VOLUME 7 | ISSUE 2

North American Clean Energy

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2013 Geothermal Buyers Guide

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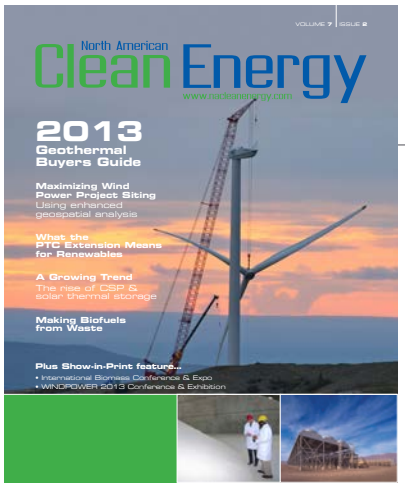
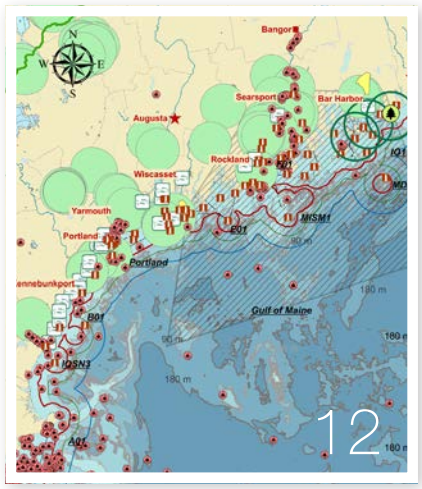
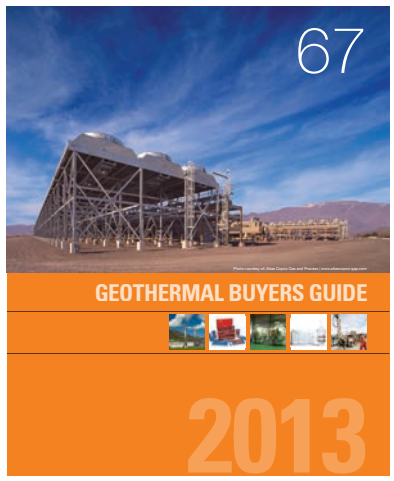


On our cover...
Check out the blades being installed on one of 12 turbines at the Eva Creek Wind Farm in Ferry, Alaska. The 24.6-megawatt (MW) wind farm is owned by Golden Valley Electric Association, and was built by Michels Wind Energy, a division of Michels Corporation.

Photo courtesy of:
Joe Ebretsch | Michels Corporation
(www.michels.us)

contents





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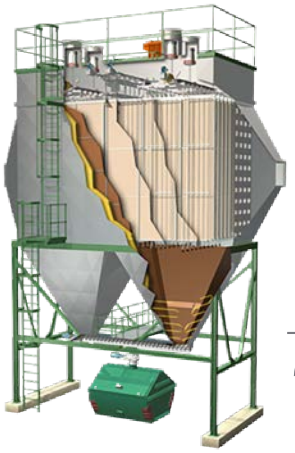

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Photo by Michelle Moore

Tunnel visi On. Figuratively speaking, we've likely all experienced it before: our mind is so focused on a particular task or a specific goal that we lose some of our peripheral vision. At times, this can be a good thing. It can be how we move from point A to point B without getting sidetracked, or how projects get done on time and on budget.

An interesting article on page 36 of this issue, however, suggests that some stakeholders in the clean energy sector might be experiencing "clean tunnel vision"—meaning, they are so focused on a set product or technology, that the bigger picture is getting missed. In this case, the bigger picture could be the larger needs of the market or even the environmental impacts of manufacturing or of a set project. It could also include thinking outside the box, and developing more hybrid solutions (so, combining industries for the greatest impact).

I suppose it's a fine line between perseverance as it relates to tunnel vision and narrow-mindedness as it relates to tunnel vision. Although this article focused on solar power, clean tunnel vision can be seen in other industries as well. Take for example, the geothermal industry. Granted, it's been experiencing steady growth over the last decade, which is a good thing. The Geothermal Energy Association's "2013 Annual GEA Industry Update" showed installed capacity growing by five percent (147.05 megawatts) since last year. GEA even revised its estimate of total installed capacity upward by 128 MW, bringing current US geothermal capacity to 3,386 MW.

But, as GEA executive director Karl Gawell maintained, the industry could do more: "To achieve even more dramatic growth, geothermal power needs continued and predictable federal incentives to spur investors…governments need to cut the time it takes to manage leasing and permitting—it should not take seven or more years to complete a project." (source: www.geo-energy.org)

It would be easy to focus on the growth of the industry, without envisioning more. By looking outside the box (avoiding clean tunnel vision), however, greater geothermal gains can be fought for and pursued.

To that end, we present our 2013 Geothermal Buyers Guide this issue (see page 67), along with a myriad of articles and new product information in sectors ranging from wind power to solar energy, and more.

Enjoy the read!

Michelle Froese

Solar marketplace

EnergySage, an online marketplace for solar and other clean technologies, has launched a comprehensive platform for researching and shopping for solar power systems for homeowners, businesses, and non-profit organizations. Partially funded by the US Department of Energy Sunshot Initiative, the platform makes it easier for consumers to make informed decisions, reduces the soft customer acquisition costs for solar installers, and increases demand by removing long-standing purchase barriers through increased awareness and education.

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- Integrated ratings and reviews of products, manufactures, installers, and financing providers, emphasizing the economic as well as the environmental benefits.

energysage | www.energysage.com

Advanced & cellulosic biofuels approved

Recently, the US Environmental Protection Agency issued long-awaited approval for new feedstocks and biofuel processes, under the Renewable Fuel Standard. The rule clears a path for advanced and cellulosic biofuels from camelina and energy cane, as well as renewable gasoline from previously approved biomass sources, to contribute to US energy security and greenhouse gas reductions.

Brent Erickson, executive vice president of BIO's Industrial & Environmental Section, stated, "US companies are making visible progress in developing domestic sources of renewable fuels that reduce our reliance on foreign oil and contribute to a cleaner environment. These companies have made significant, multimillion-dollar investments to put steel in the ground for commercial facilities, and created thousands of new jobs. US consumers can be assured that under the EPA rules biofuels contribute to a cleaner environment."

With the approval of energy cane and renewable gasoline, there are now a total of five pathways for producing cellulosic biofuels, which meet the Renewable Fuel Standard volume requirements. Thirty companies continue to await approval of new proposals to generate qualifying cellulosic and advanced biofuels.

The Biotechnology industry Organization (BiO) | www.bio.org

Uncovering offshore wind

Despite the many benefits that offshore wind power offers, currently zero megawatts of capacity are installed or even under construction in the United States, with only three projects in the advanced stages of development. So, what is going wrong? In comparison with the rest of the world, and particularly Europe where offshore wind has been spinning for more than 20 years, the US is only on the verge of getting serious about implementing policies that will exploit this vast, renewable resource.

The underlying limiting factor for US offshore wind development—a factor not found in other places—is the lack of available economic and financial conditions for such projects to succeed. Without them, investors are not comfortable providing capital, and the sector will continue to struggle to get off the ground. The only way forward for US states seeking to reap the benefits of offshore wind is clear: targeted investment polices that provide the revenue certainty and debt capacity necessary to make offshore projects viable are required.

For a look at policy successes and lessons from the German offshore wind market, check out the latest report, "Fulfilling the Promise of US Offshore Wind," from the Natural Resources Defense Council (NRDC). The paper also examines the German approach to transmission issues as a cautionary tale that should not be replicated in the US.

nRDC | www.nrdc.org | www.nrdc.org/business/files/offshore-wind-investment.pdf

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Production Tax Credit Extension Means Greater Short-term Investment

But does it mean a more likely phase-out?

By John Marciano

Congress finally got around to extending the production tax credits (PTCs) and investment tax credits (ITCs) for wind, geothemal, biomass, marine, landfill gas, and hydro projects. That is not news. However, in extending these credits, a precedent was set for future tax credit policy. Developers can prop open a closing tax credit window by starting construction of a project this year. This is a double-edged sword. It will spur investment in the short-term, but it could also provide Congress with a palatable pathway to ramp down these incentives.

Ineffective carrots

Tax credits are carrots that spur development of a nascent industry. However, Congress wants incentives with large, short-term gains, but little long-term budgetary effect. When it comes to renewable projects, this is a real dilemma.

Wind power provides an easy example. Under the old rules, if a project was placed into service by "X" date, you received a tax credit. In the most recent iteration, wind projects placed in service in 2012 generated a 2.2¢ credit for each kilowatt-hour (kWh) sold to a third-party for 10 years. Congress used the in-service deadline to prod early investment. Granted, the policy had good intentions, but it was flawed.

Using an in-service deadline does create a sense of urgency if the deadline isn't too far down the road. But it often fails to provide a sufficient runway to get project development up to speed. The tendency has been for Congress to extend the deadline until the end of the current year.

> Making only part of its investment up-front reduces the extent to which the investor will face operational risks.

These intentions are good. The problem is that credits have been needed to make projects economical. Most developers couldn't start developing a project until they had certainty around tax credits. A one-year deadline gives a windfall to projects under development; it does little to help new projects move from planning to implementation. Perhaps more importantly, the uncertainty prohibits new investment in manufacturing. That keeps costs high, limits job creation, and stunts the industry's development.

Back in 2009, Congress did extend the tax credit deadline by four years for wind (and five for other technologies)—which was effective in promoting short-term investment in new project development and manufacturing, at least temporarily. However, as the deadline approached for wind last year, we saw investment in new projects fall off a cliff. There wasn't enough runway to get to completion. Plus, because the deadline for wind differed from that for other technologies, it meant investment flowed downhill to easier, more certain opportunities.

A working carrot

The latest extension sticks with the theme of creating artificial urgency to invest. But Congress did it right this time, albeit a two-year extension would have been better. The urgency is coupled with a goal developers actually can meet. This time, wind, geothermal, biomass, landfill gas, hydro, and marine projects that are under construction by year-end will qualify for 10 years of PTCs, or a 30% investment tax credit.

Moving away from the completion hurdle permits an exponential expansion of development. A little spending today buys access to certainty on a project that could take years to develop (producing many jobs along the way), if certain benchmarks are met. It also means all development won't cease at the same time as the deadline approaches. Projects will be completed over the next few years on a staggered basis.

This has the effect of phasing out the credits. Each year, fewer and fewer projects will get access to the credits. Congress' hope is that this gradual ramp-down of credits will give the industry time to reduce costs, save jobs, and remain viable.

Starting construction

Now that the tax credits are back in place, starting construction must be defined for new projects. Sources say the government is leaning toward a start of construction definition that's similar to the one used for Treasury's 30% cash grant program. This should mean a developer would start construction by beginning physical work on a site, or start work offsite under a binding contract. The IRS is also expected to adopt a similar safe harbor that deems construction to start if the owner "incurred" more than a set percentage (five percent under the grant rules) of a project's costs by the end of the year.

The main issue at this point is whether any parts of the Treasury cash grant rules fail to translate for use with production tax credits. It's worth noting that PTCs are tied to a "facility." The cash grant program focused on "units of property." For instance, each wind turbine (and its tower and pad) is a unit. The Treasury's cash grant rules permitted project owners to treat all of a wind farm's units (turbines) as a single facility. The industry is hoping for a similar rule under the new PTC regime. If granted, the rule would permit spending on a single turbine to count toward an entire project's start of construction analysis.

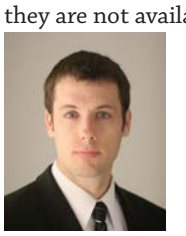
Investor demand

The owner of a wind, biomass, geothermal, marine, landfill gas, or hydro project can claim production tax credits, or a 30% investment tax credit *in lieu* of PTCs, and also depreciate—or deduct—all, or most, of the cost of the project. Most developers try to barter tax benefits to large corporations in exchange for cash infusions because they cannot use the benefits efficiently.

There are three common ways to barter tax benefits and still retain control over the facility: partnership-flip, sale-leaseback, or inverted lease. All three are available for ITC deals. Only partnerships are available for PTC deals. One would think that an investor would prefer ITCs because the benefits are immediate. However, while the ITC does have its advantages, many investors prefer the PTCs.

Given the recent recession, many investors have limited capacity to allot to tax benefits. Because PTCs accrue over 10 years, investments in these tax credit deals make a smaller dent in an investor's tax capacity than ITC deals. This levelizes the yields and permits an investor to spread risk among several projects. PTCs also permit flexibility to invest in a project over time. Making only part of its investment up-front reduces the extent to which the investor will face operational risks.

Lease transactions often provide an opportunity to increase the value of ITCs. However, they are not available for PTC transactions.



John Marciano is a partner in the project fi ance practice at Chadbourne & Parke, in Washington, DC.

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Developer's Toolset

Optimizing site selection with enhanced geospatial analysis

By Michael Roberge & Ellen Crivella

Renewable energy developers face a multitude of siting and permitting challenges when engaged in project development and acquisition. As the number of wind and solar projects under development increases, this challenge is exacerbated. Fortunately, the use of intelligent, integrated geospatial tools can make project planning and implementation more efficient and less costly. Though most developers already use these tools to some extent, experienced developers know that time spent properly siting and fully understanding development risks can yield time and cost savings in the long run, as well as a successful project.

Project planning

Southern Ontario in Canada is an example of a development area, which has become spatially complex in recent years, requiring the use of multi-criteria geospatial planning techniques to effectively site projects. Nearly 600 new wind and solar projects, each with a capacity of 10 megawatts (MW) or more, have been submitted to the Feed-in-Tariff (FIT) Program since its launch in 2009. Generally, projects cluster in areas of high-resource potential, causing most to be adjacent to other renewable energy projects. This is common in many regions in North America.

The resulting, spatially complex mosaic can significantly impact project economic viability, and produce cumulative environmental and community effects. Project viability can be affected by a variety of factors, which should be considered throughout the development lifecycle. For example, wake effects (downstream wind flow affecting turbines at a wind farm) and shading effects (such as trees, or even wind turbines, shading solar power projects) can reduce the potential power output and associated profitability of a proposed project. Data that accurately represents proposed neighboring facilities can help make a developer aware of such impacts, allowing for adjustments in siting at an early stage of development.

Another factor influencing project economic viability is the potential for constrained transmission and interconnection points. This can create long lead times in the interconnection queue, or costly transmission system upgrades. This information is often challenging to obtain, and might not even be fully understood until an interconnection study is underway—unless a developer spends a significant amount of effort exploring utility and transmission system information clearing houses.

Finally, if during the siting process not all sensitive dwellings or natural features are identified, then expensive layout iterations or modifications can occur at later stages. This can lead to re-submittals of permitting documents and potential amendments to agreements or approvals. Even experienced developers and consultants who have worked in spatially complex regimes might overlook or omit some of this data without appropriate tools to store, catalogue, and update the data.

Furthermore, the cumulative environmental effects of having multiple renewable energy projects sited in close proximity range must be included—from increased sound and shadow flicker impacts to encroachment on nearby wildlife management or other sensitive areas. Developers spend significant amounts of time and money undertaking environmental assessments and permitting studies to understand the extent of such impacts, basing mitigation recommendations on the data available to them at the time of study. In other words, the stakes are high when considering temporary and permanent environmental or social impacts of an individual project, or the cumulative impacts of adjacent and nearby projects.

Social acceptance

To further add complexity to proper project siting, some jurisdictions request planned projects be included in the impact analysis. Social acceptability has become an increasingly important element to successful projects in populated rural-residential communities. Sound and shadow flicker studies are often mandated by regulation, and can include methodology requirements for considering setback, vacant lots, impacts at lot lines, and various classifications of receptors (those inhabited or frequently used locations). Furthermore, projects can generate impacts on radio communication systems, military and weather radar, as well as airports.

Although most developers are aware of these challenges, acceptable techniques for understanding and quantifying impacts can vary from jurisdiction to jurisdiction. To reduce risks and decrease the number of project layout iterations, delays, and costs, developers need access to a wide variety of resources and analysis tools. As project siting and permitting becomes more complex, geospatial tools must evolve to enable effective decision-making and optimize site selection at a low cost and based on up-to-date data.

Geospatial planning

The information required for project planning is generally publically available, however, it isn't always in a format that can be easily used. Often it takes large amounts of time to aggregate and analyze. Moreover, smaller development organizations might not have dedicated Geographic Information System (GIS) resources to devote to these tasks. Geospatial tools that integrate external GIS information into an application that's usable for non-GIS users (such as business development managers) can be beneficial in facilitating the decision-making process.

By using enhanced geospatial planning tactics, a developer can understand the location and size of other projects, which will assist them with the assessment of potential economic impacts relative to their specific project, as well as any cumulative impacts on the surrounding area. When considering these factors early in the project lifecycle, strategies can be put in place to mitigate costs and schedule delays.

Fortunately, a new advanced geospatial application has become available. This new tool integrates multi-source information pertaining to renewable energy for different jurisdictions in North America, and includes the following considerations: project boundaries; locations of all types of power plants; transmission lines; substations; location of First Nations and Native American reservations; as well as natural features and sensitive areas, overlain on a high-resolution mesoscale wind speed map.

Developers are constantly searching for strategies to help them succeed in early-phase prospecting, siting, and permitting. Geospatial tools are quickly becoming a key means of determining and evaluating a successful renewable energy site. By thinking spatially, developers can see the larger picture, including potential constraints on development or areas for avoidance, which may yield a big pay-off or a faster project timeline down the road.

Michael Roberge is the lead of GIS Services at GL Garrad Hassan, and is a specialist in the siting of renewable energy projects and the production of a geospatial atlas for the energy sector. Ellen Crivella is the department head for North American Environmental and Permitting Services at GL Garrad Hassan.

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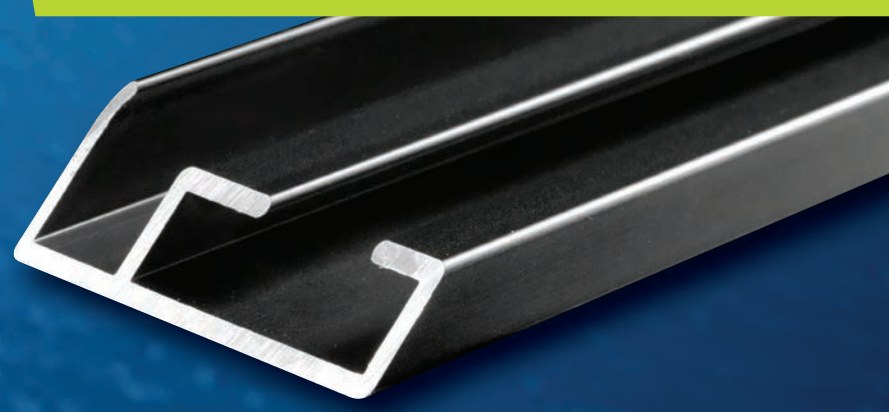

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Using Ecospatial GIS to Site Offshore Wind

Geospatial technology helps power Maine's ocean wind industry

By Lisa Schoonmaker

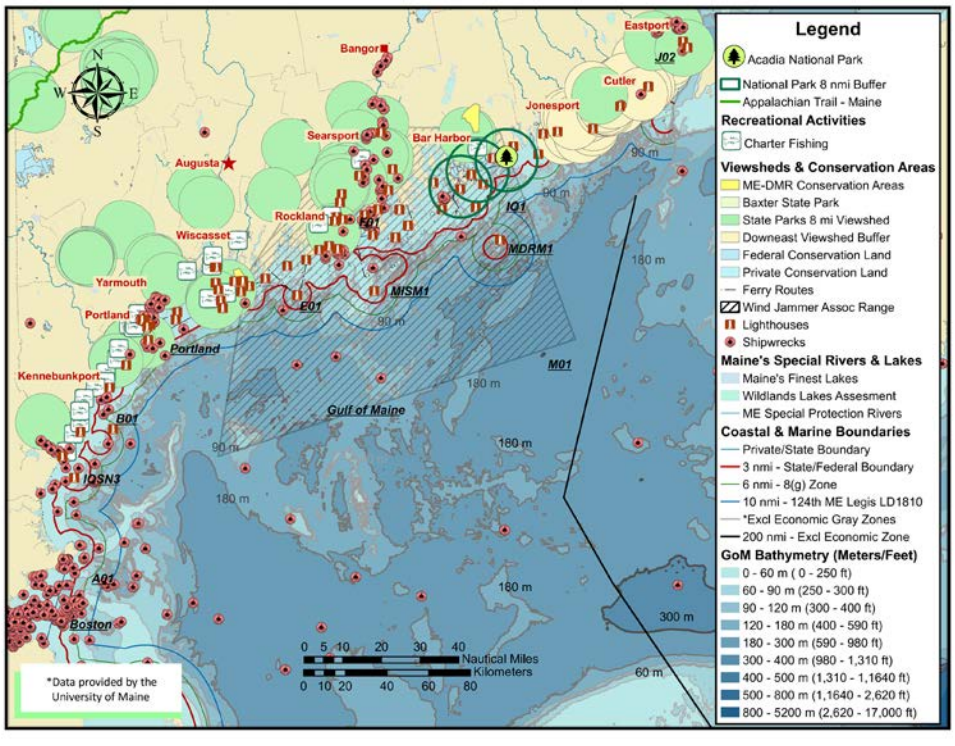

Figure 1. *Human activity: cultural and aesthetic qualities.*

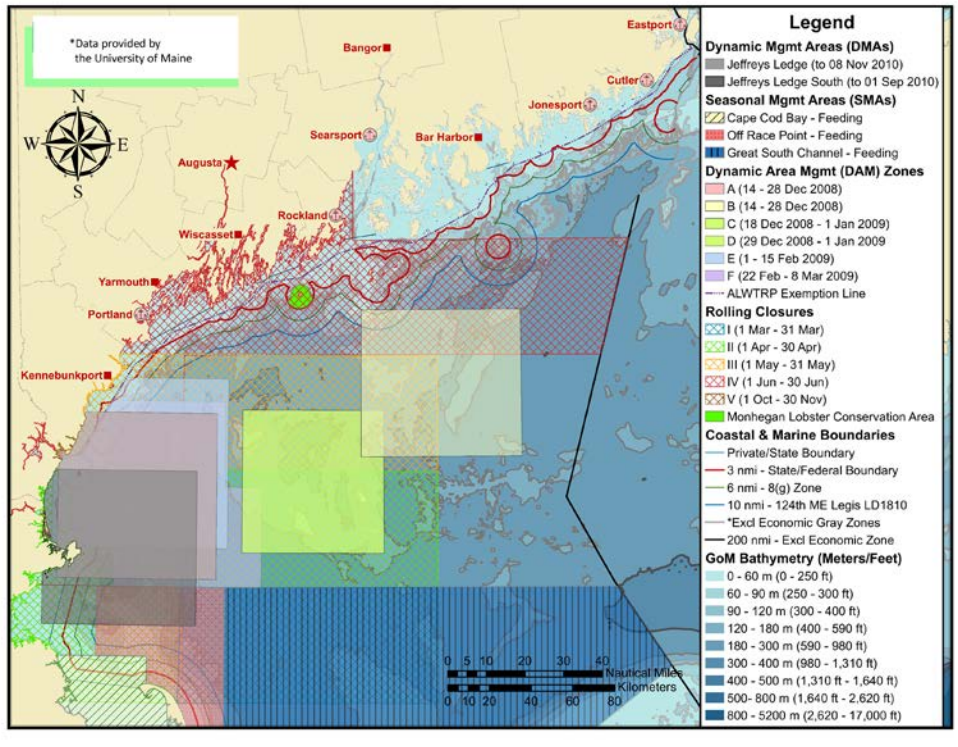

Figure 2. *Human activity: coastal economic and extractive resource uses.*

The US Department of Energy (DOE) has recently allocated over $200 million in grants to develop and deploy offshore wind energy projects in the Great Lakes and Gulf of Mexico, as well as off the Atlantic and Pacific coasts. This funding is dedicated, in part, to advancing offshore wind technologies through select demonstration projects—seven of which have been awarded first-phase funding for engineering, design, and permitting, with the potential follow-on funding for siting, construction, and installation. Two of these projects are located in the Gulf of Maine (GoM), which is proving to be a great source of untapped, deep-water, commercial-scale wind power.

The GoM's energy production potential—estimated at 156.6 gigawatts—has been an intensive focus of study by Maine wind industry collaboratives in recent years. In support of the Maine Ocean Energy Task Force, the University of Maine (UMaine) has played a key role in advancing this effort through the innovative use of geospatial technology. In partnership with an engineering and consulting firm, they've developed the Ocean Wind Energy GIS (OWEGIS). OWEGIS is an ecospatial information system that combines a wide range of environmental, cultural, economic, and commercial data in new ways for assessing offshore sites for development. Now with over 800 layers of information relevant to the GoM, OWEGIS provides a model for future wind farm siting in the GoM, as well as in other offshore areas across the country.

Decision-making support system

OWEGIS was created with the intent to collect, analyze, and display graphical information to support planning, permitting, and the development of offshore wind energy in the GoM. Specific objectives were to investigate the GoM's wind resource and wind power development potential, to identify potential sites for offshore wind farms, and to rank these sites according to wind resource potential and cumulative development impacts.

The power of the system is in combining a tremendous amount of relevant information in graphical map format, providing users with an intuitive, interactive, and visual tool for decision-making. During an eight-month period, the research team collected critical environmental and resource data from multiple geospatial and temporal sources, including: public GIS data websites, such as the Maine Office of GIS; state environmental regulatory agencies; and federal agencies, such as the National Oceanographic and Atmospheric Administration (NOAA), the US Geological Survey (USGS), and the then current Minerals Management Service (MMS). Additionally, some data was developed directly from written descriptions of management zones and other regulatory areas contained in the Federal Register.

This information was integrated in an ESRI ArcGIS-based data management system, which organizes, standardizes, and displays the data for geospatial analysis. To aid in rating wind development regions of interest, the data layers were grouped into five logical categories:

1. Physical characteristics and environment;
2. Coastal restrictions and marine hazards;
3. Human activity, including coastal economic and extractive uses, cultural and aesthetic qualities, and ecological-environmental impacts and wildlife;
4. Infrastructure and commercial uses; and
5. Legal, technical, and permitting boundaries.

Designed to be flexible, the system easily accommodates continuously evolving spatial and temporal data, as well as modifications to meet user and stakeholder needs.

Results & future impact

UMaine, working in conjunction with the Maine Ocean Energy Task Force, has used OWEGIS to identify and rank potential areas in the GoM for offshore wind development, according to key factors that impact siting and permitting. The assessment process initially included 12 regions along the Maine coastline. Through *Continued on page 14.*

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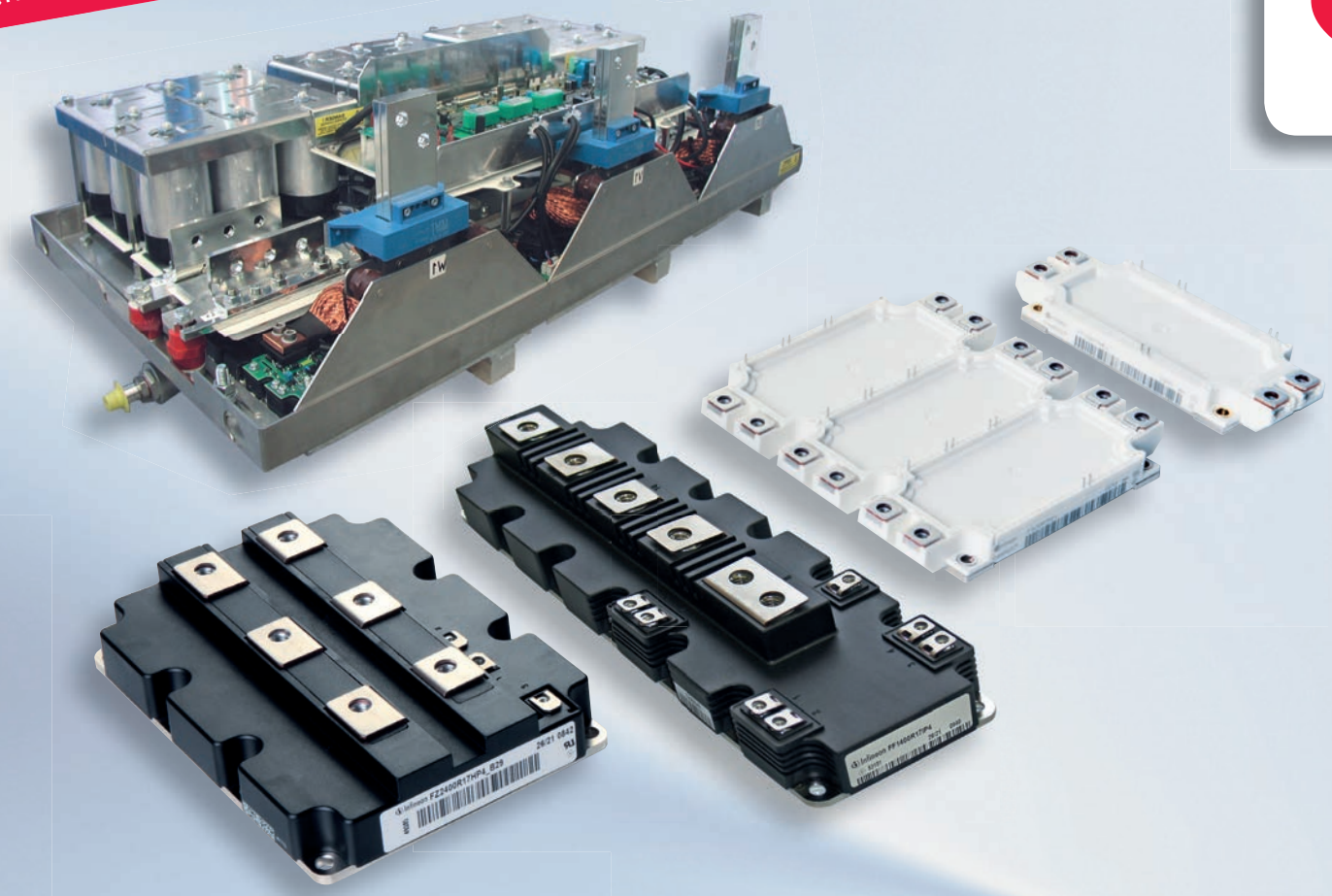

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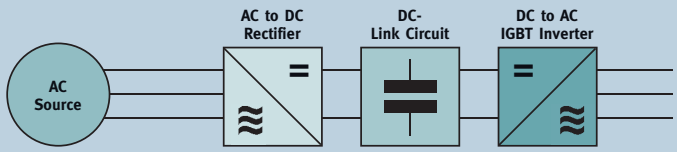

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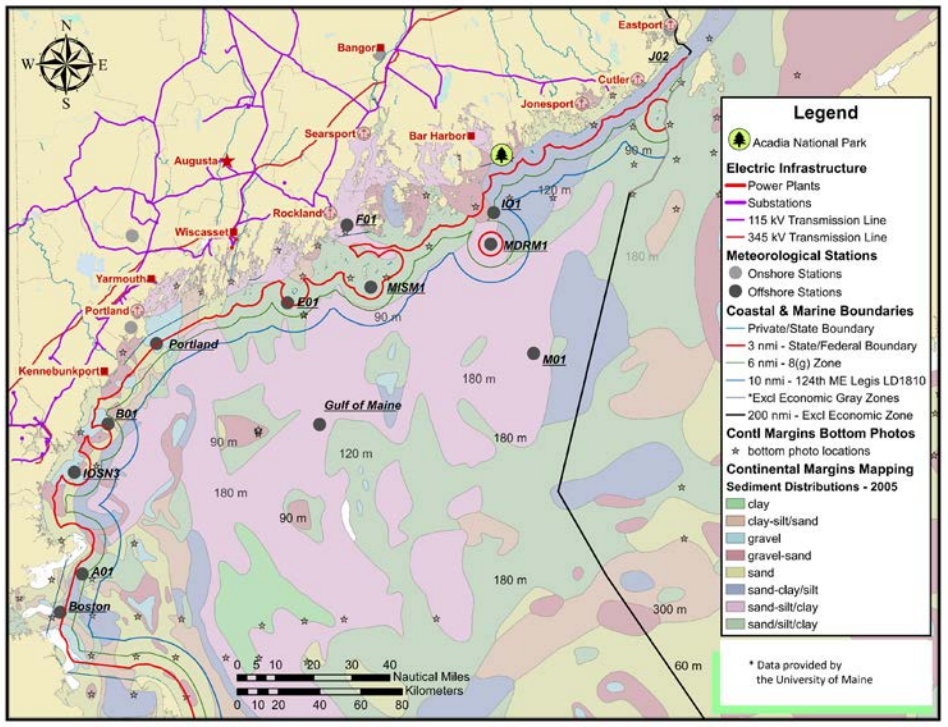

Figure 3. *Physical characteristics/physical environment.*

CATEGORY	DATA LAYERS (EXAMPLES)
Physical Characteristics/Physical Environment	Wind resource/mean annual wind speed Bathymetry Seabed surficial sediments
Coastal Restrictions & Marine Hazards	Military zones Obstructions & hazards Unexploded ordinances, dumping grounds
Human Activity--Coastal Economic & Extractive Resource Uses	Lobster management zones Shellfish collection regions Worm harvesting regions
Human Activity--Cultural & Aesthetic Qualities	Native resources Shipwrecks, lighthouses National & state parks
Human Activity--Ecological/Environmental Impacts & Wildlife	Dynamic area management zones (Right whales) Threatened/endangered/depleted species Bird, bat, mammal migratory routes
Infrastructure & Commercial Uses	Airports Shipping lanes, traffic separations Electric transmission systems
Legal, Technical & Permitting Boundaries	Private/state boundary State/federal boundary (3 nmi) Territorial seas (12 nmi)

Table 1. *Assessment criteria for evaluating regions of interest for offshore wind development.*

analysis of the criteria, five were selected as the most optimal sites for potential offshore wind development. Two sites have been awarded the DOE first-phase demonstration project funding.

UMaine's Advanced Structures and Composites Center will use the first site—off Monhegan Island—to build, deploy, test, and monitor a floating deep-sea wind farm, with two six-megawatt direct-drive turbines on concrete semi-submersible foundations. The second site—off Boothbay Harbor—will be used by Statoil North America of Stamford, Connecticut, to deploy four three-megawatt wind turbines on floating spar buoy structures. These projects, both based on innovative construction technologies, are expected to result in improvements in commercial-scale wind energy production that will lower operational costs going forward.

The OWEGIS database, successfully used to evaluate sites in the GoM, is now the basis for building a similar decision support tool for the Great Lakes. The proposed system, which will be online, will provide developers, regulators, government officials, NGOs, landowners, and other organizations with high-value environmental and ecospatial information for use in identifying offshore project sites and evaluating the potential environmental, economic, and social impacts of development in the Great Lakes region.

Lisa Schoonmaker is director of Marketing and Communications at Sewall, an international engineering, GIS, and natural resource consulting fi m.

sewall | www.sewall.com

Medium-intensity LED strobe system

Hughey & Phillips (H&P), a global leader in the obstruction lighting industry, announces the new HORIZON line of medium-intensity strobe, LED-based obstruction lighting solutions for daytime and nighttime lighting on tall structures, such as wind turbines. Intertek (ETL) certified and Federal Aviation Administration (FAA) approved, the L-864/865 provides daytime white and nighttime red lights within a single unit, and is part of the newest addition to H&P's obstruction lighting portfolio, the HORIZON line. The series is available in L864 (Red), L865 (White), and L864/L865 (Red/White). Daytime white strobe eliminates the need to paint the structure with aviation orange and white stripes, and the nighttime red flashing beacon lights are community friendly. The HORIZON L-864/865 is best suited for structures between 150' (45 m) and 500' (150 m), above ground level, and operates at a range of 95-277VAC, 50/60Hz.

The new microprocessor-controlled LED strobe system boasts a self-contained power supply that simplifies wiring, but also accepts external signals if necessary. Its compact design, built-in testing, GPS sync, automatic day/night sensor, and wiring compatibility make the product easy-to-use and install. Like other products in the HORIZON line, the units are compatible with existing cable systems in most cases, allowing users to retrofit to LED without purchasing entire new systems.

Hughey & Phillips | www.hugheyandphillips.com

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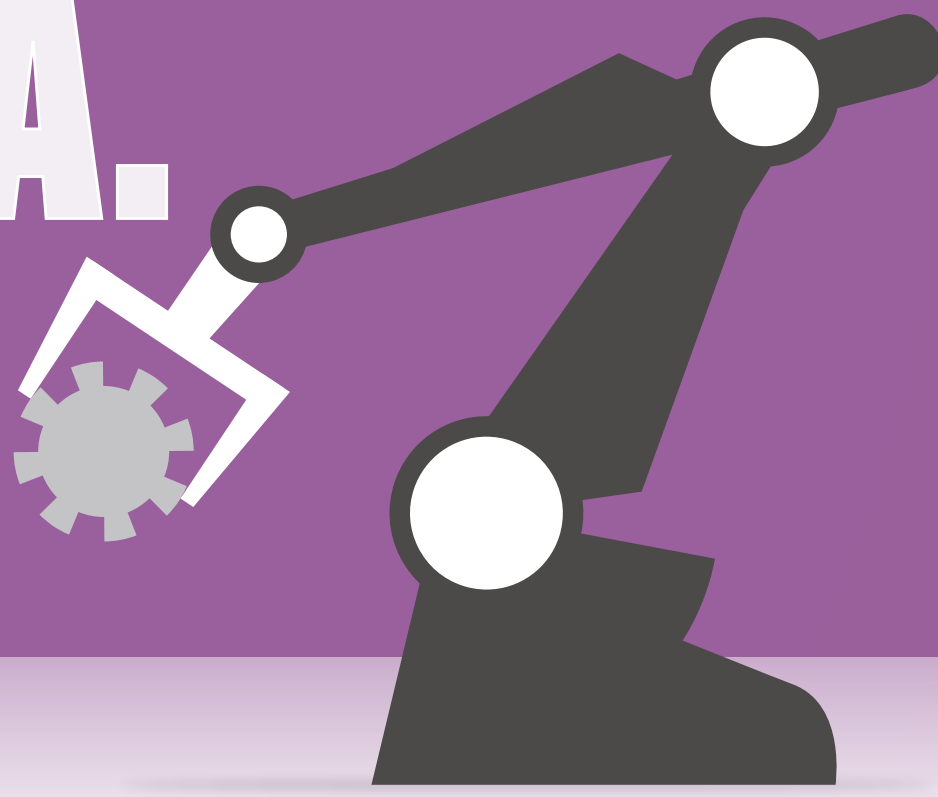

Be honest. You've thought about outsourcing overseas to cut costs. Perhaps you already are. The trouble is, will it create other headaches? Quality slippage? Labor issues? Logistical nightmares? There's a solution closer to home: Iowa. We're a right to work state with the second lowest cost of doing business over the past five years. We have a well-developed transportation system, so you're never far from your markets. Our research universities produce patents in manufacturing and educate the engineering graduates you need. Our $27.6 billion advanced manufacturing sector is Iowa's single largest business sector. That's three times larger than farming.

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Far left: *Just before midnight, a blade is attached to a wind turbine at the Eva Creek Wind Farm in Ferry, Alaska. During the height of summer, it was light nearly 24 hours a day.*

Top right: *Wind turbine generator blades are off-loaded at a rail siding in Alaska, before being transported 10 miles up a steep, mountain road by trucks.*

Bottom right: *A crew member watches as wind turbine generator parts are hauled across a bridge over the Nenana River to the project site.*

An Alaskan Adventure

The logistics of Eva Creek

By Jill Badzinski

WHeTHeR iT's five miles of underground collection systems, six inches of clearance on an essential railroad bridge, or 24 hours of light each day, numbers often tell the story when it comes to a wind farm. This is especially true of the construction of Eva Creek Wind Farm—the largest wind project in Alaska.

The 24.6-megawatt (MW), 12-turbine wind farm was constructed in Ferry, Alaska between April and October of 2012, but it took months of additional planning, particularly in relation to the complex logistical issues of this project.

To save you from pulling out a map, Ferry, Alaska is a remote city. Located 100 miles south of Fairbanks, and 250 miles north of Anchorage, Ferry is found just outside Denali National Park. It's close to Mount McKinley, the tallest peak in North America, which is in clear sight of the turbines on a clear day. A prime location for a wind farm, perhaps, until the issue of getting there is taken into account.

The road less taken

Because of how remote Alaska's interior is, transportation was the primary challenge during the construction of Eva Creek. Every component of the wind turbines—from generators to blades—along with all of the vehicles and crew members needed to cross an existing railroad bridge, over the Nenana River, to access the construction site. This bridge barely afforded six inches of clearance between the equipment and the trusses. Gravel and sand for road improvements and concrete projects were the only components to be sparred passage over the bridge during this time.

Project site clearing and grubbing was done in preparation from August to November 2011, before the project shut down for winter. In 2012, the six months between April and October provided just enough of a weather window for construction to get completed. During that time, tiny Ferry, Alaska (which has an average population of 30) bustled with activity, as more than 100 project team members and a man-camp descended on the area.

In total, the project included:

- 13 miles of upgraded or new access roads;
- 12 turbines on 80-meter towers;
- 12 concrete spread foundations;
- Five miles of an underground collection system—installed in permafrost, rock, and arctic conditions;
- A 230-kilovolt (kV) substation; plus
- Two operations buildings, two communications towers, and one meteorological tower (another two meteorological towers were also relocated).

Most of the materials, and all of the vehicles and turbine equipment, were transported by truck from either Fairbanks or Anchorage to Healy, which is 14 miles southeast of Ferry. A mammoth crane was the largest piece of equipment moved to the site. It was broken down into 42 component pieces, shipped by barge and rail to Healy, from its last project in California. Other equipment included everything from lattice boom and hydro-boom cranes to haul trucks, excavators, loaders, graders, rollers, and dozers. There were even tractors with specially designed trailers, portable batch plant, rock crushers, drill rigs, and ready-mix concrete trucks.

Once the equipment and all of the materials crossed the bridge, it was off-loaded at a rail siding before being transported 10 miles up a mountain road. This was managed at grades as steep as 10%, so as to ensure the two strings of turbines made it to the top. The road was built specifically for the project, and remains in use today, providing access to the turbines for maintenance.

A high-wind venture

Planning and preparation were critical to the success of Eva Creek. Not only was the project done on a tight schedule, but the only option for any must-have, on-the-fly materials was an auto parts store about 15 miles away. Otherwise, additional supplies had to get driven in from about 100 miles away.

Transportation was, of course, only part of the challenge in building this wind farm. It wouldn't be a project worth mentioning in the 49th state without some words on the weather. During the seven-month work span, temperatures ranged from as high as 72° F to in the lows of -20° F. Winds often exceeded 70 miles-per-hour (mph), topping out at 84 mph. Record amounts of rain in June damaged one of the access roads, which was rebuilt with more aggressive erosion-control measures.

However, the land of the midnight sun did provide some extra working hours, with nearly 24 hours of straight daylight for part of the construction season. Although the spring and fall only allowed for about seven hours of light conditions, the long days in-between meant longer working hours for many. During the longest days, some sub-contractors opted to run two shifts per day.

The Eva Creek Wind project received $13.4 million in state grants, and will meet owner Golden Valley Electric Association's goal of having 20% of the system's peak load generated by renewable resources in 2014.

The towers have been commissioned and are successfully generating electricity, showing anything is possible with determination and the right plan in place.

Jill Badzinski is corporate writer at Michels Corporation. Michels Wind Energy, a division of Michels, was the EPC contractor on the Eva Creek Wind Farm.

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Wind M&A

Market trends & transactional considerations

By Paul Zarnowiecki & Christopher Gladbach

Understanding trends in the wind mergers and acquisitions (M&A) market, along with various business, regulatory, tax, and project-specific considerations, is critical to achieving a successful deal in today's competitive landscape.

Recent developments

The wind M&A market saw significant activity during the first three quarters of 2012. According to one market source, asset sales were up 15% year-to-date as compared to the 2011 year-to-date numbers through Q3. M&A activity seriously began to wane in Q4, as the December 31st expiration of the production tax credit (PTC) loomed last year. Ultimately, Congress extended the PTC for wind projects, which start construction by the end of 2013. This extension will prove a catalyst for increased development and acquisition activity. However, the Internal Revenue Service has yet to provide guidance on when construction is deemed to have started for the PTC extension.

Foreign and domestic independent power producers and utilities continue to be active buyers in the US wind market. In addition, institutional investors—particularly funds, insurance companies, and foreign pension funds—have emerged as active participants. Amid an environment of uncertainty, and with coordinated central bank easing and a low interest rate environment (US, German, Japanese, and UK 10-year yields are around or below two percent), these institutional investors frequently seek steady, higher yielding investments, with low correlation to traditional equity and debt investments. Accordingly, they are mainly interested in investing in operating or late-stage construction assets. Because wind investments tend to have low operating and fuel costs, return profiles can be fairly predictable and attractive.

Sellers are coming to the market for a variety of reasons. Certain developers, as a part of their strategic plan, are selling development and construction-stage wind projects to long-term buyers. In response to continued Eurozone fragility, some European-based parents are shedding US assets to strengthen their balance sheets. At the same time, some larger companies are looking to exit non-core business areas through wind asset sales. Turbine manufacturers are also expected to be a source of continuing M&A activity, motivated by finding projects and markets for their turbines.

The wind power market remains competitive and challenging, currently favoring developers who are able to maximize project economics. Many high-wind areas of the country are power purchase agreement (PPA) or transmission-constrained environments. Plus, the ongoing low price of natural gas, which competes as a generation resource, hampers sustained development.

Tax equity trends

Tax equity is frequently an essential part of the project capital structure. There was an estimated $5.3 billion in tax equity investments in 2012, and wind received $2.5 billion of that total amount. Most wind projects utilize the PTC.

Solar energy projects factor into the overall tax-equity outlook. The Treasury cash grant, *in lieu* of investment tax credits (ITC), only remains available for solar projects that met the "start of construction" criteria by year-end 2011. Solar projects not meeting this requirement will need investors willing to utilize the ITC—typically a large balance sheet investor. This need for solar tax-equity will increase competition for tax-equity demand overall.

The traditional tax equity pool in the US, which consists of around 30 investors, might not be large enough to serve increased demand, causing more expensive pricing. New tax equity investors, such as tech companies, utilities, large industrials, and integrated oil companies could, therefore, play a bigger role in the coming years to meet the demand for tax equity. Evidencing this trend, a small number of non-traditional tax equity investors committed capital to projects in 2012. However, it's unclear whether 2013 will be the year these players make more significant investments, given the relative illiquidity and complexity of tax equity investments, and constant uncertainty caused by on-again/off-again US energy subsidy policies.

Transactional considerations

Buyer and seller trends in the wind M&A marketplace, coupled with the dynamic nature of the tax equity market, elevates the importance of optimal transaction structuring and diligence. On the seller side, structuring a transaction requires attention to sponsor motivations. Some sponsors prefer to retain a minority equity stake in a project, whereas others look to sell entire projects.

At the development stage, the timing of a sale can create different valuations and attract different types of investors. The purchase price could be structured as an asset sale, or as a sale of project company membership interests, depending on a number of different considerations. The allocation of liability for project-specific risk and credit support are crucial considerations during early-stage negotiations. Other key contractual provisions must be analyzed closely, including: indemnification; representations and warranties (and their survival following closing); closing conditions; consent rights prior to closing; and the transfer requirements for permits and key contracts.

On the buyer side, diligence cannot be underestimated. Key considerations include: permitting; transmission; interconnection; project contracts; and real estate. A buyer should closely analyze change of control considerations, as well as management considerations, such as voting rights and ongoing project management.

In addition to business concerns, parties must grapple with a variety of tax and regulatory considerations. Buyers of construction or near-construction stage projects should engage with the tax equity investor or project lender and the seller at an early stage. Parties should consider the implications of a 708 termination if 50% or more of the profits and capital interests in a partnership holding the project company are transferred within a 12-month period. Such termination would result in a re-start of the depreciation period for project company assets. Investors should also consider recapture considerations, stretched depreciation, and the use of blocker corporations for foreign entities. Pension funds require special attention, as co-investment in projects employing tax equity can pose critical tax issues for non-taxable entities.

On the regulatory side, dealmakers must consider applicable requirements to file with federal agencies, such as the Federal Energy Regulatory Commission (FERC) and

state and local energy authorities, as a condition to closing the deal. For foreign in-bound investors, Committee on Foreign Investment in the United States (CFIUS) clearance is advisable. Filing with CFIUS is voluntary, but failure to file potentially opens the transaction up for future divestiture. Pursuant to CFIUS recommendations following a transaction closing, President Obama ordered a Chinese firm to divest itself of recently acquired Oregon wind projects, apparently because of the project's proximity to a military flight training range. This CFIUS review and subsequent order demonstrate the risk in forgoing a filing with CFIUS and request for clearance before consummation of the transaction.

Institutional buyers raise unique coordination issues regarding tax equity. Tax equity investments are typically structured to provide investors a preferred rate-of-return until a pre-determined internal rate-of-return is achieved. This structure can conflict with the institutional investor's need for a cash-on-cash return. Transfer limitations, driven by tax laws and traditional project partnership agreements, also make investments like these less liquid than some institutional investors prefer. Given such constraints, many institutional investors, especially pension funds, might favor projects at or near the partnership flip stage of a project, when the tax equity investor is exiting the deal.

The future

The coming year should be another active year for buyers and sellers of wind projects. The PTC requirement for commencement of construction by December 31st, 2013, will drive transaction timing. New players and non-traditional purchasers will be active on the acquisition and financing side. As always, careful transaction structuring and diligence is critical to any successful wind M&A transaction.

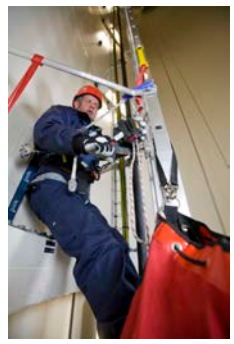
Paul Zarnowiecki (left), partner, and Christopher Gladbach (right), managing associate, are both based in the Energy and Infrastructure Group at Orrick, Herrington & Sutcliffe LLP in Washington, DC.

Orrick, Herrington & sutcliffe ll P
www.orrick.com

Surface finishing products

Saint-Gobain Abrasives, introduces its new portfolio of Rapid Prep products under the Norton brand. Made of non-woven nylon impregnated, with abrasive grain and proprietary smear-free resin, Norton Rapid Prep surface conditioning discs are ideal for surface finishing applications—such as removing surface defects, oxides, corrosion, deburring, mold cleaning, and blending uneven edges and marks. Norton Vortex Rapid Prep's design enables up to four times the performance of available surface finishing products on the market. For the wind power industry, the Norton Rapid Prep portfolio is ideal in blending and deburring, as well as for use in repairing cracks in turbine blades, increasing uptime and maintaining operational efficiency.

norton Abrasives | www.nortonindustrial.com



Far left: *Working in the wind: safety at tower heights.*

Top right: *Preparing to climb a ladder system with fall protection.*

Middle right: *Service technician securing onto a Climb Assistance, endless rope.*

Bottom right: *Safe operation from a work cage.*

Safety Matters

Operating secure, tower equipment

By Lars Brix

sAfe Ty is PARAmOun T AT Any j OBsiTe, but this is especially true at a wind farm. It falls on the project owner to bear responsibility for the ongoing safety of any wind tower, including all onsite equipment. This means equipment must not only be in perfect working order upon arrival, but must also be maintained over time. Turbines have to be inspected at least once a year, and repaired or replaced as needed. It's not only necessary to ensure the safest, most secure working conditions, it's the law in most countries, including in the United States.

The key to any successful project most often lies in the preparation and maintenance. At a wind-power project site, this means having the properly tested safety equipment. Safety equipment entails pretty much anything contributing to the construction of a wind tower and the safety of the technicians, construction workers, or anyone visiting the jobsite. For example, ladder systems, fall protection systems, work cages, fire extinguishing equipment, safety anchor points, as well as a rescue and evacuation unit (which must be available in the nacelle or with the technician at all times) are paramount to a safe working environment.

Making the right choice

Wind towers range in height from under 30 meters (about 100 feet) to over 80 meters (260 feet) tall. One of the most important ways to secure safe work at turbine heights is a stable ladder system, designed to securely bring technicians up and down the tower. It's a statutory requirement that all ladders in wind towers be equipped with a safety system, which prevents workers from falling off—if, for instance, a person loses footing or suddenly becomes ill. The fall protection system automatically stops after falling only a few centimeters, and remains locked until either the worker can regain his or her step and continue alone, or until he or she can be rescued on scene.

Different systems are available, and flexibility is worth noting. Obviously, selecting a ladder system that meets the highest safety requirements is of utmost significance; however, it terms of additional features, it's also important to take project expectations and timelines into account. When using wire-based systems, for instance, a service technician must wait until his or her turn, ensuring a colleague has reached the top of the tower before using the system him or herself. But, with a fall protection system designed with a fixed rail on the ladder, several technicians can use the system simultaneously—saving valuable project time.

In this case, the rail in the middle of the ladder allows a worker to simply "click-on" a runner that's fitted to his/her harness (the runner is fastened to the

technician's harness with a carabineer of the same type used by rock climbers).

Another option that allows a service technician to climb a tower quickly is a strategically designed, endless rope, which runs from the bottom to the top of a tower. It's connected to a motor at the base of the tower, where the technician can set the system to the proper weight. Once properly connected, the service technician gently pulls on the rope, and the system holds the selected bodyweight throughout the entire ascent and descent. If the technician stops climbing, the system stops as well, starting again after a gentle pull on the rope. This type of system reduces the risk of injuries to a worker's knees, arms, shoulders, and feet.

Older turbines must be serviced more frequently, and this means many hard climbs for technicians on ladders. Of course any climb assistance system or device isn't synonymous with an anti-fall protection system. It's merely an aid for technicians, and must always be used together with an approved anti-fall system. Again, safety is paramount.

Safety checks

Most newer and large-scale turbines are installed with a work cage/service lift. Much like an elevator, it's designed to cart workers and their tools up and down inside the tower. It can also be stopped anywhere, and the technicians can climb out or operate directly from the work cage if necessary.

To secure safe work in wind turbines, work cages must be inspected, tested, and approved every year. It's required by law that an owner must keep a certification journal with dates of the latest inspection, describing the inspection, as well as the testing of all safety equipment in the turbine tower in detail. The certification journal must always be present when authorities perform a check. The legislation differs from state to state in the US but, in general, the requirements for maintenance are the same. It is always the owner's responsibility to ensure that safety equipment works and is regularly tested and maintained.

Ongoing training

Not many people doubt the importance of having effective safety equipment. However, it's equally important that any workers or service technicians using equipment at a wind energy site are properly trained to work with it, and to deal with any dangerous situations and accidents that might occur.

During training, technicians should learn everything about safety in relation to proper installation, fire, evacuation, and rescue from wind towers. Courses might include theory, but should also heavily rely on practical exercises using the actual equipment used at a jobsite. For example, this could include practicing fastening a colleague to the safety equipment from a rescue and evacuation unit in the nacelle, and then lowering the subject down the tower as if they were injured. Training should be done on a consistent basis and with every new project or piece of new equipment.

As a final note, testing and maintenance cannot be over-emphasized. Most turbine owners assume all safety equipment is correctly installed by authorized personnel, but often leave it at that. Testing safety equipment on an ongoing basis to ensure it's still up to code is just as important. Too many owners rely on either his or her own or a third-party WTG technician to report safety failures in the towers. By then, it could be too late.

Avanti Wind systems | www.avanti-online.com

Offshore wind turbine

Siemens Energy recently launched its new, offshore wind turbine: the SWT 4.0-130. This turbine features a generating capacity of four megawatts (MW), and a rotor diameter of 130 meters. It utilizes all of the key technologies of the proven 3.6-MW family; in fact, the nacelle and tower are advanced variants of the 3.6-MW design. The rotor blades are manufactured using Siemens' IntegralBlade process, cast in a single piece, without the use of adhesive bonding. The new B63 rotor blade, measuring 63 meters in length, is the longest and technologically most advanced blade in the four-megawatt class. The B63 sweeps an area nearly equivalent to the size of two football fields. Thanks to optimized coupling of blade bending and twisting, these aeroelastic blades react more flexibly to high wind loads, absorbing forces similarly to the cushioning effect of shock absorbers on cars. This technology allows use of longer rotor blades, which boosts wind power capture and increases unit performance.

siemens | www.siemens.com

Integrated power control system

Urban Green Energy (UGE) has created a new, grid-tie power management system capable of taking inputs from wind and solar with integrated monitoring. A first for distributed renewable energy, SeamlessGrid includes all of the components necessary to connect an UGE hybrid wind/solar system, and monitor it with ViewUGE. For sites looking for greater sustainability and energy independence, along with lower costs, SeamlessGrid weaves together wind, solar, and the grid to provide a truly seamless installation. It is the first comprehensive power management solution that looks at the customers' wind/solar needs holistically, with a goal of providing renewable energy all year long.

urban Green energy (uGe)
www.urbangreenenergy.com/seamlessgrid

Backboard bag

Corgo Industries is helping bring safety to new heights with their COR-BACKBOARD BAG. With options of pockets, tie downs, handle placement, and a 200-pound vertical lift rating, EMS or HSE technicians can now store, transport, and get backboards up-tower more quickly and more safely. Made of red or orange ballistic denier, with a reinforced bottom, these bags will be visible on any site or in any storeroom.

CORGO industries
www.corgoind.com

Wind anemometer

NRG Systems, manufacturer of measurement equipment and turbine optimization systems for the global renewable energy industry, has introduced a new version of the WindSensor anemometer: the P2546C. Designed for resource assessment, site calibration, and power performance measurement, the WindSensor anemometer offers superior performance in turbulent environments. This new version of the WindSensor replaces the mercury switch with a coil-based signal generator, which produces a sine wave output. The P2546C features the same one-piece rotor for added durability that was introduced on the P2546A last year.

nRG systems
www.nrgsystems.com

Mobile service units

Moventas announces the launch of their new, custom-built Mobile Service Units for wind gears. Designed to support Moventas' up-tower field service program, the self-contained, climate-controlled mobile workshops are outfitted with a retractable roof, a power generator, plumbed air lines, a parts wash basin, and an induction heater. The units are stocked with proprietary up-tower tools and equipped with cutting and welding capabilities, making it possible to offer a wider range of onsite services than ever before.

Moventas' unique ability to repair the entire helical side of the gearbox up-tower greatly reduces maintenance costs by utilizing small cranes in place of large capacity boom and tail cranes. Repair times are collapsed by eliminating the need to ship gears to and from service centers, while weather delays are mitigated as fewer lifts are required. Up-tower services include full helical repair, high-speed pinion and bearing repair, intermediate and low-speed assembly, as well as planetary sun pinion repair.

moventas | www.moventas.com

Polycarbonate enclosures

Hammond Manufacturing has launched its new PCJ Series, a family of polycarbonate enclosures designed for housing electrical and electronic equipment in installations where NEMA 4X (IP66) environmental sealing for dust and water protection is required. The screw-down cover versions meet the higher NEMA 6P sealing requirements. Polycarbonate is an extremely versatile material, offering impact-resistance, protecting against aggressive chemicals, and ensuring no chips or cracks. It can be used in ambient temperatures of -35° C to +130° C (131° F to 266° F), allowing installation in a wide variety of industrial environments and across many different industries, including for wind and solar power projects. An initial five sizes, ranging from 5.93 x 6.16 x 4.91 inches to 13.94 x 12.16 x 10.82 inches, are available. The basic enclosure can be supplied in 80 different configurations to suit the intended application.

Hammond manufacturing | www.hammondmfg.com

Reaching Great Heights

Choosing the right aerial lift bags & buckets

By Barry Rolbin

Over the past 20 years, the use of lift bags and buckets have become common when it comes to getting tools and equipment up-tower to perform maintenance on a wind turbine. As technologies have changed for getting workers up a tower—from external and internal lifts, to interior winch systems, and climber assist ladders—bags and buckets have remained a constant in terms of fast and easy lifts for project equipment.

What has changed, however, is the material, the options, and the safety ratings. Aerial lift bags and buckets, especially those with covers, when properly maintained and inspected are still the reliable go-to tool and equipment lift option in the wind industry.

Material composition

Originally, lift bags were made out of a heavy canvas. They were manufactured for the oil fields, and were generally inexpensive and unrated. Next, came a variation of a regular tool bucket that was used in the telecom, metal structure, or any industry that required tools be lifted up to a worker. Simple enough, but the times and uses have changed.

In terms of the wind industry, some companies still offer canvas bags and buckets for turbine maintenance, however, they are no longer very reliable. Oils and greases can easily permeate the canvas, changing its composition. Add to that fluctuations in weather, and the canvas is no longer capable of the same lift rating as when it left the factory.

As a result, many manufacturing companies have turned to synthetic materials that are rated. Some companies offer ballistic materials or heavy woven polyvinyl. Look for materials that are laboratory tested to find out the true

strength of the material. Even stitching can be tested to give the true load capacity of the bags or buckets. Material can be rated for a 200-pound load and the webbing can be rated for 1000 pounds, but if tests aren't performed to determine any fail-points in the stitching, then the bag is not fully rated.

Shape selection

Rated lift bags and buckets are becoming more varied as new technologies are making their way into the market. There are three basic types of lift bags available: round, square, and rectangular. However, alternative shapes and new possibilities are becoming more prevalent, so the choices are almost endless.

Regardless of the type, lift bags and buckets are not something that should be imposed on an end user if it doesn't fulfill their needs. The primary rule to live by in terms of selecting the right lift for a project is that it should be manufactured solely with the user's requirements in mind, and fully adaptable to their needs.

Safety is paramount. Though sometimes this comes down to preference. Many European-based companies, for example, prefer to use bucket-style bags when doing maintenance as they tend to like using smaller loads. Herein, either multiple lifts are used or slings are attached to individual buckets and brought up in a manner that certain bags can be removed and placed on different decks. The original bucket with just one snap hook is prone to tipping over during a lift.

North American companies seem to prefer square or rectangular bags as they allow for a larger load, maximizing the capacity of equipment brought up tower. Larger buckets are available with greater capacities than ever before—up to 600 pounds, incorporating a four-point lift system that's comparable with square or rectangular bags.

A basket-type load-rated bag, for instance, allows for a more balanced and secure lift without any tipping. Due to their shape, these bags are ideal for bringing up hydraulic pumps, inverters, or any square or rectangular equipment that wouldn't fit in a round bag.

Job considerations

The styles of bags that are used in the wind power industry are extremely varied. For example, there are cold weather products available, which can be manufactured with materials that are cold-crack tested to -45° C or -49° F.

There are insulated first-aid bags, back-board lift bags, bags that are securable while transferring from the nacelle to the hub, bags for changing out neon light bulbs and fixtures, and more. There are hydraulic pump and tool bags, specifically created with different dimensions and work sheets to place equipment. There are even bags with rolled closures, or covers, or both.

The concepts are endless because one project isn't the same as another, and one maintenance team doesn't work in the same way as another. It is up to manufacturers to modify, create, and remake the safest and most durable products needed for today's work environments.

Safety inspections

As with personal safety harnesses and gear, lift bags have to be inspected before each use. Small holes can become larger ones very quickly. Worn slings and Dee-rings can become unusable. Anything that's lifted has to be inspected.

A lift bag manufacturer can and should supply a checklist, but it's ultimately up to the end user to carry out the inspection. Better safe than sorry. If unsure of a product's condition, wait before use. Contact the supplier to see if it should be disposed of, or if it can be repaired. Most companies offer a warranty; some even offer free repairs and inspections.

Don't make the mistake of using a damaged bag or bucket. It's a small expense when considering the alternatives.

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Navigating the Permitting & Design Process of a Solar Power Project

By Maureen McHale

Below: *ESA Renewables and City of Orlando employees checking out a newly commissioned 417-kilowatt solar rooftop installation.*

Left: *Solar installation at St. Johns.*

THe PROPeR ins TAll ATiOn Of A sOl AR ARRAy provides system owners with a renewable source of energy for several decades. The process of getting from conceptualization to installation, however, can be a grueling one if not managed correctly. From permitting to project design, maintenance, and monitoring, many factors must be evaluated and steps implemented for a successful solar installation.

To maximize the return on investment (ROI), it's imperative to follow the correct codes, select quality equipment (panels, mounting systems, etc.), and develop a project design that maximizes efficiency and energy output. There's a lot to consider along the way…

A look at permitting

Building and electrical permits are usually legally required before any work on a solar installation can begin. These permits help ensure the grid, electrical customers, and their property are safe. Code requirements and permitting processes vary somewhat from one jurisdiction to the next; however, most PV-related electrical codes are based on national electrical code standards.

Municipalities generally set solar permit fees using either a valuation or a flat-fee method, or a combination of the two. Valuation-based assessments calculate fees based on the cost of the solar system, whereas flat-fee methods charge the same fee regardless of system size. Permitting can take anywhere from three to six weeks for a commercial-scale project, and three to six months for a utility-scale project.

In areas without streamlined methods, the permitting process can be arduous and long. Many in the industry are calling for mandatory training for permitting officials unfamiliar with solar permitting standards, so as to simplify the process for all residential and commercial solar installations.

Contracting with a solar solutions' provider who is familiar with local permitting fees, policies, and guidelines can be the key to a less arduous permitting process. Working with a PV system contractor that specializes in engineering, procurement, and construction (EPC) means a project can be controlled and managed from a single point of contact, which can result in a much more organized and streamlined project—from installation to implementation. EPC contractors can be responsible for everything from viability studies and permitting to project design and installation.

Project design & installation considerations

Before a solar permit can be approved, the solar farm conceptual design is created. Load calculations are performed to determine how much total power is required. If a business or residential customer is looking to calculate their energy load, it can be determined by reviewing previous electric bills to estimate usage. Load calculation is an important step, as it helps establish everything from the type of panels and inverts to use to the project layout, including the proper safety disconnects, batteries, and charger.

Sunlight levels must also be considered and factored into the design equation. A solar panel will only perform at optimum levels when correctly aligned with the sun. In the US and Northern Hemisphere, solar panels should face true south for optimum performance. Panels should also be tilted in relation to an array's location and latitude for optimum power generation. Shading by buildings, trees, or other obstacles can cause substantial reductions in generated power, and should be taken into account during project design. The interconnection point, layout of the strings, and the distance between various components of a solar array should also be factored into the layout. The greater the distance between components and the interconnection point, the greater the drop in voltage.

A well-designed solar farm not only generates maximum energy at the highest efficiency levels, it also enhances the ease of operations and maintenance (O&M). Though tempting, price should not be the primary decision-making factor when installing a solar project. Systems that incorporate top-tier supplies tend to be more durable, reliable, and better able to provide maximum ROI. Do the research. Selecting the least expensive panel per watt can end up costing an asset manager a lot more money in the long run. Lower cost panels might also be lower watt panels, for instance, and require more panels per project. Along with higher maintenance concerns, consider the wiring, mounting, and any other parts or tools needed.

Another system design aspect that should be taken into account in regards to O&M is ground leveling. For a ground-mounted installation, level ground is important for navigating around a project site. Not only does this make cleaning and servicing easier for maintenance crews, managing vegetation is easier, too. Additionally, runoff and ground erosion may become a problem if the property is sloped.

A good asset manager will also assess a project in terms of the future, and consider how it will be accessed, monitored, and maintained. A monitoring system should be selected that not only includes a computer and display onsite, but remote access as well. This type of system allows technicians to monitor the health of the system, and set schedules for preventative maintenance. Any under-performance issues can, then, be recognized and resolved immediately to help maximize energy production and optimize operations.

Preventing design flaw

In most types of power plants, design flaws can result in catastrophic events. Take, for example, the nuclear crisis at the Fukushima power plant in Japan. A dangerous flaw resulted in cooling system failures in four reactors, causing explosions and fuel to melt down. In a solar power installation, design flaws can be hazardous and costly as well. Design weaknesses can lead to fires that damage not only the solar array, but also the rooftop or building on which it was built. Property or buildings adjacent to a ground-mounted solar project can also be affected.

A fire can occur in a solar array when ground shorts occur. Insulation can be damaged during an install that either doesn't allow for proper spacing, or is simply poorly designed in that wires are exposed, pinched, crimped, or cut accidentally. Mounting design flaws can cause solar panels to get too hot, thereby decreasing output. It's important to take careful and proper precautions during solar installations. Mount panels with a sufficient air gap under the panels to keep them at a normal temperature. Know the safety procedures, and plan projects accordingly.

Maureen McHale is a marketing consultant, who has been actively promoting the solar industry and green products for the last six years (http://hiremaureen.com).

ESA Renewables, which provides turnkey solar PV systems, owns and operates a diverse portfolio of more than 500 solar PV power-generating facilities globally. Th y offer EPC and O&M services, as well as fi ancing, testing, and monitoring.

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What Advanced DC Analysis Can Reveal About an Array

By Bryan Randall

Over the past few years, several module-level electronics have been introduced into the solar PV market. These types of devices include microinverters, optimizers, and module-level power monitors. Module-level electronics can help improve performance on the DC side of the inverter. Additionally, in the case of precise power monitors, further analysis of string or module-level DC side data by appropriate advanced software can create even greater insight.

The DC side of a solar PV array can be made up of thousands of modules, miles of wiring, and a network of electrical interconnections, fuses, combiner boxes, and electrical buses, making manual inspection costly and time-consuming. Alternatively, short-term power, monitor-based, advanced DC analysis can create a "virtual inspection" of an array. Virtual inspections can identify physical impairments, such as open electrical connections and module damage. Advanced DC analysis over a longer period of array operation can further reveal transient impairments to performance from soiling and shading.

Findings from retrofit installations of advanced DC power monitors and ongoing advanced DC analysis are shown in Figure 1. The data presented was drawn from experience at over 25 solar PV systems, ranging in size from 25 kilowatts (kW) to 20-plus megawatts (MW). The age ranged from new to eight-years-old, across a variety of designs, including commercial rooftops, carports, and ground-mount systems throughout North America.

As these case examples demonstrate, accurate and granular DC monitoring and advanced analysis down to the string or even module-level can be advantageous for inspection and ongoing performance management. Intelligence from advanced DC analysis can improve operations and management (O&M) practices, saving time and money.

Virtual inspection field findings

Virtual inspection at the solar PV sites identified numerous instances of wiring faults, blown fuses, open DC disconnects, damaged modules, and mismatched modules within a string, and were associated energy loss (see Figure 1).

Figure 1. *Typical physical DC impairments (from left to right): poor mounting, resulting in module damage, internal short, and damage from falling rock.*

The following was found among the virtual inspection results:

- DC disconnects accidently left open after annual maintenance, resulting in a four percent energy loss. This type of loss would typically go undetected by inverter-based monitoring alone, due to the lack of sensitivity of the current sensors in those types of systems.
- Numerous string fuses not replaced after annual maintenance, resulting in a one percent energy loss. This type of loss would be undetectable by inverter-based monitoring.
- Blown string fuses (perhaps incorrectly sized at commissioning, and/or the result of a DC current surge). These faults would also be undetectable by inverter-based monitoring.
- Weak string power production due to module damage. Advanced DC analytics identify panels and strings operating at sub-optimal maximum power-point voltage (Vmp), a precursor that indicates damaged panels. Such weak strings cannot be detected by traditional string monitoring using smart combiner boxes.
- Weak string power production due to mixed panel power ratings (255 and 275 watts). Advanced DC analytics identify panels and strings operating at sub-optimal maximum power-point current (Imp), a precursor that indicates mismatched panels. These strings also can't be detected by traditional string monitoring that use smart combiner boxes.

Virtual inspections often revealed an "as-built" electrical configuration differing, sometimes critically, from final drawings and documentation. Mismatches between drawings and an array can result in additional hours of troubleshooting and fault isolation, posing potential safety risks to maintenance personnel.

A feature of some advanced DC monitoring and software systems is a spatially accurate representation of an array, reflecting its as-built electrical condition. In fault cases such as these, the visual representation reflects the overall array layout and actual location of the fault within the array (see Figure 2). An advanced DC monitoring system with this capability can substitute for, or augment, traditional site documentation.

Figure 2. *A New Mexico one-megawatt (MW) ground-mount array. The patial and electrical array map shows the precise location of an open circuit (orange).*

Advanced DC analysis findings

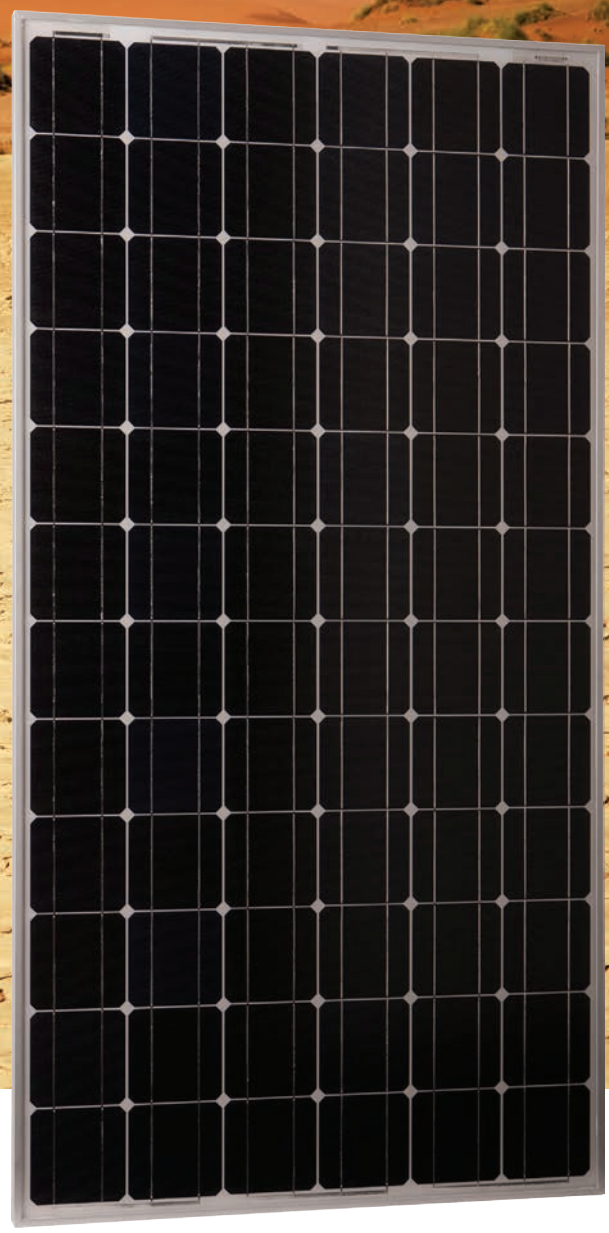
Field experience with advanced DC analysis also provided insight into transient impairments stemming from soiling and shading.

- **Soiling**

Array soiling rates differ dramatically by locale due to variables, including: climate and precipitation patterns; industrial,

Continued on page 30.

The Leader in Off-Grid Solar Power



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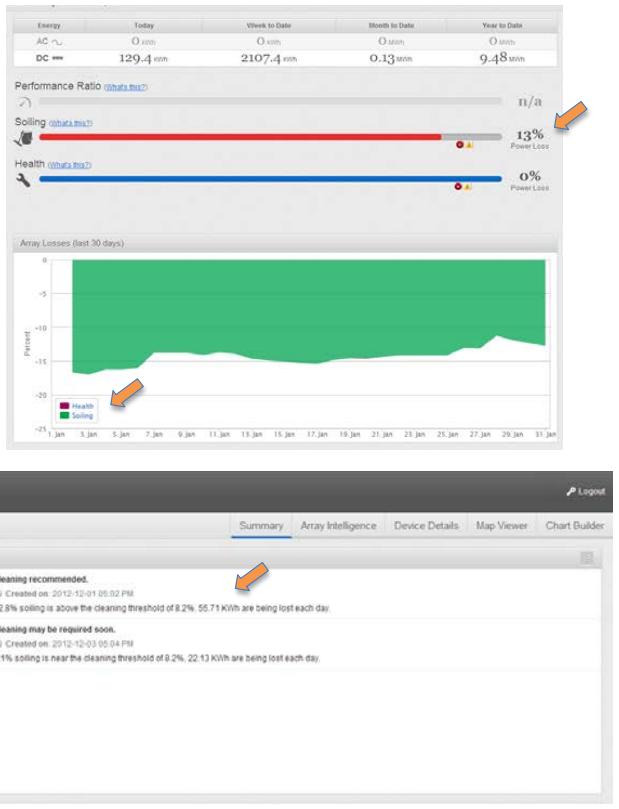

agricultural or urban pollution; avian activity; and array design (specifically module-tilt angle). Expected annual losses because of array soiling vary from less than one percent of nameplate capacity, to well over 15%.

Field findings showed the cleansing benefits of heavy rain events on high-tilt angle arrays and, conversely, showed that light rain on near-horizontal rooftop or carport arrays often acts as a soiling accelerant. Precise DC data, combined with advanced soiling analytics, determined the impact of soiling and the financial payback of array cleaning. This answered the oft-asked question: "When should I clean my array?" Of course, knowing this answer can improve O&M practices, saving thousands of dollars.

In the example shown in Figure 3, advanced DC analytical software detects soiling above the user-set threshold of 8.2%, and issues an alarm when over 55 kWh of energy are being lost daily due to soiling. The software, then, recommends array cleaning.

Figure 3. *Soiling detection and cleaning alarm.*

• Shading

Ongoing advanced DC analysis has helped to locate and quantify losses unique to daily and seasonal shade. For example, the 100 kW system installed at the New Jersey high school shown in Figure 4 has tall evergreen trees on the west side of the array, and a two-storey bell tower at the southwest corner of the building. As shown in red, advanced DC analysis recognized that on October 5th, 2012, at precisely 4pm, the strings were making less than 50% of the average array power due to shade.

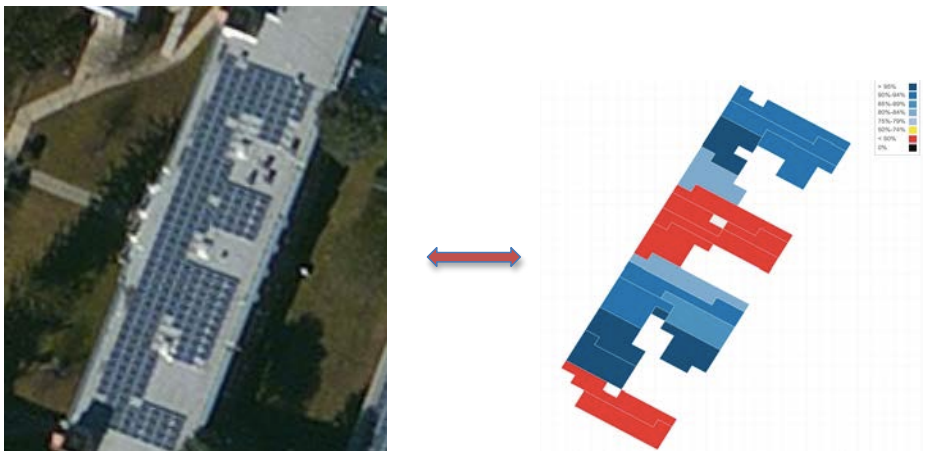

Figure 4. *Aerial view of system and software screenshot, showing lost output from shading.*

This review of findings from new and retrofit installations shows that advanced monitoring and management systems can identify and help to remedy DC side impairments within an array as it locates physical damage, connectivity problems, and transient events, such as soiling and zonal shading. Advanced DC monitoring and analysis can help to improve array output and reduce O&M costs; thereby, improving levelized cost of energy (LCOE). This, in turn, could improve financing terms for new projects, and shorten the payback on advanced DC monitoring and management systems for retrofits.

Bringing over 25 years of engineering experience, Bryan Randall (VP of Operations) manages Draker's IT, Project Engineering, Project Management, Production, Field Service, and Technical Support teams, serving as a liaison between the company and customers.

Since 1999, Draker has provided monitoring, management, and control solutions for commercial and utility-scale PV systems. For more information, read Draker's DC Analytics White Paper, found on their website.

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Symbiotic Solar on the Electrical Grid

Through advanced, configurable inverter functions

By Michael Mills-Price

sOl AR ene RGy is GAinin G in CReAse D ReCOGni TiOn as a tool to reduce our carbon footprint and achieve energy independence. Precipitated by a continuous drop in module prices and Balance of System (BoS) costs, the US solar industry as a whole saw unprecedented photovoltaic (PV) growth in 2011 and 2012. However, solar power still makes up only about one percent of energy generation in the United States. New challenges will undoubtedly arise as this percentage is expected to rise. Though manageable, in order to maintain the growth and the success of the industry, ongoing research, testing, and innovation will be required.

One of these challenges comes from the intermittent nature of solar power when compared to traditional energy resources. Resulting grid variations and subsequent impacts on existing voltage regulation equipment are a concern, particularly under high-penetration scenarios. Too much power means local voltage and its respective frequency can rise, causing problems for motors, lights, and a host of other electronics. Conversely, a lack of power and voltage means frequency can dip. This problem is not specific to solar. However, other energy sources tend to be more controlled and predictable, since they aren't dependent on the weather and the sun shining.

Additional challenges stem from the design of existing infrastructure, its protective control features, and electromechanical equipment settings. Traditionally, electrical infrastructure was built to deliver electricity from a central generation station out to customer loads. With the increase in distributed generation PV projects, rooftops, carports, brownfields, and other areas are now becoming sources of electrical power, distributed throughout the grid. This is resulting in a demand to re-haul operation and control practices by the local utilities.

Although such challenges can take a variety of forms—depending on a project's geographical location, the utility control practices, local loading (circuit loading), and seasonal load and generation variations—advancements in configurable inverter functions can help. Configurable inverters provide a deterministic response at the point of interconnect, based on the holistic electrical system needs.

Advancing technologies

Widely recognized as the respective hub of a PV system, inverters need a high level of user configurability to satisfy the needs of local engineering procurement construction services (EPC), customers, and utilities. There are a number of technologies that have been developed to address the challenges of widespread PV integration into existing electrical distribution circuits, including:

1. Local scheduling capability;
2. Voltage support functionality;
3. Closed-loop, point-of-interconnect control; and
4. Phasor Measurement Unit (PMU)-based island detection.

These functions have been demonstrated and investigated under the Department of Energy's (DOE) Solar Energy Grid Integration Systems Advanced Concepts (SEGIS-AC) program. This program leverages a systems' based approach to alleviate the voltage concerns caused by solar power's sporadic nature, looking beyond the point-of-interconnect to address feeder wide power quality and voltage stability concerns. As a result, the program is improving inter- and intra-operation of geographically distributed resources.

As power electronic-based devices, inverters are in a specific position to manage many of the voltage and frequency issues expected to increase, as solar power becomes a larger percentage of the energy demands on distribution circuits. Reliability is key: the coordination and aggregation of these capabilities allows for system operators to maintain reliable, efficient control, even under widely varying intermittency events that can sometimes be caused by PV systems.

Efficiency improvements of the overall electrical system are possible since real and reactive power can be generated close to point loads, which in turn decreases the losses typical of longer distance power transmission. With power electronic-based devices, the ratio of real and reactive power can be controlled in a linear fashion, eliminating the step changes in voltage often associated with today's electromechanical voltage regulation equipment—and resulting in a smoother, voltage profile at a customer's load points.

For the issues associated with distributed generation, the SEGIS-AC program is tapping wide-area information to better utilize PV resources that are spread across electrical and geographic areas. This system state information, combined with the advanced inverter control functionality, allows for optimization of PV resource performance at and above the distribution feeder level. This allows for virtual power plants to be optimized for the appropriate individual circuit needs, even if the PV resources are spread over a geographically wide service territory.

All these factors allow for more efficient operation of the electrical distribution circuits, enabling tighter control bounds and increased capacity for the sub-transmission and transmission systems.

Seamless operations

With advanced intelligence through wide area information, the inverter and PV system can better integrate with the legacy electromechanical voltage regulation equipment, resulting in extended life, improved customer voltage profiles, and lower system losses. With increased awareness and visibility throughout the electrical distribution network, and quicker reaction capabilities, these advanced inverters are enabling vastly larger PV penetration rates on today's electrical systems, without major overhauls of electrical circuits (and the associated cost implications).

PV growth is a crucial step in lessening our need for traditional fossil fuel sources, and lowering our collective impact on the environment. Through advanced inverter and system control features, aggregation across service territories (virtual power plants), and deterministic response (priority driven schedulable control), the solar industry continues to lead the way in developing technologies that have resulted in improvements to power quality, voltage stability, and overall system efficiency throughout electrical distribution systems.

Michael Mills-Price is SEGIS program manager and technical lead for the Solar Energy business unit at Advanced Energy Industries. He's one of the principle designers responsible for bringing the TX product line to market.

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Left: *Engineers at work at a molten salt plant.*
Below: *Molten salts.*

A Growing Trend

The rise of CSP & thermal storage

By Emilio Iglesias Sola

In the United States, 2013 is set to be a significant year for the concentrated solar power (CSP) industry. So far, the market is showing continued growth that's fueled by several factors, including: technological advancements in thermal storage and molten salts; ongoing studies proving the benefits of thermal storage to utilities' bottom line; and the unique political and geographical climate of the US. These factors, combined with several projects coming online this year, will not only increase total CSP generation capacity by more than 120%, but will also enable utility-scale CSP to be commercially viable for the first time.

Salts & storage

In 2013, the solar power industry will see an even greater adoption of technological advancements in molten salts and thermal storage. A recent Research and Markets report found that the positive attributes of molten salt due to recent R&D efforts have driven the growth of the market. One example is a new generation of molten salts using potassium calcium nitrate (CN-K). CN-K-enhanced ternary molten salts have a lower melting point than current binary salts, an innovation that expands their effective temperature range, while reducing the amount of energy that's required to reach this range. As a result, plant operators will see improved heat transfer and storage performance, and face less risk of damage from salts freezing in circuits.

These same advancements will help drive utility-scale CSP production in 2013 and beyond, as decreased capital and operating costs will make projects more profitable for investors and plant owners. Compared to thermal oils and previous salts, molten salts using CN-K are more competitively priced—a trend that will continue over time. Additional savings come from the salts' expanded temperature range, which not only makes them less expensive to heat during the melting process, but also means fewer salts need to be purchased during construction. Overall operating costs are, therefore, reduced given the longer lifecycle for equipment. The purer and less-corrosive synthetic molten salt molecules help decrease corrosion of plant components, cutting maintenance costs, as well as safety concerns.

Experts further predict the continued adoption of solar thermal technologies, based on recent studies showing the improving profitability achieved by CSP plants that incorporate thermal energy storage. According to a November 2012 report by the National Renewable Energy Laboratory (NREL), the storage capacity of concentrating

solar power can add significant value to a utility company's mix of energy sources. The study found that even when the sun isn't shining, CSP plants with six hours of thermal storage can add $35.80/MWh to the capacity and operational value of the utility, compared to photovoltaic (PV) solar power alone. NREL also concluded that CSP with thermal storage helps utilities offset the need to build new gas-fired generators to meet peak demand in the evenings once the sun sets, which PV cannot.

Climate & geography

The United States is also positioned to capitalize on CSP opportunities, given its unique geographic and political climate. Utilities are only beginning to take advantage of the ample land availability in some of the world's best irradiation locations in the US Southwest. The high land availability offers plant managers the opportunity to develop larger, more efficient CSP plants, which will lower costs and produce better yields. To illustrate the scales involved in such projects, a 100-megawatt (MW) plant requires almost one square-mile of land. Moreover, as the Southwest continues to face rising population levels and increasing needs for power, CSP will be an attractive solution in a climate where drought conditions make hydropower less feasible. Politically speaking, renewable portfolio standards (RPS) have mandated companies supplying electricity to produce a specified portion of their electricity from renewable energy sources. A few states, such as Nevada and Arizona, require some portion of the RPS to come from solar resources.

Past & present

If 2012 was a year of construction, 2013 will be a year of dramatic growth to the US solar energy supply, as nearly 800 MW come online. Several major projects are expected to be meet completion in 2013 in the US Southwest. For example, Abengoa's Solana parabolic trough project will add 280 MW with six hours of storage in Arizona, while SolarReserve's Crescent Dunes solar power tower will add 110 MW, with 10 hours of molten salt storage in Nevada. Plus, California will add 620 MW of solar power, as both BrightSource Energy's pressurized steam solar power tower Ivanpah Units One, Two, and Three, and NextEra Energy's Genesis trough project come online this year.

With construction of CSP in the US expected to accelerate in the next decade, the time for utility-scale production has never been better. With improved technologies, which are lowering project expenses, and ongoing research confirming the benefits of CSP and solar thermal, conditions are ripe for continued expansion. Indeed, 2013 is poised to be an exciting year of growth in the CSP and solar thermal markets, as utilities begin to seize advantage of this unique opportunity.

Emilio Iglesias Sola is an agricultural engineer and a sales manager at Yara International ASA. Since 2003, he has focused on developing calcium nitrate applications for various industries throughout the world, including for CSP projects.

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Overcoming Clean Tunnel Vision

Striving for successful solar projects

By Zev Rosenzweig

There are few issues on the international agenda that receive the same widespread support as the need to achieve energy stability and battle the harmful effects of climate change. The desire to wean ourselves off of fossil fuels is the clarion call for a range of supporters from a variety of political backgrounds.

At the vanguard of this movement, cleantech developers have been advancing technologies to better harness clean, renewable energy from the sun, wind, ocean waves, and more. Yet, for all of the promise, global support, and scientific breakthroughs, the clean technology revolution hasn't come close to reaching its potential.

There is a range of contributing factors that have led to this point. Key among them is the costs, and a decrease in financial support from investors and governments in the wake of a global economic recession. Where some might consider this a reasonable explanation, it points to a more problematic issue: the cleantech community suffers from a severe case of "clean tunnel vision."

The road to success for any industry is flexibility, and the ability to develop products and technologies that are adapted to the consumer and the realities of the market. Though cleaner technologies certainly play a crucial role in helping combat the harmful effects of pollution and climate change, to be truly successful, they must also adhere to the same standards that govern other industries. Products must be developed with end-users in mind.

Some companies operating in the renewables' sector, however, remain narrowly focused on the specific technical advantages of their product, at the expense of the bigger picture and the needs/limitations of the market. "Clean tunnel vision" might blind a company into strictly focusing on the innovation they've developed, rather than on who it's for and the environment it will work in—the environment in terms of access, ease-of-use, supply-and-demand, and grid connections, etc.

A look at solar power

A glaring example of this is visible in the solar energy industry. The solar market can largely be divided into photovoltaic (PV) panels and Concentrated Solar Power (CSP). PV panels are limited in terms of efficiency, mainly due to the reliance on grid-based energy for power during night and low-light conditions. This is a reality that limits their use in off-grid projects or in regions where grid stability is a concern.

Generally, CSP systems are able to provide higher levels of output efficiency, but also have limitations. They require viable placement options (often not available in cities), and require high, initial financial commitments. Additionally, CSP installations can place a heavy burden on limited natural resources. Projects are often found in desert-like conditions due to the requirement for large, flat expanses of land, with an abundance of direct sunlight. Beyond placing strain on electrical grids (as a result of the large distance the generated power must travel to reach its intended target in populated areas), deserts don't contain copious amounts of water—a primary requirement for a CSP steam powered turbine.

Facing challenges

Although the sun provides a tremendous energy resource, the two leading systems to harness that power are either too small to have a major impact, too environmentally taxing, or too financially demanding to be within reach of the average business or municipality. For example, a large-scale project, designed to produce 400-megawatts (MW) of solar power in California will cost over two billion dollars. The initial project cost is so high that it tends to restrict access to the technology, requiring financial sponsorship and support from state and federal governments.

Even more, although the sun has a great deal of energy to provide, it has a dogged habit of setting every evening. This has led CSP technologies to rely

on expensive and inherently inefficient storage techniques that are less than ideal. Even when storage works well, it only provides a limited time frame for use, meaning a series of cloudy days can lead to a powerless station.

The solution? Though there is certainly room for traditional PV and CSP technologies to play a role in modern society, innovation is still needed to meet the greater market demand. There are no readily available, obvious answers, but here are some options to consider...

- **Hybrid systems.** Long the buzzword for other cleantech markets, hybrid solutions can serve to enhance the availability and reliability of solar power. Creating hybrid solutions means utilizing natural gas or other alternative fuel sources to help guarantee a seamless, 24/7, power supply. This approach could allow solar technologies to bridge the gap until power stations alone can harness enough of the sun's energy to provide a full day's power.
- **Modularity.** Currently, CSP stations only come in two sizes: massive and more massive. Logistics requirements demand financial commitments that are beyond the reach of most companies, municipalities, and even some countries. A modular structure would allow for a lower initial investment and flexibility, with greater proximity to residential and industrial zones.
- **Aesthetics.** Solar technology leaders are generally not thought of for their expertise in design or urban planning, but that shouldn't preclude looks from being considered. Placing solar stations closer to residential areas allows for a reduction of stress on the grid, and the efficient use of a system's heat byproduct to power other services, such as air conditioning. To make this possible, stations could be designed in a way that is aesthetically pleasing, blending in with the local environment.
- **Environmental side effects.** Though technologies, such as solar power, are assuredly more environmentally friendly than fossil fuels, there are still side effects to consider. PV panels often rely on the finite resource of silicon, and large-scale CSP stations use a tremendous amount of water to generate power in steam turbines. By substituting alternative cell designs for PV, or gas turbines instead of steam turbines, it's possible to protect these limited resources.

Few factors will contribute as heavily to the goals of fighting climate change and achieving energy security as implementing renewable technologies. By breaking free from limited "clean tunnel vision" thinking, however, the industry can become more adept at filling the gaps in sustainable energy markets, developing successful technologies that are accessible to a wider range of consumers.

Zev Rosenzweig is the CEO of AORA Solar, a developer of applied, ultra-high temperature concentrating solar power (CSP) technology. AORA is a pioneer in developing mid-sized, scalable solar solutions.

AORA solar | http://aora-solar.com

High-current DC interference filter

SCHURTER presents its 2300 A FMER SOL interference filter. Designed for use on the DC side of the inverter in PV and other DC systems, the new series is offered without ground capacitors to safely prevent any leakage of current to ground. Usually, maximum power point (MPP) trackers generate disturbances into the grid's AC power line, as well as the DC side of the solar module. An AC filter is typically used on the grid's AC power line, but the noise generated on the DC side tends to be overlooked. EMC standards EN 61000-6-3 and EN55014-1 also place strict limits on the noise generated downstream from the grid, such as the line to the solar panels. Using the FMER SOL DC filter on the DC side of the inverter ensures EMC compliance, as well as overall reliability of the entire PV system.

Large solar inverters exposed to high-temperature operating environments also tend to require a cooling system. The FMER SOL provides high-temperature resistance to simplify the system and reduce the energy needed to cool. Accordingly, the FMER SOL filters are designed for rated currents from 25 A to 2300 A, with a standard ambient temperature rating of 55° C (131° F). The series is also rated at 75° C (167° F) ambient temperature up to 1200 VDC, with corresponding current de-ratings.

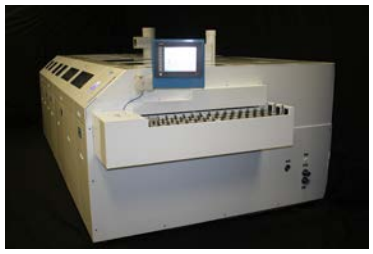
sCHuRTeR | www.schurterinc.com/new_emc

Solar ground-mount system

The latest PV racking product from PanelClaw is taking an innovative approach to large-scale solar ground-mount applications to reduce project risk and decrease total project lifecycle costs. Called Sun Bear, the new penetrating ground-mount solution furthers PanelClaw's mission to accelerate adoption of PV worldwide with its drastically simplified construction, including pre-assembled components and zero loose fasteners.

Through 18 months of collaboration with solar industry experts, collectively encompassing over six gigawatts (GW) of global PV experience, the Sun Bear system directly addresses critical challenges in the existing solar ground-mount space. Key product features include: a low-component count; interchangeable foundation options; in-field adjustability; and a pre-assembled, telescoping frame all leading to fast installation time and reduced construction risks.

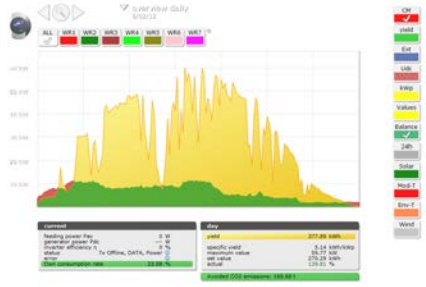
PanelClaw Group, inc.
www.panelclaw.com



Thin-film production tool line

MicroTech, a Silicon Valley wet process station supplier, has launched a product line specifically designed for high-throughput processing of thin-film solar cells. These cells can produce substantial cost reduction and cell integration by processing an entire array of solar cells on a single substrate. The MicroTech TF 1200 production tool can process substrates up to two meters in size. It also offers the following benefits: low-water consumption with strict control and recycling of water through a patent-pending technology; effective particle filtering; a modular design for process flexibility and ease of change; roller technology for substrate transfer; high-energy ultrasonic cavitation for hard-to-remove materials; process support, including proprietary solar processes; and a unique liquid handling system, which allows spray, puddle, and immersion processes.

microTech | www.microtechprocess.com



PV monitoring & metering solution

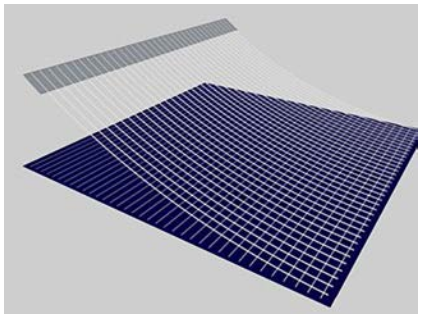
Solar Data Systems has expanded its Solar-Log Performance Data Provider (PDP) portfolio to include automatic reporting for PV installations that participate in state and regional incentive programs. This customized monitoring and metering solution meets the specific reporting requirements around the country. Solar-Log is inverter independent, and compatible with over 70 inverter brands. It optimized plant performs, providing: plug-and-play installation; web-based administration; remote diagnostics; automatic notification of PV performance problems; and improved maintenance and response times.

solar Data systems
www.solar-log.net

Flashed tile hook

New from Quick Mount PV, the Quick Hook USA is currently the industry's first flashed tile hook mount—bringing fast, cost-effective waterproofing to curved and flat tile roof installations. Engineered to Quick Mount PV's high standards for code-compliant, waterproof mounting systems, the curved and flat tile models of the Quick Hook USA use the same tile hook, which mates with the base. An extra-wide base allows the installer to choose from multiple clearance holes for attachment of two lag screws to the rafter. And, a slot in the matching base enables the hook to perfectly fit the curve of the tile.

Quick mount Pv | www.quickmountpv.com/quickhookusa



Solar cell connection technology

Meyer Burger's patented, SmartWire Connection Technology (SWCT) for solar cells achieves higher efficiency solar modules, reducing production costs in PV manufacturing. Solar cells are electrically connected using thin copper wires on both sides of the cell, thereby replacing the classic two to three busbars. Typically, 30 very fine copper wires are used for cell connection, generating up to 2,000 contact points per cell. SmartWire Connection Technology (SWCT) offers customers the following advantages: five percent higher power output compared to best-in-class 3BB technology; a 10% higher energy yield (kWh/kWp); a reduction of production costs of up to 0.25 USD/cell; and SWCT is compatible to all crystalline silicon cell technologies. The SGS Fresenius Institute has already certified Heterojunction (HJT) modules with the SmartWire Connection technology, plus Meyer Burger's laboratories have successfully performed four-fold, IEC-compliant damp heat, and eight-fold temperature cycles.

meyer Burger Technology AG | www.meyerburger.com

C-Head cutters

BURNDY expands it product offering with the PATHCC10 (battery) and RHCC10 (remote) C-Head Cutter Series. The unique C-Head tool allows users to simply scoop and cut, without the need to open and close a latch, which makes cutting easier in solar project applications. The PATHCC10 and RHCC10 Series of cutters are available with four individually designed blades, enabling users to optimize the cutting of the intended cable type with ease and effectiveness. The PATHCC10 is a self-contained battery operated cutting tool (18 Volt Ni-MH), and the RHCC10 is a remote, power-operated hydraulic cutter (10,000 psi). Both platforms have covered head versions available and come with blade alignment technology, ensuring a clean cut and maximum blade life. A variety of options are also offered, such as ordering the tools with all blades or specific blades only.

BuRnDy | www.burndy.com

Energy management & storage system

Joule.System from Demand Energy is an intelligent energy management and modular storage system that's enhancing the acquisition, control, and use of electricity at the edge of the utility grid. In commercial and industrial buildings, this retrofit solution interfaces digital intelligence and energy storage with building management systems—giving building owners the ability to control usage and save on spiraling electricity costs. The system communicates with building and grid management devices to control usage and support load fluxuations, mitigating the risks associated with voltage drops and outages. The Joule.System can be used to integrate and firm renewable generation (solar and wind) for integration into the utility grid, or to create a standalone microgrid. From kilowatt to megawatt applications, Joule.System's modular design and comprehensive software is adaptable and scalable to meet the needs of virtually any sized configuration or application.

Demand energy
www.demand-energy.com

Solar carport

SolarSupports.com introduces a structurally, pre-engineered solar carport for any weather region and geographic site orientation. The design will integrate all commercially available solar panels and EV charging stations. The PV panels can connect easily to purlins, which are pre-wired electrically. It has a quick lead-time, and can be shipped anywhere in North America. SolarSupports.com manufactures all steel structures in their own facilities. They also fabricate DSA pre-check designs, and are licensed and compliant with Cal/OSHA safety programs, state prevailing wage law, and project labor agreements.

solarsupports.com
www.solarsupports.com

Thermal backup or standalone water heaters

Stiebel Eltron Tempra Plus whole house, tankless, electric water heaters are 99% efficient and feature advanced flow control to automatically keep output temperature constant. They provide unlimited hot water and are water saving, space saving (17" x 15" x 5"), energy saving (offering 15% to 20% savings), and easy to install. Tempra Plus tankless electric water heaters provide an ideal backup to the Stiebel Eltron solar thermal systems when the sun needs a little assistance.

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

PV power potential

When the potential power output of a plot of land for a PV ground-mount installation is required, PV Groundbreaker can do the work. This free software from Schletter utilizes Google Maps to simulate a solar field anywhere in the world. From the developers of Helios 3D, users need only enter basic information about the desired system—module size and power and the number of rows and columns, as well as other optional customizations—and PV Groundbreaker makes it quick and easy to: establish the number of PV modules that will fit into a specific site; find out the number of racks that will be necessary; determine the potential power output of any plot of land; and generate a visual example of the optimal racking layout.

schletter | www.pvgroundbreaker.com

Specialized thin-film coating process

Deposition Sciences, Inc. (DSI), global manufacturer of thin-film optical coatings, announces the enhanced capability to apply highly specialized, durable coatings onto extremely complex shapes and multifaceted surfaces. Utilizing DSI's proprietary IsoDyn LPCVD (low-pressure chemical vapor deposition), this method is ideal for coating almost all types of optical glass crystalline materials, ceramics, and metals. DSI's IsoDyn LPCVD process, a high-temperature method (approximately 500° C | 932° F), is permitting exceptionally conformal coatings on many complex, substrate geometries.

Deposition sciences, inc. (Dsi)
www.depsci.com

Mono- & polycrystalline modules

MAGE SOLAR, a turnkey provider of optimally coordinated PV solutions, introduces a brand-new product line of the highest wattage MAGE POWERTEC PLUS modules. Joining the existing product family of AC and DC modules are a 72-cell, 300 W monocrystalline module and 72-cell polycrystalline modules in strengths from 285 W to 290 W. With more watts per module, the new power classes give installers the distinct advantage of decreased labor costs and installation time. MAGE POWERTEC PLUS modules are backed by the company's industry leading 0 to +5 watt tolerances, and MAGE SOLAR's signature 30-year, 80% power output guarantee. All modules are CEC, FSEC, and UL listed; the US-produced 245 W module is also fully ARRA-compliant.

mAGe sOl AR us A
www.magesolar.com

PV combiner box series

Shoals Technologies Group announces the latest addition to their already diverse product line, the Slimline Series of PV combiner boxes. This series capitalizes upon Shoals' decade-worth of balance-of-system experience by reducing enclosure sizes and optimizing the internal components to provide a lighter, more compact, and cost-effective product. Shoals designed the new Slimline combiner boxes to optimize the usage of space within the enclosure, without comprising standards, to reach the price points customers are requesting due to the continual downward pressure on BOS components. Listed for ETL 1741 and CSA 22.2, and rated for 600 VDC and 1000 VDC systems, the Slimline series supports up to 18 inputs. It's available with UL98B disconnects and SNAPShot wireless monitoring. Standard features include: finger-safe fuse holders; oxygen-free, plated busbars; NEMA 4X enclosure; and a five-year warranty standard on all models.

shoals Technologies Group
www.shoals.com

Stainless steel roof hook

Quickscrews International has developed a stainless steel roof hook for stone coat steel rooftops. The hook uses five-millimeter thick stainless steel, with bends, to work in the standard set-up for metal rooftops. This addition to the other roof hooks gives customers a complete range of choices for the majority of standard rooftops. Specification pages and test results are available on the Quickscrew website, under the "Information" tab.

Quickscrews international
www.quickscrews.com

Integrated inverter solution

KACO new energy launches an integrated inverter solution optimized for use with smart modules for the North American market. The blueplanet 6400M and 7600M inverters are equipped with internal Tigo Energy Management Units (MMUs), and the PV SafeTM button. This integrated solution simplifies system design, increases safety, and reduces the amount of DC BOS equipment. Incorporated MMUs increase intelligence within the inverter by allowing MPPT and impedance matching at the inverter and module level, providing the highest possible level of functionality and energy harvest. This technology also enables control of the input voltage range directly at the inverter, and provides cost optimized electronics within the inverter, removing the cost of boost-stage electronics and other control devices. The integrated Smart Curve technology allows for strings to be 30% longer, reducing installation time and cost.

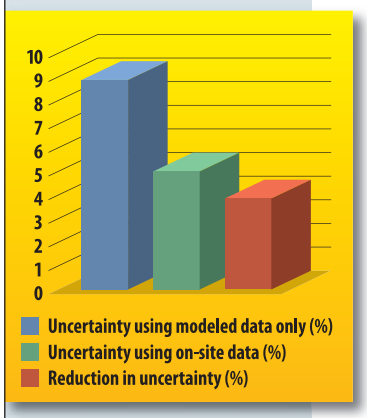
KACO new energy | www.kaco-newenergy.com
Tigo energy | www.tigoenergy.com

Energy storage inverter

Dynapower Company LLC introduces its newly developed MPS-100, 100-kilowatt (kW) line of integrated, air-cooled, bi-directional inverters for energy storage. With the MPS-100, customers will have the option of single DC, or dual DC connections, which are independently controlled, including configurable software for energy storage or PV system applications. This feature enables users to integrate solar power and energy storage through a common inverter, resulting in reduced system cost and integration complexity. To further decrease the total installed system cost, Dynapower also offers DC switchgear, DC fuses, and AC switchgear as standard features of the MPS-100, providing a truly integrated product to the market. UL listing of the inverter is pending and is expected during the second quarter of 2013.

Dynapower | www.dynapowerenergy.com

Solar Resource Assessments: Optimizing Ground Truths to Correct Long-term Data



On average, excluding outliers, on-site monitoring reduced project expected uncertainty by a mean of 3.9%[2]

[1] 3Tier–Best Practices for Solar Assessment, July 2012

[2] AWS Truepower–The Impact of Solar Uncertainty on Project Financeability: Mitigating Energy Risk Through On-Site Monitoring

WHILE SATELLITE-DERIVED DATA provides a multi-megawatt solar developer a historical perspective for understanding solar resource assessment (SRA), satellite data alone cannot capture the micro-scale features that affect a specific site's year-to-year solar variability.

The risk of solar variability is why common project lending structures require debt service payments each year, rather than every ten years. This means a one-year P90 value (not a 10-year P90) is necessary; it assures the lender debt can be serviced if power production decreases significantly in a given year due to solar variability.[1]

Reducing Resource Uncertainty

There are many sources of project risk. Smart project developers take measures to aggressively manage whatever risk they can. A significant portion of energy production risk can be mitigated by a short-term, on-site solar resource data collection campaign.

Case studies have demonstrated the importance of on-site data collection. When used in combination with long-term satellite modeled data, on-site data collection using best measurement practices can significantly reduce project energy uncertainty an average of 3.9%.[2]

Improved Project Financeability

Risk identification and allocation is a key component of project finance. As renewable energy policy drivers become more uncertain, the emerging model is for project finance terms to be based solely on project cash flows. Short-term, 'ground truth' site data combined with long-term modeled satellite data means project developers can be armed with more bankable production estimates. The impact of resource uncertainty is reduced and the developer is potentially rewarded with more favorable project finance lending terms.

Michael J. Fisher
Solar Resource Specialist at NRG Systems
mjf@nrgsystems.com

For more information on the latest in best practices for solar resource measurement:

SOLAR.nrgsystems.com

Multichannel sync Hipot tester

Chroma Systems Solutions has released their new, 19020 Series Multichannel Hipot tester. A brand-new architecture enables the 19020 to measure Hipot leakage current of all channels at the same time, and conduct tests on a maximum of 100 DUTs simultaneously—increasing regulatory test efficiency and productivity. The 19020 was developed with the world's first synchronous Hipot test function, allowing one single unit to perform 10 channels sync output and measurements at the same time. A maximum of 10 units can be controlled for 100 channels in total. They can also be grouped for output to avoid creating voltage differences.

Chroma's 19020 synchronizes the output signal, removing risk of high-voltage differences on adjacent DUT's, and minimizing any occurrence of error in the test. The 19020 can be used in various applications where testing multiple DUT's at once benefits productivity, such as quality assurance sampling and testing for PV panels and inverters.

Chroma systems solutions, inc.
www.chromausa.com

Load break switches

Woehner USA, the official distributor for the complete range of Telergon PV switches, has announced that Telergon's S5000 DC load break switches are now UL Listed to the UL98B standard. These products are offered in addition to the ETL recognized product range, according to the same UL98B standard. Currently, four sizes of the load break switches have been UL Listed: Size 1 (250 amp); Size 2 (400 amp); Size 3 (600 amp); and Size 4 (800 amp). Aimed at North American PV installations that require NRTL (Nationally Recognized Test Laboratory) certification, Telergon's S5000 DC load break switches are typically used in string combiner boxes, re-combiner boxes, and inverters that are constructed to the UL1741 standard. They can be used to safely disconnect live, direct current at up to 1000Vdc.

Woehner us A II C
www.woehner.com/en/

Bulk fastening power block

Marathon Special Products has released a unique addition to their line of power terminal blocks. This new bulk fastening power block (BFPB) differs from traditional power blocks by providing a series of fasteners to terminate numerous combinations of listed crimp lugs or flexible busbar to distribute power. The product was developed in response to a demand for power blocks with more amps, volts, and wiring combinations. In addition, the BFPB provides the ability to reliably terminate large, flexible-stranded wire, and distribute power with flexible busbar.

The product features a current carrying capacity up to 1605 amps, a voltage rating up to 1000 V AC/DC, high short-circuit current ratings (SCCR) and meets the requirements for use in feeder circuits. The SCCR includes the industry's first 35 K approvals with no over-current protection requirement, and 100 K SCCR with specified over-current protection. The BFPB Series can be used for variety of applications, including junction boxes and inverter panels.

marathon special Products | www.marathonsp.com

Secure solar racking fittings

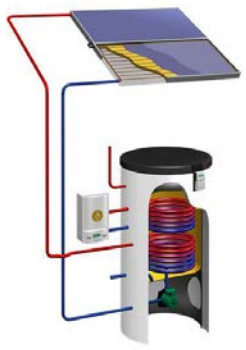
Hollaender has introduced two new Speed-Rail fittings, designed specifically for installation of solar racking systems in areas that experience extreme wind. The fittings include a tee and elbow for use with two-inch IPS pipe. The ability to withstand uplift caused by wind loads is critical in solar pipe racks. Though most regions of the US must design for 90 mph winds, certain coastal areas (such as South Florida) and the Gulf Coast must design for 135 mph and higher wind speeds.

On a Speed-Rail fitting, the component that produces pipe-holding power is a single, integrated proprietary internal/external reverse-knurl, cup-point set screw, which securely attaches the fittings to the pipe, and provides tremendous resistance to loosening and pullout. The new fittings are designed with two set screws, producing a substantial increase in pullout resistance.

Speed-Rail slip-on pipe fittings are used with aluminum, galvanized steel, stainless steel, or black iron pipe to easily and cost-effectively build solar panel racking systems. They come in a variety of fixed and adjustable configurations, including the tees and flanges most commonly used in solar panel installations.

Hollaender manufacturing

http://solar.hollaender.com



Solar thermal appliance

With over two years of product development and field tests, Wagner Solar Inc. (a division of Wagner & Co.) unveils its newest line of SECUSOL systems. Designed as a stand-alone appliance for domestic hot water preparation, SECUSOL systems are backed by an electrical heating element (4.5 kW_{el}) and can be used to retrofit existing DHW heaters. SECUSOL is a non-pressurized, hybrid drain-back appliance. The patented design allows for the solar loop-fluid to drain directly back into the heat exchange coil, thereby eliminating the need for a separate tank to be installed. The appliance's pump is also directly mounted to the bottom of the heat exchanger, complete with safety group and shut-off/fill valves. The unique pump integration means that a traditional pump station doesn't need to be installed. The biggest advantage of SECUSOL is the total installation time, which (including collector mounting) typically takes only four to six hours.

Wagner solar inc. | www.us.wagner-solar.com

IV tracers

The Stratasense IV tracers provide PV researchers and plant operators with the first, *in-situ* IV tracer, which can remain in the field to perform regular measurements of operating solar panels over months or years. Patent-pending technology allows the Stratasense IV tracers to collect IV curves of panels that are connected to any load, allowing uninterrupted power production, as well as more accurate insight on panel performance and degradation in real-world conditions. The instrumentation works on a wide range of power, voltage, and current settings, making it compatible with almost any PV technology. The Stratasense IV tracers have a small form factor, and utilize low-power, wireless technology for all data transmission, making the system simple to install and highly scalable.

stratasense

www.pvtracer.com

PV inverters

Danfoss Solar Inverters introduces the Danfoss DLX UL PV inverter series. These transformer-based UL and cUL Listed string inverters deliver industry leading 97.3% efficiency, maximizing the effectiveness of solar power applications. Galvanic isolation ensures full compatibility with all PV cell technologies. Convection cooling helps minimize noise (<37db), ensuring long life and reliable operation, even when subjected to temperatures ranging from -13° F to 149° F (-25° C to 65° C). The IP65-rated, die-cast aluminum housing is well suited for indoor or outdoor mounting. The lightweight design (42 lbs to 46 lbs) makes these inverters easy-to-handle and mount by one person, and a two-way interactive display provides multiple language options for quick country configuration. A fully integrated on or offsite monitoring capability—no special software required—is also included.

Danfoss solar

www.danfoss.us/solar

Programmable faulted circuit indicator

The new Cooper Power Systems S.T.A.R. Programmable Delayed Reset Overhead (SDOH) faulted circuit indicator (FCI) is designed to quickly and easily locate faults on bare overhead cable systems to shorten outage times and lower standard outage indices. The S.T.A.R. (superior, tough, and reliable) FCI is designed as a one-size fits-all device for ease of application and stocking, and can be used with medium-voltage cabling in a step-up transformer. Self-adjusting trip technology and programmable reset allow one model to adapt to a variety of electrical systems and desired reset times. Because the S.T.A.R. FCI is easily field-programmable with a simple reset tool, customers no longer need to specify the reset time when ordering. The unit can be programmed for 2, 4, 8, or 24-hour automatic reset, or manual reset.

Cooper Power systems

www.cooperpower.com

Product Spotlight: Batteries

ROlls BATTeRy en Ginee Rin G

Product: 6-Volt S-500EX Deep-cycle Battery

Description: Combining the versatility of the popular L16 battery size with the extended cycle life of Rolls Battery's heavy-grade 5000 Series cells, the S-500EX offers customers long-term, dependable power storage options, backed by a new, even stronger warranty.

Capacity (AH @ 20hr rate)**:** 357 AH

voltage: 6-Volt

Cycle l ife: 3300 Cycles

Dimensions: 12-1/2" x 7-1/8" x 16-3/4" (L16)

Weight: 130 lbs (59 kg)

Key f eatures:
- Popular L16 case size for easy transportation and installation;
- Offering 3300 Cycles versus 1500 Cycles on standard L16 models (50% Depth-of-Discharge); and
- A three-year, full-replacement and four-year, pro-rated warranty.

Website: www.rollsbattery.com

full Rive R BATTeRy COmPAny

Product: DC400-6 (Group Size: L16)

Description: The DC400-6 is a high-capacity, 6-Volt AGM battery, ideal for high-demand solar backup applications. This maintenance-free battery is an excellent solution to remotely located systems.

Capacity (AH @ 20-hour rate)**:** 415 AH

voltage: 6-Volt

Cycle l ife: 1250 Cycles at 50% Depth-of-Discharge, and 2300 Cycles at 25% Depth-of-Discharge

Dimensions: 11-5/8" x 7" x 16-11/16"

Weight: 123.5 lbs (56 kg)

Key f eatures:
- The sealed construction requires no watering, and eliminates terminal and cable corrosion;
- Includes thick grids and a high-density paste for long life;
- AGM electrolyte retention provides superior performance in low temperatures, and is reliable and safe in hot climates; and
- Non-hazardous, non-spillable, as well as non-gassing.

Website: www.fullriverdcbattery.com

u.s. BATTeRy

Product: US RE L-16XC

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

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

voltage: 6-Volt

Cycle l ife: 675 Cycles at 80% Depth-of-Discharge, and 1150 Cycles at 50% Depth-of-Discharge

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

Weight: 114 lbs (51.7 kg)

l istings or Certifications: ISO 9001-2008

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

Website: www.usbattery.com

mK Battery

Product: DEKA Solar GEL

Description: DEKA Solar GEL batteries, marketed by MK Battery, are a premiere, deep-cycling choice for renewable energy applications. They are designed for use in even the harshest environments, and are deployed on all seven continents.

Capacity (AH @ 20hr rate)**:** 180 AH @ C20

voltage: 6-Volt

Cycle l ife: 2000 Cycles at 50% Depth-of-Discharge

Dimensions: 10.25" x 7.13" x 10.88"

Weight: 68.4 lbs (31 kg)

l istings or Certifications: UL-listed

Key f eatures:
- IPF technology (individual plate formation);
- Thixotropic GEL;
- 100% QC-tested valves; and
- 250 QC checkpoints from raw materials to finished product.

Website: www.mkbattery.com

sun XTenDeR BATTeRy By COnCORDe BATTeRy CORPORATiOn

Product: PVX-4050HT

Description: A deep-cycle battery for off-grid and grid-tied systems, SunXtender L-16 battery is the highest capacity in the 6-Volt solar battery series. The sealed, maintenance-free design means no spilling, spewing, or watering, with the option to operate upright, on its side, or on its end.

Capacity (AH @ 24-hour rate)**:** 405 AH

voltage: 6-Volt

Dimensions: 11.64" x 6.95" x 15.7"

Weight: 120 lbs (54.4 kg)

l istings or Certifications:
UL-recognized component

Key f eatures:

- Sun Xtender pioneered renewable energy storage deep-cycle AGM batteries for off-grid and grid-tied systems;
- All Sun Xtender batteries offer Concorde's sealed, valve-regulated, lead-acid absorbed glass mat (VRLA-AGM), which is constructed with the same designs as their aircraft batteries;
- Design-specific, engineered, and produced for consistent and dependable power requirements, Sun Xtender batteries are shipped fully charged and Hazmat exempt; and
- Sun Xtender batteries are adopted by commercial and military users worldwide.

Website: www.sunxtenderbattery.com

TROj An BATTeRy COmPAny

Product: Industrial IND 33-2V

Description: The Industrial line is engineered to support renewable energy systems, with large daily loads, where the batteries are cycled regularly. It's ideal for large off-grid PV systems, off-grid hybrid PV systems, micro-grid systems, grid-tied PV systems with battery backup, and applications where the batteries regularly operate at a partial state of charge.

Capacity (AH @ 20-hour rate)**:** 1849 AH

voltage: 2-Volt

Cycle l ife: 1,500 cycles at 80% Depth-of-Discharge

Dimensions: 17-1/3" x 10-1/4" x 24"

Weight: 278 lbs (125 kg)

Key f eatures:

- Dual-container design protects battery plates against damage caused by harsh environmental conditions, and safeguards against potential acid leaks;
- Stability control with lower battery profile and wider stance to evenly distribute weight, making batteries easier to handle during transport and installation;
- Advanced battery technology includes Trojan's Alpha Plus Paste with T2 Technology for sustained battery performance; DuraGrid Technology for greater corrosion-resistance; Reinforced Protection Wrap for the electrochemical performance of active materials; Maxguard XL Separator for resistance to stratification; and a Moss Shield, which protects separators from damage.

Website: www.trojanbatteryre.com

North American Clean Energy
www.nacleanenergy.com

Product spotlight

The Product Spotlight feature offers a detailed look at specific solar-related products to better help readers determine what's available in the market today for their solar energy projects.

next issue, we're highlighting solar Racking systems.

The Center of Your Solar System

CROWN®
RENEWABLE POWER
BATTERIES

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

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

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

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

Contact us for more information:

419.334.7181
www.crownbattery.com
sales@crownbattery.com

CROWN BATTERY MANUFACTURING CO. | FREMONT, OH | MADE IN U.S.A.

CROWn BATTeRy mAnuf ACTuRinG COmPAny

Product: 2CRP3690 Power Module

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

Capacity (AH @ 20 Hr): 2550 AH

voltage: 2-Volt

Cycle l ife: 1500 Cycles @ 100% Depth-of-Discharge; 4300 Cycles @ 30% Depth-of-Discharge

Dimensions: 12.81" x 6.56" x 33.38"

Weight: 313 lbs (141.9 kg)

Key f eatures:

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

Website: www.crownbattery.com/applications/renewable-energy-systems

DemAnD ene RGy

Product: ABE12-200FT with X-anode

Description: A drop-in anode replacement for float or sealed lead–acid batteries, X-anode technology improves utilization of the active material and plate thermal management through the use of higher conductivity materials. Delivering increases in power and efficiency, it improves cycle life by achieving uniform, current distribution, across the entire electrode surface.

Capacity (AH @ 20-hour rate)**:** 240 AH

voltage: 12-Volt

Cycle l ife: 2,500 @ 50% Depth-of-Discharge

Dimensions: 21.5" L x 4.9" W x 12.6" T (battery with X-anode)

Weight: 125 lbs (56.6 kg)

l istings or Certifications: Meets all applicable UL and ISO battery standards.

Key f eatures:

- The X-anode is plug-and-play with any conventional lead-acid battery production line;
- Provides 10% better charge efficiency than standard lead-acid batteries (92%), and 50% greater energy density (40 WH/Kg) than conventional lead-acid batteries;
- It offer three times the cycle life of conventional lead-acid batteries; and
- Greater sulphation recovery, regardless of paste formulation, allowing for lower density pastes while still maintaining cycle life.

Website: http://demandenergynetworks.com

Simple, Clean & Reliable.

U.S. Battery's American Made batteries have been energizing the industry since 1926.

U.S. Battery Manufacturing Company is providing you with the highest rated batteries available today. With the addition of *XC™ Diamond Plate Technology®, Outside positive plates OSP™ design, and an all new Defender™ Moss Shield* specifically designed to prevent topside mossing. Our batteries will last longer and outperform the competition, saving both time and money. U.S. Battery offers you both flooded (wet) and AGM (sealed) deep cycle batteries making us your one-stop-shop for premium lead acid batteries. Our new line of AGM maintenance-free batteries offer ease and convenience, minimal gassing and no leak applications.

U.S. Battery has three manufacturing plants strategically placed within the USA and a network of distributors throughout the entire world making it extremely easy to obtain our superior made-in-America battery products no matter where they are needed.

Member since 2009 SEPA solar electric power association

U.S. Battery Manufacturing Company

PROUDLY MADE IN THE U.S.A.

see our entire line of American made products at: www.USBATTERY.com

WINDPOWER 2013 Conference & Exhibition

McCormick Place—Chicago, Illinois
May 5th to 8th, 2013

WINDPOWER brings nearly the entire wind power industry together in one room. With a vested interest and commitment to wind energy—and linking the industry together to find solutions for the advancement of wind energy—this event provides a not-to-be-missed opportunity to meet new people, learn from industry experts, and solidify existing relationships. Interact with hundreds of exhibitors representing every segment of the global wind industry.

www.windpowerexpo.org/2013

show in print

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

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 Group | www.elexco.com
Booth 4144

O&M, inspections & repair

Frontier Pro Services provides technical services to the wind industry. They cover operation and maintenance (O&M) services, including: OEM maintenance; composite (blade) inspections and repair; and commissioning services. FPS currently holds more patents than any other wind service company, including blade root repair and dynamic rotor balance. Through the acquisition of Monitek, they also provide turbine-specific, integrated data acquisition hardware and software systems, designed by their own vibration analysts, CME engineers, drivetrain experts, and turbine operators. Monitek also provides oil and grease analysis, including wear debris and spectrographic analysis. With the attainment of Spin Trends, they offer physical inspections, specializing in the wind turbine drivetrain. Their certified inspectors have completed more than 10,000 individual gearbox inspections on 30 wind turbine platforms.

f rontier Pro s ervices
www.frontierpro.com
Booth 5048

Cable & wire manufacturer

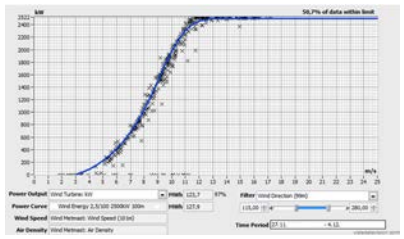
As an international manufacturer of cables, wires, and cable accessories, HELUKABEL provides system expertise to the wind power industry, focusing on: nacelles; cable loops; down towers; and tower controls/transformers, including medium-voltage applications. Each area of the turbine requires cables to have a unique set of attributes. Their HELUWIND cables are Oil Res II, heat resistant (nacelle), and torsion tested up to 18,000 cycles in HELUKABEL's 26-foot tall test tower (cable loop). They come in flexible aluminum or copper for easy, one-length installation (tower). HELUKABEL's wind cables provide superior performance in various climate conditions—from -55° C to +145° C (-67°F to 293° F) for CCV and HCV environments—and resist the harmful effects of salt water from offshore applications. They've been internationally approved by UL, CSA, CE, and VDE, are WTTC rated, and have passed the FT4 flame test.

Helu KABel us A | www.helukabel.com
Booth 1765

Cranes & lifting equipment

Manitowoc Cranes is one of the world's largest providers of lifting equipment for the global construction and wind industry, including lattice-boom crawler cranes, tower cranes, mobile telescopic cranes, and boom trucks. Specifically dedicated to the wind industry, Manitowoc offers the model 16,000, with wind attachment and boom raising system, allowing users to erect taller towers with one crane—saving time and money. Manitowoc's manufacturing, service, and sales network extends around the world, with over a dozen manufacturing facilities in nine countries, and over 20 regional sales and support offices in 14 countries.

manitowoc Cranes
www.manitowoccranes.com
www.youtube.com/manitowoccranes
Booth 1003



Wind energy data handling

Vista Data Vision (VDV) is a comprehensive data management software for handling the information from data loggers that runs data visualization, alarms, and reports. An enhanced Wind Energy Toolkit is now also offered to handle wind data and wind energy data during the planning and operation of wind farms. The input parameters include real data and wind turbine profiles, while the output data includes estimate and actual power in kilowatts (kW), energy in kWh, wind speed profile, as well as histogram with Weibull statistics, Diural profile plots, reports, and more.

vista Data vision
vista engineering
www.vistadatavision.com
Booth 3017

Resource assessment & monitoring

NRG Systems is an independently owned company that has served the global renewable energy industry for 30 years. The company designs and manufactures resource assessment equipment, turbine control sensors, and turbine health monitoring systems for customers in the utility-scale wind and solar energy industries, in 150 countries around the world. Used in the early development and operational stages of a renewable energy project, the company's products help electric utilities, developers, turbine manufacturers, and others reduce uncertainty and minimize costs.

nRG systems | www.nrgsystems.com
Booth 2032

Aluminum extrusions

Sapa Extrusions North America is a global manufacturer of extruded aluminum profiles, and is a key supplier to the renewable energy industry. Sapa provides solutions to all wind power market segments, including: nacelle support structures; turbine mounting brackets and frames; extrusions for ladders and lifts; platform/stairway/railing/elevator components; bus bar; aluminum hydraulic manifolds; rigid aluminum conduit; inverter housings and components; and thermal management systems. Supporting Sapa's 16 North American locations is Sapa's North American Technical Center (NATC). Sapa's NATC works with customers to establish finished designs for 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 extrusions north America
www.sapagroup.com/na
Booth 3438

Power conversion & film capacitors

SBE, Inc. has over a half-century of experience making film capacitors, which provide higher reliability, power density, and simpler cooling for wind power, as well as other renewable applications. SBE's annular form-factor Power Ring Film Capacitors handle more ripple current than can-style capacitors. Power Ring Film Capacitors offer industry leading ESL and ESR, increasing the life and reliability of an inverter. Moreover, SBE's Bank Hardener offers a smaller, less expensive, method of meeting inverter and power-conversion DC-link requirements. The Bank Hardener combines the capability of Power Ring Film Capacitors, with the capacitance capability of aluminum electrolytics to provide: reduced up-front costs and maintenance expenses; increased efficiency; greater power; and double the life.

sBe, inc. | www.sbelectronics.com
Booth 2419

EPC contractor

Michels Corporation is a full balance-of-plant engineering, procurement, and construction (EPC) contractor with more than 4,100 MW of wind farm experience. Michels delivers turnkey wind power projects by self-performing all scopes of work, ranging from civil and foundation to erection, substation, transmission, and collection system construction. Michels also uses its main erection cranes to perform heavy corrective work. All projects are supported by strong management and a corporate quality management system. Michels is focused on safety in performance and environmental compliance, with established relationships with turbine manufacturers and their customers.

michels Corporation | www.michels.us
Booth 5021

Tools, safety & onsite consultation

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

snap-on | www.snapon.com/industrial
Booth 3362

Pre-insulated connectors

Three new configurations (shapes) have been added to ILSCO's NIMBUS4FLEX line, and include an X, T, and L. With the exclusive and unique configurations of these new shapes, NIMBUS4FLEX now has some of the most flexible pre-insulated connector series on the market today. These new configurations are excellent in applications where space is at a premium. The NIMBUS4FLEX offering accepts building code, as well as fine-stranded conductor. Configurations currently available include 2-, 3-, or 4-port design, which come standard with ILSCO's patented screw design—meaning the product is re-usable. The entire line of NIMBUS connectors is UL Listed, CSA Certified, RoHS Compliant, and dual-rated for copper or aluminum conductors.

ils CO | www.ilsco.com
Booth 2608

Electrical & integrated solutions

CG is a global provider of electrical products and integrated solutions. Their products, solutions, and services range from distribution and power transformers, to medium- and high-voltage switchgears, to SCADA and automation to complete turnkey substations and lines EPC solutions. They offer: transformers; switchgears; substations; integrated solutions; automation; and engineering services. CG is a reliable equipment and solution provider to the renewable market, with a track record of on-time delivery and completion, and an installed base of more than 20,000 MW in North America.

CG | www.cgglobal.us
Booth 4554

Optical fiber solutions

Harnessing energy from the wind is more complex than serenely rotating blades might suggest. Fiber optic products from OFS help simplify communications throughout the wind farm. From data links for lightning isolation within the mast and distributed sensing fibers for structural health, to ultra-reliable fiber optic cables supporting SCADA and smart grid systems, OFS applies photonics technologies to help keep wind farms at peak operation.

Ofs | www.specialtyphotonics.com
Booth 2945

Improved Ethernet slip ring communication

The Phoenix Contact PSI-MODEM-SHDSL/ETH uses multiple carrier frequencies and data paths to improve the transmission of Ethernet data in demanding communication environments. In wind turbine applications, efficient rotor-to-nacelle communication of Ethernet data is often challenging due to poor slip ring electrical contact and vibration. The PSI-MODEM-SHDSL/ETH modem replaces the standard Ethernet signal encoding with a multiple carrier frequency signal, for more robust transmission. Noise band detection ensures that electrical noise is masked from the transmitted signal. By replacing standard Ethernet data wiring with a dual-data path, communication is ensured if only two of the four wires make electrical contact. Digital outputs can be used to monitor signal quality. The PSI-MODEM-SHDSL/ETH can improve wind turbine uptime and extend maintenance intervals. The modem is suitable for either new or retrofit applications.

Phoenix Contact | www.phoenixcontact.com
Booth 3103

Remote sensing technology

Developed by Pentalum, the SpiDAR is a wind LiDAR system that's revolutionizing wind measurement and significantly improving the profitability of wind farms across the globe. The SpiDAR is a cost-effective, patent-pending pulse wind LiDAR (light detection and ranging) system, for remote sensing of wind. Developed by professionals in the areas of optics, fluid mechanics, atmospheric remote sensing, and meteorology, the SpiDAR is manufactured using common, reliable components—making it a practical solution for commercial deployment in wind farm development and operations. Second Wind and Pentalum have formed a partnership to promote the use of remote sensing, with Second Wind selling and supporting the Pentalum SpiDAR system. Second Wind's experienced field organization, data management services, and SkyServe Wind Data service, allow wind developers to view, analyze, and manage SpiDAR data, along with their Triton Sonic Wind Profilers and Nomad Wind Data Loggers on one secure, web-based dashboard.

second Wind | www.secondwind.com/lidar
Booth 2117

Blade coating solutions

ALEXIT BladeRep is an advanced blade coating solutions that maintains turbine blade surfaces for optimal performance and efficiency. The coatings meet the requirements of the cosmetic blade maintenance market, as well as OEM blade specifications for high-quality, durable products. With the ALEXIT BladeRep Leading Edge Protection system, a built-in BladeRep Maintenance Service Indicator (MSI) has been developed. MSI is a "system within a system," where a variety of application colors indicate a blade's wear pattern. These contrasting colors (grey, red, and white) are easily visible from down-tower, so it's easy to see a blade's life expectancy. By visually identifying surface erosion, it's possible to be proactive with blade maintenance and to avoid costly repairs.

BladeRep | www.bladerep.com
Booth 3606

Bolt-securing systems

The Nord-Lock Group provides bolt-securing systems, offering a unique combination of bolting expertise and a wide product range. Their mission is to safeguard human lives and customer investments by securing the world's most demanding applications. Products include wedge-locking solutions and Superbolt tensioners. Nord-Lock products have also documented success in every major industry, including wind power, and hold several certificates from independent institutes, including AbP, DIBt, DNV and TÜV.

The nord-l ock Group
www.nord-lock.com
Booth 3912

Medium-intensity LED obstacle lights

TWR Lighting Inc./Orga Aviation introduces a new L450 RED LED/ Infrared LED "All-in-One Solution." The new L450 product range of red and red/infrared, medium-intensity LED obstacle lights incorporate advanced optical engineering design and LED/ Infrared technology—enabling the development of cost-effective solutions for the medium-intensity obstruction light market. The L450 products are focused on minimizing the visual impact that obstacle lights can have on the surrounding environment, while making them highly visible when utilizing Night Vision Technology. The L450's "All-in-One" concept follows the designs successfully adopted over the past 10 years, with the light having a built-in power module, controller, and GPS synchronizer. This product design makes the lights simple to install, enables them to operate reliably under the harshest conditions, and minimizes the capital costs and cost of ownership.

TWR l ighting inc./Orga Aviation
www.twrlighting.com
Booth 1732

Wind turbine maintenance & repairs

ZF Services supports wind farm operators, service providers, and wind turbine manufacturers with a comprehensive service portfolio for the maintenance and repair of wind turbine gearboxes. Their regional service center in North America offers multi-brand driveline services to provide a one-stop shop solution. Technical know-how, high-quality standards, flexibility, and a global service network makes ZF Services a reliable wind power partner, worldwide.

Zf services | www.zf.com/windenergy
Booth 5055

Engineering & consulting services

SEL Engineering Services offers cost-effective engineered systems and consulting services for renewable energy. SEL designs solutions to protect and automate wind power systems worldwide, with products currently backed by the industry's best warranty. SEL has contracted over 150 complete turnkey control buildings and thousands of engineering projects for electric utilities, independent power producers, and industrial customers.

sel engineering services and Consulting | www.selinc.com/wind
Booth 4245

Insulation-resistance testers

Megger's new 5- and 10-kilovolt (kV) insulation-resistance testers are designed based on significant feedback from actual end-users. The new range consists of three models: two 5-kV units (MIT515 and MIT525) and a 10-kV unit (MIT1025). A key productivity feature is the ability to take measurements while connected to line power when the battery is fully discharged. The units feature a lithium-ion battery with an ultra-fast charge time. Two-and-a-half-hour full battery charge time significantly increases efficiency. These units offer a five percent accuracy all the way up to one tera-ohm (T-ohm) at 5 kV, and two tera-ohm (T-ohm) at 10 kV—ensuring the highest precision where it matters most. A CATIV 600 V safety rating on all terminals allows for safe use in the widest range of applications. They're built into a unique dual-case design for fire-retardant protection, while maintaining ruggedness. The case is rated to IP65, preventing water/dust ingress.

megger | www.megger.com

Booth 1205

Wind service & repairs

As an independent service provider (ISP) in the wind energy industry, PSI Repair Services offers fast, affordable repairs, including upgraded/longer-life products for the electronic, hydraulic, and precision mechanical components that drive turbines' pitch and yaw systems and down-tower electronics. PSI uses the latest diagnostic tools to detect failures down to the microchip level. They service: printed circuit boards; H-bridges (hub converters); IGBTs; PLCs; controls; VRCC units; hydraulic pumps; servo motors; transducers; and much more. Solutions can range from minor repairs to full replacement printed circuit boards, with enhanced designs to improve performance and reliability. PSI also provides comprehensive re-manufacturing services for unsalvageable, obsolete components. Unlike other ISPs, PSI can take a cooling plate from a blown IGBT and completely rebuilt it. Service options like these allow operations and maintenance (O&M) professionals to significantly increase meantime between failures (MTBF), and prevent costly downtime and/or repeat repairs.

Psi Repair services, inc. | www.psi-repair.com/wind-turbine-repair

Booth 2504

EPC services

Wanzek Construction partners with industry-leading firms and equipment manufacturers to offer turnkey solutions for the renewable energy industry. Their dedicated crews have built, expanded, and maintained dozens of renewable energy facilities nationally. They emphasize value engineering during design, focusing on operational efficiency and long-range implications of design features throughout all phases of construction. Wanzek's role varies from EPC to O&M services of existing generation facilities. Currently, Wanzek has installed more than 5000 MW of wind generation capacity across the country. With over 40 years of experience, they offer a commitment to safety and extensive resources.

Wanzek Construction

www.wanzek.com

Booth 2112

Engineering & construction

Infrastructure & Energy Alternatives, LLC (IEA) was created to integrate a portfolio of energy infrastructure service companies. Through the acquisition of RMT and White Construction, IEA has developed a team of engineering and construction experts who can provide turnkey solutions for renewable energy project, including for wind power. With their combined experience, they've installed over 9,500 MW of renewable energy projects across North America.

infrastructure and energy Alternatives II C (ieA)

www.iea.net

Booth 2139

Video borescope

The VJ-Advance from RF System Lab is an ultra-portable, full-featured, video borescope with the following features: a 3.9-mm or 6.9-mm diameter insertion tube; joystick-controlled four-way articulation; a built-in 3.5" display; as well as an on-board image and video capture capability. The company will also ship a no-cost, no-obligation demo unit, to try before purchasing.

Rf system l ab | www.rfsystemlab.us
Booth 1436

Non-contact current measurement

Current measurement at high voltages has become a concern with smart grid and FERC regulations. Southern States CMD II technology measures current on high-voltage systems with zero footprint, no solid insulation to ground, and no batteries. It uses 5.8 GHz communication technology to transfer data securely, economically, and reliably from a high-voltage system to ground potential in real time. It provides for additional protection, control, and monitoring, resulting in higher reliability, while preventing major failures and reducing outage durations in a system.

southern states ll C
www.southernstatesllc.com
Booth 4063

Turbine maintenance & repair

Rope Partner is a provider of wind turbine maintenance, repair, and inspection services, requiring specialized access approaches. In the last 11 years, their rapid-response WindCorps technicians have completed over a thousand projects for nearly all of the major manufacturers and wind farm owners in the industry. Applying safe, cost-effective, and environmentally appropriate practices, Rope Partner collaborates with their clients to increase turbine availability and operational longevity.

Rope Partner | www.ropepartner.com
Booth 2448

Turbine component supplier

OBO Bettermann of North America is a division of OBO Bettermann GmbH & Co., a global supplier to the wind energy industry. They specialize in wire management components for wind turbines, including cable routing systems, surge and lighting protection, as well as equipotential bonding systems throughout the US and Canada.

OBO Bettermann | www.obous.com

Booth 3344

EPC services

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. Through their incorporation of engineering and construction excellence from both AMEC and Black & McDonald, respectively, the joint venture provides a one-stop solution for a project's development and realization. They are a reliable and experienced contractor, who self-performs all aspects of the EPC contract, with: financial strength and stability; a history of delivering high-quality projects; an investment in customer and community relationships; and a national presence utilizing local resources. Over the past 10 years, AMEC Black & McDonald has constructed over 650 MW of wind development, with another 200 MW currently underway.

AmeC Black & mcDonald

www.amecblackandmcdonald.ca

Booth 4812

Wind energy environmental consultants

Ecology & Environment (E & E) offers the know-how to guide developers and natural resource agencies through every phase of their wind energy projects. E & E's strategic consulting services help meet the tight schedules mandated by tax credit legislation, renewable energy portfolio standards, and other economic incentives. They are experts in the development and implementation of public engagement programs that engage stakeholders early, and identify and address issues proactively throughout the permitting process. E & E can not only help select sites that can be permitted, but also can conduct all of the specialized studies needed to gain regulatory approvals around the world.

ecology & environment

www.ene.com/markets/wind

Booth 2648

Project planning & construction

Founded in 1828, Bureau Veritas has developed a network to help businesses and organizations assess, attain, and demonstrate compliance with standards and regulations in the fields of Quality, Health & Safety, Environmental and Social Accountability (QHSE-SA). The company's focus is on protecting its clients' brands, assets, and business. They offer a comprehensive array of services touching all phases of a program's or a project's lifecycle—from planning and design through construction and operation. Specific to the power sector, Bureau Veritas has been actively involved with the power generation industry since 1950. Working in concert with vendors, owners, and program managers, they've developed and tailored their operating procedures to meet the stringent needs of clients in this market.

Bureau veritas | www.us.bureauveritas.com
Booth 3020

Turbine component manufacturer

Dokka Fasteners Inc. is a US manufacture of high-quality, high-tensile, large-diameter bolts, studs, and threaded rod, using local, raw material. Dokka Fasteners uses high-end robotics and automation to manufacture their products, and utilizes their in-house heat treat to ensure product consistency in every lot. Dokka Fasteners supplies products to all major wind turbine OEMs, and can provide inventory management services through their parent company, The Würth Group. Dokka Fasteners further provides security to customers as a result of their solid business practices, LEAN operational skills, and quality, raw material and manufacturing processes.

Dokka f asteners inc. | www.dokkafasteners.us
Booth 3233

Access platform

PALFINGER is home to the largest access platform in the world—the WT 1000. With a maximum working height of 337 feet (103 meters), the WT 1000 is built for assembly and maintenance work on wind turbines and other high-towering structures. The size of the equipment doesn't hinder its working capabilities: the WT 1000 mounts on a five-axel, all-terrain mobile crane chassis, and can be set up in four different stabilizing configurations. Such features allow the equipment to work in the tightest spots and the most remote working conditions—it can go practically anywhere. Advanced electronics and safety features, such as telescopic stabilizers, guarantee stability and allow for safe operation in wind speeds up to 12.5 m/s.

PAlfin GeR | www.palfinger.com
Booth 3752

Wind resource assessment buoy

The AXYS WindSentinel is the world's first commercially deployed wind resource assessment buoy capable of accurately gathering data on wind speed, wind direction, and turbulence at turbine hub-height and across the blade span, using advanced laser wind sensing. The WindSentinel uses the Vindicator III—a simultaneous pulsed LiDAR designed for deployment on a free-floating platform in hostile environments. The standard WindSentinel system contains full meteorological and ocean data sensors, and is capable of supporting a full environmental sensor assessment suite, including microwave temperature sensor, water quality, as well as bird and bat sensors. AXYS' Field Service Specialists offer training and continued support to customers in the operation and maintenance of WindSentinel. WindSentinel has been deployed to reduce the costs and risks associated with offshore wind resource assessment.

AXYS Technologies Inc. | www.axystechnologies.com

Booth 4040

Gear oil

Klübersynth GEM 4-320 N is gear oil that's based on polyalphaolefin. High-quality additives impart excellent anti-wear characteristics, which have been proven utilizing standardized test rigs, such as FE8 for rolling bearings. Klübersynth GEM 4-320 N covers a wide range of temperatures with a good viscosity temperature relationship and resistance to oxidation. The oil is neutral toward most nonferrous metals, elastomers, and interior paints, protecting against corrosion. Resistance to foaming is a major feature of Klübersynth GEM 4-320 N, and the formulation reaches the highest stages for resistance to scuffing and micropitting. Converting to Klübersynth GEM 4-320 N is easily accomplished by utilizing a flushing and cleaning procedure. Klüber Lubrication leverages over 80 years of experience with wind farm OEMs and operators, manufacturing lubricants that exceed industrial standards.

Klüber Lubrication North America L.P. | www.klubersolutions.com

Booth 2752

Heavy lifting sling chain

Harrington Hoists, Inc., a KITO Group Company, is a supplier and manufacturer of hoists, trolleys, cranes, and related components and replacement parts. They recently released the Grade 100 Sling Chain, which is used to make chain slings when appropriate sling fittings are attached. Typical applications requiring sling chain are those involving the lifting of heavy loads or in repetitive lifting situations, such as for the construction of wind farm sites. Harrington Grade 100 Sling Chain is durable, flexible, and will tolerate a wide range of temperatures. It's exceptionally economical due to its long wear life, and is easy to inspect, handle, and store. This product is currently offered in three chain diameters: 9/32" (7mm); 3/8" (10mm); and 1/2" (13mm).

Harrington Hoists, Inc. | www.harringtonhoists.com

Booth 4216

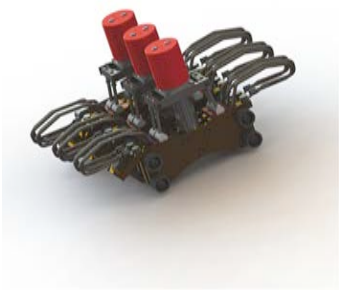
Transmission & engineering solutions

Worldwide Integrated Rating Enhancement (W.I.R.E.) Services is a business initiative of Manitoba Hydro, Canada's fourth largest electric utility. W.I.R.E. Services began operations in 2001, using the experience and expertise developed in applying LiDAR data to transmission line analysis and upgrade engineering solutions. W.I.R.E. Services was the first utility-based company to combine LiDAR surveys with utility applications, and to provide third-party electric utilities with a full-service solution package for their transmission line needs. Its knowledge and experience in using LiDAR technology, coupled with extensive utility experience in transmission line design, enables W.I.R.E. Services to provide meaningful information on utility transmission assets.

Worldwide Integrated Rating Enhancement (W.I.R.E.)

www.wireservices.ca

Booth 3215



Carbon brush holder

Carbex's new carbon brush holder is set to reduce maintenance costs for doubly fed generators in wind turbines. The Carbex V-type brush holder ensures all the carbon brushes push against a turbine's slip ring with equal force, preventing uneven wear and premature brush replacement. This also reduces electrical and mechanical losses, lowering the temperature of the carbon brushes, and improving their lubricating properties. Moreover, remote monitoring is simplified, as only one switch per phase is required. Brushes typically wear unevenly as each has different pressure against the slip ring, however, the V-type holder eliminates any variations. The brushes are fitted and locked into position in single brush pockets. Through equal load on all carbon brushes, and lower temperature, the V-type holder provides longer life to the brushes, resulting in maintenance savings.

Carbex | www.carbex.eu
Booth 1411

Aerial devices

Bronto Skylift offers a wide selection of high-reach, truck-mounted aerial devices for wind turbine blade and tower inspection, maintenance and repair, as well as other applications. With Bronto aerials, operators are able to drive directly to the jobsite and, in a matter of minutes, be fully operational and able to access overhead areas faster and safer than other methods currently in use. Bronto machines have been used in Europe for many years, time-tested in the toughest conditions. For example, when elevated S 90 HLA machines can withstand wind speeds of up to 28 mph (12.5 m/s) and can lift up to 1000-pounds in a 8x3-foot, fully-enclosed platform, to a 295-foot (90 m) maximum working height. The maximum horizontal outreach is 108 feet (33 m). With advanced controls, and one-button automatic leveling of the outriggers, Bronto aerials can be driven onto a site, then set-up and elevated to the overhead area in 20 minutes or less.

Bronto | www.bronto.fi
Booth 2545

Data acquisition systems

Campbell Scientific, Inc. delivers highly accurate, rugged, and flexible data acquisition systems to wind energy professionals throughout the world. Data acquisition systems for resource assessment and power performance are built around Campbell Scientific dataloggers, and offer unmatched capability. Campbell Scientific now offers the ZephIR300 wind lidar as a complement or replacement to traditional meteorological masts. The ZephIR300 provides wind measurements across 10 user-defined heights, from 10 m to 200 m. The ZephIR300 can be used throughout the lifecycle of a wind project, including site prospecting, wind-flow model verification, power curve assessment, permanent wind farm anemometry, and operational wind farm analysis. Data from traditional meteorological mast instrumentation and the ZephIR300 can now be shared on Campbell Scientific dataloggers to optimize the usability of the hardware and, ultimately, the performance of the data collection campaign.

Campbell scientific, inc.
www.campbellsci.com/wind-energy
Booth 2748

Steel galvanizer

AZZ Galvanizing Services, a division of AZZ, is the largest steel galvanizer in North America, owning and operating 35 hot-dip galvanizing plants across the US and Canada. Corrosion costs the US economy—including the wind power industry—billions annually. The most economical solution to this problem is hot-dip galvanizing. 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. Their network of plants works cooperatively to accommodate the largest wind power projects, with stringent standard operating procedures that meet the highest quality standards necessary in the after-fabrication steel market.

AZZ Galvanizing services
www.azzgalvanizing.com
Booth 4416

Wind project development

With decades of experience in the wind industry, Black & Veatch offers solutions for every component of a wind energy project. Black & Veatch features the following services that span a project's entire life cycle: project planning; development support; interconnection and transmission; engineering, procurement; and construction; and asset management. From utilities to developers and government agencies to financial institutions, Black & Veatch offers clients the confidence they seek in the delivery of their projects. Black & Veatch knows how to integrate renewable energy into the grid. Its professionals provide a single point of responsibility that simplifies project coordination. Black & Veatch has more than 19,000 MW of wind project, development, and design in recent years. Since 1915, they've helped clients improve the lives of people in over 100 countries through consulting, engineering, construction, operations, and program management.

Black & veatch | www.bv.com
Booth 1405

Tower maintenance & repairs

H&N Wind, a Timken brand, strives to keep America's wind farms running with minimal downtime, providing service offerings that are flexible and reliable to meet customer needs. They perform up-tower wind generator and gearbox services with an inventory of carbon brushes and a full supply of replacement parts. H&N Wind's team creates greater tower up-time by offering the following services: up-tower generator bearing service; large correctives (large component installation/removal); high-speed and intermediate gearbox repairs; factory repairs; down-tower oil changes; gearbox bore scoping; in-shop generator reconditioning/rewinds; and condition monitoring. They also offer certified supplemental labor, main bearing preventive maintenance services, and provide parts' replacements.

H&n Wind, a Timken brand
www.wazeeco.com
Booth 4366

Wind energy & turbine technology degree

Offering America's first 'Associate in Applied Science degree in Wind Energy and Turbine Technology,' Iowa Lakes Community College produces entry-level wind energy technicians. Through hands-on realism with resources like a 70-meter, 1.65 MW, Vestas V-82 turbine, the program delivers a broad spectrum utility-scale wind energy curriculum, from power generation and distribution, to networking and SCADA systems. The program's concentration is on the operation and maintenance of wind turbines. Classes cover many aspects of the wind energy industry and include, most importantly, safety training, as well as: extensive immersion/mastery in theory and practical application of electrical (AC/DC/high voltage); mechanical systems; hydraulic theory; wind turbine siting and field training; and project operations, which includes crane signaling and rigging fundamentals.

iowa Wind Pavilion | www.iowalakes.edu
Booth 2209

Legal advisers

With a history that spans more than four decades, Fredrikson & Byron's attorneys are experienced in representing developers and investors with project development and financing for renewable energy projects, including wind power. They also represent the trade side, advising domestic and international turbine and component manufacturers, project construction contractors, and service and maintenance providers in the development, construction, financing, and strategic acquisition and divestiture of assets. Fredrikson & Byron's industry experience and expertise is backed by a long history of handling complicated regulatory, litigation, and financial transactions, measured in the billions of dollars.

f redrikson & Byron | www.fredlaw.com
Booth 4142

Bridle slings

TUF-TUG Products introduces their new line of Tower Rigging Gear for O&M tasks. Their TUF-TUG Bridle Sling is ideal for running multiple loads up-tower in a single pick. It's available in 3&4 legs, with variable lengths. The pear-link upper connection can be supplied with nylon webbing, and either red warning cores or wire rope—both with a capacity of up to 6000 pounds SWL. TUF-TUG's also featuring their Material Handling Carabiners, developed as an attachment to safely lift and lower loads. The closed-loop design, with double-latch, protects against hook-tip loading and accidental dropped loads. It also meets ANSI B-30 requirements, and is made in the US.

Tuf -TuG Products | www.tuf-tug.com
Booth 5124

Harnessing renewable energy

Ulteig provides an array of engineering, surveying, and consulting services. Their commitment to providing complete wind farm design services means they see a project through the development stage to a complete design package. Ulteig designs services for the 34.5 kV collection systems, including: specification preparation for all equipment and plans for the wind turbine grounding and conduit system; medium-voltage conduit and cable system; as well as low-voltage conduit and cable system. Their experienced electrical, civil, and structural engineers bring expertise from energy projects around the world. Their client service means Ulteig delivers comprehensive services to a variety of public and private clients, whose needs and projects are diverse.

u lteig | www.ulteig.com
Booth 4851

Geospatial solutions

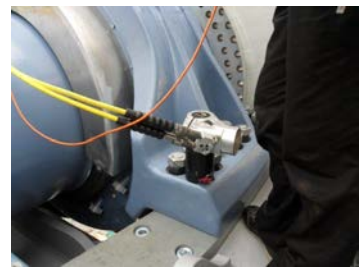
Surveying And Mapping, Inc. (SAM, Inc.) is one of the largest geospatial solution companies in the US, with the resources, equipment, and industry experience to support large-scale renewable and wind power projects. SAM's services include: professional land surveying; airborne, mobile, and terrestrial LiDAR; aerial mapping; geographic information systems (GIS); subsurface utility engineering (SUE); utility coordination; and construction-phase services. Over the past five years, they've completed more than 30,000 square miles of routing photography, over 5,000 miles of greenfield and existing transmission line mapping, and ground surveys of more than 5,000 miles of transmission corridors.

s urveying And mapping, inc. (sAm, inc.)
www.saminc.biz
Booth 4514

Project management and O&M

Airway Services is a full-service provider of technical staffing, project management, and operations and maintenance (O&M) for utility-scale wind energy projects. Their technical and operations teams are experienced in providing solutions to a wide array of issues found only in wind energy projects, including: complete turbine inspection service; O&M; safety and quality; on-demand technical staffing and resource management; site prep and construction; as well as a best practice approach.

Airway services | www.airwayservicesinc.com
Booth 2806



Turbine fastener

The HYTORC Washer is a trusted fastener upgrade for the wind power industry. The simple washer upgrade allows for safer, hands-free tensioning of bolts, with increased accuracy and resistance to loosening. Wind turbine manufacturers are learning how the HYTORC washer can improve reliability and prevent unscheduled maintenance time on various applications throughout the wind turbine. This system is currently in use on wind turbines from every major manufacturer in different areas of the world. Applications range from tower bolts to blades, and everything in between.

HyTORC industrial Bolting systems
www.hytorcwind.com
Booth 1526

Pitch & yaw solutions

Bonfiglioli is a designer and manufacturer of complete packages that control energy generation with reliable solutions for pitch and yaw control for a wide range of turbine sizes. Bonfiglioli's 712TW, the newest yaw drive for 1.5 MW to 2.5 MW turbines, is more compact and features an integrated brake and (optional) inverter, which decreases height and weight compared to its predecessor, the 712T. The 714T and 707T, Bonfiglioli's yaw and pitch drives for 2.5 MW to 3.0 MW turbines, are used by leading turbine manufacturers. The 707T yaw drive operates at a torque of 12 Nm (105 in-lb) and peak static torque of 25 Nm (220 in-lb). The 714T operates at torque of 60,000 Nm (529,8000 in-lb), and peak static torque of 150,000 Nm (1.3M in-lb). Bonfiglioli also produces a complete series of inverter drives for wind turbines, including the Integrated Agile inverter, which can be mounted directly to the yaw drive motor.

Bonfiglioli | www.bonfiglioli.com
Booth 1500

Photo courtesy of: Atlas Copco Gas and Process | www.atlascopco-gap.com

GEOTHERMAL BUYERS GUIDE





2013

GEOTHERMAL BUYERS GUIDE DIRECTORY

CONTRACTORS

NAES Corporation

NAES is a provider of comprehensive services to the geothermal power industry. For over 30 years, NAES has specialized in providing services centered on safe, reliable, and cost-effective performance, including: operation and maintenance; construction; onsite turbine inspection/overhaul services; as well as staffing solutions and customized services designed to improve plant and personnel effectiveness.
www.naes.com

DRILLING

Atlas Copco

Atlas Copco's T2W-III single-engine rig for rotary and down-the-hole (DTH) drilling in the 30,000-pound class is designed for air and mud applications, and ships with an on-board 900/350 air compressor. The Series III provides a 12-rod capacity in the carousel at 3.5", with swing in/swing-out backload capability, allowing single-person operation under appropriate conditions. A rod box mounted to the rig carries an additional 12 rods at 3.5". Total depth capacity is 480 feet. Another new feature is an optional 15,000-pound winch, with two-part line, matching the pullback of the rig. This allows the operator to trip out of the hole with the winch or the head. An optional hydraulic front drive assist delivers a functional 6x6 drive, and automatic transmission provides reduced fuel consumption, as well as simplified operation and training.
www.atlascopco.com

GEFCO, Inc.

GEFCO, Inc. provides the design and manufacture of portable drilling rigs and related equipment for renewable energy, including the geothermal industry. GEFCO, Inc. has years of field experience and product knowledge, allowing them to maintain a competitive edge. Their state-of-the-art equipment and technology provides ideal drilling rigs for today's project challenges and demands.
www.gefco.com

RigKits LLC

The K60 is a compact drilling rig, ideally suited for geothermal applications. With many customizable options—from drill heads to clamps, to added accessories such as mud pumps and remote controls, as well as optional set-ups for mud or air drilling—the K60 is compatible with all drilling methods. Standard features include: onboard rod rack; slide head; winch package; hydraulic jack legs; upgraded torque; swing-out control arm; and hydraulic breakout clamps, with many included accessories.
www.rigkits.com

WWT International Inc.

WWT International Non-Rotating Protectors (NRPS) measurably improve drilling performance and well clean-out in geothermal applications by: preserving casing integrity; limiting casing wear by maintaining tool joint standoff; protecting drill pipe; reducing torque by up to 50%; and reducing surface equipment, drill string stress, and fatigue, as well as related downtime expenses. They also reduce drag by +/-25% (Model SS), buckling and any vibration at the surface, and operate without expensive mud additives. They are proven to increase weight to bit, as well as ROP.
www.wwtinternational.com

ENGINEERING & EQUIPMENT

Nash, A Gardner Denver Product

Gardner Denver Nash is a supplier of gas removal systems for geothermal power plants around the world. Nash has over 100 years of experience designing and manufacturing liquid ring pumps and steam jet ejectors. Since every geothermal resource and every plant site is unique, Nash engineers draw on their wealth of application engineering know-how and product development data to optimize each system, maximize performance, and prolong the life of each resource.
www.gdnash.com

ENVIRONMENTAL CONSULTANTS

Ecology and Environment, Inc.

Ecology and Environment, Inc. (E & E) helps developers of geothermal energy projects by: analyzing environmental constraints; identifying permit requirements; and performing baseline studies for hydrogeology, water quality, and availability, as well as geology, meteorology, air quality, plus ecological, cultural, and natural resources. Its multidisciplinary scientific and engineering teams can prepare all required federal environmental impact statements, state or provincial-equivalent impact assessments, and local use permits. They also can assist in identifying stakeholders and engaging them early on to obtain consensus on the project. E & E's professional services are available worldwide.
www.ene.com

EXPLORATION & SITE ASSESSMENT

Bell Geospace

Bell Geospace acquires, processes, and interprets airborne, full-tensor, gravity gradiometry data for resource exploration. FTG data maps geologic structure associated with geothermal deposits by measuring changes in rock density.
www.bellgeo.com

National Geothermal Data System

The National Geothermal Data System provides information for discovery, evaluation, and development of geothermal resources across the United States. Data providers include academic researchers, private sector participants, as well as state and federal agencies.
www.geothermaldata.org

FINANCIAL SERVICES

EnergyWise Partners
PORTFOLIO MANAGEMENT

EnergyWise Partners LLC

Consider thermal metering and billing services on geothermal projects. EnergyWise provides turnkey and OEM solutions to create ongoing revenue from energy investments, including a complete software platform to quote, finance, manage, and bill for heat/cooling and hot water. Industry suppliers and project developers can offer utility-style monthly billing alternatives or power purchase agreements based on usage and value received, bringing customers a new level of low-risk, low-capital solutions.
www.ewpllc.com

GCube
Renewable Energy Insurance

GCube Insurance Services, Inc.

For over 20 years, GCube Insurance Services, Inc. has provided utility-scale renewable energy insurance, worldwide. GCube's GeoPro insurance offering is designed to address the specific issues that may arise during the construction of a geothermal facility. GCube provides comprehensive coverage, built upon proven underwriting, technical knowledge, and claims expertise.
www.gcube-insurance.com

Taylor-DeJongh

Taylor-DeJongh (TDJ), an energy and infrastructure investment banking firm, has expertise across a broad spectrum of alternative technologies and renewable energy projects. TDJ has advised on over 240 power projects globally. TDJ offers project development, capital structuring, and project financing services, with over 30 years of experience in closing energy projects. TDJ provides tailor-made capital solutions, and advises clients on corporate finance, capital raising, and M&A transactions.
www.taylor-dejongh.com

GEOEXCHANGE SYSTEMS

CORIX® Utilities

CORIX Utilities

CORIX designs, builds, finances, and manages sustainable utility infrastructure systems. They offer alternatives to using fossil fuels or electrical energy for heating, cooling, and hot water, including hybrid and renewable energy systems, as well as GeoExchange. CORIX's one-stop shop approach allows them to deliver flexible and comprehensive solutions to complex, utility infrastructure challenges.
www.corix.com

GEOTHERMAL EQUIPMENT (Suppliers & Manufacturers) ~ LARGE-SCALE PROJECT

TOSHIBA
Leading Innovation

Toshiba International Corporation

Toshiba International Corporation (TIC) offers a complete product line-up of low- and medium-voltage electric motors, adjustable speed drives, and motor starters for a wide range of applications within the geothermal industry. Many of TIC's products are completely designed, engineered, manufactured, and tested together as a complete system, before going out into the field—ensuring the highest level of quality, performance, and reliability.
www.toshiba.com/ind

Vooner FloGard
vacuum pumps

Vooner FloGard Corporation

Vacuum pump rotors in geothermal plants are destroyed by stress corrosion cracking (SCC) from H2S and chlorides. Rotor vanes experience cyclical bending, causing surface cracks, which lead to complete fractures. Vooner can prevent SCC with the right material. Vooner offers vacuum pumps, which bolt into replace CL and 904 pumps. They are fabricated in the US, in duplex stainless steel, to resist SCC.
www.vooner.com

Atlas Copco Gas and Process Division

Atlas Copco Gas and Process Division manufactures expander-generators, turbocompressors, expansion turbines, and cryogenic pumps that serve a growing range of industries, including the renewables. Because every geothermal project is unique, customers need more than just machines. Atlas Copco is a trusted, reliable partner with an eye on the big picture—from evaluating a resource to building a customized, complete Organic Rankine Cycle (ORC) plant. Seven decades of experience support the solutions Atlas Copco delivers to the geothermal industry, even after a geothermal project kicks off. With global sourcing and packaging presences and an international customer-service network, expert support is always within reach.
www.atlascopco-gap.com

Bakersfield Pipe and Supply

Bakersfield Pipe and Supply (BPS) provides quality materials and services to the geothermal industry, including: pipes; valves; fittings; steam traps and regulators; flange gaskets; wellhead products; and much more. In addition, BPS offers timely deliveries, with an extensive in-stock inventory, and 24-hour on-call service, all designed to make projects run as efficiently as possible.
www.bakersfieldpipe.com

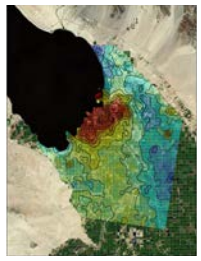
L.A. Turbine
L.A. Turbine is a design and manufacturing company of application-specific, highly engineered turboexpanders used in geothermal power generation and other power-recovery applications. L.A. Turbine also provides aftermarket repair, redesign, maintenance, and spare part production for all makes and models of turboexpanders, worldwide.
www.laturbine.com

Ormat Technologies, Inc.
With over four decades of experience, Ormat Technologies, Inc. is currently one of the only vertically integrated companies solely engaged in geothermal and recovered energy generation (REG). The company owns, operates, designs, manufactures, and sells geothermal and REG power solutions, primarily based on the Ormat Energy Converter—a power generation unit that converts low-, medium- and high-temperature heat into electricity. With over 82 US patents, Ormat's power solutions have been refined under grueling environmental conditions. Ormat's flexible, modular solutions for geothermal power and REG are ideal for the vast range of resource characteristics. The company has engineered and built power plants, which it currently owns or has supplied to utilities and developers worldwide, totaling over 1500 MW of gross capacity.
www.ormat.com

GEOTHERMAL HEATING & COOLING SYSTEMS

NextEnergy Geothermal
NextEnergy is a provider of geothermal solutions for the residential, commercial, institutional, and industrial markets. NextEnergy offers a complete selection of equipment from ClimateMaster, and they're the North American distributor for Viessmann's high-temperature/high-capacity water-to-water heat pumps. NextEnergy's in-house engineers offer knowledgeable resources for system designers. Offering turnkey solutions, their geothermal services entail: residential and commercial projects; design; engineering; as well as technical, sales, and marketing support.
www.nextenergyusa.com

MONITORING EQUIPMENT | DATA MAPPING



TRE Canada Inc.
TRE Canada is a remote sensing company, specializing in InSAR. This technology analyses radar satellite images to measure ground deformation. Measurements to millimeter accuracy can be achieved over large areas. TRE provides information on ground deformation, uplift, and subsidence that are caused by injection and extraction of fluids to users in the geothermal industry. The information is used to map faults in new exploration zones, subsidence, and uplift in producing fields, as well as for input for litigation issues.
www.trecanada.com

POWER PLANTS | PLANT DESIGN & CONSTRUCTION

SNC-Lavalin Thermal Power
SNC-Lavalin offers full engineering, procurement, and construction (EPC) services on a cost-reimbursable or lump-sum turnkey basis. Their Power Group owns and operates several generation and transmission facilities, a number of which it has designed, built, and financed. With nearly 100 years of experience in more than 120 countries, SNC-Lavalin's power projects represent an installed capacity of 380,000 MW, 110,000 kilometers of transmission and distribution lines, and 1,500 substations.
www.slthermal.com

Geothermal Development Associates
Geothermal Development Associates (GDA) is a privately held US company, with over 30 years of experience in geothermal power and direct-use applications worldwide. Their staff of engineers, geologists, and geoscientists has the capability to oversee projects at every stage—from initial resource exploration and well testing, to the design, supply, and commissioning of a new power plant.
www.gdareno.com

Hatch
Hatch is an employee-owned, professional services firm, delivering an array of technical and strategic services, such as consulting, technology, engineering, process development, and project construction management. Their project capabilities are supported by a wide range of thermal plant engineering services, which serve geothermal power projects. These capabilities include: thermal power plant engineering and design; owner's engineer and due diligence; transmission and distribution; environmental assessments and life cycle analysis; water treatment; geotechnical; and more.
www.hatch.ca

TUBING & PIPE

LaserLine® Coiled Tubing

WEBCO Industries
WEBCO manufactures LaserLine seam-welded nickel alloy, duplex, and stainless steel coiled tubing for a variety of downhole applications in the energy sector, including capillary strings for scale and corrosion inhibition in geothermal wells. Tube sizes range from 0.250" OD to 1.5" OD, with wall thicknesses ranging from 0.035" to 0.125", and lengths up to 12,000 meters or more. WEBCO tailors capillary strings to exact specifications, including limitations on orbital welds. Other energy sector applications include sub-surface safety valve control lines and high-strength workover/velocity strings.
www.webcotube.com

TOOLS

Snap-on INDUSTRIAL

Snap-on Industrial
From breaking ground, through operations and maintenance, Snap-on tools are engineered to provide the highest levels of performance, comfort, and safety possible. Offering a range of products, Snap-on has been solving problems since 1920. They can provide the basics, such as hand tools, power tools, torque tools, tool storage cabinets, and hydraulic equipment. They also offer an array of productivity tools, including the unique Level 5 integrated tool control programs, stationary and mobile tool cribs and containers, custom and specialty tools, and even credit and financing programs to help maximize financial opportunities. In addition to the Blue Point Brand, Snap-on also owns Bahco and JH Williams Hand Tools, Sioux Air Tools, as well as CDI Torque Products.
www1.snapon.com/industrial

Garbage Gains

Making biofuels from waste a reality

By Marie-Hélène Labrie

North America's fi st, full-scale municipal waste-to-biofuels facility under construction in Edmonton, Alberta.

iT's sOmeTHinG We miGHT nOT li Ke TO THinK ABOuT, let alone talk about, but every day it accumulates. Garbage. Trash. Waste. Regardless of the label, people throw out multiple items on a daily basis—from food scraps and product packaging, to bottles, papers, batteries, yard clippings, and even clothing and appliances. It's estimated each person in the United States produces approximately four pounds of garbage a day.

Perhaps not surprisingly, in 2011, the US generated a total of 459 million metric tons of municipal solid waste (MSW), of which 63% was landfilled. The remainder was recycled, composted, or incinerated. Canadians haven't faired much better, historically speaking. In 2008, Canada produced 1,031 kilograms (or 2,273 pounds) per capita of municipal waste—that's 2.6 times as much as the best performer, Japan.

Fortunately, times are changing and environmentally friendly waste programs are on this rise. More than ever before, cities around the world are seeking sustainable means of managing the increasing volumes of MSW that's generated every year. At the same time, countries concerned with their energy security are looking for viable alternatives to fossil fuels. The production of biofuels from waste offers a solution to both of these issues.

This concept is quickly becoming a commercial reality with North America's first, full-scale municipal waste-to-biofuels facility under construction in Canada's Edmonton, Alberta. Once fully operational in 2014, the waste-to-biofuels plant will produce up to 38 million litres of ethanol (10 million gallons) per year.

Renewable fuel

Biofuels (also called renewable or alternative fuels) can now be produced from an array of materials. First-generation ethanol—made from sugar crops, such as corn and sugarcane—was the first biofuel to enter the marketplace, and remains the most commonly used biofuel in the world.

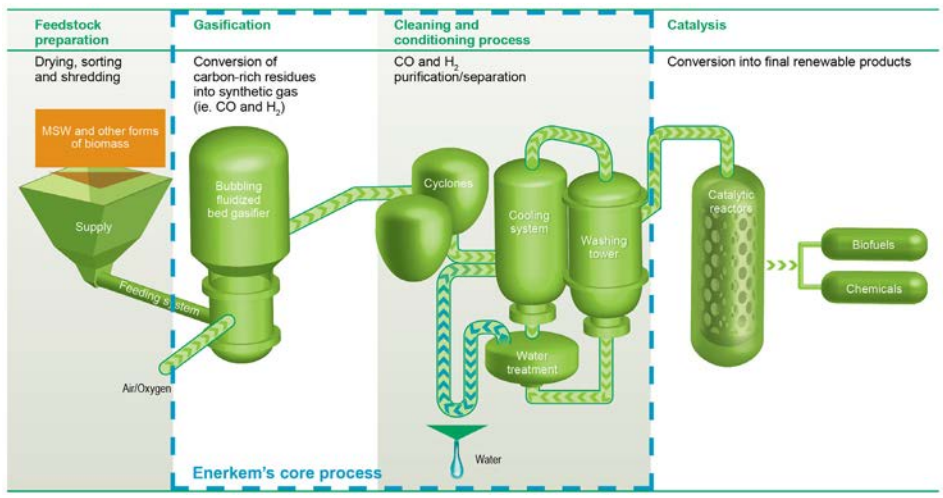
In 2011, the Global Renewable Fuels Alliance estimated world ethanol production at 84.5 billion litres; a global market size of US$57.7 billion*. Second-generation biofuels (also called cellulosic or advanced biofuels) are, in turn, made from biomass and residual materials, such as forest and agricultural residues, and municipal solid waste (MSW). The transformative technologies needed to achieve second-generation biofuels have been developed, tested, and validated over the last decade. As a result, the industry is beginning to manufacture large-scale facilities in several states and provinces across North America, representing billions of dollars in private investment.

The future waste-to-biofuels facility in Edmonton is at the forefront of this first wave of commercial, advanced biofuels development.

Waste advantages

From a practical and economic standpoint, MSW has countless advantages, and is widely recognized as a feedstock of choice. An abundant, low-cost resource, MSW is readily collected and available in rural and urban areas where waste management practices, such as garbage collection, transportation, and recycling are already in place. The use of trash as feedstock also brings value out of materials that cannot be recycled, and would otherwise end up in landfills.

At the Edmonton Waste Management Centre, the city has already diverted 60% of its waste from the landfill through its recycling and composting programs. The city's vision was to increase that already impressive diversion rate to 90%. After analyzing more than 100 technologies from around the world, the city decided to partner with a Canadian clean



energy company to convert non-recyclable and non-compostable MSW into renewable transportation fuels.

The proprietary technology selected by the city of Edmonton allows for the conversion of heterogeneous, carbon-rich materials into fuels and chemicals. This innovative green chemistry process converts MSW into a pure, chemical-grade synthesis gas, which is then transformed into biofuels and chemicals through catalytic reactions.

The technology offers an alternative to landfilling and complements recycling efforts. It also produces a marketable, high-demand product. The 38 million litres of ethanol to be produced at the facility will be blended with gasoline at the mandated five percent. More than 400,000 cars could be fueled annually with the production of this facility, contributing to the Renewable Fuel Standard (RFS) established in the province of Alberta, as well as the federal mandate.

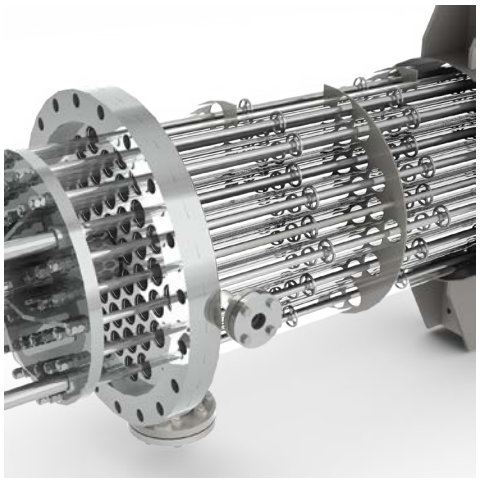
In the US, the RFS program establishes an annual minimum requirement for volume of biofuels production and consumption. For 2013, the volume established by the Energy Independence and Security Act calls for a volume of 16.55 billion gallons. Ethanol produced from separated MSW qualifies as cellulosic biofuels under these regulations.

Clean technologies, using non-recyclable, municipal solid waste to produce biofuels, provide a local solution for waste issues and energy needs. In addition to reducing GHG emissions and providing municipalities with an alternative to landfilling, the technologies create quality jobs, stimulate regional economies, and help diversify the energy portfolio. The production of second-generation transportation fuels, such as ethanol from biomass and MSW, is now becoming a reality in North America—and, that's good news for future generations.

**Based on total global production of 84.5 billion litres in 2011 and one year average ethanol price of $0.68/litre in 2011 from contracts traded on the Chicago Mercantile Exchange.*

Marie-Hélène Labrie is the VP of Government Affairs and Communications at Enerkem, Inc.

enerkem inc. | www.enerkem.com



Scraped surface evaporator system

The Unicus heat exchanger is the main part of the HRS Scraped Surface Evaporator System, which is widely used in wastewater projects around the globe—including for solvent recovery and waste-to-energy anaerobic digestion plants. The Unicus is a scraped surface heat exchanger for high-fouling and viscous fluid applications. The design is based on a traditional shell and tube heat exchanger, but with scraping elements inside each interior tube. Moved back-and-forth by a hydraulic action, the scraping movement introduces turbulence in the fluid, increasing heat transfer. The unique design of the HRS Unicus heat exchanger makes it ideal for high-fouling/low-heat transfer biofuels applications.

The Unicus carries many advantages over standard heat exchangers, and other types of scraped surface exchangers. It's extremely energy efficient, the maintenance downtime and spare requirements are reduced, and the scraping system is much gentler when compared to standard rotating scraped surface units.

HRs Heat exchangers l td.
www.hrs-heatexchangers.com | www.youtube.com/watch?v=WI2B1-D3Xd0

3D level scanner

BinMaster Level Controls introduces the 3DLevelScanner HT for measuring the volume and mapping the material surface in bins, tanks, and silos with high temperatures. This new model of the 3DLevelScanner has an operating temperature range of up to 356° F (180° C) to accommodate the high temperatures that may be present when material has been heated in the production process, and before it's conveyed into storage silos. The device measures the material level in multiple locations in the vessel, estimating the volume in storage silos containing challenging materials such as clinker, alumina, frac sand, and fly ash.

The 3DLevelScanner HT is ideal for use in power industries where there are multiple challenges, such as excessive dust or high humidity, as well as in large silos where the material surface in the bin is irregular and difficult to measure. It's currently one of the only solutions on the market that can measure, map, and visualize the material surface in bins with irregular topography or very wide bins. Dependent on the number of scanners installed, volume accuracy can be three percent, or better in large vessels, surpassing the accuracy of any radar or other single-point measurement devices.

Binmaster | www.binmaster.com

Dry chemical feed system

Sodimate, Inc. engineers and manufactures turnkey feed systems for heavy metal removal. Typical chemicals handled with Sodimate equipment include: lime; soda ash; Trona; urea; and powdered activated carbon (PAC). Sodimate systems feature a mechanical unloader, designed to fully unload storage containers (such as silos, hoppers, and big bags) without bridging, jamming, or compaction of the product.

sodimate, inc.
www.sodimate-inc.com

International Biomass Conference & Expo

Minneapolis Convention Center—Minneapolis, Minnesota
April 8th to 10th, 2013

The International Biomass Conference & Expo unites current and future producers of biomass-derived power, fuels, and chemicals with waste generators, energy crop growers, equipment manufacturers, project developers, investors, and more makers. The event fosters public and private partnerships that help bioenergy producers and large-scale waste generators identify available production resources and viable technology solutions for improving operational efficiencies and reducing industrial greenhouse gas emissions.

www.biomassconference.com

show in print

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

Grinders

For over 10 years, Rotochopper electric powered grinders have been popular with co-gen plants, pellet manufacturers, transfer stations, and other facilities with steady wood waste streams. Recent upgrades to the Rotochopper EC series grinders ensure they're more efficient and easier to maintain. Upgrades include a full-length roller bed collection conveyor, roller bed discharge conveyor, wear liners, and independent power application system controls (optional). The EC series, like the larger Rotochopper B-66 E electric grinder, is available with an optional wear package for grinding asphalt shingles and other highly abrasive feedstocks. Rotochopper electric grinders can be combined with an in-line hammermill for companies that need fine grinding capacity for fuel pellets, suspension burner fuel, and other short fiber applications. A Rotochopper two-stage grinding system can take pallets, sorted C & D, baled agricultural residue (such as corn stover), and other raw materials down to short fiber specifications in a single pass.

Rotochopper, inc. | www.rotochopper.com

Integrated control systems

Offering integration and scalability, the new, high-efficiency integrated control systems from Hurst Boiler for boiler room monitoring and communications provide advanced supervisory boiler controls for all Hurst products. Integration has become essential for efficient operation and shared duty load. Hurst Boiler developed and offers a full line of processor-based smart controls, fully compatible with all Hurst designs, including alternative fuel models. Precise control of fuel and combustion air can result in very high efficiencies. Hurst intelligent control systems allow users to harness these savings, while increasing overall boiler plant productivity. The HURST integrated controls family provides a source of diagnostics and information, including energy usage and predictive maintenance.

Hurst Boiler | www.hurstboiler.com/boilers/integrated_control_systems

Mixing system

DustMASTER Enviro Systems is a US manufacturer of ash storage and ash conditioners for the biomass industry. The DustMASTER mixing system processes flyash into a low-moisture, dust-free material for safe transportation and land filling. The DustMASTER system works extremely well with flyash from waste wood, refuse derived fuels, and FBC boilers. A PLC-based control allows complete system flexibility for mixing times and water-to-flyash ratios. From a complete load-out system to a mixer retrofit, DustMASTER has a solution.

DustmAsTeR enviro systems
www.dustmaster.com

Biomass power generation

Pratt & Whitney, a division of United Technologies (UTC), is committed to providing clean, efficient, and reliable power within the renewable energy industry. Pratt & Whitney Power Systems' (PWPS) Organic Rankine Cycle (ORC) products provide heat-to-electricity generation for biomass, heat recovery, and other renewable energy applications. ORC systems are ideal for utility-scale or distributed power plants installations from one megawatt (MW) to 10 MW. PWPS' ORC products include benefits, such as: 24/7/365 remote monitoring; 195° F to 660° F (90° C to 350° C) temperature range; standardized components; and assembly process. PWPS also delivers high-quality, aftermarket services designed to ensure maximum plant availability.

Pratt & Whitney Power systems

www.pw.utc.com

System installation & equipment

For more than 45 years, SHW Storage & Handling Solutions GmbH has delivered installations for processing, feeding, and storage of special bulk materials that are difficult to handle, including: wood chips; bark; paper waste; paper sludge; FGD-gypsum; RDF; secondary fuel; as well as filter cake from industrial and municipal sludge and municipal waste, etc. By way of their wide range of discharge equipment designs, which fit rectangular and circular silos, SHW develops useful and economical systems in close cooperation with their customers. SHW also provides special equipment for metering multiple mixed waste fuel systems in front of the furnace in the various industrial sectors. The design, production, and installation are carried out by SHW-SHS from one source.

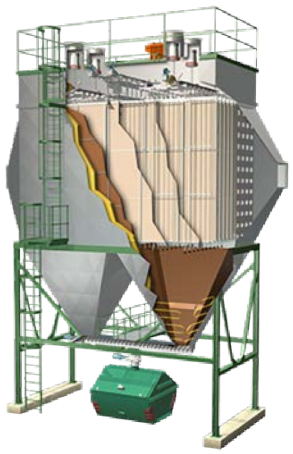
sHW storage & Handling solutions GmbH

www.shw-shs.de

Industrial wastewater treatment & anaerobic digestion

ADI Systems Inc. provides a variety of anaerobic digestion and waste-to-energy solutions to industrial processors. Technologies offered can meet the needs of virtually any industry and include ADI's own proprietary, as well as licensed, technologies. ADI's preferred approach to doing business is on a design/build basis, as it offers one-stop shopping and a single point of contact and responsibility for an entire project; this approach allows for consistency in design and construction quality. Technology-only packages are also offered when deemed appropriate for the situation.

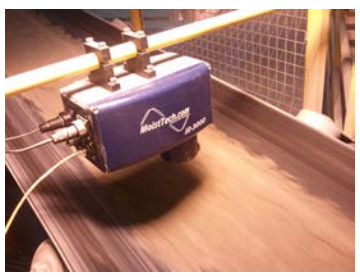
ADi systems inc. | www.adisystemsinc.com



Electrostatic precipitators

WEIS ENVIRONMENTAL LLC is a company specialized in manufacturing of dry and wet electrostatic precipitators, specifically designed for biomass power plants. They represent Beth Filtration, which has more than 120 years of experience in pollution control (dedusting) technology, offering tailor-made engineering solutions in designing, constructing, and implementing dust removal systems.

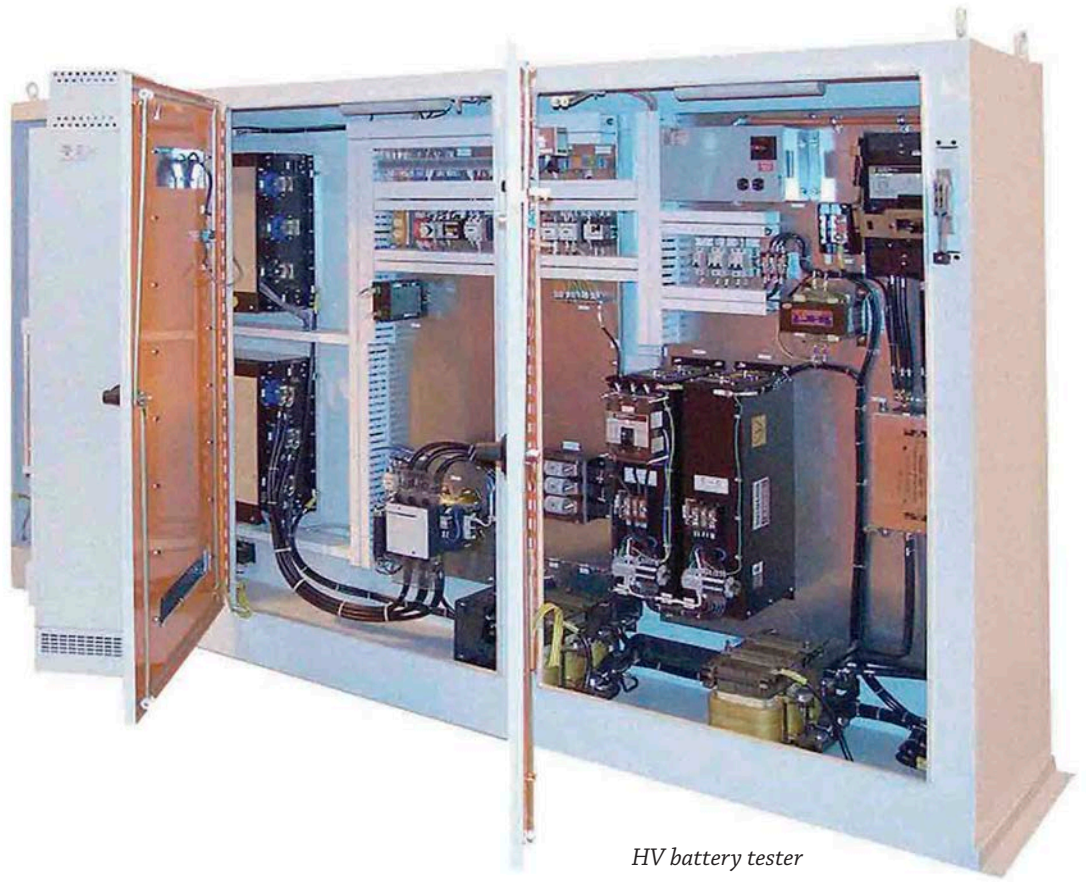
Weis envi ROnmen TAl ll C
www.weis-environmental.com



Moisture sensors

MoistTech Corp. offers the latest series of online sensors for moisture measurement, developed for real-time process control. Their IR3000 moisture sensors are designed for instant, non-contact measurement for all types of applications to within 0.1% accuracy. These sensors are engineered to allow users to optimize their process and improve product quality. Unsurpassed in performance, stability, reliability, maintainability, and cost, the MoistTech series of sensors are ideal for monitoring and controlling moisture levels.

moistTech Corp. | www.moisttech.com



HV battery tester

Advanced Battery Testing Technology

For efficient electric vehicles

By Randall Beattie

Despite the environmental benefits electric cars deliver over our everyday gas-guzzlers, electric vehicles (EV) haven't taken over the highways yet. Production costs aside, there are challenges that have hampered their popularity and success. How and where to re-charge these cars and trucks is one issue, and so electric-vehicles stations are slowly beginning to pop up across the country. Another issue has been the batteries themselves. Powering these vehicles takes strength, reliability and, preferably, efficiency.

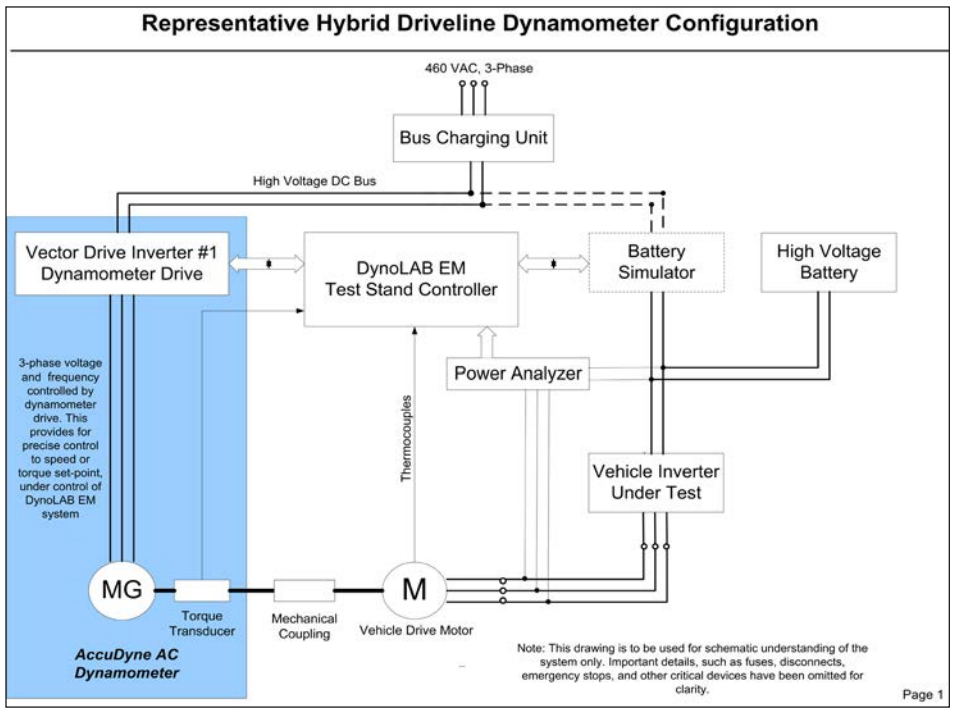
Advanced battery testing technology is now being developed in response to the critical need for testing the high-voltage batteries that are at the heart of an electric vehicle or hybrid/electric vehicle (HEV). Absorbed power created by dynamic braking is being re-generated back to the AC mains instead of being dissipated as waste heat, a common practice among previous generation testing systems. This provides much greater power efficiency, and measurably reduces overall operating costs.

This new, high-voltage battery simulator and test system technology is being developed specifically to test EV and hybrid/electric vehicle HEV batteries, and to simulate these batteries in an electric drivetrain environment. At the heart of the system is a fully, line-regenerative, DC power source, which provides reliable, repeatable power that's 95% energy efficient. Absorbed power is, then, placed back on the AC mains to be re-used or re-sold. This results in significant savings in the total testing costs.

Technology uncovered

Typically, a HV battery test system would include a high-voltage regenerative DC power supply, which hooks directly to the battery being tested, as well as a test cell supervisory system to serve as a command to the battery testing system. External instrumentation would depend upon system use, and might include a bank of thermocouples and pressure transducers.

However, the newly developed battery testing technology uses an inverter system to convert high-voltage, three-phase AC power to a very stable DC. This produces high-power, high-frequency switching, as well as quality filtering to provide the stable DC voltage that's required. Along with providing precise testing, electricity usage is minimized. The system can actually cause the electric meter to run backwards, reducing the electricity bill, wasting little or no heat energy. It can also simulate road conditions, so engineers can see how a battery would respond under real-world load conditions.



Hybrid test system functional schematic

Testing defined

Technology used in a variety of testing scenarios and designed to simulate real-world conditions is important when it comes to the success of electric vehicles. New product engineering requires the use of test systems for:

1. Research and development (R&D);
2. Performance; and
3. Durability testing.

The same basic equipment is needed to conduct all three types of testing, although there are a few significant differences. R&D systems are usually more expensive because they

tend to have more data acquisition/data logging capabilities. Also, care must be taken to size testing equipment with a high enough capacity for the largest possible battery—a battery that might not even be built yet. For example, one company was recently asked to develop a 120-kilowatt (kW) system, sized up to 150 kW, so it would have a sufficient margin for future safety and growth. In this case, the customer began its R&D efforts by testing 80 kW and 120 kW batteries, but by the time the system was built and installed, they were testing a 220-kW device. This is a concern because running either too close or over the system design can severely limit a system's lifespan.

Performance testing systems are similar to those used for R&D, but can be less complicated as engineers typically have a better idea of the highest voltage, current, and power requirements, and often know more about what kind of speed response will be needed. They also usually require less instrumentation.

With durability testing, engineers are simulating what the device will actually see in the real world, as well as the worst-case scenarios. Performance is known, so the system doesn't need a lot of extra capabilities. However, it must be stable and robust, since durability tests can run uninterrupted 24/7 for days, weeks, or months. The system can be set-up to run unattended, and can a text message or trigger a call if there are any problems.

Testing & technology

Rather than testing a battery's response under simple laboratory cycling, modern testing systems must create a cycle that accurately represents what a battery would experience a the vehicle during real-world conditions—whether it's driving uphill, downhill, or starting and stopping. One way to do this is by mathematically simulating charge and discharge dynamics, and performing specific drive cycles developed by regulators or customer-specific requests. Another is to instrument the vehicle and drive it over an actual road course, while monitoring key required parameters, such as throttle position, vehicle speed, voltage, and current. The resulting profile is, then, loaded into the test system and played back to ensure the battery experiences exactly what it would in a vehicle.

When a high-voltage battery test system is coupled with a high-performance AC motoring dynamometer, a system is capable of testing the entire vehicle drivetrain with extreme accuracy and efficiency. As a result, time and money can both be saved. For instance, a standard 100-kilowatt (kW) system requires approximately 110 kW to 120 kW from the AC mains to account for energy losses from heat, plus another 100 kW to cool the water that's used for the dynamometer. This costs around two times as much as the operating power of the system.

Thanks to the latest advanced battery testing technology, however, a system can now recapture and reuse most of the absorbed power. Only 10 kW to 15 kW is used to run an entire 100 kW system, including the cooling. Moreover, control is easier, as switching from driving to loading happens automatically. The result is a significant reduction in the total operating cost by using a much more energy efficient technology to perform full system testing, which is an important step in any successful EV battery.

sAKOR Technologies, inc. | www.sakor.com

events**calendar**

MARCH

12-14 **Geothermal energy and Waste to Power: utilizing Oil & Gas Plays**
SMU Campus—Dallas, Texas;
http://smu.edu/geothermal/Oil&Gas/GeothermalEnergyUtilization.htm

19-21 **AmeRiCAnA**
Palais des Congres de Montreal—Montreal, Canada; www.americana.org

APRIL

02-04 **Ontario f eed-in Tariff f orum (April 3rd to 4th—co-located with the national Renewable energy f orum on April 2nd)**
Metro Toronto Convention Centre—Toronto, Ontario; www.ofit2013.com

08-09 **energy efficient Roofing Conf ence 2013**
Omni Charlotte Hotel—Charlotte, North Carolina; www.roofingconference.com

08-10 **international Biomass Conference & expo**
Minneapolis Convention Center—Minneapolis, Minnesota; www.biomassconference.com

11 **international Geothermal energy f inance f orum**
Marriott Marquis New York—New York, NY; http://geo-energy.org/events.aspx

16 **Pathways to 100% Renewable energy**
Fort Mason Center—San Francisco, California;
www.renewables100.org/pathways-to-100

16-20 **sOl AR 2013**
Baltimore Convention Center—Baltimore, Maryland; www.ases.org/solar2013

30-01 **Advanced energy 2013**
Jacob K Javits Convention Center—New York, New York;
www.aertc.org/conference2013

MAY

05-08 **WinDPOWeR 2013**
McCormick Place Convention Center—Chicago, Illinois; www.windpowerexpo.org

14-16 **Pv America West**
San Diego Convention Center—San Diego, California; www.pvamericaexpo.com

JUNE

11-12 **small and Community WinDPOWeR Conference & exhibition**
Rochester Riverside Convention Center—Rochester, New York;
www.smallandcommunitywindexpo.org

16-19 **Hydrogen + f uel Cells 2013 (Hf C 2013)**
Vancouver Convention Centre—Vancouver, BC; www.hfc2013.com

18-19 **Renewable energy storage summit**
Toronto, Ontario—Metro Toronto Convention Center; www.ress2013.com

19-21 **intersolar europe**
New Munich Trade Fair Centre—Munich, Germany; www.intersolar.de

26-27 **national Geothermal summit**
Reno, Nevada; http://geo-energy.org/events

JULY

9-11 **intersolar north America**
Moscone Center—San Francisco, California; www.intersolar.us

SEPTEMBER

9-10 **AWeA f inance & investment seminar**
New York, New York; www.awea.org/events

10-12 **energy storage north America**
San Jose Convention Center—San Jose, California; www.esnaexpo.com

29-02 **GeA Geothermal energy expo 2013 & GRC Annual meeting**
MGM Grand—Las Vegas, Nevada; http://geo-energy.org/events

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OBC	Argosy Windpower	www.argosywind.com
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