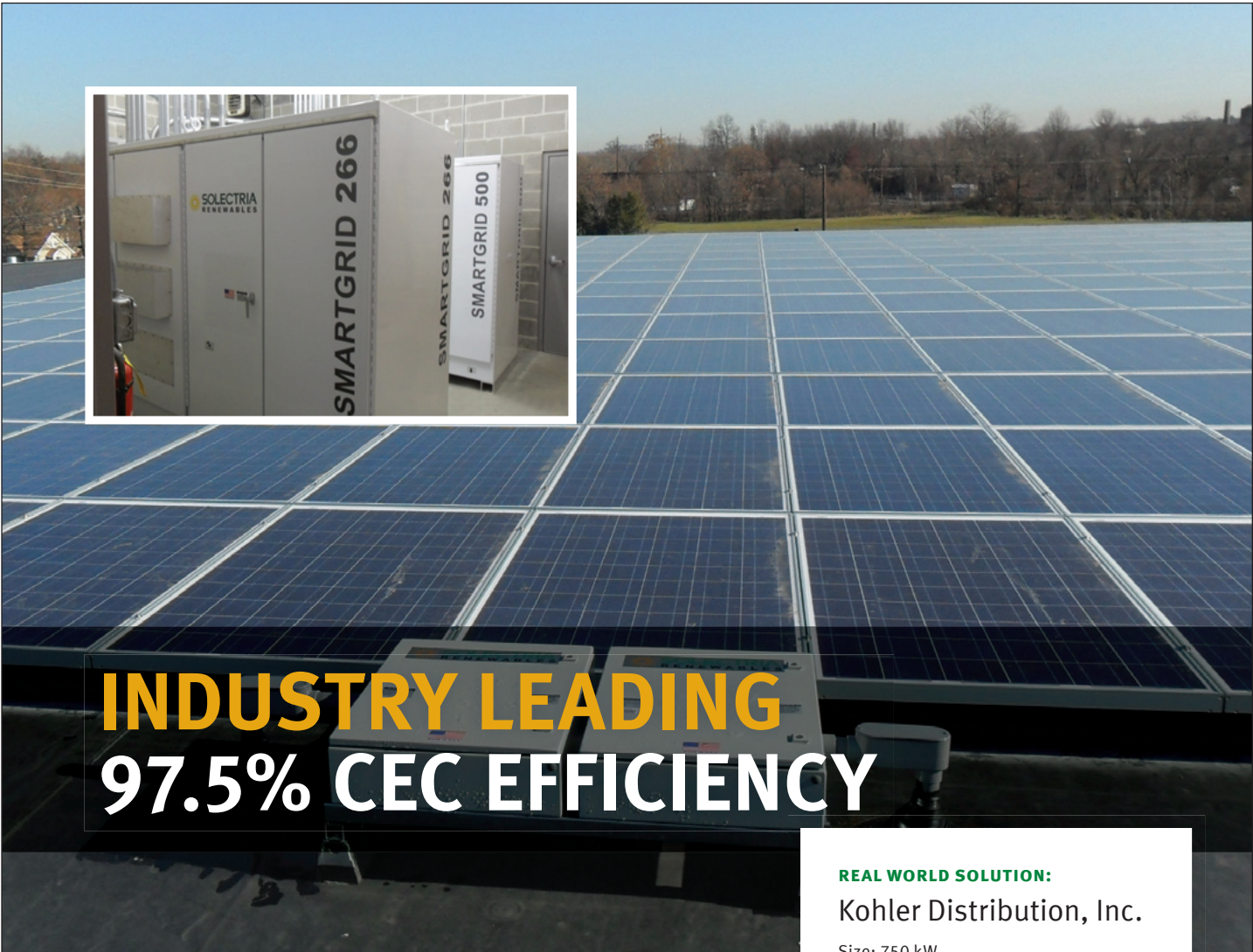
competitors. Partnerships through JVs or other M&A activity can offer firms the opportunity to acquire new technologies, consolidate their research, and increase efficiencies—all with the effect of reducing costs and improving performance.

Conclusion

As the PV marketplace continues to expand, companies need to continually re-evaluate mechanisms by which they can increase profitability and market share. One effective tool to achieve these

goals is through M&A activity and strategic partnerships. Partnerships allow companies to hedge risks, react more quickly to a changing marketplace, reduce costs, and improve margins. In the coming years, more non-Chinese manufacturers may benefit from the pursuit and execution of strategic JVs and acquisitions to remain competitive with their Chinese counterparts.

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Renewable Energy Development on Federal Land

Policy, Eligibility, Permitting & Contracting Perspectives

By Robert E Jackson, PE

AS THE LEADING CONSUMER of energy in the United States, the federal government is actively pursuing projects that promote economic viability, environmental integrity, and energy independence. Developing renewable energy projects on federally owned properties provides a basis for the public and private sector to achieve a myriad of objectives. While several mandates have recently been issued to promote renewable energy development on federal sites, financiers and government agencies must address various eligibility, permitting, and contracting challenges to develop a successful renewable energy partnership.

Existing federal policy

The Energy Policy Act of 2005 requires renewable energy development on federal sites to occur at the following pace:

- Not less than 3% in FY 2007 to FY 2009;
- Not less than 5% in FY 2010 to FY 2012; and
- Not less than 7.5% in FY 2013, and thereafter.

Executive Order 13423 issued in 2007 further requires federal agencies to satisfy 50% of their energy demand through renewable sources, while Executive Order 13514 issued in 2009 mandates the implementation of renewable energy projects on federal lands and sites.

Additionally, a policy developed by the Department of Defense—Net Zero Energy Installation (NZEI)—provides guidance for energy projects at military facilities, while considering missions, cost, and security. An ideal NZEI involves a renewable energy installation that provides excess power during the peak hours of solar insolation, while the excess net-metering credits are utilized to power the military installation at night.

Eligibility & incentives

With the federal policy framework in place, gaining an understanding of federal eligibility requirements for financing and economic incentives, in addition to permitting and contracting, provides financiers more efficient access to the market.

Direct federal appropriations are available through economic incentive programs and through federal programs like the Environmental Protection Agency's Repowering America Initiative, which is the process of selecting Brownfields and Superfund sites for renewable energy evaluation. A similar independent evaluation for solar development is currently ongoing at the federally regulated Sullivan's Ledge Superfund Site and the Parker Street Waste Site in New Bedford, Massachusetts.

Renewable energy development on these sites provides beneficial property use, while limiting environmental liabilities associated with exposure to contaminants. Renewable energy is also powering Superfund remediation projects including energy intensive technologies, such as electrical resistive heating systems, and is significantly reducing estimated durations of remediation. Energy consumption of the onsite groundwater remediation system on Sullivan's Ledge Site will be considered as part of the overall renewable energy development strategy.

Permitting

When seeking a renewable energy partnership with the government, financiers must be aware that agencies are required to review and adhere to various permitting requirements when developing on federal lands. These permitting requirements are site specific and involve environmental laws, such as the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA). Comments from the Advisory Council on Historic Preservation (ACHP) are mandated on federal sites, including those involving renewable energy. Requirements associated with NEPA require coordination with federal permit-

ting agencies to receive a "Finding of No Significant Impact," if applicable. Project financiers and developers are advised to seek environmental experts early in the process to select optimal sites, gain a firm understanding of permitting requirements, and access guidance throughout the permitting process.

Contracting

Contracting between the government and financiers often involves a federal agency purchasing renewable energy from a project financier. To optimize efficient, long-term energy output, federal agencies should consider property access and indemnify the financier from existing environmental liability. Renewable energy systems are typically benign during operations, although financiers may need to consider incurring some liability during installation. To ease the mind of financiers, many existing Superfund sites have undergone extensive environmental review processes and are ahead in the land development process; thereby, further reducing the risk of environmental liability. Federal agencies should also consider the financier's need to make the project bankable, and be able to negotiate in terms of allocating project risks.

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Financier understanding of Federal Acquisition Regulations (FARs) and Defense Federal Acquisition Regulations (DFARs) is important within the federal contracting process, as well. To further streamline the contracting process, federal agencies may consider the inclusion of power purchase agreement (PPA) provisions within FARs and DFARs to provide the greatest economic benefits to financiers, while limiting liability risks to the federal government.

Several provisions relating to revenue, dispute resolution, termination, insurance, liquidated damages, and deal structures contribute to challenges in achieving signed agreements. Energy saving performance contracts (ESPCs) are favorable vehicles for federal agencies and financiers, and involve an agreement between an energy service company (ESCO) and federal agencies following a federally sourced competitive bid process.

Under an ESPC, an ESCO performs the required due diligence, finances the project, and constructs the renewable energy system, while the federal agency benefits from reduced energy costs and attainment of renewable energy goals. ESPCs include terms of up to 25 years, and incorporate provisions relating to renewable energy development and distribution of the associated renewable energy credits (RECs).

Another contract option for federal agencies is the Utility Energy Services Contract, which involves federal agency partnerships with utilities. Under this arrangement, utilities provide the project financing and the resources to implement and operate the project with few costs to the federal agency. With the financier's access to economic resources and the availability of government land, an optimal partnership between the two provides benefits for both parties, revenue from RECs for financiers, and energy cost savings for the government.

Conclusion

Existing policy measures relating to renewable energy development on federal sites provide the framework for attainment of energy, environmental, and economic goals. To form partnerships that meet these goals, financiers and federal agencies must continue to develop reasonable contract vehicles that provide beneficial terms and conditions for both parties. It's critical that financiers gain an understanding of federal agency permitting requirements and select sites on federal land that may reduce transactions costs, including military installations, and Brownfields and Superfund sites, where risk and environmental liability cost be significantly reduced by consulting with environmental experts.



Robert E Jackson, PE is an environmental engineer with TRC Companies, a national engineering, consulting, and construction management firm that provides integrated services to the energy, environmental, and infrastructure markets.

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Solar Power Keeps Water Agencies and Wastewater Treatment Facilities Afloat

By Marissa Muller



ELECTRICITY COSTS are among the largest portions of the annual operating budget for water and wastewater treatment facilities. In fact, electricity accounts for roughly 80% of municipal water and wastewater processing and distribution costs. According to the US Environmental Protection Agency (EPA), \$4 billion is used in treating wastewater and delivering drinking water. In Massachusetts alone, \$150 million per year is spent by cities and towns on electricity costs to treat 662 billion gallons of wastewater and drinking water. In New York, this adds up to between \$250 and \$300 million.

With electricity costs increasing by nearly 22% in the past five years—with even higher and more volatile prices projected—water agencies face a daunting challenge in keeping costs down for ratepayers, while finding the resources to invest in critical infrastructure projects. Add to this higher energy costs for the advanced treatment processes required to meet stringent legislative standards, along with reduced carbon emission mandates, and solutions for lower-cost and cleaner electricity become even more imperative.

The good news is that the cost of large solar system projects will fall by 50% by 2020, at least according to Bloomberg New Energy Finance. Water facilities in several states are already taking control of their energy costs, and putting their assets to work generating electricity with rooftop, carport, and land-based solar installations.

Success at water agencies

Across the US, water agencies and wastewater treatment plants are recognizing that solar means smart business. The benefits are tough to ignore: adding solar power results in meeting nearly all of the onsite electricity requirements, while controlling energy costs, conserving power, and minimizing the carbon footprint.

“Increasingly, wastewater utilities are realizing that in addition to being a consumer of energy, they can be a generator of energy,” states the US Environmental Protection Agency.

Since 2007, Massachusetts has been aggressively rolling out solar projects and energy efficiency measures at 14 water and wastewater facilities across the state in an effort to reduce greenhouse gas emissions, and 20% of the energy used by water treatment facilities. Through this program, \$3.7 million in annual energy savings is anticipated through energy efficiencies and onsite clean energy power generation.

In California, water and wastewater agencies spend more than \$500 million each year on energy. With this being their largest controllable cost, water agencies statewide are targeting energy efficiency opportunities. The Vallecitos Water District (VWD), which serves over 80,000 residents of North San Diego County with water, wastewater, and reclamation services, has installed a solar carport system, shading their fleet of vehicles and employee parking lot. Utility rebates paid for nearly 43% of the cost of the solar PV installation, and the system offsets roughly 90% of VWD’s annual electricity bill.

A hybrid solar solution

A hybrid solution is now available to further extend the options for solar at water agencies and wastewater facilities. In addition to solar on land, solar can now float on water. This provides a solution if land is too costly, since floating solar converts an available holding pond into a renewable energy producing platform.

Water agencies can also look to another provider of liquid sustenance—wineries—for an example of putting water assets to work to reduce energy costs. At a Far Niente winery in California’s Napa County, a combined 477-kilowatt land and floating solar power system has been running successfully on their retention pond for the last three-plus years.

“We were looking for a creative solution to install solar, but not have to take up valuable vineyard land. Floating solar provided us the opportunity to offset 100% of our electric-

ity needs and requires minimal maintenance,” said Larry Maguire, chief executive of Far Niente winery. This system has saved precious vineyard land while significantly reducing algae growth and evaporation in the retention pond.

Floating solar power

The world’s first floating solar power system, operational since 2007, is designed for installations on fresh water surfaces, ranging from ponds and lakes to reservoirs and water storage ponds. By floating solar on one square acre of water in California, 500,000 kWh of clean, renewable energy can be produced.

While there are a few companies globally developing floating solar power systems, the only current commercially operating system mounts solar photovoltaic panels on a racking system that floats on pontoons and is secured by mooring lines. For durability and longevity, this system is engineered to keep all metallic components above water; leaving only closed HDPE plastic floats (which have been approved for use in drinking water reservoirs) in contact with the water. This robust floating solar system is engineered to withstand 85mph winds and changes in water levels.

Floating solar is now cost competitive with roof and ground-based single-axis tracking solar systems, and uses the same commercially available solar panels. Similar to land-based solar, the floating installations qualify for federal and local grant and incentive programs, and are equally effective at generating clean, renewable energy.

Whether on land, rooftops—and now even on water—water agencies and water treatment plants are realizing the business case for solar. Through innovative solar power systems, operating costs can be reduced, as can future rate increases to customers.

Marissa Muller is the senior manager at SPG Solar. SPG Solar has been delivering innovative solar power solutions to water agencies, water treatment, and sanitation facilities since 2002.

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Floating solar systems offer water agencies the following added benefits:

- **Frees up land.** It capitalizes on a non-revenue generating area—water. This makes it possible for agencies with limited land or roof space to turn water into a renewable energy producing platform.
- **Reduces evaporation.** With the system shading the water, evaporation is reduced by up to 70%, saving 1,400,000 gallons of water for every acre covered by solar panels. A three-acre storage pond covered with a floating solar system could save over four million gallons of water annually—enough to provide drinking water to more than 40 homes for a year.
- **Improves water quality.** As bodies of water are exposed to the sun, photosynthesis occurs, causing the growth of organic matter, including algae. Algae clog pumping and filtration systems and require costly treatment to control. By shading the water, algae growth is reduced, minimizing the associated treatment and labor costs.
- **Increases power production.** By installing a floating solar system over a pond, the PV panels are naturally cooled, resulting in improved power production performance. The cooler environment also reduces stress on the system, extending the system’s lifespan.

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KUKA Systems' automated string testing

Quality Becomes Flashpoint for PV Panel Manufacturers

By Bernd Richter

WITH DECLINING FEED-IN-TARIFFS, and other government subsidies becoming harder to come by, makers of crystalline solar panels are being pressured to deliver a better quality product at a lower manufactured cost. Scaling up and automating production, including module assembly, is an effective way to accomplish the latter. But, the thinner a wafer is sliced to stretch raw material costs, the greater the rate of imperfections in finished cells, and their increased sensitivity is a challenge in final assembly.

Quality is becoming an increasingly important USP, or unique selling proposition. The absence of official quality standards in the industry affords photovoltaic producers great latitude to differentiate their products on quality-based criteria. Technology can provide empirical support for such claims.

The first line of defense against defects that impair panel performance is active control over materials—selecting quality cells, ribbons, EVA sheets, stringing systems, laminators, and much more. Testing of cells, strings, and panels provide additional lines of defense. Automated testing systems embedded within fully or semi-automated production environments accomplish their tasks without slowing output. The most advanced, automated cell stringers have extremely sensitive handling capabilities and, therefore, enjoy very low breakage rates.

Next, employing an automated string-testing unit as module assembly begins assesses the integrity of entire strings. They can perform flash, electroluminescence (EL), and dark I-V tests, which, taken together, will weed out most defects. A robot positions strings optimally for analysis by a probe with 3MP front and backlight cameras. The strings are measured, the proper alignment of bus bars verified, and the individual cells (re-)inspected. Defective strings are rejected to a buffer or shuttle to be repaired manually. The EL test will reveal micro-cracks and other deficiencies too small for the naked eye.

This automated string analysis takes eight to 20 seconds, depending on the tests performed and string size. Tolerances can be adjusted to suit the manu-

Continued on page 16.

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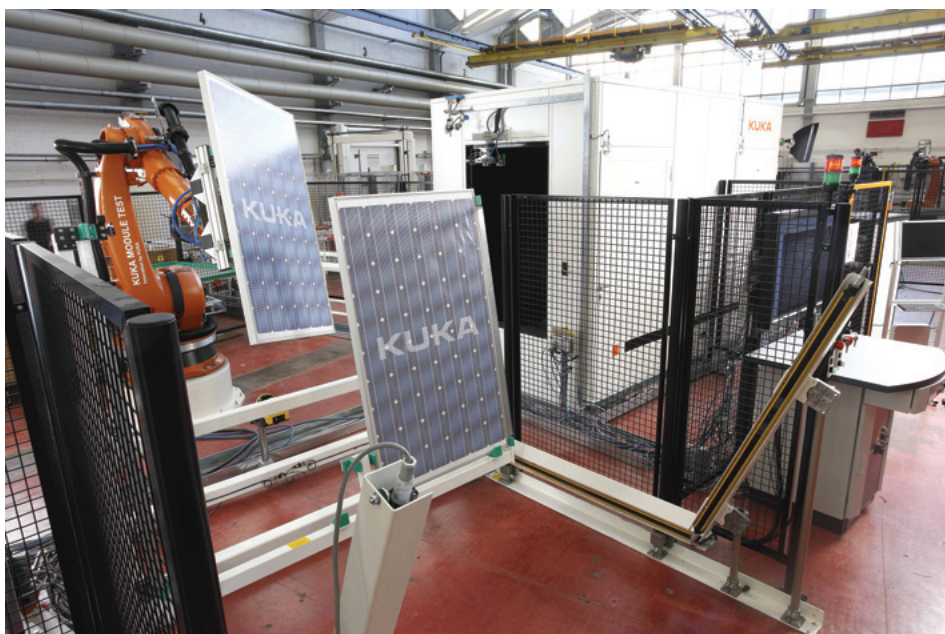
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KUKA Systems' Sun Sim module testing

...continued from page 14.

facturer's preferences, but are typically +0.2mm for cell size deviation, 0.8mm x 0.8mm for chips and contour defects, and 5mm x 5mm inactive areas for an EL test. Catching defects at such an early stage means fewer completed panels are ultimately rejected or down-rated. The precision and 100% repeatability of automated assembly processes—each of which is monitored for quality—also reduces instances of breakage, scratching of glass substrates, poor connectivity or adhesion, and other defects common in manual assembly.

Submitting the completed panel to a final test stop (generally, a Hipot test and flasher or sun simulation) is analogous to giving a new car a short test drive and performance diagnostic as it comes off the assembly line. With robot handling, a leading sun simulator (a Xenon flash tube, which emits a pulsed light inside a test cabinet) can test up to three modules per minute. The main task of this station is to classify the modules according to the nominal power classes, and other properties, defined by the manufacturer.

A high-power module will command a higher price than a lower power module. An EL test can be performed in the flasher to create a storable build image of each panel. The operator will evaluate and classify modules based on the visual representation of the panel, and other criteria set by the manufacturer. For example, it may be decided that repaired panels or those containing repaired strings be rated Class B, and tested and sold accordingly. Test results can be shared in a number of formats. Flexible and scalable test equipment, such as a sun simulator, is a critical, yet cost-effective quality assurance and classification tool—a must-have for manufacturers who want to reinforce their *bona fides* for making quality products that meet or exceed specifications, including customer and end-user expectations.

Bernd Richter is part of sales and engineering for KUKA Systems GmbH, Augsburg, Germany.

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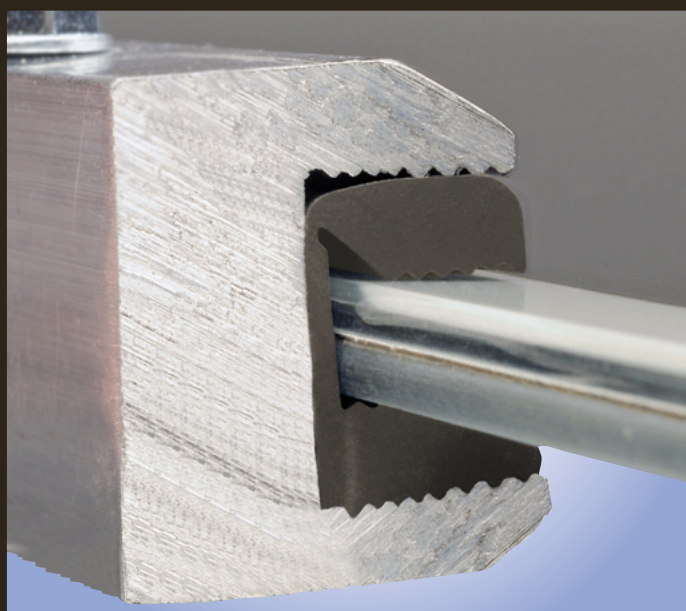
Measuring tilted global & diffuse solar radiation

The position and angle of fixed PV panels makes a big difference to the performance and return on investment of a power plant. The best way for prospecting and performance measurement is by measuring solar radiation with horizontal and tilted pyranometers. Kipp & Zonen now offers an accessory to tilt a CMP pyranometer to a preferred angle—the Adjustable Tilt CMP Mounting Kit. A horizontally mounted pyranometer measures the global short-wave radiation from the sun and sky in a way that's easily comparable with other sites and with solar energy database information.

However, for fixed angle (non-tracking) PV panels, it's important to know the energy available within the "view" of the panel. This tilted global radiation is measured using a pyranometer inclined at the same angle as the panel. The new Adjustable Tilt CMP Mounting Kit allows a CMP series pyranometer of Kipp & Zonen to be positioned at that correct angle. The Adjustable Tilt CMP Mounting Kit can be fixed to a horizontal surface, and has a clear scale in degrees and a secure locking device for easy adjustment of the angle of a pyranometer—between 0° and 90° solar zenith angle.

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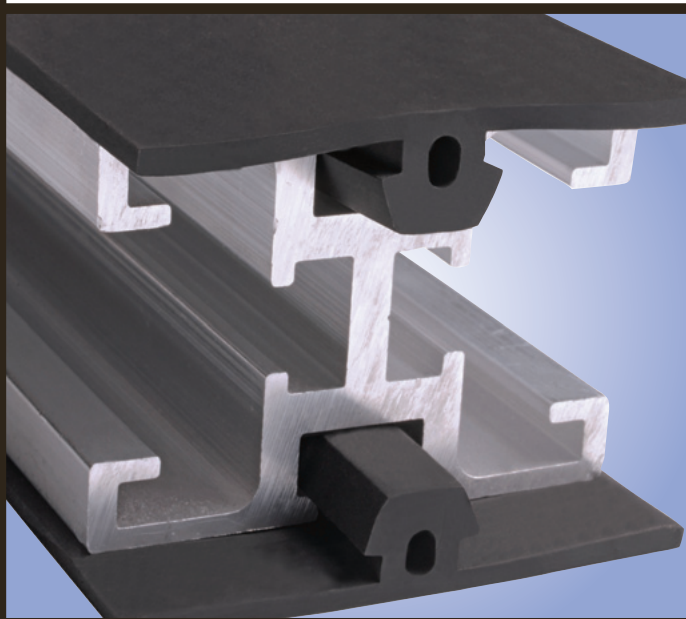
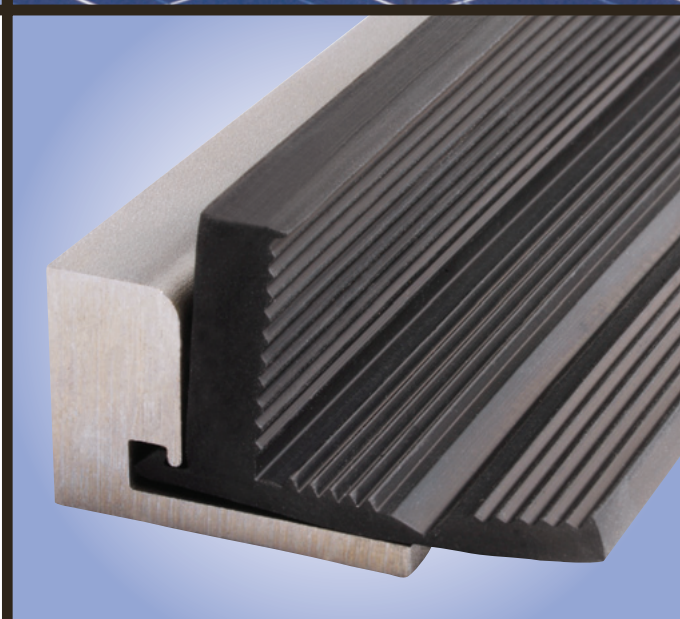
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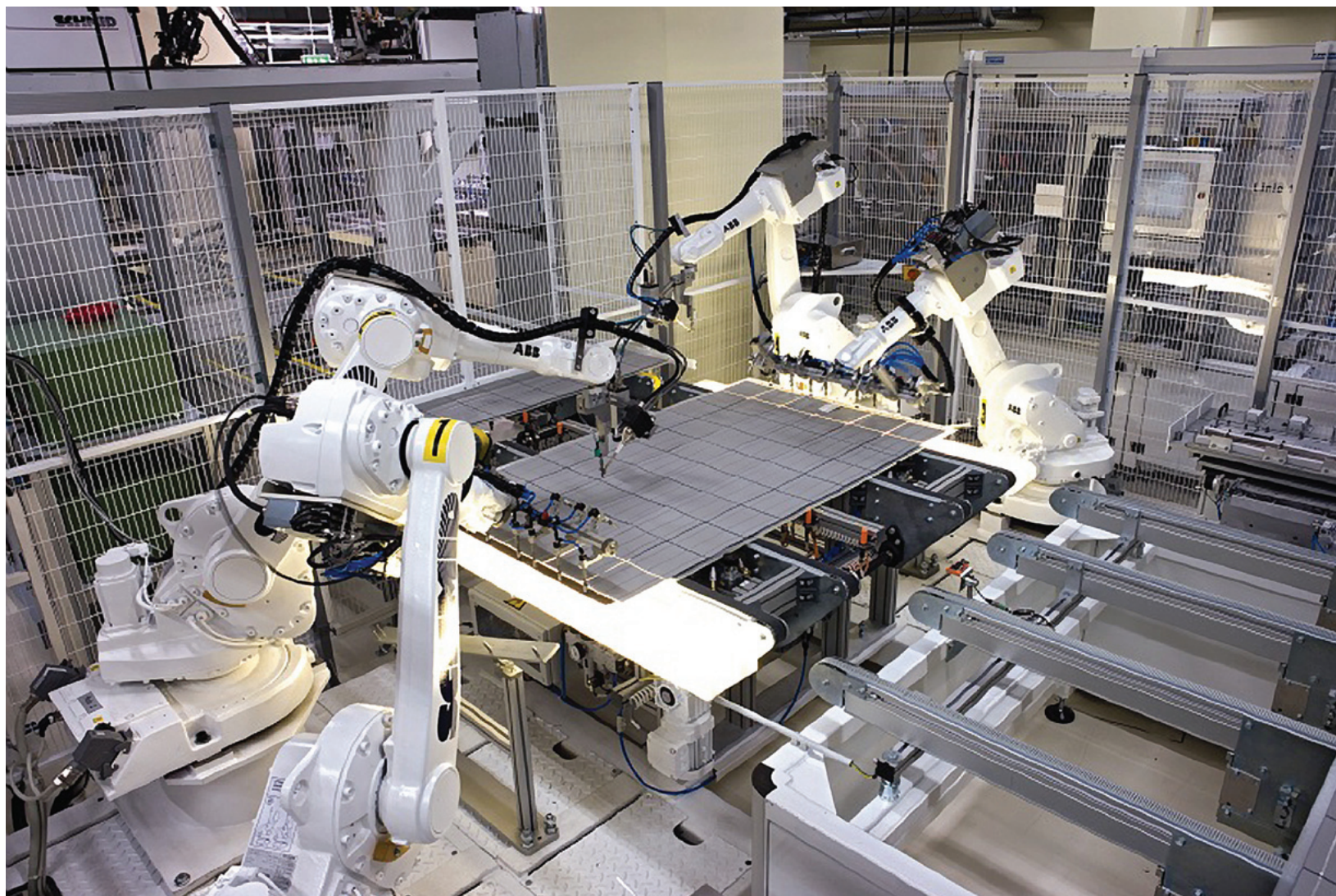


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Since the construction of this vertically integrated (VI) manufacturing facility in Frankfurt (Oder) Germany in November 2006, there has been over US\$350 million (or €250 million) invested into setting up highly automated, VI production facility to produce more than two million quality PV modules.

Maintaining Quality Control

Total quality management & automated PV manufacturing

By Dr Karl Heinz Kusters

The target of PV module manufacturing is to offer quality products that are highly efficient, but at the lowest possible cost per watt peak. However, this goal isn't always accomplished. Many PV manufacturing plants focus solely on assembling completed parts and, without the proper "total quality management" (TQM), this can lead to a significant loss in quality. When a manufacturing philosophy is applied that considers process optimization across the whole value chain—from the silicon ingot to the finished module—there's greater quality control and efficiency. DIN EN ISO 9001 and 14001 are the standard certificates for an integrated quality system.

Wafer production: tracking

With increased work on process and tool mastering, the tracking of wafers throughout the process has recently gained more attention in the industry. With a sophisticated production control system and information on the process history of the materials used in production, different materials can be tracked from wafer production to module manufacturing. For example, feedback loops allow the evaluation of new materials (e.g. silicon) on a module level within a short time.

To increase control of individual wafers, a wafer-marking method is recommended. For instance, a laser can imprint a barcode on the sidewall of the brick. Along with each marking, the position of the wafer can also be marked by a laser groove running diagonally across the brick. The grooves at the sidewall of the wafer can, then, be tracked throughout the cell process. It's important to note that the laser process should be optimized, in this case, to maintain a good contrast of the laser marks throughout the process.

For a module manufacturer purchasing wafers, it's important to incorporate this type of inputs and data from its upstream supplier into its TQM approach to ensure a quality end-product.

Cell production: control production & testing

As part of quality control, cell production should be optimized when based on an inline scheme in which lines are operated in parallel. A cluster concept allows the exchange of cells at multiple positions during the process. The exchange of cells at these positions can be used to compare the tool results from different lines.

When evaluating a cell manufacturer, it's important to obtain and analyze inline measurements for key parameters, such as reflection or sheet resistance, which are essential to control production. The data obtained should be transferred to the production control system, and a statistical process control (SPC) applied to ensure all processes are at the optimum working point.

Any quality cell manufacturer should be performing electrical testing of solar cells combined with an electroluminescence (EL) test. The EL tests allow the generation of a *pareto* of cell efficiency detractors, as a base for further engineering work. The careful investigation of silicon material properties throughout the manufacturing process is essential for cell efficiency optimization, as well as the optimization of screen print. The correct methodology for determining critical parameters in cell production provides the basis for quality in module manufacturing.

Since a cell's quality directly impacts the overall yield of a solar module, it's essential that the quality control of cell manufacturing be factored into the TQM.

Continued on page 20.

Nature provides us with the gift of energy through the sun, but unfortunately, nature's wrath may not be all that friendly to your PV system under stressful conditions. Snow, wind, extreme heat or cold, and seismic activities can wreak havoc on underengineered, underdesigned and insufficiently tested racking structures. Only UNIRAC solar structures have been engineered and third-party tested to withstand the harshest of elements and events for a long and enduring service life. Complies with IBC, IRC, ASCE-7-05, ADM, AISI, AISC, NEC and UL. For the highest level of engineering and construction with the lowest cost of ownership in the business, Unirac is the 24/365 solution for performance in and out of the sun. Visit unirac.com for more information.

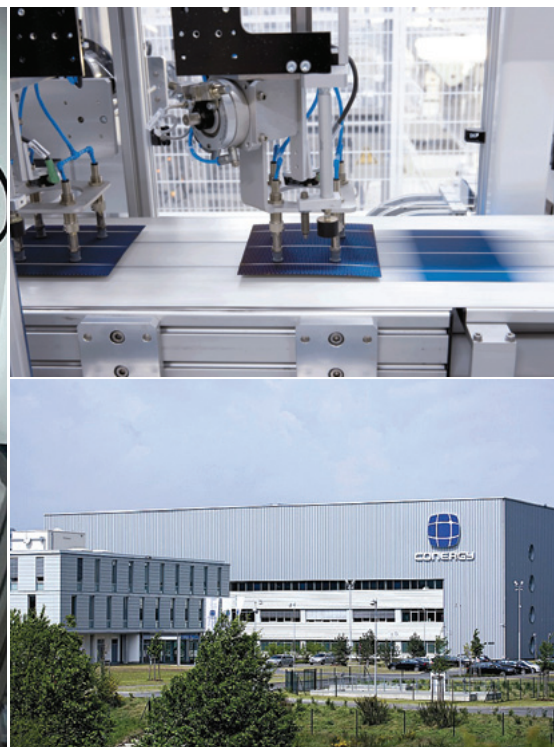


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Module production: High-level automation

High-level automation in module production is essential for product quality, which requires reproducible processes at every production step. In addition to reproducibility, the automation prevents typical human errors that cause problems with PV modules.

Key elements of automation:

- Automated transport of materials with a low tact rate; operators are focused on production and quality control.
- Automatic processes for soldering, lamination, framing, mounting of junction box, and flashing.
- Quality control based on manual inspection, camera systems, electrical testing (including assessment of the diode characteristics), and electroluminescence (EL)—a key diagnostic tool that visualizes potential deficiencies of modules.

High-level automation increases the amount of production process data and, combined with in-depth knowledge of key cell parameters and cell production best practices, results in excellent quality control.

High-level automation in a production plant generates additional investments for robotics, as well as an IT system for the plant, which virtually eliminate human error and produces high-quality modules. Modules manufactured at automated sites with TQM offer better and longer warranties.

Plant investment

To establish excellent quality control, a PV plant needs additional investment for measurement systems, data systems, automation, and engineering. Although there are initial upfront costs incurred during the development of a plant, with a focus on quality control, the result of higher reliability is of key value for a product, which is expected to function more than 30 years.

Furthermore, the knowledge and first-hand experience of vertical integration is key for deploying a holistic approach in creating optimized modules. An example of the type of optimization that can be achieved is the development of the three-busbar cell design, which creates a higher yield module. Another example is the optimization of cell sorting to ensure modules achieve good “lowlight” performance, and avoidance of hot spots that come from cells with lower standard diode characteristics.

Because of feedback loops between cell and module production and fast module build, faster implementation of industry innovations in cell processing is possible, and advancements of process and materials are verified by in house R&D labs and climatic chambers. Optimum quality of modules can be achieved with high-level automation in manufacturing, and by applying insights gained from vertical integration to the process of selecting a cell provider. The investment in automation and factory set-up achieves benchmark quality in PV products, which tends to reduce any customer complaints to below the industry average.

Dr Karl Heinz Kusters is the head of Technology at Conergy.

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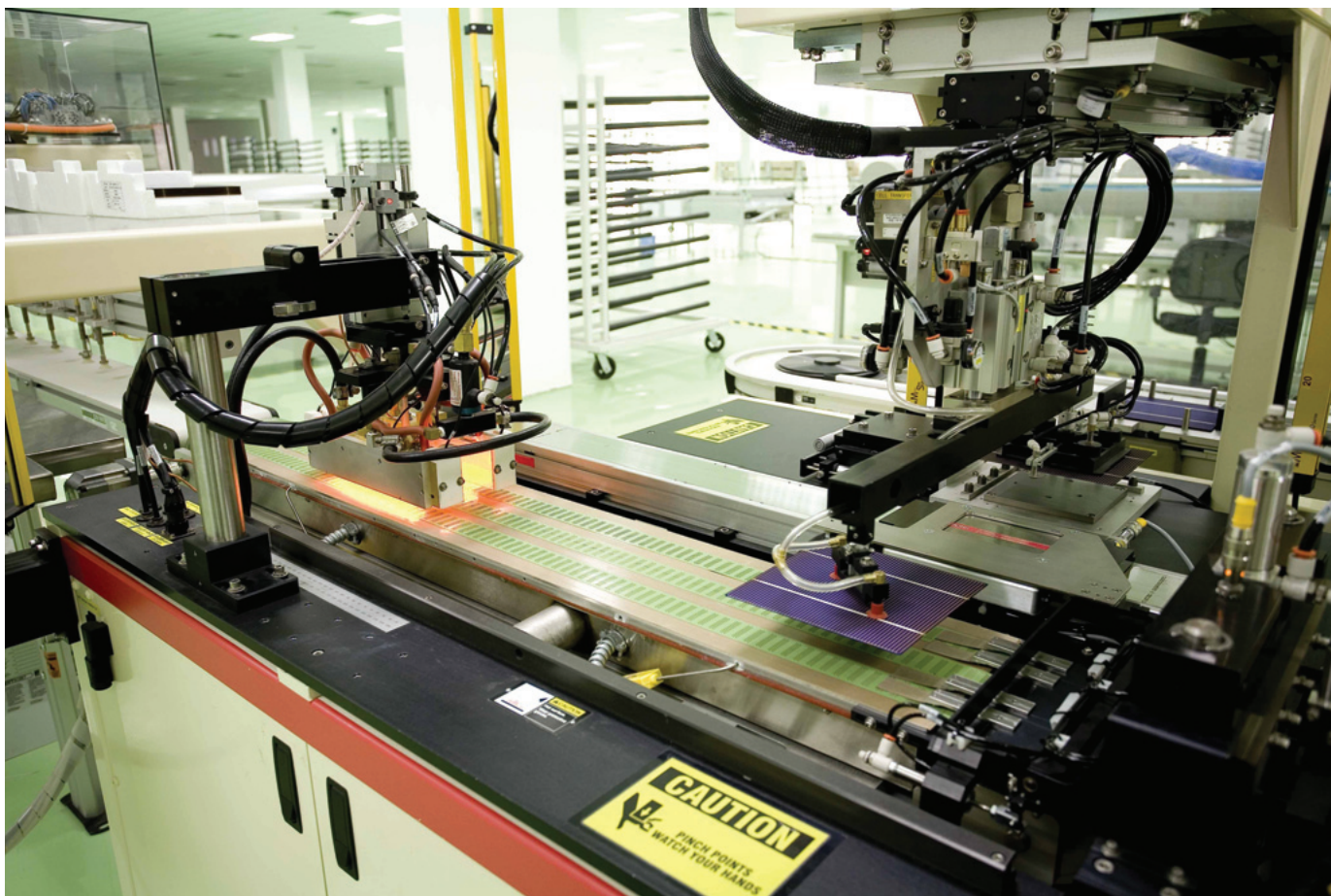
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4 Steps to Achieving the Benefits of Asset-light Manufacturing Platforms

By Stéphane Dufrenne

AS THE PV MODULE MANUFACTURING base continues to expand around the world, a basic misconception persists throughout the industry. The original equipment manufacturer (OEM) model, in which a company outsources its manufacturing to selected partners, is often perceived to be a simple process: send a purchase order specifying module type, quantity, bill of materials, and delivery date...and *voilà!* One month later, the company receives its order and everything is set.

To the contrary, there's always opportunity for unpleasant surprises to occur—even with a highly regarded OEM—in terms of quality, viable capacity, and/or flexibility. However, by strategically allocating resources and focusing on a few key operational adjustments, module suppliers, OEMs, and customers alike can benefit from an asset-light manufacturing model.

1. Monitor the entire supply chain

To address production challenges in a timely manner, it's essential to implement a management structure at the site of the OEM that covers the entire supply chain—from strategic sourcing and procurement to quality control and operations. Having such a structure in place enables the asset-light company to drive down the cost of non-quality. Final products are within specification, the number of customer complaints decreases, and deliveries are on time.

Retaining control of the manufacturing process and maintaining quality standards ultimately drives down the cost of the products for the end-user. Additionally, strategic sourcing and procurement helps companies optimize their network of trusted OEM partners based on technical and commercial criteria, ensuring a company can reach its required capacity at the optimal cost.

2. Redefine the customer-supplier relationship

A successful manufacturing partnership relies on close relationships throughout the relevant organizations, from engineering teams to upper-level management. A strong rapport requires both parties to redefine their roles in the traditional customer-supplier relationship, with an end goal of creating a quality product through equal contribution. This bond is solidified through the aforementioned onsite operations, where supplier/OEM communication isn't limited to e-mails or phone calls, but also includes a daily presence and collaborative problem solving. When both sides are able to form an understanding of the issues facing one another, they create a stronger foundation for compromise, and are better able to meet market demands for reduced product costs and higher quality.

3. Constantly evaluate & strive to improve

To effectively monitor operations and drive quality improvements, it's necessary to establish an onsite evaluation system. By implementing a balanced scorecard with key performance indicators and quarterly targets, companies can efficiently observe and optimize OEM performance. In the event that production targets aren't reached, the provider's quality control team can then launch process improvement programs to achieve manufacturing excellence and close the gap.

4. Provide strong after-sales support

A module purchase is an investment that must be accompanied by a knowledgeable technical support team in the event of any unforeseen product issues after the point of sale. An asset-light manufacturer should be well equipped to provide this support, and can use these opportunities to collect valuable customer feedback. Allocating adequate resources to address issues and evaluate special requests from the customer (thinner frames or special laminates, for example) not only encourages the swift implementation of corrective actions, but also provides fodder for future innovation in product development.

An asset-light model allows a company to increase the number of partners in its OEM network, and/or expand its production capacity without expansion of its core technical team. Having these scalable resources in place enables companies to concentrate their time and financial resources into research and development efforts, linking up with strategic partners, and integrating their innovations into new products.

Such innovations necessitate a change in the manufacturing flow, and a close OEM relationship allows for smoother implementation of these changes for accelerated volume ramp-up capabilities. With the recommended procedures outlined above in place, the manufacturer improves its own lines, and the asset-light provider is able to rapidly incorporate new technologies into its product portfolio.

The benefits afforded through an asset-light business model ultimately manifest for the end-user in the form of better-performing products available at lower costs.



Stéphane Dufrenne serves as the Chief Technology Officer for Upsolar, an international supplier of PV modules. He brings to Upsolar more than 10 years of experience from asset-light operations and technology development in the semiconductor industry.

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Central Inverter Lifecycle Cost Considerations

By Ed Heacox

THE SOLAR PV INDUSTRY uses a wide range of performance metrics, yet many of those are incomplete and do not address the most fundamental challenge of renewable technologies—lowering the cost of energy produced.

Although the solar industry is littered with notable metrics—such as PV efficiency, panel manufactured cost, and installed cost per watt—ultimately developers earn maximum returns by optimizing the overall system design and lifecycle performance to achieve the low-

est levelized cost of energy (LCOE) in dollar/kWhr terms. For commercial and utility-scale solar projects, the central inverter is arguably the most active and critical component. All energy from the PV array is conditioned, monitored, and optimized via the central inverter. The harsh field environment and dynamic operation challenge inverter reliability, uptime, and power conversion efficiency.

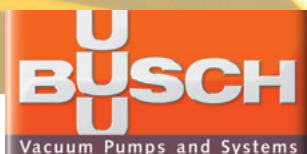
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As the solar industry matures, developers recognize the importance of the inverter and evaluate its effect on LCOE. Interestingly, while the overall project LCOE is dependent on low installed system cost (USD/W), the LCOE contribution of the central inverter far outweighs the cost of the inverter itself. A challenge for the industry is how to evaluate a critical component in LCOE terms; clearly, a simple metric such as USD/watt is easy, yet incomplete. Every project has unique variables and optimization trade-offs.

Energy harvest & revenue generation

The most obvious metric to evaluate harvest is the inverter power conversion efficiency across load factors ranging from 10% to 100% load; however, the “standard of comparison” is not so consistent. For example, if an indoor inverter is put into an enclosure, energy requirements to move or condition ambient air must be deducted from inverter harvest energy. A 15kW, nominal air conditioning load for a 1 MW power station equates to a 1.5% efficiency loss.



Additionally, uptime (or “availability”) is an emerging metric and a huge factor for overall PV site performance. The central inverter has been cited as a primary cause of lost production. In years past, inverter uptime was sometimes less than 97%. Now, industry leaders have developed uptime guarantees, whereby developers pay for assured uptime and receive penalty cash flows for downtime—an insurance plan that eliminates one variable in a project financial model.

But, what is the value of incremental energy harvest? Each project is unique, but a NPV (net present value of expected cash flows) calculation suggests the value of just one percent incremental inverter harvest may be worth in the range of \$20,000 per 500kW inverter*—a high fraction of a typical inverter unit cost. The combination of one percent efficiency advantage, plus one percent uptime advantage may be equal to approximately \$40,000 in value. Compare this to a nominal 500kW inverter cost of \$100,000, and these harvest factors generate a +40% value versus the inverter unit cost. As a result, procurement fixation on unit cost dollar/watt without consideration of harvest performance is a severe oversight.

Balance of System (BoS) costs & capital investment

The inverter selection impacts secondary BoS costs beyond the inverter. These costs can be grouped as dollar/watt installed costs, but to properly assess inverter cost, all consequential costs must be accounted for and compared across prospective suppliers. A complete accounting of tradeoffs will equal a high percentage of the inverter unit cost, including: the inverter unit price itself; enclosures; air moving/conditioning equipment; switchgear; transformers; data monitoring; turnkey substation bundling options; etc. Also, not to be overlooked, other details must be assessed such as: warranties; warranty extensions; hardware transportation costs;

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mandatory maintenance contracts and terms; field labor costs; schedule risks; and, associated cost of delays.

Depending on project specific system design optimization, the BoS cost savings via turnkey power stations and outdoor-ready inverters may range from \$30k to \$50k per inverter. Compared to a nominal \$100k per 500kW inverter, this equates to 30% to 50% leverage verses the inverter unit price.

Lifecycle service costs

Getting excellent long-term performance from the central inverter requires proactive maintenance, and sometimes even reactive high-speed service. Therefore, evaluation and selection of the ideal inverter must not overlook service factors as a complete project lifecycle perspective is necessary to capture long-term costs. Up-front, the inverter standard warranty must be considered carefully, as not all warranties are the same.

Questions to consider: Does the warranty cover only workmanship and materials, or is it comprehensive including “wear parts,” such as fans or blowers? Who pays for technicians to travel to repair? Does the supplier include product training? How responsive is the supplier?

Another often-overlooked aspect of inverter cost is the product lifespan. Today, most PV-project finance models plan for replacement of central inverters in approximately year ten. However, central inverters with a 20-year design life are available via precision cooling schemes and design for serviceability. The financial benefit of not having to replace the inverters in year 10 is equal to the NPV of the year 10 \$100k inverter, field of replacement expense, and the associated downtime. The NPV of these may be in the range of \$25k, a large percentage of the initial unit cost.

Inverter evaluation: beyond USD/W

The information here provides a framework for evaluating central inverter costs beyond the unit price, and estimates the dollar value of cost variables dependent on the inverter. When assessing performance factors in NPV terms, the value of harvest performance, BoS costs, and lifecycle service expenses can outweigh the purchase cost of the inverter itself. Developers and application engineers must analyze system design optimization for each unique project, and strive to fully assess cost elements beyond the upfront unit price.

** The example cited is for a 500kW inverter with \$100k nominal unit cost, and estimated secondary cost variables that may exceed \$100k per inverter unit. Those variables include energy harvest (\$40k), BoS costs (\$30 to \$50k), and service expenses (\$20k to \$45k). Of course, for a 10 MW project, these items are multiplied 20X, translating to a \$2M financial impact.*

Ed Heacox is the VP for Advanced Energy, Solar Energy.

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Banking on Renewable Energy Systems

Battery life & energy storage

By Dean Middleton

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We look forward to your visit at the PVSEC in Hamburg, 05 to 08 September, 2011. Hall B6, booth B35

Solar Power International in Dallas/USA, 18 to 20 October, 2011. Exhibit Level 2, German Pavilion 1717



Trojan Battery's Industrial flooded line of batteries for renewable energy (RE) and backup power applications are designed to support large daily loads where the batteries are cycled regularly.

Whether a renewable energy system is grid-tied with battery backup, or completely off grid, the battery bank is a vital component of the system. As the battery bank represents a large portion of the cost of a system, careful attention must be paid to battery sizing and maintenance to ensure the maximum return on investment. Longevity of the battery depends on a number of factors, many of which are difficult to predict or control, since no two systems are alike.

Once a system has been designed and installed properly, daily charging and discharging, and regular maintenance of the battery bank are the most important factors influencing its lifespan. Failing to properly design a system to meet specific load requirements, under- or over-charging batteries, and neglecting regular maintenance can all reduce the life of a battery bank.

Sizing & optimizing

When sizing renewable energy systems, there are two important factors to consider: the electrical power requirement or load of a particular application, and the size of a photovoltaic system to ensure proper charging of the battery bank. Both under- and over-charging batteries can reduce battery life, so it's important to optimize systems to meet the load requirements of an application.

The specific nature of the charging sources available must also be taken into account. If the manufacturer's data isn't available for a particular load, steps should be taken to measure actual power use, rather than just estimating. Small mistakes can have a big impact on the overall performance of a renewable energy system, potentially causing it to lose power. Replacing the battery bank sooner than anticipated is another potential and unnecessary outcome.

The number of days a battery bank is designed to power loads without a charging source is referred to as the "days of autonomy." Autonomy assumptions vary depending upon the location, the nature of the loads, one's budget, and how critical the supply of power may be. For example, an off-grid PV system in the sunny state of Arizona will experience far fewer days of cloudy weather in winter when compared to an off-grid PV system in the mountains of Washington. These conditions must be taken into account when making calculations to determine proper battery size. Ambient temperature can also have a dramatic effect on the life and function of batteries. Temperature will impact the capacity of a battery bank, and should be considered during the design process. Battery capacity is typically rated by manufacturers at 77° F. Rated capacity will decrease at lower temperatures and increase at higher temperatures.

Under- & over-charging

It's always worth noting a battery's charge state when in use. For instance, batteries that never reach a full state of charge on a regular basis may appear to function well initially, but will likely suffer long-term damage as a result. The net effect on a battery



bank of spending long periods of time under only a partial charge is reduced performance, premature failure, and a shortened life. Regular charging of the battery bank to a full state of charge, or float mode, is an important factor influencing longevity.

However, just as under-charging is an issue, so is over-charging batteries. Ideally, a system should be optimized to meet the load requirements of a particular application while taking into account the specific nature and size of the charging sources available. It's also critical to ensure the PV charge controllers and inverter/chargers have been programmed according to the voltage set points recommended by the battery manufacturer to ensure optimal performance. The life of a deep-cycle battery can be severely shortened if it's discharged to 100% of its rated capacity. The shallower the design depth-of-discharge (DOD), the longer the battery will last. A battery operated at 50% DOD will last about twice as long as a battery operated at 80% DOD, assuming all other factors are equal. Understanding this relationship is crucial to getting the longest life possible out of a battery bank.

Maintaining & maximizing

Regular battery maintenance is par for the course. Some "off gassing" of hydrogen normally occurs with flooded (FLA) batteries, which reduces the electrolyte level. As a result, periodic "watering" of the batteries with distilled water is required to ensure maximum life. New installations should be monitored closely until a sense of the watering frequency requirement is determined. As flooded batteries age, their gassing rate will increase, requiring more water on a regular basis.

No matter how frequently a battery bank is watered, it should be done according to a regular schedule and with a routine check of terminal connections. A poor electrical connection in a system, whether caused by a loose connection or corrosion, can lead to poor performance.

To tighten battery connections, some expertise is required. Use tools with insulated handles for safety and to avoid short-circuiting the positive to negative terminal. Because the electrolyte in a flooded battery is a solution of acid and water, take extra precautions to avoid contact with skin and clothing.

Value Regulated Lead Acid (VRLA) batteries are referred to as maintenance-free for a reason—unlike FLA batteries, adding watering isn't necessary with VRLAs. Maintenance is reduced, however, the terminals still need to be tightened and cleaned on a regular basis to ensure the battery bank operates at full capacity.

Regular monitoring of a renewable energy system, while maintaining the health of the batteries, are key steps for optimal operation. Effective battery sizing, proper charging techniques, and maintenance practices ensures that a renewable energy system's battery bank will continue to operate at peak levels of performance and reliability, keeping the total cost of ownership to a minimum.



Dean Middleton is director of renewable energy sales, Americas, for Trojan Battery Company.

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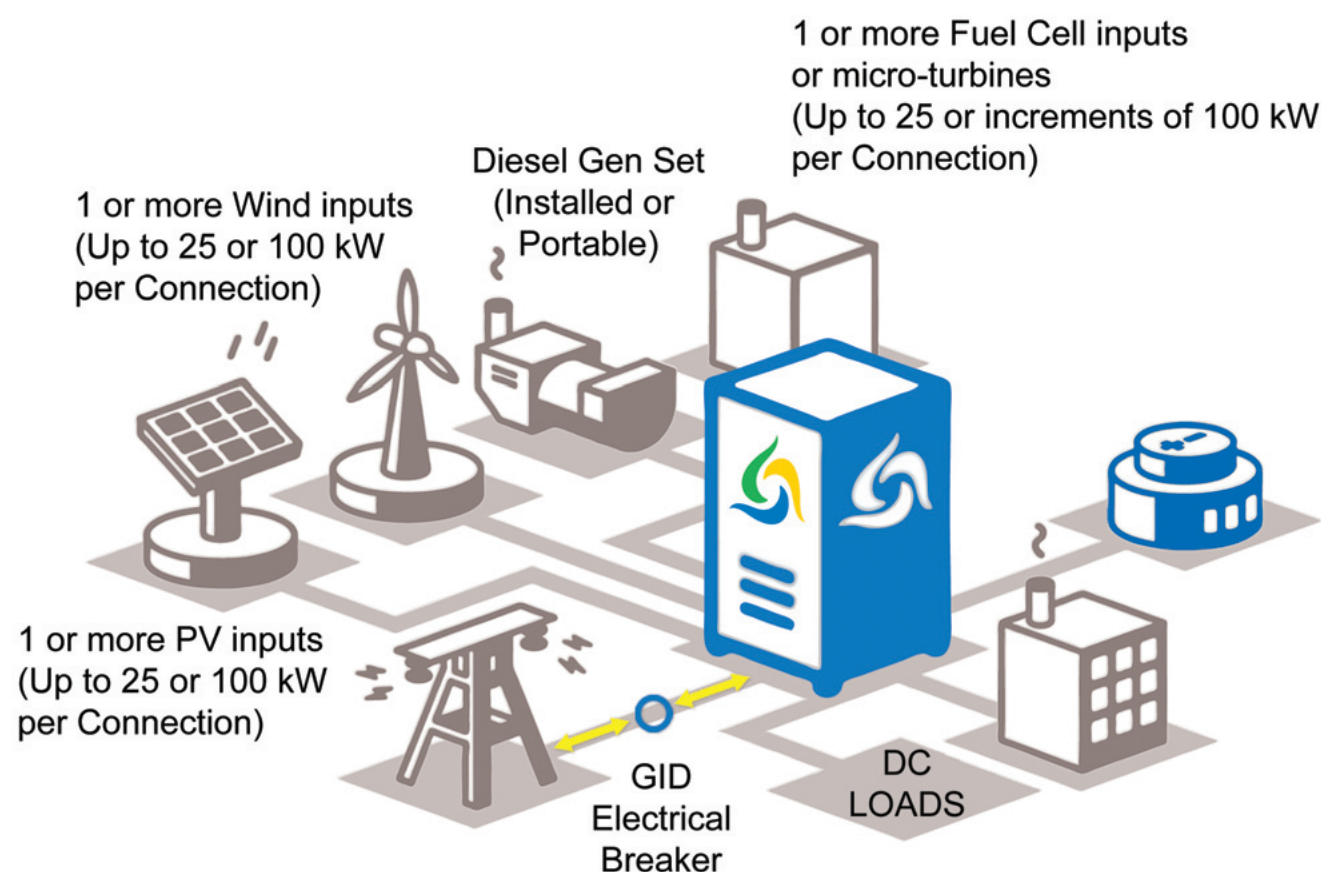
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Leveraging Power Management & Energy Storage Technologies

By Dan Nordloh



Commercial buildings account for approximately 40% of all energy use in the US. With energy costs and demand rising, there exists a real opportunity to rethink the way buildings can benefit from cleaner and more cost-effective energy. To support the President's goal to reduce energy use in commercial buildings 20% by 2020, commercial building owners, managers, and integrators have viable technologies available today to reduce costs and improve the reliability, security, and efficiency of electric power in their facilities.

A grid-tied intelligent energy management platform that leverages renewables—such as commercial or community solar or wind power—and utilizes energy storage, creates a hybrid power conversion system, giving customers the ability to proactively manage energy on their own terms.

Drivers for change

There are several factors driving energy supply and demand management systems in commercial buildings, which can provide energy cost savings from 10% to more than 50%. For example, electric rates are higher during certain times of the day based on demand. Energy use and demand can be optimized through time-of-use management, utilizing intelligent power management and energy storage technologies.

Meeting demand

Most utilities charge commercial buildings based on consumption and demand. Since demand charges can be a large percentage of an electricity bill, the goal is to minimize peak demand whenever possible, and this can be accomplished with intelligent power management and energy storage technologies. Demand response allows customers to adjust their electricity use. Temporarily reducing consumption helps to reduce the height of peak demand. Onsite energy storage can be used (discharged) during these periods, resulting in additional credits paid by the utility.

Emergency supply

In modern commercial buildings, most emergency power systems are diesel engine powered generators. With the expense of generators and the complexities of federal emissions compliance, intelligent power management and energy storage technologies offer alternatives to diesel generators.

Contractors and other equipment owners are faced with a whole new world of regulatory compliance and diesel technology. Tier 4i standards mandate cleaner and more efficient engines, and failure to comply with this regulation can result in large fines.

Rebates & credits

The federal government and some states offer a variety of tax credits and rebates for implementing integrated renewable energy systems. Building owners can save money, and provide reliable electricity at a total cost of ownership much lower than the diesel generator options.

Many commercial buildings have already implemented energy efficiency retrofits and strategies with the installation of solar panels, energy efficient lighting fixtures and bulbs, natural daylighting, high-efficiency refrigeration units, and HVAC upgrades. Though every change for the environment and for the better counts, it's also worth rethinking where, how, when, and the way our power flows to achieve even bigger energy savings.

Intelligent energy management

With a grid-synching intelligent energy management architecture, power that flows to or from the grid can be directed based on demand response, load management, and shift supply by the time of day for peaking needs. It can also be used as back up, independent of the grid during outages.

Energy storage systems enable renewable energy source deployment, and greatly reduce wasted energy inherent in current systems. It can reduce the cost of electricity by shifting energy purchases from on-peak periods with higher time-of-use (TOU) energy charges to off-peak periods with lower TOU charges.

With the ability to tie into multiple renewable energy sources, users can take advantage of utility metering programs. Through strategic load shifting with energy storage, users can

reduce demand charges by consistently reducing the peak load as measured by the utility meter. Energy storage systems allow users to participate in demand response programs without having to shift energy intensive operations. Additionally, revenue generation is provided through demand response programs, along with the other associated benefits of energy storage. An intelligent energy management system can be used as an emergency/back-up power system, independent of the grid during outages, and solves diesel emission compliance and fuel storage issues.

Integrated management platform

An intelligent management platform supports the integration of any combination of generating sources—including having the grid as a two-way input. By adding energy storage, the platform creates a dynamic “on demand” power plant system that optimizes the supply of each energy generating source.

An integrated platform with a modular and scalable architecture allows users to directly connect multiple renewables and capture multiple value streams, such as:

- Use energy storage for peak shaving/demand charge avoidance;
- Reserve power for specialized or dedicated loads with or without a permanent onsite diesel generator;
- Use non-interrupted DC power distribution for an emerging class of DC voltage devices such as VFDs, LEDs, elevators, and system controls;
- Regenerate power directly back to the DC bus; and
- Deliver a more efficient use and firmer supply of renewables.

Solar panels, wind turbines, diesel gen sets, and fuel cell inputs are installed and connected to the energy management platform, creating a hybrid power conversion system that optimizes all of the interconnected resources—utilizing a singular connection to the grid.

When investigating a commercial building solution that manages power to and from the utility grid, while optimizing renewable energy sources, look for a system that:

- Is modular and scalable;
- Factory built, tested, and uniquely configured to your application;
- Operates in ambient temperatures (-22 F° or -30° C to 122° F or 50° C);
- Allows for hybrid configurations of energy storage in parallel operation;
- Easily integrates renewables initially and incrementally in the future; and
- Offers grid-independent output, allowing for off-grid operation to provide emergency/back-up power.

Commercial building owners and integrators can realize the financial and environmental benefits of implementing an integrated energy management platform, while simultaneously providing a continuous supply of energy and optimizing all of the interconnected resources, to create a smarter, greener building.



Dan Nordloh is vice president of sales and marketing at ZBB Energy Corporation.

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Solar Skies Mfg., LLC | www.solarskies.com



Mobile solar water heaters

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Premium Solar | www.presolarnet.com



Modular & scalable flow batteries

ZBB Energy Corporation has introduced its third generation Zinc-bromide flow battery. ZBB EnerStore V3 flow batteries are modular, scalable, self-contained, and front accessible—making them ideal for distributed energy projects whether operating on or off the grid. The new design has redundant features, is easy to maintain with operation indoors or outdoors in the widest ambient temperature range of any flow battery. The ZBB EnerStore flow battery is predominantly manufactured with highly recyclable materials, allowing for low-production costs and economical mass production, while being environmentally friendly in the manufacturing process and recoverable at the end of their service life.

ZBB Energy Corporation | www.zbbenergy.com



Process development for wafers & cells

Baker Solar, a division of M.E. Baker, introduces FlexTool, an inline wet bench conceived and designed specifically for the R&D and pilot-scale requirements of today's wafer and cell manufacturers. FlexTool is a highly flexible tool designed to handle a variety of wet chemistries through a range of single- and double-sided applications. With a small system footprint and wide process window, FlexTool offers batch-size testing in an inline environment. This provides a PV company with a scalable, reproducible result that is production-ready—but with low chemical usage, intelligent process control, and attractive CAPEX. Sumps are sized and configured for rapid chemistry changes, allowing one tool to be used as a platform for testing many different processes.

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Magnum Pv offers the new MPV Gold series solar module featuring high-output solar cells with a guaranteed module output in the 60-cell format reaching 260 watts, and the 72-cell format reaching 310 watts, with a plus-five watt rating. This latest technology has been in development for the past two years. Selective emitter laser technology minimizes and localizes the highly doped phosphorus area. Minimizing the phosphorus concentrations converts more light to electricity, rather than losses to heat found in conventional cell technology. In addition to solar PV modules, Magnum Pv offers financing options to project developers across North America. All Magnum Pv modules are backed by a best-in-class 25-year comprehensive product warranty.

Magnum Pv | www.magnumpv.com

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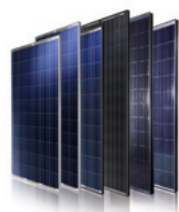
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Intego GmbH | www.intego.de



Solar Power International
Date: 17th-20th October, 2011
Location: Dallas, Texas, USA
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Tigo Energy has introduced a new Energy Module Maximizer, specifically designed for recently introduced higher power solar modules. The Tigo Energy Maximizer Solution enables owners of PV projects of any size—residential, commercial, or utility scale—to increase power production by reducing the effects of shade, dust, clouds, and uneven temperature on system performance. The 350-Watt Module Maximizer ES75 can harvest the most energy possible from new high-efficiency mono-crystalline module architectures. By using the Module Maximizer, system designers can achieve the value of the solution at an unprecedentedly low-cost per Watt-peak (Wp). Due to the Tigo Energy Module Maximizer's statistical efficiency of 99.5%, the ES75 can produce optimal performance without dissipating extra heat on or near the solar module.

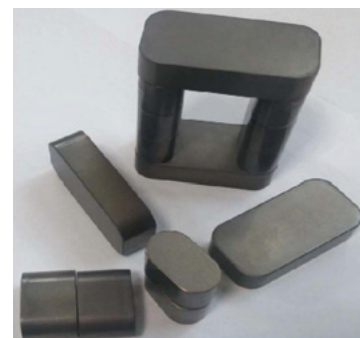
Tigo Energy | www.tigoenergy.com



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Atlas now offers a new control system for its Ci4000 and Ci5000 model Weather-Ometers. This latest enhancement is the platform for revolutionary features in weathering instruments. The new Panel PC equipped models will provide a complete suite of data acquisition, remote access control, and monitoring tools featuring the innovative data acquisition (DAQ) software WXView. WxView provides: user interface for efficient transfer of information including test cycle parameters, control system data, etc.; local area network (LAN) interface for remote access; remote functions available in all current languages; remote functionality allowing for multiple networked Weather-Ometers to be accessed; and, the ability to create and apply a unique identification, or “name” to each Weather-Ometer. This control system also provides a platform for upcoming enhancements including compatibility with the Atlas UVTest instruments and older Atlas Weather-Ometers, remote access to control/monitor and e-mail messages/alerts, as well as links to Atlas Weathering Services weather data summaries.

Atlas Material Testing Technology | www.atlas-mts.com



Increasing inverter reactor efficiency

MH&W International Corp announces New Ellipse Cores from Chang Sung Corp. Ellipse cores are an improvement in their MegaFlux block cores to increase efficiency of the smoothing chokes (Reactors) in inverters. The improvement in the block material consists of a 7.5 radius edge, creating an Ellipse core. This elliptical core design results in a wider window area and reduction in the number of turns due to higher DCB. The length of wire on one turn of the core decreases the length of wire by eight percent. This effectively decreases the copper loss and winding cost of the reactor. The DCB of the Reactor also increases over that of both MegaFlux block and High Flux Block cores, demonstrating a difference in the percent change of permeability of almost 10% at 200 Oe.

MH&W International Corp
www.mhw-intl.com



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Bryce Fastener, Inc. | www.brycefastener.com



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Tekmar Control Systems | www.tekmarcontrols/406.html

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Engineered Conductive Materials, LLC
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nfigone@ene.com

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David McIntyre
(619) 696-0578
dmcintyre@ene.com

Biomass/Waste-to-Energy

Robert Santa Maria
(716) 684-8060
rsantamaria@ene.com

Hydroelectric

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(503) 248-5600
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Unlocking the Best Wind Resources in the Country

Transmission & The Rock Island Clean Line

By Brian Crowe



Transmitting wind energy to where it's needed most has long been an uphill toil for wind power developers. But, in recent years, it has also become an opportunity to unlock the country's best wind resources, while discovering the potential and power of wind as a long-term, viable renewable energy source.

Many in the wind business believe building additional transmission lines are vital to the development of an industry that can help the country meet its new alternative energy goals. Today, a number of proposed lines across the country are sending a resounding message that the grid needs to be updated in an efficient and responsible manner.

One such project is The Rock Island Clean Line, a transmission line capable of transmitting up to 4,000 megawatts of new renewable energy from Iowa, Nebraska, South Dakota, and Minnesota, to communities in Illinois and states farther east. The \$1.7 billion project will consist of an approximately 500-mile overhead, high-voltage direct-current (HVDC) transmission line that is being developed in Iowa.

The Rock Island Clean Line is expected to attract wind farm developers to the region and generate millions of dollars in state and local tax revenues, while addressing the nation's ongoing efforts to increase energy security. It will also deliver enough clean energy to meet the needs of more than 1.4 million American homes, and allow for approximately \$7 billion investments in new renewable projects.

A recent study by Midwest grid operators shows wind energy has the potential to provide 20% of the energy to the power grid that serves most of eastern North America. The study also determined that the cost for building transmission lines would be about \$80 billion. Of course, the construction of these lines is not an easy task, particularly in the face of some resistance. It's a lengthy and complex process, but one that should pay off in the end.

Transmission challenges

Transmission is one of the biggest issues facing the wind industry, and Iowa is just one of the states experiencing challenges navigating the transmission maze. Wind energy advocates continue to work to debunk misinformation on the negatives associated with transmission lines, including the concern many consumers have that they'll be forced to pay for the new lines through their local power bills, even though power may be going elsewhere.

However, the upside is that these lines are attempting to unlock many of the country's best wind resources, where wind power can be produced at an extremely low cost—a cost that's competitive with any other form of power generation. This is an issue The Rock Island Clean Line could face, even though it will ultimately allow Iowa to sell wind power to other states and reduce its own costs.

Environmental concerns

Those involved with the Rock Island Clean Line are well aware of the environmental concerns. "It would be disingenuous of us to build a line through environmentally protected areas," said Cary Kottler, project development manager for Clean Line Energy.

According to a recent study by Ventyx, the project will actually create a number of environmental benefits. The study focused on the emissions and water use reductions that long-distance transmission lines make possible through the creation of new wind power. Wind energy generation allows other generators to run less and burn less fuel, eliminating

Continued on page 38.

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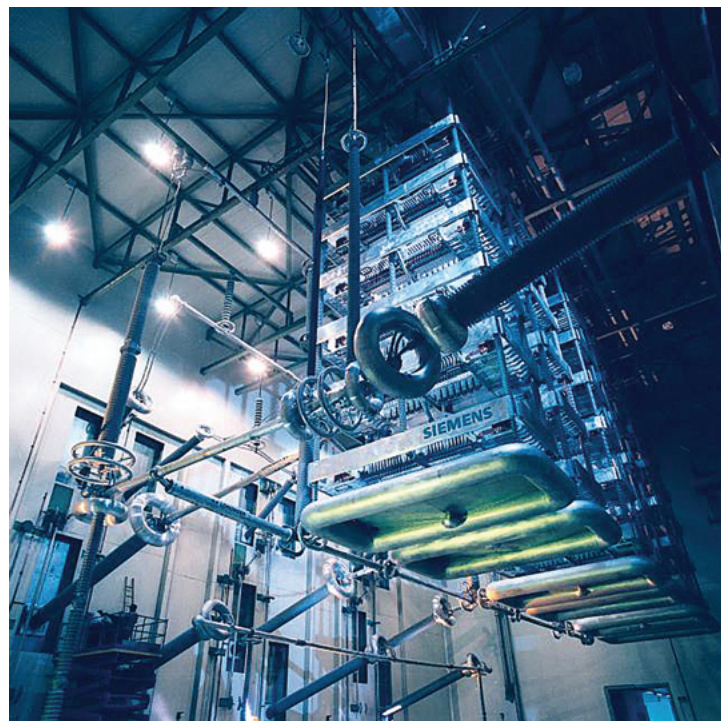
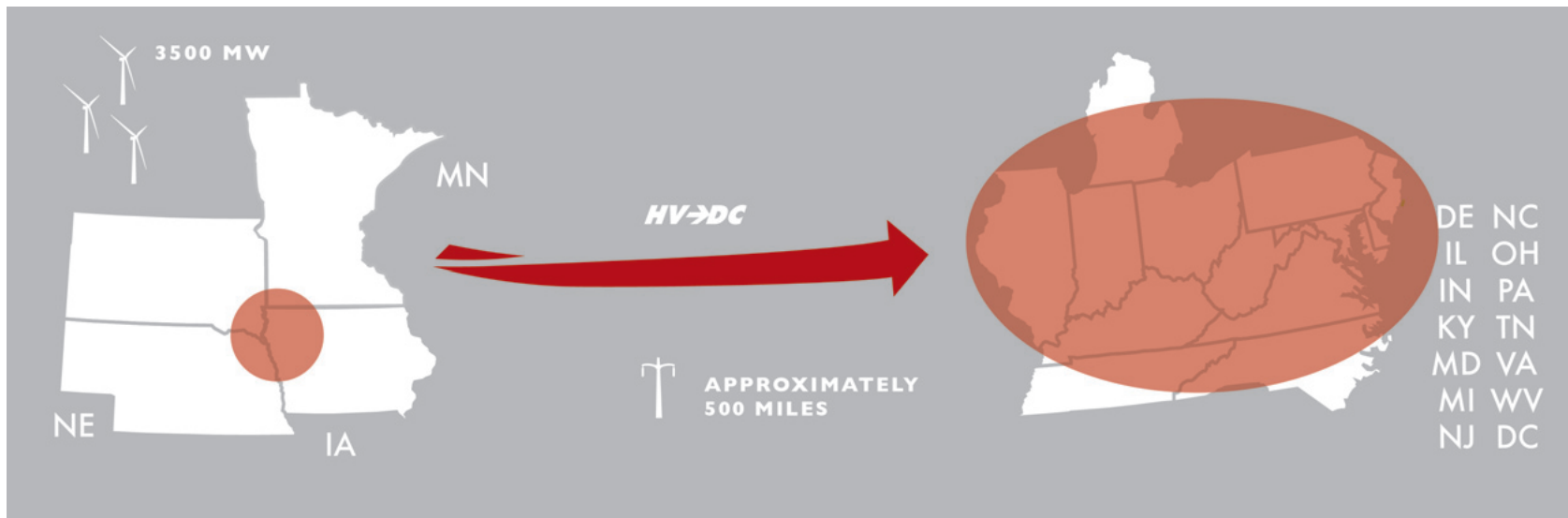
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imagination at work



A look inside a converter station valve hall (Image courtesy of Siemens)

Map of the The Rock Island Clean Line project

...continued from page 36.

the need for the equivalent amount of energy derived from fossil fuels; thereby, reducing pollution and water use.

The Rock Island Clean Line will make possible more than 4,000 megawatts of new clean wind energy generation. The results of the Ventyx study show that this will reduce carbon dioxide pollution by more than 10 million tons, which is equivalent to removing more than 1.9 million cars from the road. In addition, Ventyx determined that the project will reduce sulfur dioxide and nitrogen oxide pollutants (precursors to smog and acid rain) by approximately 11,300 tons and 6,900 tons, respectively.

Many wind energy backers across the country believe the wind energy industry would benefit from transmission projects. Case in point: the lack of long-distance transmission lines is a key factor limiting the demand for new wind projects in the Midwest.

Gaining approval

The Rock Island Clean Line is expected to be in operation by 2016. So far, draft corridors (3- to 10-mile wide study areas) have been developed where the line could potentially be routed, and extensive public outreach with local residents and governments has begun. The ultimate route for the line will require regulatory approvals from the Illinois Commerce Commission, the Iowa Utilities Board, and various other federal and state government bodies.

Various utilities are also working together on a proposed 8,000-mile transmission line that would deliver wind energy from the Dakotas to larger population centers in the eastern part of the country. The success of wind energy in the Midwest is highly dependent on electric reliability of the transmission grid.

Delivering wind energy to where it's needed most is more easily conceptualized than done, but strides are being made. With each new development, the industry is one step closer to realizing the vision of transmission lines in order to unlock the country's best wind resources and deliver clean power to America's electricity mix.

Brian Crowe is a project manager at the Iowa Department of Economic Development.

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Connecting to the Grid

Developing successful wind power cable standards

By Damien M Polansky

COMPANIES THAT PARTICIPATE IN THE WIND ENERGY value chain have a unique opportunity to impact this fast-growing industry. Power cable standards should be developed and implemented quickly, so those in the industry can collaboratively prepare to meet expected regulations. The wire and cable industry can also improve the reliability and efficiency of this growing energy source by educating developers about how to specify the right cable materials to meet their goals.

Not all cables are created equal. Even when one compares cables made of similar materials, there can be significant performance variations. It's essential to align a project's long-term goals with the best available materials to achieve a positive outcome.

The wind energy value chain should create cable specifications that require a minimum cable electrical performance level, as well as the use of TR-XLPE insulation. Owners and operators should, then, partner with an experienced high-quality cable manufacturer who will help balance the need for low life-cycle cost with specific performance requirements.

Specification for wind energy collection systems

Because wind farms ultimately connect to the larger grid, there's no question that cable standards should be similar to those of the existing utility infrastructure. This can be accomplished by identifying the system requirements, aligning those requirements with the best materials available, and taking a long-term perspective to ensure the development of a lasting, sustainable business.

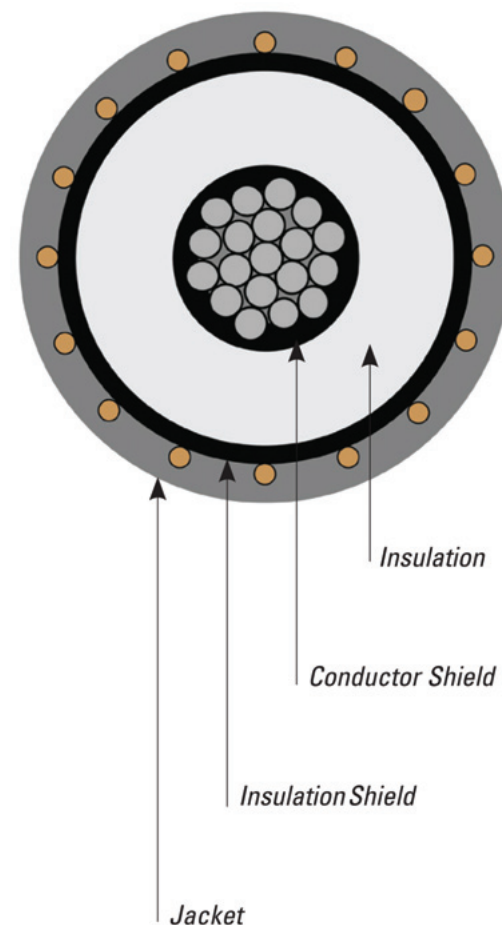
Power failures in any business are challenging, but for wind farms, the cost per failure is much higher than traditional utility distribution applications. Wind power is intermittent and, until power storage technology is perfected, any downtime from system failure adds to the downtime already experienced when the wind is not blowing.

A reliable power collection system can impact the return on investment for the entire system, while providing benefits such as:

- Enhanced consistency of revenues;
- Lower operating and maintenance expenses;
- Fewer forecasting penalties;
- Maintained public image/goodwill; and
- Deferred or eliminated need for future capital expenditures.

Weighing the options

There are various cable choices available. Medium-voltage (MV) power cable insulation, for instance, can be made with cross-linked polyethylene (XLPE), ethylene propylene rubber (EPR), and water tree-retardant XLPE (TR-XLPE)—to name just a few material options. However, there are many performance variables between these materials, the most important of which is cable life expectancy.



TR-XLPE insulation is now widely utilized for MV underground (UG) power cables for reasons of quality, cost competitiveness, and lower long-term operating costs. In fact, studies have shown that TR-XLPE cable made with jacketing and insulation materials in UG applications have demonstrated little to no wear after nearly 30 years in the field*. They also have a forecasted lifetime performance of more than 40 years, which would meet, or exceed, current wind farm life expectancies. But, it's important to note that not all TR-XLPE materials offer similar performance characteristics.

Cost/benefit analysis

As the bottom line is always an essential part of the specification process, it can be tempting to choose the lowest cost components, knowing that repairs can be made later. However, this short-term strategy can be the downfall of a great opportunity. To ensure long-term system reliability, cable purchase and installation decisions need to be based on more than price.

Installation is also an essential part of the overall cable collection system performance and should be completed by trained installers who are experienced in handling, splicing, and terminating high-performance systems. A diagnostic test should be performed at commissioning to ensure a system is in peak working order. Ultimately, this work will pay off. Modeling based on field data suggests that a five percent upfront investment in quality cable materials and installation can save as much as 600% over the lifecycle of the system.

Collaborative efforts

It all comes down to collaboration. Effort is required from all industry players—investors, developers, independent power providers, utilities, equipment, cable, and material suppliers, and others—to achieve the energy goals that are likely to be legislated soon.

Until cable standards for wind farms are developed and field-tested, specifiers and end users should require cables to meet or exceed the current power industry minimum standards. This will help ensure the use of excellent materials and quality cable manufacturing processes, which contribute to system reliability and achieve the highest return on investment.

As part of the power chain, cable design and performance is just as, if not more, important than other wind farm components. Therefore, it's essential those in the wind energy industry work together to provide power transmission and distribution that wind farm owners, utilities, and consumers can count on to last the lifetime of a system.

** Studies conducted by the Southern Company/Alabama Power, NEETRAC, and Dow Electrical & Telecommunications on cables made with Dow material buried in 1983.*

Damien M Polansky is the North American market manager for Dow Electrical & Telecommunications.

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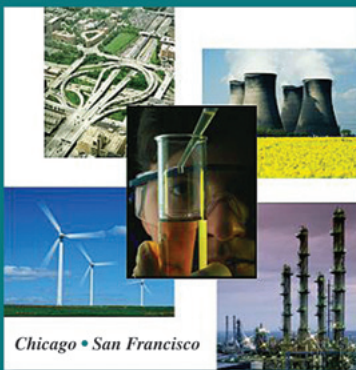
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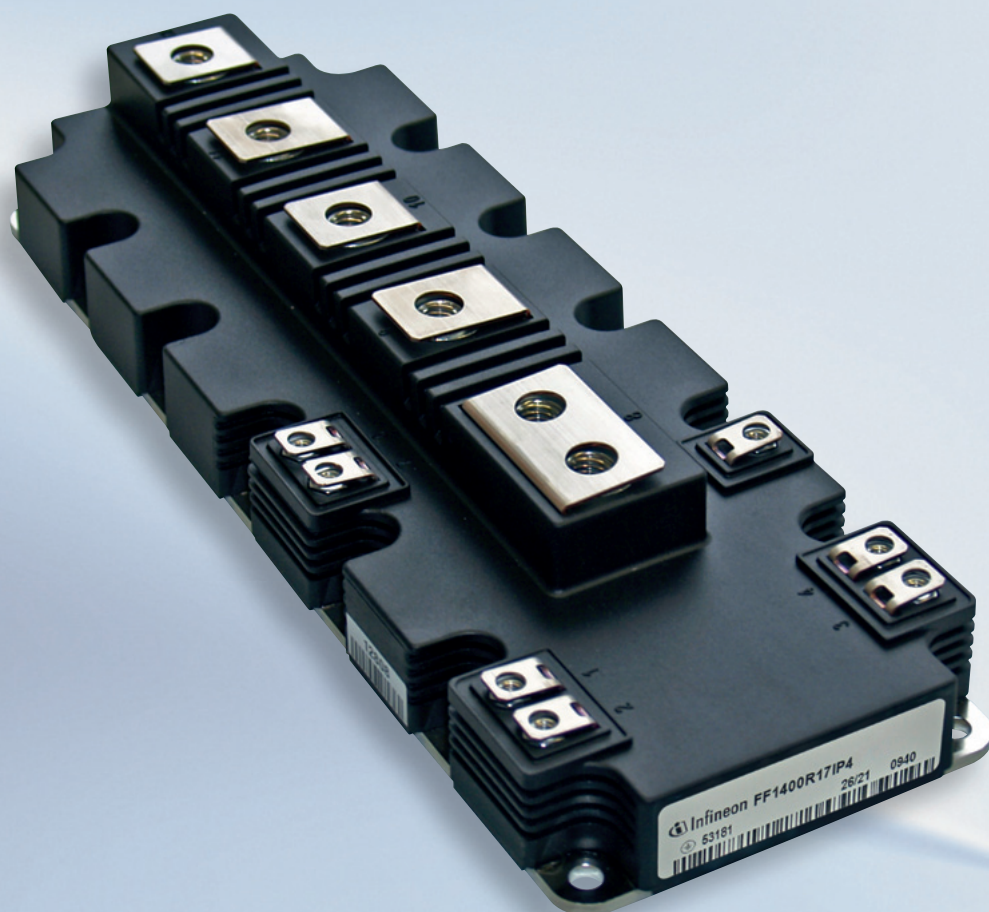
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Energy Storage in Paradise

“Buffering” island wind interconnection in Hawaii

By Kristen Brewitt & Rick Fioravanti

Island nations typically have a high dependence on imported fuels to supply their electric generation portfolio. The State of Hawaii is no exception. Oil imports currently account for 90% of the state's energy fuel source portfolio. Seeking to address the significant environmental and economic implications of imported fuel dependence, Hawaii has set some of the most aggressive state renewable energy targets in the country—40% renewables by 2030. The challenge is integrating a high-penetration of alternative energy, without sacrificing electric grid reliability, availability, and power quality.

The variable nature of renewable generation can lead to difficulty in maintaining electricity grid operations. This problem can become even more acute for island applications. As such, the Hawaiian utilities established a set of requirements that renewable energy project developers must meet to qualify for interconnection. Energy storage can be a core component to meeting interconnection requirements and creating the balance between harnessing variable energy resources—such as wind and solar power—while maintaining a stable, reliable, and robust grid.

Buffering challenges

Applying energy storage technologies to renewable resource applications helps to address the three “buffering” challenges posed particularly by wind and solar power: smoothing, capacity firming, and time-shifting.

Briefly, smoothing (or ramp control) is a storage function that helps reduce the adverse impacts of a very fast change in renewables' generation level or output. Capacity firming is a storage function to help maintain the power output at a committed (or firm) level for a reasonable time. Time-shifting can be an essential storage function with renewable generation as these systems often supply energy during off-peak demand periods. The device can store energy during this period, and discharge back to the grid during peak periods.

In selecting a battery storage system, there are a number of key technical criteria deserving evaluation in performance and operation:

- **Response time.** A storage device with a response time of less than five seconds (<5 sec) is being utilized for smoothing applications. However, a high-power storage device with less than a two-second (<2 sec) response time would be more cost effective.
- **Capacity.** Capacity firming, like smoothing, requires a fast-response energy storage system, but requires more storage capacity to continue the discharge at the rated power when generation is down. To date, the energy storage technologies being used for such applications are fast-response, high-power devices with a discharge time of about one hour.
- **Discharge Duration.** Time-shifting applications are best served with high-energy devices with a discharge time of over one hour, but preferably three to five hours. Time shifting is not a requirement for renewable energy interconnection, but has always been considered a “natural” revenue-generating application for storage devices. For cases such as wind power, where wind farms often generate at night when there’s less load, the more energy that can be stored (long duration), the more advantages with the technology.

Case study

These energy storage wind application technical factors were among those evaluated for an Independent Power Producer (IPP) developing a wind farm on one of the Hawaiian Islands. Here is a summary of how the developer approached the storage system evaluation to meet the interconnection ramp rates and potential power fluctuation requirements stipulated in Hawaiian Electric Company’s (HECO) model power purchase agreement (PPA).

To address the interconnection needs for one island’s wind farm, the project developer examined the potential of integrating an advanced energy storage device that could offer performance characteristics that would allow the wind farm to meet the PPA. The developer selected an advanced storage system that best suited the wind farm’s application needs. As these devices are just now being introduced into the field, the developer took the step of contracting with an independent third party to confirm its evaluation of the technology, the system’s performance, and its operation.

The third-party confirmation of the technology analysis and validation of the system performance was a critical step on the path forward to commissioning and operation of the wind farm.

This battery system analysis and validation process included:

1. Evaluating the technology selected for the application;
2. Assessing the control algorithm that was utilized to ensure the wind farm and battery were operating properly;
3. Confirming the selected size (MW) of the application;
4. Reviewing the factory acceptance test documents; and
5. Observing the actual testing at the battery manufacturer’s site. The preparation provided the basis for a successful introduction of the unit into the field.

With the support of the independent battery system analysis and validation findings, the wind developer was able to meet HECO’s requirements for grid connection. By confirming the appropriate battery size, the third-party evaluation helped the wind developer maximize wind energy storage capacity for the wind farm and minimize the costs of operating system; thereby, ensuring energy production from this renewable resource.

The result: the project developer has been successfully operating their 30 MW wind farm after commissioning the project in early 2011. The project will contribute to the State of Hawaii’s Clean Energy Initiative, which aims to achieve a 40% clean, renewable portfolio by 2030. The project is one step along the way to decreasing Hawaii’s dependency on fossil fuels and reducing greenhouse gas emissions.

Kristen Brewitt is the senior consultant for KEMA, and Rick Fioravanti is VP of KEMA’s Storage Applications & Support.

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The Future of Offshore Wind

Collaboration integral to the offshore industry evolution

By Michael Rosenfeld



BY THE END OF 2010, the US utility-scale wind power sector accounted for more than one-fifth of the world's installed wind power capacity. Wind farms now exist in 37 US states and 10 Canadian provinces. Based on those numbers, one could easily believe that all sectors of the wind power industry are flourishing in North America.

But zero of that activity is offshore. For all the onshore wind development, not a single offshore wind project has come online across the continent to date.

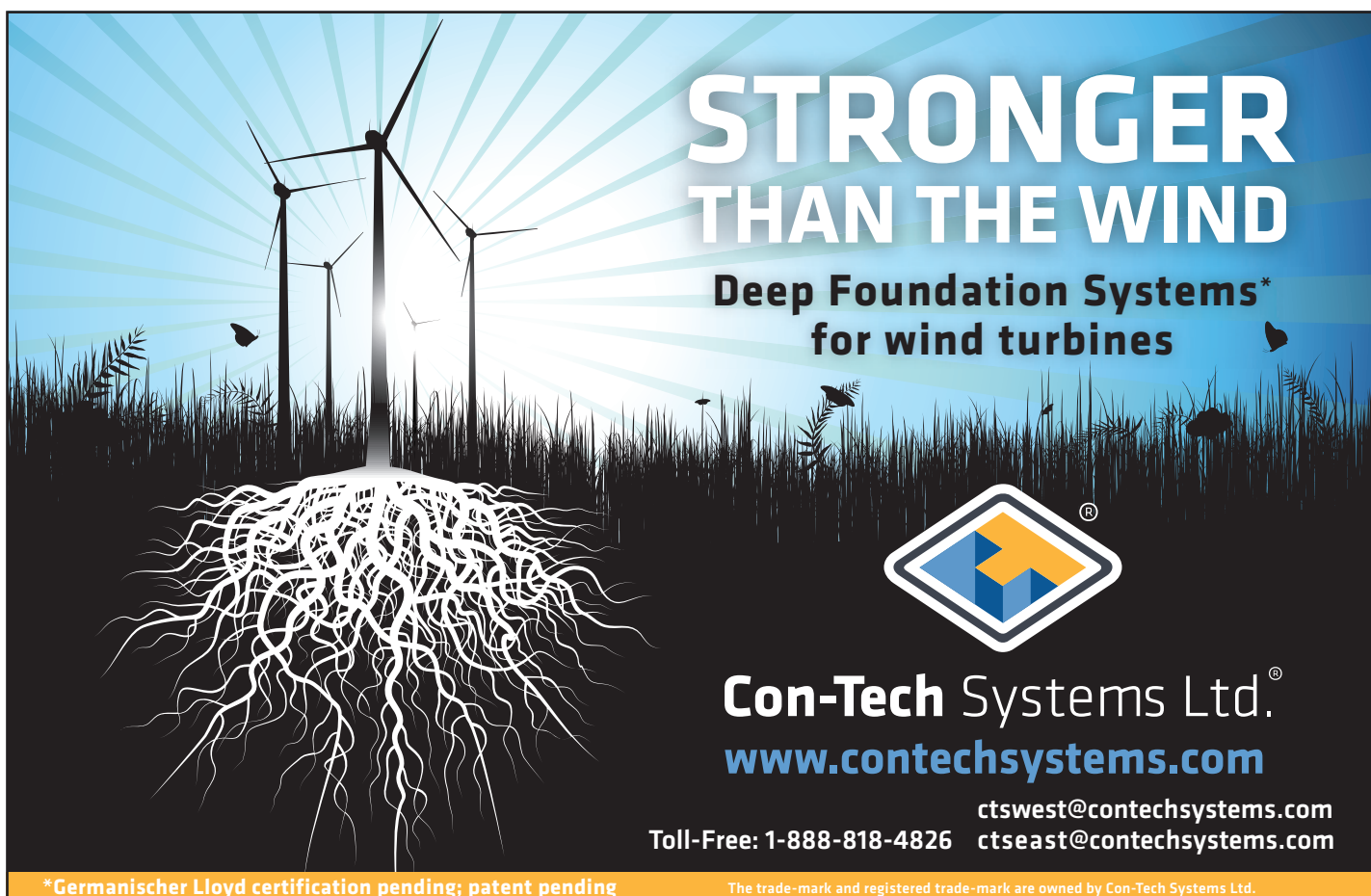
Encouraging signs lie ahead, though, as North American offshore wind implementation appears imminent. In February 2011, the US government ambitiously announced its goal to develop 10 GW of offshore wind power by 2020 and 54 GW by 2030. Driven by more than \$50 million of funding throughout the next five years, the National Offshore Wind Strategy will ramp up research and development of offshore technology, identify ideal project sites, and undertake economic and environmental evaluations, primarily along the East Coast.

In the private sector, Google is helping to bring the offshore industry closer to reality by financing one-third of the \$6 billion Atlantic Wind Connection (AWC), a transmission backbone for offshore wind along the eastern seaboard. Meanwhile, Coastal Point Energy, a

Texas wind developer, could take the "first in the water" prize as it already has secured permits to build a 3 MW test turbine off the coast of Galveston by the end of 2011—the first step of a potential 300 MW offshore wind farm.

The question then is not if, but when North America's offshore wind industry will emerge as a reality. Though North America has many of the building blocks for a prosperous, domestic offshore wind sector, its successful development will require tapping outside knowledge, experience, and expertise—as is the case for many emerging industry sectors. Turbine installation vessels from Denmark might be used. Offshore turbines from Germany may be imported.

It's safe to assume that the United Kingdom, a global leader in offshore wind with 1.3 GW of current installed capacity, will be an integral contributor to the scale-up of the sector in North America. With the most abundant natural resource for offshore wind in Europe, the UK began capitalizing on this opportunity early. To build a thriving offshore wind industry, the UK leveraged the technical expertise it gained from offshore oil drilling, including managing complex logistical and operational challenges like subsea engineering, off-



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shore site identification, and platform building.

Since completing its first major offshore wind farm in 2003, the UK has built a deep portfolio of wind energy capabilities ranging from turbine manufacturing and engineering, to site analysis and project management. Employing past experience from offshore oil extraction, while simultaneously gaining knowledge through lessons learned, the British have innovated new solutions, technologies, and approaches to build a successful offshore wind sector.

But as with any nascent industry, obstacles did exist, which is now available as gained experience and intelligence that the first-movers in the emerging North American offshore market can draw upon. One important lesson from the UK experience is that cross-industry coordination is imperative to being successful in an intricate, high-cost sector like offshore wind. To overcome the industry's risks and complexities, programs like the Energy Technologies Institute's Offshore Wind program were launched in the UK to synchronize research, development, and implementation of new offshore systems, techniques, and technologies. Collaborations such as this are critical to driving down costs, reducing technical challenges, and streamlining innovation within budding industries.

Another takeaway is that faced with a global lack of private investment, as well as the inherent market uncertainty of emerging industries like offshore wind, there is a vital role for government. National renewable energy policies, backed by long-term incentives, provided the stability and confidence necessary to stoke the advancement of the UK's offshore wind sector.

The Renewables Obligation (RO) requires electricity providers to source more than 15% of power from renewable sources by 2015. In place through 2037, the program already has helped more than triple the UK's eligible renewable electricity generation since its launch in 2002. Beginning next spring, the government's \$4.86 billion Green Investment Bank will begin investing in clean energy technology, with a strong focus on offshore wind. Similar government support could be an important catalyst to maturing the offshore wind sector in North America, where most federal policy support for renewables doesn't extend beyond one or two years.

Finally, despite its offshore wind know-how, the UK recognizes that continuous international knowledge transfer is fundamental to its own domestic success. While North America matures its own market, partnership between the two regions will be important to achieving the UK's offshore goals, which include expanding its current 1.3 GW

of installed offshore power to 50 GW of electricity by 2030. North America won't only turn to the capabilities and experience of the UK, but also will be providers to the British for new technologies and approaches refined along its path of offshore wind development.

As offshore wind grows to no longer being a novel sight across the shores of North America, and as the UK continues to advance its leading industry, the UK and North America will increasingly rely on and benefit from the innovations and real-world experience of each other. Collaboration will be key.



Michael Rosenfeld is Vice-Consul with UK Trade & Investment, the UK Government's international business development department, and is based in Los Angeles. He serves as lead officer in the US for the Clean Technology sector, working with clean technology companies from the UK and North America.

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Transferring Automotive Technology to the Wind Industry

Developing low-noise geared transmissions for turbines

By Zach Wright & Dr Ashley Crowther



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DECADES OF R&D have allowed the automotive industry to develop low-noise products. The competitive market and the requirement for improved quality in each new vehicle model have been strong drivers. The industry even spent millions on improving the sound quality of the closing passenger door when moving to lightweight doorframes, primarily to ensure vehicles aren't perceived as "cheap" or poorly made.

The automotive transmission and final drive unit are major noise sources. They can generate irritating tonal noises, including gear whine and broadband noise (such as idle gear rattle). Fortunately, much of this technology can be directly translated to the wind industry to meet the requirement for improved engineering. For example, larger wind turbines transmit higher power through the gearbox for greater noise. But a move to class III wind sites has lowered background masking from blade noise, and for those wind farms being sited close to residences, demands for lower sound power transmitted from the nacelle are a must. With the need for improved engineering and quieter wind turbine transmissions, technology from the automotive sector has come into play for the wind industry.

Gearboxes: a comparison

A quick comparison between automotive and wind turbine gearboxes is provided in Table 1. Several key differences stand out. For starters, the wind industry not only has less of an ability to methodically build and test prototypes, but also performs fewer revisions before mass production. The gearbox size, cost, and the market drivers simply don't allow for it; however, wind gearboxes are much simpler and their principle noise is limited to gear whine. Use of sophisticated, computer-aided engineering tools can improve this situation. Thanks to the automotive industry, gear whine is now well understood and engineering a single-speed gearbox for low noise is easily achievable.

Automotive	Wind
Build and test many prototypes, and go to volume production once product is proven.	Test one prototype, build pilot plant while securing orders for several farms and go to volume production before product is properly proven.
Detailed instrumentation and measured noise assessment.	Minimal instrumentation and measured noise assessment.
Detailed and sophisticated computer-aided engineering for low noise.	Basic computer-aided engineering for low noise.
Complex gearboxes with many gear ratios.	Simple gearbox with one gear ratio.
Mature vibration and sound quality expertise.	Minimal vibration and sound quality industry expertise.
Whine, sideband noise, rattle, and clunk noise issues.	Principally whine noise issue only.
Most modern automotive transmissions feature low-gear whine noise (when new).	Many wind gearboxes have significant gear whine, including at multiple harmonics of mesh frequency.

Table 1: Key differences for low-noise development for geared transmissions between automotive and wind sectors.

An example from the automotive industry is provided in Figure 1 and Figure 2, where an analysis model was validated against a test for a complicated, six-speed automatic transmission. This model included all shafts, bearings, gears, clutches, and housing. The engineering effort was focused on the design for six sigma, with a goal of ensuring all transmissions leave the assembly line with low-noise characteristics. This required a thorough understanding of how the tolerances for assembly and manufacture affect noise. The CAE model was validated and followed by intensive simulation to achieve six sigma requirements.

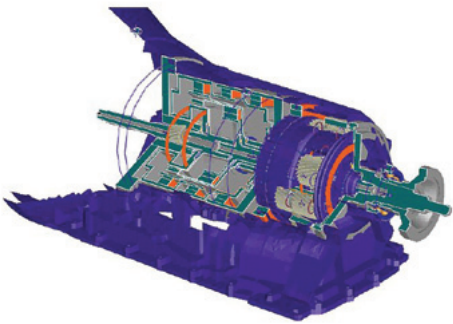


Figure 1: Semi Analytical/Finite Element Model in RomaxDesigner of a six-speed automatic transmission.

Generating quieter technology

The first step in limiting gear whine is to understand its origin. The mechanism for gear whine is as follows: gears, when they roll through a tooth engagement cycle (gear meshing) naturally have a “transmission error,” which is a deviation from the nominal transmission ratio. Factors, such as the bending of the gear teeth under load, geometric errors due to manufacturing and assembly, and the tooth geometry and its corrections are important. The transmission error at each gear mesh is the vibration source—its magnitude is load dependent and the frequency is speed-dependent. The vibration is transmitted through the shafts, bearings, and housing, resulting in acoustic radiation (see Figure 3).

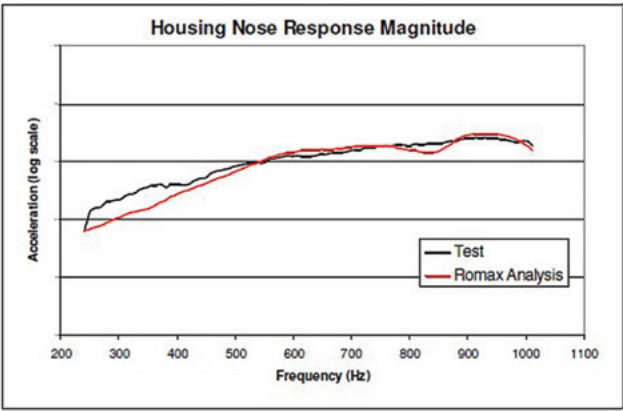


Figure 2: Validation of software prediction vs. measurement in a gearbox prototype test.

Continued on page 48.



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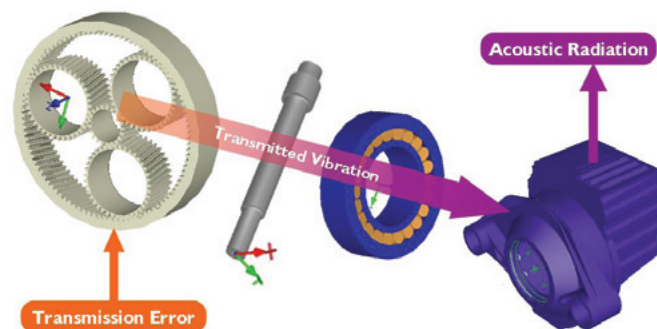


Figure 3: Mechanism for gear whine noise.

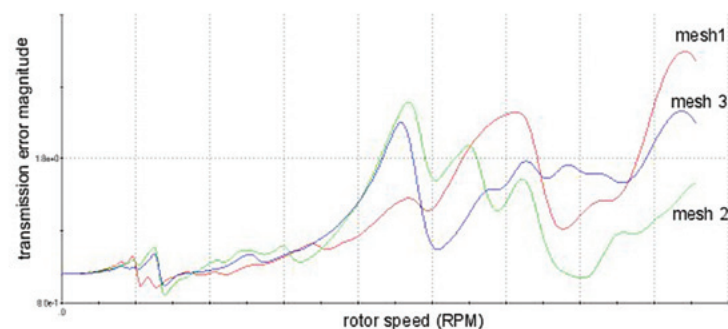


Figure 4: Gear transmission error (first harmonic).



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...continued from page 47.

Some details of a vibration analysis for an example wind turbine application are shown in Figures 4 through 6. Such an analysis is carried out using a detailed computer model that includes gear and bearing contact mechanics, flexible shafts, flexible housings and supporting torque arms/main frame, gear and bearing micro-geometry (such as gear tip relief, lead slope corrections, and roller profile modifications), and the small clearances/pre-loads in the machine elements, which are critical to system behavior. The off-nominal design characteristics, such as the manufacturing and assembly errors, can also be incorporated.

The transmission error is calculated at several load levels and, then, the gear geometry is optimized for transmission error reduction (see Figure 4 for an example of transmission error vs. speed). This can be achieved by either performing parametric studies via design of experiment, or by Monte Carlo methods with fast simulation times. The system and, in particular, the housing are then assessed to ensure it doesn't resonate with the vibration source over the operating speed range (see Figure 5 for an example gearbox vibration mode that transmission error potentially could resonate). The housing dynamic response may now be predicted. Figure 6 shows several gear mesh frequencies, their harmonics, and how they resonate the structure at particular speeds. Prevention of damaging resonances is critical, and modifications can be made before producing a prototype—such as local stiffening of the structure or good gear tooth design to reduce transmission error.

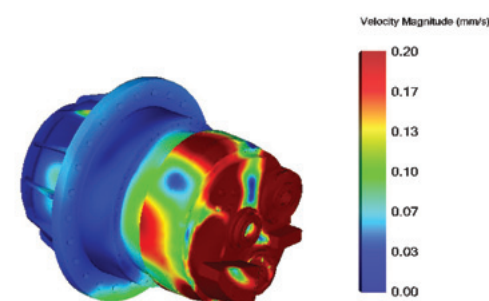


Figure 5: Gearbox vibration mode.

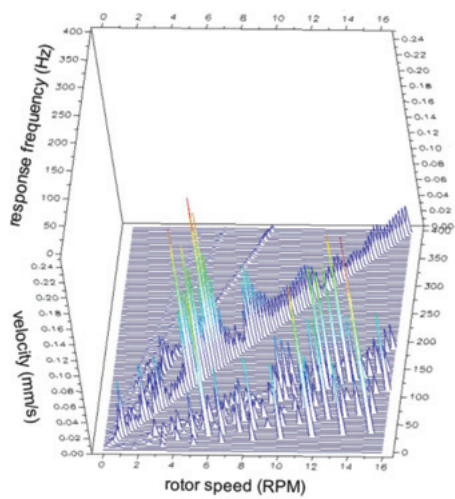


Figure 6: Gearbox housing dynamic response.



Figure 7: Romax-licensed design for low-noise wind turbine 2 MW gearbox under a vibration test.

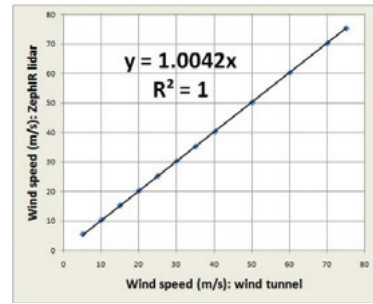
Gearbox technology

Leveraging from lessons learned the hard way for the high volume and quality requirements in automotive, off-highway, and aerospace industries allows wind gearboxes to be made more reliable and cost effective. The level of engineering work necessary to design a quiet, multi-megawatt wind turbine gearbox and drivetrain is actually reduced given the relative simplicity of the product. Plus, simulation tools have been developed over many years and validated against tests for component, subsystem, and full system levels.

However, low-noise gearbox technology should be utilized at the design stage. Application of such technology will allow quieter machinery that meets the increasing low-noise requirements for wind turbines.

** Images provided by Romax Technology, from "Vibration Engineering for Automotive and Wind Turbine Applications."*

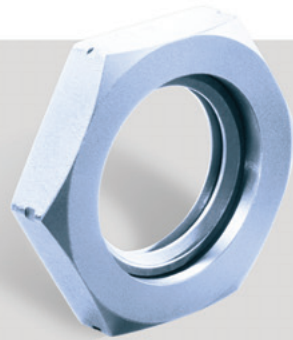
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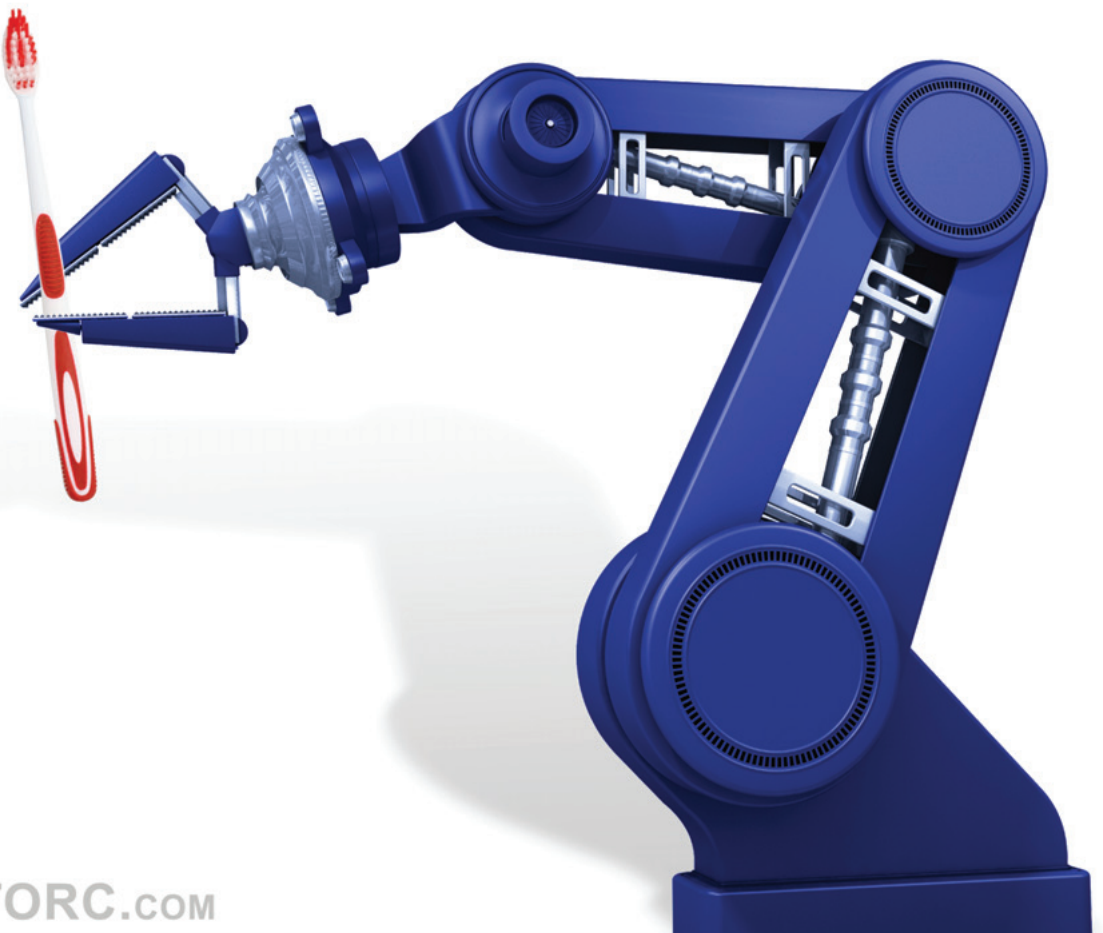
Wind speed lidar system

Natural Power has achieved a world first in demonstrating matched performance of its continuous wave wind lidar, ZephIR, to a calibrated wind tunnel as part of a Danish National Advanced Technology Foundation (DNATF) project. ZephIR 300—a lidar system for measuring wind speed and characteristics from ground level up to 200 metres—was deployed in LM Windpower's wind tunnel in Denmark, and successfully measured wind speeds from 5m/s to 75 m/s with an averaged difference of just 0.4% for a sustained period of time—and across all measured speeds. To the company's knowledge, these are the first reported tests in the world to accurately measure the performance of a lidar in a wind tunnel and help demonstrate ZephIR's ability to measure low and high wind speeds for wind resource campaigns in the renewable energy sector.

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Decentralizing Power with Small Wind Turbines

By Sharolyn Vettese

Where there are adequate wind resources and good siting, there are also significant environmental, security, political, cultural, and social advantages of a decentralized power supply—which includes small wind turbines (SWTs) generating renewable electricity closer to users. A major benefit of decentralization is reducing electricity loss via transmission over long distances. Greenpeace estimates 67% of primary energy input is wasted in the current global centralized model, and promotes a decentralized model as the best way to dramatically reduce global CO₂ emissions from power generation.

Decentralization would also result in a less susceptible centralized power system to sabotage, either because of human error or natural causes. The March 2011 disaster at the Fukushima nuclear plant demonstrates centralized electricity system vulnerability. It reveals the unmanageable environmental risk of nuclear power plants, despite the fact that Japan was well prepared for the effects of earthquakes. Centralized power system failure has often proven to be unpredictable, have far-reaching effects, and severe economic and social consequences.

Media reports have quoted experts to estimate the cost of clean up in Japan to be anywhere between \$130 billion to \$450 billion. Professor Roger Pulvers, head of the Center for the Study of World Civilizations at the Tokyo Institute of Technology, has been quoted as saying that over 80,000 people in Japan had to abandon their homes, thousands have no livelihood, and there are approximately 1000 radioactive dead. The cost includes rebuilding towns and clearing over 20-million tons of mainly radioactive waste, and securing and decommissioning the stricken reactors. To date, water is still being used to cool damaged reactors and its disposal is a huge problem due to contamination.

Advantages of small wind

If decentralization isn't enough reason, another benefit small wind turbines present is reducing water and land use in electricity generation. The global power sector is the largest industrial water user. Wind power very likely uses the least water to generate power, and SWTs need no water to operate. Only periodic blade cleaning is needed and, even then, only in the most arid areas. SWTs also have the added benefit of minimizing land use because of their small physical footprint.

Many SWTs are quiet, don't pose a migrating bird hazard, and their adoption by big-box retailers is just one indicator that they don't divide communities (as can be the case with their megawatt counterparts). Moreover, SWTs complement other renewable technologies, serve as a diversified energy supply, and their increased deployment would democratize power production. SWT use should be encouraged to give small electricity consumers and producers a choice, and enable them to take advantage of dense winter wind when electricity needs are high.



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Financial incentives

In the Canadian province of Ontario, financial incentives have accelerated renewable energy development and created new jobs. The Green Energy Act (GEA) 2009 resulted in a fast-tracked green energy industry. According to the provincial government, it created 20,000 new green jobs up to July 2011, with 50,000 expected by 2012. The province's coal use for the first six months of 2011 was 94% lower than coal use for the same period in 2003. This is likely because the province's FIT (Feed-in-Tariff) and microFIT (the FIT for under 10kW) programs have been a success. Over 10,000 microFIT projects are connected or ready to connect, according to the Ontario Power Authority's July 4th, 2011 Government news release. However, it's worth noting, the majority of these projects are for solar PV. The MicroFIT rate is 80.2 cents/kWh CAD for solar PV rooftop, but only 13.5 cents/kWh for SWTs. This skews the microFIT toward solar and away from wind power even though installation costs are similar for both technologies; however, prices for solar are falling and there's a customer expectation of a three- to five-year payback.

The Canadian Wind Energy Association (CanWEA) Small Wind Market Survey 2010 found that a recommended FIT for SWTs would mean average annual growth rates of 40% in the next 15 years. It points out that's 1,800 MW of installed SWT capacity and an estimated 17,900 more Canadian jobs. The predicted scenario for Ontario, which has 30% of the national SWT market, is for 5,300 extra jobs. Without adequate FITs for SWTs, the estimate is only 15% annual growth and just 57 MW installed nationwide.

Currently, Nova Scotia's new Community FIT supports small-scale, locally owned renewable energy projects (excluding solar PV). It's proposed a rate of 45.2 cents/kWh for small wind (50 kW or less)—which, as of now, puts this province's development of the SWT industry way ahead of Ontario's, but there's still a cap of 100 projects to a total of 5 MW.

In the US, the 2010 AWEA (American Wind Energy Association) SWT Global Market Study reports that despite the economic downturn, the US market for SWT (under 100kW) grew 15% in 2009. This growth was partly attributed to a mix of new and improved incentives. The 2009 American Recovery and Investment Act expanded the federal investment tax credit (ITC) for SWTs, allowing consumers to take fully 30% of the total cost of a SWT system as a tax credit. The continuation of such incentives, along with the increased uptake of small wind FITS in the US, should encourage growth in this sector.

For the SWT industry to flourish, so there can be growth in employment opportunities and innovation, it needs to receive a similar boost to that given to the solar industry. It's vital that SWTs play a greater role in decentralization to help reduce the world's pollution from power generation, help build a less susceptible electricity system, minimize land and water use, and diversify and democratize our power supply.

Sharolyn Vettese is the Wind Simplicity inventor and CEO.

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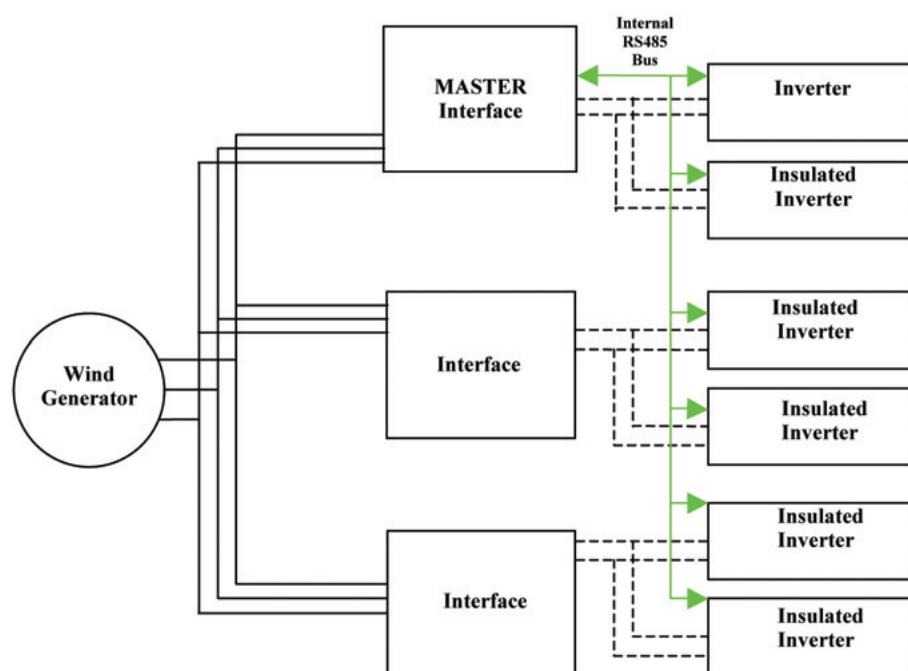
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Multiple Inverter Architecture for Community Sized Wind Turbines

By Mirko Bindi

Figure 1. Multiple Modular Structure System

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The small wind turbines (SWT) trend of growing in terms of power rating is raising a question about which converter to use when connected to the grid. Solar photovoltaic (PV) commercial installations of up to 100kW are a parallel application to this scenario. Just as solar inverters must connect to the grid, imagine taking a similar approach when connecting small wind turbines to the utility grid. In fact, the possibility of “paralleling” multiple inverters is one of the most feasible and cost-effective solutions that turbine manufacturers or installers could consider. This is primarily because inverter modules are adapted from the PV market—a large market that has already reached a very competitive cost per watt.

Typically, small wind turbines require a tri-phase AC output to the grid when connected in Europe, or a single-phase AC output when connected in North America. Paralleling multiple inverters to a single, small wind installation offers a number of advantages from market availability, to lower costs leveraging. This is something the PV residential/commercial market has already reached at a multi-gigawatt level.

Moreover, paralleling multiple inverters adds instability to the entire wind converter system, especially in the presence of fast, variable wind speed conditions. Wind speeds are extremely difficult to manage while keeping the maximum energy harvesting working point.

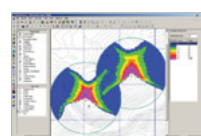
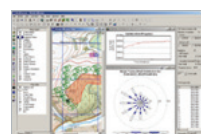
From a system standpoint, the ideal solution is to resolve the instability using a master/slave approach with a single dispositive that manages the

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power curve tracking, and rectifies the AC output from the wind turbine generator. Ideally, this dispositive should be designed for use in installations in conjunction with single-phase and three-phase inverters in a master-slave configuration, depending on the power output rating of the turbine and the characteristics of the wind site itself. This modular structure would allow the connection of several inverters to each interface dispositive, forming a unique wind system fed from the same generator. This set-up would employ just one communication architecture—ideally, via RS485—to minimize the system feedback reaction time.

In theory, it's also worth considering a multiple modular structure system in terms of extending the modular concept to the interface dispositive level; wherein, several wind interface dispositives would share the same wind turbine generator. This configuration allows use of the same components, only with wind turbines having a higher rated power up to the community market level (up to 100kW). The use of this approach would mean turbine manufactures could be more flexible, and free to design turbines without the costs of custom wind converters.

Each wind converter system would accomplish the following fundamental features:

- Two-channel, wild AC rectification and filtering;
- Command the inverter power set point for optimal energy harvesting;
- Activate diversion load and braking resistor;
- Protect wind inverters from generator over-voltages; and
- Provide a "ready to run" command to the external safety mechanical or electrical brake. (This command is a relay-dry contact that should be intended as a "no internal electrical failure" indication.)

Having two independent rectification channels is fundamental. The first channel feeds the braking resistor to assure the safety of the turbine itself, as well as the auxiliary power supply (if the AC line voltage is not present). The second channel provides the DC voltage to the wind inverters (which feed the grid) and, eventually, to the diversion load—which could be used for a number of different functionality/external features. The use of a half-controlled bridge rectifier permits disconnecting of the inverters should the voltage level exceed the absolute maximum voltage rating. The "ready to run" command should be switched when the self-diagnostic doesn't detect an internal fault; this signal should be

used to release the safety brake, so if the brake control doesn't detect dangerous conditions, it can allow the turbine to run.

In the above scenario, it would be possible to efficiently answer all of the possible "bigger," small wind turbine electrical needs by using basic and modular component already available in the market—and at a competitive cost.

Mirko Bindi is the business development manager for wind power in the Renewable Energy business unit of Power-One, Inc.

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Clamp meter

AEMC has developed a clamp-on meter that is CAT IV at 1,000V, making it the only clamp-on meter on the market to meet the specific needs of the wind industry. Some OEMs and maintenance providers are requiring a CAT IV rating for wind turbines, which are typically 690V, making the new AEMC clamp meter the right choice. Additionally, this unique clamp-on meter has phase rotation indication, measures single- and three-phase power, and is UL 94 Flame-retardant and self-extinguishing.

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Upgraded line reactors

When a wind turbine operates at full capacity, various deficiencies of the standard line reactor often lead to its failure due to overheating. The overheating causes resin to seep out between the windings, followed by a large short circuit in the power converter cabinet. As a result, the line reactor's purpose of minimizing high-frequency harmonics onto the grid, improving power quality, stabilizing output and input current, and providing inductance to fully charge the DC link to its operating voltage is left unfulfilled. Availon led a team of specialists in studying the underlying causes of the line reactor failures, and determined ways to minimize or eliminate them. Their new proprietary design features a significantly higher rating of 450 amps, versus the standard 375 amps, assuring increased reliability during full power generation.

To prevent short circuits caused by overheating, the new line reactor has been redesigned with wider splits between the windings and special brackets with strategically positioned slots to optimize airflow. In addition to these changes, Availon is also offering an upgraded cooling fan kit to be installed in the converter cabinet, which allows for more efficient air movement—yet another way to minimize overheating and reduce wind turbine downtime.

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Anderson Power Products (APP) introduces the SPEC Pak High-Power Connector, APP's latest addition to the SPEC Pak Connector series of sealed power for environmental conditions. This connector has power-handling capacity from 75 to 260 amps, and an IP68-rated waterproof environmentally sealed shell, making it ideal for portable and test equipment, including for wind and solar power generation. The SPEC Pak line's housing design and materials create a rugged, weatherproof enclosure to protect electrical components from water, dust, and other harsh environmental contaminants. The SPEC Pak High-Power Connector features a UL94 V-0 flammability rating and a UL 746C F1 weather-ability rating. It's compatible with industry standard PG threaded sealing glands, and has sturdy aluminum latches with lockout/tag-out capability. The shell accepts 75 to 180 amp Powerpole contacts, and up to eight auxiliary contacts. The combination of housings, power, ground, and signal contacts offer thousands of design options for the most demanding applications. Wire sizes can accommodate a range from 24 to 3/0 AWG (0.25 to 85.0 mm²).

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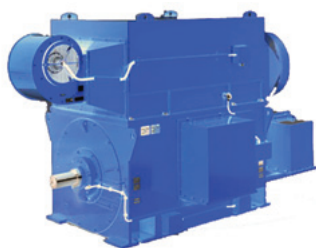
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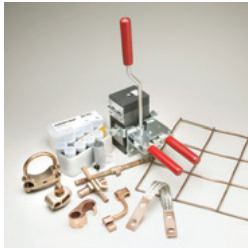


Repair for off-warranty turbine components

PSI Repair Services presents its cost-savings options for off-warranty wind turbine components. For problematic electronic systems, PSI conducts an in-depth analysis that determines the root cause of the failure. They, then, offer solutions ranging from minor component changes to full replacement printed circuit boards, with enhanced designs to improve performance and reliability. These options allow customers to significantly increase mean time between failures (MTBF), and prevent costly downtime and/or repeat repairs. PSI also provides repair services for worn hydraulic and precision mechanical components. Their stocking programs provide fast turnaround to help reduce inventories.

PSI Repair Services | www.psi-repair.com

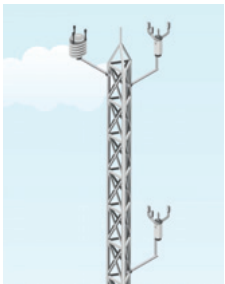
Booth 1336



Grounding applications for wind farms

BURNDY announces its expanded product offering to meet the needs of wind farm projects. The BURNDYWeld exothermic grounding option provides a portable and efficient method of welding copper to copper, and other various materials, without the use of an external power source. The resulting connection is a fusion or molecular weld of virtually pure copper. The BURNDYWeld is ideal for tower grounding applications on wind farm projects. BURNDY's mechanical grounding connectors have been designed for durability and easy installation. Only the finest copper alloys are used in their manufacture, ensuring performance under the most extreme environmental conditions. UL 467 Listed for direct burial applications. The HYGROUND irreversible compression grounding system is a complete system consisting of connectors for cross-grid connections, taps, splices, cable to ground rod, ground plates, and terminations. It's acceptable for direct burial in earth and concrete. UL 467 and 96 Listed, CSA certified, and IEEE 837 tested.

BURNDY | www.burndy.com
Booth 1424



Wind measurement system

Vaisala has released its WTS Wind Measurement System, which is specifically engineered for wind resource assessment, power curve measurement, and monitoring operational wind farms. The system includes five configurations that offer customers a choice of specialized features. These include a cold climate option, which ensures performance in the harshest weather conditions, and an option that employs sensors designed to last more than 20 years. Each Wind Measurement System includes a combination of sensors, a data logging system, power supply, tower, and options for installation and support services. The turnkey system maximizes data availability, and supports financial analysis and reporting, including energy yield analysis. Customers can own or lease the equipment, or use it as a complete service with Vaisala managing the equipment, and collecting and reporting the data.

Vaisala | www.vaisala.com/energy
Booth 1109



Wind resource assessment buoy

The AXYS WindSentinel is the only wind resource assessment buoy that uses a simultaneously pulsing laser wind sensor to accurately measure wind speed, wind direction, and turbulence offshore at turbine hub-height and across the blade span. Deployed on the NOMAD buoy platform, this fully motion-compensated solution significantly reduces the costs and risks associated with offshore wind resource assessment.

AXYS Technologies Inc. (AXYS) | www.axystechnologies.com
Booth 701




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EPC services

White Construction specializes in renewable energy power generation projects by utilizing the strengths of their history in heavy industrial construction. As one of the pioneering companies in the early days of wind farm construction, White Construction has gained the experience, high-quality standards, and safety practices required. They provide the engineering, procurement, and construction necessary to provide a turnkey approach to renewable energy projects. They also have the knowledge, experience, equipment, and management to ensure a project is completed on time and within budget. Currently, White Construction has installed more than 4,000 MW in the US and Canada.

White Construction | www.whiteconstruction.com

Booth 611



Wind farm monitoring & optimization software

Owners and operators are under increasing pressure to reduce operational costs, while improving the efficiency of their wind farm portfolios. GL Garrad Hassan has developed a new software tool to help facilitate this. WindHelm provides a single platform for the monitoring, optimization, and control of any combination of operational turbines, farms, and portfolios. It gives owners and operators uniform access to and analysis of, their SCADA data. This facilitates intelligent operational decisions, maximizing availability, efficiency, production, and financial return. WindHelm was developed out of GL Garrad Hassan's independent SCADA product, so clients benefit from the related international consulting experience and support, and can be confident of an intelligent product.

GL Garrad Hassan

www.gl-garradhassan.com

www.gl-garradhassan.com/en/software/GHWindHelmPortfolioManager.php

Booth 1217

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Hands-free laser alignment tool

The Fixturlaser UPAD XA offers users complete freedom to move and walk around a jobsite, while doing a job at the top of a rotating tower. Fixturlaser UPAD XA has an angled display box that's equipped with a Velcro strap to secure around one's arm. The display box has a large, color touch screen (3.5"), with a full VGA resolution of 640 x 480 pixels. The screen is backlit and trans-reflective, providing the best possible visibility in poor light conditions, as well as in strong sunlight. The tool is also wireless, using Bluetooth connections. With the intuitive user interface, which uses color-coded, graphical icons, symbols, and values, users are easily guided throughout the measurement and alignment process.

Services Techniques Claude Douin Inc.

www.stcd.ca

Booth 706



Land consultation

Elexco is a full-service land company providing land consulting and land administration services for the renewable energy, utility, and other industries in North America. Services include land acquisitions, land negotiations, right of way, leasing, easements, title curative, land registration, GIS services, and customized mapping.

Elexco Ltd. | www.aone-elexco.com
Booth 1618



Handling & transportation services

With over 10 years experience in wind tower erection and maintenance, offering complete material handling and transportation services, NC Services Group companies are a lifting and heavy haul solutions provider in North America. Their modern fleet includes: crawlers up to 825T and all-terrain cranes up to 1350T. They're well suited to service the wind industry.

NC Services Group
www.ncservicesgroup.com
Booth 1236

Wind power electrical & equipment solutions

With over 125 branches across Canada, Westburne provides local access, support, and inventory on a wealth of products and services. Having been involved in over 1000 MW of wind energy projects, Westburne has extensive expertise in renewable energies, supporting all of the stakeholders involved in the wind and solar markets by offering solutions for the collector network, substations, and all of the electrical products and equipments related to these projects.

Westburne | www.westburne.ca
Booth 125



Consulting & project permitting

E & E Consulting, Inc. (E & E) can provide all the environmental support required for developing wind power projects anywhere in Canada. They offer services in strategic environmental permitting, agency consultation, and public outreach, plus the full range of required avian, bat, terrestrial, aquatic, cultural, socioeconomic, and historic resource studies. E & E's multidisciplinary expertise has proven valuable for clients at over 200 North American wind energy sites from coast to coast.

E & E Consulting, Inc. | www.ene.com/service/energy/wind.aspx
Booth 1426

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Designed specifically for wind turbines, the **SafAscent™ Turbine Maintenance Platform** enables unrestricted access to the tower and blades. With more than 85 branches throughout North America, Safway and SafAscent can reach any project, in any location.

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www.safway.com/wind.



Scaffolding & Access Solutions



Direct-drive wind turbine generators

LEITWIND is a producer of direct-drive wind turbine generators. It's a company of High Technology Investments (HTI), and formerly known as Leitner Technologies. Through the use of synergies, with its ropeway technology know-how, the company conceptualized a wind turbine based on the principle of a direct-drive generator. The synchronous generator, using permanent magnets, reduces electromechanical losses to a minimum and maximizes performance at all operating levels. LEITWIND's three additional wind turbine generators (LTW101, LTW86, and LTW70) will complement its already existing product line, and offer the optimal solution for each type of wind conditions: from 1 MW to 3 MW.

LEITWIND | www.leitwind.com

Booth 535



Wind energy development

Finavera Wind Energy is a publicly traded wind energy development company based in British Columbia. Founded in Ireland in 2003, the company is focused on developing, constructing, and operating wind farms in North America and Ireland. Finavera showcases its four energy projects in the BC Peace Region that have 25-year electricity purchase agreements with BC Hydro. With these projects, Finavera will be generating 301 MW of clean energy—enough to power 75,000 households—by program completion in 2015, making Finavera the largest wind developer in BC.

Finavera | www.finavera.com

Booth 1600



Renewable energy business development

Elgin County is strategically located in the heart of southwestern Ontario, a province that has committed to renewable energy through the development of green legislation. Elgin recognizes the importance of sustaining growth and driving new investment. Innovative and forward-thinking interest from the public and private sector in the deployment of emerging environmental technologies, including wind, ethanol, waste treatment, and bio-energy, continues to grow. Elgin is poised to benefit from upgrades to the transmission system with two 500kV (proposed) core transmission projects slated to occur within the next five to 10 years. Running just north of Elgin, the transmission system moves power from the region into the Greater Toronto Area (GTA), making the region ideal for renewable energy business.

Elgin County

www.progressivebynature.com

Booth 608

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www.vbine.com



Project design, operation & EPC services

Renewable Energy Systems Canada Inc. (RES Canada) has developed, constructed, owned, and operated renewable energy projects since 2003. RES Canada develops and constructs wind and solar energy projects, and 60% of its projects are construction for third parties in most Canadian provinces. RES Canada is the developer and constructor of 198 MW in Ontario, and has another 1,500 MW in its development pipeline. It offers in-house expertise in resource analysis, development, site design, procurement, engineering, construction, through to operations. This in-house accessibility ensures a smooth transition from one phase to the next, that budgeted costs are met, and the project is completed on time. RES Canada can sell its developed and constructed projects to others, construct projects developed by others, and own and operate projects.

RES Canada | www.res-americas.com

Booth 423



Remote wind data service

Second Wind showcases SkyServe 2.0, a new release of their satellite- and cellular-based remote wind data service. SkyServe offers users of the Triton Sonic Wind Profiler and the Nomad 2 Wind Data Logger the ability to: acquire wind data via satellite or cell modem; analyze wind conditions instantly; archive wind data on a secure server for later analysis; monitor a campaign to preserve measurement up-time; and, maintain field assets with Second Wind's support and field services. Furthermore, customers with Nomad 2 Wind Data Loggers may now choose to have their Nomad data automatically uploaded to the SkyServe portal on a daily basis. This provides the advantages of SkyServe to most Nomad customers, including being able to compare Nomad and Triton data. SkyServe 2.0 also offers an upgraded user interface and several security and reporting enhancements.

Second Wind | www.secondwind.com

Booth 1009



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Elexco Land Services, Inc.

New York: 1.866.999.5865

Pennsylvania: 724.745.5600

Michigan: 1.800.889.3574

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www.elexco.com



Turnkey wind energy solutions

The AMEC Black & McDonald joint venture serves the renewable energy industry by providing a full range of environmental, engineering, procurement, and construction (EPC) services on a design-build basis. AMEC's expertise in engineering and project management, complemented by Black & McDonald's construction and maintenance services, provides a one-stop solution for the development of renewable energy projects. With over 20 years of combined experience in the renewable energy industry, AMEC Black & McDonald has established a reputation as a reliable and experienced contractor with a national presence and local resources; a history of delivering quality projects on time and within budget; financial strength and stability; the ability to self-perform entire EPC contracts; and, an investment in stakeholder relationships and local community development.

AMEC Black & McDonald
www.amecblackandmcdonald.ca
Booth 847



Wind turbine installer

Eagle West Wind Energy Inc. is a wind turbine installer in Canada. They offer a growing fleet of over 100+ cranes, along with highly experienced wind turbine technicians and project managers. Eagle West fosters an environment that is safe and hard working, providing high-level service to clients from coast to coast.

Eagle West Wind Energy Inc.
www.eaglewestcranes.com
Booth 741



Wind farm construction & contracting

Mortenson Construction is a US-based, family-owned construction company. Mortenson provides a complete range of services including planning, program management, pre-construction, general contracting, construction management, design-build, and turnkey development. Since entering the renewable energy market in 1995, Mortenson has built over 100 wind projects generating nearly 11,000 MW of clean, renewable energy across the US and Canada. In addition to wind power, Mortenson's Renewable Energy Groups also constructs facilities that generate solar power and other renewable resources and is a provider of transmission and distribution infrastructure.

Mortenson Construction | www.mortenson.com
Booth 917



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Greenwich Wind Farm - 99MW
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 Roark Lanning - Turbine Engineering Manager

Renewable Energy Systems Canada Inc. is a fully-integrated energy company which develops, constructs, owns and operates renewable energy projects across Canada.

RES Canada is an industry leader, bringing over 5,200 MW of renewable energy experience to Canadian construction and development projects.

Develops | Constructs | Owns | Operates

Renewable Energy Systems Canada Inc.
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For more info, scan the QR code with your smartphone. If you don't have a QR code app, it can be downloaded for free.



Remote wind sensors

Many published articles and reports across the wind industry highlight underperforming wind turbines and stress on turbine components leading to reduced energy output, premature fatigue, and increased maintenance. The Vindicator laser wind sensor now offers a better way to control wind turbines. Catch The Wind's team of aerospace engineers has designed and tested a game-changing wind turbine control system—in production and ready for installation. They have over two years of wind turbine control data from installations on six different turbines in six different locations, which confirms the benefit of controlling utility-scale wind turbines using forward-looking remote sensors. Turbines are designed to be occasionally misaligned between zero and eight degrees, but in reality the turbines are misaligned by more than double that design parameter, all the time.

Catch The Wind Inc.

www.catchthewindinc.com

Booth 701



Transportation & integrated logistics services

As one of the largest privately owned transportation companies in Canada, Challenger is dedicated to providing global transportation and integrated logistics services, delivering a true end-to-end solution for their customers. The company has established a presence in the wind energy market by expanding its Special Commodities Division to offer Renewable Energy Transportation services. Challenger's asset-based turnkey logistics' solutions reach all points, delivering all types of product with configurations to meet any need, including: double schnable, schnable dolly, beam dolly, flat deck, vessel deck, blade, and more. In addition, a vast array of pre-contract and value-added services is available to meet or exceed a customer's growing needs, saving time and money.

Challenger | www.challenger.com

Booth 1210



Turnkey solutions & services for wind industry

KR Wind provides turnkey and single service solutions for the wind energy industry, and has many years of experience and knowledge. As wind energy is their sole focus, they are committed to uncompromising safety and quality. KR Wind provides: full logistical and transportation solutions; their own fleet of cranes specialized for the wind industry; erection and installation of wind farms of any size, which also includes mechanical and electrical completion; a vast range of services and maintenance solutions; as well as, a partnership solutions that allow them to support customers and offer EPC, BOP, and door-to-door solutions.

KR Wind | www.krwind.com

Booth 323



Telecom remote tower

Starting in 2005, Vbine Energy set out to build a turbine that would take advantage of the low-pressure system created by effluent exiting a smoke stack. As they developed such a turbine, they also solved the main problems that had been plaguing vertical axis turbines—mainly the excessive bearing wear and broken drive shafts and vibration issues. As Vbine realized this design, the telecom industry emerged in search of a green energy solution to the power requirements for their remote towers. Vbine spent the next five years designing a turbine that addressed the specific requirements of the telecom sector (including maintenance, vibration, electromagnetic interference, wind shear, and power requirement). Today, Vbine has a turbine that can be retrofitted on existing towers, as well as many other applications.

Vbine Energy | www.vbine.com

Booth 1449



Environmental assessment provider

Hemmera is an environmental assessment (EA) provider in Western Canada. Their experience has led them to support over 4,000 MW of proposed power on several distinct wind projects. Hemmera's wind services include: data management and mapping; environmental impact assessment; environmental mitigation and monitoring during construction and operation; First Nations engagement and negotiation; project planning guidance around environmental and socio-economic considerations; preliminary constraints identification; project permitting and authorizations; as well as, public communication and consultation

Hemmera | www.hemmera.com

Booth 1013



Wind power plant integration

S&C Electric Company offers field-proven solutions for integrating large and small wind energy plants into the grid. Over the past decade, they've helped satisfy the interconnect requirements for over 2700 MW of renewable energy with substations, collection systems, and VAR compensation systems. As a total solution provider, S&C designs, installs, commissions, and maintains electric power collection, transmission, and distribution systems. They also design and manufacture switching and protection products for those systems. Their Vista Underground Distribution Switchgear and System VI Switchgear reliably controls power flow from wind turbines to collector substations. Wind energy plants around the world have used the S&C PureWave DSTATCOM Distributed Static Compensator, a fast-compensating reactive power source, to reduce voltage variations and meet grid codes.

S&C Electric Company | www.sandc.com

Booth 534



Access any turbine anywhere with SafAscent

Designed specifically for wind turbines, the SafAscent Turbine Maintenance Platform from Safway Services provides access to towers and blades for maintenance, cleaning, and repairs. The 6'6" modular platform has a 500-pound capacity, allowing companies to reach any access-point to perform routine maintenance, while the padded roller system protects the tower and blades. With more than 85 branches across North America, Safway can efficiently deliver products and services to handle any wind turbine project anywhere. Since 1936, Safway Services has offered reliable scaffolding and access solutions. As wind power became one of the fastest growing forms of new electricity across the US, the need for wind turbine maintenance increased, as well. Now with SafAscent, the newest addition to Safway's Motorized Division, Safway Services is able to support the fast-developing wind energy industry.

Safway Services | www.safway.com

Booth 1326



Gearbox filter lifetime extension kit

Over the lifetime of a gearbox, filtration needs may change. When this happens, HYDAC has cost-effective solutions that allow for an expanded range of filter element options. Benefits include: longer service intervals; the ability to address oil-aging issues; improved oil cleanliness levels; two-stage filtration for protection during cold start and optimal use of available space; and, a simple design that keeps costs and installation difficulty to a minimum. It's important to always ensure the proper condition of turbine oil before attempting any changes to the filtration system. Ensure proper oil analysis has been completed using the oil manufacturers recommended test procedures.

HYDAC International

www.hydacusa.com | www.hydac.ca

Booth 1015



Show in Print

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

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The AWEA OFFSHORE WINDPOWER 2011 Conference & Exhibition brings together exhibitors and attendees from all over the world who are interested in becoming players in this new and highly promising market. Recent steps taken by federal and state governments have put offshore wind high on the nations' priority list, signaling to investors that the US is serious about advancing the development of the offshore wind industry.

www.offshorewindexpo.org



Renewable energy consultancy

GL Garrad Hassan is one of the world's largest dedicated renewable energy consultancy, and a recognized technical authority on the subject. It offers independent technical and engineering services, products, and training courses to the offshore and onshore wind, wave, tidal, and solar sectors. The GL Garrad Hassan name is new, but the company is borne of the integration of specialist companies that, united, form the renewable energy consulting division of the GL Group. GL Garrad Hassan is a consulting company; it has no equity stake in any device or project—a rule of operation that's central to its philosophy.

GL Garrad Hassan

www.gl-garradhassan.com



Renewable, offshore development

Virginia strives to become the energy capital of the east coast. It's an attainable goal, especially in the area of offshore wind power generation. Virginia also stands to succeed as a major hub, if not the east coast epicenter, for manufacturing and assembly of wind turbine equipment and other major offshore components. A geographic advantage, a ready workforce, no height restrictions, as well as an abundant and cost-effective "lay-down space" for the components are among the requirements for offshore wind success—and Virginia has them all. For example, The Port of Virginia (see image) boasts a natural harbor with the deepest US east coast port channels, and no obstructions such as bridges and overpasses.

Virginia Economic Development Partnership

www.yesvirginia.org



Wind project siting, design & permitting

Established in 1880, Sewall is an engineering, surveying, and natural resources consulting firm with offices strategically located along the east coast. They provide siting, design, and permitting services for land-based and offshore wind energy projects. To date, their experienced team has assisted with more than 10 commercial-scale wind projects representing 300 wind turbines, and over 600 MW of potential power production—including permitting of the first floating offshore wind project in North America.

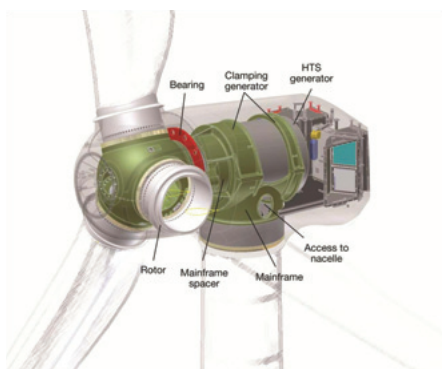
Sewall | www.sewall.com



Offshore risk prevention

Bureau Veritas is involved in the Quality Assurance, Health, Safety & Environmental (QHSE) and Social Responsibility industry. They provide the tools and expertise to minimize risk in renewable projects—including offshore wind—helping clients move forward with confidence. Bureau Veritas is present in 140 countries, developing solutions that contribute to risk prevention and performance improvement. They help organizations create long-term value through their technical and regulatory expertise.

Bureau Veritas | www.bureauveritas.com



Offshore turbines

Through its advanced wind turbine designs, customer support services, and electrical control systems (ECS), American Superconductor's (AMSC) Windtec solution is lowering the cost of offshore wind energy. For manufacturers looking to establish a position in the offshore market, AMSC can provide development capabilities for a wide variety of turbines up to 10 MW in power rating.

American Superconductor

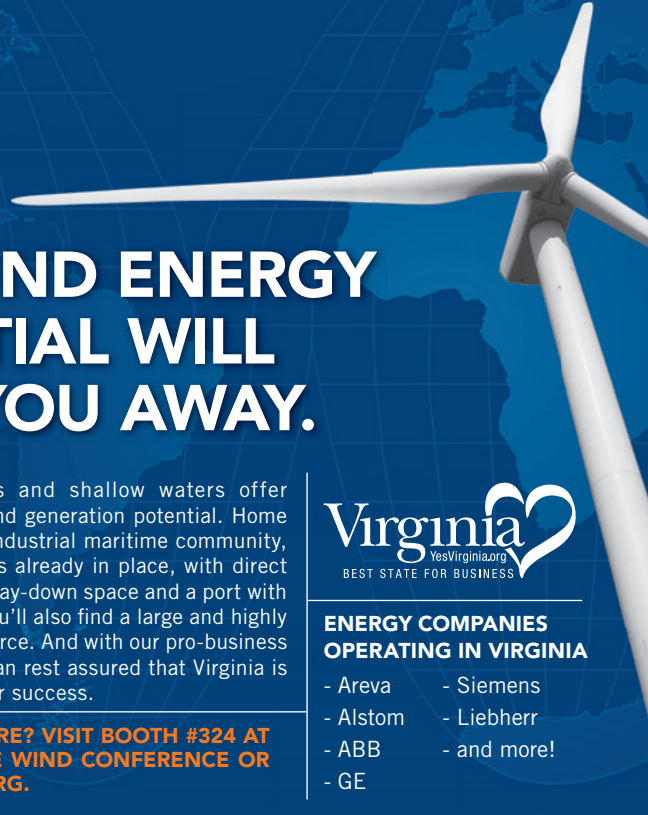
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Marine survey & geotechnical firm

Fugro is one of the world's largest collectors and users (for engineering purposes) of data that define the physical character of the earth's surface, subsurface, and oceans. Fugro is unique in its long-term contribution to the advancement of energy development in the world's oceans, and has providing siting, investigation, design, and construction services for more than two-thirds of the oil and gas industry, and for offshore wind project developments around the world. Fugro's owns and operates more than 50 survey and exploration vessels, and jack-up rigs. Fugro has been a primary supplier of services to the offshore wind industry since it began.

Fugro

www.fugro.com/services/sustainable-energy/offshore-wind



OUR WIND ENERGY POTENTIAL WILL BLOW YOU AWAY.

Virginia's strong winds and shallow waters offer unparalleled offshore wind generation potential. Home to the nation's premier industrial maritime community, our wind infrastructure is already in place, with direct access to rail, abundant lay-down space and a port with no height restrictions. You'll also find a large and highly skilled wind-ready workforce. And with our pro-business economic climate, you can rest assured that Virginia is always committed to your success.



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Wind Power & Market Expansion

Warranting a course of action

By John McLane



OVER THE LAST FIVE YEARS, the US onshore wind sector has been a relatively stable environment for investors, and is viewed as a growing industry that supports many state economies through employment and taxes. It's on track to produce 20% of the US's power capacity by 2030. The immediate future, however, is less certain. Competitive gas prices, transmission issues, the general economic slowdown, and a number of questions over national energy policy continue to cause independent power producers to scale back their plans.

These issues, coupled with ageing equipment, have the potential to create a scenario that will worsen the prospects for investors, increase wind energy prices, and threaten new developments that, ultimately, could derail future market expansion. Now, that a significant amount of US wind energy equipment is reaching the stage where it's no longer supported by manufacturers' warranties, energy producers and wind farm owners must evaluate how they can manage and mitigate the large costs involved in servicing and re-commissioning equipment no longer supported by OEM warranties.

While the wider macro issues of price comparisons for alternative energy sources and national policy tend to require a governmental or market response, on the issue of maintaining the economic viability of wind energy equipment, the insurance sector has its part to play—and beyond that of providing traditional cover during the construction and operations phase. Through the creation of suitable policies, educated underwriting, and supporting services, insurers should be able to price the long-term risk involved in ageing equipment at a level the industry can absorb.

The biggest problem with wind energy equipment in the US market today may be attributed to traditional issues, such as blade and gearbox failures. Much of these costs are initially borne under the manufacturer's initial two-year warranty. Once that expires, these losses are frequently covered by appropriately structured property damage insurance. This protection, however, frequently has a "serial loss clause," limiting the number of losses to which the policy will respond when arising from the same cause.

Where ongoing operations and maintenance (O&M) and property damage is concerned, the costs are calculated on the basis of how well a turbine design is proven in operation, and then used to justify a recommendation for elements of the financing structure. Where turbines come from manufacturers with a strong track record in the industry, the risk profile of the project is reduced. Where the converse is true, or the equipment supplier is new to the market, the profile is naturally higher, leading to increased upfront costs. With failures that occur out-of-warranty, and in excess of the limitation of the serial loss clause, a major maintenance fund may be required—which, in turn, will be reflected in a large spare part budget or a contingency reserve required by lenders. Increased contingency reserves reduce a project's overall investment return, a critical financial measure for equity investors.

Although manufacturers typically provide warranties that cover equipment for the first two years of commercial operation, such warranties tend to come with covenants that place the burden of proof for failure with the owner or operator. This adds additional financial burden and a diminished return on investment.

For the insurance industry, there are two roles that may be adopted in working with wind project owners to address the end of the initial OEM warranty. First, is the development and support of industry wide "best practices" in the pre-loss prevention strategies of condition monitoring and predictive maintenance. Although these services are available from insurers in the conventional power generation business, little is offered to owner/operators in wind power generation. Post loss, there are also recovery and mitigation strategies that minimize loss costs from downtime through equipment and services supply chain management.

The second role for insurers is to provide cost stabilization to operating expenses for project owners over the long term; thereby, providing lenders with a greater assurance that debt service requirements can be met over the duration of a loan. In this capacity, insurers would provide a "cost cap" form of protection to the annual expenses associated with equipment failures.

Using insurance in this role, project owners would retain some level of expected annual losses. Insurers would step in to respond in the event annual equipment losses—as measured in dollars, number of events, or some combination of the two—if they exceed the pre-agreed retained amount. If properly structured, this approach to using insurance can be cost effective and minimize frictional costs in the insurance transaction. And, by pricing this risk accordingly, insurers can ensure costs are spread out over a long period of time, rather than as a series of price shocks that would be more detrimental to the industry participants.

The terms of coverage would also be modified to some degree to address losses and events that may not, otherwise, be covered by a traditional property damage policy. Wind farm owners and operators should be covered for a range of scenarios: from unforeseen and unscheduled repairs associated with defective wind turbine parts, faulty workmanship and design, to the longer-term cost of removal and repair.

Some insurers are uniquely positioned to take this two-part approach for the simple reason they have accumulated years of loss experience. This experience provides insight to the loss frequency and loss severity associated with various pieces of equipment and the respective manufacturers. It also gives insurers insight into the causes of loss, and a better understanding of the measures to be taken to identify situations and scenarios prior to mechanical or electrical breakdown. Both aspects of this experience put knowledgeable insurers in the position to intelligently price risk transfer, and provide a long-term solution and continuity in their market participation.

The insurance industry can't provide all the answers to sustaining the US wind energy sector, but it can provide a level of security that will help provide some guarantees against the charges that wind energy can't match the long-term security of supply of the traditional energy sectors.

John McLane is the president of GCube Insurance Services Inc.

GCube Insurance Services, Inc. | www.gcube-insurance.com



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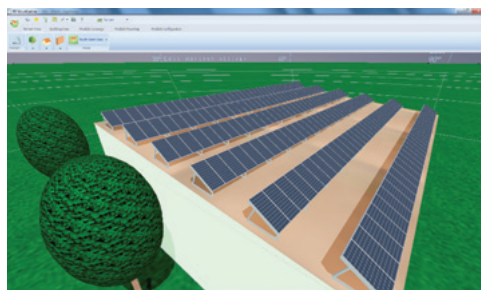
Features just some of the companies and technologies attendees will see at this year's show.

Solar Power International

October 17th to 20th, 2011 • Dallas Convention Center—Dallas, Texas

Solar Power International (SPI) is North America's largest, most comprehensive solar power trade show and conference. This annual, business-to-business event was the first of its kind in North America, growing every year. Nearly 24,000 professionals from over 125 countries attend. One out of five attendees arrive from outside of the United States, making SPI a truly global event. This year, over 1,100 companies from all vertical markets in the solar power spectrum will exhibit in a space of more than one million gross square feet.

www.solarpowerinternational.com



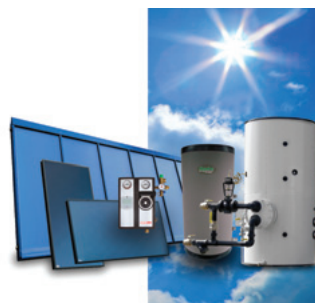
3D PV system software

PV*SOL Expert 5.0, a simulation program with 3D visualization and detailed shade analysis of PV systems has been released by Valentin Software, with many new features for mounted PV systems. Taking account of each planning situation and the possible mounting systems, inter-row shading of mounted modules can now be calculated with PV*SOL Expert 5.0 and the positioning and orientation optimized. System planners can create standard mounting systems and fully edit these, independently from the statics. In addition, it's possible to automatically cover the roof with the mounted PV system, which at the same time is adapted to the roof architecture. Single rows of modules can also be fully edited and added, or removed in groups. PV*SOL Expert 5.0 also comes with an extended version of the climate data module MeteSyn, which now has 8,000 global climate data records. PV*SOL users can select between five languages in the program.

Valentin Software

www.valentin-software.com

Booth 1717-h



Commercial solar thermal line

The new line of commercial solar thermal products from Lochinvar Corporation, a manufacturer of high-efficiency water heaters, boilers, and pool heaters, and TiSUN, a specialist in solar heating technology, features advanced quality and technology. The Lochinvar/TiSUN line includes solar thermal panels, solar thermal storage tanks, a pumping station, and a wide array of system accessories. The solar thermal panels are available in two options: the Commercial Solar Flat Panel Collector and the Light Duty Commercial Solar Collector. Both feature a laser-welded absorber with PVD coating and serpentine heat coil design, which allows for optimum heat transfer in a forced circulation solar system. The Lochinvar/TiSUN Commercial Solar Pump Station is an all-in-one solar pumping package, complete with a Differential Solar Control that offers eight different system capabilities and Btu metering. Lochinvar/TiSUN also offers solar thermal storage tanks and accessories that help designers to specify a commercial solar thermal system utilizing a single source.

Lochinvar | www.lochinvar.com

Booth 3833



Thermal solar water heating system

Stiebel Eltron SOLKITS 2 and 3 thermal solar systems are Energy Star Rated and have SRCC OG300 system certification. The SOLKITS consist basically of a well-insulated storage tank with heat exchanger(s) and high-performance flat plate collector panel(s). They constitute an economical and reliable solar domestic hot water (DHW) system for commercial and residential applications, including space heating and swimming pools. The solar closed-loop system includes the new SOL 27 PREMIUM flat plate collector panel(s) and mounting hardware, a SB/SBB storage tank with heat exchanger(s), a pump station with expansion tank, as well as various temperature/pressure gauges, pressure relief and check valves, and a controller unit with corresponding sensors. There is an industry leading 10-year warranty on Stiebel Eltron solar panels and tanks.

Stiebel Eltron | www.stiebel-eltron-usa.com

Booth 3945

SPEC Pak™ Solar Series

Features

- 40 Amps Max at 1000 Volts
- Meets NEC 2008 Tool Requirement
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Surge Protection Since 1937

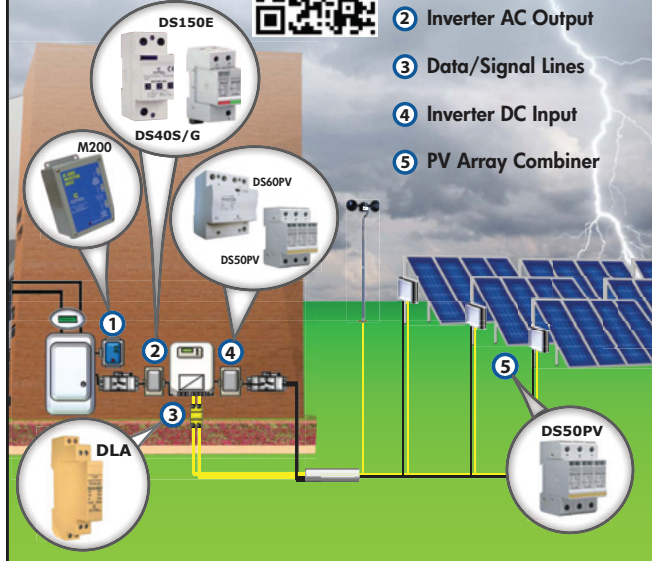
A comprehensive approach to the application of lightning and surge protection will help to ensure the maximum life expectancy and efficiency for your solar PV power system. The following illustration details the application points for the surge protectors and the primary protection goal of each device.

Use your smart phone to view more info.



Are you protected?

- 1 AC Distribution Panel
- 2 Inverter AC Output
- 3 Data/Signal Lines
- 4 Inverter DC Input
- 5 PV Array Combiner



DS150E
DS40S/G
M200
DS60PV
DS50PV
DLA
DS50PV



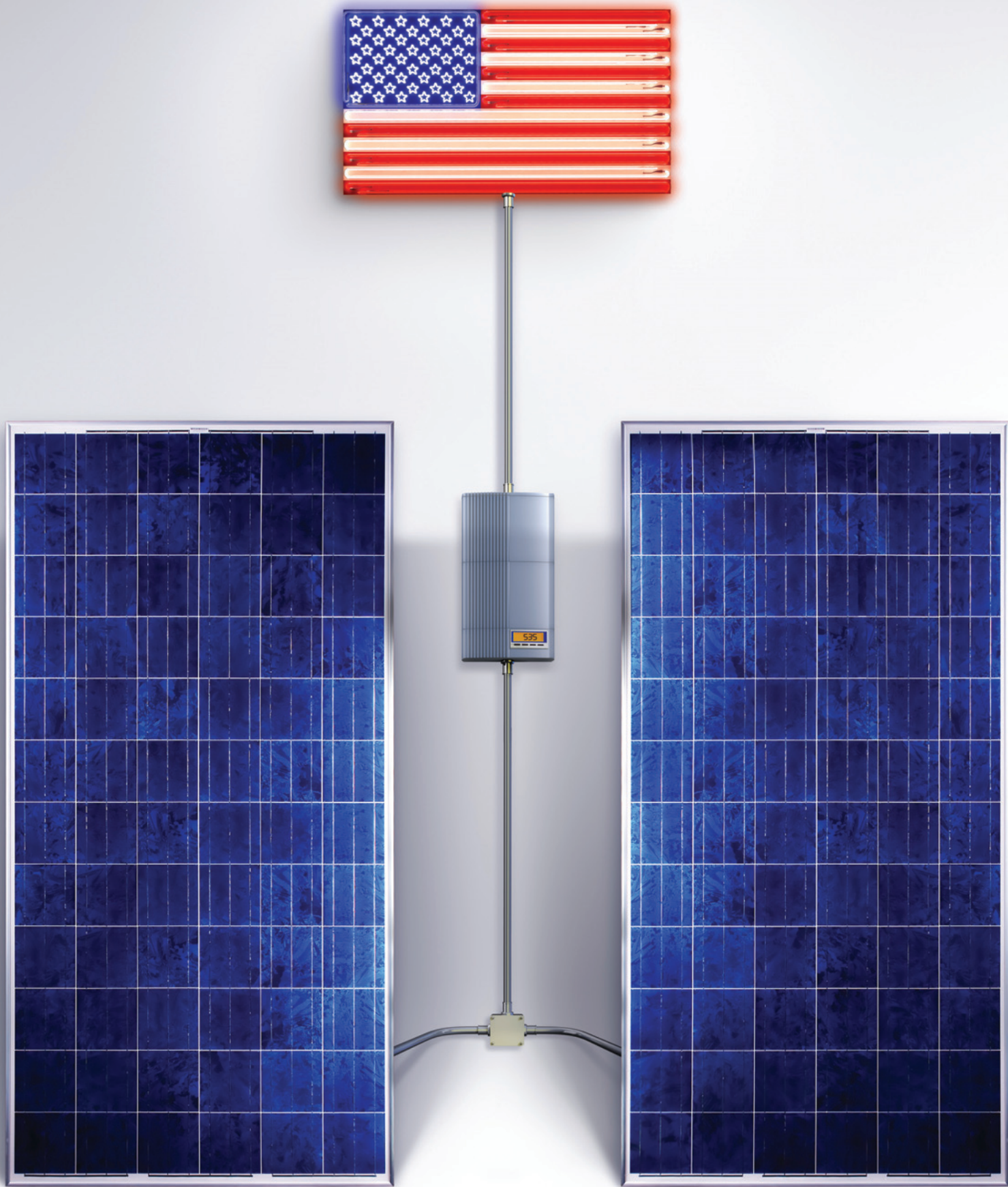
Utility-scale solar

Mortenson Construction, a renewable energy contractor in North America, is widely recognized for their expertise in collection systems, substations, transmission lines, interconnect arrangements, and their rapidly growing PV, CPV, and CSP construction experience. Mortenson has installed nearly 11,000 MW of renewable wind power facilities and utility-scale solar power systems over the past 16 years.

Mortenson Construction

www.mortenson.com

Booth 1855



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Solar powering a green future™



Packaging technology for power semiconductors

Semikron has developed a new packaging technology for power semiconductors that does away with bond wires, solder, and thermal paste. The current density is doubled to 3 A/cm², compared with 1.5 A/cm² achievable with standard technology, reducing the converter volume by 35%. Eliminating wire bonds results in a higher current carrying capacity and 10 times the load cycle capability of current power electronics technology. The new packaging is also free of thermal paste. Instead, a sinter layer replaces the thermal paste layer and the soldered base plate. By replacing this, the thermal conductivity between chip and heat sink is improved, resulting in a 30% increase in usable electric current. With SKiN technology, it's possible that a 3 MW wind/solar power converter can be fit into a single switch cabinet. For converters in wind/solar power units, liquid-cooled systems are used, and the compact and lightweight converters used offer customers a competitive edge.

Semikron | www.semikron.com

Booth 1153



Solar racking solution

Ontario-based manufacturer Kinetic Solar offers products such as their K-Flash water-tight flashing system, barn rails for metal roofs, and the cable manager for quick cable management. Now, Kinetic also offers an additional product—the new multi-rail. The multi-rail incorporates all the benefits of their original K-Rack rail with the addition of wider top edges, which enables it to carry two panels in landscape orientation on one rail. This means that when using the multi-rail in an array consisting of three runs of panels, now only four rails are required as opposed to the traditional six. Using this new multi-rail will result in savings of approximately 15% on racking. Combined with the estimated 30% savings in installation time, this provides substantial benefits over traditional landscape mounting methods.

Kinetic Solar | www.kineticsolar.com

Booth 1908



Roll forming profiles

Samson Roll Formed Products Company has been designing, developing, and manufacturing roll formed profiles for over 90 years to serve various industries, including a one-of-a-kind parabolic shaped channel for the solar industry. This roll formed part is the main component of solar parabolic collectors, which are used for a variety of heating and cooling projects. Samson also makes bracket channels designed specifically to support PV arrays. Samson has developed tooling for more than 2,100 roll formed shapes—many of which are tool-free options—from simple angles and channels, to more exotic profiles requiring multi-stage operations. Punching, notching, welding, and bending are some of Samson's value added options that can be incorporated into the roll forming process for substantial savings in handling and processing costs.

Samson Roll Formed Products Company

www.samsonrollform.com

Booth 4946



Wireless monitoring device

OPTI-Solar offers a new, wireless logger for its GT series inverter. The colorful design, large touch screen, and user-friendly software, makes it an ideal option for PV monitoring at home or at work. Other interesting features include external sensors and multiple inverter monitoring with a single logger, as well as a connection to the OPTI central server for web monitoring anywhere. All data is stored in a SD memory card. Users can also receive daily reports and event alarms via e-mail, SMS, and fax, and data can be transferred to a USB flash drive. OPTI-Solar further offers PV Grid inverters for residential and commercial installation with sales and service.

OPTI-Solar | www.opti-solar.com

Booth 120



Copper & aluminum compression terminals

BURNDY has announced the expansion of the wire range for its BREAK-AWAY HYLUG line of copper and aluminum compression terminals for the solar energy market. The BREAK-AWAY HYLUG provides maximum field flexibility by allowing the installer (using the BREAK-AWAY feature) to easily convert a two-hole terminal to a one-hole terminal to best suit the specific application. The BURNDY UL Listed and CSA Certified BREAK-AWAY HYLUG line of terminals is rated to 90° C, 600 volts to 35kV. With a slotted second stud, the BREAK-AWAY line of terminals can conform to various bus bar dimensions. For additional flexibility, the Narrow Tongue design allows the terminal to fit into tight spaces. Additionally, the BREAK-AWAY line of terminals accommodates a wide range of conductor combinations including AWG, Compact, DLO, Flex, and Metric.

BURNDY | www.burndy.com

Booth 4253



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2. Launch application to scan this code.



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Less Guts, More Glory

the new KACO blueplanet 00xi transformerless inverter series

KACO has worked closely with installers all over the US to provide them with the most reliable and efficient products and technology. Now KACO plans to usher in a new era of solar. KACO has launched a **transformerless inverter** series like you've never seen.

These inverters **produce more kWhs** than ever before. They **enhance efficiency numbers** by using a single stage DC conversion process. The **low component** count makes this inverter series the **most reliable and lightest** in the world.

Best Performance

KACO transformerless inverters have a maximum efficiency of 97.2% and are already 90% efficient at 35 watts of input power

Newest generation IGBTs provide accurate and reliable operation

Highest quality chokes and microcontrollers ensure maximum performance and longevity

Highest Reliability

Sealed outdoor enclosure protects power electronics from insects, dust, humidity and ocean air

Redundant high quality power capacitors increase lifetime

3.3 GW of KACO PV inverters are in operation around the world - These are the most reliable inverters you can find

Easiest Installation

Minimize mounting time to approximately 15 minutes with the **easyinstall** T-bracket

Up to 50% lighter than comparably sized inverters

DC Disconnect housing includes a code compliant string combiner with four fused DC inputs

We turn passion into power



Solar module cleaning system

Schletter has unveiled a new PVSpin (patent pending), a unique system that was developed as a means to effectively clean module surface areas for improved power production. Unlike conventional methods of cleaning photovoltaic modules, which use brushes and rods, the PVSpin System uses water pressure to rotate two large circular cleaning heads while spraying the modules with a clean, steady flow of water. The operator guides the device up and down the panel surface area reducing the cleaning time as compared to hand-held brushes. PV modules drop in efficiency as soil builds up on the module surface. This is especially the case in dry, sunny locations where many such systems are located. The PVSpin is a direct answer to this issue, and will result in greater energy payoffs for owners of solar systems.

Schletter Inc. | www.schletter.us

Booth 5145

If only everything was as predictable

1986



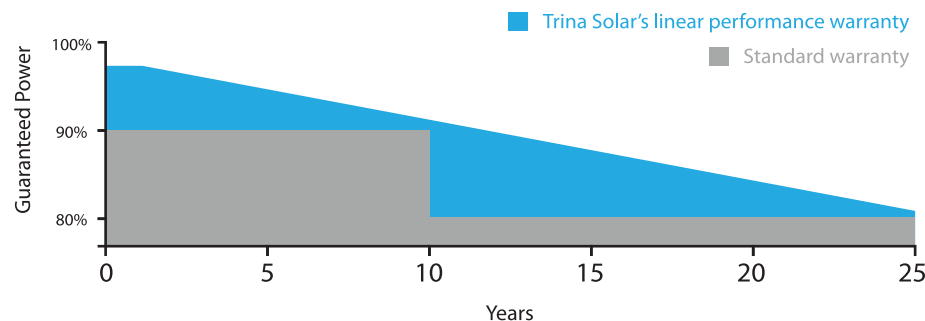
25 years later...

2011



With our new 25 years linear performance warranty and our 10 years workmanship warranty, you know the minimum electricity output your system will be delivering, year after year. And this for the next 25 years. If only everything could be as predictable...

NEW linear performance warranty



Trina solar
The power behind the panel



Vertical integration solar modules

Renogy is a global producer of solar ingots, wafers, cells, and modules, ensuring reduced cost at each step in the production chain. Vertical integration enables Renogy to carry out quality control processes, while offering competitive pricing. Product insurance is now available for Renogy's panels, which protects customers from economic losses by offering full coverage and guaranteed product quality and performance.

Renogy | www.renogy.com

Booth 5619



Aerial solar measurement reporting

Aerialogics, a pioneer in aerial measurement services for the roofing and insurance industries, announces Aerial Solar Reports (ASRs). Utilizing Aerialogics' aerial CAD technology, aerial solar reporting provides credentialed PV installers with accurate, diagrammed, roof measurements, combined with a first-of-its-kind shadow mapping solution that provides authoritative documentation for preliminary estimates, finished proposals, and permit filings with to-scale diagrammed measurements produced in custom presentation PDF and CAD formats. Order online and ready in 24 hours, roof measurements are accurate to one- to two-percent of actual measurements. Plus, the shadow mapping solution provides authoritative shade-cast diagrams for any roof structure nationwide. Get a 360° view of any project from the air and get more done in less time; expedite estimates and permit documentation with Aerial Solar Reports from Aerialogics.

Aerialogics | www.aerialogics.com

Booth 7012



Mono- & polycrystalline solar modules

The Upsolar team secures strategic partnerships with reputable and forward-thinking companies in the industry, allowing the company to incorporate the latest balance of systems solutions directly into its modules. Upsolar is partnering with Tigo Energy and Zep Solar to bring added value to Upsolar’s complete line of mono- and polycrystalline solar modules. Upsolar is showcasing Tigo Energy’s Module Maximizer, which actively manages the performance of the PV system, while significantly increasing the systems’ energy harvest. Zep Solar’s integrated mounting solutions reduce the amount of hardware and time required to install a solar array, allowing for simple installation and alignment, as well as overall improved aesthetics. They’re featured in tandem with a series of Zep-compatible Upsolar modules. The two technologies allow customers to accelerate their return on investment and get the most out of their installations at all times.

Upsolar | www.upsolar.com
Booth 2127



Construction & development of renewable energy projects

For more than a decade, Renewable Energy Systems Americas Inc. (RES Americas) has developed, constructed, owned, and operated renewable energy projects. RES Americas offers in-house expertise in resource analysis, development, site design, procurement, engineering, and construction through to operations. This in-house accessibility ensures a smooth transition from one project phase to the next, so budgeted costs and project deadlines are met on time. RES Americas can sell its developed and constructed projects to others, construct projects developed by others, and own and operate projects. They have constructed over 4,200 MW, and have over 1,000 MW under construction, including one of the largest solar projects in the country.

RES Americas | www.res-americas.com
Booth 6538

Commercial & residential solar infrastructure

Unirac offers commercial and residential solar infrastructure products from its expansive portfolio, including the redesigned ISYS Ground Mount. ISYS Ground Mount (IGM) provides engineering and design support, code compliance, availability, installation speed, and reliability. IGM is the only ground-mounted racking system that offers module pre-assembly, allowing for further reductions in project time and cost. IGM is optimized for commercial and utility projects, ranging from 500 kilowatts to gigawatts, and custom designed for each customer’s unique module and site conditions. To accompany their line of products, Unirac also offers free mobile tools for installers, including the U-Clinometer, which measures roof tilt and pitch, and a mobile QR Code Reader to make instructions easily accessible and reduce paper waste/packaging. These are available online in the App Store for iPhones.

Unirac | www.unirac.com
Booth 3037



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TYPE	CAPACITY Amp-Hours (AH)			VOLTAGE
	5-Hr Rate	20-Hr Rate	100-Hr Rate	
IND9-6V	355	445	545	6 VOLT
IND13-6V	533	673	820	6 VOLT
IND17-6V	711	897	1090	6 VOLT
IND23-4V	977	1233	1500	4 VOLT
IND29-4V	1245	1570	1910	4 VOLT



Solar project planning, management & design

White Construction offers a complete range of services for clients ranging from thermal to PV, and from ground-mount to roof-mounted systems. Displaying technical expertise and a keen awareness of the emerging solar market, White Construction has the ability to pull from their strengths in other renewable markets and offer constructive approaches to solar power initiatives. Services offered are: site planning; storm water management; financial analysis; project management; electrical design; road design; foundation design; commissioning assistance; as well as, a self-performing construction approach.

White Construction | www.whiteconstruction.com
Booth 630



Linear motion solutions

Servomech offers a wide range of linear motion products that can enhance performance and drive down cost. From conceptual ideas to designs and manufacturing of new products, Servomech delivers linear motion solutions in the form of linear actuators, screw jacks, as well as Acme and Ball screws to industrial applications.

SIPCO Mechanical Linkage Solutions
www.sipco-mls.com
Booth 4143



Turnkey PV systems

SOLON delivers complete and cost-effective turnkey photovoltaic (PV) systems to its partners with a streamlined approach from project development, design, and construction to financing and operation. With the launch of their latest solutions for commercial and utility-scale systems, SOLON's innovative design continues to lead the way in solar PV.

SOLON | www.solon.com
Booth 3820



Solar system controllers

RESOL's product portfolio includes solar and heating controllers, as well as a broad range of accessories. The new DeltaSol BX L system controller has been especially developed as an economical solution for multi-tank solar thermal systems. It has an extra-large display and an intuitive operating interface, which features pre-programmed system layouts for a range of two- and three-tank systems, as well as special functions such as an extended priority and loading logic. The BX L is also equipped with a thermal disinfection function to protect the DHW store against Legionella, a heat dump option to avoid system overheating, an evacuated tube collector function, a thermostat function, and more. With the integrated SD card slot, system data can easily be logged and transferred to a computer. The DeltaSol BX L also has a RESOL VBus interface, which allows for controller connections to additional modules such as remote displays and data loggers. It's cTUVus certified.

RESOL | www.resol.com
Booth 3928



Steel galvanizer

Corrosion costs the US economy almost \$300 billion annually. A solution to this problem is hot-dip galvanizing as provided by AZZ Galvanizing Services. AZZ Galvanizing Services, a division of AZZ, incorporated, is the largest steel galvanizer in the US, owning and operating 33 hot-dip galvanizing plants strategically located nationwide. AZZ has provided cost-effective, maintenance-free, environmentally safe corrosion protection for more than four decades, introducing unique processes such as GALVXtra to deal with the challenges of today's competitive standards. AZZ operates kettles ranging from 25 to 62 feet in length. With the company's network of plants, it's able to accommodate the largest projects with customized turnaround time at a competitive price. GalvXtra, its unique nickel-zinc alloy process, helps meet the highest quality standards that are necessary in the vastly competitive after-fabrication steel market. AZZ's goal is to help customers assure the function, durability, and safety of their products for generations.

AZZ Galvanizing Services
www.azzgalvanizing.com
Booth 7054



Supply & return lines

Solar-Trac offers flexible, corrugated stainless steel insulated and un-insulated supply and return lines for residential and commercial solar heated domestic hot water systems. Solar-Trac's advanced corrugated tubing, coupled with Solar-Flare self-flaring fittings, offers installers the highest levels of quality for tomorrow's energy.

Solar-Trac | www.solar-trac.com
Booth 6739

A Leader in Engineering Energy Solutions



Ulteig delivers innovative services to support emerging renewable and sustainable energy solutions. We are recognized energy leaders and have provided services and expertise on projects worldwide.

We are a leading provider of engineering services in the renewable energy industry. Ulteig has the expertise and capabilities to design solar power systems, including complete PV solar power plant design packages, that meet your needs.

For more information about the many services Ulteig has to offer, visit our website at www.ulteig.com.



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SOLON Superior Solar Solutions.

Last year we introduced the world's first preconfigured, modular solar power plant, were awarded PG&E's 2010 Generation Supplier of the Year, and reached more than 1 GW of modules and 250 MW of systems installed worldwide.

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SOLON 



PV inverter

Ideal Power Converters (IPC) has developed and patented a new current-modulation PV inverter technology, and is displaying its initial product—a 30kW 480VAC three-phase PV inverter—for the US commercial market. The IPV-30kW-480 is a 94-pound inverter that weighs 90% less than conventional voltage-source inverters. The IPC inverter supports grounded PV arrays with unipolar (GND, 600VDC) or bipolar (-500, GND, +500VDC) configurations. The lightweight wall-mount inverter reduces installation costs by \$0.10 to \$0.20/Wdc. It can be mounted in locations, such as utility rooms and rooftops, which aren't practical for 1200+-pound inverters. IPC has installed several early production units, and is completing UL certifications.

Ideal Power Converters | www.idealpowerconverters.com

Booth 118



Foundation products

MacLean-Dixie Helical Foundations feature a complete line of cost-effective steel earth foundation products for commercial, residential, marine, and solar applications. MacLean-Dixie provides products for remediation and new construction projects, including end-bearing deep foundations, helical screw tension anchors, and helical tieback systems. MacLean-Dixie Strength Squared square engagement cast coupling system provides higher strength, lower cost foundation system that forms perfect male-to-female fit on all of its foundation systems. MacLean Dixie is a business unit of MacLean Power Systems and includes the Joslyn and Dixie brands, which have supplied anchoring systems since the 1920s.

MacLean-Dixie Helical Foundations

www.macleandixie.com

Booth 4559



DC power management technology

eIQ Energy's vBoost DC-to-DC converter module increases system energy harvest and enables solar panels to be connected in parallel, rather than in series. This reduces overall system cost and provides benefits for designers, installers, and operators. vBoost's advanced DC power management technology allows over 180kW of solar to be installed with only a single pair of electrical terminations. This helps to reduce the cost and time required for a solar installation. With distributed MPPT built in, vBoost-equipped systems can harvest 5% to 30% more energy than conventional installations. Additionally, the Parallel Solar technology collects and reports detailed data on panel performance with no extra wiring, providing excellent operational visibility and reduced risk for system owners as long-term performance of each system component can be monitored and assured.

eIQ Energy | www.eiqenergy.com

Booth 815

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www.upsolar.com



PV solar modules

Phono Solar is one of the largest producers of photovoltaic solar modules. Recognized for quality, their modules feature PTC ratings of 91%, efficiencies of 15.4% and higher, and are consistently ranked in the top 1% of approved suppliers on the CEC list. The innovative group has just launched their new AC modules, which eliminate the need for expensive DC wiring and centralized power inverters. Also new are the Phono Solar high-efficiency cell (HEC) panels, which offer +3% positive tolerance and are sorted on pallets by current to maximize power generation. The group also offers high wattage options for large-scale projects through their T series 260W to 300W panels. Phono Solar has a strong history of financial backing, enabling the company to offer firm bankability on their 25-year warranties. Now, Phono Solar is actively pursuing their new developer strategy, ready to finance projects through to completion.

Phono Solar | www.phonosolar.com
Booth 5839



Flexible solar solutions

Heilind Electronics, the largest inter-connect distributor in North America, maintains a large inventory of solar products including combiner boxes, junction boxes, couplers, connectors, relays and switches, grounding products, and solar labels from various solar manufacturers. For example, products include the SOLARLOK portfolio, SolarSpec, and Helios PV connectors. The SOLARLOK connector system delivers a flexible and comprehensive solution for reliable connections between PV modules and DC/AC converters. The SolarSpec family features junction boxes, connectors, contacts, and cable assemblies—a high-quality, low-cost solution for the solar market. And, the Helios line of PV connectors can be used with solar panels, combiner boxes, and inverters. Heilind's product portfolio reduces installation times and delivers flexible solutions for solar applications.

Heilind Electronics | www.heilind.com
Booth 6562

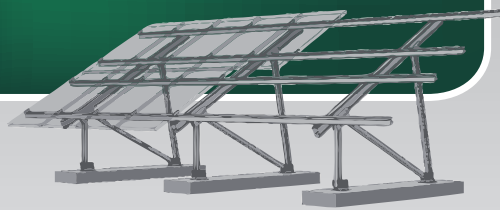


Solar tracker

Maximize a return on investment and generate more solar power with the proven SPG Solar SunSeeker Tracker. With over 38 MW installed nationwide, this high-performing single-axis tracker follows the course of the daily sun, generating up to 20% more solar power. With a robust, yet streamlined design, few moving parts, corrosion-resistant steel, and an efficient installation process, the SPG Solar SunSeeker Tracker is built to perform and last.

SPG Solar | www.spgsolar.com
Booth 2549

PVMax™ Ground Mount System — Turn a Landfill into a Solar Field with a Custom Mounting System Designed for Installation on All Terrains



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Visit WWW.PVMAX.US or call technical sales at 520-289-8730



Integrated solar combined cycle technology

Integrated Solar Combined Cycle (ISCC) technology brings solar power together with the benefits of combined cycle technologies for clean, efficient energy production. In an ISCC plant, solar energy supplements a combined cycle and reduces the required fossil fuel. Due to its maturity and proven track record, the solar technology used in ISCC plants is typically through trough systems, but solar power towers could also be used. Many benefits exist for utilities when using ISCC technology. Concentrated Solar Power (CSP) can be easily integrated into conventional power cycle plants or combined cycles at a low additional cost. Plus, CSP is ideal for supplying peak electricity demands, which are during the day. Lastly, CSP energy can be managed with hybridization and storage, providing clean and consistent electricity during non-daylight hours.

Abengoa (Teyma) | www.abengoa.com
Booth 6923



ETL certified panel mount DC solar connectors

Wieland's PST 40i1 DC solar connectors now include ETL certification for their panel mount (bulkhead) connectors and field assembled units. ETL certification assures users that Wieland PST 40i1 panel mount connectors have been tested by an independent testing laboratory and conform to applicable performance and safety standards. Rated to 40A DC, use the panel mount connectors for enclosure applications including DC-DC converters, combiner boxes, and transition boxes. External installation of panel mount connectors allows an enclosure device to be tested off-site and shipped ready to install in the field. The contact's wire size ranges from 2.5mm² (14 AWG) through 10mm² (8 AWG), allowing for higher gauge wire to mitigate voltage drops. Connector resistance, typically below one milliohm, minimizes power losses. NEC code requires a tool to disconnect the PV connection. Wieland PST 40i1 connectors provide a low-cost solution using a safety clip, which can be removed with a standard screw driver.

Wieland Electric Inc.
www.wielandinc.com
Booth 1031



Automated solar module assembly

KUKA Systems, a systems integrator, manufactures automated solutions for crystalline silicon and thin-film production, including entire assembly lines. Their technologies cover wafer, cell, and module production. In module assembly, KUKA Systems' product portfolio covers every process, from glass handling, string layup, and crosstieing, to all aspects of framing, lamination, and testing. When combined as part of partially or fully automated assembly lines, these automated processes give manufacturers economies-of-scale and around-the-clock reliability to achieve the highest quality at the lowest cost. KUKA Systems' expertise in building solar module production lines leverages decades of experience automating assembly lines for some of the world's largest automakers. As a turnkey vendor, KUKA Systems designs the layout of each line for optimal results, provides all hardware, software, and control systems, and manages the installation and commissioning at the customer's location.

KUKA Systems
www.kuka-systems.com
Booth 4332



Central inverters

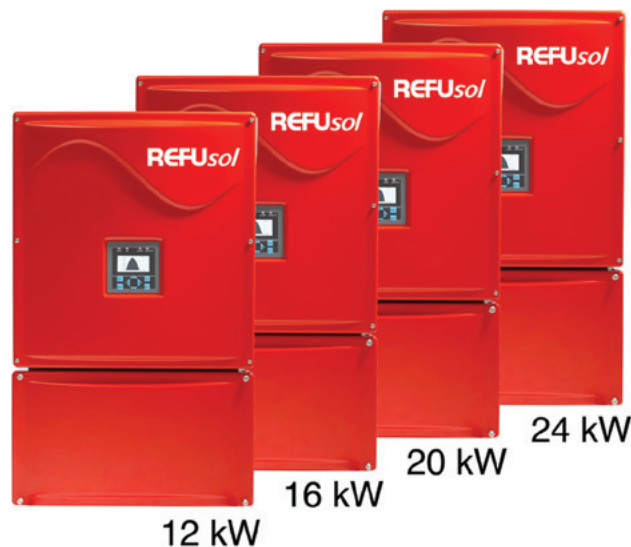
Ingeteam offers a new range of Ingecon Sun Power Max HE TL high-efficiency central inverters, with rated powers of 500kW and 625kW for "behind the fence" projects. These inverters can also be supplied without an AC output cabinet (version NAC) to make the best use of available space in the technical rooms in which they are housed. A key feature of these inverter models is their high performance, achieving values of up to 98.5% in the case of the Ingecon Sun 625HE TL model. Their modular design—as independent electronic blocks—provides increased system availability, should any incidents occur, as well as ease of maintenance. The integrated solution can include the Ingecon Sun Power Max MT, up to 1,250kW, featuring MV transformer, medium-voltage switchgear, steel-aluminum enclosure with fully integration of inverters, AC distribution panels, electrical gear, and customizable to suit the requirements of each particular customer.

Ingeteam | www.ingetteam.com
Booth 1013

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Booth #115

REFU Solar Electronics Inc.
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info-usa@refusol.com



LED enclosure light

The STEGO LED 025 offers an 870 lumen output at 6500K daylight color temperature. Units are available in commonly used AC or DC voltages. Power consumption is a mere 5W, less than half of equivalent fluorescent lights, and the service life is 60,000 hours, six times the life of a typical fluorescent. Screw- or magnet-mount options are available and it's possible to "through feed" or "daisy chain" from one light to the next, connecting up to 10 lights from the same source. Best of all, these lights come complete with integral power supplies. UL recognized, and CE and RoHS compliant.

STEGO Inc. | www.stegousa.com
Booth 4359

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*All**

Mounts for all PV modules on the market.
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Full layout and loading analysis for every project.



Renewable energy batteries

MK Battery is the supplier of Deka Solar Batteries for the renewable energy industry. Deka Solar Photovoltaic Batteries, manufactured in the US and deployed on all seven continents, exceed the highest quality standards of the alternative energy industry. The Deka Solar line includes sealed lead acid GEL and AGM batteries, in multiple configurations, as well as select flooded products. Deka Solar provides quality and environmentally conscious battery solutions.

MK Battery | www.mkbattery.com

Booth 605



Metals fabricating & processing

Elixir Industries, founded in 1948, is a privately held company concentrating efforts to broaden their focus in the renewable energy market sectors. The company has undertaken extensive manufacturing equipment upgrades over the past several months at many of their key manufacturing facilities across the US. They offer full-service metals fabricating and processing, including: advanced CNC laser/plasma cutting; plate cutting; CNC punching and forming; CNC press braking; roll forming; MIG and TIG welding; primer; powder coating; aluminum extrusion; aluminum fabrication; robotic welding; and, advanced CNC water-jet fabrication. Elixir Industries continues to offer new and existing customers lasting relationships based on quality, service, and adaptability. Their restructuring efforts, combined with equipment upgrades and a strong financial position, provides Elixir Industries with a solid foundation to support customer success.

Elixir Industries | www.elixirind.com

Booth 6159



Mounting systems

CreoTecc mounting systems, manufactured in the USA by Session Solar, are proven to reduce module installation time while providing increased flexibility and durability. With over 125 MW installed worldwide, CreoTecc mounting systems are compatible with all common mounting fixtures and module frame widths. CreoTecc provides superior module retention without the use of clamps and the labor-intensive tasks usually associated with traditional clamping methods. No need for clamping on the modules, and no tedious screwing required. Inserting modules is fast, easy, and secure. CreoTecc mounting systems allow contractors to compete on cost and aesthetics.

Session Solar | www.sessionsolar.com

Booth 1301

LEADING ENERGY PAYBACK

With our FBR silicon technology, REC uses 90 percent less energy to produce silicon. This gives our modules an industry-leading energy payback time of one year and a light carbon footprint. Learn more about how we are innovating for value right here in the US by visiting our booth at Solar Power International.

REC BOOTH # 3229



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The new Radian Series is an integrated power appliance that does it all

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- 8000 Watts of continuous power, flexible design for systems from 8 to 80kW
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- Simple to design, install, and maintain
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- High reliability and dual power modules minimize downtime risk

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October 17-20, 2011
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Solar siting & permitting

Ecology and Environment, Inc. (E & E) offers all the professional environmental support required to site, permit, and operate solar energy generation and transmission facilities. E & E's skilled, multidisciplinary project teams can help developers get the "green light" faster. E & E covers all the bases—from water supply, wetland considerations, and ecological impact studies, to land use, socioeconomic analysis, and community outreach. Operating from 41 locations from coast to coast, including a new Canadian office, the company offers over 40 years of service to the energy industry. It recently helped a developer to quickly obtain permits for its 45 MW California PV project. Now in commercial operation, it's one of North America's largest solar facilities. Altogether, E & E is supporting over 800 MW of PV capacity.

Ecology and Environment, Inc.

www.ene.com/service/energy/solar.aspx

Booth 6914



Solar monitoring

Moxa has released the IA3341 Series, which is designed for solar power and environmental monitoring applications, is based on the MOXA ART ARM9 industrial processor, and features two RS-232/422/485 serial ports, dual LANs, 4 digital input channels, and 4 digital output channels. In addition, the IA3341 computer has two analog input channels and two thermocouple channels, making it the ideal solution for a variety of industrial applications. The IA3341 was designed with the following three concepts in mind: integration, acceleration, and cost-effectiveness. This provides customers with a better and smarter industrial solution. The IA3341 is rugged and industrial-grade, providing computing for any harsh industrial environment. In addition, the open source Linux platform gives programmers a convenient tool for developing sophisticated, bug-free application software at a lower cost.

Moxa | www.moxa.com

Booth 6309

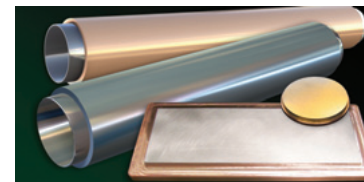


Racking solutions

The InstaRack ballasted solar racking system, manufactured by Sollega, is designed to reduce labor and shipping costs for low-slope flat roof solar installations. It's manufactured from HDPE (high-density polyethylene), utilizing 35% recycled content with a built-in UV inhibitor. InstaRack is available in tilt angles of 10° and 15°. The modular design ensures compatibility with all solar panels 30 inches to 44 inches in width. Its one-piece molded unit design requires only one tool for installation, and uses readily available rails. The Sollega QuickSnap, a new attachment method for PV modules developed in partnership, clips on the edge of the module with no hardware and snaps into the strut. The InstaRack is wind tunnel tested to 120mph. Sollega provides array layout, design engineering services, as well as wind and ballast calculations.

Sollega | www.sollega.com

Booth 242



Rotary sputtering targets

Indium Corporation is featuring its newly developed copper-gallium and indium rotary sputtering targets. The targets are made by Indium Corporation's vertically integrated proprietary process, utilizing aerospace powder metallurgy technology. The production process output produces a consistently homogeneous alloy, with low PPM contaminate levels and consistent density throughout the target, resulting in very consistent sputtering film properties. The Cu/Ga targets can be produced in chemistry ranges from 50% to 80% Cu atomic weight. The In targets are typically 4/9-5 plus grade. They are both produced as a monolithic material, bonded onto the backing tube during Indium Corporation's unique hybrid consolidation process.

Indium Corporation's

www.indium.com/solar

Booth 4939



Adhesive & sealants for solar systems

Sika supplies a full range of engineered silicones, polyurethanes, and modified silane adhesives and sealants, as well as wide roll EPDM and butyl tapes that meet the stringent performance demands of customers in the solar energy industry. Sika exceeds the standards of innovation in their products for assembly operations and field installation, and in services offered for engineering support. Although solar applications are extremely varied, the systems share the same need for demanding performance. Sika offers solutions that have been optimized to provide for long-term performance, curing speed, and increased process through-put capabilities. Coupled with comprehensive global project support, Sika is an ideal partner to manufactures of PV, solar thermal, and concentrating solar power systems.

SIKA | www.sikausa.com

Booth 4965

Intelligent pyranometer series

Customer feedback, new technology, and engineering expertise have resulted in a new generation of pyranometers from Kipp & Zonen. Equipped with an extremely low-power "Smart Interface," the new SMP pyranometers offer industry standard digital and amplified analog outputs within the well-known CMP series housings. The output range is programmed so that all SMP pyranometers have identical sensitivities, allowing easy installation and exchange for recalibration. Serial communication allows access to measurement data, instrument status, operating parameters, and calibration history. The Smart Interface also corrects for sources of inaccuracy inherent in thermopile pyranometers. The SMP series is perfect for industrial applications, especially in solar energy, and will be available soon.

Kipp & Zonen | www.kippzonen.com

Booth 3824

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Innovative solar racking products, dedicated customer service and proven system designs are why over 55 MW of TTi products have been installed since 2005. TTi engineers and manufactures solar racking solutions with quality and simplicity in mind. Every product has a streamlined installation process, minimal maintenance required and designed to last for 20+ years. From rooftop to ground mount systems, TTi provides robust and reliable solutions to maximize return on solar investments.

TTi FLATJACK®

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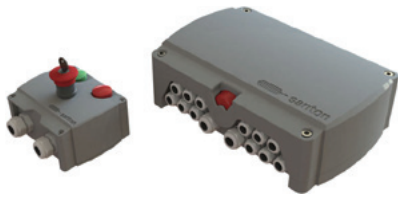
TTi ADJUSTABLE TILT GROUND MOUNT (ATGM)

Flexible and robust racking solution with seasonal adjustability and rapid assembly

TTi SUNSEEKER®

Increase power output by up to 20% with high performing single-axis tracking system to maximize return on investment

Visit www.ttisolar.com to learn more or call 415-446-0103.



Switchgears

Santon develops, produces, and maintains DC switchgears, and has for over 60 years. With the X-Type Switch (16-30A), P-Type Switch 40 -100A), E-Type Switch (250A), Silios range (switches in a box), and the Firefighter Safety Switch, Santon offers a complete range of DC safety switches for many applications. The Firefighter Safety Switch, which has been redesigned to make it more compact and easier to install, is their latest solution. It can isolate a PV installation quickly, completely, and remotely with one simple action. The Firefighter Safety Switch uses a motor driven switch located as close as possible to the PV panels, and can be operated (both on and off) remotely.

Santon | www.santonswitchgear.com
Booth 122



Inclinometer

US Digital has released two new communication protocols for its T7 absolute inclinometer, widely used within the concentrated solar power market. The versatile inclinometer is now available with RS485 or Modbus protocols. RS485 communication allows for T7 signals to be transmitted over long distances, along with the ability to network multiple T7s on the same cable run. Modbus now allows the T7 to communicate by means of an industry standard protocol to most PLCs offered on the market. The addition of two new T7 communication protocols, along with the existing RS232 and CAN communication, makes the T7 one of the most easily applied inclinometer on the market.

US Digital | www.usdigital.com
Booth 6225

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Solar actuators & custom designs

Joyce/Dayton, a global provider of solar tracking actuators, has been meeting solar specific requirements for nearly two decades. Their products are currently in use on major installations worldwide to move PV systems, large arrays in utility and commercial installations, heliostats, CPV, and in silicon ingot production. Whether choosing their solar actuators (SA), jacks and ComDRIVEs, or a custom-designed solution, Joyce/Dayton engineers and solar specialists are experienced and committed to the solar industry.

Joyce/Dayton Corp.
www.joycedayton.com
Booth 6823

SOLiViA®

The heart of your PV system



Long Life. Maximum energy harvest. Easy installation.

Delta's new high-frequency grid-connected solar inverters, designed for the North America market, feature world class efficiency and reliability to ensure years of high performance and trouble-free operation. The SOLIVIA inverters offer output power of 2.5 kW, 3.3 kW, 4.4 kW and 5.0 kW and exciting SOLIVIA features that make your life easier.



High performance

SOLIVIA solar inverters have intelligent MPP tracking and high efficiency, ensuring maximum performance from your solar modules under all operating conditions.



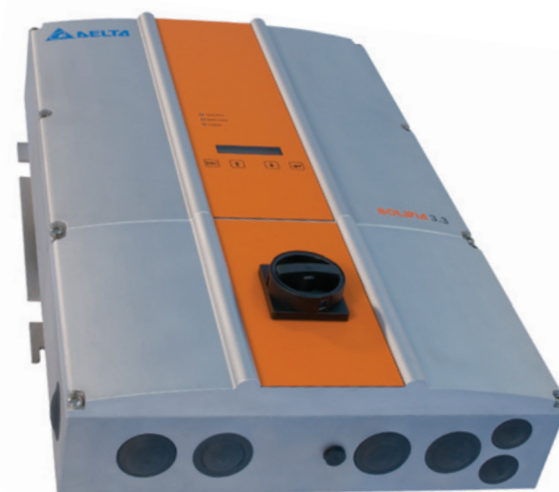
For indoor and outdoor use

A durable die-cast aluminum chassis and a NEMA 4 enclosure rating allow you to position the SOLIVIA solar inverter indoors or outdoors, worry-free for the life of your PV system, knowing the unit is dust-proof, completely safe to touch and protected from moisture damage.



Wide operating temperature range

SOLIVIA solar inverters feature industrial grade components to provide one of the widest operating temperature ranges available. Full power up to 122 °F (50 °C) without derating, maximizes energy harvest and ensures maximum return on your investment.



Visit us at Solar Power International 2011 in Dallas, TX, Booth 3901, or follow us on our website www.solar-inverter.com/na and on facebook @ "SOLIVIA Solar Inverter from Delta"!

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www.solar-inverter.com/na



Solar conformal coating

Targeted for solar and related applications, the UV40 SOLAR was formulated for use under prolonged exposure to sunlight and resists discoloring and degradation. This one-part low viscosity, conformal coating is targeted for solar CPV (Concentrated Photovoltaic Technology) cells and weather-exposed systems such as LED signs and displays. This is new technology and has the advantage of being much smaller but, at the same time, providing lower cost and higher efficiencies than standard PV cells. The UV40 Solar has similar properties as the standard UV40 with superior weathering resistance. HumiSeal Solar coating is non-yellowing and compliant with SAE-J-1960 standard (QUV accelerated age testing).

Krayden, Inc. | www.krayden.com

Booth 5662



Grid-tied PV inverters

The ISGA Series Grid-tied PV Inverters feature a transformerless design, which doesn't incorporate a cooling fan. Naturally, with no moving components, the ISGA Series will have longer, maintenance-free product lifespan, and has a warranty of up to 10 years. The ISGA Series are available in 2.2kW to 5.3kW outputs with a 240VAC 60Hz output, and an output efficiency of up to 96.4%. They can accept 150-450VDC inputs, up to two strings/two MPP trackers. The input is protected from overvoltage, ground faults, reverse polarity, and surges.

The ISGA PV Inverters feature an environmentally robust and durable powder-coated metal housing with a NEMA3R outdoor rating, and can operate from -4° F to 122° F (-25° C to + 50° C). They come standard with an RS232 output with RS485, Ethernet, USB, and Web Server also available as optional communications outputs. They're CE marked and ETL approved to meet all relevant standards.

CARLO GAVAZZI Inc.

www.carlogavazzi.com

Booth 920

INTRODUCING THE ACCELERA® 300 HEAT PUMP WATER HEATER: ACCELERATE YOUR SAVINGS!



Energy from nature.

The new Accelera® 300 can extract up to 80% of its energy requirements from the air around it. Heat pumps have been around for decades, but a heat pump water heater is a brand new concept. The Accelera® 300 works like an air conditioner - but instead of dumping the heat outdoors, it puts it into the water.

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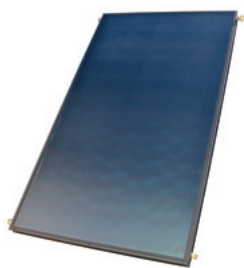
Solar 3D roofing report

EagleView Technologies offers a solar 3D roofing report for integrators and installers to calculate solar exposure, roof square footage, and panel placement by utilizing extremely accurate measurements for pitch, square, and lineal footage. The detailed, accurate 3D image of the building allows EagleView to generate diagrams such as rafter lengths, grid layout, solar orientation, and azimuth. These diagrams provide the foundation installers need to streamline the estimating and installation process for solar applications.

EagleView Technologies

www.eagleview.com

Booth 435

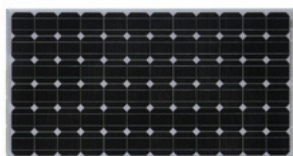


Flat plate collector

California-based solar hot water manufacturer Heliodyne has re-designed their flagship product, the GOBI flat plate collector. It has undergone several changes, which have resulted in aesthetic improvements, along with higher energy production. Structurally, the frame of the collector has been reshaped with rounded edges and a thinner profile. The GOBI's thickness has been reduced from 3.9 inches to 2.8 inches, making it the thinnest collector currently available in North America. The frame re-design has also decreased the weight of the collector for easier handling. Inside, a full plate, laser welded absorber has replaced the fin absorber plate used in previous GOBI models. A new type of foam insulation has been implemented that helps minimize heat loss. The collector was tested and re-certified by (SRCC), which recently published improved energy performance calculations for the GOBI.

Heliodyne | www.heliodyne.com

Booth 4120



Complete system provider

MAGE SOLAR specializes in offering complete solar systems—from modules to mounting solutions and brand-name inverters to value-added financing services. MAGE's signature, high-quality maximum-efficiency MAGE POWERTEC PLUS modules are produced at their North American headquarters in Georgia. The mono- and polycrystalline modules are UL-listed, ARRA-compliant, and come with industry leading +5 watt tolerances, a 10-year product warranty, and 30-year 80% power guarantees. The company is also introducing its own new-generation mounting system, SYSTEMTEC, and a host of financial services for its partner businesses, including loan and lease-programs to inventory financing. MAGE SOLAR ACADEMY is a subsidiary of MAGE SOLAR and offers committed, multifaceted PV-industry training for professionals across the nation with high-end technologies and extensive indoor-outdoor simulation areas.

MAGE SOLAR | www.magesolar.com

Booth 1831



Planning, construction & project management

CH2M HILL specializes in strategic planning, permitting, designing, and construction services for concentrated solar thermal, photovoltaic solar, and concentrated PV solar for clients worldwide. CH2M HILL serves the entire solar value chain—ranging from polysilicon plants and high-volume solar products manufacturing to solar power generative facilities with more than 600 MW of power production capability and 10 years of experience in the PV facility design. CH2M HILL's comprehensive range of services for these projects include performance modeling, economic analysis, technology review, permitting, industrial engineering, design, construction, procurement, as well as operations and maintenance. Their broad range of engineering and project management capabilities allow them to provide clients with the lowest cost of energy and the highest-quality project.

CH2M HILL | www.ch2mhill.com

Booth 750

powering change®

Webberville Solar - 30 MW
 Powering change for RES Americas
 Jitendra Morankar - Solar Engineering Manager

Founded in 1997, Renewable Energy Systems Americas Inc. (RES Americas) is a fully-integrated renewable energy company. We are a leader in the industry with over 5,200 MW of projects constructed or under construction and our in-house expertise: resource analysis, development, site design, procurement, engineering, construction, through to operations.

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Weather systems

Lufft USA is promoting their weather systems for solar projects. Lufft offers easy solutions to fulfill any climate-monitoring requirement. Lufft's WS301 and WS501 are part of the WS Family of all-in-one weather stations, integrating solar radiation measurement with wind, temperature, relative humidity, and air pressure. These two models are available with an integrated pyranometer. The WS600 integrates Doppler radar precipitation with the standard weather parameters. Each is maintenance-free, optionally heated, and conveniently compact. The WS Weather station can be integrated into a solar project a few different ways. Lufft USA offers a turnkey system with data loggers, cloud-based data storage, and monitoring—or simply as a flexible component to be integrated into any PLC using ASCII or MODBUS-RTU.

Lufft USA | www.lufftusa.com

Booth 6261



Weathering & testing services

Q-Lab Corporation offers accelerated weathering test equipment and outdoor testing services. Products include the QUV Accelerated Weathering Tester and Q-SUN Xenon-Arc Test Chamber, which are widely used to simulate sunlight and the effects of weathering in a variety of industries, including solar. Durable and cost effective, Q-Lab products meet industry standards and make weathering simple.

Q-Lab Corporation | www.q-lab.com

Booth 4722



Self-performing EPC contractor

As a self-performing EPC contractor with 84 MW of experience, Hypower has vast experience in rooftop and ground-mount solar applications, as well as with solar carports. They can provide everything from conceptual design to value engineering to federal, utility, and commercial customers. As solar and wind projects are multi-disciplinary in nature, Hypower is one of the few companies that offer all of these disciplines under one roof. This means projects are planned, engineered, designed, executed, and managed by one company—beginning with the right customized design and ending with hassle-free grid interconnection and third-party commissioning. Hypower leverages four divisions, and has the capability to augment a developer's forces during any project stage. They have an exceptional safety record, and are committed to using more than 90% of local labor on each project.

Hypower Inc. – Renewable Energy Division

www.hypowerinc.com/renewable

Booth 455

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Solar support structures

Delivering in-house experience, Baja designs highly-specialized engineered solar support structures, engineers light gauge steel structures to perform under any condition or load, and delivers a fully installed system to any jobsite, nationwide. Currently, over 20 MWs of installed solar facilities use Baja's Solar Support System to support the solar modules. Baja Solar Support System is now also the sole provider of a new, emerging market: solar RV/boat storage facilities. In their most recent install, solar panels were attached to Baja's structures, creating the backbone of a 1.75 MWdc solar energy system that was fed back to the grid and monetized using the local utility's Feed-in Tariff. Baja was able to erect the 280 solar canopies (each space approx 12' to 14' x 52') in eight weeks, which also included a wash bay area using the same materials.

Baja Construction
www.bajaconstruction.com
Booth 143



Peak-energy modules

REC Peak Energy series has been designed and engineered to meet the highest quality standards and provide reliable power output over the lifetime of the product. With a robust and durable design, REC's Peak Energy modules are guaranteed to deliver high-performance solar energy solutions for long-term value. Now offered with a black frame, the REC Peak Energy series is designed to suit any application. The new generation module provides more power per square foot with an efficient cell and glass design, and an average increase of nine watts per module compared to the third-generation module. In addition, the modules are manufactured at REC's facility in Singapore, which is one of the most integrated and automated in the industry, allowing for tight quality control and precision throughout the manufacturing process.

REC Solar US LLC | www.recgroup.com
Booth 3329



Solar carports

Solaire Generation's Premium, Solaire 360, and Solairis solar carports' design, innovation, and technology transform commercial parking lots into beautiful solar power plants. The Premium and Solaire 360 solar canopy models feature a unique, dual-incline design that generates high-energy yields and protects against sun, rain, snow, and ice. The Premium solar carport also features an integrated decking and gutter system that adds safety and security to the solar system, while also offering an option for water reclamation. Solaire Generation's Solairis carport offers a unique single-tilt design, suitable for regions where snow and ice are not a concern. Solaire's ground-breaking designs can feature integrated advertising and branding, water reclamation, and electric vehicle (EV) charging stations.

Solaire Generation | www.solairegeneration.com
Booth 324

Pluggable solutions for solar energy

contacts are green.

With 100 years of interconnect experience, Wieland manufactures pluggable connector components for the DC side of solar energy systems. Complete solutions include our PST 40i1 connector family rated to 40A DC and our new line of combiner boxes to complete the installation on the inverter's DC side.

Our PST 40i1 connector series now includes a panel mount version in addition to the field-assembled connectors. This connector's low resistance and high quality construction assure reliability of your solar installation. Ingress protection to IP 68 ensures safe operation in difficult environments. Wieland's PST 40i1 connectors meet UL and CSA standards.

Count on Wieland – We're ready for the revolution.

www.wielandinc.com

Wieland Electric offers 100 years of innovative technology.
Visit us at Solar Power International 2011, Booth # 1031



PV kit

S-5! offers innovations to industry standards for attaching solar panels using the S-5-PV Kit. The S-5! stainless steel mounting disc is ETL Listed to UL 1703, and the S-5-PV Kit is listed by the Underwriters Laboratories Inc. to 2703 (a new subject for Rack Mounting Systems and Clamping Devices for Flat-Plate PV Modules and Panels). The S-5-PV Kit has been subjected to thorough conductivity and mechanical-load testing by UL to the new UL 2703 subject. The new PV Kit provides module-to-module continuity within a string of modules—when properly installed, ground lugs and copper wire will only be necessary to connect module strings and ground the system. In most cases, the emergence of UL 2703 will produce cost savings sufficient enough to pay for the entire S-5 clamp/PV Kit set-up. The S-5-PV Kit provides an easy, cost-effective way to install solar panels directly to standing seam metal roofs.

S-5! | www.S-5.com

Booth 5106



SOLAR ON THE GO CHARGING & LIGHTING UNITS

Solar Mobile Trailer

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- 500 to 750 PV Watts
- 12 Hour Charging Outputs
- Maximum Power Output 5 Kw

Uses:

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- Off-Grid
- Construction
- Remote Power
- Disaster Recovery

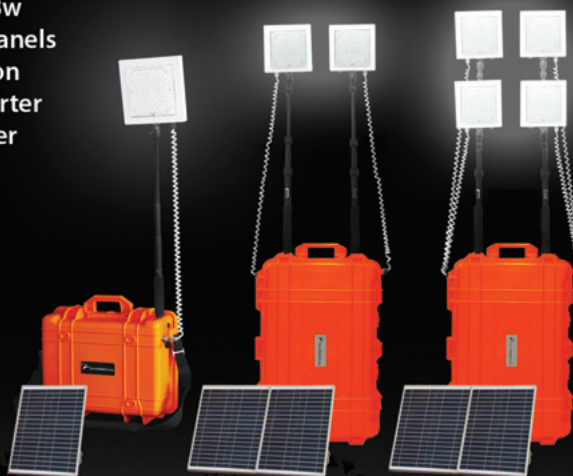


Emergency Solar Light Cases

- LED Lights from 12w to 48w
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Uses:

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- Camping, Hunting & Other Outdoor Activities
- Equipment Repair
- Charging Digital Products



Portable Solar Lighting

- 13 Hours of Continuous Operation
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- 200w to 500w Solar Power
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Uses:

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- Disaster Recovery Requirements
- Emergency Search & Rescue Needs
- On-Site Construction Solar Generator
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Sapa Extrusions, a global manufacturer of aluminum profiles, is a key supplier to the solar industry. Sapa's Renewable Energy Organization provides solutions to all solar market segments, including: PV racking and mounting systems (open field, flat roof, and residential); solar thermal (H₂O) applications; module frames and components; concentrated solar power collectors; inverter housings and components; and, thermal management solutions. Supporting Sapa's 16 North American manufacturing facilities is Sapa's North American Technical Center (NATC). Sapa's NATC works with customers to establish finished designs for innovative custom features and improved end-use applications. Sapa's manufacturing capabilities include standard and custom extrusion, finishing (painting and anodizing), as well as full fabrication and logistic services. Sapa supplies critical components for solar applications that help customers optimize the value of their products.

Sapa Renewable Energy
www.sapagroup.com/solar
Booth 5436



Solar steam generators

AREVA Solar designs, manufactures, and installs solar steam generators for its global power generation and industrial customers in a dependable, competitive, and environmentally responsible manner. AREVA's CLFR solar thermal technology is water-conservative and one of the most land-efficient renewable energy technology available.

AREVA Solar | www.solar.areva.com
Booth 6319

Aesthetically designed solar modules

As the solar industry evolves and residential installations continue to grow in popularity, so does the desire for more aesthetically pleasing installations. Traditional solar modules were designed for function not looks. The familiar appearance of solar modules—blue squares crisscrossed with white grid lines—makes them more prominent than some homeowners want. DUNMORE's DUN-SOLAR FPE Black provides the aesthetics while maintaining best-in-class performance for the life of the module. FPE Black helps modules blend into darker roofs better by eliminating the white gridlines prominent on today's solar modules. On lighter roofs, the module design looks more like a skylight than a solar module.

DUNMORE | www.dunmore.com
Booth 5312



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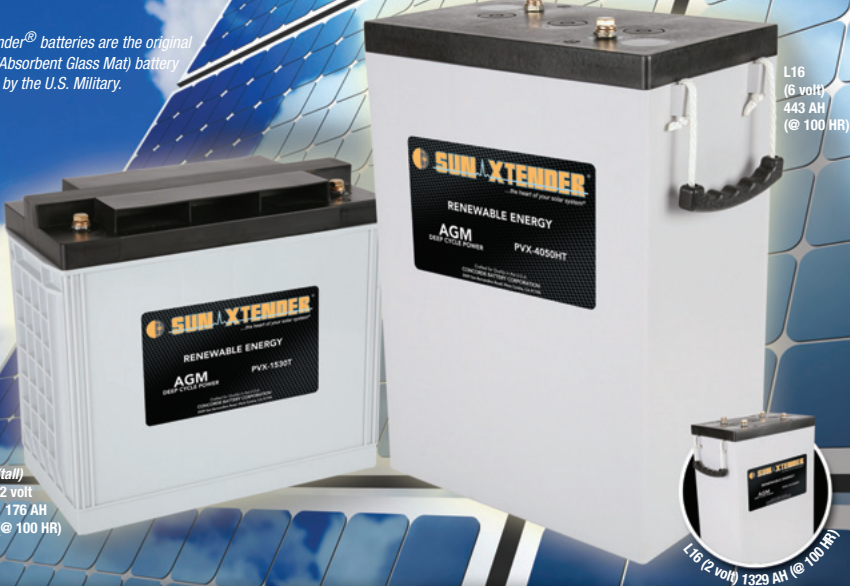
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PV upgradable power system

Alpha Energy presents a fully integrated power system customized for the renewable energy industry. The Photovoltaic Upgradable Power System is a turnkey system integrating the FlexPower ONE inverter system with front terminal deep-cycle batteries. The FlexPower One is a pre-wired inverter system consisting of a single inverter, AC and DC wiring boxes, a single charge controller, and a communication monitor. The power system is custom configurable according to specific application needs. It's built of modular components that allow for future expansion as power needs grow. Battery back-up capacity ranges from 200Ah to 1000Ah, and PV capacity is up to 5kW. The system is fully enclosed for ease-of-maintenance and protection from the elements; but has the added benefit of a small footprint.

Alpha Energy | www.alpha.com

Booth 801



Modular connection solutions for crystalline PV modules

HUBER+SUHNER has a legacy of performance for high-performance modules with Radox SOLAR junction boxes. The company is now presenting a modular system consisting of a base junction box, an application specific module for integrating "smart electronics," and the connection system. For OEMs and installers, the new system provides more flexibility regarding the choice of electronic suppliers and the complexity of electronic functions. Moreover, the junction box can be easily retrofitted and maintained. These advantages also result in cost savings.

HUBER+SUHNER

www.hubersuhner.com

Booth 2744



Turnkey module line integration

With over 100 module lines installed worldwide, Reis Robotics offers turnkey integration of PV module manufacturing lines. Reis provides some of the most advanced design and project services and support, including fully automated process solutions, as well as semi-automated and manual solutions. With 6GW of installed production line capacity, Reis has provided turnkey line integration on the largest automated line in the world, and on lines in the US, Europe, and Asia of up to 600 MW. From line layout in a factory space, to handing off a fully operating line to trained staff, Reis offers worldwide after-sales service and support, maximizing investment while minimizing risk.

Reis Robotics | www.reisroboticsusa.com

Booth 1847



Solar power trailer

Patriot Solar's SLR-TRL-3000 mobile trailer is a 720-Watt solar system with a 1200AH battery reserve, and 5000-Watt AC. They have on- and off-grid systems, in addition to their new line of mobile solar trailers. It provides an excellent source for off-grid, construction, emergency response, remote power, and more. This durable and rugged trailer can provide power anywhere a hitched vehicle can take it. The trailer is a noise- and odor-free solution for those conscious of their carbon footprint. Whether on the go or laying the foundation for an energy efficient future, Patriot Solar can provide the resources needed to be efficient and cost effective.

Patriot Solar

www.patriotsolargroup.com

Booth 4302



Commercial & residential inverter/charger series

OutBack Power introduces the Radian Series Inverter/Charger, raising the bar in the commercial and residential renewable energy market, and delivering a new standard of quality, durability, and dependability. The Radian Series Inverter/Charger is a powerful solution engineered from the ground up to simplify design and installation of grid-interactive and stand-alone power systems. Rugged reliability, in-field serviceability, and first-rate customer service minimizes “windshield time” for designers and installers. The Radian Series is unique in its ability to support large dynamic load variations without voltage spikes or sags. The grid-interactive solution combined with the ease of a basic grid-direct PV system integrates directly into standard home wiring. And, the modular, parallel architecture combined with OutBack’s robust HUB Communication Manager provides the ability to build a system from 8kW to 80kW—enough to power even larger loads.

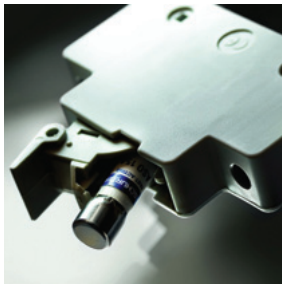
OutBack Power Technologies
www.outbackpower.com
Booth 701



Quick-installation panels

Trina Solar has combined the power of their high-quality panels with Zep Solar’s fast and easy racking system. The result is Trinamount. Its frame design allows for installations in a quarter of the time versus traditional installations. The Trinamount system is sleek and cost-effective. Trinamount offers fast and easy installations because of its low parts count. This means reduced inventory, faster and less intensive engineering and freight costs. It has a theft-resistant design and autogrounding. These features are designed to help solar installers increase profits while offering some of the best panels on the market.

Trina Solar | www.trinasolar.com
Booth 3118



Solar fuse & fuseholder combo

Schurter’s quick-acting ASO fuse provides protection up to 1000 VDC, according to the latest gPV requirements. Offered with the FSO touch-safe fuseholder, the combination meets the needed robust circuit protection for the growing solar industry in a compact 10.3mm x 38mm size. Current ratings range from 1 A to 30 A.

Schurter Inc. | www.schurterinc.com
Booth 1556

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Solar resource assessment system

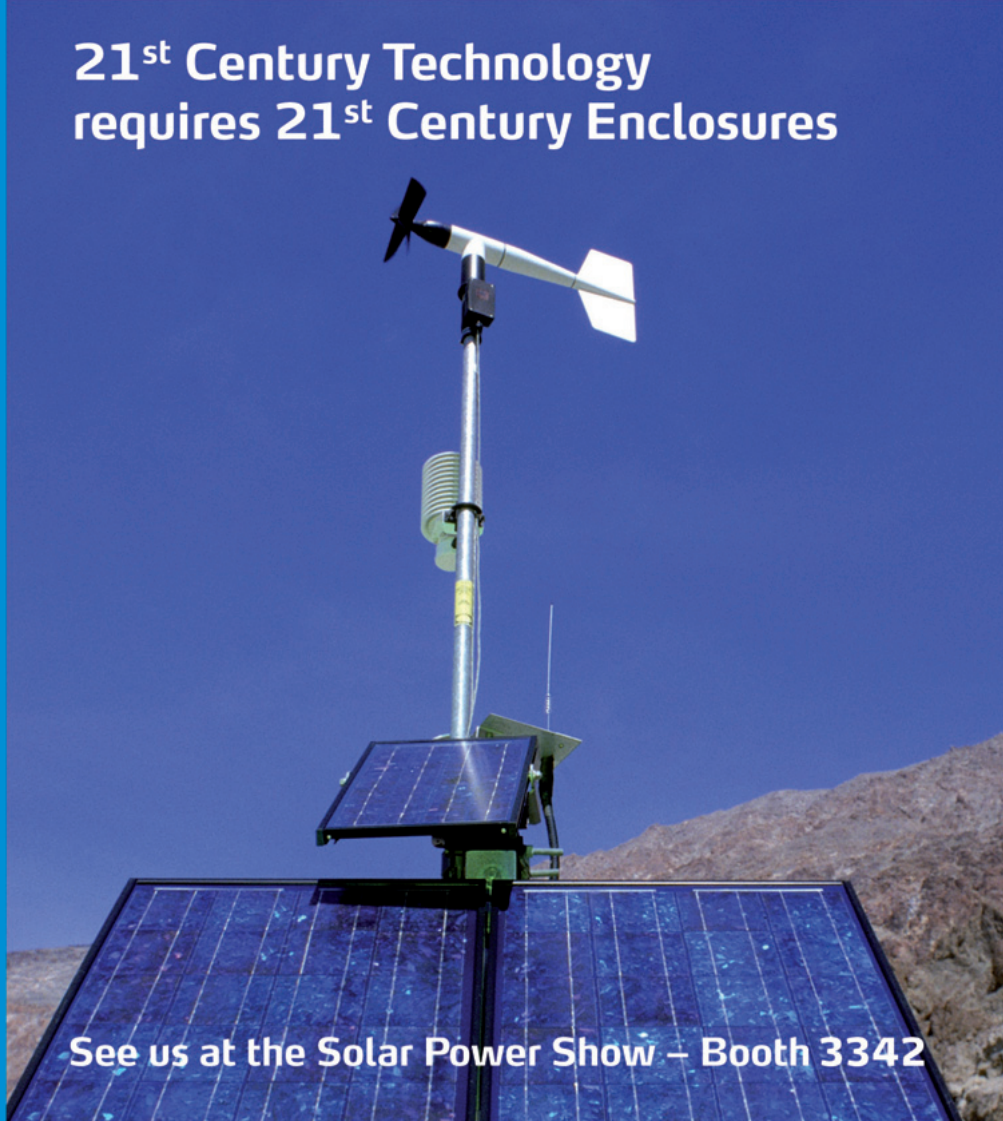
NRG Systems, a manufacturer of wind measurement equipment for the global wind industry for nearly 30 years, has brought its product and technical expertise to the solar industry with the introduction of a complete solar resource assessment system. The system, which includes tower, sensors, data logger, and communication modules, has everything a developer needs to assess a site's solar potential. The low-cost, off-grid system is designed for solar PV prospecting and resource assessment. It's easy to transport and install, making it ideal for repeatable deployments.

NRG Systems

www.solar.nrgsystems.com

Booth 6503

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Solar PV wafer inspection

Dark Field Technologies offers online, 100% thin-film PV inspection/metrology—with its best-selling NxtGen Scribe 100 system. Now, they have successfully applied their exclusive, patent-pending technology to PV wafer inspection. NxtGen SSS is the first and only solid-state scanner, marrying the benefits of lasers and cameras in a single system. NxtGen SSS delivers 100% online, real-time finger inspection and metrology with: widths and offset measurement accuracy 2µm to 5µm, finger breaks, and converging/diverging fingers at line speeds of 30m/min. There are single file or multiple wafers across the conveyor, and no maintenance required—as it's 100% solid state. No light bulbs or cooling are required either. There's a large depth of field, and consistent results for warped, bouncing wafers.

Dark Field Technologies

www.darkfield.com

Booth 2350



PV performance verification tool

Solmetric has announced updates to its PC software for the PVA-600 PV Analyzer, an I-V curve measurement tool for PV performance verification. The PVA measures I-V curves of PV strings and compares them to predictions of an advanced software model. The new software includes more module types for the model and enhanced functions for the data display and analysis. The PVA measurement unit can be connected at the DC combiner box, and it communicates wirelessly with a Windows tablet, netbook, or laptop running the PV analyzer software. Measurement results are available in seconds. An optional wireless sensor kit provides readings of temperature and irradiance nearly simultaneous to the electrical measurement. Data from an entire commissioning visit can be easily imported into the Solmetric IV Data Analysis tool for further inspection. Also featured: the SunEye 210 shade measurement tool, SunEye Extension Kit for measurements up to 18 feet from ground level, and PV Designer, PV layout, and estimation software.

Solmetric | www.solmetric.com

Booth 6712



Crimp die sets

For 30 years, Rennsteig has been manufacturing tools to the highest standards. Their tools are specifically engineered for the wires and terminals specific to the solar industry. Rennsteig has the knowledge, skill, and capacity to meet any customer specifications, and is specialized in meeting customer requirements. Rennsteig now offers a new crimp tool and die sets for SMK solar contacts (14/12 AWG). They also offer various other crimp die sets, which are available for terminals by all major manufacturers—and Rennsteig can respond quickly to installer needs.

Rennsteig Tools, Inc.

www.rennsteig.us

Booth 1024



Actuator solutions

LINAK provides intelligent movement for improved sun tracking. Their linear actuator systems are maintenance-free and can help provide instantaneous increases in yield. Embedded MODBUS communication and service datalogging are optional features. LINAK is introducing their LA36XL, a new robust actuator that supports higher wind loads and increased square footage.

LINAK | www.solar-tracking.com

Booth 3148

The newest PV Supports under the sun



Delta Strut™ for Rooftop Arrays

integrates solar panel framing and cable management into ONE welded wire support. Delta Strut is lightweight, yet strong enough to withstand 150 mph winds and extreme snow load conditions.



FAS Rack™ for Ground-Mounted Arrays

features pre-assembled grid tables that eliminate labor-intensive "stick built" installations. Patent-pending pier cap design ensures correct placement of the grid tables without measuring.

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Central inverters

Schneider Electric Renewable Energies Business highlights their new Schneider Electric XC Series. Available for shipment in early 2012, the XC Series is a new line of central inverters designed for high-efficiency and flexibility for any PV panel type and installation. The XC series has peak efficiencies of 98.7%, and its flexibility allows the inverter to be configured with voltage and power outputs up to 680 kVA. In addition, the XC series is designed to allow for DC inputs up to 1000 Vdc for longer string lengths.

Schneider Electric Renewable Energies Business | www.schneider-electric.com

Booth 1909



Solar monitoring & meteorological stations

Campbell Scientific offers pre-configured and custom-automated data acquisition packages specifically designed for solar monitoring applications. A full range of pre-configured packages is available for photovoltaic (PV) and concentrated solar technology (CST) arrays of all sizes. Two such packages are the SOLAR1000 and CST100, designed to meet CaISO EIRP Solar Telemetry Standards. The SOLAR1000 is an automated data acquisition package designed for flat panel PV monitoring applications. Typical uses include pre-construction phase solar resource assessment, baseline data collection, and performance monitoring. The CST100 is an automated data acquisition package specifically designed for CST monitoring applications where active, direct normal, and diffuse irradiance measurements are required. Typical uses include research and development, resource assessment, and performance monitoring of concentrated solar power (CSP) and concentrated photovoltaic (CPV) technologies.

Campbell Scientific

www.campbellsci.com/solar-energy

Booth 3724

Improve lead-times on your interconnection substation.

You want quick delivery and installation of your interconnection substation to bring your solar plant on-line as soon as possible. But long lead-times associated with equipment utilized in traditional substation designs can unnecessarily prolong the project schedule. With 100 years of experience in the design and manufacture of high-voltage electrical equipment, S&C offers a total switchgear solution featuring our System VI Switchgear for unit substation applications. This solution will cut your lead times by 50 – 60% compared to traditional substation delivery schedules. System VI provides a field-proven solution for interconnecting the collector system at 35kV, for solar plants between 5MW and 70MW. S&C will engineer, install, test and commission your interconnect substation, thereby ensuring lead times of unit substation package align with the delivery of your PV panels.

Visit us at Solar Power International Booth #637; or sandc.com; or call us today at 773-338-1000 for more information.



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For more information on Phono Solar, please visit us at booth #5839 and check out our website: www.PhonoSolarUSA.com

Exhibitor	Phono Solar
Event	Solar Power International
Date	October 17-20, 2011
Location	Dallas Convention Center
Booth	#5839

www.solarpowerinternational.com

Risk prevention

Bureau Veritas is involved in the Quality Assurance, Health, Safety & Environmental (QHSE) and Social Responsibility industry. They provide the tools and expertise to minimize risk, helping clients move forward with confidence. Bureau Veritas is present in 140 countries, developing solutions that contribute to risk prevention and performance improvement. They help organizations create long-term value through their technical and regulatory expertise.

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Booth 6311

Smart Solar Ideas from Moxa



The IA3341 Series

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Moxa's Rcore ready-to-run platform makes it easy for programmers to develop embedded software. Rcore includes easy-to-use application libraries, tested bug-free sample code, and requires less time for the concept validation and development cycle enabling a faster time-to-market that meets or exceeds customer requirements. The Rcore Community also offers our partners easy access to software and technical knowledge about embedded systems, along with an interactive forum to share knowledge with embedded computing professionals.

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LTi REEnergy USA Ltd. | www.lt-i.com

Booth 6863



Next-generation power optimizers

SolarEdge introduces its next generation of power optimizers, which are more efficient, smaller, and lighter. With a new, highly efficient ASIC chipset and 32% lower part count, the new power optimizer is 40% smaller in volume, and boasts world-record efficiency. Improved dynamic control and components are combined with a new MPPT algorithm that dynamically tracks the global maximum operating point for both modules and inverter, enabling maximum power optimizer efficiency of 99.5%. This ensures peak system performance at all times, with and without mismatch conditions. The new optimizers, with a 25-year warranty, provide enhanced SafeDC—electric arc detection and automatic module shutdown in case of inverter or grid shutdown. SolarEdge also provides highly efficient inverters (97.5% CEC efficiency) designed for power optimizers. By H1/2011, over 100 MW of the previous power optimizer version was installed in USA, Canada, and over 30 other countries. Additional benefits include module-level monitoring and fixed string-voltage.

SolarEdge | www.solaredge.com

Booth 4324



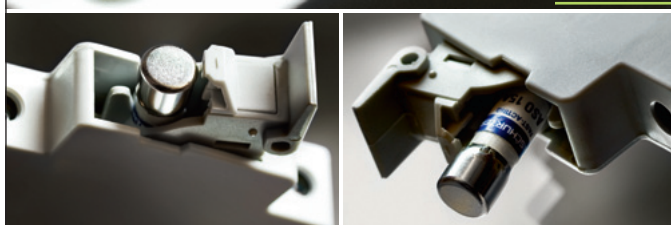
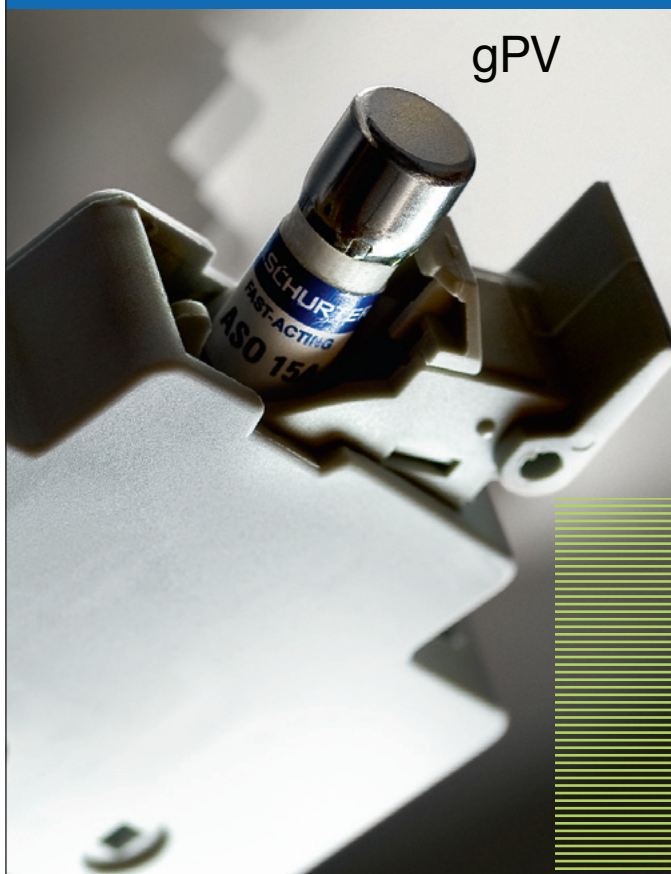
Solar engineering solutions

Ulteig is committed to driving the power of renewable energy for generations to come. They have the expertise and capabilities to design solar power systems, including complete PV solar power plant design packages. Their electrical, civil, and structural engineers have decades of experience in the industry, and provide services and expertise on energy projects worldwide. Ulteig combines technologies with client support to deliver comprehensive engineering, surveying, and consulting services to a wide range of public and private clients.

Ulteig | www.ulteig.com

Booth 6759

ASO FSO Solar Fuse and Fuseholder Combo



www.schurterinc.com/new_fuses

The ASO solar fuse protects PV Systems up to 1000 VDC according to the latest gPV requirements

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- Current rating ranges from 1-30A @ 1000 VDC
- Breaking capacity 20kA
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Phone: 248.577.0020 ▲ www.sikausa.com



Off-grid & grid-tied system AGM deep-cycle batteries

Sun Xtender is featuring four new batteries for off-grid and grid-tied systems. Engineered with the same reliable build used in Concorde's aircraft batteries, the newest Sun Xtender additions to the line-up were developed to offer flexibility when designing battery bank layout and configuration options. The valve regulated lead acid absorbent glass mat (VRLA-AGM) deep-cycle batteries are non-spillable and maintenance free. With thicker plates than the industry standard for excellent cycling capability, better float life, and extended battery life. Sun Xtender is the only manufacturer that uses proprietary PolyGuard, a microporous polyethylene separator around the positive plate and AGM to protect against shorts. Robust intercell connections are fusion welded "over the partition" for increased strength and lower electrical resistance. Copper alloy terminals provide an improved electrical connection and are more environmentally friendly than industry standard lead terminals.

Sun Xtender | www.sunxtender.com
Booth 4420



Lightning protection

Eliminate the cost of lightning and over-voltage damage to PV operations with Strikesorb SPD technology from Raycap. Only maintenance-free Strikesorb Surge Protective Devices (SPDs) can endure multiple lightning strikes and overvoltage events to effectively protect PV installations on both the AC and DC sides. Installed throughout PV operations worldwide, Raycap surge protective devices protect inverters, junction boxes, and other critical equipment from direct and indirect lightning strikes. They are: maintenance-free; fully compliant to the UL 1443 3rd edition and IEC 61643-1 standards; safe with fuse-less operation; a cost-effective solution; and, ideal for integration in PV inverters and junction boxes. Raycap provides a variety of product offerings.

Raycap Inc.
www.raycapsurgeprotection.com
Booth 112



Ballasted mounting systems

Krannich Solar, a supplier of PV system components, will display their new K2 D-level and S-Level low, ballasted mounting systems specifically designed for flat and low pitch roofs, which features fast and easy mounting for lower cost installations. Also new to the US market are the exclusive Axitec and Luxor Solar panels, using German engineering, as well as Krannich's selection of inverters.

Krannich Solar Inc. | www.krannich-solar.com
Booth 443



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Epoxy adhesive

LORD Corporation are makers of the LORD Epoxy Adhesive, which provides solutions for silicon ingot manufacturers in the PV market. Features and benefits of the Epoxy Adhesive include: reduced ingot waste; improved utilization of ingot; lower operating costs; and, increased slice wire life.

LORD Corporation | www.lord.com/solarenergy

Booth 3455



SALES OFFICE

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125 Wilbur Place
Bohemia NY 11716
USA

Rodney Esposito

T: +1 (0) 631 589 2065 ext. 338

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RENNSTEIG TOOLS, INC.

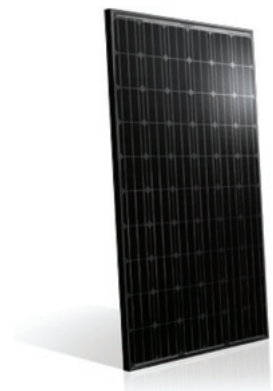
301 Route 17 North, Suite 800

Rutherford, NJ 07070

Phone: 330-315-3044

Fax: 330-319-8135

Web: www.rennsteig.us

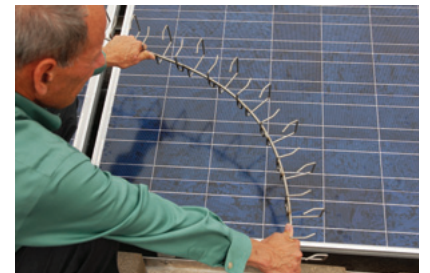


Integrated AC module

SunWize is the distribution partner for global high-tech AUO's new integrated AC module: the AC Unison. The AC Unison is an integrated module and micro-inverter in one unit. This first-of-its-kind product offers unprecedented simplicity for solar installers. The pre-assembled AC Unison is truly a "plug-and-play" unit requiring fewer parts and labor. It's certified to UL 1741 requiring no NEC DC disconnect, eliminating the need for a separate grounding conductor for the inverter. The AC Unison also eliminates the need to specify, purchase, and inventory a separate inverter. The single 25-year warranty covers the module and the micro-inverter.

SunWize | www.sunwize.com

Booth 2608



Cable management solution

Solar Snake Tray is the all-new weather-proof hand bendable cable conveyance that carries DC circuitry from solar panels to their terminations. This patented design (lobster trap principle) allows outdoor-rated cable to be effortlessly installed while protecting it from rain, snow, or hurricane-force winds. Solar Snake Tray has built-in mounting rings every four inches and connects together with a single stainless steel connector. Snake Tray manufactures a wide variety of brackets to interface with any brand of solar panels racks. Solar Mega Snake is their high-capacity, pre-configured cable tray that quickly mounts to a pole for utility-grade field installations.

Snake Tray | www.snaketray.com

Booth 527



Solar thermal system control

The Steca TR A503 TTR U provides high power, convenient installation and operation, two triac outputs, one relay output, and numerous additional functions—including heat quantity metering, system pressure monitoring, data logging, back-up heating, and more. Along with the TR A502 TT U and TR A501 T U solar thermal controllers, the TR A503 TTR U is the third product in this series, which comes with a compact designer casing, making it suitable for integration into solar stations. It can also be universally mounted on a wall or on top hat rails. The new solar thermal controller has five inputs, two RPM-controllable triac outputs that can also be used as PWM outputs for controlling high-efficiency pumps, and an additional relay output for individual programmability. The data can be stored on a standard Micro-SD card, and this can be directly plugged into the TR A503 TTR U.

Steca Elektronik GmbH | www.stecasolar.com

Booth 4824



Solar PPA

Tioga Energy's SurePath Solar power purchase agreement (PPA) allows public and private organizations to cost-effectively realize the economic and environmental benefits of onsite solar energy without requiring any capital investment. Tioga finances, owns, and operates solar electric projects, selling the electricity generated to its customers at low, fixed rates over the term of the PPA—typically 15 to 20 years. In the case of tax-exempt organizations, Tioga facilitates the monetization of otherwise unavailable tax incentives to maximize savings. Tioga has helped pioneer some new financing structures, and this year is piecing together state incentives, federal tax credits, and municipal bonds to fund county-wide solar projects in New Jersey. Today, Tioga has 100 projects in operation nationwide.

Tioga Energy | www.tiogaenergy.com

Booth 2443



Performance testing & market certification

TÜV Rheinland PTL, LLC is a provider of safety and performance testing and market certification, serving every sector of the photovoltaic and solar thermal marketplace—from the supply chain through installation. TÜV Rheinland PTL is a member of the TÜV Rheinland Group, which has the largest network of solar energy laboratories worldwide, with six major laboratories on three continents. The lab was formed as a unique partnership between Arizona State University, an institution with more than 50 years of research on solar energy and extensive solar testing know-how, and TÜV Rheinland, a \$1.5 billion global provider of independent testing, assessment, and certification services. They conduct USA safety testing and certification of ANSI/UL 1703, as well as many other global testing and certifications. This expertise speeds the time to market and improves the technical analysis of product evaluation.

TÜV Rheinland PTL, LLC | www.tuvptl.com

Booth 2043



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Transformerless grid-tied inverters

KACO has launched a transformerless inverter series, which is highly efficient and offers the best string inverter pricing for the line worldwide. The 96.5% CEC efficiency on all 00xi series inverters ensures lowest energy losses. The easyinstall T-bracket minimizes mounting time to approximately 15 minutes. The inverters produce more kWhs than ever before, and they enhance efficiency numbers by using a single stage DC conversion process. KACO has been manufacturing power electronics for more than 60 years with more than 3 GW of inverters in the field worldwide.

KACO new energy | www.kaco-newenergy.com

Booth 1101



Utility-ready solar inverters

Satcon Equinox is the next-generation in utility-ready solar inverters, built on the foundation of PowerGate Plus, the most widely deployed utility-ready inverter with over 2.5 gigawatts sold worldwide. Equinox features a best-in-class 98.5% peak efficiency, and the industry's widest thermal operating range (-4° F to 122° F). Equinox's advanced features enable remote control of real and reactive power, low-voltage ride-through, and power factor control. This solution supports fast communications, allowing it to be easily integrated into SCADA systems through standardized communication interfaces. With its unparalleled system wide intelligence, Edge MPPT performance optimization, and industrial-grade engineering, Satcon Equinox offers the highest levels of system-wide performance, uptime, and reliability, delivering the industry's lowest Levelized Cost of Energy (LCOE).

Satcon | www.satcon.com

Booth 101

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Raycap www.raycapsurgeprotection.com

See us at Solar Power International Oct. 17-20, 2011 Booth 112

Are you a PV systems designer or installer, a module or inverter manufacturer?

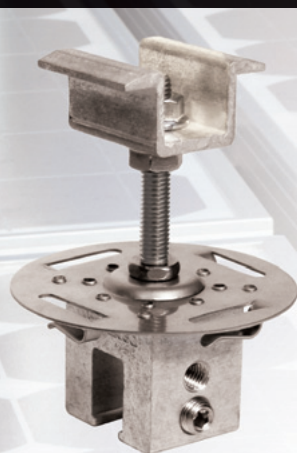
Improve efficiency, save time and reduce your labor costs with Phoenix Contact's comprehensive solar line; power terminal blocks, connectors, wiring, surge protectors, motor starters and current transformers.

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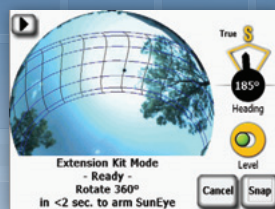


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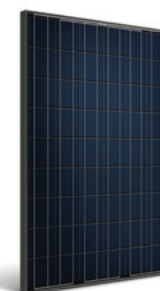
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www.solmetric.com



Solar modules

Scheuten Solar introduces their new Multisol Fusion Plus and Premium modules. The newly designed P6-60 Multisol Fusion Premium offers a versatile design, allowing for roof and field applications combining robust design and high-energy yields. Features include: power ranges from 225 Wp to 240 Wp in 5 Wp steps; power tolerance + 0 Wp / + 5 Wp; 25-year power output warranty; 10-year product warranty; rigid black anodized aluminum frame; 4mm high, transparent low-iron tempered safety glass; frontload tested with 113 Psf; design load of 75 Psf (front/back); and, micro-inverter compatible.

Scheuten Solar | www.sheutensolar.com

Booth 597



Solar sensing technology

The new DR02 Pyrheliometer and SR03 Pyranometer sensor models from Hukseflux (for DNI, GHI, POA, and Diffuse solar irradiance measurement) represent the next evolutionary step in thermopile solar sensing technology. Unlike competing ISO-9060 solar sensor models, which are slow and limited by comparison in response time, the latest DR02/SR03 sensor models feature a blistering one-second (95%) response time, enabling PV and CPV performance monitoring that's synchronous and well correlated to the real-time solar resource. Also well suited for solar thermal and routine meteorological measurement applications, additional DR02/SR03 performance benefits include no tilt dependency effect, <1% temperature dependence, full solar spectral response, low-power 1.6 watt heater for optics anti-soiling, and excellent long-term stability

Hukseflux USA | www.huksefluxusa.com

Booth 2950



Solar grounding bonding connector

ILSCO introduces a new solar grounding bonding connector, the SGB-4. Manufactured of aluminum alloy, SGB-4 is suitable for use with copper or aluminum conductors. The lay-in features provide ease-of-installation for four to 14 conductors. With a quarter-inch maximum frame thickness, SGB-4 can be mounted to solar panel frames. The connector is tested to ASTM B117-09 standard, and is resistant to outdoor salt spray. SGB-4 is UL Listed and CSA Certified for grounding.

ILSCO | www.ilsco.com

Booth 6554



Solar water heaters & tanks

SolarStor, with over 80 years of manufacturing experience, offers a complete line of solar and geothermal water heaters and storage tanks. SolarStor water heater models 80 and 119 feature two internal 1.5-inch diameter porcelain glass coated, coil heat exchangers for heating water with two separate heat sources (e.g. solar and boiler)—or, for use in tandem with one heat source to maximize heat transfer capacity. A 4500-watt electric element is available for supplemental heating. Smaller, model 40 and 50 are available with a single coil and with or without a 4500-watt electric heating element. SolarStor also offers water storage tanks in 80- and 119-gallon capacities with 4500 watt heating element back-ups. All SolarStor models, regardless of type and size, feature two inches of environmentally friendly, non-CFC, zero ozone depleting foam insulation, a porcelain glass-lined tank, factory installed brass drain valve, factory installed T&P relief valve, and two magnesium anode rods.

SolarStor | www.solarstor.net

Booth 6329

www.solar-tracking.com

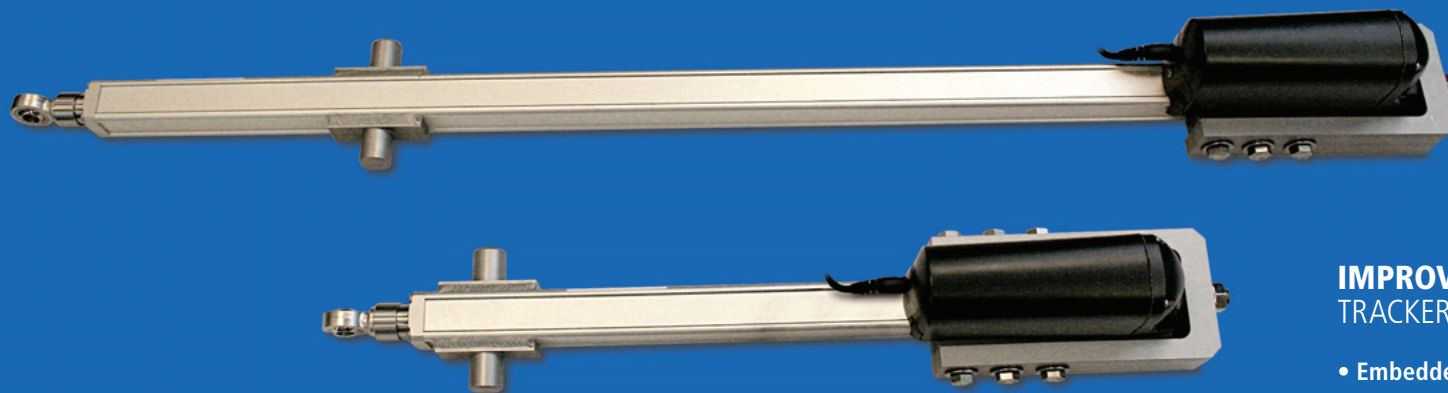


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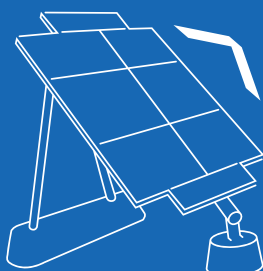
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Solar integration & grid solutions

S&C Electric Company offers field-proven solutions for seamlessly integrating concentrated solar power and photovoltaic solar energy plants into the grid. In the past decade, they've helped satisfy the interconnect requirements for over 2700 MW of renewable energy. Founded in 1911, S&C is a total solution provider as they: design, install, commission, and maintain electric power collection, transmission, and distribution systems. They also design and manufacture switching and protection products for those systems. Their compact, easy-to-install System VI Switchgear offers significant savings over breaker gear. The Smart Grid SMS Storage Management System connects 90% of the grid-scale sodium-sulfur batteries installed in the US. And, the Smart Grid CES Community Energy Storage provides distributed stored energy at the residential level. PureWave DSTATCOM Distributed Static Compensator allows solar plants to meet interconnect low-voltage ride-through and power-factor requirements. S&C's solutions support peak shaving, load leveling, power factor correction, and improved reliability.

S&C Electric Company | www.sandc.com

Booth 637



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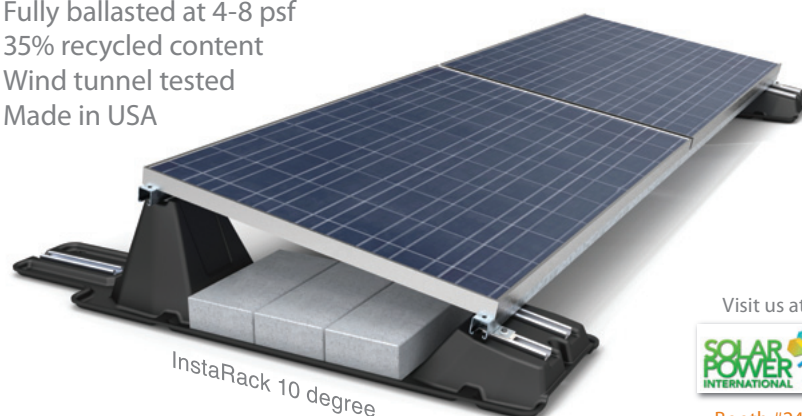
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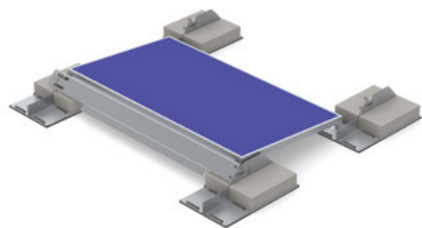


Saft makes PV power predictable

Saft delivers battery systems that make the inherently variable output from PV plants reliable and predictable. Saft's range of specialized PV batteries, including nickel-based and state-of-the-art lithium-ion (Li-ion) technologies, can provide the ideal solution for many applications—from off-grid rural electrification schemes to MW-scale, on-grid energy storage systems.

www.saftbatteries.com





Ballasted flat-roof solar mounting system

PanelClaw's Polar Bear ballasted flat-roof solar mounting system is now available in 5° and 10° tilt angles. The new 5° option adds to Polar Bear's flexibility, including a non-rail based, single module design with multiple mounting holes for wavy roof friendliness, inter-row spacing options, and platform loads as low as 3 psf. PanelClaw's flat-roof solutions also offer enhanced thermal compensation and factory integrated recycled rubber pads that deliver roof protection, reduced installation times, and lower costs. All PanelClaw products are UL 2703 listed for electric bonding and grounding, enabling their partners to bond modules and ground arrays simply and quickly. This not only lowers labor costs, but also eliminates the need for thousands of feet of copper and the vast majority of grounding lugs.

PanelClaw | www.panelclaw.com

Booth 3706



Ballasted roof mount

The newest addition to the DPW Solar POWER-FAB hardware line is their Ballasted Roof-mount System (BRM). This non-penetrating flat-roof PV mounting system is durable and designed for residential and commercial applications. The module-specific design reduces the number of components and is easy to assemble. The BRM utilizes high-strength aluminum components and corrosion-resistant hardware for long-term reliability. Factory cut module rails and mid-clamps create uniform spacing installations. Seasonal adjustability for maximizing production is provided by several tilt-angle settings, ranging from 20° to 45°.

DPW Solar | www.dpwsolar.com

Booth 2619



Full-power crystalline module

Bosch Solar Energy presents a new crystalline module with up to 260 watts. Central to the powerful module is the new Bosch Solar Cell M 3BB C4 1100 with selective emitter, as well as an optimized cell layout. Anti-reflective glass allows for more light to enter the module. Plus, Bosch Solar's new cell strings with a pyramid structure reflect the transmitted light regularly so the cell can catch more light. As a result, the module efficiency is raised to up to 260 watts.

Bosch Solar Energy | www.bosch-solarenergy.com

Booth 5115



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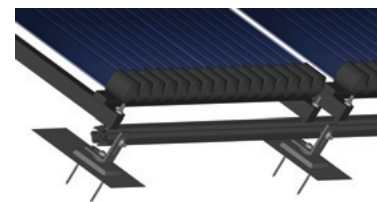


PV support solutions

Delta Strut for Rooftop Arrays is the only PV support that integrates solar panel support framing and cable management into one support. A welded-wire, open structure reduces wind drag and keeps cables close to the panels to reduce exposure to wind and UV. Delta Strut is tested to withstand 150 mph winds and extreme snow loads. FAS RackT for Ground-mounted Arrays utilizes pre-assembled grid tables for fast installation in the field eliminating labor-intensive "stick built" construction methods. Patent-pending pier cap design ensures correct placement of the grid tables without measuring to reduce overall installation costs. FAS Rack is engineered to withstand extreme wind and snow loads of any climate. Each order is specifically designed for the array and sun angle specifications to eliminate jobsite guesswork, requiring only simple tools for installation. And all hardware is RoHS compliant so the entire system qualifies for LEED points.

Legrand | www.legrand.us/deltastrut

Booth 6500



Solar mounting & thermal applications

Next Generation Energy, an engineer of renewable energy products and services, and Zilla Corporation, a manufacturer and distributor mounting and racking products, are partnering together. Next Generation Energy will be debuting their new line of thermal packages for residential and small commercial applications—SunBandit. Zilla will be featuring their new Zip Flashing, a single bolt flashing application that's affordable, as well as reliable and simple to install.

Next Generation Energy

www.ngeus.com

Zilla Corporation

www.zillarac.com

Booth 4126

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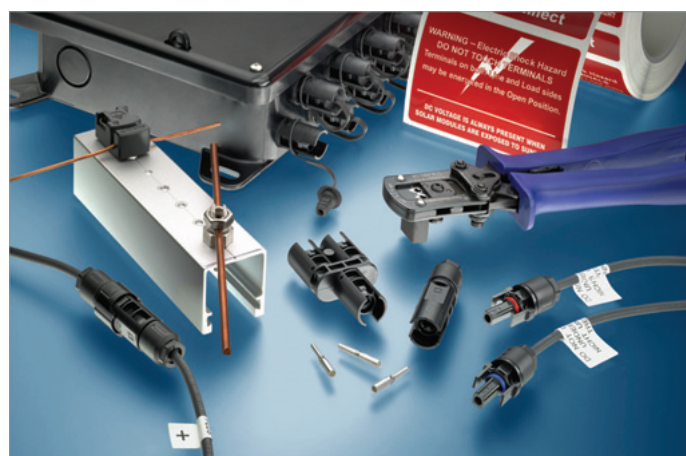


DIN-rail DC current sensors

WAGO Corporation's new Feedthrough Current Sensors continuously measure DC currents to optimize PV energy production. Via serial connection, the 789-620 (0-80A DC) and 789-621 (0-140A DC) sensors transmit data with an accuracy of 0.5% (full-scale value). This can be used to quickly identify defective or damaged PV modules, bolstering performance and reliability. Equipped with dual RJ-45 interfaces, the sensors transmit data via RS-485 serial communication lines up to 4000 feet. Thirty-two Current Sensors can reside on one line for connection to the WAGO-I/O-SYS-TEM or PC as a MODBUS Slave. The 789 Series feedthrough configuration eliminates the need to terminate conductors, simplifying commissioning. Both models are addressable via on-unit DIP switch and feature an operational status LED. Engineered for harsh environments, the sensors operate in temperatures of -20° C to +70° C (-4° F to 158° F).

WAGO | www.wago.us

Booth 1316



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View our Innovative Solar Solutions portfolio at Solar Power International, October 17-20, 2011 Dallas Convention Center, Booth 6652, www.heilind.com/rpages/solarlok_nace.

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Solar mounting solutions

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Applied Energy Technology

www.aetenergy.com

Booth 851



Industrial, deep-cycle batteries

Trojan's Industrial Line of deep-cycle batteries is the newest addition to Trojan's lineage of high-quality batteries for renewable energy and backup power applications. Designed to support large daily loads where the batteries are cycled regularly, Trojan's Industrial Line is ideal for a wide range of photovoltaic systems such as large off-grid PV systems, off-grid hybrid PV systems, grid-tied PV systems with battery backup, smart grid peak shifting systems, and a variety of other applications. Trojan's Industrial flooded batteries are specifically designed for deep-cycle use with 1,500 cycles at 80% depth of discharge, and optimized for deep discharge and recharge cycles characteristic of RE systems. The Industrial Line features five different sizes, ranging from 445 to 1,570 Ah at C20. Engineered with advanced battery technologies that deliver reliable power, Trojan's Industrial batteries are tested to meet both International Electrotechnical Commission (IEC) and Battery Council International (BCI) standards.

Trojan Battery Company

www.trojanbattery.com

Booth 6929



Pre-engineered solar thermal systems

From two to 60 complete systems, pre-engineered and ready to ship, FREE HOT WATER's systems include solar thermal collectors, racking and mounting hardware, storage options (pressurized and large, non-pressurized tanks), and pump stations engineered and sized specifically for an application with a smart controller. They also offer expansion tank(s), air vents, and connection kits. Blueprints and engineering services are available upon request.

FREE HOT WATER | www.freehotwater.com

Booth 3832

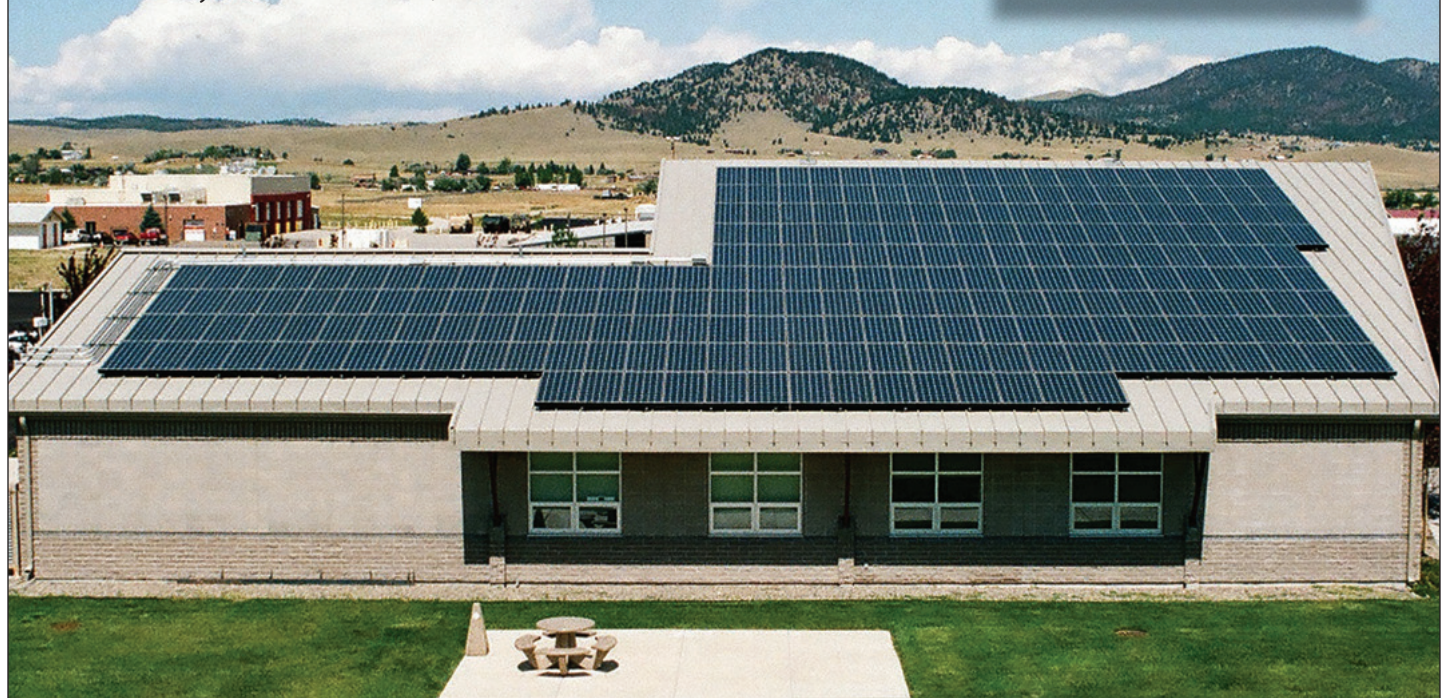
Why I switched to SunWize

"SunWize is my choice for module and balance of system supplies because their sourcing, product support, and logistical expertise keep the project costs down and allow us to deliver more kilowatts of production for every dollar spent. I can always depend on my SunWize sales person, Helga Canfield, to provide the support I need, when I need it."

John Palm, Owner/President
Bozeman Green Build
www.bozemangreenbuild.com



49.8 kW system in Fort Harrison, Montana



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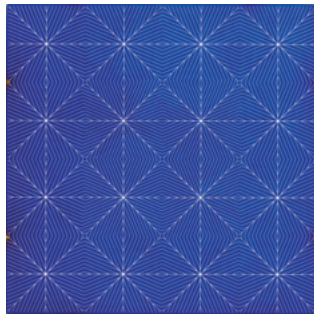
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Solar solutions

At BASF, they believe chemistry will play an important role in the future of solar technology, enabling the sun's energy to make a sustainable contribution toward a low-carbon society. BASF has solutions that can improve the efficiency and cost-effectiveness of silicon wafer and thin-film technologies, solar modules, and large-scale solar utility plants. With their broad construction materials portfolio, BASF can provide robust solutions for homes and commercial buildings to minimize the amount of energy needed from the grid.

BASF Corporation | www.basf.us/solar
Booth 3751



Proprietary cell technology

Canadian Solar, one of the world's largest solar companies, showcases its new E.L.P.S. (efficient long-term performance solution) proprietary cell technology. This new breakthrough cell technology enables solar cells to collect more light, resulting in 19.5% cell efficiency for monocrystalline cells and 18% efficiency for polycrystalline cells. These new cells feature a metal wrap through (MWT) design, which moves the front busbars to the back of the cells, allowing for 3% more light absorption per cell—as a result ELPS modules deliver 6.3% more electricity than conventional solar modules.

Canadian Solar | www.canadiansolar.com
Booth 2516



Surge protectors

CITEL's VG Surge Protectors are designed with their patented VG Technology, a hybrid Metal Oxide Varistor (MOV) + Gas-filled Spark Gap (GSG) surge protection circuit dramatically increases the life expectancy of the surge protector and eliminates working current and leakage current. Rated for DC Power Applications up to 1200Vdc and UL 1449 3rd Edition.

CITEL Inc. | www.citel.us
Booth 6442



Surge protection devices

The SES40P Series of Surge Protection Devices are designed to provide economical protection against damaging transients and surge events. This series of products are UL and cUL listed to 1449 Edition 3 as a Type 1 devices. This allows them to be installed on the line or load-side of the service panel in accordance with the NEC 2011, and without the requirement for additional circuit breakers or fuses. The DC models are listed under UL1449 Edition 3 for PV systems.

ERICO | www.erico.com
Booth 1550



Solar thermal manufacturing

SolarUS is a solar thermal manufacturing and distribution company based in the United States. In addition to the line of solar thermal collectors, they feature a new line of storage tanks, piping, and solar thermal heating and cooling systems for residential or commercial projects. SolarUS has one of the most advanced and complete systems on the market today, which is poised to become a new standard for performance, quality, and dependability.

SolarUS | www.solarus.com
Booth 6825



Deep cycle storage

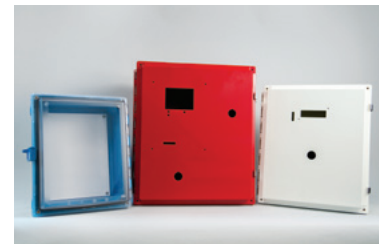
Rolls Battery continues to offer a full line-up of flooded and maintenance-free deep cycle battery lines tailored to the renewable energy market, including: three 2V L16 models (S-1380, S-1590, and S-1725) and three of the 6V L16 models (S-460, S-530, and S-600). Rolls 4000 & 5000 Series and AGM batteries offer extended AH ratings and durable premium-grade construction. They are backed by warranties, as well as the Rolls Battery reputation for reliability and service.

Rolls Battery | www.rollsbattery.com
Booth 700

Solar insolation region

Riverside County is geographically located in one of the premier solar insolation regions in the world, with a large population that creates a demand for clean energy. They assist businesses in finding the right location, providing a highly qualified workforce, and expediting permitting and approvals. Riverside County is an ideal location with reasonably priced land and building leases, as well as purchase rates.

Riverside County | www.rivcoeda.org
Booth 1001



Custom-colored enclosures

The ARCA JIC enclosure family, from Fibox, can now be molded in custom colors. In addition to the standard RAL 7035 light grey color, volume users can specify a specific color matched to PMS (Pantone Matching System), FED STD 595C, or European RAL Colors. The ARCA IN COLOR program allows users color customization to specific application needs, such as 'white' for use in solar industry applications. The ARCA enclosure line consists of 10 standard JIC enclosure sizes. Available in over 120 configurations, Fibox ARCA enclosures feature opaque or transparent screw covers, or hinged latched cover versions. This size range targets OEM instrumentation, controls, and automation applications, accommodating larger components and high-power applications. Stylized ARCA enclosures manufactured using injection-molded polycarbonate, a high impact-resistant plastic, provide ease of customization, robustness, UV and chemical-resistance, and a wide temperature range. ARCA features UL listing, NEMA 4X and IP 66 / IP 67 rating, and CE certification.

Fibox | www.fiboxusa.com
Booth 3342

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For the largest solar initiative in the greater Houston area, Pasadena Independent School District utilized the mounting systems developed and manufactured by EcoFasten Solar.

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Lorie Clements, VP Business Development
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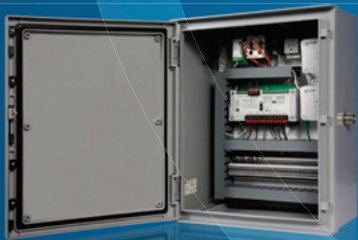
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Mounting solution

There are many standing seam profiles, which means it's virtually impossible to have a one-size fits-all approach. But, the TRA-MAGE EZ Solar Mount Clamp On fits many standing seam metal roofs profiles using a safe, reliable design that's customized for a secure fit. The exclusive attachment system, using under-the-hem clamping and bolting, provides superior strength while maintain the manufacturer's warranty. Its attractive appearance and proven performance make TRA-MAGE's EZ Solar Mount Clamp On ideal for commercial and residential projects. When it comes right down to it, a solar system is only as good as its mounting structure, so a high-quality roof mounting and racking solution is a must. With over 35 years in the roofing industry, TRA-MAGE's experience and SOLAR Mounting line creates an ideal foundation for solar systems.

TRA-MAGE | <http://sun.tra-mage.com>
Booth 7045



Transformerless inverters

Solar Services, Inc. introduces the OPTI series of high-frequency, transformerless inverters. Sizes available are 2kW, 3kW, and 4kW, with a 6kW unit coming out later this year and a 10KW three-phase unit next year. Communications software is built in, and manufacturer's technical support is available in Virginia Beach and Los Angeles. With a 10-year warranty and over 96% efficiency, the OPTI series also offers the lowest prices—as low as 35 cents/watt compared to over 50 cents/watt for other string inverters, and over 80 cents/watt for micro inverters. These inverters only require one person to install, and are slim enough that they can fit in the same plane as the electrical panel. Nema 3R rated for installation outdoors if necessary. The voltage range can be changed to 208 or 277, and the frequency changed to 50Hz, all with a quick change of software parameters.

Solar Services, Inc.
www.solarservices.com
Booth 120



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 SLT-006 Rev 7/10

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Renewable energy business

Idaho offers a diverse economy with a skilled and educated workforce, state-of-the-art facilities, and next-generation technologies. These attributes have enabled Idaho to become home to many companies and universities focused on research and manufacturing in areas such as polysilicon wafers, fuel cells, low-power batteries, electric car technologies, kinetic energy capture, and even biomass and new alternative fuels—positioning the state at the helm of alternative energy manufacturing in America.

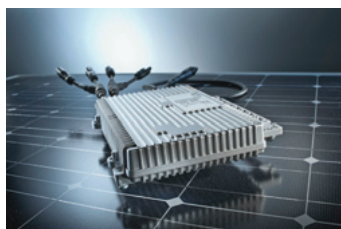
Idaho Department of Commerce
www.renewable.idaho.gov
Booth 5739



PV site monitoring system

Delta is launching the SOLIVIA Monitor, a turnkey multiple PV site monitoring system, ensuring reliable functioning and maximum yield of one's solar system investment. The system is compatible with the North American, European, and Asian-Pacific SOLIVIA String Inverter Models from Delta. The solution includes a SOLIVIA GW Gateway, a database, and a web application providing an easy online portal especially designed for installers and end customers. Real-time and historical data reports can be created and downloaded to a computer. Furthermore, automated alerts inform the operator of system activity and ensure the return from a solar investment.

**Delta Energy Systems
(Germany) GmbH**
www.solar-inverter.com
Booth 3901



Duo micro-inverter

Enecsys, a supplier of reliable solar micro-inverter systems, unveils the SMI-D480W-60—a 480-watt micro-inverter that mounts on the railing system and accepts DC input from two individual solar modules. This Duo micro-inverter enables maximum power-point tracking for both modules, and reduces inverter cost compared with using one micro-inverter per module. The DC power generated by the two solar modules is converted into a single, grid-compliant AC output in the 480-watt unit, which has a maximum input current of 24A. The Duo inverter has a peak efficiency of 96% and a CEC efficiency of 95%. The SMI-D480W-60 micro-inverter operates at an ambient temperature range of -40° F to 185° F (-40° C to +85° C), has over 25 years' service life, supplied with a 20-year limited warranty. Solar PV installations with Enecsys Duo micro-inverters deliver 5% to 20% more energy over the life of the system, depending on the operating environment and installation configuration.

Enecsys | www.enecsys.com
Booth 511



Configurable connector for solar systems

The solar SPEC pak, manufactured by Anderson Power Products, is a highly configurable interconnect with power capabilities up to 1,000 volts. The rugged, IP68 shell is flame-resistant in accordance with UL 94 V-0, and has a F1 weatherability rating. The locking latch conforms to the NEC 2008 requirements, requiring a tool to release the locking latch. Its touch-safe shell is available for wire-to-wire or panel-to-wire applications that range in temperature from -40° F to 230° F (-40° C to 110° C). This highly configurable connector provides thousands of design options for the most demanding applications.

Anderson Power Products
www.andersonpower.com/products/
spec-solar
Booth 6515



Power optimizer

The new Azuray Technologies AP260 is an advancement of the current AP250 stand-alone power optimizer. Both products re-coup up to 99.2% of solar energy lost due to shading and panel mismatch. These DC-DC MPPT converters are built from highly reliable automotive-grade components, and continually monitor the solar energy generated by each panel. In addition, the AP260 displays real-time energy production on a web portal for easy analysis. The AP260 uses power lines to communicate with the ACM300 communications gateway, which provides safety shut-off features during installation and emergencies. Like all Azuray products, the AP250 and AP260 are built for extreme reliability, include a 25-year limited warranty and are ideal for residential and commercial installations.

Azuray Technologies
www.azuraytech.com
Booth 1455

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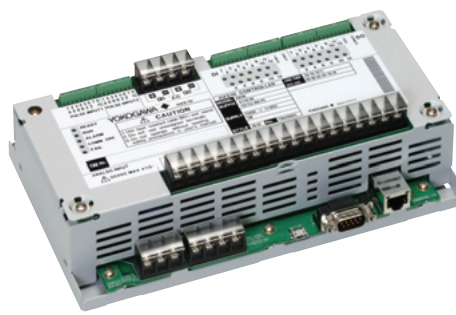
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Solar tracker controllers

Yokogawa Corporation of America provides complete control, communication, and instrumentation systems for utility-scale solar applications. Yokogawa's HXS10 controller is specifically designed for controlling solar trackers with embedded NREL Solar Positioning Algorithm, robust operating temperature (-20° C to +70° C), and extensive field communications support. Since the HXS10 was specifically designed for solar tracking applications, it has a variety specialty inputs for inclinometers and position feedback sensors including RS232, RS485, and high-speed pulse encoders, as well as full trigonometric functions for calculating positions. A single HXS10 is capable of controlling up to 20 axes for cost-effective tracker deployments. Yokogawa's turnkey control systems include tracker control panels (LOCs), Supervisory Control Systems (SCS), Distributed Control Systems (DCS), communication networks, and field instrumentation. Their field instrumentation is designed to accommodate measurement of high-temperature, concentrated solar thermal heat transfer fluid with several proven installations worldwide.

Yokogawa Corporation | www.hxs10.com
Booth 4716



Drop-in mounting solution

ET Solar Group Corp., a China-based vertically integrated producer and provider of solar modules and related PV solutions to the global solar market, introduces new Zero-Rack series solar modules for residential and commercial rooftop systems. Through a licensing agreement with Zep Solar, ET Solar developed the Zero-Rack modules with patented Zep Groove aluminum frames—providing an auto-grounding, drop-in mounting solution. Zero-Rack modules require no rails, making it easier to ship and store the system and reducing the installation time up to 50%.

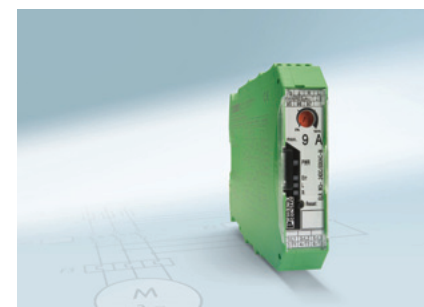
ET Solar Group Corp. | www.etsolar.com
Booth 2737



Six-volt renewable energy battery

Advanced design features of the new US Battery RE 2200 six-volt renewable energy battery include: Outside Positive (OSP) battery design; DEFENDER moss shields; as well as, an extended electrolyte reservoir. The OSP battery design increases the positive-to-negative active material ratio, and provides increased protection of the positive plate from positive plate deterioration. This results in longer life, increased capacity, and a more stable performance over the life of the battery. The use of insulating DEFENDER "moss shields" can prevent the formation of mossing shorts that limit the life of these batteries, also resulting in longevity, increased capacity, and a more stable performance. Furthermore, increasing the volume of the electrolyte reservoir not only increases battery performance, particularly in long-term (50- to 100-hour) discharges, but also allows the battery to maintain lower operating temperatures in hot environments while extending the time between watering intervals.

U.S. Battery | www.usbattery.com
Booth 3451



Contactor for solar tracking applications

Phoenix Contact's CONTACTRON 4-in-1 provides four functions in one narrow package. At just 22.5mm wide, the multi-purpose, solid-state contactor saves space and offers value for solar tracking motor applications. Designed for three-phase AC motors up to 4 kW/5 HP in size, the 4-in-1 provides forward, reverse, overload protection, and redundant emergency stop contactor functionality. The CONTACTRON also reduces wiring time by 75% compared with a conventional reversing starter. The CONTACTRON has a life expectancy of up to 30 million cycles, 10 times longer than traditional electromechanical contactors. This reduces maintenance costs, as well as total cost of ownership. Integrated input/output surge protection circuits reduce system downtime, and 16 separate motor overload settings reduce inventory requirements. LED and remote indication acknowledge motor status. The CONTACTRON 4-in-1 is rated for safety category 3, SIL 3, and ATEX zone 2.

Phoenix Contact | www.phoenixcontact.com
Booth 4224

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As solar module life expectancies now reach beyond 30 years, it's more critical than ever to fully test laminate materials and components to verify durability under extended outdoor exposure. However, testing can be very time consuming. HID UV weathering chambers are one of the solutions that can provide acceleration factors more than 10 times typical Xenon chambers. With the capability to deliver more than 30 times natural sunlight UV energy, systems can simulate three years of outdoor exposure in only nine days of testing. Correlated acceleration factors greater than 100 times natural solar UV irradiation provides proven, efficient, outdoor exposure testing. Custom spectral filtering cuts UV irradiation below 295nm to replicate natural sunlight, and electronic feedback systems ensure constant energy to target materials. All weathering parameters and cycle functions are programmable. EYE Applied Optix division is a provider of premium UV weathering chambers and Solarlux solar flash and soaking systems.

EYE Applied Optix | www.eyelighting.com
Booth 3509



Molded spine cable

C&M Corporation announces the Helios Spine Cable, a new molded product for the solar industry. Adaptable for mating with all major inverter manufacturers and available in packages of up to 200 drops, this robust yet lightweight product reduces installation time and cost while simultaneously minimizing voltage drop. Manufactured to meet IP 67 requirements, this interconnect system can be customized for profile or landscape solar installations. Available in connectorized or non-connectorized versions, and scalable for gauge sizes of 6 AWG to 14 AWG, this product includes a clip feature that locks the cable into the racking ensuring efficient and reliable installation. Offering a temperature range of -40° C to +85° C, this robust molded solution offers protection from the most challenging environmental conditions. C&M offers full engineering support to assist with creating a product solution that meets the requirements of a specific application.

C&M Corporation | www.cmccorporation.com
Booth 1957



Pipe fittings & solar racking system

Hollaender has made solar panel installation a simple, flexible, and affordable process for integrators, installers, and contractors in the commercial and residential markets. Using the company's Speed-Rail structural slip-on pipe fittings, together with 1-1/4, 1-1/2 or 2-inch IPS aluminum, galvanized steel, stainless steel, or black iron pipe, solar panel racking systems can be easily designed and built onsite. Speed-Rail fittings are strong and lightweight, and come in a wide variety of fixed and adjustable configurations, including the tees and flanges most commonly used in solar panel installations. The versatility of the fittings allows dependable support structures to be constructed virtually anywhere a solar panel needs to be installed. The same versatility also allows the systems to be easily uninstalled and moved if necessary. The system installs quickly, securely, and cost-effectively, especially when compared to welded and other more complex systems.

Hollaender | www.hollaender.com
Booth 634



Next-generation solar PV

Advanced Solar Photonics, LLC (ASP), a subsidiary of BlueChip Energy and manufacturer of crystalline PV solar modules for utility, commercial, and residential applications, is showcasing its Smart Module—the next generation of PV solar designed for the Smart Grid. ASP's Smart Module technology enhances the energy harvest of each module by delivering higher output. A featured smart junction box enables each module to produce the maximum available energy. Smart Module technology overcomes the limitations of existing solar power generating solutions with fire safety and energy loss. The ASP 400GSM, a frameless, dual sided glass-to-glass 400-watt module made in America, features: module-level optimization through embedded DC/DC controller with an integrated junction box; fixed voltage signal from inverter tunes up individual modules, virtually eliminating the need for strict string calculation and removing limitations for real life installations; and, enhanced safety through a system shutdown from the fire suppression system, or remotely for maintenance.

Advanced Solar Photonics, LLC

www.advancedsolarphotonics.com

BlueChip Energy | www.bluechipenergy.org

Booth 5320



Turnkey PV systems

First Solar provides complete utility-scale photovoltaic (PV) turnkey systems, which can be customized to meet specific solar power generation needs. Each power plant utilizes advanced thin-film modules, which are certified for reliability and safety and backed by a 25-year power output warranty. First Solar modules—both frameless and recyclable—also produce high-energy output across a wide range of climatic conditions, and have an excellent temperature response coefficient. System solutions can include project development, financing, engineering, procurement, and construction (EPC), as well as operations and maintenance. The O&M offering enables customers to maximize energy harvest. PV system solutions can also include integrated off-grid applications to meet the needs of smaller distributed generation requirements.

First Solar | www.firstsolar.com
Booth 2019



Solar linear actuators

SKF will highlight a diverse product line uniquely supporting the solar industry and underscore the many dedicated “green” initiatives introduced at their facilities around the world. The latest product on display will be the new advanced SKF Solar Linear Actuators (Type CASD-60). This actuator enables precise tracking of the sun from sunrise to sunset throughout the seasons to improve solar power generation. The actuator is designed to perform virtually maintenance-free over a 20-year service life, and can be applied for the full range of photovoltaic (PV), concentrating photovoltaic (CPV), or concentrating solar power (CSP) systems. A high static-load to dynamic-load ratio contributes to reduced energy consumption, ideal positioning accuracy, and limited backlash allowing for consistent tracking. Robust unit design features, including a sealed protective tube, promote reliability in extreme conditions and increased drive protection, while reducing installation time.

SKF USA Inc. | www.skfusa.com
Booth 7019



Energy storage solutions

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Saft | www.saftbatteries.com
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North American Clean Energy 115



Exploring the Advantages of PEXa-based Geothermal Systems

By Mike Dietrich

With a notable increase in commercial and residential geothermal system installations throughout North America, those from across the building community have begun to closely assess the variety of system options available today. This includes the evaluation of PEXa (crosslinked polyethylene) ground loops and U-bends as an alternative to traditionally used HDPE (high-density polyethylene) piping systems.

HDPE is a product that has been around for a long time in North America, and it's more familiar among geothermal installers. As HDPE is a commodity pipe that's well entrenched in the geothermal industry and readily available in the construction product supply chain, many installers see it as a comfortable choice.

However, PEXa is a high-performance thermoelastic polymer material that has been used for decades in residential and commercial HVAC and plumbing pipe applications, as well as for municipal and industrial wastewater management. The permanent crosslinking process bonds HDPE molecule chains together in a way that improves the properties of the PE, particularly in respect to high-temperature and stress-cracking resistance, flexibility, and creep. Therefore, the robust characteristics of PEXa fit well with geothermal ground-loop heat exchange applications for a variety of reasons.

Tough on the jobsite

Geothermal applications rely heavily on the performance of the well-field pipe, particularly during initial installation. Pipe can be exposed to extreme temperature changes, rough terrain, and generally severe treatment, requiring it to withstand installation in a manner that ensures its performance integrity. The unusually durable, yet flexible nature of PEXa polymer translates to a piping system that can withstand the repeated creasing, scratching, notching, and potential for puncturing typical on a jobsite, without any type of permanent damage. PEXa pipe has also exhibited resistance to tension cracking when subjected to point loads, and has exhibited no long-term crack propagation on the job.

PEXa pipe offers additional confirmed performance attributes, including resistance to thermal aging (or brittle fracture) in long-term inner pressure tests up to 203° F (95° C), and higher chemical stability in comparison to its HDPE counterpart.

Streamlining installation

As pressure to control jobsite labor costs remains one of the most crucial concerns in any construction project. PEXa pipe offers additional advantages in respect to streamlining the installation process. Its flexible nature enhances installation parameters by enabling a minimum bend radius as tight as five times the pipe's outer diameter, or OD (and three

times the OD with heat); thereby, eliminating the need for fittings at the top of a vertical loop and making it easier to install pipe in tighter spaces. Also, the elemental resistance and overall performance properties of PEXa make it possible to eliminate the use of a sand bed and install the pipe directly in the soil, translating into significant cost savings in material and labor. PEXa pipe can also be installed during a wide range of weather conditions, including in temperatures as low as 5° F (-15° C).

The nature of a PEXa pipe system's unique cold expansion compression-sleeve fitting solution offers several additional benefits in respect to streamlining installation, including requiring no heat or electricity onsite. Also, these fittings eliminate the need for labor that's specially trained in butt and socket fusing techniques, which are typically used in HDPE pipe installations. Fusion-welded pipes additionally can vary in performance, depending on the quality of the labor, whereas compression-sleeve fittings perform with consistent reliability. Like their fusion-welded counterparts, compression-sleeve fittings can also be buried underground or in concrete, and provide a long-term strength greater than the pipe itself.

The U-bend advantage

A U-bend, which is the 180° bend of pipe length at the bottom of a vertical loop, represents a crucial component of the geothermal system. PEXa U-bends can be considered particularly desirable, as they are constructed in a joint-free manner in which the pipe itself is pre-bent and cast into a solid resin shell. The result is a highly reliable U-bend with no connecting point flow obstructions, and no chance of failure in the borehole due to a fitting's malfunction.

Offering an additional system performance advantage, PEXa U-bends can also be coupled together as double U-bends, promoting the potential for 15% to 20% more heat exchange in each borehole. As a result, drilling costs can be significantly reduced. In addition, when each loop is connected separately to a central manifold, a double U-bend arrangement provides an extra level of security through virtue of redundancy as, if one loop is damaged, the entire borehole is not lost.

Continued on page 118.



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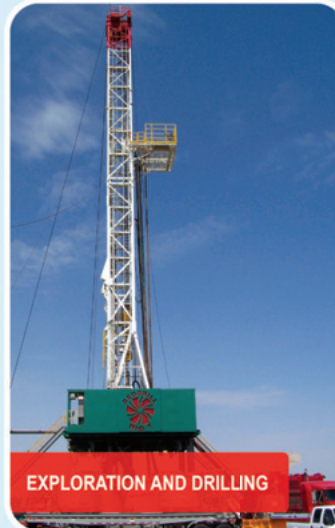
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www.ormat.com

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...continued from page 116.

Integration attributes

While able to be integrated with either water-to-air or water-to-water systems, a PEXa-based ground loop's performance is optimized when combined with a centralized water-to-water geothermal heat pump system. In this type of configuration, energy is transferred from the external loop field to the internal HVAC fluid stream that heats and cools the building. This is achieved as the conditioned water flows through a system of radiant heating and cooling pipes (also typically composed of PEX), embedded in the walls, floors, and/or ceilings.

A radiant system can more efficiently distribute heat in a building via the use of water versus air, and, therefore, requires more moderate overall operating temperatures (on average, 115° F/46° C in the heating mode, and 60° F/15° C in the cooling mode). This translates to notably less energy demand on the actual geothermal heat pump when a radiant system is used.

To illustrate the performance efficiencies of a radiant (water-to-water) versus a forced air (water-to-air) geothermal system configuration, a nominal four-ton (45,700 Btu/hr) water-to-air heat pump with a ECM blower motor that requires 677 watts at full speed has a delivery efficiency of 67.5 Btu/hr per watt. In comparison, a properly designed radiant (or hydronic) system can deliver the same amount of heat using a single 40-watt ECM circulator instead, with a resulting 1,143 Btu/hr per watt distribution efficiency. A hydronic system can operate at less than six percent the wattage of a forced air system's ECM blower, notably reducing energy consumption and cost.

Geothermal in action

It's true that many installers are more familiar with and more comfortable using HDPE piping systems. HDPE offers a simplistic manufacturing process and is cost-effective. The PEX alternative is fairly new on the North American front, but is also proving quite promising and efficient.

In the recent construction of its University Commons student center, Philadelphia-area Arcadia University was encouraged to switch its geothermal ground-loop piping specifications from HDPE to PEXa. In all, forty-two 396-foot wells have been drilled to support the system, which is in its final stages of installation. Using a PEXa-based system for the first time, geothermal installing contractor Jake Kocher of Kocher Geothermal Services has noted some key advantages.

According to Kocher, "The PEX pipe is definitely more flexible than HDPE, and the fittings are very quick to make. Also, being able to isolate individual boreholes on the manifold is a great advantage. With HDPE, we were connecting five or eight boreholes together, either in a circuit or in parallel. But with the way that the PEX system is designed, we have a lot more control in the initial balancing of the system, and will also have more control over its operation."

Mike Dietrich is the business team manager for building technology at REHAU.

REHAU | www.rehau.com



Geothermal manifold

The GeoCal pre-assembled manifold for ground-source geothermal loops offers an alternative method of piping parallel earth loops, bringing all circuits to a common manifold station without labor-intensive fusion welding. GeoCal manifolds provide significant installation, commissioning, and operational advantages. With optional 3/4" or 1" QuickSetter balancing valves with flowmeters and shutoff ball valves, GeoCal allows easy individual circuit isolation and balancing leading to lower pumping costs and greater system efficiency. Shutoff ball valves installed on the return manifold simplifies individual circuit filling and purging while minimizing purge pump size. GeoGrip couplings are used for connecting to polyethylene piping, either directly to the manifold or to the balancing valves and shutoff valves, making the ground earth-loop installation completely free of fusion joints.

CALEFFI | www.caleffi.us



Heating & cooling comfort system

GeoStar introduces its Cypress Series energy efficient geothermal comfort system, which provides forced air heating and cooling, hydronic heating for radiant floors, and a "de-superheater" hot water assist option that can provide homeowners with free supplemental domestic hot water in one package. The Cypress Series achieves high efficiencies by utilizing two-step Copeland Scroll UltraTech compressors and variable-speed (ECM) fan blowers that consume less energy and provide improved comfort. The compressors are mounted on double-isolation plates made of acoustic metal, and are wrapped in a compressor blanket to provide whisper-quiet operation.

Available in three- to six-ton capacities, the ENERGY STAR-rated Cypress Series also features environmentally friendly R-410A refrigerant to meet the most stringent requirements of the US Environmental Protection Agency. Coated air coils add durability and longer life to the unit. A sophisticated microprocessor control sequences all components during operation of the Cypress Series for optimum performance, and provides easy-to-use troubleshooting features with fault lights and on-board diagnostics. The unit includes a Comfort Alert to monitor compressor operation and faults.

GeoStar | www.geostar-geo.com



Heat pump system

ClimateMaster introduces the Tranquility 22 Digital (TZ) Series geothermal heat pump system. This cost-competitive product incorporates high-end features including a two-stage compressor, EnergyStar tier-3 efficiency, a variable-speed fan, communicating digital controls, and "plug-and-play" functionality. It also offers one of the industry's smallest footprints, making it suitable for installation in confined spaces. It's expected that uncapped 30% (residential) and 10% (commercial) US federal tax credits on geothermal systems, coupled with the Tranquility 22 Digital Series' ease of installation, will engage residential/light commercial HVAC dealers in a wider adoption of geothermal systems, making them a substantially larger part of the overall North American HVAC industry. The Tranquility 22 Digital system additionally delivers on all the reliability features for which the ClimateMaster Tranquility series is known. It's available in vertical and horizontal configurations in 024k, 030k, 036k, 042k, 048k, and 060k Btuh capacities.

ClimateMaster | www.climatemaster.com

Every year, the Geothermal Energy Expo hosts the world's largest gathering of vendors, providing support for geothermal resource exploration, characterization, development, production, and management. It provides a unique opportunity for exhibitors to showcase their projects, equipment, services, and technologies to the geothermal community.

www.geothermalenergy2011.com

Show in Print

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



Resource assessment & energy monitoring

Campbell Scientific offers packaged systems for geothermal resource assessment and energy monitoring. Meteorological stations and geothermal systems accurately and reliably monitor direct-use plants, acting as onsite, customizable BTU meters for commercial/residential distribution. Their products measure ground-water level and temperature, thermal gradient profiling, well casing monitoring, water quality, and water flow in open/closed systems.

Campbell Scientific | www.campbellsci.com



Generators, turbogenerators & support systems

Brush is an original equipment supplier of Steam & Gas Turbine-driven electrical generator equipment for industrial, utility, and process applications on and offshore. Their range of products built is generally rated 10 MW to 200 MW for geothermal applications. Direct air – TEAAC (air to air) and TEWAC cooling is available. Brush's product range includes: salient pole generators for geared turbines 5 MW to 50 MW; turbo type direct-coupled generators and motors rated 10 MW to 150 MW; as well as, water- and hydrogen-cooled turbogenerators rated 150 MW to 1000 MW. Brush also supplies excitation control products that provide monitoring and protection of the generator support system. And, Brush customizes new-build generators for geothermal applications, and provides aftermarket support services worldwide.

BRUSH Turbogenerators Inc.

www.brush.eu

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More on our energy recovery solutions at www.atlascopco-gap.com.

Sustainable Productivity

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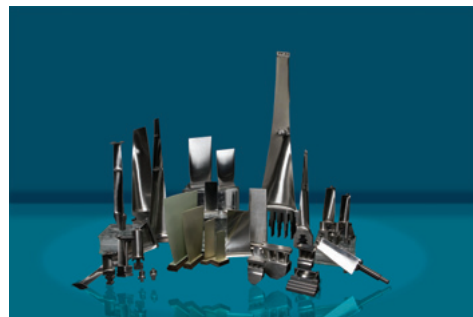
SEE US AT 2011 GEOTHERMAL ENERGY EXPO - BOOTH #212



Geothermal power producer

Ormat Technologies, Inc. is a geothermal power producer specializing in the design and development of geothermal and recovered energy generation power plants. Ormat offers a single point of responsibility; full control over delivery time, cost, performance and completion; unsurpassed knowledge and field-proven experience; proven lifecycle costs; and, tailor-made equipment to match any resource condition for optimal power production. Ormat is currently providing more than 1370 MW worldwide.

Ormat Technologies, Inc.
www.ormat.com



Blade manufacturer

Stork H&E Turbo Blading is one of the world's largest ISO 9001 certified independent, aftermarket turbine blade manufacturers, making new replacement blading for turbines utilized in geothermal power generation. They offer the best alternative to high prices and long delivery times with over 70 years of proven dedication to quality. They have two manufacturing facilities in the US, and one in Holland. Stork H&E Turbo Blading can help save time and money at the next outage, without sacrificing quality.

Stork H&E | www.he-machinery.com



Geological mapping

Geophysics (and, in particular, EM methods) has been used for geothermal exploration for some time, designed to map the electric properties of the geology at depth. Techniques such as ground MT provide good depths of investigation and resolution, but at a very high cost. A new technology is now available that provides the ability to cost-effectively map large areas, while detailing the geological structures at depths. The ZTEM system uses naturally occurring Afmag magnetotelluric fields as the source of the primary fields. The ZTEM offers clients the ability to survey large areas and map the structural and electrical properties at significant depths—all at a cost-effective price. The advantages of using ZTEM solution is its ability to provide valuable geophysical data covering large areas, without the ground restrictions and permitting requirements that are needed with MT.

GEOTECH LTD. | www.geotech.ca



Drilling equipment

GEFCO (George E. Failing Co.) has been manufacturing high-quality drill equipment for 80 years, and continues to develop and support all new technologies that introduce clean energy to the industry. GEFCO's newest models, including the 185 K and SS-1100 top-head drills, are suited for both clean natural gas drilling and large geothermal projects. Some of their smaller units, such as the SS-135 and SD-300, are well suited for the heat-loop market.

GEFCO | www.gefco.com

Geothermal equipment

Incorporated in 1919, one of the world's most experienced manufacturer of geothermal valves and wellheads has been producing superior geothermal equipment continuously since 1962. The company has an extensive history to sites on all continents (excepting Antarctica).

TIX-IKS CORPORATION | www.dns.tix.co.jp



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Atlas Copco | www.atlascopco-gap.com/geothermal

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Capturing Wasted Energy from Natural Gas

By Chris Cote

There is enough energy currently being wasted in the United State at gas pressure reduction stations to power about 10 million homes—and for mere pennies. So, why aren't we using it?

Much natural gas is found in remote or distant regions (like Canada), and needs to travel thousands of miles from the wellhead to more populated areas (like Southern California) where gas consumers live. An elaborate 272,000+-mile natural gas pipeline grid pushes gas downstream using compressor stations every 40 to 100 miles or so. Compression stations are used to increase the pressure, often to a linepack of 1,000 psi to 1,750 psi. Energy in the form of enthalpy is contained in this highly pressurized gas.

As the gas nears populated areas, however, this tremendous pressure needs to be reduced to acceptable levels, and eventually to as low as 1/4 psi for residential use. That's where letdown stations come into play (also known as citygates, gate stations, farm taps, or reducing stations, etc.). Though a necessary part of the process, it's the series of letdown stations in the distribution system where all the potential energy from pressure is wasted due to the use of reduction-throttling valves.

The challenges

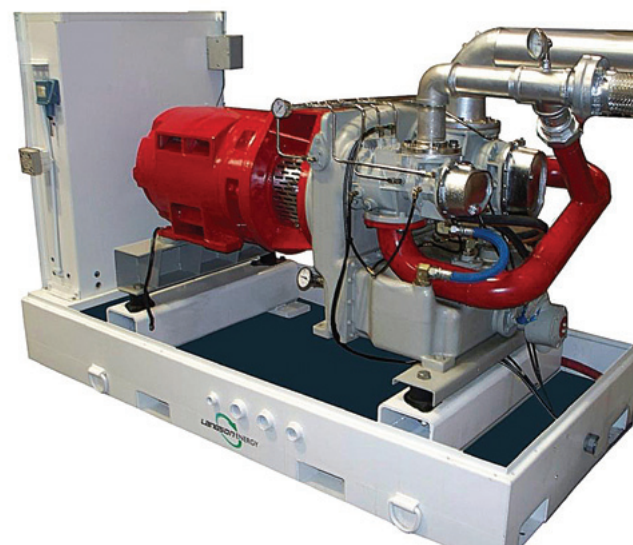
This wasted energy isn't a new discovery. Many attempts have been made to capture wasted energy with turboexpanders, a complex centrifugal or axial flow turbine. Turboexpanders were originally designed for other applications and have been used for over a century but, in the 1980s, axial flow turbines were placed in natural gas pipelines between the high-pressure and low-pressure pipes. As the gas flows from the high-pressure pipe into the turboexpander, it spins the turbine, which in turn spins a generator to produce electricity. By replacing a conventional control valve or regulator with a turboexpander, the energy in the pressure of the high-pressure gas (or the enthalpy) that would otherwise be lost, can be converted to electricity. Simultaneously, the turboexpander reduces the pressure of the gas for the local gas network.

The challenges associated with utilizing turboexpanders in the natural gas pipeline letdown stations are primarily cost related. For one, the equipment must be custom-engineered for each specific application. Turboexpanders are complex machines that generally operate efficiently in a specific band of flow-rate volume. Efficient sizing of the turboexpander requires an analysis of seasonal flow-rate fluctuations. Maintaining a turboexpander is also relatively expensive as the delicate, rapidly spinning blades can be damaged by moisture or foreign elements. Perhaps, most significantly, the capital cost doesn't increase proportionally with the expected output. The larger the output, the lower the cost on a per-kilowatt basis. Therefore, an acceptable payback can only be obtained at the higher pressure stations—those which are furthest from the cities. Yet, a huge part of the unharvested energy is found closer to the cities at smaller letdown stations.

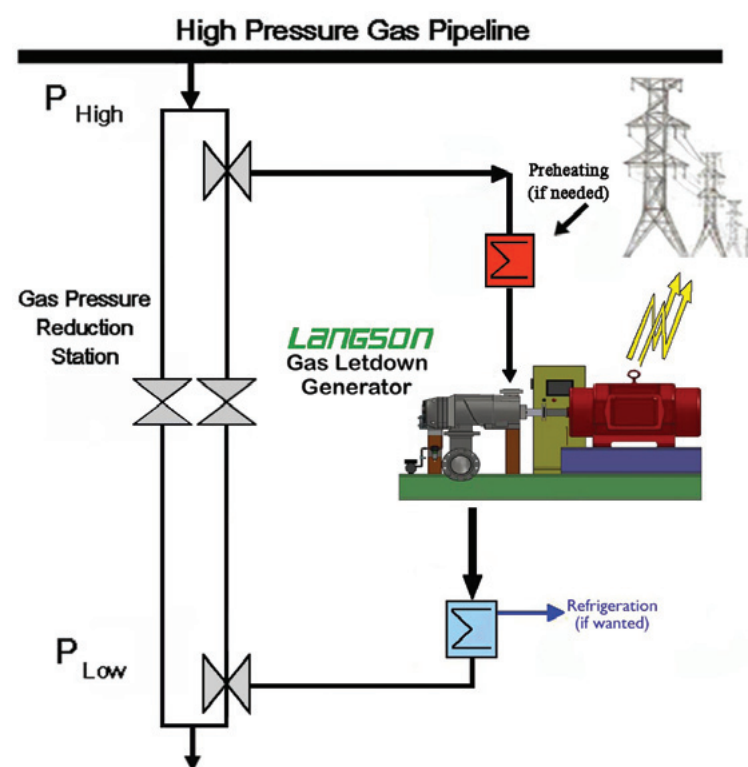
In 1983, San Diego Gas and Electric attempted to recover this energy with a turboexpander, as did other companies in later attempts in other states. Even many European companies, including the owner of most of the UK's gas pipeline network (the National Grid), have or have considered installing turbine generating systems, but couldn't justify the cost to capture this wasted energy without being subsidized. More complicated systems with fuel cells have been tried in Canada but, once again, the cost was just too great.

The benefits

Giving up is one option, however, the benefits of utilizing the wasted energy at gas reduction stations are compelling and numerous—particularly from an environmental stance. Not only is the energy readily available and cheap (assuming there's a cost-effective way to capture it), but it's a form of baseload power that's available 24/7, rain or shine. It's the epitome of distributed energy: located where the need is the greatest, both close to and in



The Langson Total Flow Generator—technology that requires a new classification for power generators. In June, Langson Energy, Inc. announced that they're ready for commercialization and third-party validation of their new product at a demonstration site.



cities. Moreover, no fuel is used to generate this energy; it's simply the pressure from the gas. So, there are no emissions and no CO₂.

Another potential by-product of using such wasted energy to generate electricity is the creation of extreme cooling—which can be a challenge at gas letdown stations, but would be a huge benefit to end users of gas further down the distribution line (such as manufacturers who can use the cooling to eliminate air conditioners).

The solution

The good news is that when there's a need, more often than not, there's a way. Thanks to dedicated innovators and engineers, equipment has recently been commercialized that solves the challenges of turboexpanders.

One solution is a robust expander with very low RPMs (1/5th the speed of turboexpanders). This equipment allows gases, dry or wet steam, hot water, impurities, and contaminants directly into the machine without damaging it. It also allows changes in flow rates and pressure, so it's flexible enough to handle multiple applications, and can use either a synchronous or an induction generator. As a direct-expansion device, the generator isn't limited to gas, and may be designed for various applications, including natural gas letdown, wet or dry steam, geothermal liquid/vapor, as well as hot air and hot exhaust gas streams.

Simply search online for "gas letdown generators," to find viable solutions other than turboexpanders available to capture wasted energy. Some are even worth the cost. With new technology available at a cost of less than \$2,000/kW, wasted energy no longer has to be wasted when it comes to gas pressure reduction systems—or other systems.

Langson Energy, Inc. | www.langsonenergy.com

Biogas Energy Recovery Project

A public-private renewable energy partnership

By Michael T Bakas



A NEW BIOGAS ENERGY RECOVERY FACILITY, developed in Texas by the City of Dallas Water Utilities (DWU), represents the kind of promising and productive partnerships being forged across the country between municipal governments and the private sector. In models such as this, city agencies collaborate with private corporations that provide know-how and technical support, conduct research, cover capital costs, and oversee operations. For this project, agency leadership sought ways to convert the biogas emitted from anaerobic digesters at city-owned wastewater plants into a usable source of energy.

DWU, a not-for-profit department of the City of Dallas, provides water and wastewater services to about 2.5 million people in Dallas and 27 nearby communities. The DWU wastewater biogas-to-energy facility, which went online in April 2011, converts methane or biogas into energy. Projects such as this one are notable as they take an otherwise harmful greenhouse gas—methane, which is significantly more toxic than carbon dioxide (by a factor of 21)—and use it to generate electricity and thermal load to power wastewater facilities.

Taking the “waste” out of wastewater

Wastewater is the used water that goes down the drain in homes and businesses. Currently, the DWU facility can treat up to 110 million gallons of wastewater per day. Traditionally, as

required by law, excess gas at a wastewater facility is burned off by flares. Flaring is safe and generally effective, but often represents money wasted for a utility.

DWU worked in a public-private partnership to design, build, and operate the 4.3 MW biogas capture and refining facility. With municipal budgets shrinking and energy and infrastructure “to do” lists expanding, this kind of public private-partnership is garnering attention and accolades—and for good reason. This new facility is expected to save the City of Dallas at least \$1.5 million annually, and offset approximately 60% of the electricity that the DWU currently pulls from the grid. This facility has already shown to be clean, green, and cost-effective, and is capable of treating and delivering up to 1,200 standard cubic feet per minute of biogas to power the wastewater plant. The city already has plans to incorporate future production increases.

In addition, the project was designed to convert waste heat, efficiently making use of it as a renewable resource. This approach allows DWU to utilize about 80% of the biogas resource. In comparison, a typical electrical production plant might only be able to utilize 35% of its energy product. The biogas facility was designed with a capacity to reduce greenhouse gas emissions, and its operation is equivalent to reducing annual greenhouse emissions from nearly 35,000 passenger vehicles, or the reduction of the carbon dioxide emissions from over 20 million gallons of gasoline consumed (according to the US Environmental Protection Agency’s emission reductions and environmental benefits calculator).

Market potential

DWU is leading the way for other wastewater utilities in the US with its decision to recycle biogas energy. The first sewage facility in the States to refine biogas for the natural gas grid went operational in September 2010, when the San Antonio Water System (SAWS) opened a new biogas facility at the Dos Rios Water Recycling Center. This methane capture technology is commonly constructed at landfills across the country, but there is growing interest among municipal leaders throughout the country who are looking to increase energy savings in other settings.

Both of these Texas-based projects in Dallas and San Antonio should serve as a model to other wastewater treatment plant managers and operators throughout the country. There are other opportunities to build these projects, and these projects showcase the revenue opportunities—whether in the form of royalties for the gas, or a cost-effective source of energy, and particularly in markets where energy prices are high.

Michael T Bakas is senior vice president of Renewable Energy at Ameresco, Inc.

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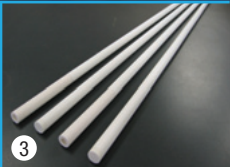
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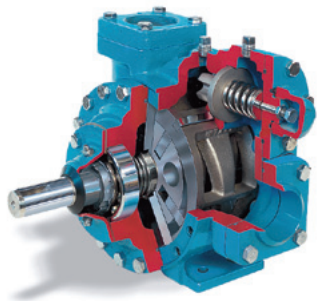



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Vane pump for biodiesel processing

Blackmer has designed its XL Series Sliding Vane Pumps to deliver optimum performance in biodiesel processing, filling, and transfer applications. XL Pumps meet the needs of biodiesel producers because they possess the operational ability to seamlessly handle a wide array of unique feedstocks. XL pumps are constructed of ductile iron that will withstand sudden thermal shock and stress well beyond the capabilities of cast iron. All models are fitted with replaceable casing liners and end discs that allow easy rebuilding of the pump without the need to remove the pump from the piping. The XL models are available in 1.25-, 1.5-, 2-, 3-, and 4-inch port sizes with flow capacities from 5 to 345 gpm (19 to 1,305 lpm). The 1.25- and 1.5-inch models have NPT-tapped ports, while the 2-, 3-, and 4-inch models have flanged ports. They also feature Blackmer's unique sliding-vane pump design that self-adjusts for wear, while the vanes can be easily replaced without removing the pump from the piping system.

Blackmer | www.blackmer.com



Software for multiple bin monitoring

BinMaster Level Controls announces 3D MultiVision, a Windows-based inventory management software for the 3DLevelScanner that enables users to view data for multiple bins in a single window. 3D MultiVision software can be used with all versions of the non-contact, dust-penetrating 3DLevelScanner including the S, M, MV, and MVL models. By clicking on a single bin, users can zoom in on detailed information for the bin including minimum, maximum, and average levels, and see the 3D visualization of bin content for the MV and MVL models. The software allows multiple users at multiple locations to view bin level and volume data 24/7 via their Local Area Network (LAN).

3D MultiVision software makes real-time bin data available across the entire organization to improve purchasing, logistics, operational decision-making, and financial management. The software is compatible with Windows XP and Windows 7, and features user-friendly set-up and intuitive operation. It allows each user to customize their screen to view all bins or a group of bins, and color-code bins by material type. Users can set high- and low-level alerts to be notified when bins reach critical levels.

BinMaster | www.binmaster.com



Turnkey pellet production systems

From processing the raw material to bagging the finished pellets, Vecoplan Midwest designs, builds, and installs complete pellet production systems. Equipment in a typical line includes size reduction, conveyance, metering, pelletizing, cooling, screening, packaging, and customized system controls. The heart of every system is a Vecoplan pellet mill, which features belt-driven dual drives for increased performance and lower maintenance costs. The brains of every system are Vecoplan controls, designed and manufactured to maximize ease-of-use and optimize system performance. Vecoplan pellet systems deliver production rates from 1,000 to 8,000+ lbs per hour, depending on the material being pelletized and the size of equipment specified. Vecoplan expertise includes pelletizing both hard and soft woods, wood scrap, agricultural bi-products, grasses, manures, ethanol waste, virtually any type of biomass, paper, cardboard, carpet scrap, and MSW.

Vecoplan Midwest | www.vecoplanmidwest.com



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Onsite Ethanol in Gasoline Blend Analysis

Eliminating uncertainty in fuel blends & saving costs

By Sandra R Rintoul

Wilks InfraCal Ethanol Blend Analyzer can help fuel blenders flag out-of-spec product and ensure the final blend meets specifications.





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THE USE OF ETHANOL as a gasoline additive has increased dramatically over the past few years, and will likely continue to increase. For fuel blenders, this means an added challenge to avoid an incorrect blend that could lead to regulatory fines, loss of customer confidence, and damage to equipment. A quick onsite analysis with a portable mid-infrared based analyzer can help fuel blenders quickly flag out-of-spec product and ensure the final blend meets specifications.

The four most common reasons for incorrect fuel blends are described below, highlighting how essential a quick check of the fuel blend can be.

1. Mechanical failure of blending equipment.

The majority of ethanol fuel is blended at a fuel terminal using a loading rack. Although blending systems at fuel terminal loading racks are considered quite reliable, they are never foolproof—and neither are the operators who make the adjustments. Too much or too little ethanol could be loaded into the tank truck without being detected at the rack and, ultimately, make its way to the consumer. Having the capability to quickly check the blend at the loading rack not only ensures correct deliveries, but also avoids delays in waiting for sample results sent to a centralized laboratory for measurement.

2. Multiple bay loading rack issues.

Multiple bay fuel loading racks can experience variations in the flow rates of ethanol and gasoline due to sudden pressure changes as one of the tank trucks begins or completes filling. If the blending equipment is not properly set up to compensate for these flow rate changes by maintaining a set pressure in the main header, the resulting blend ratio can be different than expected. An onsite test takes less than five minutes, providing the added assurance that the fuel blend in the tank trucks is correct.

3. Ethanol denaturant level variations.

Even in a situation where the blending equipment is working properly, other factors can affect the final blend percentage. One of the most notable is the variation in the denaturant level of ethanol. The denaturant is usually natural gasoline, and is typically blended at five percent. If this percentage differs from the expected level, the contribution of the denaturant to the ethanol blend ratio will not be correctly compensated, resulting in an incorrect blend. Again, an easy onsite check of the blend quickly identifies any inconsistencies.

4. Ethanol and gasoline expand when mixed.

Another cause of uncertainty in the final blend level can be related to the fact that when ethanol and gasoline are blended, the total volume will expand. For example, a mix of 100 gallons of ethanol added to 900 gallons of gasoline will add up to more than 1000 gallons of blended fuel. Consequently, without some way to actually test the fuel blend at the rack, simple proportional blending could lead to an incorrect blend calculation. Portable Infrared analyzers offer a simple, accurate, and low-cost solution to onsite blend testing.

Should any of the situations described above occur at the blending rack, the resulting costs of an incorrect blend can far out way the modest cost of an onsite ethanol blend analyzer. Fortunately, many analyzers are already in use at petroleum terminals and by regulatory agencies. Ethanol blend analyzers have proven to be a reliable tool to ensure safety and fuel blend accuracy.

Sandra R Rintoul is the president of Wilks Enterprise, Inc.

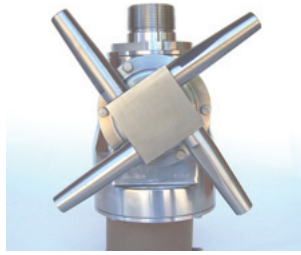
Wilks Enterprise, Inc. | www.wilksir.com



Automated biomass receiving, storage & metering

Compared to free-flowing materials such as liquids, gasses, grains, or coal, most biomass or refuse derived fuel can cause material handling challenges. KEITH WALKING FLOOR systems reliably automate the receiving, storage, and metering of difficult bulk materials into grinding, screening, and refining processes (or, also when used as unprocessed fuel). An efficient biomass plant needs an effective fuel storage and metering system. KEITH WALKING FLOOR systems automate the feeding process, delivering material in a consistent manner, and storing it until needed. This results in decreased jams, virtually no bridging problems, and reduced maintenance.

KEITH Mfg. Co. | www.keithwalkingfloor.com



Tank cleaning

Lechler's M20 Tank Cleaning Machine is a powerful, gear-driven unit, designed to clean large tanks and handle difficult cleaning applications. It's the ideal product to tackle large cleaning jobs such as storage tanks in ethanol plants. Available in either a two- or four-nozzle model, the M20 provides high-impact cleaning at relatively low inlet pressures. It systematically sweeps the entire tank interior within a specified cycle time, which is based upon the number of nozzles on the unit and the inlet liquid pressure. Its quality construction not only results in outstanding cleaning performance, but also in lower costs when maintenance becomes necessary. M20 can provide years of regular maintenance and quality performance.

Lechler, Inc. | www.lechlerusa.com



Horizontal grinder

Vermeer Corporation has redesigned the HG6000 horizontal grinder with new design enhancements and a Tier 4i/Stage IIIB engine to meet wood-waste processors' needs for productivity and government emission regulations. The HG6000 is powered by a Cat C18 Tier 4i/Stage IIIB engine that meets all US, Canada, and European Union tier regulations while producing 755 horsepower (563 kW)—a 20% increase in horsepower over the previous Tier 3 engine. A dual-screen system allows screens to be mixed and matched to attain the desired end product. The screens are also reversible and interchangeable to obtain the maximum usage of the wear portion.

Customers now also have the ability to adjust the screen support, allowing the screen to be moved closer or farther away from hammer tips to match clearance with the type of material being processed. Vermeer eliminated the transition area between the anvil and screen, increasing the screen area on the HG6000, which allows for more throughput. The Series II duplex drum hammer-mill consists of 10 hammers and 20 cutter blocks, with a 36.4-inch (92.5 cm) cutter tip diameter and 62-inch (157.5 cm) cutting width. This patented design helps to decrease daily maintenance time, while increasing the life of major wear components by reversing the cutter blocks, hammers, and center section of drum.

Vermeer Corporation | www.vermeer.com



Asphalt shingle grinder

The Shingle Pro is now bigger, stronger, more reliable, and more productive. Some of the advanced features include a unique hog box design, which allows the upper hog box and bonnet assembly to hydraulically lift to expose the rotor and grates for safer and easier maintenance; a heavy-duty reinforced housing with replaceable wear liners; a rugged forged rotor with heavy-duty hammers and tips that are easy and cost-effective to maintain; and, an integrated water spray system designed to control dust more efficiently in the grinding chamber (which also doubles as a color injection system). There is a completely enclosed discharge conveyor for added dust control and a unique engine cooling system that prevents radiator clogging. These features make the Shingle Pro ideal for high-volume reprocessing of all types of material into a small uniform end product. This includes wood and bark reground into the highest quality mulch, or any other feedstock that requires it to be reground into a fine uniform product, such as pellet feedstock, pulverized fuel, or waste material into kiln fuel.

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Energy Efficient Bio-ethanol Production

The development of membrane-assisted dehydration systems

By Ken-ichi Sawamura, Suguru Fujita, Masanobu Aizawa & Ryuichi Hosokawa

BIO-ETHANOL IS ONE of the most promising fuels, but requires further improvement in its energy intensive dehydration process to be effective. In the production of bio-ethanol, ethanol should be dehydrated to reach fuel-grade water levels (generally 0.5 wt% or less). Although means are available to do so, successful and efficient dehydration has proven challenging.

Distillation is certainly a robust method for concentrating ethanol from fermentation broths; however, its energy efficiency drops when removing water to less than 20 wt%, where relative volatility of ethanol against water is low. In addition, simple distillation cannot remove water to less than 4 wt% because ethanol forms azeotrope at 4 wt% water. The azeotropic distillation is one way to break the azeotrope, but it consumes intensive energy.

To lower this energy consumption, many current commercial-scale ethanol plants employ Pressure Swing Adsorption (PSA). In the typical PSA process, ethanol is dehydrated with water content from 8 wt% to less than 0.5 wt% by using microporous aluminosilicate crystals, or zeolites as adsorbents. Though PSA is an efficient

method to remove water at low content, its efficiency decreases with increasing water content due to an increase of energy consumption for regeneration of the adsorbents.

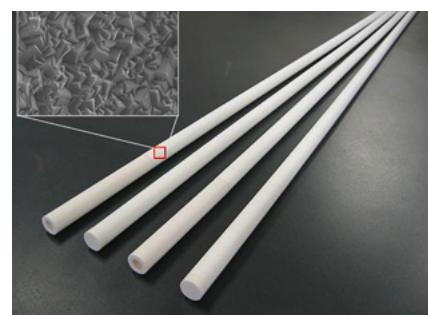
Finding a solution

In principle, a membrane-assisted separation system is the most effective method for minimizing energy consumption in the dehydration process. In this system, hydrophilic membranes selectively and continuously transport water to permeate side, concentrating ethanol in retentate side. A preliminary study suggests that the installation of a membrane separation unit can significantly decrease the load of distillation and/or PSA, resulting in a substantial decrease in energy consumption by 20% to 80%. Although membrane separation technology hasn't been broadly commercialized in the bio-ethanol production, recent progress with these systems provide an opportunity to significantly reduce energy consumption in existing and future bio-fuel production process.

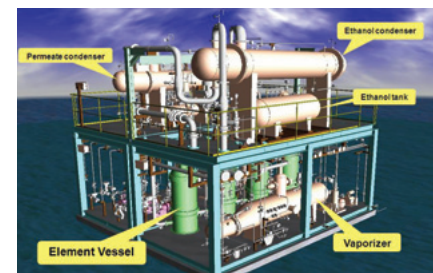
Zeolite membranes

Initially, much effort was devoted to the development of polymeric membranes because they are relatively easy and economical to fabricate. However, due to a lack of thermal stability and swelling of polymeric materials, recent effort has been devoted to the development of robust inorganic membranes—particularly, zeolite membranes. Since then, much work has been done on the development of zeolite membranes for production of fuel-grade ethanol by dehydration.

As part of this work, one such zeolite membrane element has been created with extremely high water flux ($> 50 \text{ kg m}^{-2} \text{ h}^{-1}$ or $6 \times 10^{-6} \text{ m}^{-2} \text{ s}^{-1} \text{ Pa}^{-1}$), and maintains high water permselectivity (> 1000) at 130°C (266°F) with an ethanol/water mixture of 90/10 wt%. The flux of such a zeolite membrane is two to six times higher than that of previous membranes reported. Composed of only robust ceramic materials, it's at a great advantage for improving durability and reliability of the membrane element, preventing common concerns (such as leaks from the seal) often encountered when organic materials are used as sealant.



Above: Appearance of zeolite membrane elements, 16mm in diameter and 1150mm in length. The surface of membrane is covered with highly inter-grown zeolite crystals.



An image of Hitz dehydration system (HDS) for a bio-ethanol plant with the capacity of 50,000 L/day (13,209 gallon/day). The dehydration system has four membrane vessels. Each membrane vessel contains 276 membrane elements, and total element number is 1,104.

Case study

The HDS dehydration system has resulted from zeolite membrane research. The HDS system was adopted for a commercial bio-ethanol plant with the capacity of 50,000 L/day (13,209 gallon/day) in Hokkaido, Japan in 2008. In this bio-ethanol plant, membrane dehydration units containing approximately 11,000 zeolite membrane elements were installed in the latter part of the distillation tower. The plant has been in operation since March of 2009.

Over time, the system has proven successful without causing any trouble and/or maintenance, such as membrane replacement. In this process, 20% to 30% of energy saving has been achieved, which is noteworthy in comparison to PSA.

Installment of HDS dehydration systems is promising for enhancing energy efficiency of existing and future bio-ethanol plants.

For its performance and reliability, Hitz dehydration system (HDS) was honored with the Ministry of Economy, Trade and Industry, Industrial Science and Policy and Environment Bureau Director-General's Award (Japan) in July 2011.

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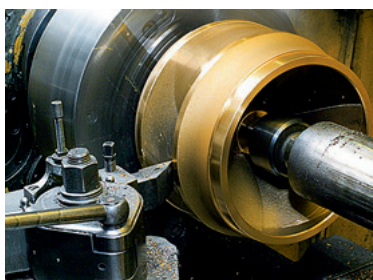
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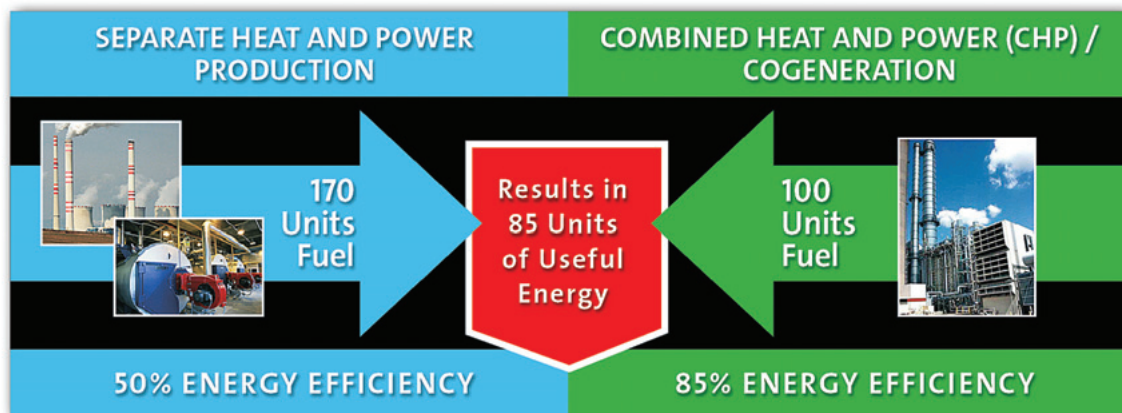


Reduced energy costs of pumping applications

With studies indicating that pumps and related equipment consume approximately 20% of energy used in industry, it's clear that improving this type of equipment's energy efficiency has enormous potential for saving money and reducing environmental impact. To achieve this goal, KSB has developed an integrated approach to energy efficiency that looks at all aspects of pump system performance. This approach, termed Fluid Future, begins by looking at the complete fluid transport system where the pumps will be working. Once a full understanding of the operating parameters has been obtained, the next step is to select the right equipment for the job.

In addition to selecting the best type of pump for the application, it's important to ensure optional features—special materials, impellers, seals etc.—meet the requirements of the application. The equipment configurations are then fine-tuned in terms of both the hydraulic characteristics and the system of motors, drives, and controls to ensure the pumps' optimal duty points will match to the flow conditions required by the application. By taking this comprehensive, systems-based approach to specifying and optimizing equipment, applications' engineers can work with customers to get the best possible performance for their pumping solutions.

KSB | www.ksb.ca



Energy Efficiency through Cogeneration

How a proven technology is revitalizing city infrastructure

By Rowan Sanders

THE THREE "RS" of environmental stewardship—Reduce, Reuse, and Recycle—are the foundation of Combined Heat and Power (CHP), an efficient energy solution that's garnering attention and interest throughout the United States. CHP is not new. The technology has been used around the globe for decades, but it's currently seeing a resurgence as economic and environmental developments require better energy solutions.

Often referred to as cogeneration, CHP produces both power and thermal energy simultaneously—which can be used for heating, cooling, and processing. With conventional power generation, the majority of the fuel energy is released into the air or water as wasted thermal energy, and only 25% to 35% of the waste heat is converted into useful energy. When heat and power are produced separately, about 50% of the fuel consumed is converted into useful energy, and the remaining 50% becomes waste heat.

In contrast, by producing heat and power concurrently, CHP typically converts about 85% of the fuel to useful thermal energy. Unlike many other energy systems, CHP is clean, environmentally friendly, and Kyoto Protocol-compliant.

Case study: Exporting steam

The Boston and neighboring Cambridge, Massachusetts, district energy networks have increased the utilization of waste heat from a Cambridge-based energy plant that discharges millions of gallons of heated water into the Charles River every day. By piping the waste heat to Boston, commercial buildings, hospitals, and universities benefit from the addition, and the Charles River benefits from a decreased heat load. The notion of exporting steam became the proverbial "win-win." Boston was able to utilize the steam created from waste heat, and the environmental impact on the Charles River was dramatically improved.

Today, approximately 50% of the steam used by the Boston district energy network is "green," cogenerated steam that is imported from Cambridge. This steam has reduced the region's fossil fuel consumption and greenhouse gas emissions. Plans are also underway to make use of even more waste heat by converting it into useful thermal

energy, or "green steam," and importing it into Boston—which will further reduce the amount of hot water discharge into the Charles River from the Cambridge power plant.

CHP plants

In addition to municipalities, hospitals, universities, industrial plants, and other large-scale facilities located on campus environments are prime candidates for CHP plants. These plants can meet the critical energy requirements of multi-building campuses on a stand-alone basis, or they can produce energy for district energy networks in central business districts that serve a wide variety of buildings.

In Boston, a city rich with institutions that usually have a campus or district perspective, CHP—with a district energy distribution network—can provide desired energy and environmental benefits. For example, many Harvard-affiliated teaching hospitals in the Longwood Area, including Beth Israel Deacon-

ess Medical Center, Brigham and Women's Hospital, Children's Hospital, and Dana-Farber Cancer Institute receive cogenerated steam, so cooling and power from the Medical Area Total Energy Plant (MATEP).

In Cambridge, a CHP plant is maintained and operated within the campus of a major biotechnology center located near the Massachusetts Institute of Technology (MIT). This center utilizes its own plant as the primary source of energy, while the Cambridge district energy network serves as its back-up source of thermal energy. The green network concept has also been growing with Boston's high-rise residential and commercial buildings, and even the tanks that ring the New England Aquarium benefit from CHP. In fact, for two years in a row, the Boston network has been recognized by the International District Energy Association (IDEA) for adding and renewing the most buildings of any network in North America.

Investing in the energy infrastructure that serves communities ensures the highest level of reliability and efficiency, decreases the volume of fossil fuels consumed, and reduces the region's carbon footprint. The combination of CHP and the district energy networks in downtown Boston, MATEP, and Cambridge has already resulted in annual carbon dioxide emissions reductions equivalent to 50,000 cars being removed the streets. Once additional steam is imported into Boston from Cambridge, the equivalent of 80,000 cars will be removed from the streets in terms of carbon dioxide emissions reductions. District energy and CHP are proven technologies that can produce material results, revitalizing cities and campuses.

Rowan Sanders is director of marketing and communications at Veolia Energy North America.

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Modular conveyor guards

Martin Engineering Company has announced a new generation of modular conveyor guards that enables workers to do their jobs with reduced risk and greater efficiency, while helping to ensure plant compliance with safety standards and regulations. EVO Conveyor Guards provide a simple, flexible, and cost-effective solution to conveyor guarding, with component designs to help keep personnel safe by restricting access to moving parts and pinch points. The user-friendly design of the new guards is provided by standardized panels, which take a systematic approach to guarding, along with the flexibility to fit virtually any conveyor design. Wedge clamps allow the guarding panels to be removed and reinstalled quickly and easily, so systems can be expanded or relocated as needed. A variety of wedge bolts and bracket sizes are available to suit a wide range of mounting options.

Martin Engineering Company

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ClimateMaster introduces the TMW large high-efficiency water-to-water series. The larger series is available in sizes 360 (30 tons) and 600 (50 tons). This water-to-water series offers efficiency with advanced features and application flexibility at competitive prices. As ClimateMaster's most adaptable EarthPure HFC410A refrigerant units, the TMW series can be used for radiant floor heating, snow/ice melt, chilled water for fan coils, hot/chilled water for make-up air, and many other types of HVAC applications. The TMW 360-600 has advanced digital controls for BAS interface, four LEDs for unit status, and compressor isolation switches. The front and back service access panels allow for side-by-side installation, and the larger capacity requires fewer units per job site. Staggered top water connections allow for ease of manifolding multiple units and DDC Controls. The DDC controls provide 11 safety protections for the refrigeration circuits.

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Equipment design

KnightHawk Engineering has been working on green energy projects for many years. They've worked in the areas of biodegradable plastics, wave energy, solar power, thermal energy storage, off-peak energy storage, wind power, clean coal technology, and biofuels. They're typically involved in the design of specialty equipment required in these industries. KnightHawk Engineering's integrated systems approach to equipment design is recognized as one of the best approaches to developing new equipment design that maximizes efficiencies, while maintaining safety and reliability in the equipment. This is accomplished by defining all the physics involved and, then, by determining the boundaries of the problem using numerical methods. The results are reviewed by a project team, wherein the limits of conservatism can be assessed. The result is a safe and reliable design that maximizes efficiency and production.

KnightHawk Engineering
www.knighthawk.com



Briquettes & pellets

Briquetting Systems not only briquets and densifies torrefied wood, but also produces a fuel-puck format with their briquetters for co-fired power generation. Herein, biomass is treated at high temperatures (475° F to 575° F) under low oxygen conditions. When torrefied wood is compressed into pellets or briquettes, the properties compare more favorably to coal. Torrefication has the added benefit of reducing, or at least eliminating, undesirable volatiles, such as nitrous oxides and sulfur dioxides—and is considered to be carbon neutral. Briquetting Systems also has experience in densifying torrefied products. This is often not taken into account during torrefication and binders are required (because all of the natural lignin have been burned out of the fibers, so the wood is too dry to densify). However, Briquetting Systems works with a dryer, which offers significant energy heat consumption efficiency, important in areas with high-fiber feedstock moistures or in places with high-energy costs.

Briquetting Systems | www.briquettingsystems.com



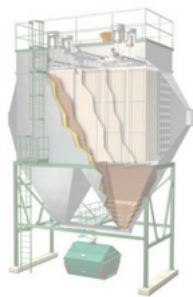
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S&C Electric Company provides electric power solutions for renewable energy plants, electric utilities, and commercial, industrial, and institutional power users worldwide. Over the past decade, they've helped develop VAR compensation and collection systems, satisfying the interconnect requirements for over 2700 MW of renewable energy. Founded in 1911, they're applying their experience to address challenges facing the world's power grids; thereby, shaping the future of reliable electricity delivery. The mission of employee-owned S&C is to continually develop new solutions for electricity delivery, fostering the improved efficiency and reliability required for the intelligent grid. As a total solution provider, S&C designs, installs, commissions, and maintains electric power collection, transmission, and distribution systems. They also design and manufacture switching and protection products for those systems.

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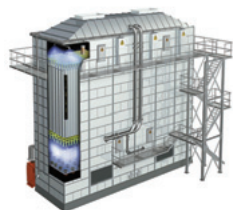
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AWEA Offshore WINDPOWER 2011
Baltimore Convention Center—Balimore, Maryland; www.offshorewindexpo.org
- 11-12

BioGas West
San Francisco, California; www2.greenpowerconferences.co.uk
- 12-14

Biodiesel & Renewable Fuels
Houston, Texas; www.acius.net/aci/conferences/biodiesel-and-renewable-fuels.asp
- 13-14

3rd Annual RFS2, RINs & Biodiesel Forum
Renaissance Blackstone Hotel—Chicago, Illinois; www.opisnet.com/rfs2rins/index.html
- 13-14

Global Commerce Forum: 4th Annual International Conference on Energy, Logistics & the Environment
The Grand Hyatt—Denver, Colorado; <http://globalcommerceforum.org>
- 16-19

Electrical Energy Storage Applications and Technology (EESAT)
Marriott San Diego Hotel & Marina—San Diego, California; www.sandia.gov/eesat
- 17-20

Solar Power International
Dallas Convention Center—Dallas, Texas; www.solarpowerinternational.com
- 23-26

GEA Geothermal Energy Expo 2011
Town and Country—San Diego, California; www.geothermalenergy2011.com
- 25-27

2011 Algae Biomass Summit
Hyatt Regency Minneapolis—Minneapolis, Minnesota; www.algalbiomass.org/events

NOVEMBER

- 02-04

AWEA Wind Energy Fall Symposium
La Costa Resort & Spa—Carlsbad, California; www.awea.org/events/fall_symposium_f2011.cfm
- 07

E3 2011: The Latest in Renewable Energy Innovation
McNamara Alumni Center—Minneapolis, Minnesota; <http://environment.umn.edu/e3/>
- 8-9

Advanced Biofuels Markets
Parc 55 Hotel—San Francisco, California; www2.greenpowerconferences.co.uk
- 8-9

PV Power Generation Mid-West and East
New York; www2.greenpowerconferences.co.uk
- 08-10

2nd Annual 2011 GridWise Global Forum
Ronald Reagan Building & International Trade Center, Washington, DC; www.gridwiseglobalforum.com
- 30-01

PV Power Plants—USA 2011
Phoenix, Arizona; www.solarpraxis.de/en/conferences

DECEMBER

- 14-15

AWEA Wind Resource & Project Energy Assessment
Seattle, Washington; www.awearesourceassessment.org

JANUARY

- 9-10

AWEA Wind Power Health & Safety Workshop
San Diego, California; www.awea.org/events
- 10-11

AWEA Wind Project Performance & Reliability Workshop
San Diego, California; www.awea.org/events
- 16-19

World Future Energy Summit
The Abu Dhabi National Exhibition Centre—Abu Dhabi, United Arab Emirates; www.worldfutureenergysummit.com
- 24-25

Offshore Wind Power Congress USA
Boston, Massachusetts— www2.greenpowerconferences.co.uk
- 26-27

MiaGreen 2012 Expo & Conference
Miami Beach Convention Center—Miami, Florida; www.miagreen.com
- 30-01

Energy, Utility & Environment Conference
Phoenix Convention Center—Phoenix, Arizona; www.euec.com

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35	Ecology and Environment, Inc.	www.ene.com	104	Saft America	www.saftbatteries.com
62	Elexco Ltd	www.elexco.com	61	Safway Services	www.safway.com
104	Elixir Industries	www.elixirind.com	45	Sapa Extrusions	www.sapagroup.com
57	Equipment Express	www.equipmentexpress.com	3	Satcon	www.satcon.com
33	ET Solar	www.etsolar.com	77	Schletter	www.pvmax.us
39	Exxon Mobil Corporation	www.mobilindustrial.com	101	Schneider Electric	www.schneider-electric.com
94	Fibox	www.fiboxusa.com	7	Schneider Electric	www.schneider-electric.com
54	Finovera	www.finavera.com	98	Schurter	www.schurterinc.com/new_fuses
37	GE Energy	www.ge-mcs.com/wind	51	Schweitzer Engineering Labortories	www.selinc.com
120	Gefco	www.gefco.com	86	Session Solar	www.sessionsolar.com
28	GFC	www.gfc-antriebe.de	98	Sika Corporation	www.sikausa.com
52	GL Garrad Hassan	www.gl-garradhassan.com	110	Solar-trac by Omega Flex	www.omegaflex.com
48	GLOBE 2012	www.globe2012.com	9	Solectria Renewables LLC.	www.solren.com
106	Heilind Electronics	www.heilind.com/rpages/solarlok_nace	104	Sollega	www.sollega.com
15	Heliene	www.heliene.ca	102	Solmetric	www.solmetric.com
40	Herguth Laboratories Inc.	www.herguth.com	75	Solon	www.solon.com
122	Hitachi Zosen USA Ltd	www.hitachizosen.co.jp	105	Sovello	www.sovello.com
91	Huber + Suhner	www.hubersuhner.com	82	Steca	www.stecasolar.com
90	HuksefluxUSA Inc	www.hukseflux.com	94	Stego, Inc	www.stegousa.com
42	Hydac	www.hydacusa.com	86	Stiebel Eltron	www.stiebel-eltron-usa.com
49	Hytorc	www.hytorc.com	69	Suntech	www.suntech-power.com
88	IlSCO	www.ilSCO.com	107	Sunwize	www.sunwize.com
50	Industrial Encoder	www.globalencoder.ca	83	Thompson Technology Industries	www.ttisolar.com
41	Infineon Technologies Industrial Power	www.infineon.com/highpower	72	Trina Solar	www.trinasolar.com
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126	JNT Technical Services	www.infra-view.com	70	Troutman Sanders	www.troutmansanders.com
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112	Krannich Solar	www.krannich-solar.com	76	Upsolar	www.upsolar.com
92	Kuka Systems	www.kukanao.com	106	US Digital	www.usdigital.com/solar
127	Langson Energy	www.langsonenergy.com	62	Vbine	www.vbine.com
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94	Lufft Industries	www.lufftusa.com	27	ZBB Energy	www.zbbenergy.com
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