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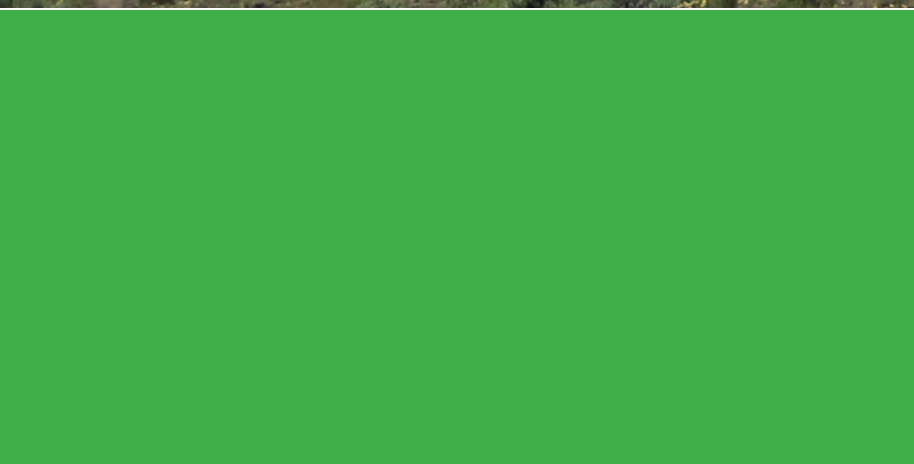
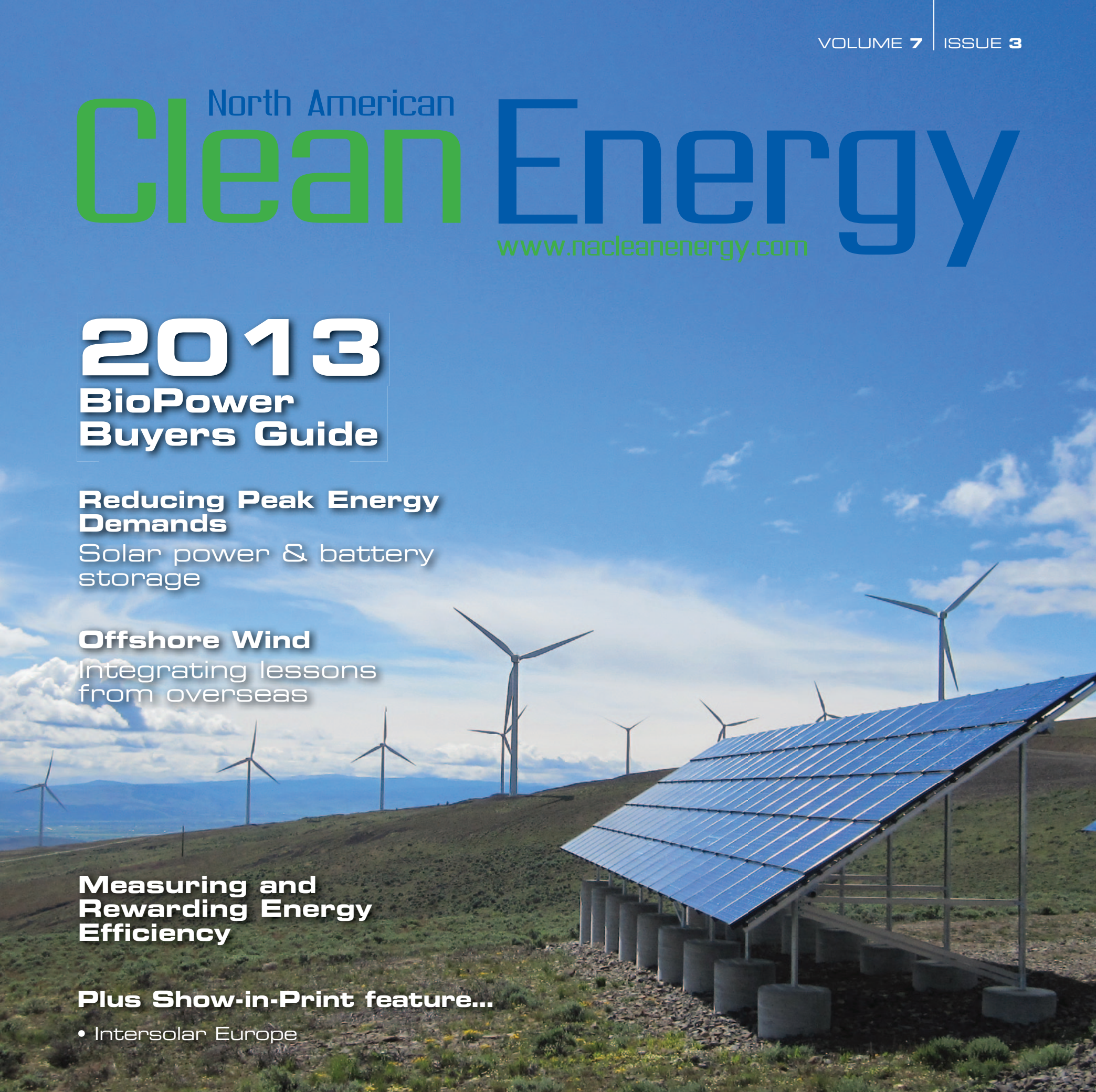
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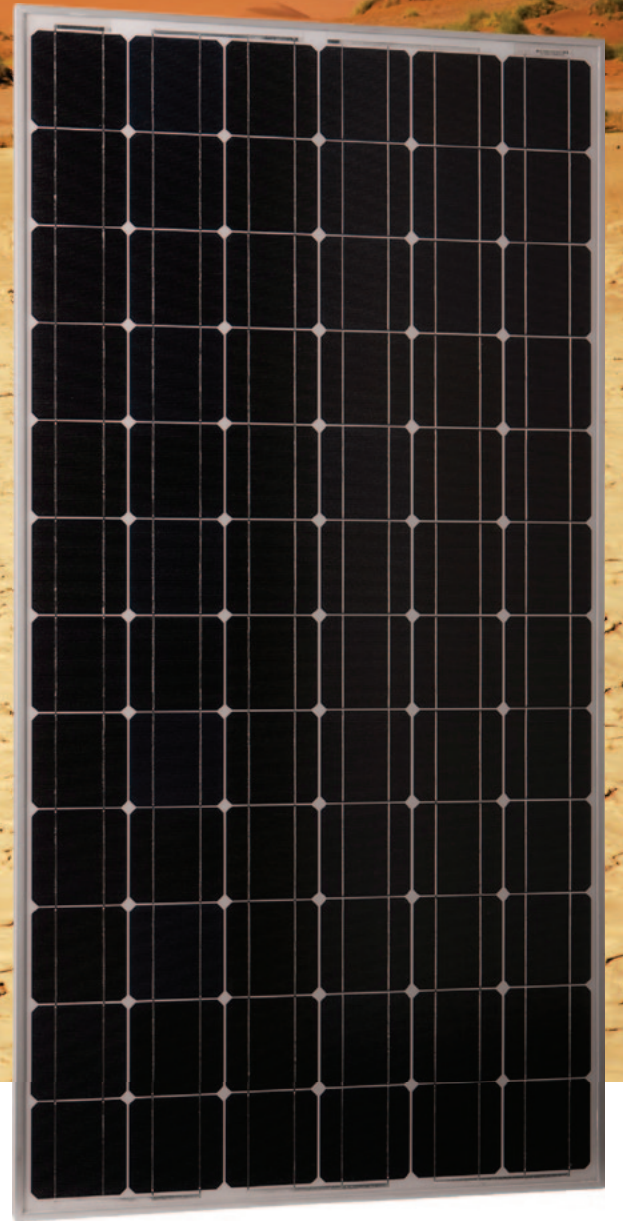
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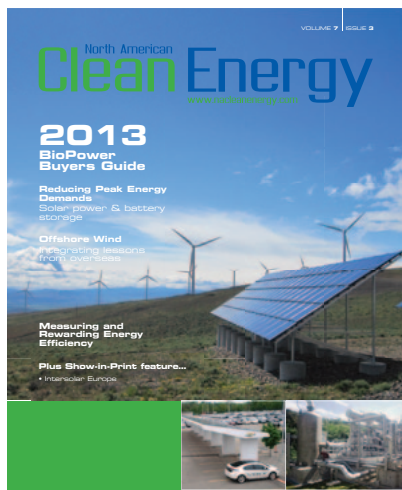


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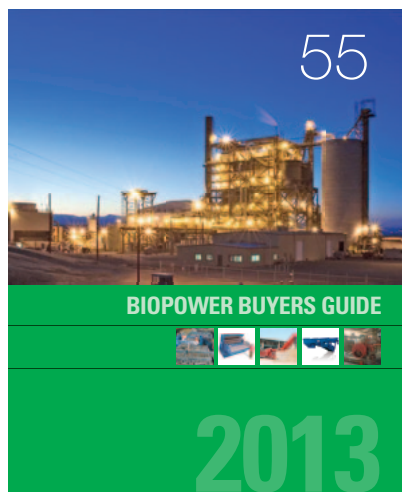
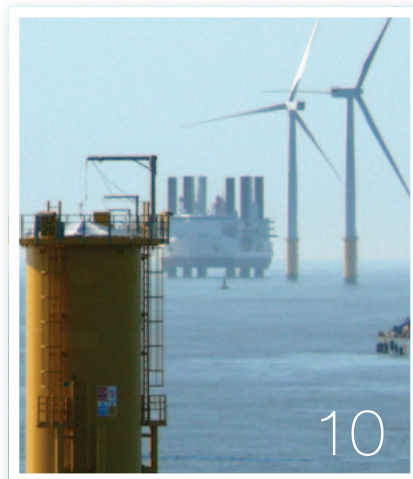
PVHardware
Sales
222 Sutter Street, Suite 410
San Francisco, CA
94108
h: 415-243-4469
e: sales@pvhardware.com

PVHardware
Research and Development
2750 Mercantile Dr.
Rancho Cordova, CA
95742
Ph: 916-853-1760





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 Photo of the Wild Horse Wind and Solar Facility near Ellensburg, Washington; courtesy of DNV KEMA (www.dnvkema.com)
 Photographer: Betsie McLain

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EDITOR
 Michelle Froese
 mfroese@nacleanenergy.com

ART DIRECTOR
 Rommel Ramirez
 production@nacleanenergy.com

SALES MANAGER
 Ian Stuart
 istuart@nacleanenergy.com

SALES
 Ian Stuart
 istuart@nacleanenergy.com

Jake Fidler
 jake@nacleanenergy.com

Dave Benton
 dave@nacleanenergy.com

CIRCULATION MANAGER
 Kristy Vail
 circulation@nacleanenergy.com

ACCOUNTING
 Alison Bell
 abell@nacleanenergy.com

PUBLISHER
 Ian Stuart
 istuart@nacleanenergy.com

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

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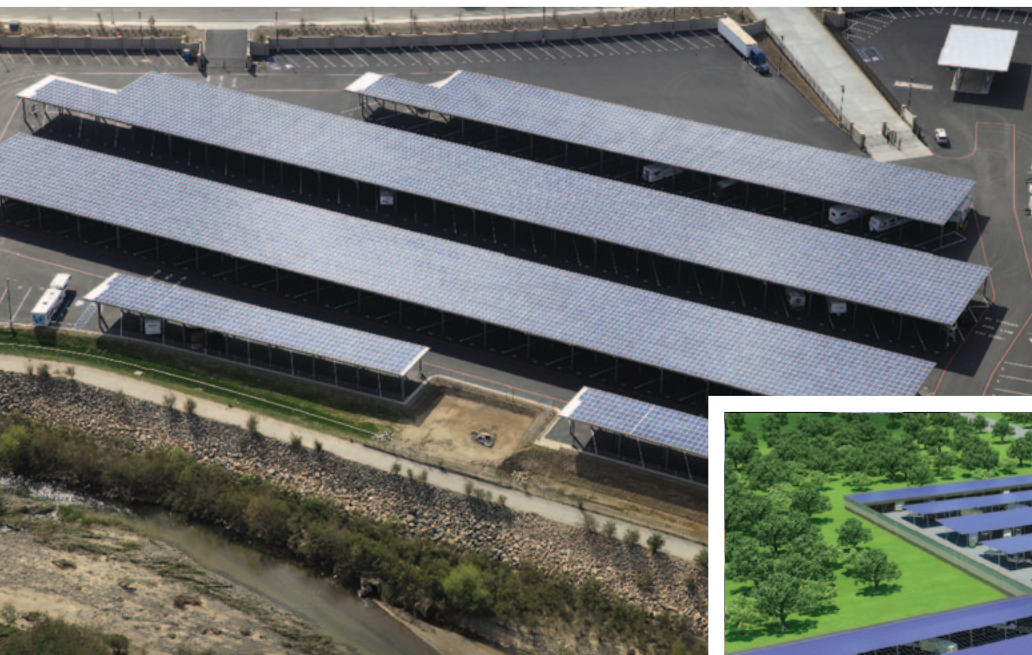
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Photo by Michelle Moore



AS MICROSOFT CO-FOUNDER, Bill Gates, lends some financial assistance to a US-based, renewable energy storage R&D company (he's a member of a group of high-profile investors, who are contributing some \$35 million into Aquion Energy),

a new report has been released that has revealed a rapid, growing need for energy storage in photovoltaic systems. Of those surveyed, nearly one-third of respondents—which included global PV installers, system integrators, and wholesalers—indicated that they expect to be using energy storage in over 40% of the PV systems they install by 2015.

Conducted by IMS Research (now a part of IHS Inc.), respondents from Germany, Italy, and the UK selected energy storage as being more critical than any other requirement for future PV inverters. The survey also found that over 60% of respondents felt that a 10% to 29% increase in system price for the inclusion of energy storage would be justified, with almost 30% indicating that they would be willing to pay an even higher premium. Perhaps Bill Gates is onto something yet again.

The company he's investing in is reportedly creating a water-based battery system for large- and small-scale energy storage projects that's intended to not only be environmentally friendly, but also rather inexpensive (check out www.aquionenergy.com/technology for more details). Cost is, of course, a major factor in any project's success—particularly for renewables, which can face intermittency and delivery challenges. When the sun doesn't shine or the wind doesn't blow, solar and wind power projects, respectively, cannot maximize production. Of course, this is where storage can make a difference, supplementing those low production times.

Interestingly, when IMS Research's participants were asked what the main driver for the adoption of energy storage would be, the most common response was a reduction in battery prices that could, in turn, help lower system costs and make storage more financially viable (www.pvmarketresearch.com).

With this in mind, Germany seems to be paving the way. The country has not only introduced an aggressive feed-in tariff (providing homeowners who implement solar systems with a strong financial incentive), but they've also been heavily focused on improving battery storage technology. As of May of this year, solar-friendly homeowners will be able to supplement their solar energy system with a new and improved battery storage system, subsidized by the federal government. Germany has allocated about \$30 million for this initiative during its first year of implementation. The new battery systems will allow those making use of renewable energy to store their electrical power more efficiently than ever before.

Some food for thought when it comes to North America's approach to renewables and energy storage. This issue we look at the advantages of PV systems and batteries (see page 22), as well as peak demand and distributed energy storage (page 24). And, don't miss our annual BioPower Buyers Guide, which features many of the latest products and services in the industry (starting on page 55).

Enjoy the read!

Michelle Froese



Business models for success

A new book by IEA-RETD, entitled "Business Models for Renewable Energy in the Built Environment" (Routledge, 2013), provides insight to policy makers as to the best ways in which new business models and/or policy measures can stimulate the deployment of renewable energy technologies and energy efficiency measures. Initiated and funded by the IEA Implementing Agreement for Renewable Energy Technology Deployment (IEA-RETD), this project analyses 10 business models in three categories, covering different types of energy service companies (ESCO's), including:

- Developing properties certified with a "green" building label;
- Building owners profiting from rent increases after EE measures;
- Property Assessed Clean Energy (PACE) financing;
- On-bill financing; and
- Leasing of renewable energy technology equipment.

Coverage extends to the organizational and financial structure of the models, and the existing market and policy context, focusing on the strengths, weaknesses, opportunities, and threats. The book concludes with recommendations for policy makers and other market actors on how to encourage and accelerate built environment renewable energy technologies.

Taylor & Francis Group | www.taylorandfrancis.com



New forest biomass harvesting guidelines

The Forest Guild's new guidelines for sustainable harvest of forest biomass in the Northwest detail how to produce renewable energy from the region's forests, while protecting them for future generations. Developing domestic, renewable sources of energy is a national priority, and in the Northwest, forest biomass is a potential source of renewable energy and fuel that also supports local economies.

Regional guidelines don't only have to be specific enough to provide the necessary protection for forest values, but the targets also have to be practical and flexible enough to be economical—these guidelines accomplish both of those goals.

"The Forest Guild guidelines show a much needed middle path. We don't have to forfeit environmental protection to produce renewable energy and create jobs," explained Mike DeBonis, Forest Guild Executive Director.

Forest Guild | www.forestguild.org/biomass.html



Saving the environment one cell at a time

In the last year, 50 million iPhones have been replaced with newer versions and the question remains—what happens to all of these old iPhones? The no-longer

used technology is a burden on the environment. To combat the waste, People Power has created the first-ever application to utilize unused smart phones and devices, and it's now available for download on the iTunes App Store.

The People Power Presence application recycles old devices, while providing a free, real-time monitoring system and a secure way to check on loved ones. Presence is a cloud-based app that allows users to operate unused smart phones as a wireless video camera. It will be able to serve as a monitoring device, while users are away from home or other areas. It can detect motion and audio, send alerts, and capture images, video, and audio from the event that set it off.

People Power | <http://peoplepowerco.com/about>

Seeking tax credits extensions

The Geothermal Exchange Organization (GEO) has formally asked the US House of Representatives Ways and Means Committee to recommend extending federal tax credits for residential and commercial geothermal heat pump (GHP) installations, beyond their December 31st, 2016 expiration date, through the year 2020.

In comments to the committee, GEO President and CEO Doug Dougherty made the case for continued federal interest in the health of the GHP industry: "Buildings are the largest single sector of total US energy consumption. GHPs can efficiently and significantly reduce the heating and cooling loads of buildings, with positive benefits for our environment and economy."

The Geothermal Exchange Organization
www.geoexchange.org

Solar financing standards

Assurant, Inc. recently announced that it's joining a consortium of 16 leading companies working in the solar industry to develop financing standards, which are designed to increase available capital for solar projects. The consortium, truSolar, is the first industry-wide effort to systematically address a comprehensive range of commercial and industrial-scale project risks that have prevented more lending institutions from participating in the industry.

"More than 95% of the country's lending institutions have been sitting on the sidelines, watching the solar industry's rapid growth during the past few years," said Jeanne Schwartz, VP of new venture commercialization at Assurant. "To improve participation and fuel continued growth, the industry needs to adopt these standards to deliver greater efficiency to the loan underwriting process."

The consortium, led by Distributed Sun and DuPont Photovoltaic Solutions, will work on developing solar project credit screening, rating, and underwriting standards. The framework is expected to be transferred to a standards body in 2014, and made available as open-source to the entire industry.

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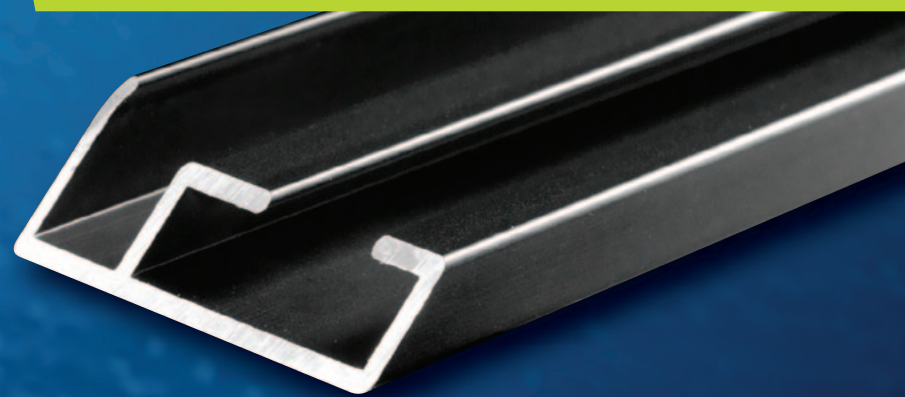
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Master Limited Partnerships

Can MLPs lower renewable electric project costs while increasing liquidity?

By Lee J Peterson, Esq.

Where equipment costs were historically blamed for the high start-up costs of wind and solar energy projects, it seems times are changing, as are barriers to new sites. Of late, the apparent consensus of the renewable energy financial community is that equipment costs are no longer the principal constraint on wind or solar project development. Rather, it's the combination of balance of system (BOS) costs, along with the overall cost of capital, which impede broader and more rapid deployment of renewable energy electricity generation projects in the United States.

Capital costs

It seems fairly simple: reduce barriers to investments in renewables and you'll get increased capital inflow. BOS costs aside, some investors are still hung up on the cost of capital and devoting new funds to wind or solar energy projects. There's also a continued reluctance of debt providers to offer long-term, or permanent financing for small and medium-sized renewable projects—particularly in conjunction with the transactional costs of tax equity financing, coupled with relatively few regularly active tax equity investors.

In this light, more pragmatic minds have considered tweaking existing federal income tax law to stimulate large-scale capital investment in wind and solar energy. Supporters of this idea have settled on expanding the reach of publicly traded partnerships, or Master Limited Partnerships (MLPs).

At face value, using an MLP to raise capital looks appealing. You simply call a securities broker and invest in a "fund" that would underwrite a renewable project. Theoretically, this would result in substantial amounts of new capital, raised to fund some (or all) of the capital costs of a large project or a pooled fund of smaller projects, which otherwise might not be financed.

Indeed, this could work. But—and it's a big "but"—only if other federal income tax laws and regulations are also changed. And, that's where the greatest challenges arise from a tax and legal perspective.

Background

MLPs generically function like a typical tax-equity finance structure. And, as one that could allow the most valuable tax benefits (federal PTC, ITC, or other tax credits, as well as MACRS accelerated depreciation) to pass into the hands of MLP unit holders, in exchange for their cash. These funds would, in turn, be used to finance the capital costs of renewable energy projects.

However, unless other federal income tax rules are also conformed, simply amending the tax code to allow MLPs to earn income from the ownership of wind, solar, or any other clean energy projects isn't sufficient enough to open up the capital markets—at least not to the extent anticipated by many current supporters of the MLP reform, such as proposed by Congress, in the Coons-Moran legislation. (US Senators Chris Coons and Jerry Moran are the ones who introduced the legislation, or the Master Limited Partnerships Parity Act, to give investors in renewable energy projects access to the same tax advantage now available only to investors of fossil fuel-based energy.)

There are now two versions of this Act. Yet, what both versions of the Coons-Moran MLP legislation don't do is amend other equally necessary governing federal income tax provisions, which would expressly allow the MLP unit holders to not only use the PTC, ITC, or other federal income tax credits, but also to claim the associated accelerated or other depreciation deductions they're entitled to as a true partner in the MLP.

MLPs & renewables

With the exception of making it slightly more convenient for a widely held corporate financier to invest in a renewable energy project at a potentially reduced transaction cost, there's little value in MLPs for newly constructed renewable electric projects, as currently proposed, other than providing a vehicle for "going-public." There might, however, be a play to finance storage and transmission facilities, or projects that would otherwise not qualify for tax credits. With this exception, no groundswell of tax-equity investment capital should be expected from the Coons-Moran legislation, simply because the list of approved investments for MLPs is expanded. It's still necessary to consider the investors and their tax requirements.

In today's capital market, a tax equity investor in a partnership that owns a renewable energy project eligible for the PTC, ITC, and MACRS depreciation, is typically a widely held large financial institution, a bank holding company, a lease holding company, a large national insurance company, or a well-known Wall Street investment firm. These corporate entities all happen to share a similar federal income tax profile, in which they are exempt from what are known as the federal income tax "At-Risk" and "Passive Activity Loss and Tax Credit" rules (see IRC § 465 and See IRC § 469, respectively).

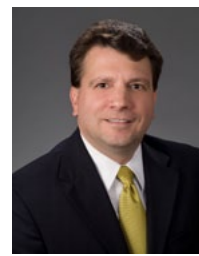
Merely adding renewable electric energy projects eligible for tax credits to the list of approved MLP investments doesn't change the fact that the average retail purchaser of an MLP interest under a new MLP law, who isn't a large financial company, wouldn't be able to use their full share of the PTC or ITC to eliminate a portion of their income tax, nor deduct much, if any of the MACRS depreciation. They would still remain limited by these rules.

Amending the rules

For MLPs to work as a retail tax-equity solution with renewable electricity projects, Congress would also need to amend other rules—specifically, the At-Risk and Passive Activity rules. In theory, this is possible, but in reality it seems unlikely.

A substantial reason for the 1986 tax act was to shutdown perceived abuses in partnership tax structured financings. Known then (and even now) as "abusive" tax shelters, Congress intentionally limited the tax benefits that individual, non-corporate partners, and closely held corporations could expect to receive by virtue of being a partner in a project. This fact, coupled with the gradual move toward overall tax reform (predicated on the desire for eliminating tax preferences, such as tax credits and/or special tax deductions like depreciation), indicates the MLP concept, as proposed, might not be workable in today's political reality.

If enacted as drafted, either version of Coons-Moran would find it challenging to work for tax-equity finance on the scale needed or desired by its supporters. The probability of amending either the At-Risk and Passive Activity limits remains slim. It is, therefore, unclear whether the MLP concept can serve as the solution to the problems faced by the renewable electricity generation industry. A more comprehensive re-write of multiple tax provisions would be required.



Lee J. Peterson is a licensed attorney and senior manager for CohnReznick's National Tax Practice. He also leads the firm's Tax Research and Planning Department in Atlanta. To date, Lee has been a tax advisor in over \$4 billion of renewable energy projects within the US.

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Getting U.S. Offshore Wind Farms Built

Integrating knowledge from the European market

By Simon Luby | Images courtesy of Centrica

AT THE END OF 2012, the estimated installed capacity of offshore wind exceeded five gigawatt (GW). Of this worldwide capacity, a total of 4,993 megawatts (MW) lie in European waters (according to www.ewea.org), with 400 MW installed in China, and a small demonstrator plant installed in Japan. Although a number of offshore American projects are at advanced stages of development, installation is yet to take place. A look to the European experience of large-scale, offshore wind development through construction and operation can provide the United States with an outline of the issues that have arisen and the solutions taken abroad for project success.

Common challenges, different results

The development and delivery of multiple, large, offshore wind farms present a number of non-project specific challenges, common to large power projects, which include:

- A lengthy consenting and development process;
- High development and construction costs;
- Design risk and ground risk;
- Accurate predictions of energy production;
- Lack of long-term data on large-scale wind turbine generator (WTG) reliability, and long-term operating costs;
- Constrained supply chains;
- Uncertainty regarding government support and targets;
- Construction delays caused by lack of experience with new WTGs and installation techniques;
- Adverse weather and contract interface issues;
- Risk of contractor insolvencies;
- Grid capacity and interconnection; and
- Lack of long-term operating experience on larger WTG models.

Although these challenges exist on almost every offshore wind development, the chosen approach and level of success across the European spectrum has varied considerably between individual projects and developers. This variety is the result of differing levels of experience and expertise, strategic management, and engineering resources available to developers in the planning, construction, and operation of projects—and, ultimately, a given project's priorities and budgetary constraints.

Typical development and consenting timescales are five to seven years, with differences between actual construction times versus original schedules varying (from 0 to 12 months). Delays of three to six months have been commonplace on many offshore projects constructed to date.

Experience and expertise on core development-phase tasks are now at levels where projects are going into construction phase in highly advanced states. But experience in managing contracts, contractors, and installation issues during this key phase has been mixed across European projects. As a result, actual versus planned costs and completion dates have significantly differed.

Delays & differences

As more offshore wind farms are developed and constructed, industry learning has increased. Despite the growing understanding of offshore wind farm delivery, however, costs on an installed, megawatt-basis have increased steadily over recent years. Even with better development-phase investigations and engineering, for example, a surprisingly high number of foundation and cable installation issues have been encountered on several projects. This has led to knock-on delays and additional expenses in a construction schedule.

Utilities tend to budget for relatively small levels of contingency, especially considering their preference for using multi-contract approaches to project delivery. This approach often results in supply chain, construction, and interface issues—all of which add to project cost forecasting. When multi-contracting works, it can deliver clear savings compared to industry average costs, however, when it doesn't work, the resultant delays and expenses often end up being higher than for projects with smaller and (at financial close) more expensive "mini-EPC" style contracts.

In spite of the benefit of team resource and sector experience, project management teams formed by utilities can still experience significant time and cost issues. Smaller, independent developer teams, working with a smaller number of mini EPC contracts, often find that contractors will aggressively seek time and cost variations almost immediately after financial close.



Centrica's Lynn and Inner Dowsing offshore wind farm off the UK's East Lincolnshire coast (www.centrica.com)

Managing risks

Even with the risks, it remains possible to deliver projects with minimum delays and within overall construction budget allowances. Achieving this requires a combination of experience, willingness to seek and act on independent advice regarding the risk profile of a project (versus what the developer thinks is the risk profile), use of proven technology and suppliers, as well as realistic provisions for construction costs and timescales. Interface risk exists on all contracting structures, so early identification, along with an active and ongoing management of these risks makes all the difference.

When backed by realistic construction schedules and budgets that support flexibility, management teams are in a strong position to rapidly identify and reduce (or avoid) problems that could lead to significant time and cost issues. Using supply chain companies who've successfully delivered in the past, and have the physical and financial resources to back up their commitments, has also shown to achieve better overall results. This is true even when cheaper, but less experienced alternatives (at least in terms of pre-construction estimates) exist.

Furthermore, strict contract management, which includes avoiding late changes to design and manufacturing plans, can prevent significant levels of claims for additional costs from contractors, who might be quick to take financial advantage of any project problems.

Future outlook

With construction experience in offshore wind growing, it's reasonable to expect future costs to improve. This is supported by the UK Government's Offshore Wind Task Force initiative, for example, which is aimed at facilitating cost reductions through lower construction and operating expenses, in parallel with increasing energy production.

Project companies, contractors, and staff knowledge are all increasing, and supply chain capacity is also on the rise. Those project participants who are less capable are quickly being identified, with natural selection often resulting in market consolidation. Even with this growing experience, improvements can be made. Specifically, supply chain growth with the pace of projects and maintenance of quality standards, while undergoing capacity ramp-up, are key.

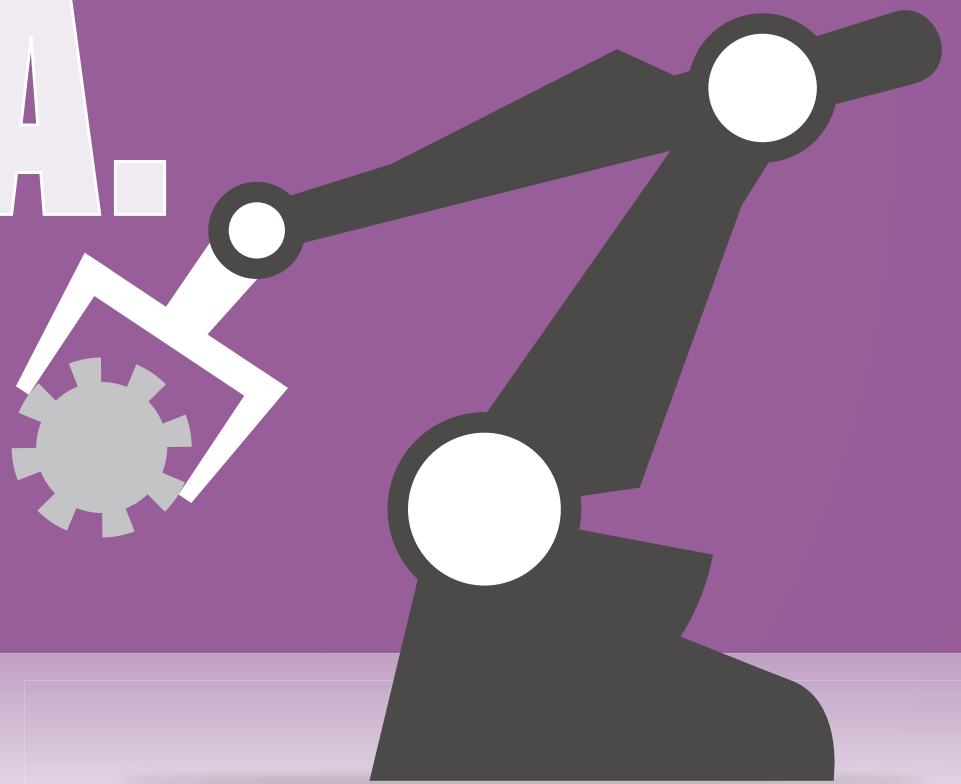
Some of the reasons the supply chain has found it difficult to meet project demands could be related to any uncertainty or lack of consistency from the wider industry, including government commitment. Incentives could be needed to support the large, European offshore wind targets set for 2020, and beyond.

Despite having to overcome some hurdles, offshore wind is seen to be a growing industry, with many other countries moving forward with offshore wind projects of their own. Although the future of offshore wind energy in North America is in its infancy, some committed companies are pushing to make their projects a reality. These pioneers have made progress by understanding the issues Europe has had with offshore wind, and by taking these as lessons learned.

Simon Luby is the director of Advisory Services for SgurrEnergy.

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Lessons Learned from Overseas

Successfully developing offshore wind projects

By Georg Becker-Birck

Numerous studies have already identified the positive benefits of developing offshore wind projects in the United States, which include creating jobs, supplying domestic clean energy, capping extensive peak energy production, as well as reviving the port industry.

One need only look abroad to note many of these advantages in other offshore wind markets. According to the European Offshore Wind Energy Association (www.ewea.org), for instance, 10% of their annual wind energy installations are found offshore, and a total of five gigawatts (GW) have already been installed (as of the end of 2012).

Today, several US offshore projects have reached the planning, permitting, or development stages. Before the first kilowatt-hour (kWh) is produced, however, these projects still have several construction and installation challenges to overcome. For one, there are a limited number of installers in the country with experience in the offshore wind industry; therefore, all activities require personnel recruiting and training. Secondly, no project can be built without the suitable port infrastructure, as well as the necessary installation and service vessels. Finally, a successful, self-sustaining industry needs to have a developed local supply chain.

Workforce development

Addressing the challenges facing an offshore wind industry begins with the people behind the projects. Developing a local workforce is important to stimulate the economy and to reduce the reliance on hiring only foreign workers. The marine industry, onshore wind, and civil construction fields are the prime recruiting fields to facilitate the build-up of qualified offshore wind personnel. However, candidates must be willing to learn the specifics of this young industry. The strongest candidates will recognize that offshore wind development has specific procedures and requirements and, for example, that offshore oil and gas procedures cannot simply be “copied and pasted.” Because of the longevity of wind installations and the longer cost amortization horizon, the offshore industry requires a longer-term, more cost-conscious approach.

One way to ensure a local workforce is ready to meet the rigorous demands of offshore construction is to apply a stringent qualification and training process—which relies on leveraging the knowledge and lessons learned from the European experience. Knowledge in design, construction, installation, and commissioning can be transferred, for instance, by pairing experienced European staff with newly hired US staff. European experts can provide guidance through on-the-job training and mentorship, while US team members can learn by actively performing skills and the tasks required.

Practical experience (what has worked, what did not) is a vital pillar in the learning curve. It’s important for installers, developers, and consultants to gain the skills to successfully select a given product based not only on its concept and design, but also on its long-term reliability and performance in the offshore sector.

Harbors and staging areas

Harbors and staging areas are the backbone to wind turbine installation, and are a vital component in each project. Establishing the infrastructure provides business opportunities for local assembly and supply chain providers, as well as management opportunities.

Criteria for a successful future port location include:

1. Accessibility of next-generation jack-up vessels, as used in Europe;
2. Stable harbor sediment, which can sustain the weight of a jacked-up vessel;
3. Sufficient quay weight bearing capacity for foundations of 1,000 tons or more;
4. Ample storage space for blades, towers, and foundations; and, most importantly
5. Proximity to the wind lease areas. (Proximity is crucial because it greatly influences the travel time to the sites, affecting the overall vessel lease costs of a project.)

Harbor development can take several years, making it critical for ports that want to lead in the US offshore wind sector to begin preparing for future construction projects today. Although development is capital intensive, it's also quite promising because staging areas can revive a local port industry with near-term and long-term jobs. Esbjerg in Denmark and Bremerhaven in Germany are shining examples for port revitalization, turning areas of former high unemployment into prosperous industry centers.



Georg Becker-Birck is a mechanical engineer and project manager, serving as a senior consultant and project manager at K2 Management, supporting US clients who are implementing their onshore and offshore wind projects.

K2 Management is an independent wind energy, design, advisory, and consulting company. K2 Management applies experience and practical knowledge to help deliver safe and efficient project solutions for clients in the global onshore and offshore wind industries.

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Vessels

Any crew transfer vessels used for construction, as well as operation and maintenance, must comply with the Jones Act, which restricts the use of foreign flagged vessels in the US. Compared to the oil and gas industry, the wind industry uses smaller, more agile vessels. Shipyards have already reacted to this future industry, and have acquired licenses for UK/EU vessel designs. Since crew transfer vessels have shorter lead times, no constraints are expected for the US offshore wind industry.

The first US projects will likely use a mix of European and US jack-up vessels for foundation and turbine installation; however, as of today, the latter don't yet exist. When using European vessels, local feeder barges will be used for wind turbine transfers between staging areas and project sites to be compliant with the Jones Act—creating a potential constraint. To have installation capacity available in time, it's essential that local companies start building US flagged jack-up vessels as soon as possible. Along with fulfilling US vessel legal requirements, such construction would also benefit the shipbuilding industry.

Local supply chain

Creating long-term benefits in offshore wind requires developing and enabling the growth of a local supply chain. Relying on imports from Europe is not a lasting solution. But many suppliers aren't prepared for the market, failing to fully understand the offshore industry's specific quality and capacity requirements. All offshore wind projects are for-profit and, therefore, have strict supplier requirements. Local content is important, but only possible if suppliers can competitively meet industry requirements. Industry connections and networking with project developers and manufacturers—particularly those with offshore experience—can build knowledge about the industry's specifications, along with identifying strengths and areas of concern.

By following these steps and applying some of the major lessons learned from European projects, the US offshore wind industry can avoid costly installation mistakes, accelerating its development to become a mature and vital maritime industry.

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Corrosion Control

Maintaining offshore wind towers

By Steve Nikolakakos

Whether it's in shallow or deep seawaters, offshore wind turbines face a challenge that onshore turbines don't—and that's the water. Though both onshore and offshore towers and blades deal with various weather systems, from rain to hail, and sometimes snow, the foundation of offshore turbines face the ocean waves 24/7.

This is an issue, as most wind turbines and support structures are fabricated from carbon steel materials. The corrosion effects of steel structures in seawater are well known and documented. Resulting damage can range from negligible to severe, depending on the type of protection systems utilized. As a result, there are factors that must be considered during the planning and design phases of an offshore project to maintain the longevity of the turbines, including: the service life; the environmental conditions; as well as the level of inspection and maintenance required.

Deterioration of construction materials caused by corrosion is important when determining the service life of an offshore wind project and, as such, the overall corrosion potential must also be evaluated. Generally, the service life of a wind farm is about 20 to 30 years; meaning most of the materials used in tower construction would be affected by the corrosive environmental conditions over time. Corrosion control measures, therefore, become essential to maintain the structural integrity and the overall success of any offshore wind farm.

To properly minimize corrosion effects on steel structures, it's critical that the design and the material specifications for an offshore project be reviewed by an expert in the corrosion field, so appropriate recommendations are provided and become a part of the overall project design.



Assessing the environmental zones

Corrosion of steel in marine environments is mostly electro-chemical in nature. To fully evaluate corrosion of any offshore steel structures, it's necessary to examine each area or "zone" of the structure exposed separately, as the environmental conditions for each area differs. The zones of environmental evaluation include: atmospheric; splash/tidal; submerged; and soil (the soil below mud line).

Although it might not seem all that significant, the corrosion rate in each of these zones can vary considerably. The lowest corrosion rate is in the soil zone (approximately 25 μ to 100 μ (microns per year), while the highest rate is found in the splash zone (approximately 100 μ to 350 μ per year).

Causes of corrosion

Corrosion occurs either because of the physical and/or chemical differences present in metals or in the environment, and normally takes place in the presence of moisture and oxygen. The corrosion mechanism is electrolytic or chemical.

The rate of corrosion is affected by many environmental factors, of which some of the most important are as follows:

- **Different aeration.** This includes variations in oxygen concentration at the steel surfaces. Oxygen concentrations near the steel surfaces (below the mud line) are normally low and, therefore, the differential aeration cells in this area are either quite weak or don't develop at all. This is one of the reasons why the corrosion rate in soil is so small.
- **Soil/water resistivity.** This involves the ability of soil/water to conduct electric current. The lower the resistivity, the more corrosive the environment.
- **pH factor.** This is an indicator of acidity or alkalinity. The pH of seawater is usually in the range of pH 7 or pH 8. If pollutants are in the water, however, it's possible to have low pH value (below 4), which indicates acidic conditions. This can accelerate corrosion.
- **Marine organisms.** Organisms, such as barnacles, can accelerate corrosion by creating a differential aeration condition. Another organism, anaerobic bacteria (found in oxygen-free environments), increases corrosion by changing sulfate to sulfides, which attack steel.

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Corrosion protection

Optimum corrosion control tends to be achieved by a combination of methods. There are four basic methods that can be used to effectively control corrosion, and should be considered during the planning stages of any wind power project.

These methods include:

1. Material selection. Material selected for a project must not only perform adequately in the environment it's to be installed in, but it must also be economically justifiable. As previously mentioned, the material mostly specified for wind farms is carbon steel, and this is primarily due to cost considerations.

2. Design/fabrication practices. Wind tower designs should take the effects of combining multiple materials into consideration. If possible, combining two or more different metals should be avoided to eliminate the formation of galvanic cells, which can result in bi-metallic corrosion.

3. Coating considerations. Coatings are used to insulate steel from the environment. Coatings are the main corrosion control system for the splash/tidal and atmospheric zones. They can also be effective in reducing the cathodic protection current requirements (see point 4), when used in buried or submerged structures. Protective coatings are specified and applied to structures in all three zones of environmental exposures (atmospheric, splash/tidal, and submerged). To be effective, however, the coating must be selected based on the criteria provided on project specifications, and meet the service life requirements of the project.

Here are some coating considerations per zone...

- *Atmospheric zone:* The coating system must be designed to resist UV, chlorides, damaging winds, and temperature changes.
- *Splash/tidal zone:* The coating system must be designed to resist moisture permeation to the substrate, some UV exposure, chlorides, marine growth, and abrasion.
- *Submerged zone:* The coating system must be designed to resist moisture permeation to the substrate, chlorides, marine growth, abrasion, and must be compatible to the cathodic protection system.

4. Cathodic protection. Cathodic protection is an electrochemical method of corrosion control. It's an effective way of protecting not only coated, but also bare metallic structures installed in water or below the grade (soil). It's also partially effective in the tidal zone. There are two types of cathodic protection systems: the galvanic, which uses sacrificial anodes

(such as zinc or aluminum); and the impressed current, which uses specially formulated anodes and a rectifier that changes AC power to DC power.

Coatings and cathodic protection can minimize, and sometimes even completely prevent, the corrosion issues that an offshore wind farm faces for the specified service life of towers and their foundation. Corrosion control measures should be an integral part of any offshore project plans, so the water is no longer a concern.

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A technician tests a harness with a weighted dummy body. Capital Safety maintains its own testing lab, rather than using an outside facility, in part so that tests are done in a timely manner.

Understanding the ANSI Z359 Standard

What it means for wind power projects

By Craig Firl

In October 2012, compliance for the new ANSI standard for Qualification and Verification Testing went into effect, requiring all fall protection products to be tested by an accredited lab. As it's known, "ANSI Z359.7" is considered a fall protection umbrella standard, meaning it applies to all products within ANSI Z359, rather than just one particular type of product.

Specifically, ANSI Z359.7 outlines the minimum testing and verification requirements for third-party testing labs, as well as for manufacturers' labs testing products subject to ANSI Z359, which includes full body harnesses, energy-absorbing lanyards, self retracting devices, and anchorage connectors—the safety equipment required at any wind energy project site.

With the tallest towers reaching several hundreds of feet, wind energy workers are subject to extreme heights and must be equipped with fall protection equipment designed to meet the risks of the job. According to the new standard, there are three important requirements a fall protection product must meet to be compliant. A product must comply with:

1. Both ANSI Z359.7 and the applicable Z359 product standard;
2. All aspects of the standard, including performance, design, markings, inspections, instructions, maintenance, etc.; and
3. The most current edition of the standard.

Each test lab is also subject to strict regulations under the new standard. Labs must meet the requirements of ISO 17025—General Requirements for the Competence of Testing and Calibration Laboratories—including annual audits and accreditation by an outside agency. Additionally, the structure of the lab, and all measuring equipment used, must be in compliance and calibrated annually. Although there are a few ISO 17025 certified labs found throughout the country, many fall protection equipment manufacturers are now working toward housing their own accredited labs to help with these testing and re-testing efforts.

Putting safety first

Essentially, the new standard in the ANSI Z359 family takes the safety of fall protection products one step further, requiring equipment to pass stringent testing procedures before becoming certified as compliant. ANSI is widely known for having the most current, comprehensive standards that help to optimize workers' health and safety on the job, which is what makes Z359.7 so important.

To meet this standard, certified labs must perform both initial qualification testing on at least three units, and repeat verification testing every five years if the manufacturer has a registered quality program in place (or every two years without a registered program). Companies that choose ANSI Z359.7-compliant products are choosing equipment that has proven to be the safest and the most up-to-date with the latest standards. As a result, end-users gain the peace of mind and the reassurance that comes with using vigorously tested, cutting-edge fall protection gear.

This is essential at wind energy sites where at-height workers face the possibility of serious injury or death from a fall. As with any at-height industry posing risks to workers, job-specific equipment and training can save lives, keeping workers safe.



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Although providing the best possible fall protection equipment is crucial, it is only half the battle. It's imperative workers are well trained on appropriate equipment usage. Incorrect equipment usage can decrease its effectiveness, safety, comfort, and usability. Understanding how to properly use and secure a safety harness or how to install a tower ladder or climbing kit, for example, is the only way certified equipment can truly stand up to those certifications—and that responsibility lies on the site owners, project managers and, of course, the workers subjecting themselves to such great heights. The key to addressing this issue is simple and involves practical, hands-on training in controlled environments, which simulate the complexities of working on a turbine.

Wind turbine installation and maintenance requires tight safety measures. Fortunately, with ANSI Z359.7 compliant products, properly trained workers can be reassured that their equipment will help them get the job done safely every time.



Craig Firl is the North American technical manager at Capital Safety.

Capital Safety is a designer and manufacturer of height safety and fall protection equipment, with related training courses available. They are the first fall protection manufacturer to have an ISO 17025 accredited lab onsite.

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If you ask the average person about energy storage, they'll probably talk about batteries. But, ask a utility executive, grid operator, or wind farm developer and the answers will vary as much as the wind itself.

Wind energy installations are increasing around the world, adding degrees of supply variability and challenging grid stability. Grid operators are taking a close look at the impact of increasing penetration of highly variable wind energy, and how energy storage can play a role in stabilizing the electricity network. In many regions, the issue is not if grid-stabilizing solutions will be needed, but when.

Although today's level of wind penetration in North America is not yet at a point that creates significant grid instability, utilities and grid operators are certainly paying attention. Based on the growing confluence of industry studies, utility initiatives, regulatory orders and filings, and early results from initial projects, the market clearly recognizes that expanding wind power resources will require stabilizing support.

One of the key sources of support can be deployment of grid-scale energy storage systems, and technology developers are racing to provide them.

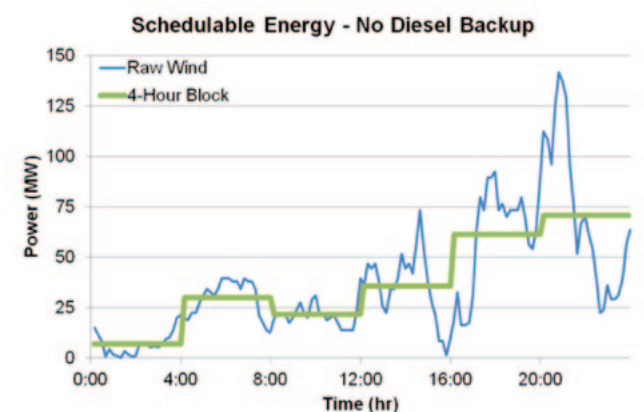
Weighing storage options

So, what might an ideal storage solution look like? To deliver the greatest benefit, it must be reliable, cost-effective, and unconstrained by geography. In high-energy applications, such as wind integration (i.e. four to six hours, or more), bulk storage must have a long cyclic life, low initial and O&M costs, and be able to perform many deep-charge/discharge cycles without degradation.

An obvious question is: why not use giant batteries? Despite advances in chemistry and improvements in cost, new battery-based solutions have largely been limited to short-duration, high-power applications. They can provide short bursts of power to smooth out variations in frequency, power, and voltage. However, batteries cannot provide extended duration, long-life, utility-scale performance. To do so requires storing and discharging energy at high rates (hundreds of MW), in very large amounts (thousands of MWh), over many thousands of cycles, for a utility-standard period of 20 to 30 years. The limited, deep-discharge cycle lives of batteries (a few thousand cycles at most) make them impractical for such long-term, high-energy applications.

Recent grid-level battery installations have, therefore, focused on high-power applications, such as frequency and voltage regulation. For example, Duke Power's recently commissioned Notrees Windpower Project in Texas is a 36-MW/24-MWh system (at an estimated cost of \$44 million), which is slated to provide several services, including smoothing and frequency regulation. A technical and economic assessment by the Electric Power Research Institute (EPRI) and Sandia National Labs, expected at some point in the future, will evaluate its performance in these functions.

There are non-wind, bulk storage applications, but these also tend to be of high power and short duration. AES Energy Storage has two battery storage projects now operating at AES-owned power plants in Northern Chile. One is a 12-MW system that uses Li-on batteries from



This graph depicts a typical 24-hour period of wind farm output (blue line). The energy levels reflect significant generation peaks and valleys—with a >125 MW swing over a four-hour period. The addition of ICAES in a potential application (green line) adds certainty to grid operation by firming variable wind energy and transforming it into a predictable, schedulable product. ICAES is able to provide fast-ramping reserve energy, while zero-minimum generation allows more wind to reach load, minimizing the need for fossil fuel-fired balancing power.

A123 Systems to provide short-term spinning reserve. The second is a 20-MW battery plant that operates in tandem with a 544-MW coal plant to provide up to 15 minutes of spinning reserve. That system comprises about one million Li-on battery cells, divided among ten, 2-MW battery containers and five, 4-MW power control containers.

Finding grid-scale solutions

For long-duration/high-energy applications, pumped hydro and conventional compressed air energy storage (CAES) have proven to be the most effective methods of bulk storage from a cost and performance standpoint. However, conventional CAES, which relies on underground salt caverns for air storage, and a natural gas-fueled combustion turbine to generate power as the compressed air is expanded, is used in only two places worldwide. The last system was built in 1992, and several recent proposed projects have been cancelled due to escalating costs and other issues.

Pumped hydro is by far the most widely used bulk energy storage method today. It represents more than 99% of bulk storage capacity worldwide (around 127 GW, according to EPRI), but has limited potential for expanded use. The types of sites needed for new pumped hydro systems are few and far between, and environmental concerns often cause delay or cancellation of projects. As a result, a few companies are devising new methods to move water around. Ultimately, conventional CAES and pumped hydro are limited by scale, siting, and/or emissions, requiring enormous capital outlay—and patience.

Building on the advantages of CAES (economics, efficiency, scalability, and mechanical durability), with the added benefits of flexible siting and clean, fuel-free operation, is the more advanced isothermal compressed air energy storage. Isothermal CAES captures the heat produced during compression by trapping it in water, and storing the warmed air-water mixture in conventional pipelines or fabricated in-ground storage vessels. When energy is needed, the process reverses and the air expands, providing greater efficiency because of the presence

of heated water in the system. No fuel is needed to re-heat the air, and no emissions are produced.

Calculating carbon footprints

When looking at long-term grid solutions, another important factor to consider is the carbon footprint of various storage methods. One way to measure this is the return on energy expended to build a system. Until recently, these energetic costs had never been researched or quantified. A study published in March by Stanford University's Global Climate and Energy Project (GCEP) looked at the "energy stored on investment," or ESOI, of various technologies, including five types of batteries (namely, lead-acid, lithium-ion, sodium-sulfur, vanadium-redox, and zinc-bromine), as well as pumped hydro and CAES.

The study found that all five batteries have exponentially greater embodied energy costs when compared to the two pre-dominant bulk storage methods. In other words, thanks to their much longer lifetimes and relatively basic components (earth, air, water, steel), pumped hydro and CAES can return 20 to 25 times as much energy over their operational life, compared to the top-performing batteries. The study didn't look at emerging bulk storage technologies, such as Isothermal CAES, but these systems are also made up of proven industrial components (including air, water and steel), so the future looks promising.

The final word

Real-world experience has shown that energy storage can be highly useful in integrating wind and solar power, as well as providing ancillary services to the grid. Isothermal compressed air energy storage overcomes the limitations of conventional CAES, combining the low-cost, large-scale, and long-lifetime benefits of mechanical storage in a site, with zero-emissions. With such advantages, isothermal CAES can provide the flexibility to expand wind penetration in challenged grids.



Richard Brody, PhD, is the VP of Business Development for SustainX and has over 20 years of experience in technology-based business development.

Later this year, SustainX will connect and begin operation of its first megawatt-scale ICAES system—a 1.5-MW pilot at its facility in Seabrook, New Hampshire.

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Short-term Wind Power Production Forecasts

A case study using the micro-scale physical model

By Céline Bezault

Assessing and forecasting wind is crucial to the design, implementation, and success of a wind farm. It might seem fairly straightforward, however, wind is among the most difficult weather variables to predict. Various factors—from topography and temperature to atmospheric shifts and surrounding foliage—affect its strength and direction. One solution to reduce the uncertainty of wind output and production is by using forecasts that incorporate meteorological data to predict wind production.

A recent study of a wind farm located in Nova Scotia, Canada was done with the aim of demonstrating how a micro-scale physical model, combined with statistical correction for the short-term wind power forecast, performs better against simple statistical methods.

The working environment

The Nova Scotia wind farm site under study is complex, with 34 turbines located on rough terrain with high wind speeds, and an installed capacity of 51 megawatts (MW). Fortunately, more than a year's worth of wind data and production data are available for the site. The forecasting horizon considered herein was 72 hours, with production forecasts given every 10 minutes. The predictions were updated every six hours.

As the terrain of the site is quite rough and challenging, a method of assessment that considers the terrain and roughness effects on the wind farm at a micro-scale level was selected for the study. Thanks to a CFD (Computational Fluid Dynamics) code, which allows the integration of results from meso-scale numerical weather prediction (NWP), this was even possible. Additionally, different atmospheric thermal stabilities and roughness land covers were considered to take into account seasonal variability. The calculations of thermal stabilities have been done with wind speed and temperature profiles given by the meso-scale model.

Wake effects, or the downstream flow caused by multiple turbines, was calculated at each time-step behind operating wind turbines. The analysis of the production by turbine allows correcting the theoretical power curves by air density, and limiting the error on the cut-in and cut-out wind speeds.

Understanding calculations

Ensuring the proper forecasting methods available for a wind farm can mean the difference between a successful wind farm and one that doesn't fully maximize the power of the wind.

For the CFD meso-scale model, the meso-scale points are transferred to each wind turbine location from the speed-up coefficients obtained by the CFD model. The local

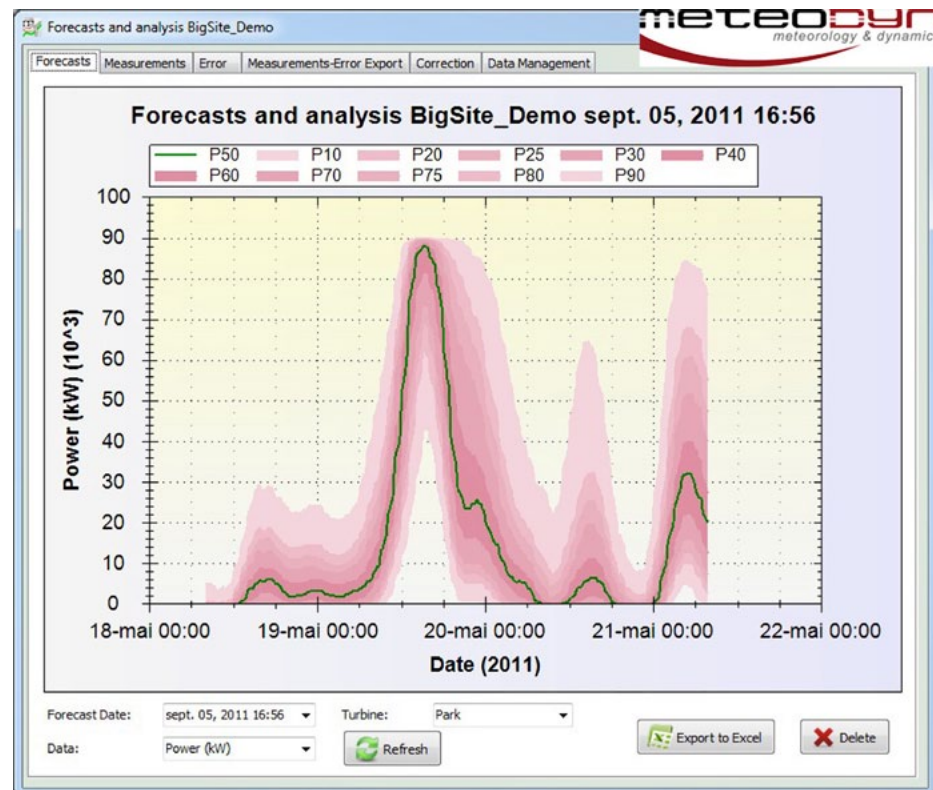


Figure 1. Forecast: wind power curves analysis

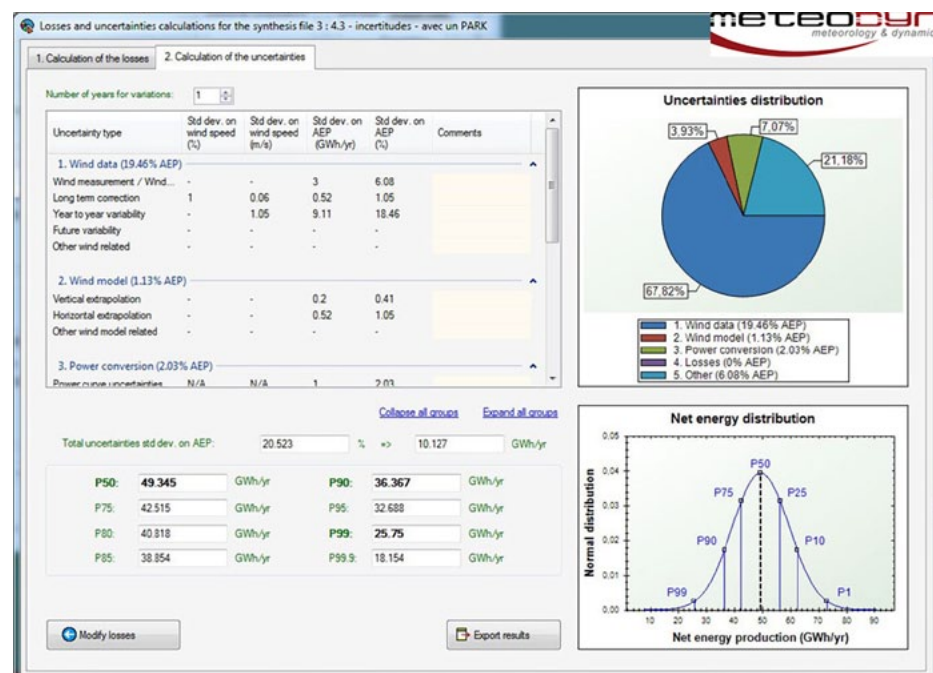


Figure 2. Forecast: wind production uncertainties calculation



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effects taken into account include orography (mountainous terrain) and land use. The wind speed coefficients allow the statistical correction of meso-scale data by using met mast measurements to correct power curves, according to IEC standards. Calibration also takes into account seasonal variations (such as snow, foliage density, etc.)

The meso-scale data also defines the stability class at one moment. Methods for estimating stability classes include vertical heat and momentum fluxes, vertical gradients of wind speed and air temperature, as well as the parametrization of the stability classification.

When considering wake effects, all of the important physical parameters were considered, including turbulence intensity, air density at hub height, as well as even considering any temporary out-of-order wind turbines.

When real-time measurements are available, other actions are possible, such as: amplitude correction, or the correction of the amplitude on the atmospheric phenomenon; and phase correction, or the correction on the time shift of the phenomenon.

Uncertainty computation is based on the gaussian (or row reduction) analysis of the errors, sorted by wind direction sectors and thermal stability classes. In this case, CFD coefficients are used to compare meso-scale results and measured speeds. The uncertainty on the forecasted production is deduced from the uncertainties on the wind speed and the power curves. For very short-term forecast, however, statistical methods become pertinent.

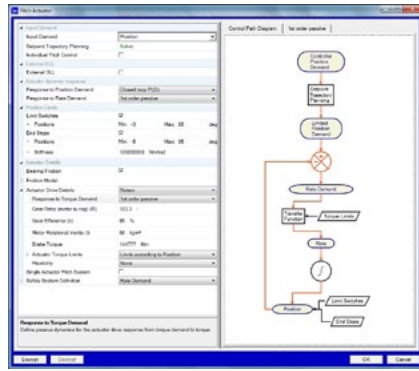
Current results

At last, the features of the Model Output Statistics (MOS) have been revised with a multi-criteria approach to correct speed by direction and thermal stability class and production by direction, thermal stability class, and bin of speed. The standard error measurements were evaluated at the Nova Scotia wind farm, and compared for this method using CFD calculated wind coefficients at the wind turbines with MOS, as well as using only statistical correction. Mixing short-term statistical predictions and the corrected meso-scale predictions seems most efficient, especially in complex environments.

So far, this study has been performed for a six months period, demonstrating satisfactory results for the considered horizon.

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Updated, integrated software

GL Garrad Hassan has released Version 4.4 of Bladed, the industry standard integrated software package for the design and certification of onshore and offshore wind turbines. The release of Version 4.4 represents a significant milestone for Bladed, with many new features, including a new pitch actuator model with additional functionality, a new external controller interface, improved moorings capability for floating turbines, and several updates to the hardware test module.

More specifically, this latest release of Bladed includes some important updates, particularly to the pitch actuator modeling, which comes complete with such additional features as set-point trajectory planning, limit switches, end-stops, and variable torque limits. A new interactive user interface screen also provides a clearer description of the model and options available. Furthermore, the introduction of a brand new interface between the simulation code and the external controller makes it even more straightforward and clearer to write controllers, which utilize a large number of variables and options.

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BURNDY announces a product addition to their line of Micro-adjustable Ratcheting Torque Wrenches. The BTW1575F12 is a new, half-inch drive, professional grade torque wrench, enabling customers to reliably terminate the complete line of BURNDY mechanical compression connectors and other hardware to their recommended installation torque. It's estimated that 90% of electrical failures occur at connections, so correct installation is imperative at project sites. Applying the correct torque value to the connection ensures the safety and long-term integrity of an electrical system—mechanically and electrically.

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The Unique Advantage PV + Battery Storage Gives Commercial Buildings

By Paul Bundschuh

It is widely recognized that the power grid requires energy storage to smooth delivery of electricity from an increasing amount of solar and wind energy, as well as for intermittent demands. The cost of implementing energy storage, however, has generally been considered too expensive for widespread deployment. Due to continuing price reductions and efficiency improvements in battery systems, it's rapidly becoming technically practical and economically attractive to use large battery systems for selective energy storage applications.

One particularly attractive application is peak demand reduction for commercial electricity customers. Peak demand refers to the highest amount of electricity being consumed at any one point in time, across the entire network system. Commercially speaking, peak energy demands occur during the work or school days, when computers, lighting, as well as heating, ventilation, and air conditioning (HVAC) systems are on full power.

To help mitigate not only the pressure on the grid, but also the strain on the pocketbook (customers pay more at higher energy times), peak demand reduction simply involves decreasing electricity consumption during peak hours. This is where energy storage comes in, and how PV and battery systems can help make a difference. There are not only key advantages, but also certain requirements that are unique to commercial-scale battery storage systems to reduce peak demand.

Market segments

Battery energy storage market segments are similar to the photovoltaic (PV) generation market, with residential, commercial, utility, and off-grid market segments. In the PV industry, the largest market segment, globally, is in commercial-scale systems. These systems provide economies-of-scale, while displacing higher value retail electricity. In many geographic regions of the world, commercial-scale PV is becoming cost-effective with conventional generation.

Like the PV industry, the application and value of battery-based energy storage varies significantly across all market segments. For commercial customers, storage provides the opportunity to reduce peak demand charges—something that only the commercial market segment experiences. Utility regulatory changes aren't required for these systems to be cost-effective, but incentives can certainly provide motivation. A recently enacted Self-Generation Incentive Program (SGIP) from the State of California, for example, rebates up to 40% of the installed cost of battery storage systems. This incentive should accelerate market demand for commercial storage in the next few years.

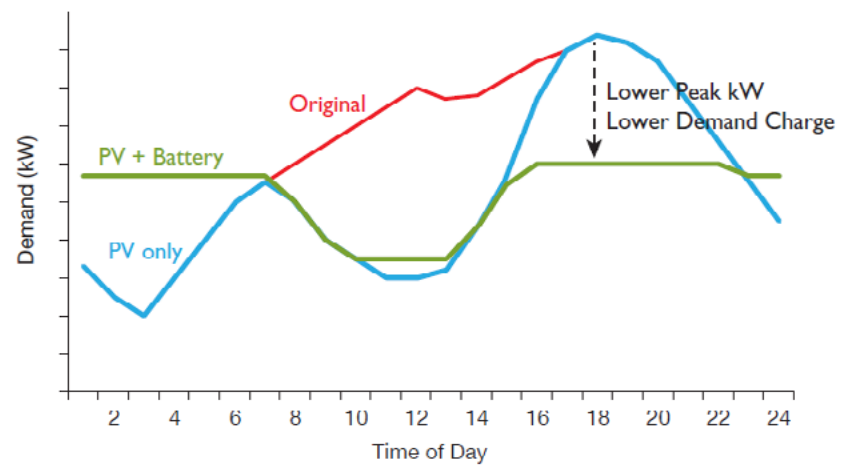
Reducing peak demand charges

Commercial electric customers, unlike residential customers, typically pay for demand charges (in kilowatts), in addition to energy charges (in kilowatt-hours). The peak demand charge is normally calculated as the highest peak demand during the monthly billing cycle, based on a 15-minute sample interval. Although the average commercial retail rate in the United States is \$0.10/kWh, the marginal cost of energy during these peak periods can be \$1.00/kWh or more, making this an attractive opportunity for cost savings.

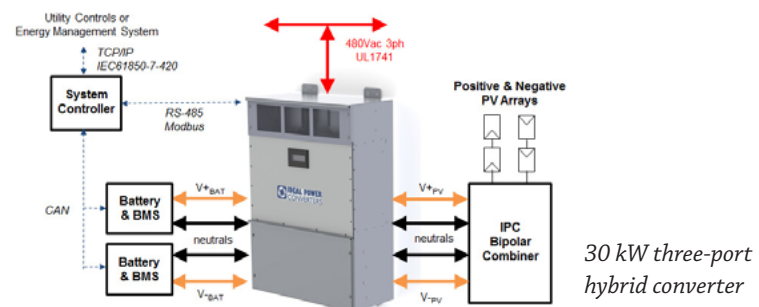
For many commercial customers, the peak demand part of their utility bill can equate to 30% to 40% of the total electric bill. For some customers, it can be much higher. Electric vehicle (EV) fast charger installations, for instance, can have peak demand (kW) charges reaching 80% to 90% of a monthly electric bill. Commercial customers with a high to average peak demand will have a higher percentage of their utility costs tied to demand charges, and will benefit more from peak demand shaving that's enabled by energy storage.

But, first things first. The primary step in reducing energy costs for commercial customers begins with addressing general energy efficiency issues, which can include everything from replacing lighting with LED and fluorescent lighting to upgrading HVAC systems. Additionally, if customers have heavy intermittent loads (such as large industrial motors), they will need to optimize usage when possible. In some cases, utilities will contract with large industrial and commercial customers to curtail load during peak times. There are a number of attractive energy management systems to help commercial customers with these issues, but local energy storage can also play a role.

Adding onsite PV generation to a commercial building reduces utility energy (kWh) charges, but often has little effect on peak demand (kW) charges. Summer peak demands often occur during the late afternoon and early evenings, just when PV generation is sharply dropping. Commercial customers with PV generation have lower average energy (kWh) requirements, but often with the same high-peak power (kW) demand. Since they have a high-peak power to average energy demand ratio, they will generally benefit more from a peak reduction energy storage system.



Combining PV and battery storage systems offers lower energy (kWh) and lower peak demand (kW) utility charges.



Battery storage requirements

Typically, only medium to large commercial and industrial customers pay peak demand charges. These customers normally have a 480Vac, three-phase AC grid inter-tie, which is a requirement for battery storage systems to eliminate the cost and efficiency loss of an external transformer. The system needs to be certified by a Nationally Recognized Testing Laboratory (NRTL) to conform to UL1741, which is the same grid-tied standard found in PV inverters. UL1741 guarantees a number of critical aspects of power grid safety, and is required by local utilities for distributed energy storage systems. The system should be scalable from tens of kilowatts to megawatts of power to address different customer requirements.

Battery storage systems require a highly efficient, bi-directional battery converter.

Conversion efficiency is even more important in this application than with PV inverters because two power conversions are required: rectifying or charging the DC batteries from the AC grid; and inverting or discharging power to the AC grid from the DC batteries. The battery converter efficiency is particularly important at relatively low-power levels. PV inverters typically operate at 50% to 75% of rated power for five or six hours per day; whereas, battery storage systems often operate at about 10% of rated power for 24 hours per day. As a result, the 10% rated power efficiency is the most important efficiency specification.

Though conversion efficiency is critical to battery storage systems, battery chemistries also need close scrutiny. Traditional lead-acid chemistries are seeing increased competition from lithium-ion and from other battery chemistries, which reduce kilowatt-hour costs by increasing the number of battery cycles supported. Significant capital investments for EV lithium-ion batteries can be leveraged for grid storage applications if the storage system can use standard EV battery packs. Lithium-ion batteries also have zero maintenance requirements, and can be easily sited in commercial environments without the burdensome requirements of some other battery chemistries.

Distributed PV systems reduce kilowatt-hour energy charges, while battery storage systems can reduce kilowatt peak demand charges. By combining distributed commercial-scale PV generation and battery storage, commercial-scale energy users can leverage the benefits of both technologies, creating more economic value together, than by using each system individually or not at all.

Paul Bundschuh is the CEO of Ideal Power Converters.

Ideal Power Converters | www.idealpowerconverters.com

PV and battery storage combined

There is strong market demand for combined PV and battery systems, and ongoing research to further improve cost and efficiency of power conversion solutions for these hybrid systems. One example of new technology being developed combines the functionality of a PV inverter and battery converter together in a single-stage, three-port power converter. This option offers two independent DC ports, transferring power between any of the three ports in any mix, which provides an efficient alternative to AC grid-tied or DC bus-tied hybrid systems.

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Distributed Energy Storage Benefits on both sides of the meter

By Doug Staker

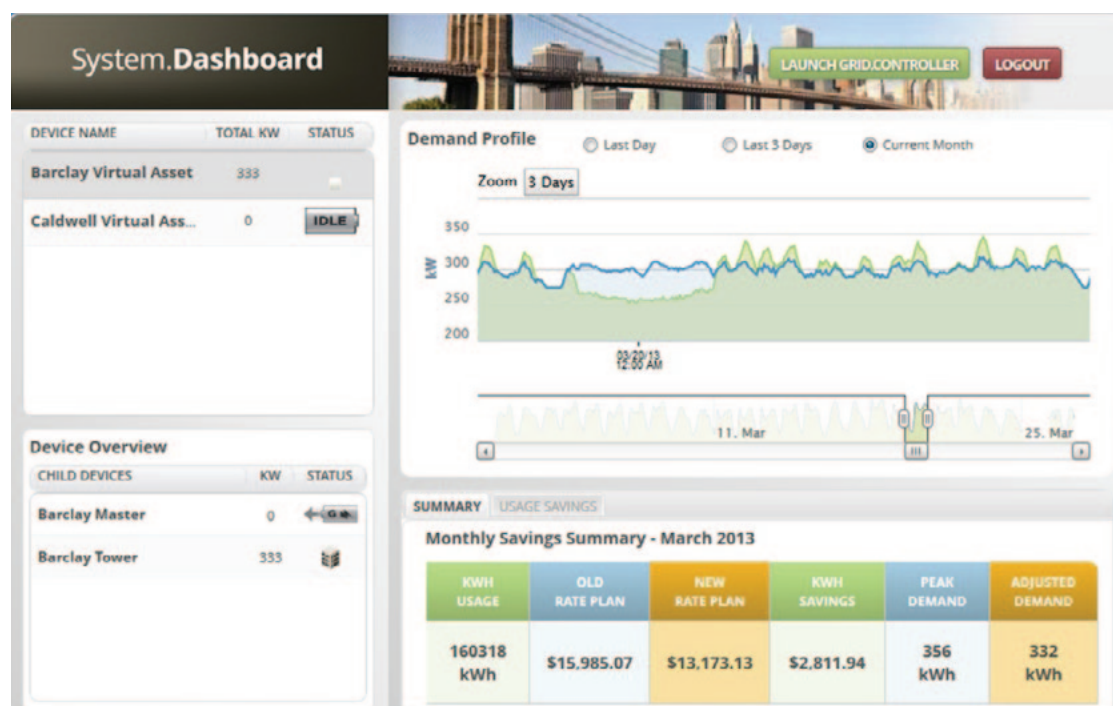


Figure 1. This energy management dashboard shows the time-shifting effect of increasing demand at night-time (blue shaded area), and capping demand peaks during the day.

SOLAR AND WIND ARE EXCELLENT SOURCES of clean, renewable energy, but as they contribute a larger share to the generation fleet, their integration will become increasingly challenging. The reason: solar and wind cannot be dispatched in the same way other sources of energy are, such as nuclear, hydro, and fossil fuels. Because the grid must operate “just in time,” with generation continually matching demand to maintain stability, special accommodation is required to efficiently integrate a significant contribution from the sun or the wind. Their intermittent production and tendency to produce peak power during periods, don’t always align nicely with peak demand times.

Battery storage has long been recognized as a way to integrate more solar and wind energy into the grid. Deploying intelligent energy storage at the very edge of the grid, where energy is consumed, creates some compelling benefits on both sides of the meter. The benefits of such distributed energy storage (DES) derive from its ability to create and reduce demand by consuming and generating power, respectively. In effect, this makes demand dispatchable by enabling it to be increased or decreased as desired to accommodate changing grid conditions. And, by making demand more dispatchable, it also becomes easier to integrate at higher penetration levels of solar and wind generation.

Customer gains

Figure 1 shows how a commercial customer time-shifts demand by increasing “demand” at night to charge the batteries (in this case, preferably using wind energy), and then “generates” electricity to reduce peaks in demand throughout the day.

The benefits of DES to the customer can be considerable. The ability to time-shift demand enables commercial and industrial (C&I) customers to cap demand charges during the day, and take full advantage of reduced time-of-use rates at night. Under most rate structures, C&I customers are able to achieve a payback of the investment in a DES system in five to seven years. The payback can be even shorter if solar energy is integrated, or by participating in the local utility’s demand response program, which DES facilitates in a less disruptive manner.

DES also makes it easier to integrate onsite solar generation by accommodating periodic spikes in demand and passing clouds with less disruption to the customer, and more stability for the grid. Depending on the capacity and capabilities of the onsite solar and DES systems (potentially as part of a microgrid), the customer should be able to survive a power outage, again with little or no disruption to operations.

The utility side of the meter

There’s equal benefit from distributed energy storage on the other side of the meter for all utilities that generate, transmit, and/or distribute electricity. DES is beneficial for wind generation because these power plants are most often located away from the hub of a city, in sparsely populated rural settings, where winds happen to blow the strongest. However, transmission to distant population centers is required. But, the real problem involves the temperament of the wind, which often tends to peak in the evening, when energy demands are relatively low.

The Renewable Energy Certificate (REC) market allows wind producers to earn credits only for power actually put onto the grid. For this reason, producers often find it necessary to pay other generation resources to ramp or shutdown during periods of low demand (such as at night) to qualify for the production credit. In the spring of 2010, for example, the cost of getting other resources to go offline went as high as 10¢/kilowatt-hour.

The intermittency of wind and solar requires other generation resources to step in and support grid stability during a drop in wind speed or a lack of sunshine on a cloudy day. For small levels of penetration, such intermittency is easy to accommodate. For larger levels of renewable integration, however, this is a problem. Integrating energy storage with distributed solar installations enables the batteries to act as a buffer, ensuring a constant and dispatchable power output from the PV system. Traditional baseload and peaker plants will benefit from the demand-leveling effect of DES with a reduction in start-ups and ramping rates, resulting in reduced equipment wear, fuel use, and emissions.

Similar benefits accrue to transmission and distribution utilities, based on more efficient utilization of the existing transmission and distribution (T&D) infrastructure. I2R losses are minimized with the ability to transmit and distribute power during periods of low demand. DES also makes C&I customers more likely to participate in demand response programs, and reduce power consumption even more during DR events. Changes, including growth in distributed generation and the adoption of electric vehicles (EVs), become less threatening to grid stability. DES systems can also be operated to enhance grid stability by providing ancillary services, such as frequency and voltage support, as well as power factor correction.

By increasing the utilization of existing T&D infrastructure, utilities will be able to postpone and possibly avoid a costly expansion or upgrade as demand grows and renewable generation increases. Finally, North America (and the entire planet for that matter) stand to benefit from greater use of clean, renewable sources of energy that are integrated into a more stable and reliable electric grid. DES can even help society achieve another important objective: energy independence from greater use of EVs—charged, of course, with clean solar and wind energy.

Conclusion

As the contribution of solar and wind generation increases to 20% or more, as it likely will under Renewable Portfolio Standard mandates, the deployment of distributed energy storage at the edge of the grid affords an opportunity to make this clean energy more dispatchable and firm. Indeed, by delivering benefits on both sides of the meter, DES has the potential to transform the way electricity is generated, transmitted, distributed, and consumed. It is for this reason that utilities should be providing incentives for their C&I customers to deploy intelligent distributed storage from renewable sources.

Doug Staker is VP of Business Development & International Sales at Demand Energy, with a total of over 25 years of experience developing new technology solutions for the global utility markets.

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Overcoming Challenges Technology & concentrated solar power

By Barinder Lalria

THE RELATIVELY NEW TECHNOLOGY known as concentrated solar power (CSP) holds much promise for countries with plenty of sunshine and clear skies. CSP plants produce electric power by converting the sun's energy into high-temperature heat, using a configuration of lenses or mirrors. Unlike photovoltaic (PV) systems, which use photon energy from the sun, CSP systems use solar energy as a thermal heat source. Their output nicely matches the shifting daily demands for electricity, particularly in places where air-conditioning systems are widespread. When backed up by a thermal storage capability, CSP offers electricity that can be dispatched when required, enabling it to be used 24 hours per day.

There are four main technologies in use today that collectively make up CSP:

1. Power tower;
2. Sterling engine;
3. Solar trough; and
4. Linear Fresnel reflector.

Solar troughs collect the sun's energy using long, parabolic mirror collectors (whereas linear Fresnel reflectors use long, thin segments of mirrors). Solar trough fields consist of a large array of these modular collectors and, to date, they dominate in numbers.

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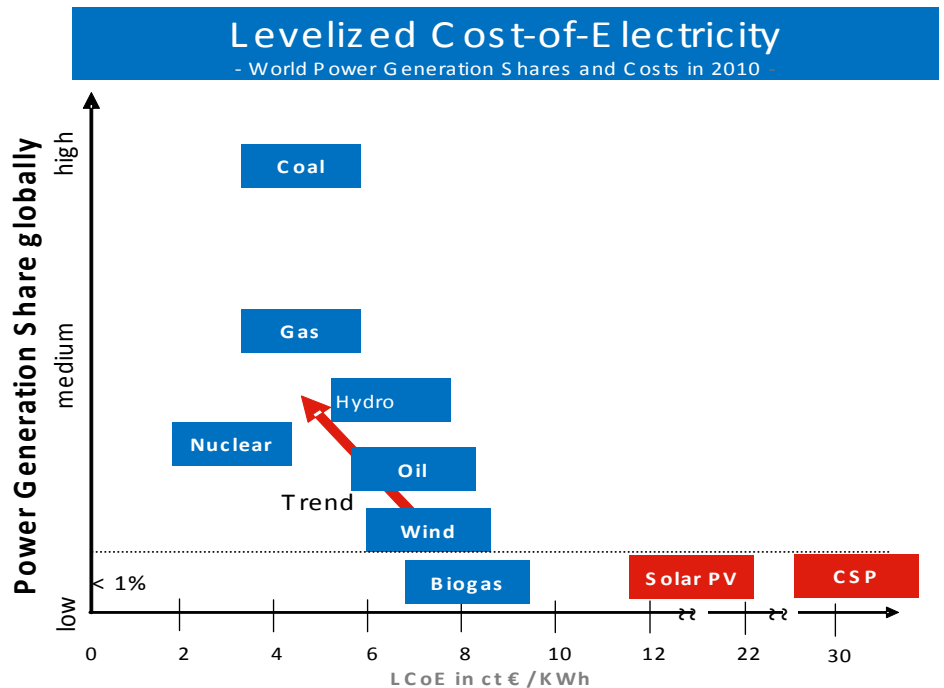


Figure 1.

There are far more of these power plants constructed than any other technology, at least throughout the United States and in Spain. However, the forecasts indicate that power tower is expected to grow at a faster rate than the other technologies over the next three or four years. Power tower makes use of a heat-transfer fluid (either water/steam or molten nitrates salt), which is heated in a receiver to generate steam, and then is used in a conventional turbine generator to produce electricity.

Ideally, within a decade, CSP will be able to compete with coal plants that emit high levels of CO₂. Moreover, the sunniest regions (such as North Africa) might be able to export surplus solar electricity to neighboring regions (such as Europe), where demand for electricity from renewable sources is strong. Ongoing research in CSP is allowing newer innovations, such as the sterling engine, which can replace the parabolic dish in some of these plants (dish Stirling tends to be more suited to off-grid or highly distributed power generation).

Nevertheless, the cost of entry for CSP is still prohibitive when compared to transitional electricity generating methods. And, this holds true even compared to more mature renewable technologies, such as wind power. This is due to the installation, operating, and maintenance costs of running CSP plants. Pricy generating costs, or the Levelized Cost of Energy (LCOE), could be considered the primary challenge concentrated solar plants must overcome.

Developmental difficulties

Aside from LCOE, other challenges exist as well, and can stand in the way of a potential CSP project. Economics, technology development, supply, construction, operation, and sustainability should all be considered as follows...

1. Economics. Understanding the economics of solar power is fundamental to a successful project. Considering the cost drivers of solar power in comparison to the cost distribution between collector, receiver, turbine, and balance of plant (BoP) is key. Planning a successful solar strategy requires a detailed understanding of these expenses and revenue drivers, and includes the dispatch-ability of CSP power. Often times, price will be the primary barrier of a CSP project.

2. Technology development. From the initial design to the final engineering, technology development should be managed on a broad range of indicators—and not just based on costs alone. Risk can be assumed, but must be rigorously managed for success. Winners in this sector will be the project owners who protect their technology, handle intellectual property (IP) with a developed IP strategy, and work well with third parties. Capturing the requirements and joining the development process together from beginning through to verification and validation is critical; otherwise, a CSP project likely won't deliver on its promises.

3. Supply. Running a robust tender process is vital for all solar projects, and especially for concentrated solar ones. Assembly and supply partners should be considered, herein. The process should be designed to manage risk by assessing tenders on a range of factors. Long-term demand, for instance, is an element within this process. Project pipeline and forecast volume projections can, and should, be used to help support drive, and a fact-

based negotiation strategy is imperative. Additional factors include: the type of relationships desired for a project (whether it be a partner or someone at arm's length); ensuring all non-disclosure agreements (NDAs) are in place, and are enforceable; identifying higher risk items that may drive dual sourcing decisions; and making sure engineering teams have commercial design skills in-house, or can partner to get them.

4. Construction. Construction projects have a number of understood risks, but there are a few that are critical for driving down the risks and costs in solar energy projects. Renewable plant construction is made complicated by the size of the "volume" components, so it's important to develop a cost-effective assembly strategy and to optimize construction sequencing. Heliostat assembly is often required at the site, for example, along with the related facilities that are necessary. In the case of CSP heliostats, assembly is also made difficult in the field due to the physical size and high-tolerance requirements.

5. Operation. Integrating the operation and maintenance (O&M) team into the design process as early as possible is vital to a successful project. This helps with any challenges related to the maintenance procedures, the project's health and safety, and the life testing of all critical parts. Other considerations include field calibration and optimizing field spares.

6. Sustainability. As it is, CSP faces challenges in technology and capacity road blocks, including never-before-seen high-value, high-volume commodities. Therefore, growing the capability and competence base—in terms of manufacturing and technology capability, as well as human capital—is fundamental in building CSP into a commercially sustainable industry. Over time, providing a development pathway from subcontracting/manufacturing provision, through to research and development (R&D), and established suppliers, can provide high, value-added solutions. The implementation of knowledge-transfer processes and an educational system will help aid sector maturity.

Coming of age

Concentrated solar power holds great potential for the future. Its scale can provide volume leverage to bring prices down. Plus, with new, molten salt storage technologies, it's now possible to generate power when the sun goes down—technically breaking one of the previous laws of solar power. However, its ascent is not without challenges, particularly when it comes to costs.

The good news is that the emerging existence CSP plants around the world

suggest that these challenges can be successfully overcome. The technical advances being made today are allowing larger plants to be constructed. Plus, borrowing tips from other sectors, (such as using the approaches and tools developed for high-volume production in the automotive sector) is also driving progress in many areas of CSP, especially in professional strategic sourcing,

supplier development, and supply chain integration. The future of CSP remains promising.

Barinder Lalria is a renewable energy expert at PA Consulting Group.

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Technology Upgrades Combined photovoltaic-thermal modules

By Sean Furlow & Marie Rauscher



A Combined Heat and Power (CHP) PV-Therm module

When French scientist Edmond Becquerel discovered the photovoltaic effect in 1839—creating voltage or electricity from emitted light—little did he know, or even imagine, the inventions and developments that would follow. Almost two centuries after Becquerel’s discovery, solar PV technology has advanced to include an installation on the International Space Station.

As research and real-world performance demonstrates, however, PV technology has met successes and challenges over time. One drawback of the conventional photovoltaic module is that once the surface temperature of the glass laminate starts to rise, the module’s ability and efficiency in producing power begins to decline.

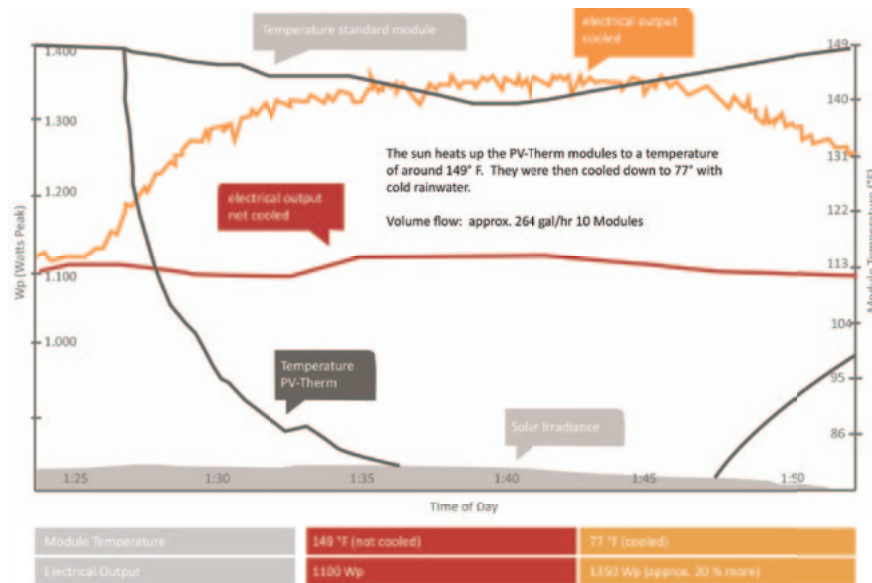
In fact, for every degree above 77° F (25° C), efficiency of a module declines by 0.5%. If the surface temperature rises high enough, a module will completely stop producing electricity.

Beyond rising temperatures

In an attempt to overcome increases in temperatures and its limiting effect on solar modules, engineers have developed a module that incorporates liquid cooling capabilities. By circulating liquid across the back of the module laminate, heat from the surface of the module is transferred to the liquid and transported away. This circulation ensures maximum output by not only counteracting the sharp fall of voltage, but also by counteracting the significant loss of power that occurs when crystalline modules face higher cell temperatures.

The resulting combined photovoltaic-thermal (PV-T) module represents a major leap forward in the evolution of solar energy, allowing for the capture and utilization of more of the sun’s energy. On a summer day, the temperature behind a conventional PV module can exceed 180° F (82° C), resulting in a 25% to 30% drop in electrical output. PV-T essentially extracts heat from the PV portion of the module, raising the module output dramatically, while simultaneously providing useful thermal energy.

As can be seen in Figure 1, the increase in output of a module is a fairly substantial once cooling is initiated. Cell efficiency can increase up to 30%, and overall electrical output is up to four times greater than a conventional photovoltaic module. And, much like conventional PV systems, PV-T systems use direct and indirect sunlight; therefore, they can be installed in any climate zone.



A working model

Advantages to the combine PV-T system are many, and include:

- **Production of thermal energy.** Including the availability of significant amounts of “free” thermal energy.

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- **Increased life expectancy of the module.** By cooling and holding a module at a more constant temperature, it isn't subjected to harsh up-and-down temperature cycles.
- **Better space utilization.** The combination of higher output and higher efficiency means better utilization of limited roof or rack space, allowing for more modules to be installed with fewer installation costs.
- **A cooler roof surface.** Extracting heat from the back of a module lowers a building's cooling load during the summer months and extends the life of the roof.

An additional benefit to this system is that once the thermal energy has been captured in the circulating liquid, this energy can be transferred into various other energy systems—simply and directly (such as the heating of hot water through a heat exchanger in a water tank). Furthermore, the energy can be used to create heating and cooling through adsorption technologies and drying operations.

This technology is equally suited for all climate zones, including those zones in which the potential for ice and snow build-up have long been reasons not to utilize solar power. The captured and stored heat can be used to melt off the snow from the module by simply reversing the flow of the liquid. In climate zones where the modules face very high ambient and glass surface temperatures, the cooling effect will keep modules at optimum energy production temperatures, extending the life expectancy of the modules.

Conclusion

Though we've come a long way since the days of Edmond Becquerel, it is very much to his credit as the researchers and engineers of today are still working with his initial scientific discovery. Newer challenges might have arisen related to photovoltaics, as we attempt to maximize their efficiency and generating power, but the PV effect is now allowing many to benefit from the renewable power of the sun. The combination module PV – Therm was developed to counteract the sharp fall of voltage and the significant loss of power of crystalline PV modules, when faced with higher solar cell temperatures.

As energy costs soar and the environment faces an uncertain future, protecting the global climate has become one of the greatest challenges facing modern society. Through a combination of past research and

findings, and future solutions and technologies, we might one day find ourselves progressing full-speed ahead to a healthy, energy efficient climate.

Established in 2009, Solarzentrum North America (SZNA) started with distribution and installation of PV-Therm modules. Since March 2013, they've also established manufacturing operations in the US.

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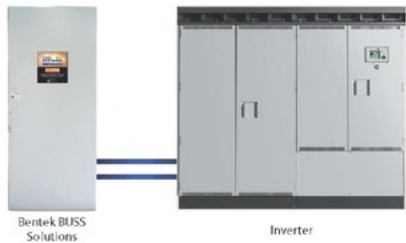


www.mkbattery.com

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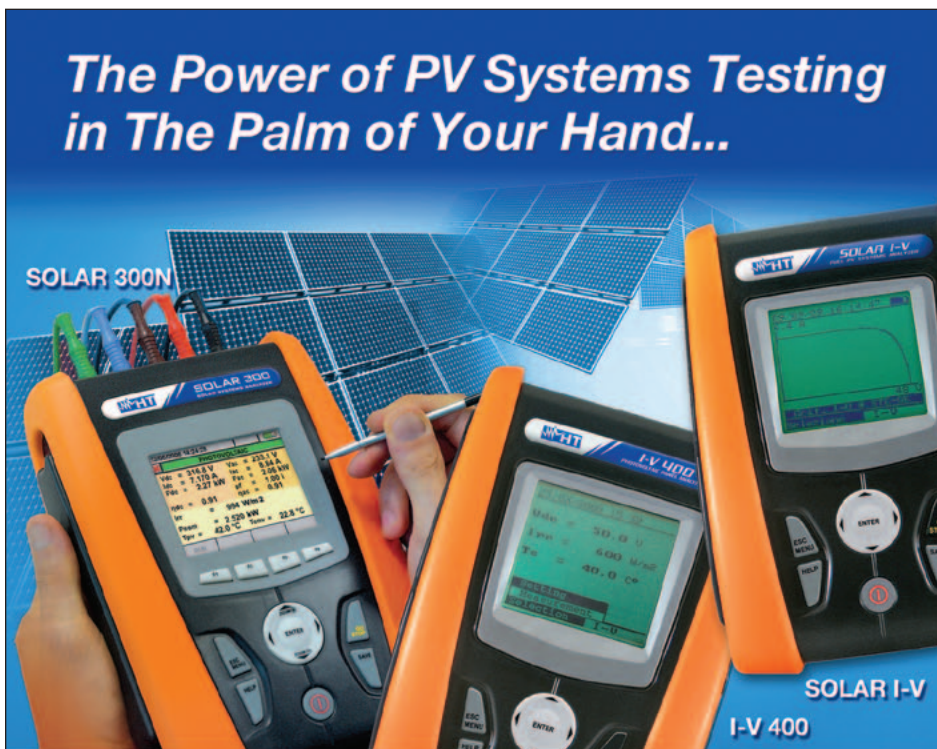




Utility-scale breaker

Bentek Solar, a designer and manufacturer of PV products connecting panels to inverters for the commercial and utility-scale marketplaces, announces that it has begun shipping its new Breaker Universal Safety System (BUSS). Designed to work with almost any inverter, Bentek BUSS is highly configurable, allowing up to 14 1000VDC 100%-rated circuit breakers that provide over-current protection, along with NEC 2011 compliant individual disconnects and zone current monitoring. The common output BUSSbar connects to virtually any inverter input bus bar. Available in grounded and ungrounded versions, the BUSS allows designers to standardize on PV designs independently of the DC inputs in the inverter.

Bentek | www.benteksolar.com



The new HT line of portable test instruments for PV system efficiency and I-V curve trace analysis are ideal for module manufacturers, PV system installers and test labs alike, for both laboratory and in field PV module-string and end to end PV system performance testing.

- I-V Curve Trace Meters
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All-in-one thermal storage & water heater

Designed to provide a simple, cost-effective means of integrating solar energy into any application, Lochinvar's Strato-Therm+ offers the functionality of a solar thermal storage tank, indirect water heater, and hydronic buffer tank in a single, space-saving unit. Equipped with a solar heat exchanger connected to the storage vessel, and a corrugated stainless steel coil within the tank, the advanced new Strato-Therm+ maximizes heat transfer in a solar thermal system and increases collector performance. In addition, Lochinvar's new Thermal-Stor offers the same characteristics as the Strato-Therm+, but without the stainless steel coil. This makes it an ideal fit for solar thermal applications with an emphasis on hydronic space heating.

Lochinvar | www.lochinvar.com



Central inverters

Schneider Electric introduces the Conext Core XC-NA Series. This is a new line of highly efficient central inverters based on the existing XC inverter platform. The Conext Core

XC-NA Series is UL listed (pending) to 1,000 Vdc, and comes with integral AC and DC switchgear that meets the requirements of NEC 690.17. In addition, the Conext Core XC-NA has an integrated DC combiner with a variety of fuse and monitoring options. It also includes a ground-fault detection system to help reduce hazards from PV array blind spots. The Conext Core XC-NA is NEMA 3R rated for outdoor applications, and can be part of a skid-mounted or PV box solution.

Schneider Electric

www.schneider-electric.com/us



Solar charge controller

Steca Elektronik has added further functions to the established solar charge controller Tarom 4545, allowing for more flexibility in use. This further development—designed for any PV application, even in telecommunication systems or hybrid PV systems—will then be available in 12 V, 24 V, and 48 V versions, with an initial capacity of 45 A. Among other features, the device has a new, backlit graphical LCD display, which sets new standards for the off-grid market. In addition to dawn, nighttime, and evening lighting functions, this development also offers time-based switching and two freely programmable switching contacts. Moreover, the Tarom offers an attractive designer housing and compact form, making installation easier. Overall, the solar charge controller is a highly flexible device that adapts to the specific demands of an off-grid system.

Steca Elektronik | www.stecasolar.com

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



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Renewable energy batteries

OutBack's EnergyCell RE Valve Regulated Lead Acid (VRLA) battery is designed for high-power density and renewable energy cycling applications. Absorbed Glass Mat (AGM) technology provides for efficient gas recombination of up to 99%, and freedom from tedious electrolyte maintenance. Features include: high-density pasted plates for a high cycle life; high recharge efficiency; front terminal access design for ease-of-installation and maintenance; thermally welded case-to-cover bond to eliminate leakage; and lead-calcium, tin-alloy plates for a long life in cycling and float applications.

OutBack Power | www.outbackpower.com



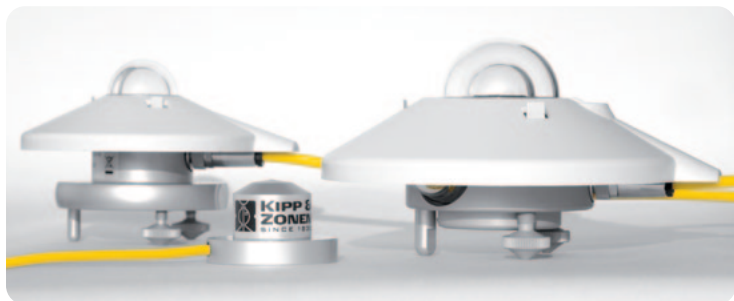
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Kipp & Zonen USA Inc.
125 Wilbur Place
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USA

Rodney Esposito
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M: +1 (0) 631 786 1558
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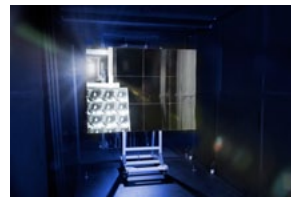
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Solar simulator for CPV modules

After nearly two years of research, experts from TÜV Rheinland in Germany and TÜV Rheinland Photovoltaic Testing Laboratory (PTL) in Arizona have developed a new solar simulator for characterizing concentrator photovoltaic (CPV) modules. The new simulator allows for more precise comparison measurements on CPV modules designed for commercial use because it generates and maintains the standard temperature condition of 77° F (25° C) under the laboratory conditions.

In the simulator, compact, high-intensity xenon lamps are positioned in the focal plane of a parabolic mirror. The light reflected by the mirror is just as parallel as the light from the solar disk onto the earth. The new flash solar simulator shortens the process for the comprehensive design certification and qualification of CPV modules, according to IEC 62108. The performance measurements required for the qualification can be performed more quickly and with higher repeatability. The flash solar simulator can also be used for measuring characteristic curves of concentrator solar cells under the high-light intensity to determine conditions for their maximum performance.

TÜV Rheinland PTL | www.tuv.com/us/ptl



Solar thermal water heating system

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

Stiebel Eltron
www.stiebel-eltron-usa.com



Watering system for flooded batteries

Trojan Battery Co. has launched a single-point battery watering system for its line of flooded batteries for renewable energy and backup power applications. The new watering system makes maintenance of Trojan's deep-cycle flooded batteries faster, easier, and safer. The single-point watering kit is designed to take the guesswork and mess out of properly watering flooded batteries. The flexible tube routing allows the watering system to work with various battery bank sizes and configurations. It also features an automatic valve shutoff to control the electrolyte level within each cell, which prevents overwatering. Additionally, the kit enables users to fill their deep-cycle batteries without having to remove the vent covers, an important safety feature which reduces the chance for contact with the battery's electrolyte. The single-point watering kit comes in three configurations to fit 12V, 24V, and 48V battery models.

Trojan Battery Company
www.trojanbatteryre.com



Corrosion-resistant fasteners

In addition to the features of all DURA-CON corrosion-resistant fasteners, the updated Power Lag 2.0 is equipped with a Type 17 Auger Point tip, and a serrated flange under the hex head, eliminating the need for a separate washer. Providing resistance to loosening from vibration, the optimum thread angle increases pullout strength. The 5/16" x 3-1/2" size is used for anchoring solar racking in residential systems. DURA-CON corrosion-resistant fasteners provide the extra strength of heat-treated alloy and greater resistance to environmental corrosion, while avoiding galvanic reaction with aluminum racking materials. Mudge Fasteners believes the Power Lag is quickly replacing the stainless steel lagbolt as the preferred fastener for installing PV racking systems.

Mudge Fasteners, Inc.
www.mudgefasteners.com



Solar grounding solution

ILSCO's new SGB-5 solar grounding connector features a raised, lay-in wire way to accommodate various racking systems. The patent-pending clamp design eliminates the need to drill mounting holes into the frame and saves installation time. The connector is UL 467 Listed and CSA Certified for use with copper or aluminum conductor.

ILSCO | www.ilsco.com



WHEN FAILURE IS NOT AN OPTION.



Generation modules

Hanwha SolarOne Co. Ltd. announced the global launch of its new generation modules, the HSL Series. Compared to previous generation modules, these offer a smaller, lighter design, with higher power output and enhanced durability. New features include anti-PID (potential induced degradation) technology, anti-salt mist corrosion, and an increased capacity for snow and wind loads—30% greater protection against snow and 65% better wind resistance, withstanding a snow load of up to 7000pa and a wind load of up to 4000pa. Approximately two percent smaller than the previous generation, these modules also yield a higher average module efficiency of two percent. Hanwha SolarOne's HSL Series is built for utility, commercial, and residential applications. HSL60 Poly and HSL72 Poly are the first among HSL Series modules to have passed the stringent TUV Rheinland PID test.

Hanwha SolarOne Co. Ltd.
www.hanwha-solarone.com

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Switched combiners

Diversified industrial manufacturer Eaton has expanded its line of switched combiners with new solutions for utility-scale PV solar applications. The new, 1000-volt (V), direct-current (DC) switched combiners incorporate the function of a solar combiner box and separate disconnect—providing a visible means of disconnect and fuse protection in a single, convenient enclosure for enhanced safety and simplified installation.

The 1000 V DC switched combiner solutions facilitate the combination of multiple inputs from a solar array into a single output, offering a single-point location to safely isolate the DC side of a PV system closer to the modules. The switched combiner design meets the intent of the National Electrical Code (NEC) 690.16(B), providing the ability to disconnect all sources from the fuse holders so that the fuses can be serviced.

Eaton

www.eaton.com/switchedcombiners



Field assembly connectors

Cost pressure in the photovoltaic industry is increasing. That's why Yamaichi Electronics has developed another connector version for 4-to-6 mm² cable cross-sections, which extends their successful Y-Sol4 F.A.T. product line. The Y-Sol4 F.A.T. has a spring clamping mechanism for simple clamping of stripped cable in the field. This permits quick, effective assembly, without crimping. The new versions of the Y-Sol4 F.A.T. are specifically suited for thin wire outer diameters of 4.5 mm to 6.1 mm. Thin wires tend to be more popular in PV installations because they're more cost-effective due to the material savings. The existing versions continue to cover the range of larger cable diameters from 6.1 mm to 7.6 mm. Plus, versions are now also available in the product line for cable cross-sections from 1.5 mm² to 3.5 mm² for thin-film installations. All the new versions are based on the familiar concept of tool-free field assembly.

Yamaichi Electronics | www.yamaichi.eu

WWW.ADVANCEDPOWERPRODUCTS.COM



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Temperature controller

MKS Instruments, Inc. introduces the MultiTherm 1000 temperature controller, an all-in-one solution for solar equipment. It features 16 precision sensor input channels, accepting RTDs and thermocouples, and provides 16 PWM output channels with built-in SSRs for up to 2A, 220VAC. The built-in PID makes the unit ideal for dynamic control applications where extreme temperature stability is required. The MultiTherm 1000 is offered with EtherCAT connectivity to provide high-speed data exchange, and seamless integration into an EtherCAT network. In addition, MultiTherm features heater diagnostics, which provide an alarm for heater failure or degradation to reduce the chance of costly process damage. Its safety interlocks allow the integration of over-temperature and EMO switches into the system. Its heater power routing with internal fusing is a cost-reducing feature that eliminates the need for additional hardware.

MKS Instruments, Inc.

www.mksinst.com



Solar panel clip

Made of heat-stabilized, weather- and ultraviolet-resistant nylon, the new Ty-Rap 90-Degree Solar Panel Clips from Thomas & Betts install quickly without tools, holding up to four cables perpendicular to the panel frame. The patent-pending design provides quick and easy installation, requiring no drilling or mounting bases. Fitting most module frames, a sliding capability along the length of the frame enables installers to increase tension on cables to eliminate sagging beneath PV modules. Ty-Rap 90-Degree Solar Panel Clips also allow for the addition and removal of cables as needed, without cutting and replacing cable ties. Moreover, as Ty-Rap 90-Degree Solar Panel Clips are constructed of polyamide 6.6 nylon, they aren't metallic and don't require grounding. They fit frames that range in thickness from 0.060 inches to 0.120 inches, hold up to four no.10 AWG solar photovoltaic cables, and operate in temperatures from minus 40° F to 220° F (-40° C to 105° C).

Thomas & Betts Corporation

www.tnb.com



Universal PV kit

PV integrators have been attaching solar panels to standing-seam metal roofs with increasing frequency over the past two decades, due in large part to their compatible life expectancy. PV panels will perform reliably for about 30 years, which is 30% to 50% longer than the life expectancy of many roof materials. The life expectancy of a standing-seam metal roof, however, is 30+ years. S-5-PV Kit is a rail-free, DirectAttached solar panel installation assembly for metal roofs, making solar panel attachment is quick, easy, and cost-effective.

Recent improvements to the S-5-PV Kit include a universally directional, embossed, stainless steel mounting disk, with a module guide to make module placement easier. The mounting disk also features four under-disk hooks to help with wire management, and has strategically placed holes for zip-tie connections. The universal PV grab now also has broader ears, making installation easier and more precise, while the universal PV stud is longer to accommodate solar panel frame thicknesses from 32 mm to 64 mm. S-5-PV Kit mounting disk is ETL-1703 and UL 2703 listed for module-to-module conductivity, eliminating the need for expensive inter-module copper wires and lug bonding.

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



Glass-glass solar panels

SolarWorld recently introduced its Sunmodule Protect glass-glass solar panel. No heavier than a standard glass-film panel, the new product is protected by one of the industry's highest-value performance guarantees. In Sunmodule Protect solar panels, SolarWorld has substituted a panel's conventional backsheet with lightweight glass, so as to better shield energy-producing solar cells from the elements. Even with a second pane of glass, Sunmodule Protect solar panels remain light, at about 46 pounds, comparable to glass-film panels. In addition, they include the same sturdy aluminum frame used in Sunmodule Plus glass-film panels, so will still work with all of the line's approved mounting systems.

These advancements have allowed SolarWorld to extend its linear performance guarantee to 30 years, up from 25 years—offering only 0.35% percentage points in lower performance protection over each of the 30 years. This is currently one of the best performance guarantees available in the world solar market. Sunmodule Protect solar panels will debut in the second half of 2013.

SolarWorld AG | www.solarworld-usa.com



Inverter transformers

As part of CG's ongoing drive to continue to offer the highest reliability and best overall value in the industry, CG has announced the addition of the LHL 3-Winding to its popular line-up of CG SolarPAD series inverter transformers. The new LHL style winding allows for galvanic isolation of two inverters when connected to the same transformer, while still maintaining a high impedance between each inverter as required by many of the largest inverter manufacturers. The LHL style 3-winding offers similar performance to the industry proven 4-winding style, while offering the benefits of reduced complexity and cost, particularly for inverters one megawatt or smaller. Moreover, the typical SolarPAD is significantly smaller and lighter than a conventional substation. It's available in a wide range of kVA, voltages, ambient conditions, and colors to suit the particular requirements of the end user.

CG | www.cgglobal.com



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Flat-roof mounting system

Schletter introduces the Fix-EZ, a new PV mounting system for flat-roof applications. Wind tunnel tested with integrated grounding, the Fix-EZ offers seven or 15-degree, module-tilt options, and is engineered 100% IBC code compliant. Designed with multi-functional components, the system's integrated ballast blocks act as ballast weight, as well as a support mechanism. Module mounting rails support modules and perform as the system's windbreak, using Schletter's ETL Listed Rapid2+ clamps for bonding/grounding the modules to the rails.

Schletter | www.schletter.us

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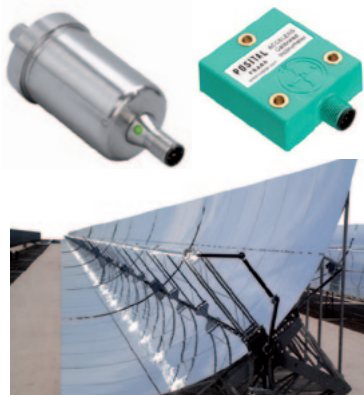
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ACPV system

Homeowners in search of flexible financing for their solar systems now have a product option that dramatically increases energy harvest and improves system uptime: ACPV systems. In a partnership with residential lease provider Sunnova, TrueAC module systems from ET Solar and SolarBridge Technologies will now be offered to Sunnova's residential lease customers.

Sunnova's decision to include TrueAC systems in their product portfolio signals a move by the solar leasing industry toward increasingly plug-and-play systems that reduce installation, as well as operations and maintenance (O&M) costs. Powered by SolarBridge microinverters, every ET AC module system comes equipped with a gateway device that provides module-level monitoring and cloud-to-cloud access of site performance for contractors, site owners, and leasing companies. This enhanced fleet visibility is ideal for solar lease providers, eager to reduce O&M costs and actively troubleshoot any performance gaps. The introduction of TrueAC systems to the leasing marketplace will enable even more homes to qualify for solar, since ACPV systems maximize energy harvest regardless of roof orientation or shading.

ET Solar Inc.

www.etsolar.com

SolarBridge Technologies

www.solarbridgetech.com

Sunnova

www.sunnova.com



Solar panel cleaner

Solarbrush is a robot designed to clean solar power systems, which maintains the efficiency and economy of solar cells. The robot is specifically engineered for use within aptly named "Sunbelt Countries," for those countries that are particularly sunny and dry. The device brushes residual dust and sand from the solar panels by following programmable patterns of movement.

Solarbrush avoids air and water pressure cleaning in favor of battery life, low maintenance, and cost. Since contamination restricts the operation of solar cells by 35%, effective cleaning of the modules contributes significantly to the effective operation of a solar power system. Currently, prototypes of the robot cleaner are being tested, and distribution partners acquired.

Solarbrush | www.solarbrush.de



Hybrid inverter

Fronius' new Hybrid Inverter provides a much-needed, flexible storage solution for PV systems. Any of the self-generated solar energy that cannot be used immediately can be stored in the Hybrid Inverter for use at a later time. This means, for example, that the green current can also be used during the night. Other key benefits include increased self-consumption and a greater independence in terms of energy supply. The power supply can also be maintained in the event of a grid failure. Moreover, the modular design allows memory flexibility and expansion, which means the battery can also be upgraded at a later stage. The system operator uses innovative communication channels, such as Web server, WLAN, and Ethernet to keep a constant eye on the performance of the PV system. This device will be available in 2014.

Fronius | www.fronius.com



Central solar inverter

AEG Power Solutions (AEG PS) has enhanced its product portfolio with an 880 kVA central solar inverter, the Protect PV.800. A new member of the Protect PV solar inverter family, the Protect PV.800 is able to support up to 1300 kWp, which extends AEG PS' existing range of products for multi-megawatt, utility-scale PV systems. In designing Protect PV.800, grid stability issues were taken into consideration, so the PV.800 offers improved features for the grid connection, such as stabilizing reactive power input in case of load peaks. Fault Ride Through (FRT) capabilities are configurable for voltages and current, and field programming solution allows for specific customization for all grid codes.

Designed for global use, the Protect PV.800 fulfills all requirements in compliance with relevant national standards and guidelines. As with the previous versions, it can also be integrated in the turnkey container solution, TKS-C 1600, enabling a total nominal AC output of 1600 kVA and connecting to a DC generation capacity of up to 2600 kWp.

AEG Power Solutions | www.aegps.com



Solar siting tool

Sun Number, LLC is making it easier, faster, and less expensive for solar companies to analyze the solar potential of properties and to close sales with customers, using a new tool developed with support from the Department of Energy's SunShot program. Utilizing high-resolution aerial data, advanced GIS technology, and proprietary algorithms, Sun Number produces instant analyses of the solar potential of residential and commercial building rooftops. With only a street address and a single click of a mouse, solar companies can immediately obtain information about a property's solar suitability that was previously only available if they sent an employee onsite for a lengthy, costly inspection. And, because of the high level of resolution and accuracy of the Sun Number data, there's little actual deviation in the final design after site audit, versus the remote design using the Sun Number service. Sun Number removes the uncertainty of the remote shade analysis process.

Sun Number, LLC | www.sunnumber.com



Dual-axis PV tracking system

Sfinkx Corporation announced it has launched its next-generation SolarTower, a dual-axis PV tracking system featuring an integrated solar array and bifacial solar modules. The dual-axis solar tracker is designed to maximize solar tracking performance, while reducing costs and operational risks for large, commercial and utility-scale solar power plants. The solar tracker system includes six, high-efficiency crystalline silicon PV modules, and uses a motor and GPS to turn the solar panels from east to west and up and down—ensuring the panels always follow the sun's elevation. Compared to a fixed array of the same production capacity, the Sfinkx solar tracker will produce up to 37% more electricity.

SolarTower is the first PV tracker to feature an Integrated Solar Array (ISA), a design solution that reduces the cost of balance of systems (BOS) and solar panels. It fully integrates the modules into the mounting structure, thereby eliminating the need for an aluminum frame, grounding wire, clips, and nuts or bolts. SolarTower also offers bifacial solar panels, dual-sided glass modules (G2G) that generate more electricity by converting direct, radiant, and scattered solar energy on the front and the backsides of the module.

Sfinkx Corporation | www.sfinkx.com



Wafer vacuum-handling system

Virtual Industries Inc., a supplier of manual vacuum handling solutions, announces the availability of its new WAFER-VAC system with 8" molded wafer tip (WV-9000-MW8). The WAFER-VAC is a general-purpose wafer vacuum-handling tool, which plugs directly into 110 Volt 50/60 Hz, and handles a wide variety of wafers, solar cells, and other substrates. The long-life diaphragm vacuum pump generates up to 10" of mercury with an open airflow of 2.3 lpm. The unit connects to ground automatically with a three-wire power cord. Plus, the WV-9000 is Class 100 Cleanroom safe, and comes standard with long-life pump and push-button wafer tip pen (VWP-500-2.5 mm) Additionally, it has a footprint of 7-1/4" x 3" x 2-1/2", and comes with six feet of clear-coiled vacuum hose.

Virtual Industries Inc. | www.virtual-ii.com

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Product Spotlight: Solar Racking

A highlight of some of the latest Racking Systems available in the solar industry.



Unirac, Inc.

SEE AD IN THIS ISSUE ON PAGE 31

Product: Utility Ground Mount (UGM)

Application (roof, ground-mount, utility-scale): Custom-designed ground-mount, which is unique to each customer's module and site conditions

Type: Fixed

Material: Galvanized steel

Pre- or Post-assembly? Pre-assembled components (top chord; large/small clip; module rows)

Certifications/Approvals: ISO 9001:2008 for QMS and ISO 14001:2004 for EMS and OHSAS 18001:2007

Warranty: 20-year structural performance warranty

Key features:

- Parallel assembly and pre-panelization;
- Ultimate field adjustability;
- Fast "Shot Pin" connections; and
- Table to string size compatibility.

Website: www.unirac.com



AP Alternatives

SEE AD IN THIS ISSUE ON PAGE 43

Product: APA Ground Mount Racking

Application (roof, ground-mount, utility-scale): Utility-scale, ground-mount

Type: Fixed

Angle: Site-specific, 0° up to 35°

Material: Galvanized steel

Pre- or Post-assembly? Pre-assembly

Certifications/Approvals: PE Certified in every state

Warranty: 20 years

Key features:

- Racking systems are pre-assembled at the factory, and modules are pre-panelized onto racks before being shipped;
- During pre-assembly, modules are pre-grounded to the racking;
- Installation is extremely efficient, with post/racking/modules installed at a rate of one megawatt per week with 18 labors; and
- APA offers a full Turnkey Racking Installation package.

Website: www.apalternatives.com

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 www.daetwylerce.com



Opsun Systems Inc.

Product: SunRail Universal

Application (roof, ground-mount, utility-scale): Flat-roof; residential or commercial

Type: Fixed

Angle: 10°, 15°, 20°, 25°, and 30°

Material: Aluminum beam and clamp, with stainless hardware

Pre- or Post-assembly? Optional rail and clamp pre-assembly

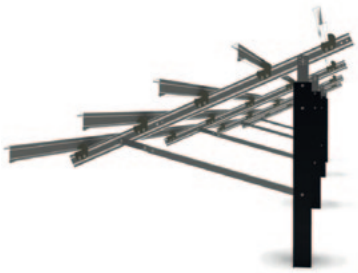
Certifications/Approvals: UL 2703

Warranty: 10 years

Key features:

- Variable pitch, height, and tilt angle;
- Quick-connect rail clamp, which greatly reduces installation time; and
- Easy roof maintenance with free access under the array.

Website: www.opsun.com



Schletter Inc.

Product: FS Uno

Application (roof, ground-mount, utility-scale): Affordable all-steel ground-mount solution

Type: Fixed

Angle: Custom-designed system

Material: Hot dip galvanized steel

Pre- or Post-assembly: Pre-assembled components

Warranty: 5-year limited warranty

SEE AD IN THIS ISSUE ON PAGE 41

Certifications/Approvals: IBC 2006, 2009 & ASCE 7-05. Wind tunnel tested and Schletter is ISO 9001:2008 certified.

Key features:

- Pre-fabricated for faster installation;
- Extended lifecycle of steel with no exposed edges;
- Full, in-house engineering services at no additional cost; and
- Increased distances between foundation supports, further reduces cost.

Website: www.schletter.us



DPW Solar

Product: Power Rail KTS Kick Tilt System

Application (roof, ground-mount, utility-scale): Roof-mount

Type: Fixed

Angle: Up to 25°

Material: Aluminum rail construction, with stainless steel module clamps and hardware

Pre- or Post-assembly? Post-assembly

Certifications/Approvals: None

Warranty: 10 years, but longer warranties are available

Key features:

- High strength with reliable design;
- Reduced installation time and costs;
- Flexible mounting options; and
- Single tool assembly.

Website: www.dpwsolar.com



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212-359-0205 or www.gamechangeracking.com

Product Spotlight: Solar Racking



Applied Energy Technologies (AET)

Product: RAYPORT · G—Utility Scale Ground Mount System

Application (roof, ground-mount, utility-scale): Utility-scale ground-mount system

Type: Fixed

Angle: 10° to 45°

Material: Galvanized steel

Pre- or Post-assembly? Seven pre-assembled parts

Certifications/Approvals: ETL Listed to UL2703 (pending)

Warranty: 10-year limited warranty

SEE AD IN THIS ISSUE ON PAGE 47

Key features:

- Fits all major solar modules;
- Currently the fastest system on the market to assemble;
- Unique quarter-turn, snap-in-place panel clamp installs anywhere along the rail; and
- Turnkey installation is available.

Website: www.aetenergy.com



Conergy

Product: SunTop IV

Application (roof, ground-mount, utility-scale): Flush-mount roof

Type: Fixed

Angle: 10° to 30° tilt units available

Material: Aluminum

Pre- or Post-assembly? Pre-assembled

Certifications/Approvals: Designed to comply with UL Subject 2703; CBC2010; IBC2009; Aluminum Design Manual 2005, ASCE 7-05; and conforms to all North American building codes.

Warranty: 10 Years

Key features:

- Module-specific rail lengths eliminate the need to cut rail (standard and heavy-duty profiles available, in black or mill finish);
- Common components for all rail types, as well as a lower total parts' count reduces the learning curve and simplifies inventory management;
- Pre-assembled components speed installation, reducing the number of loose parts on the roof; and
- New lower pricing.

Website: www.conergy.us



Wagner Solar Inc.

Product: TRIC F BOX

Application (roof, ground-mount, utility-scale): Flat-roof

Type: Fixed

Angle: 10°

Material: Allow AW 6063 aluminum

Pre- or Post-assembly: Assembled onsite

Certifications/Approvals: None

Warranty: 10-year

Key features:

- Low ballast; as little as 10 pounds per module;
- East/west installation allows for 96% roof utilization;
- Installs in portrait to maximize roof coverage; and
- Installs at a rate of seven minutes per kilowatt for first time installers, with only two tools needed.

Website: www.usa.wagner-solar.com





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Solar Mounting Systems



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EcolibriumSolar



Ecolibrium Solar

Product: Ecofoot2
Application (roof, ground-mount, utility-scale): Roof-mount
Type: Fixed
Angle: 4° to 12°
Material: ASA resin

Pre- or Post-assembly?
Pre-assembled
Certifications/Approvals:
PE Certified in every state
Warranty: 25 years

SEE AD IN THIS ISSUE ON PAGE 44

Key features:

- Ecofoot2 is the first injection molded mounting system;
- Lightweight, modular design includes only a few parts, easily installing around obstacles;

- Embraces EPDM on the bottom of the foot and facilitates a roof's natural drainage; and
- The mid-clamp provides integrated grounding, eliminating the need to run copper and grounding lugs and reducing the time spent on a roof.

Website: www.ecolibriumsolar.com



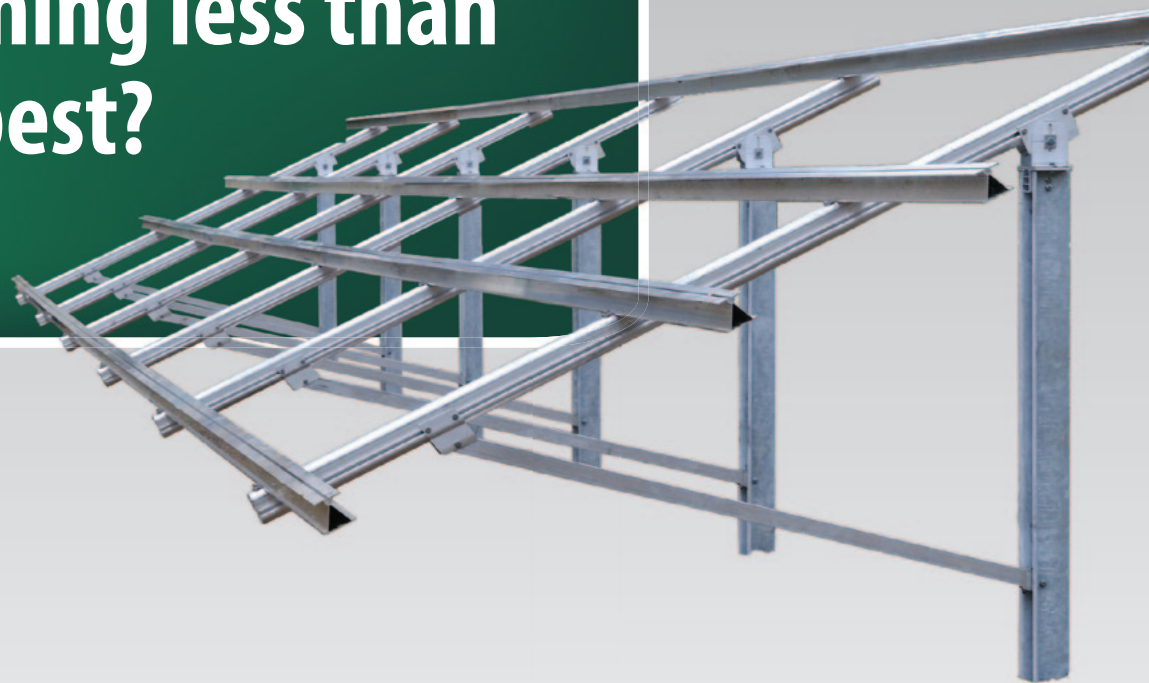
HatiCon Solar

Product: Pitched-roof System
Application (roof, ground-mount, utility-scale): Pitched-roof installation for residential to light commercial-scale
Type: Fixed
Angle: Up to 70° pitch
Material: Aluminum, with stainless steel hardware
Pre- or Post-assembly? Pre-assembled components
Certifications/Approvals: IBC 2006/2009; ASCE 7-05; Aluminum Design Manual 2005; AISC 13th Edition codes
Warranty: Standard 10-year warranty
Key features:

- Portrait or landscape orientations available;
- Onsite leveling capacity, with no fabrication;
- Click technology, universal module clamps; and
- A minimal parts' count.

Website: www.haticonsolar.com

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Companies invest a significant amount of time and money selecting the right PV module. So why would any less consideration go into selecting a mounting system, which is expected to safely secure module investments for decades to come?

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System solutions for any terrain, ETL Certified to UL 2703, 100% IBC Code

compliance, PE stamped drawings, a standard 10-year warranty—these are a few of the expectations Schletter is proud to be known for.

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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.

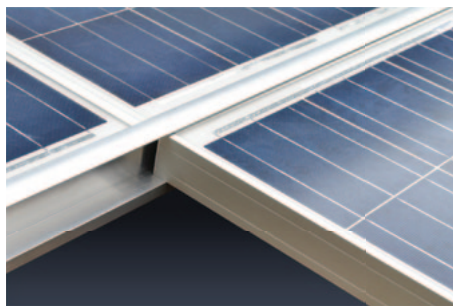
Next issue, we're highlighting Commercial inverters



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Product Spotlight: Solar Racking



Creotecc US

Product: CREOTERRA Ground Mount
Application (roof, ground-mount, utility-scale): Custom-designed ground-mount
Type: Fixed
Angle: 5° to 50°
Material: Aluminum rail, steel piles
Pre- or Post-assembly? Post-assembly
Certifications/Approvals: UL 2703 Recognized; P.E. Certified
Warranty: 10 years

SEE AD IN THIS ISSUE ON PAGE 49

Key features:

- Clampless module mounting results in: accelerated panelization, reduced stress on modules, and straight, even rows, with a gap-free appearance;
- Fully scalable from small, “garden” mounts to large, utility-scale arrays; and
- UL 2307 Recognized for bonding and grounding.

Website: www.creotecc.us



PV Racking

Product: Ground Solution
Application (roof, ground-mount, utility-scale): Ground-mount
Type: Fixed
Angle: Varies
Material: Galvanized steel and aluminum
Pre- or Post-assembly? Post-assembly
Certifications/Approvals: None
Warranty: 15-year limited warranty
Key features:

- A slide-in place system eliminates the need for clamps, significantly cutting down on installation time;
- No gaps between modules creates a clean, seamless array;
- Partial or complete installation available (depending on location); and
- A helical pier foundation is available.

Website: www.pvracking.us

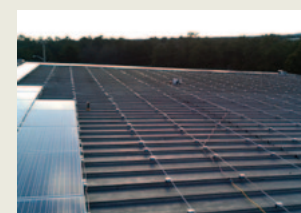


Brittmore Group LLC

Product: WaveRack PV Ground Mount
Application (roof, ground-mount, utility-scale): Utility-scale ground mount
Type: Fixed
Angle: 5° to 35°
Material: Galvanized steel
Pre- or Post-assembly? Pre-panelized module assemblies; factory configured tilt angle
Certifications/Approvals: Pending
Warranty: 10 years
Key features:

- Rapid rack assembly with no field adjustment;
- Pre-panelized frameless or framed modules;
- Automated panel delivery by robotic shuttles; and
- Populate entire arrays from one end with centralized logistics, so there's no heavy equipment between rows.

Website: www.brittmore.com



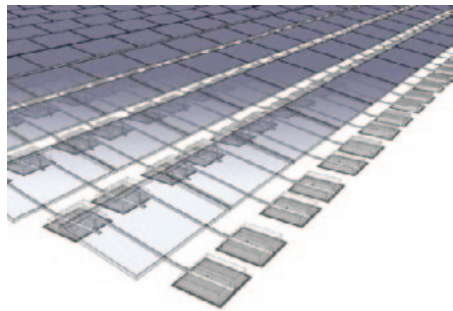
TRA Snow and Sun, Inc.

Product: EZ Solar Mount Clamp On
Application (roof, ground-mount, utility-scale): Custom-designed roof-mount, engineered for each customer's site
Type: Fixed
Angle: Flush to the roof, with the ability to attach angled frames on top of the clamp
Material: 3/16" steel
Pre- or Post-assembly? Pre-assembled
Certifications/Approvals: UL 2703 pending
Warranty: Exceeds industry standard; 25-year limited product warranty
Key features:

- Customized for a secure fit using a safe, reliable design that doesn't penetrate the panel;
- The under-the-hem clamping and bolting provides added strength, while maintaining a roof's warranty;
- Stainless steel grounding clip assures the system is grounded; and
- No rails are required.

Website: www.trasnowandsun.com





Zilla Corporation

Product: Zilla Cobra

Application (roof, ground-mount, utility-scale): Flat-roof ballasted

Type: Fixed

Angle: 10° in landscape orientation

Material: Aluminum rails, galvanized steel ballast pans, and stainless steel hardware

Pre- or Post-assembly: Post-assembly; a three-step installation process includes attaching rails to modules, connecting rails to rails, and installing ballast pans

SEE AD IN THIS ISSUE ON PAGE 46

Certifications/Approvals: Per AHJ and/or structural engineer

Warranty: 10-year limited product warranty, and 5-year limited finish warranty

Key features:

- Minimal number of modular components reduces labor costs;
- Lightweight materials significantly decreases shipping costs;
- Convenient packaging simplifies warehousing and staging; and
- The Cobra system is self-spacing, with no layout required.

Website: www.zillarac.com



Zep Solar, Inc.

Product: ZS Comp

Application (roof, ground-mount, utility-scale): Roof-mount

Type: Fixed

Angle: Scalable; ZS Comp is a flush-mount system, so the pitch of the modules will match the pitch of the roof

Material: Aluminum; stainless steel

Pre- or Post-assembly? Assembled onsite

Certifications/Approvals: Zep Compatible; ETL Listed; UL Listed

Warranty: 10 years for the structural components; 5 years for the anodized finish

Key features:

- Rail-free installation system;
- Auto-grounding connections;
- Rapid, drop-in module installation; and
- Quick and easy array leveling, with enhanced aesthetics.

Website: www.zepsolar.com



IronRidge

Product: IronRidge XRS Standard Rail

Application (roof, ground-mount, utility-scale): Roof-mount and ground-mount available

Type: Fixed

Angle: 0° to 45°

Material: Corrosion-resistant aluminum

Pre- or Post-assembly? Assembled onsite

Certifications/Approvals: PE Certified in most states

Warranty: 20-year manufacturer's warranty and a 10-year structural warranty

Key features:

- Currently offers the longest spans in the industry, with fewer roof attachments;
- Equipped with a full set of components for pitched-roof, flat-roof, and ground-mount options;
- Certified, and compatible with leading third-party roof attachments; and
- Web-based design tool and bill of material generator.

Website: www.ironridge.com

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GROUND MOUNT

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Off Site Pre-Panelization
Integrated Module Grounding
Interlocking System

ROOF MOUNT

Modular Design
Rapid Installation
Grounding Provisions
Interlocking System

Product Spotlight: Solar Racking



Daetwyler Clean Energy

Product: Modu-Rack

Application (roof, ground-mount, utility-scale): Ground-mount system with varying anchor options

Type: Fixed

Angle: Tilt ranges from 10° to 30°

Material: Galvanized steel

Pre- or Post-assembly? Modu-Rack allows for the pre-panelization of the module columns, which can be done prior to or simultaneous to the installation

Certifications/Approvals: ETL Listed to the UL 467 for grounding and bonding

SEE AD IN THIS ISSUE ON PAGE 38

Warranty: 10-year warranty for material workmanship

Key features:

- Offers the lowest system cost with an economical installation;
- Meets all the topographical conditions;
- Offsite, pre-assembly capability; and
- Various anchor options available, which include: single point soil anchor; single pole driven beam; helical piles; and ballasted.

Website: www.daetwyler.com



terrafix Groundworks Corporation

Product: Contour Track

Application (roof, ground-mount, utility-scale): Large-scale ground-mount

Type: Single-axis tracker

Angle: +/- 45°

Material: Galvanized steel and aluminum

Pre- or Post-assembly? Pre- and post-assembly

Certifications/Approvals: TÜV certificate according to CAN/CSA C22.2 No.0.4.

Warranty: 5 to 25 years

Key features:

- Follow all terrain topographies with minimum grading;
- All soil conditions possible;
- Minimized maintenance; and
- Maximum reliability and durability.

Website: www.terrafix.com



Solar Solutions International

Product: LevelOne

Application (roof, ground-mount, utility-scale): Ground-mount

Type: Fixed

Angle: Customizable

Material: Aluminum

Pre- or Post-assembly? Assembled onsite

Certifications/Approvals: None

Warranty: 15 years

Key features:

- Flexible line of made-in-America mounting components for spans up to 20 feet;
- Creative custom solutions for even the most unique applications;
- Proven quality and fast delivery; and
- High value at low cost.

Website: www.levelonesolar.com



SnapNrack

Product: Series 100

Application (roof, ground-mount, utility-scale): Roof-mount, pitched and flat roofs

Type: Fixed

Angle: Parallel to roof to 45° pitch

Material: Aluminum and stainless steel

Pre- or Post-assembly? Clamps come pre-assembled with hardware

Certifications/Approvals: Structural Engineering Certifications in all 50 states

Warranty: 10 years

Key features:

- Full installation of system with one tool, a 1/2" socket;
- Rails are sized so there's no cutting or drilling with standard 60-cell and 72-cell modules;
- Universal clamps work with all module frame types, plus the Open Channel Rail allows for clean and efficient wire management; and
- Available with edge screen kits to prevent animals and debris under the array.

Website: www.snapnrack.com

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KINETIC Solar Racking and Mounting

Product: K-Rack, K-Flash
Application (roof, ground-mount, utility-scale): Pitched-roof, ground-mount, and flat-roof available
Type: Static mount
Angle: Flush-mount to 40°
Material: Anodized, extruded aluminum

Pre- or Post-assembly? Some pre-assembly required
Certifications/Approvals: Fully engineered. LCAB, UL 467, CSA-C22.2 No. 41.

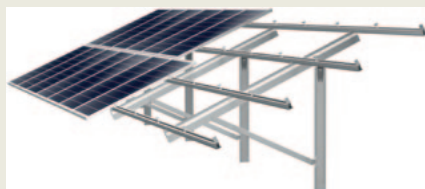
SEE AD IN THIS ISSUE ON PAGE 42

Warranty: 20 years

Key features:

- 100% watertight flashing;
- Easy-to-use, and includes knowledgeable service.

Website: <http://kineticsolar.com>



Mounting Systems, Inc.

Product: Sigma I XL

Application (roof, ground-mount, utility-scale): Ground-mount

Type: Fixed

Angle: 10° to 45°

Material: Posts are made of galvanized steel, the fasteners of stainless steel, and all other parts are made of extruded aluminum (6063 T66)

Pre- or Post-assembly? 80% is pre-assembled

Certifications/Approvals: UL 2703 pending

Warranty: 10 years standard; 20 years extended (additional charge)

Key features:

- There are less than 10 different components per unit;
- Single post installation allows for simplicity and speed; and
- Efficient component design, reduced parts' count, and extensive pre-assembly eliminate onsite fabrication and speed installation.

Website: www.mounting-systems.us



S:FLEX Inc.

Product: S:FLEX Ground Mount System

Application (roof, ground-mount, utility-scale): Ground-mount, residential to utility-scale

Type: Fixed

Angle: 0° to 45°

Material: Aluminum racking, with galvanized steel post

Pre- or Post-assembly? Pre-assembled components (Engineered in Germany and Made in USA/Canada)

Certifications/Approvals: Meets and exceeds industry standards (current International Building Codes & National Electric Code)

Warranty: Standard 10-year limited product warranty, plus extended product warranty options available

Key features:

- Engineered from the ground up, with patented technology, for efficient onsite installation without any cutting or welding;
- Adjustable click technology fitting all module frame sizes in landscape or portrait orientation;
- High, in-field adjustability even after posts are rammed/set (east/west up to 6° on each side, and vertical height up to 12" or more); and
- Flexible foundation options, including rammed posts (shallow embedment depth), helical piers, and concrete (in-ground or above-ground ballast).

Website: www.sflex.com

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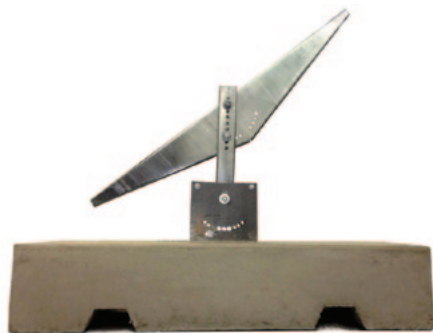
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Product Spotlight: Solar Racking



Patriot Solar Group

SEE AD IN THIS ISSUE ON PAGE 45

Product: Ballasted Ground Mount

Application (roof, ground-mount, utility-scale): Ground-mount

Type: Fixed

Angle: 10° to 40°

Material: Galvanized rails and electroplated powder-coated truss and post (Aquence 930 Coating)

Pre- or Post-assembly? Post and trusses can be pre-assembled

Certifications/Approvals: None

Warranty: 10-year guarantee against mechanical failure (breakage) of the frame construction

Key features:

- Low PSF (pounds per square feet), ideal for landfills or brownfields;
- Low profile, with multiple post angles and adjustable height position; and
- Racking assembly requires no heavy machinery and equipment; all can be done by hand.

Website: www.patriotsolargroup.com



Genmounts Solar Racking Systems

Product: Genesis Series Model 2010

Application (roof, ground-mount, utility-scale): Flat-roof

Type: Fixed

Angle: 0° to 20°

Material: 5052 H-32 aluminum and stainless steel hardware

Pre- or Post-assembly? Post-assembly

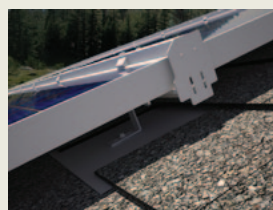
Certifications/Approvals: Listed to UL-467

Warranty: 15 years

Key features:

- Mounts to holes in PV frames, and includes redundant integrated electrical bonding;
- Custom designed to fit any PV module, and 100% USA made; as well as
- Wind tunnel tested.

Website: www.genmounts.com



Solar SpeedRack LLC

Product: Solar SpeedLatch

Application (roof, ground-mount, utility-scale): Flat-roof or sloped roof

Type: Fixed

Angle: 0° to 25°

Material: Anodized aluminum with stainless steel hardware

Pre- or Post-assembly? Pre-assembled

Certifications/Approvals: Compliance certified in 12 states; UL467 (in process)

Warranty: 20 Years

Key features:

- Self-grounding;
- Little to no tools required; and
- A 25% to 50% labor and material reduction

Website: www.solarspeedrack.com

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SOLARCUBE

Product: KIVO IR

Application (roof, ground-mount, utility-scale): Roof; corrugated sheet roofs

Type: Fixed

Angle: Following the roof inclination, or upon demand

Material: Galvanized steel

Pre- or Post-assembly? Post-assembly

Certifications/Approvals: Eurocode/ISO

Warranty: 20 years

Key features:

- Fast installation (anchoring to the roof structure of the building roof); and
- Low-cost, patented clamp design.

Website: www.solarcube.com



RBI Solar Inc.

Product: GMI

Application (roof, ground-mount, utility-scale):
Ground-mount

Type: Fixed

Angle: 10° to 45°

Material: Galvanized steel

Pre- or Post-assembly: Pre-assembled top chords

Certifications/Approvals: ETL Classified to UL 2703

Warranty: 20-year, industry best, limited warranty

SEE AD IN THIS ISSUE ON PAGE 40

Key features:

- Self-grounded, ETL classified to UL 2703, and robust—based on post strength, embedment, and foundation design;
- Fixed cost, all in number for providing design, engineering, posts, racks, mounting hardware, and installation of racks/posts;
- Projects individually designed to meet local building code requirements; and
- By following terrain, there's a reduced amount of grading on each project.

Website: www.rbisolar.com



Sollega Inc.

Product: FastRack FR5

Application (roof, ground-mount, utility-scale): Roof-mount

Type: Fixed

Angle: 5°

Material: HDPE Plastic

Pre- or Post-assembly? No assembly required

Certifications/Approvals: UL2703 Grounding; Wind tunnel testing

Warranty: 25 years

Key features:

- Universal design, compatible with all framed modules;
- High-density with nine-inch row spacing, and all top-down connections have only one sized bolt;
- Cost-effective shipping, staging, and installation; and
- Fully ballasted with optional, non-penetrating mechanical anchor option.

Website: www.sollega.com



Everest Solar Systems, LLC

Product: Everest D-Dome System

Application (roof, ground-mount, utility-scale): Commercial roof solution

Type: Fixed

Angle: 10°

Material: Aluminum (EN AW-6063 T66);
Connecting elements: 300-series stainless steel

Pre- or Post-assembly? Pre-assembled

Certifications/Approvals: Wind tunnel tested by leading structural aerodynamics labs

Warranty: 12 years

Key features:

- Maximum power output with 20% to 40% higher module density;
- A double-sided, low-ballast system, suitable for all orientations;
- Integrated grounding solution and an ultra-low component count, which lowers labor costs; and
- Aerodynamic optimization enables minimal ballast.

Website: www.everest-solarsystems.com

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Product Spotlight: Solar Racking



PV Hardware, LLC

Product: Axone Single-Axis Tracker

Application (roof, ground-mount, utility-scale): Utility-scale tracker specifically tailored to each job, providing maximum site coverage

Type: Single-axis tracker

Angle: 45°

Material: Durable, hot dip galvanized ASTM steel components and fasteners

Pre- or Post-assembly: Pre-assembled components require no field welding and utilize bolted splice connections

Certifications/Approval: Full Black & Veatch Bankability report; UL 508 controller; UL 2703

SEE AD IN THIS ISSUE ON PAGE 3

Warranty: 10-year standard, with an extended warranty available

Key features:

- Proven tracker controller and integrated grounding using UL 2703 solution;
- Lowest risk tracker on the market, Axone doesn't need to stow at 90 mph wind at full 45° tilt exposure C);
- Configurations available up to 150 mph; and
- All permit engineering included: structural, corrosivity, soils, and reliability.

Website: www.pvhardware.com



Legrand North America

Product: FAS Rack Ground Mount PV Supports

Application (roof, ground-mount, utility-scale): Ground-mount, utility-scale

Type: Fixed

Angle: Built to geographic location needs

Material: All supports are fabricated from hot dip galvanized steel

Pre- or Post-assembly? Factory fabrication, with minimal field erection required

Certifications/Approvals: Meets UL 2703 bonding requirements

Warranty: Structural warranty up to 20 years

Key features:

- Suited for large utility-scale or commercial applications;
- Reduces onsite racking labor by 75%, with pre-fabricated components;
- Tested to withstand extreme wind and snow loads as steel cable management keeps wires supported for decades; and
- Splice design allows for thermal expansion and contraction.

Website: www.legrand.us/cablofil



Sunmodo Corporation

Product: EZ SunBeam System

Application (roof, ground-mount, utility-scale): Commercial Flat-roof

Type: Fixed

Angle: Adjustable for any tilt desired

Material: All aluminum

Pre- or Post-assembly? Post-assembly

Warranty: 10-year product warranty and a five-year finish warranty

Key features:

- Robust, versatile, and advanced engineering that's designed for multiple configurations, the Ez SunBeam system is adjustable for any tile;
- By spanning over obstacles, the system takes full advantage of roof space to maximum the system size, offering increased ROI;
- Lightweight for structural loads, and strong for high costal winds; and
- Made of all-aluminum to resist costal salt air corrosion.

Website: www.sunmodo.com



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GameChange Racking

SEE AD IN THIS ISSUE ON PAGE 39

Product: GC MaxScale Ground System 1.1 and 2.0

Application (roof, ground-mount, utility-scale): Post-driven, ground-mount system

Type: Fixed

Angle: Available in 15°, 20°, 25°, and 30°

Material: Hot dip galvanized post with galvanized beam and braces, as well as either galvanized or aluminum rails

Pre- or Post-assembly? Post-assembly standard; pre-assembly available

Certifications/Approvals: Product is designed to ASME and IBC standards; ETL approved UL 467

Warranty: Industry best 20-year warranty

Key features:

- Superior post design allows all beams and braces to be attached without brackets;
- Aluminum system has three axes of play for challenging terrain;
- Integrated grounding, with all posts, components, hardware, and grounding strips included; and
- Rapid installation due to design simplicity.

Website: www.gamechangeracking.com



SOLON Corporation

Product: SOLquick system

Application (roof, ground-mount, utility-scale): Roof-mount

Type: Fixed

Angle: 10°

Material: Fibrex material

Pre- or Post-assembly? Fully assembled

Certifications/Approvals: Wind tunnel tested; ETL listed; CEC listed; and UL 1703 certified

Warranty: 10-year workmanship and a 25-year performance warranty

Key features:

- Ships as a fully integrated system, with the frameless module and rack pre-assembled at factory;
- Extremely lightweight, with minimal edge and point (loading at 80 lbs and 2.7psf);
- No tools, staging, or assembly required as it ships as one unit; and
- No grounding required, contributing to fast installation (15 units/man-hour).

Website: www.solon.com



ISA Corporation

Product: WSS Trellis Roof Racking

Application (roof, ground-mount, utility-scale): Roof-mount

Type: Fixed

Angle: 5° to 30°

Material: Aluminum

Pre- or Post-assembly? Post-assembly

Certifications/Approvals: PE Certified in most western states

Warranty: 20 years

Key features:

- Can be positioned at any height, up to eight feet above a roof, to clear equipment and maximize roof space for solar;
- Supports up to 12 modules with only one roof connection; and
- Allows re-roofing without removing the solar system.

Website: www.isa-corporation.com



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Product Spotlight: Solar Carport

Check out the most recent Solar Carports and Solar Support Structures offered in the industry.



Baja Construction Co., Inc.

Product: Custom-engineered Solar Support Structures/Solar Carports

Roof inclination: 0° to 20°

Height clearance: 7' to 20'

Depth: 10' to unlimited (20' to 40' is typical)

Space-to-column ratio: 2:1 typical, with 4:1 max

Configuration: More than 3,000; standard. Multiple solutions to accommodate any financial model. Most Popular: Full Cantilever Boxed.

Options: Direct solar panel attachment to purlins; solar thermal panel option; thin-film or crystalline; as well as concrete bollards, field painting, fascia, standard and custom, and racking.

EV charging: Available

Panel type: Neutral, can design/engineering to any module

SEE AD IN THIS ISSUE ON PAGE 5

Power generated (per kilowatt-hour): Based on module selection, orientation, layout, and location. Baja can accommodate proposed PV layout, improving integration and implementation of solar-to-canopy structures.

Certifications: NABCEP Technical Sales/Installation; Certified Fabricators; General Contractor; Licensed Engineers; and Certified Welders. Baja is licensed in more than 27 states, and their engineers are licensed in all 50 states, plus Puerto Rico.

Key features:

- Fully designed, supplied, and installed by Baja;
- Pre-fabricated, pre-engineered, all-galvanized, and custom-engineered to site, soils, local codes, and solar panels;
- Turnkey solutions with industry partnerships facilitate and improve project schedule timelines; and
- Engineering includes footing design.

Website: www.bajacarports.com



Structural Solar LLC

Product: Cantilevered Solar Canopies

Roof inclination: 0° to 10°

Height clearance: 8.5' to 14'

Depth: 20' to 42'

Space-to-column ratio: Columns every 18' to 34'

Configuration: Single slope or multiple slope, including curved canopies

Options: Roof; lights; and charging stations

SEE AD IN THIS ISSUE ON PAGE 51

EV charging: Available

Panel type: Any and all commercially available modules

Power generated (per kilowatt-hour): 325 kW DC (for subject project)

Certifications: PE/Structural Engineering in 50 states

Key features:

- Durable, hot dip galvanized or industrial/marine-grade coating included;
- Functional, economical and attractive.

Website: www.structuralsolarllc.com

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Solar PV + Accelera® 300 Heat Pump Water Heater

We designed our heat pump water heater to be as efficient as possible. We don't waste energy pumping DHW through the heat pump – we transfer the heat from the refrigerant via a wrap-around condenser on the tank. We rely on the heat pump to make hot water, using a single 1700 watt element only as back-up (that can even be disabled). We make an 80-gallon tank that over the course of a year is more efficient than a 50-gallon tank.

The heat pump portion of an Accelera® 300 draws only 500 watts, low enough that solar photovoltaic is a viable option. Use the electric back-up element and you'll probably need grid-tie, but with a full tank of 140°F water, and a 78.6 gallon first hour rating, your daily hot water needs may be satisfied without the back-up element. Solar thermal will always remain a viable solution, but now there's another renewable energy option.

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- » Reduces hot water costs by up to 80%
- » 80 gallon storage capacity uses less energy during a year than competing 50 gal. models
- » 20 sq. ft. wrap-around heat exchanger for efficient energy transfer and no possible contamination of potable water
- » Single 1700 watt backup element
- » Removable sacrificial anode with wear indicator helps ensure long life
- » Reliable German technology & manufacturing backed by a 10 year warranty

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SolarSupports.com

Product: Custom-designed Solar Support Structures

Roof inclination: Customized for all applications and engineered to all geographical locations

Height clearance: 7' minimum; can build to suit

Depth: Build to suit

Space-to-column ratio: Standard 27 feet (three car spaces), or standard 40 feet; V-frame up to 47 feet

Configuration: T-frame, L-frame, X-frame, high and low Y-frame, rolled beam

Options: Continuous coverage of large parking areas; fixed or tracking solar systems; optional carport abutments

EV charging: Available

Panel type: Landscape or portrait; layout to suit



M BAR C CONSTRUCTION
The Strength Between Sun and Shade



**SEE AD IN THIS ISSUE
ON PAGE 48**

M Bar C Construction

Product: Custom-designed "T" and "OT" structures

Roof inclination: 0° to 15°

Height clearance: 9' to 15'

Depth: 10' to 40'

Space-to-column ratio: 2:1 or 3:1

Configuration: Any

Options: Module direct attachment; underside decking; concrete bollards; paint; and hot dip galvanized

EV charging: Optional

Panel type: Any

Power generated (per kilowatt-hour): Based on project size

Certifications: General contractor; structural steel contractor; certified welders

Key features:

- Design-build for any job; and
- Custom-engineering for each project.

Website: www.mbarconline.com

Power generated (per kilowatt-hour):

Built to accommodate all power generated profiles

Certifications: CA Class B, C-61, and C-50 steel fabricator and erector; AISC, LA City Fabricator #1801, AWS, DSA pre-check

Key features:

- In-house design, engineering, fabrication, and installation (available for carports, as well as the mounting of solar panels or ground-mount installations);
- No light gauge metals for columns or beams;
- Optional finishes include prime, high-zinc prime, galvanizing, powder-coat, or custom paint; and
- Most frames are bolt connected, allowing the option of client installation or shipment.

Website: www.solarsupports.com



Solaire Generation

Product: Long Span R5, Solar Canopy Solution (for new or existing parking garages)

Roof inclination: 5°

Height clearance: 7'6" minimum

Depth: Customized to each project

Space-to-column ratio: Unique to each parking garage

Configuration: 5° facing south, regardless of garage orientation

Options: Water management; grey water collection; integrated branding

EV charging: Optional

Panel type: Any panel can be integrated

Power generated (per kilowatt-hour): Based on project

Certifications: None

Key features:

- Provides an improved, top-level parking experience and achieves optimal coverage ratios

Website: www.solairegeneration.com

INSPIRED Solutions



Solar Canopies: Structural Design, Manufacturing and Construction by **STRUCTURAL SOLAR LLC**

Client: Burke Inc. Cincinnati OH

Solar Project Development & Construction: Dovetail Solar and Wind (740 592-1800, www.dovetailsolar.com)



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Schletter Inc.

Product: Park@Sol Solar Carport
Roof inclination: 0° to 20°
Height clearance: 7' to 25'
Depth: up to 50'

SEE AD IN THIS ISSUE ON PAGE 41

Space-to-column ratio: up to 3:1
Configuration: From a single-car carport to a large commercial lot, Schletter offers a modular carport system to accommodate almost any orientation, inclination, and lot area
Options: Cable channels; cable ducts; lightning protection system; efficient drainage system; illumination; custom powder coating; corporate branding; and more
Panel type: Compatible with most module types
Power generated (per kilowatt-hour): Unlimited, dependent on land area
Certifications: Schletter is ISO 9001:2008 certified
Key features:

- Structural engineering support with complete drawing packages;
- Durable, corrosion-resistant aluminum construction;
- Compatible with a variety of foundation types, including: micro pile, drilled shaft, and fully ballasted; and
- Comes with a 20-year durability warranty

Website: www.schletter.us

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ProtekPark Solar

Product: Module-ready Pre-Engineered Site Specific Solar Carports (for surface lots and garage decks)
Roof inclination: 0° to 15°
Height clearance: 13'-6" Standard (8'+ Available)
Depth: Custom 17' to 45' available
Space-to-column ratio: 3:1 standard
Configuration: Single/double cantilever, long span, with saw tooth available
Options: WEEB certified integrated racking, Water control measures, Snow/Ice shed mitigation,
EV charging: Available with direct attachment to structure
Panel type: Module agnostic
Certifications: In-house structural PE stamp for all 50 states
Key features:

- Factory applied performance powder over ECoat standard;
- Pre-fabricated, with no onsite welding or finishing; and pier-construction standard, with no wet setting of columns;
- Integrated aluminum racking system and hardware, with a standard 20-year structural warranty.

Website: www.protekparksolar.com



CriderAmericas Solar, LLC

Product: Single Stall Carport Kit
Roof inclination: 5°
Height clearance: 9'
Depth: 22'
Space-to-column ratio: 4:5
Configuration: Any increment greater than 5 posts (4 spots)

Options: 90 MPH, 5 PSF, EXP C, Seismic D, for California and Arizona markets. Hot dip galvanized; bolt-together installation (requires zero field welding); portrait orientation; and rapid install racking, which includes mid- and end-clamps. Kit Systems also available upon request for other regions of the country.
EV charging: Available upon request

Panel type: Standard 39" x 65"
Power generated (per kilowatt-hour): Based on module selection, orientation, layout, and location
Certifications: Licensed engineers; certified welders—CriderAmericas Solar's engineers are licensed in all 50 states

Key features:

- Fully designed (includes footing design), fabricated, and shipped by CriderAmericas Solar;
- Turnkey option available upon request;
- Project management assistance on initial kits available; and
- Installation manual included.

Website: www.crideramericas.com



Arning Companies, Inc.

Product: Pre-engineered Solar Carport & Canopy Structures
Roof inclination: 0° to 30°, with custom slopes available
Height clearance: 20'-0" maximum, with custom heights available
Depth: 3' min to unlimited
Space-to-column ratio: 18' to 27' column spacing typical, with custom column spacing available
Configuration: Customized to site layout and customer needs
Options: Galvanized steel finish; factory-finished paint coat on steel; direct-mount solar panels to purlins; pre-finished metal fascia; water/snow management; wire management; and multiple structure styles that conform to architect's design

EV charging: Available

Panel type: Any

Power generated (per kilowatt-hour): Based on module selection, site conditions, array layout and location; customized layout to optimize structure size and cost

Certifications: American Institute of Steel Construction (AISC); American Welding Society (AWS); Licensed AIA Architect on staff; licensed engineers (PE) for all 50 states, including BC and Puerto Rico, with an extended network available for international requirements

Key features:

- Pre-engineered and manufactured to meet or exceed local building codes (including foundation design);
- Fully customizable structure configuration to meet customer requirements;
- Aesthetically pleasing and a cost-effective carport solution; and
- Residential and commercial applications available.

Website: www.arningco.com/solarcanopies.html

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Submitting Successful 1603 Grant Applications

Top 10 helpful tips

By Kathy Parker, CPA, MST

The 1603 Treasury Program provides access to capital and financial means that allows renewable energy project developers to receive a direct federal grant. Applying for this grant for a project, however, can take time and supporting documentation. Organization is key.

Listed below are some application tips, as well as some additional documentation recommendations. Although the initial application for 1603 doesn't require any extra records, it's worth having on hand. If and when the US Treasury does request additional information for an application, it only allows for 21 days to respond. Therefore, it's important to be prepared and to respond in a timely manner.

Consider the following top 10 for a successful 1603 grant application...

1. Canceled checks. It's important to hold onto available copies of all canceled checks, front and back, related to the project at stake. Sometimes the Treasury questions expenses and requests copies of any payments or canceled checks. Requesting check copies from the bank can take weeks, so plan ahead. It's best to keep all checks and bank statements on file from start to finish.

2. Costly projects. If the project in question is an expensive one on the cost-per-watt scale, the Treasury will likely be asking about it. Consider having a narrative ready to go, which explains why the costs are higher than average. Examples could include geographic factors, weather, technology, etc. These explanations need to be factual, and be backed-up by documentation. Treasury can and will request statements from vendors to confirm the accuracy of these expenses. If other quotes for the project were received, keep them on hand as well. If choosing a more costly vendor, an explanation will be needed. Providing alternative quotes for proof of the different levels of service from one vendor to the next is definitely helpful.

3. Clarifying fees. Most projects include either a management or development fee (often paid to some form of related party). Such fees must be justified with documentation, and can include contracts, time records, and/or a detailed explanation of the actual work warranting the fee. Be mindful of where the project's cost-per-watt falls once this is included in the qualified expenses.

4. Cost breakdown. The more details supplied for the cost breakdown of a project, the better. Prepare a very detailed listing, and don't lump related costs together. For example, if an invoice says "Installation and panels," the two need to be separated. Not having items broken down can delay the application process. In many cases, a project's EPC contractor will help with this information. Again, this can take time, so plan ahead.

Examples of cost breakdowns can include:

- a. Site work;
- b. Permitting;
- c. Engineering;
- d. Panels (how many; what brand?);
- e. Inverters (how many?); and
- f. Transformers.

5. Disqualified costs. Be careful not to include any expenses that do not qualify. Examples include fencing and transmission lines. Also, some site work might not qualify, depending on its nature. If unsure, send an e-mail to the Treasury asking, and keep a copy of the response in your support file. The Treasury will sometime respond with vague answers. If this is the case, ask for specifics.

6. Checklists. Review all of the Treasury's checklists and sample attachments thoroughly. They provide applicants with examples and what the expected documentation should look like. To avoid any application delays, conform to their requests.

7. Connected parties. Much like any management fees, if there are related parties to a project, be prepared to have a narrative explaining not only why, but also how any fees or costs are billed. Having contracts in place is helpful in defining the relationship and services to be provided. The Treasury is aware and cautious of any related parties inflating costs to increase the grant proceeds.

8. Contacts. It's important to use a separate e-mail address for the contact e-mail listed in the 1603 application, and the e-mail address related to the 1603 website login. This ensures two people within the organization receive e-mail updates as to the status of the application, so someone is aware of any additional information requests at all times. Make sure these e-mails are not getting stuck in a spam filter. An application status can also be checked by logging onto the 1603 account.

9. Payment confirmation. Register with the government System for Awards Management (SAM)—formerly called CCR—which is the method the government will use to wire payment. If not registered, it will delay the payment once a grant is awarded.

10. Time cut-off. There is a 21-day limit to respond to the Treasury if additional information is requested. This is non-negotiable. If this deadline is missed, the application is denied and one cannot re-apply. At this point, the only option would be to utilize the investment tax credit (ITC) on the tax return. So, be sure to continually check e-mail, as well as the website, for status updates on an application.

Kathy Parker, CPA, MST is a partner at Rodman & Rodman, P.C., which provides accounting, tax, and business services to small- and medium-sized companies. The Rodman & Rodman "Green Team" is a specialized green energy and clean technology accounting and tax services practice that serves "green" clients throughout the US.

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Fluid Components International

Fluid Components International (FCI) has released its Model ST51 Mass Flow Meter for owners, operators, and manufacturers of biogas production and methane capture and recovery systems. These users will find the new Model ST51 provides the high-performance and features required of these applications in an explosion-proof instrument that is easy to install, safe, and requires virtually no maintenance to deliver a best cost solution. FCI's ST51 Flow Meter is designed specifically to measure biogas and all methane composition gases, including natural gas. ST51 features a thermal mass, insertion-style flow element with flow accuracy to $\pm 1\%$ of reading over a broad flow range, from 0.3 to 400 SFPS (0.08 to 122 MPS), and repeatability of $\pm 0.5\%$ of reading. The flow element is available for use in line sizes from two to 24 inches (51 mm to 610 mm) diameters.

www.fluidcomponents.com

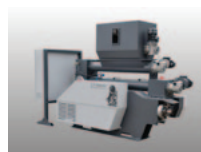


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West Salem Machinery Co.

West Salem Machinery's (WSM) field-proven grinding, screening, milling, and conveying equipment, and complete systems, supply and benefit biomass and biofuel processing solutions. WSM's horizontal grinders and screens provide primary processing of raw feedstock and green fiber. WSM's high-volume disc screens and vertical grinders offer secondary processing of pre-hogged fuel. Finish milling can be done efficiently with their heavy-duty hammermills. WSM further supplies: metering feed hoppers; motor starters/controls; in-feed and discharge chutes; support structures; access platforms; and associated conveyors to deliver a complete system. From feedstock to premium quality finished fuel, WSM provides an integrated solution, supplying quality equipment and creating long-term partnerships with customers. Their solution-oriented approach and application expertise in processing systems is demonstrated in successful fiber prep systems in operations throughout the world.

www.westsalem.com



briquetting systems

briquetting systems provides briquetters for making fuel pucks and large-format pellets from plant dust, torrefied product, and other biomass feedstocks. They're offered in various sizes, from a few hundred pounds per-hour output to several tons per-hour output. Modular, mobile, in-plant, and large silo configurations are also available.

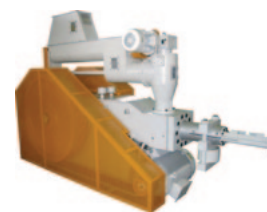
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www.rwii.net



Sunomi, LLC DI PIÙ S.r.l.

Sunomi, LLC is the exclusive North American representative of DI PIÙ BRIK series, heavy-duty mechanical briquetters. The BRIK series briquetters offer industrial solutions to turn biomass, such as wood or agricultural waste into clean, slow-burning solid biofuel, which can be used to produce energy as heat, biogas, or electricity. Briquettes or pucks can be manufactured for the consumer market or for industrial and commercial markets as space heat, process heat, or power generation.

www.sunomi-llc.com

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www.hurstboiler.com



Metso Power

Metso Power provides engineering, construction, and manufacturing services, as well as technology (CFB&BFB) products, along with automation, instrumentation, and integrated solutions, by delivering environmentally friendly combustion solutions to the power sector. Metso boilers use Fluid Bed technology, combining high-efficiency combustion of high-calorific value fuels with low emissions—even when burning various fuels simultaneously. Boiler service comprises of rebuilds and repairs, including: boiler chemical cleaning; boiler inspections; maintenance; replacements in kind; made-to-order; and spare parts. Boiler tubes include a wide range of stock tubing, non-standard tubes, and special mill orders for larger quantities located within Metso's US manufacturing and service facilities. Pressure parts include: membrane wall panels; economizers; generating banks; tubular heat exchangers; superheaters; and loose tube bending. Also offered: full metal fabrication; engineered solutions; alignments bars; headers; air heater seals; machining and saw cutting; assembly; shearing; bending; welding; plating; and powder coatings. Tube-shield styles are available to solve tube wear problems fast, as well as significant spare parts inventory.

www.metso.com/energy
www.metsopowerservice.com



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CPM specializes in total solutions for superior production levels of high-quality biomass pellets. CPM's hammermills, pellet mills, coolers, and other equipment are efficient and economical—and built to run 24/7 in the toughest conditions. CPM provides high-capacity biomass pellet production, with low-energy consumption and excellent pellet quality.

www.cpm.net



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Biogreen is a platform for thermochemical conversion of all residues, from biomass and polymers. The conversion is completed through torrefaction, pyrolysis, and gasification to create biochar, oil, and gas. Beltomatic is a continuous flow conveyor dryer system from Norris Thermal Technologies, which can be used in conjunction with Biogreen to dry all biomasses and polymers.

www.norristhermal.com

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E & E's environmental planning teams perform all required studies for solar intensity, meteorology, hydrogeology and water availability, terrestrial and aquatic/wetland habitats, sensitive species impact, land use, socioeconomics and cultural resources.

PERMITTING

E & E can prepare all required federal environmental impact statements, state-equivalent impact assessments, and local use permits.

STAKEHOLDER ENGAGEMENT

E & E can assist in identifying stakeholders and engaging them early to obtain consensus on your project.

Solar

Nick Figone
 (415) 398-5326
nfigone@ene.com

Wind/Hydroelectric

Jeff Hammond
 (757) 456-5356
jhammond@ene.com

Geothermal

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

Biomass/Waste-to-Energy

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

Transmission

Dan Belin
 (703) 522-6065
dbelin@ene.com

Canada—All Services

John Montgomery
 (503) 248-5600
jmontgomery@ene.com



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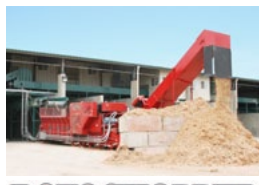
www.ene.com



PROCESSBIO A/S

Processbio is a front-end specialist in handling biomass. They apply their material handling expertise from the point biomass arrives at the plant, all the way through to the plant's production cycle. Processbio's biomass handling systems include robotic cranes for bale handling, shredders for bales, and other pre-processing, such as screening and filtering equipment. Processbio solutions can be configured to plants that consume baled material to generate power, produce ethanol, or manufacture pellets. Using insight and innovation, the company can design, quote, and install a complete turnkey biomass processing system. And, using their proprietary simulations, Processbio can translate customer's requirements into a production plan, adapted to their specific type of baled biomass and quantities.

www.processbio.com



Rotochopper, Inc.

Rotochopper, Inc. specializes in grinding equipment for converting raw wood waste and agricultural residue into biomass fuels and other high-quality end products. Rotochopper horizontal grinders are available with diesel or electric power up to 875 horsepower. New products include the FP-66 diesel powered grinder and the EC-366 electric powered grinder. The FP-66 offers many of the same advantages of the Rotochopper B-66 (the largest Rotochopper grinder), only in a smaller platform. With 475 to 630 horsepower, the FP-66 comes equipped with a replaceable mount rotor, concentric powerfeed lift system, and other Rotochopper exclusive features that were previously available only on the B-66. As the third generation of the long popular EC series, the EC-366 offers even simpler operation and lower operating costs.

www.rotochopper.com



BIOFerm Energy Systems

BIOFerm Energy Systems deliver a wide array of turnkey biogas energy solutions that use biomass and organic waste as the primary input in North America. They offer a comprehensive range of digester technologies, including wet and dry AD systems. These systems produce biogas that can be combusted directly in a combined heat and power unit (CHP), or further upgraded to create compressed natural gas for vehicle use or to be injected into the natural gas pipeline. Other technologies can also be applied to convert biogas to higher value liquid chemicals or plastics.

www.biofermenergy.com



Biomass Briquette Systems, LLC

Biomass Briquette Systems, LLC is a manufacturer of grinders, conveyors, and briquette presses, and the exclusive distributor for LIN-KA Energy biomass boilers in the US and Canada. LIN-KA Energy biomass boilers are a true multi-fuel boiler. Options are available to burn baled feedstock, woodchip, pellets, or briquettes, among other feedstocks.

www.biomassbriquettesystems.com



Heyl & Patterson Inc.

Since 1887, Heyl & Patterson has provided high-quality thermal processing solutions that are trusted by industries worldwide. Heyl & Patterson custom-engineers torrefaction equipment to heat and dry wood biomass, without allowing it to burn. Moisture is completely removed from the wood, and the result is a high-energy content, friable, and hydrophobic material, which can be pelletized or briquetted. Their pilot-plant testing lab can determine the appropriate processing conditions for all applications.

www.heylpatterson.com



TSI Inc.

TSI produces dryer islands and torrefaction systems for wood pellet production. This includes TSI's unique rotary classifying dryers, as well as their heat energy systems and emission control equipment. TSI is currently the only company that offers the complete package, using in-house technology. TSI technology is used in many biomass-operating plants, including the world's largest operating plant of this type.

www.tsi-inc.net

BIOMASS THERMAL ENERGY



K&K Environmental, LLC

K&K Environmental provides K&K-GiantFlex balers, producing wrapped bales for biomass and biofuel projects. Shredded wood, wood chips, C&D wood, as well as other biomass can be baled into secure, two-ton plastic wrapped bales, which can be transported by truck, rail, or ship. Bales can also be stored outdoors, so there's no need for pellet production or storage barn cost.

www.kkenvironmental.com



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Urecon factory insulates all types of pipe, from half-an-inch to 40 inches, for central district heating and cooling systems (hot water/LP steam/condensate return/chilled water) to hydronic heating applications, including for renewables and biopower plants. Freeze protection and temperature maintenance is included, with specialty piping for treatment plants.

www.urecon.com | www.pexflex.com

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Innovative Magnetic Technologies, Inc.

Innovative Magnetic Technologies (IMT) designs, manufactures, and markets innovative magnetic equipment for industrial markets worldwide. The IMT product line consists of: suspended plate magnets; cross-belt separators; magnetic head pulleys; plate separators; new XHD in-line chute separators; vertical magnetic conveyors; drum separators; permanent magnetic lifting devices; and magnetic sweepers. IMT equipment is available in ceramic (ferrite) or rare earth (standard or high-temperature) configurations. www.imt-inc.com



Oil Skimmers, Inc.

Oil Skimmers, Inc. is the manufacturer of the original tube oil skimmer, with over 40 years of experience removing oils, fats, and greases from the surface of water, coolants, and other industrial fluids. This specially formulated tube floats around any debris, and attracts oils and greases. Plus, these oil skimmers can run unattended, 24/7. www.oilskim.com

CONSTRUCTION & CONSULTING SERVICES



Fagen, Inc.

Fagen, Inc. is an international industrial contractor, utilizing a database of over 25,000 direct-hire employees. They've constructed a variety of projects, including biomass-to-power, conventional power plants, and other industrial process facilities. Fagen, Inc. has the experience and workforce necessary to take any size project from conception to operation. www.fageninc.com



F.E. Moran Special Hazard Systems

F.E. Moran Special Hazard Systems provides power generating, chemical processing, and heavy industry facilities with reliable, cost-effective fire protection solutions. Boiler buildings, fuel handling systems, turbine areas, and electrical equipment all demand specific methods of detection and suppression to achieve an optimally effective protection system. The risks and hazards unique to power generating plants must be factored into every aspect of a fire protection system. With experience that spans five decades, F.E. Moran Special Hazard Systems has developed the knowledge and expertise to match and deliver the right system for each individual environment. www.femoranshs.com



W. Soule

W. Soule's unique fabrication capabilities, with their 125,000 square feet of space, along with their installation and contracting services, make them ideal partners for the renewable energy industry. W. Soule provides the fabrication and installation services crucial to delivering a successful project. Services include: utility and process piping; skid fabrication; engineered pipe supports; equipment rigging and setting; plant turnarounds and shutdowns; stack and column fabrication; and tank and vessel fabrication. www.wsoule.com



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Ecology and Environment, Inc.

Ecology and Environment, Inc. (E & E) brings over 40 years of worldwide environmental consulting experience to biopower projects. They can identify and measure available biomass and waste-to-energy resources, and model and monitor air emissions, surface, and groundwater supplies, as well as wastewater effluents and noise. They also assess project land use, transportation, and socioeconomic and cultural resource impacts. E & E's highly multidisciplinary teams include specialists in outreaching to a broad range of stakeholders and specialists in obtaining all of the required federal, state, and local government regulatory permits. E & E can help get the "green light" for biopower projects throughout North America and overseas.
www.ene.com



ECODynamic Solutions (EDS) Inc.

ECODynamic Solutions (EDS) Inc. is a British Columbia, Canada registered environmental consulting firm, specialized in the provision of third-party environmental monitoring (IEM) services, construction environmental monitoring (EM) services, construction environmental management and mitigation planning, as well as erosion and sediment control planning. Their technical professionals continuously promote environmentally sound construction practices, working to create a legacy of sustainable developments.
www.ecodynamicsolutions.com

Resource Recycling Systems

Resource Recycling Systems provides assistance to power plant developers and financial institutions. Developing sound technology and financial evaluations for biomass energy opportunities are the heart of their expertise and experience. Their team excels in developing fuel availability prospects, assessment/feasibility analysis, and plans for feedstocks from farms, institutions, commercial, or industrial sources. Resource Recycling Systems' understanding of the financing process required by banks/equity investors provides clients the necessary information to make development decisions.
www.recycle.com



Process And Storage Solutions

Process And Storage Solutions provides services for the wood pelleting industry. Services include: process and plant feasibility studies; foundation and structural design; plant layout and equipment specifications; equipment procurement and installation; as well as site supervision and start-up.
www.processandstorage.com

ENGINEERING & EQUIPMENT



Evergreen Engineering, Inc.

Evergreen Engineering, Inc. is a multi-discipline, full-service consulting and engineering firm. Among various different markets, they service the power generation and biopower industries. Services encompass all project phases, from planning through construction, including: scheduling; feasibility studies; preliminary engineering; capital estimates; detail engineering; process design; environmental permitting; purchasing; commissioning; start-up assistance; and project management.
www.evergreenengineering.com



Sodimate, Inc.

For over 30 years, Sodimate has supplied bulk-handling systems for flue gas treatment. The company provides a wide range of equipment—from conventional screw feeders to completely automated bulk storage silos, discharge, and feed systems. Typical treatment processes include flue gas desulphurization and heavy metal removal.
www.sodimate-inc.com



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LOTUS MIXERS is global manufacturer of agitators (top entry, side entry, static, and portable mixers), providing technology expertise to the biofuels market. With more than 1,000 mixers installed in biofuels' applications—including corn-based ethanol, Gen2-cellulosic, biodiesel, as well as biogas and anaerobic digestion—LOTUS MIXERS offers customers the experience needed to find the right solution to their mixing requirements.
www.lotusmixers.com



Precision Energy Services Inc.

Precision Energy Services Inc. (PES) is an engineering, procurement, and construction (EPC) company, specializing in unique biomass energy projects that require experience and attention to detail. PES has provided engineering services for over 20 years. Their energy system expertise includes: fluid bed combustion and gasification; heat exchangers; material handling systems; fly ash systems; as well as general industrial construction services and repairs.
www.pes-world.com



Yale Mechanical

Yale provides and installs mechanical equipment, conveyors, and process equipment. They have the capability of providing a turnkey biomass handling system from site soil borings, foundations, silos, mechanical conveying, as well as process sizing and sorting equipment installation, through to electrical controls, installation, and start-up. Yale also provides ongoing service and maintenance of the equipment. They will move a plant or individual pieces from one jobsite to another.
www.yalemech.com

FINANCIAL SERVICES



GCube Insurance Services, Inc.

For over 20 years, GCube has been providing insurance services for renewable energy technologies around the globe. They offer specialized focus and underwriting authority for property risks during the construction phase of utility-scale biofuel and biomass projects. At GCube, they understand the multi-dimensional nature of power generation projects, helping clients to identify, quantity, and mitigate risk efficiently and economically, while achieving business objectives.
www.gcube-insurance.com

Plante Moran

Plante Moran is the nation's 11th largest certified public accounting and business advisory firm, providing financial, operations improvement, strategic planning, technology consulting, and wealth management services. They offer a depth of industry knowledge, as well as exceptional professional experience working with energy and renewable energy companies across the nation.

www.plantemoran.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, and has 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

FOREST & WOOD PROCESSING



Rawlings Waste Wood Recovery Systems

The original rotary hog was invented and developed by Rawlings Manufacturing in 1977. Since then, the family-owned company has manufactured and marketed several series of product lines. The wood waste recovery systems are available in stationary, portable, and skid-mounted systems—with both vertical and horizontal models available.

www.wastewoodhogs.com



Bandit Industries

Bandit Industries offers whole tree chippers and Beast horizontal grinders, vital machines for meeting the increasing demands of the biomass industry. Bandit utilizes patented designs to create high-quality, dimensional wood chips for biomass boilers, as well as raw material, which is ideally suited for wood pellet production. Bandit offers eight whole tree chippers and four Beast horizontal grinders, with numerous options. Engines run up to 1200 horsepower, allowing these machines to be custom-built to suit any operation.

www.banditchippers.com



Brunette Industries Ltd.

Brunette Industries is an independently owned and operated company, serving the North American forest industry since 1942. Brunette offers a variety of products, including: drum-style debarkers (reclaimers); hogs; chippers; conveyors; and log handling equipment. Brunette Industries' long history of manufacturing experience and commitment to quality gives their customers an advantage as they compete in an ever-changing global economy.

www.brunetteindustries.com



Forest Concepts, LCC

Forest Concepts has developed low-energy technology to produce patented, uniform, precision feedstock, down to a two-millimeter particle size, called Crumbles. Crumbles can be produced from wood, corn stover, switchgrass, miscanthus and other agricultural residues at normal field moisture content, without pre-drying. It also uses much less energy than hammermilling.

www.forestconcepts.com

MATERIALS HANDLING SOLUTIONS



Atlas Systems LLC

Using a simple and unique design, the Atlas works well on sawdust, sander dust, wood chips, wood shavings, bark, hogged wood waste, and refuse-derived fuel. The Atlas live bottom system consists of a storage unit, a sweep conveyor, and one or more discharge conveyors. Configurable for a wide range of sizes, the Atlas is adaptable to open storage—and, in some cases, to existing storage. The system can be used for fuel feed, process feed, or truck loading, and is designed to meet a user's unique storage and feed requirements. The Atlas has been around since 1959. Some advantages of an Atlas include automated positive material retrieval, low-energy consumption, and easy maintenance.

www.atlassystems.net



Jeffrey Rader, a division of TerraSource Global

Jeffrey Rader, a division of TerraSource Global, manufactures size reduction, material handling, pneumatic conveying, screening, and feeding equipment and systems to unload, convey, screen, and crush many different bulk materials. Materials can include wood chips and pellets, biomass, alternative fuels, as well as other recyclables.

www.terrasource.com



CST Storage

CST is a global provider of storage solutions for the bioenergy industry, supplying integrated tank designs and coatings to meet the demands of any bioenergy system. This includes: factory coated epoxy and glass-fused, to-steel enamel; welded and bolted storage tanks and silos; aluminum domes; steel roofs; flexible membranes and reclaimers for digester or biomass applications.

www.cst-storage.com

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www.rotaryvalve.com



DustMASTER Enviro Systems

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.

www.dustmaster.com



KEITH Mfg. Co.

An efficient biomass plant needs effective fuel storage and metering systems. KEITH WALKING FLOOR systems automate the feeding process, delivering material in a consistent manner and storing it until needed. Systems also require minimal power and maintenance compared to conventional belt, chain, and screw systems. When installed in a trailer, WALKING FLOOR systems provide flexibility to unload at a variety of sites during backhauling, and can be used to unload material near or inside buildings.

www.keithwalkingfloor.com



SHW Storage & Handling Solutions GmbH

For more than 40 years, SHW Storage & Handling Solutions GmbH delivers installations for processing, feeding, and storage of special bulk materials that are difficult to handle, such as: wood chips; bark; paper waste; sludge; FGD-gypsum; RDF filter; cake from industrial and municipal sludge; municipal waste; animal meal; etc. Design, production, and installation are carried out by SHW-SHS, from just one source.

www.shw-shs.com



Thomas & Muller Systems LTD.

Thomas & Muller Systems Ltd. has over 50 years of experience in the design, engineering, and fabrication of custom mechanical bulk materials handling and conveying equipment. Some of the equipment and systems they design, engineer, and manufacture include: screw conveyors; screw feeders; multiple screw feeders; live bottoms for bins; hoppers or silos; blenders; belt conveyors; drag conveyors; bins; hoppers; and more. Thomas & Muller Systems Ltd. also work with customers on how to correct, change, or improve their current systems or equipment to improve the service life. Furthermore, they repair damaged and worn equipment when it's most cost-effective to do so.

www.thomasandmuller.com



USA Tank

USA Tank is a design-build and services organization, specializing in engineering, manufacturing, and the construction of customized storage tank systems for the renewable energy and power, as well as the dry bulk (including biomass) industries. With over 30 years of experience, they provide expertise and technical knowledge across every phase of a project.

www.usatanksales.com

NEXT-GENERATION BIOFUELS



Eagle Valley Eco Fuel, Inc.

Eagle Valley Eco Fuel provides biomass heating bricks, logs, pellets, as well as fire-starter manufacturing. Eliminating solid waste, while producing a sustainable natural heat, Eagle Valley Eco Fuel's technology is all, natural, manure-based, and patented. They contribute to the removal of contaminants, while producing renewable energy.

www.eaglevalleyecofuelinc.com



Western Pneumatics, Inc.

Western Pneumatics, Inc. (WPI) manufactures material handling equipment, and particularly pneumatic conveying and mechanical conveying systems. They also install like equipment in wood yards for wood processing and storage. With over 30 years of experience in materials' handling systems, Western Pneumatics provides installations, troubleshooting, and parts supply.

www.westernp.com

PLANT OPERATIONS



NAES Corporation

NAES is a provider of comprehensive services to the power generation market, and is diversifying into related infrastructure markets. For over 30 years, NAES has specialized in providing services centered on safe, reliable, and cost-effective performance, including: operations and maintenance; maintenance and construction; onsite turbine inspection/overhaul services; staffing solutions; and customized services designed to improve plant and personnel effectiveness.

www.naes.com

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Endress+Hauser measurement solutions act on the demands for climate protection and efficiency. They meet the expectations of small and large plants, as well as national and international standards. Endress+Hauser's complete offering of flow, level, pressure, temperature, and analytical products is complemented by a complete service and support network that's available wherever their customers need.

www.us.endress.com

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- Functional heel loop
- Full, padded bellows tongue
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- Steel midsole
- Rubber tread sole
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WASTE-to-ENERGY EQUIPMENT & PROCESSING



R2 Energy Inc.

R2 Energy Inc. provides expert engineering, fabrication, and assembly of fully automated, turnkey vacuum production, robotic, and alternative energy systems under just one roof. A reliable, controlled, and quick fabrication is assured through their manufacturing and fabrication division. Renewable energy, including biomass services include: analysis; thermal; stress; process; design; electrical; mechanical; software; controls; and full engineering. www.r2energyinc.com



Warren & Baerg Manufacturing, Inc.

Warren & Baerg Manufacturing, Inc. manufactures d-stringing and grinding systems for agriculture and biomass applications, including densifying/cubing systems that compress materials for feed, convert paper, cardboard, plastic, wood, sludge, and biomass into high-density cubes for fuel—a clean alternative to coal. They also manufacture conveyors, including: drag chain; chain belt; slider bed; roller chain; flat belt; trough belt; and bottom drag. They further provide magnetic systems for metal removal, as well as offer engineering services and plant design. www.warrenbaerg.com



Elliott Group

Elliott Group has designed and manufactured steam turbines for more than a century, with tens of thousands in operation around the world. Their custom-designed STG sets support commercial energy requirements up to 50 MW, including renewable energy applications, green energy initiatives, and CHP applications. www.elliott-turbo.com



Helmick Corporation

Helmick Corporation has been the predominant manufacturer of boiler tube shields since the 1950s. Most tube erosion and corrosion problems can be resolved through use of tube shields, and Helmick engineers are available to analyze and create the proper product for use in a boiler. www.helmickcorp.com



Jackson Lumber Harvester Co., Inc.

Jackson Lumber Harvester Co., Inc. is a worldwide manufacturer and seller of biomass Webb Burners. These cyclonic suspension burners are ideal for generating large quantities of heat for industrial processes, at substantially less cost per BTU than traditional oil- or gas-fired systems. They can be fired with a variety of solid fuels, including sawdust, corn cobs, sunflower hulls, flax shives, pelletized wood, charcoal, peat, and coal dust. Using a variety of alternative fuels, years of clean combustion performance has resulted in positive evaluations by environmental protection agencies. The Webb Burners continue to hold the rank as "Best Available Combustion Technology." www.jacksonlbrharvester.com



RUD Chain Inc.

RUD conveyor and drive systems offer optimal solutions for energy production. They design, fit, and manufacture complete conveyor systems to meet the requirements of individual application. RUD also offers a wide range of drive solutions, which use round steel chains as a traction mechanism. <http://cratos.us.com>



SEaB Energy Limited

SEaB Energy Ltd. is an award-winning company that specializes in the renewable energy and energy-from-waste sectors, internationally. The company has developed the pioneering MuckBuster and Flexi-Buster compact and easy-to-install anaerobic digestion systems, which convert food waste and other bio-wastes into energy. The systems are modular, easily configured, and scalable to address food and other bio-wastes directly at the sites of smaller waste producers, such as farmers, food producers, and caterers. www.seabenergy.com



Vecoplan, LLC

Vecoplan engineers and manufactures complete feedstock prep systems, including: pre-shredding; separation; screening; air classification; re-shredding; unloading; and delivery. Systems are used in prep of biomass boiler fuel, co-firing with coal, and other fuels. They're also used as size reduction prior to gasification and pelletizing, as well as in the conversion process for cell ethanol and other biofuels. Vecoplan shredders provide consistency, flexibility, high throughputs, heavy-duty construction, with a low cost and with easy to replace parts. www.vecoplanllc.com

OTHER Cooling Towers



Service Tech Cooling Towers

Service Tech Cooling Towers provides new, field-erected and packaged cooling towers for plant expansion, green field, or capital projects. They also offer quality cooling tower maintenance and performance upgrades. Many customers have benefited from a cleaning and preventative service schedule that's individually tailored to a company's needs, budgets, and schedules. Service Tech Cooling Towers has the experience, along with the capability, to solve tough cooling challenges. www.stct.biz

Fire Prevention



Firefly AB

Firefly is a supplier of spark detection, as well as fire and dust explosion protection systems, with more than 40 years of experience. Firefly supplies True IR technology. Each customer is offered unique solutions based on a range of patented components and functions. Firefly co-operates with experts and institutions around the world to develop safe high-quality solutions. www.firefly.se

Moisture Analyzer



MoistTech Corp

MoistTech provides moisture analyzers for online, as well as for at line, instant, non-contact measurement of biomass, including: wood chips; pellets; fiber; waste solids hog fuel; paper; recycled products; and flyash. The IR3000 provides accurate moisture analysis to within 0.1% on many products. www.moisttech.com

Plant Sales & Auctions



Maas Companies

Maas Companies is an international marketing company, specializing in the sale of biodiesel, ethanol, and biomass plants and equipment. They're experienced in customizing successful marketing plans that will market surplus assets for maximum price recovery. Maas Companies has currently sold more ethanol and biodiesel plants, with related equipment via auctions and orderly negotiated sales, than any other company in the US. www.maascompanies.com

Storage Tanks



Fusion Tank and Silos

Permastore (Fusion) Tanks specializes in glass-fused to steel-bolted tanks, having installed over 300,000 tanks globally in various industries—including for biopower plants. Permastore's five different grades of glass coating ensure the proper product is available for use, depending on the application. Permastore's products are 100% tank-panel tested, and their factory-produced panels must meet a zero-defect policy, setting them apart. www.fusiontanks.com

Intersolar Europe

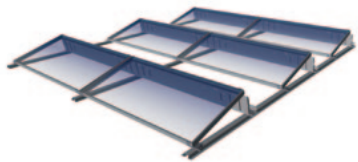
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www.intersolar.de

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



Ballasted roof-mount solution

An extremely lightweight and cost-effective ballasted roof-mount solution, Schletter's AluGrid solar mounting system makes efficient use of materials, while maintaining strength. Concrete pavers serve multiple purposes, including providing ballast and interconnecting rows, while ensuring compressive forces to the roof are well distributed. Engineered based on the most current wind dynamic research, AluGrid also features 10- or 15-degree fixed-tilt options, and an aluminum structure that directly integrates the module frame—reducing the number of system components and the installation time, with virtually no tools necessary.

Schletter

www.schletter.us | www.schletter.de



Solar thermal control system

The Steca TR A503 TTR U provides high power, convenient installation and operation, two triac outputs, one relay output, as well as numerous additional functions, such as: a BTU metering; system; pressure monitoring; data logging; back-up heating; a drainback; and more. Along with the TR A502 TT U and TR A501 T U solar thermal controllers, the TR A503 TTR U is the third product in this series, which comes with a compact design case, making it well suited for integration into solar stations. It can also be universally mounted on a wall or top hat rails. The new solar thermal controller has five inputs, two RPM controllable triac outputs (that can also be used for controlling 0 V to 10 V high-efficiency pumps), and an additional relay output for individual programmability. System data can be stored on a Micro-SD card, which can be directly plugged into the TR A503 TTR U controller.

Steca Elektronik GmbH

www.stecasolar.com



Multi-pin connector

APP's Solar SPEC Pak 4-position connector now complies with both the European test standard BS EN50521 and the US test standard UL 6703A, meeting such stringent requirements as the -35° C impact, thermal cycling, and humidity tests. The Solar SPEC Pak 4-position connector meets NEC 2008 section 690.33(C) requirements for a locking feature that requires a tool to unlock for any system greater than 30 volts. The Solar SPEC Pak is environmentally sealed (IP68), has a weatherability rating of F1 per UL 746C, a flammability rating of V0 per UL94, as well as a temperature range from -40° C to 105° C (-40° F to 221° F). The touchsafe, color-coded Powerpole housings inside the SPEC Pak shell have power, signal, and ground contacts that accept wire gauges from #24 to #10 AWG (0.25 mm² to 4.0 mm²), and are configurable to 1000 volts.

Anderson Power Products

www.andersonpower.com



Modular, intelligent junction boxes

HUBER+SUHNER presents two intelligent solar boxes, based on its modular junction box system. The RADOX SolarBox HM-Blue-Safety, with its integrated safety switch, and the RADOX SolarBox HM-Blue-AC, with inverter module. A modular junction box system provides module manufacturers and installers with a flexible platform, regardless of whether or how any smart electronics will be connected later on. The modular system consists of a base box and the RADOX SolarBox HM, which can be equipped or retrofitted with an optional BlueBox at any time. In joint development with two prominent partners, HUBER+SUHNER implemented various application-specific smart electronics in this BlueBox. The RADOX SolarBox HM-Blue-Safety and the RADOX SolarBox HM-Blue-AC will soon become part of the HUBER+SUHNER product portfolio.

HUBER+SUHNER

www.hubersuhner.com



Racking & module clamps

HatiCon Solar continues to improve their IBC-compliant solar PV racking technology. All systems, including the pitched-roof, low-slope, and ground-mount, are designed for simple and fast installation. Helping with this is HatiCon Solar's module clamps, which offer universal, click-on, technology. Module clamps can be used across projects and with different modules, simplifying inventory and logistical considerations. With distributions and manufacturing capabilities throughout North America and Europe, HatiCon Solar can quickly and efficiently supply projects worldwide.

HatiCon Solar | www.haticonsolar.com



MPPT charge controller

OutBack Power's FLEXmax Extreme is the first sealed, outdoor-rated, maximum power point tracking (MPPT) charge controller. The FLEXmax Extreme features a passively cooled design, offering full power output over a wide range of temperatures. Its sealed unit is capable of protecting circuit boards and other sensitive components from dust, dirt, insects, and other contaminants. The FLEXmax Extreme's advanced thermal engineering provides full power output from -20° C to 45° C (-4° F to 113° F), without requiring a cooling fan. It significantly improves efficiency and performance of solar energy systems, allowing industrial users to get the most out of installations.

OutBack Power | www.outbackpower.com



Certified modules

Sonali Solar presents their new, 300-watt modules, which have been added to their list of UL 1703 certified products. By first running all solar cells through an electroluminescence tester, before and after the modules are laminated, Sonali ensures there aren't any micro-cracks getting in the way of the photo-electric effect—leading to improved quality and reliability. And, after testing all solar cells in the production line, Sonali saves the most efficient cells to produce the 300-watt, 72 cell modules. Large, commercial projects can save a lot of money on the cost of labor by getting more power out of each module installed. Moreover, increasing the different size of modules offered allows Sonali Solar to provide customers with more options, ensuring they find exactly the right equipment for each individual project.

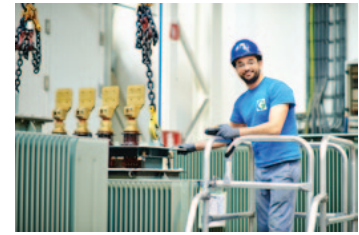
Sonali Solar | www.sonalisolar.com



Energy monitoring solution

Introducing the new eGauge 3000 series. eGauge hardware integrates a 12-channel current and a three-phase voltage meter, data logger, and web server—all in one hardware unit. With direct Ethernet or HomePlug AV communication capability options, eGauge can be installed quickly and easily in residential and commercial applications. eGauge has an open XML API for third-party developers, as well as an intuitive user interface for direct consumer viewing of the monitored energy system. eGauge can provide second-by-second data, and has a useful URI push functionality. It comes without any software subscription fees, as it has an extensive, solid-state memory on board, with a web server. eGauge is also compatible with third-party devices, such as inverter-direct values from leading solar energy companies.

eGauge | www.egauge.net



Distribution & power solutions

With over 75 years of experience in the energy sector, CG is an established manufacturer of three-phase distribution and power transformers. A strong competitor in the market of substations, integrated solutions, automation systems, and services, CG focuses on providing smart solutions to customer challenges.

CG Power Systems
www.cgglobal.com



Power optimizer

SolarEdge released a new product specifically designed for the commercial PV market. The OP600 power optimizer can be connected to two modules of up to 300 watts (60 cells), and is operational with SolarEdge three-phase inverters from 16 kW upwards. Communication with the inverter occurs through the PLC, so no additional communication hardware is required. A two-in-one power optimization solution makes sense for larger installations, without significant shading or intricate roof structures. Module-level optimization will mitigate mismatch losses caused by soiling, module damages, temperature variances, and uneven aging degradation. PV strings can include up to 44 modules, saving as much as 50% on cables, fuses, and combiner boxes. Pinpointed, module-level performance monitoring increases system uptime and saves maintenance costs. A built-in safety mechanism automatically reduces voltage across the system to one volt per power optimizer during emergency or maintenance. The OP600 is the most cost-efficient commercial module-level optimization solution currently available.

SolarEdge | www.solaredge.com



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Revamping Geothermal

Case Study: The Mori geothermal start-up

By Tomoji Tomoe, Rob Petrick, Paul Murray & Paul Bernard



Pump 1 of the pump/ejector hybrid system

Second-stage ejector of the pump/ejector hybrid system

THE GRADUAL, GLOBAL MOVEMENT from traditional to alternative energy might be a more recent endeavor, as we seek less harmful and more energy efficient ways to power our planet. But, geothermal energy (or, the heat from the earth) has been used for centuries. From bathing and cooking since the Paleolithic times, to heating since the ancient Roman times, hot springs have provided heat and fresh warm water to humans for ages.

In more recent times, the earth's springs have been used to generate not only heat, but also power and electricity, and can often be found in even the most remote regions of the world. A small town in the Hokkaido prefecture of Japan, Mori, is just one example. Mori is home to a geothermal power plant that has been generating electricity for the inhabitants of Hokkaido for more than 30 years now.

This plant was originally designed to produce 50 megawatts (MW) of electricity for the grid but, as with anything, changes over time have impacted its efficiency and workflow. In

this case, specific changes in the geothermal resource—which can include how much energy is in the steam, the quantity of steam available, or the amount of non-condensable gas present in the steam—have gradually reduced the plant's output to about 15 MW. At the Mori plant, the resource is brine, which is flashed or expanded into steam in order to drive the turbine.

Not surprisingly, the town and company contractor identified the Mori plant as one that was in desperate need of improved efficiency. Fortunately, a team of engineers could provide just that.

Plant upgrades

Any system inefficiencies can noticeably impact the power of a geothermal plant, affecting the energy it can produce for the grid. This is especially true of a plant with a gas extraction system, which can account for one of the largest parasitic loads on a geothermal power plant—and was the case for the Mori plant.

With electricity capacity so low (at only 15 MW), the Mori plant owners (Hokkaido Electric) were convinced to upgrade the plant's gas extraction system. A simple plan, perhaps, but no easy feat. The original system consisted of a turbo blower, which was driven by a steam turbine that also helped drive a generator. The plan during this upgrade was to remove the existing turbo blower, which had a gross weight of 220,000 pounds. Removal of the system required proper planning. This work took approximately two months, but was nicely timed to coincide with the plant's bi-annual maintenance shutdown.

For this project, it was out with the old and in with the new. In place of the turbo blower, a new, hybrid gas removal system was designed for the Mori plant, engineered to work with its current, non-condensable gas load. In terms of efficiency, the hybrid system used much less power than the original blower. The hope was that the plant would provide closer to 18 MW of power after the upgrade.

To help with the switch, a start-up team was sent to the jobsite to monitor and check the installation of all of the equipment. During the five days this engineering team was at the plant, the pump and the entire gas extraction system were started. The turbine was balanced, while cycling through various loads, and then the whole unit was started. The generator began putting power out to the grid as intended.

In fact, the new gas extraction system responded better than originally intended. As a result, the team increased the load from the anticipated operating level of 18 MW, to over 20 MW. Even though the gas content of the steam was higher than the system was designed for, the condenser vacuum held steady and the gas removal system continued to operate flawlessly.

Final operations

The final goal of this project upgrade involved reducing and analyzing all of the data acquired at the Mori plant, and presenting it to Hokkaido Electric's plant management. The data showed a minimum increase of 5.5 MW output over the previous system, which was even higher than what was predicted or designed for the non-condensable gas amounts—and, actually, equated to almost twice that of what was initially guaranteed for the upgrade. Even better, were the payback figures, which showed that the plant upgrades reduced the originally computed payback time for the project by almost 50%.

Before leaving the Mori plant, the engineering team provided a hands-on demonstration and instruction session for plant personnel on the proper operation and maintenance of the new gas removal system. Upgrades are of little value if the equipment isn't run or maintained properly.

As far as geothermal plant upgrades go, however, the Mori plant proved to be a successful, well-executed project, demonstrating the ongoing benefits of an age-old energy source from the earth—the power of geothermal energy.

Gardner Denver Nash is a manufacturer of liquid ring vacuum pumps, compressors, and engineered systems, serving the power and environmental industries. Nash also provides global service and technical support for its products through its worldwide locations.

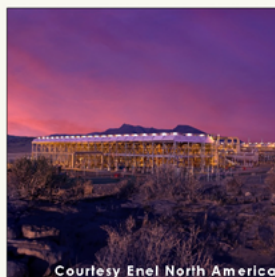
Gardner Denver Nash | www.gdnash.com

NATIONAL GEOTHERMAL SUMMIT

June 26-27, 2013 • Reno, NV

The Geothermal Energy Association (GEA) will host the third annual National Geothermal Summit on June 26-27, 2013 at the Grand Sierra Resort and Casino in Reno, NV. The event will focus on policies and technologies moving forward geothermal development in Nevada, California and the Pacific Northwest.

On Wednesday, June 26th, in the evening there will be a networking reception and open exhibit area which will kick off the Summit. On Thursday, June 27th, the National Geothermal Summit will start with a plenary session followed by afternoon break-out sessions, and closing plenary session. The plenary sessions will feature policy leaders invited to speak and engage in discussion about the future of renewable and geothermal power.



Produced by:
GEA
GEOTHERMAL ENERGY ASSOCIATION

For more information and to register, visit
www.geo-energy.org.



Geothermal heat pump system

GeoStar introduces an update to its Aston Series, now featuring Aurora controls that provide two-way communication with components for superior performance and troubleshooting capabilities. The Aston Series packaged geothermal heat pump provides forced air heating, air conditioning, and even generates a portion of a home's hot water—all from a single unit. Available in nine single-speed and five dual-capacity sizes, from one to six tons, the system achieves an energy efficiency ratio (EER) of 30 and a 4.8 coefficient of performance (COP), and features a variety of advanced technology and components.

The dual-capacity units include Scroll UltraTech compressors for added efficiency and reliability. A variable speed electronically commutated blower motor (ECM) further enhances system efficiency, running only at the speed required. Other choices include a standard permanent split capacitor (PSC), or a high-efficiency 5-Speed blower motor for comfort and quiet operation. The ENERGY STAR-rated Aston Series also features environmentally friendly R-410A refrigerant to meet the most stringent requirements of the US Environmental Protection Agency. In addition, the Aston Series qualifies for a 30% federal tax credit.

GeoStar | www.geostar-geo.com

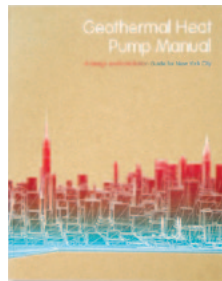


Multi-positional heat pump

Fully customizable to meet individual installation needs, the CDi series Greensource geothermal heat pump from Bosch Thermotechnology comes with multi-positional configurations. Whisper-quiet operation, and a fiber-free, closed-cell insulation helps to keep the system highly efficient, while improving indoor air quality. Low operating costs allow owners to save up to 70% on utility bills. Financing is also available, along with a 30% tax credit for the total system cost. The unit comes with a 10-year limited parts and labor warranty, and has earned the ENERGY STAR Most Efficient 2013 rating. Combine the Greensource geothermal heat pump with a Bosch thermostat, designed to work exclusively with the system.

Bosch Thermotechnology

www.bosch-climate.us



A manual for GHP

Spring is finally here, and New Yorkers are happily turning down their thermostats after an especially long, cold winter that saw an increase in energy bills. An alternative to costly, conventional energy sources, geothermal heat pumps (GHP) offer a cheaper, cleaner, and more efficient way to heat and cool buildings. The New York City Department of Design and Construction (DDC) has identified GHP as an important strategy for developing sustainable energy in the city, especially for the reduction of greenhouse gas emissions. Working with the DDC, Pentagram's team has designed "Geothermal Heat Pump Manual: A Design and Installation Guide for New York City."

GHP systems take advantage of the relatively constant temperature of the earth's interior, using it as a source or sink for heat. For cooling, heat is extracted from the building and dissipated into the ground; for warmth, heat is extracted from the earth and pumped into the building. They are a part of PlaNYC 2030, the city's official plan for sustainability.

Publisher: Pentagram | www.pentagram.com



Non-pressurized flow centers

Enertech Global has announced that they are the first manufacturer to carry the new Non-Pressurized Flow Centers from Geo-Flo. Raising the bar for non-pressurized applications, this latest model builds upon Geo-Flo's three-way flushing valves with Flo-Link connections. Not only does it eliminate the need for external flushing ports, but it also provides isolation for pump replacement. Utilizing union-style, Flo-Link double O-ring connections, it allows top or side connections to the loop and/or the heat pump.

Plus, the NP Series by Geo-Flo never allows the flow center tank to go into a vacuum or become pressurized (above 13 psig), and it prevents negative pressure or flat hoses (so the lid never "pops" off). Additional features include: Grundfos UPS26-99 three-speed pumps (also available with UP26-116 pumps); lower watts; greater flexibility; and a controller that allows GPM settings for part load and full load (two-stage heat pumps).

Enertech Global | www.enertechgeo.com



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Measuring and Rewarding Energy Efficiency

By Alden M Hathaway & Govi Rao

GREEN IS DEFINITELY STILL THE NEW BLACK. Driven by global competition and regulatory pressures, corporations appear to be sharpening their focus, not only lowering energy costs, but also finding new ways to achieve cleaner, greener energy. Energy efficiency is the goal, and so far this seems to be met in three specific ways:

1. Replacing older equipment with more energy efficient technology;
2. Optimizing operation of equipment/facilities; and
3. Continually fine-tuning equipment for more economical performance.

The replacements: energy efficiency technology

For the past several years, technological innovations in lighting and HVAC (heating, ventilation, and air conditioning) have driven efficiency upgrades in buildings, enabling up to 60% savings through innovations such as: T-8 lamps; electronic ballasts; CFLs; LEDs; heat pumps; front-load washers; variable speed drives; screw/scroll compressors; thermal recovery systems; desiccant wheels; and more. Utility efficiency program managers find these technology upgrades easy to quantify and administer, since they represent specific reductions in power that occur in all market applications. As a result, utility programs have generally focused on upfront rebates to reduce upfront technology costs (so long as the technology is proven).

However, sustaining these kinds of large saving opportunities from additional energy efficiency upgrades becomes challenging when it's necessary to factor in and build upon earlier equipment upgrades, as well. Once T-8 or T-5 lamps have replaced T-12 fluorescent lamps and lumen-per-watt efficiencies achieve nearly 110, for example, another 60% reduction in energy use is impossible unless lumen levels are dimmed or attenuated. Even LEDs, which promise some significant savings over compact fluorescents, need dimming controls to improve their savings and ROI. The same could be said for chiller efficiencies, which are already meeting levels below 400 watts per ton.

Control technologies that switch, dim, or attenuate a piece of equipment can significantly increase energy savings by reducing hours of operation at full output. These control technologies are the next frontier in energy efficiency, especially in commercial and industrial sectors.

Optimizing operations

New control technologies offer an opportunity to meet, or exceed, the energy savings of many of the technology efficiency upgrades described herein. Achieving similar or superior payback is possible by taking steps to optimize the delivery of light, heat, cooling, compressed air, etc. This can be done at precisely the level needed for the specific application, and at precisely the right time—meaning only the required amount of light, heating, cooling, ventilation, or equipment is used, and only when needed.

The next wave of energy savings will not only include control technologies, but also continual optimization techniques. These controls have to be customized for specific sub-load applications in commercial enterprises, and at the process/equipment level in industrial facilities. And, as with any technology, maintenance is key. In addition to upgrading building systems and integrating controls, it's essential to sustain these technologies for optimal performance. This can be done proactively and periodically by building operators, usually through continual commissioning, testing, adjusting, and balancing of systems.

Quantifying energy efficiency

Although reduced energy use is widely regarded as beneficial to the bottom line, company executives often lack the information needed to make the best decisions about energy usage at their facilities. This is sometimes compounded by a lack of clear incentives and/or standards in quantifying energy efficiency. In fact, utilities have found the prospect of encouraging large energy users to achieve greater energy efficiency a more difficult process than one might think.

Reasons for this include: behavior-based energy savings and corresponding rebate levels are not predictable; utility rebates are a one-time payment and cannot guarantee sustained savings; and such rebates don't provide real-time feedback on how systems are operating.

One solution designed to maximizing energy efficiency decisions and rebates involves energy efficiency certificates. These certificates or "tags" represent meter-measured, verified energy savings that have already occurred. Each tag stands for one megawatt-hour (MWh) of conserved electricity, or one-thousand cubic feet (MCF) of conserved natural gas, resulting from some type of quantifiable improvement in energy use. Current energy usage can, then, be compared with a clear, defined baseline to determine energy savings—or, the quantity of tags produced.

Such performance-based instruments reward the facility owner for sustained energy savings. In addition to the monetary rewards, building owners receive a valuable tool to help fine-tune operations and continue optimization.

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Comprehensive rewards for energy efficiency with lower costs

Source: Cost-Effectiveness of Electricity Energy Efficiency Programs, Nov. 2009, Resources for the Future

Figure 1. Comparing costs

Case study: meeting compliance objectives

As a case in point, DTE Energy received these energy certificates, or tags, to supplement the utility's energy optimization results, and to help meet Michigan energy efficiency goals. Working with General Motors at the GM Romulus Engine Plant in Romulus, Michigan, it was possible to verify 994 MWh of savings (or 994 tags) in 2011 and 2012 from GM's new "switch-and-stage maneuvers," designed to meet new standards for dynamic air compressor operations set in 2010. Since 2012, electronic scheduling automatically optimizes and perpetuates energy savings, in essence becoming an ongoing "tag" generator for the GM facility.

Measurement & verification

So, how does a company establish an accurate baseline of energy use, then reliably measure and validate energy savings? The solution comes from software. One cloud-based software platform currently being used provides real-time measurement, verification, and visualization of building energy and water usage. The platform maps and compares all energy sources, including conventional and renewable, tracking usage, on a real-time basis at the main meter and at the sub-meter level. The system also receives data from weather stations to integrate local conditions and building energy usage, with built-in education and communication components to drive behavior change.

Using an advanced SCADAR-type system, the installed software provides continuous measurement and feedback on any efficiency measures implemented, automatically updating the quantity of tags (see Figure 2).

An important supporting feature of any web-based, software application for monitoring energy usage and efficiency is that it remains accessible anytime, from anywhere, sending automatic alerts/notifications via telephone, e-mail, or text. It should also allow users to continually identify opportunities for optimizing energy usage.

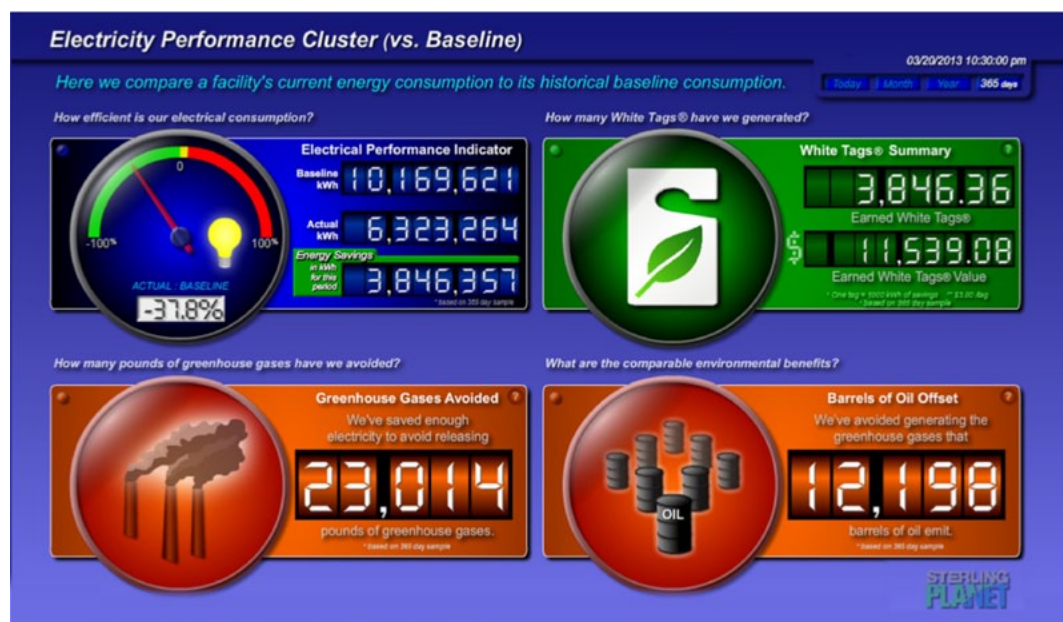


Figure 2. Relying on interval data feeds from the building utility meters, this software solution can be linked to workflow systems, and includes built-in, 24/7 alerts that are customizable.

Conclusion

Green might very well be the new black, but as can be seen, change is not always easy. Retrofits are great, but only when all of the technology is fully up-to-date. Sometimes changing one thing, means changing many things to be effective.

One solution that goes beyond rebates and incentives for change are energy efficiency certificates. Such tags, as they are often referred to, are beginning to emerge as a new form of currency for energy efficiency, serving as proven instruments for measuring, rewarding, and promoting energy efficiency in commercial/industrial settings—and helping utilities cost-effectively meet mandated goals for increased efficiency.

Alden M Hathaway, PE CEM, SVP, is involved with business development for Sterling Planet, and Govi Rao is the president and CEO of Noveda Technologies.

Sterling Planet works with businesses that have generated energy savings and resultant White Tags energy efficiency certificates. These performance-based instruments reward a facility owner for sustained energy savings. Noveda provides the patented, cloud-based software platform, enabling continuous analysis of energy consumption.

Sterling Planet | www.sterlingplanet.com

Noveda Technologies | www.noveda.com



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San Diego Convention Center—San Diego, California; www.pvamericaexpo.com

JUNE

- 03 **NHA Hydropower Finance Summit**
The Roosevelt Hotel—New York, NY; www.hydro.org
- 10-12 **10th Annual Energy Ocean International**
Crowne Plaza—Warwick, Rhode Island; www.energyocean.com
- 11-12 **Small and Community WINDPOWER Conference & Exhibition**
Rochester Riverside Convention Center—Rochester, New York; www.smallandcommunitywindexpo.org
- 16-19 **Hydrogen + Fuel Cells 2013 (HFC 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

- 09-10 **AWEA Wind Power on Capitol Hill**
Hyatt Regency Washington—Washington, DC; www.awea.org/events
- 9-11 **Intersolar North America**
Moscone Center—San Francisco, California; www.intersolar.us
- 28-30 **Pellet Fuels Institute Annual Conference**
The Grove Park Inn—Asheville, North Carolina; <http://pelletheat.org/events>

AUGUST

- 07-08 **National Geothermal Summit**
Hyatt Regency, Sacramento—Sacramento, California; <http://geo-energy.org/events>

SEPTEMBER

- 03-06 **International Conference on Thermochemical Biomass Conversion Science**
Sheraton Chicago Hotel & Towers—Chicago, Illinois; www.gastechnology.org/tcbiomass2013
- 9-10 **AWEA Finance & 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
- 24-25 **Optimizing Wind Power O&M**
The Mid-America Club—Chicago, Illinois; www.greenpowerconferences.com
- 29-02 **GEA Geothermal Energy Expo 2013 & GRC Annual Meeting**
MGM Grand—Las Vegas, Nevada; <http://geo-energy.org/events>

OCTOBER

- 02-03 **ALL-ENERGY CANADA 2013**
Direct Energy Centre—Toronto, Ontario; www.all-energy.ca
- 03-13 **US Department of Energy Solar Decathlon**
Orange County Great Park—Irvine, California; www.solardecathlon.gov
- 7-10 **CanWEA 2013**
Metro Toronto Convention Centre—Toronto, Ontario; www.canwea2013.ca
- 21-23 **Solar Power International 2013**
McCormick Place—Chicago, Illinois; www.solarpowerinternational.com
- 22-23 **AWEA Offshore WINDPOWER Conference & Exhibition**
The Rhode Island Convention Center—Providence, Rhode Island; www.offshorewindexpo.org

Send us your clean energy show and event listings. Email information to the Editor at mfroese@nacleanenergy.com

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