

SOLAR BUILDER™

SOLARBUILDERMAG.COM NOVEMBER/DECEMBER 2013

WINNER

STONE BREWING CO.'S PACKAGING HALL

INSIDE COVER

**GROUND-MOUNT WINNER:
HOLSTON VIEW ELEMENTARY**



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SOLARBUILDERMAG.COM NOVEMBER/DECEMBER 2013



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HOLSTON VIEW ELEMENTARY





☀ ON THE COVERS

Our two covers feature the ground-mount and roof-mount winning projects of our Project of the Year awards: Holston View Elementary and Stone Brewing Co.

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After many submissions and many more votes from our enthusiastic readers, we're happy to present to you the winning projects of *Solar Builder's* first Project of the Year awards, separated into ground-mount and roof-mount categories.

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MADE IN THE USA

As Solar Power International was winding down in Chicago this year, Fronius USA offered industry journalists the chance to tour its headquarters in nearby Portage, Ind. The company had been operating out of Michigan since 2002, but in the last year, the solar electronics and welding technology divisions moved to the brand new, \$30 million, 500,000-sq ft facility near Lake Michigan.

The building is beautiful and so is the surrounding area. Fronius employees have access to hiking trails that reach the lake and are encouraged to get outside and experience nature. The view from the roof of the new Indiana headquarters is pretty nice too — a solar system feeds power to multiple Fronius inverters in the company's downstairs learning lab. Fronius is able to monitor its own inverters in real-time and see how they function in the "real world."

When we visited in the last few weeks of October, the assembly lines were still in training mode. Fronius was making sure each person knew their duties backward and forward before ramping up production. That dedication to perfection is great for U.S. manufacturing. Fronius wants to eventually reach 100 percent capacity at the Indiana plant for its UL-approved inverter models.

There are many more U.S. solar manufacturing success stories, and we hope to bring you more good news about these companies in the future. Our "I am a Solar Builder" campaign kicks off in 2014, and we hope you'll join us to learn about unique individuals involved in this great industry.

See you next year,

Kelly Pickerel, Associate Editor

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news

SOLAR POWER INTERNATIONAL

2013
Recap

APPROXIMATELY 13,000 energized solar industry professionals packed McCormick Place in Chicago for Solar Power International 2013 (SPI '13), Oct. 21-24. The energy was palpable as the show welcomed significant crowds from the Midwest, the largest first-time attendance in years and record-breaking attendance in conference program sessions.

The event, which is co-owned by the Solar Energy Industries Association (SEIA) and the Solar Electric Power Association (SEPA), had an estimated \$35.5 million economic impact on the Chicago area.

Knowledge and information seemed to be found at every turn of host center McCormick Place, including the exhibition floor, where the latest industry technology and innovations

could be found. Epitomizing the industry's spirit of innovation was Start-Up Alley, a section of start-up companies that were given the opportunity to attend SPI and take part in a competition to determine the most promising business concepts.

Information also flowed elsewhere on the exhibition floor, from the Solar Central

section to the Industry Trends booth (home of presentations and data from GTM Research and the Interstate Renewable Energy Council, as well as SEPA and SEIA) and the Poster Presentation area.

"SPI is a concrete manifestation of what an amazing industry we have," said Stephen



I AM A SOLAR BUILDER

Many solar builders stopped by our booth at Solar Power International, including these winners of our free money giveaway: (clockwise from top) Berkowatts Electric with *SB* marketing director Kelly Dadich, electrician Cornelius Brent with *SB* editor Kelly Pickerel and *SB* conference event coordinator Vicki Miner, and Good Electric Inc. with Pickerel.



Miner, CEO of Solar Energy Trade Shows LLC. “We thank our exhibitors, speakers and every single attendee, all of whom came together to create an event like no other. The reason behind SPI’s dynamism: Solar energy is an industry like no other.”

At Wednesday’s General Session, attendees got a rather unique experience: listening to solar companies, utilities and regulators all try and think like one another. The experiment proved to foster greater understanding of the different responsibilities and priorities of each stakeholder — and hopefully more effective dialogue.

“SPI ’13 truly has been one of the best iterations of SPI ever, and that’s thanks to everyone who participated in the event, right down to each and every attendee,” said SEIA President and CEO Rhone Resch. “One important role SPI serves is to give the industry an annual energy boost, and I certainly felt that energy all around me here in Chicago. Now it’s time to harness it, take it home and take action.”

Solar Builder had its own fun at our booth on the exhibition floor. We kicked off our “I am a Solar Builder” campaign, aimed at showcasing the many talents of solar installers, contractors, developers and everyone behind the scenes of North America’s great projects. Attendees were encouraged to wear our *Solar Builder* stickers around the show, and we chose one winner each day for a Visa gift card. Congrats to our winners: Israel Berkowitz with Berkowatts Electric from Lakewood, N.J.; Good Electric Inc. from Chicago; and electrician Cornelius Brent from the Chicago area.

Mark your calendars for SPI 2014, Oct. 20–23, 2014, in Las Vegas. See you there!



REPORT: MAJORITY OF U.S. CONSUMERS WOULD CONSIDER RESIDENTIAL SOLAR INSTALLATIONS

New E2 (Energy + Environment) research from Market Strategies International finds that interest in residential solar installations is stronger and broader than expected among American consumers, even when those consumers are educated on associated costs. With few exceptions, this interest is strong across virtually all age and income groups.

Sixty-one percent of survey respondents overall are either somewhat or very interested in purchasing and installing a home solar system. The initial interest is strong across most age groups and all income groups, although only 46 percent of consumers over age 55 are interested. Three-quarters of the 18–34 age bracket and two-thirds of the 35–54 age bracket are interested.

Survey participants were informed that “The cost of a typical home solar system is about \$30,000 and provides about 60 percent of a home’s electricity needs. The final costs of a solar system can be reduced through a federal tax credit that allows purchasers to deduct 30 percent

of the system’s cost from their income taxes. Some states also provide financial incentives for solar installations.” This information made 51 percent of respondents more interested in home solar systems, with consumers older than 55 again the only group to show less interest. A majority of respondents across every income group continued to show interest, even low-income households with incomes under \$25,000.

“It’s pretty clear that most utilities in the U.S. have to figure out an effective strategy for working with their customers who want solar power,” said Jack Lloyd, senior vice president of the energy division at Market Strategies, whose team works with 20 of the top 30 regulated energy utilities in the United States and conducts a nationally based benchmarking service. “Companies will take different approaches in adapting to the situation, but rooftop solar appears to be poised to move beyond its early adopter niche and become a more mainstream phenomenon.”

GLOBAL SOLAR INVERTER REVENUE TO DROP ALTHOUGH SHIPMENTS RISE IN 2013

NEW COMPETITION

The price of low-power three-phase inverters decreased rapidly in the first half of 2013, due mostly to intense competition from suppliers releasing new inverter products, like Power-One's Aurora TRIO for the North American market.



GLOBAL MARKET revenue for solar PV inverters will drop by 9 percent in 2013, due to rapid price declines for commercial and utility-scale inverters and intense cost pressure in mature markets such as Germany and Italy, according to the latest data from IHS Inc.

Although worldwide solar inverter unit shipments will rise by 7 percent in 2013, projections now show that market revenue this year will fall. Revenue is set to decline to \$6.4 billion, down from \$7.1 billion in 2012. The previous IHS forecast issued in July predicted a 5 percent decline in revenue in 2013.

Average inverter prices now are set to decrease to \$0.18 per

watt in 2013, down from \$0.22 per watt in 2012, according to the latest PV Inverter Market Tracker report from IHS.

As total PV system prices continue to decrease, all parts of the supply chain, including inverter suppliers, are under increasing pressure to reduce prices.

“During the past few years, solar module makers have endured much more price pressure than the inverter suppliers have,” said Cormac Gilligan, senior PV market analyst at IHS. “However, module prices now have reached an inflection point and have begun to rise. This is having major ramifications for inverter suppliers, with price pressure having shifted to their segment of the business.”

Inverter makers now must absorb some of the price pressure that module suppliers can no longer sustain. Further pressure is occurring because the inverter makers now are being forced to decrease prices in order to win business in a crowded market. Moreover, the solar market is entering a period when government subsidies have been reduced or eliminated in many countries, forcing inverter makers to cut costs to keep their products affordable.

SLOWDOWN IN DOMESTIC MARKETS

One catalyst for the intense inverter price pressure is declining demand in some of the larger solar markets such as

Germany and Italy, where subsidies have been rapidly reduced or removed completely.

Combined inverter shipments to these two markets will fall by more than half this year, dropping to 5.7 GW in 2013, down from 11.5 GW in 2012.

Inverter suppliers that previously relied heavily on these two markets now are being forced into a fiercely competitive market environment, compelling them to decrease prices.

"Total PV inverter revenue throughout Europe in 2013 will be down by 50 percent compared to 2011," Gilligan noted. "However, the number of inverter suppliers in Europe is largely unchanged. This will result in fierce competition and will prompt inverter suppliers to aggressively enter new emerging

markets, such as South Africa and Thailand, in order to find new growth opportunities."

LOW PRICES FOR LOW-POWER INVERTERS

The price of low-power three-phase inverters — i.e., those up to 35 kW in size — decreased rapidly in the first half of 2013, due to a combination of intense competition from suppliers releasing new inverter products and commercial markets shrinking in size in some markets like Europe. A number of Chinese suppliers are also targeting this market, further adding to the competition that European suppliers are facing. In some key European markets such as Germany and Italy, the price of these inverters will decrease by 20 percent to \$0.14 per watt in

the commercial and utility-scale markets.

In the United States, the world's two largest suppliers, SMA and Power-One, have released inverters in this power range and have earned certifications from Underwriters Laboratories.

"IHS predicts that shipments of 20- to 35-kW inverters in the United States will reach more than 200 MW in 2013, and new products from the two largest inverter suppliers will certainly help to drive this growth," Gilligan added. "Pricing in this segment in the United States is relatively high compared to Europe, and it is likely that the presence of SMA and Power-One will contribute to American prices decreasing to European levels."



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WALMART STILL LEADS COMMERCIAL SOLAR SECTOR WITH 89 MW INSTALLED

LEADING THE PACK

Walmart remains America's commercial solar leader. Here, an install at a store in Ohio.
Photo courtesy of SolarCity.



THE SOLAR ENERGY Industries Association (SEIA) and the Vote Solar Initiative released the annual Solar Means Business report in October, identifying major commercial solar projects and ranking America's top corporate solar users.

The report found that Walmart remains America's commercial solar leader with 89 MW at 215 locations. The Top 25 companies, ranked by installed capacity, are Walmart, Costco, Kohl's, Apple, IKEA, Macy's, Johnson & Johnson, McGraw

Hill, Staples, Campbell's Soup, U.S. Foods, Bed Bath & Beyond, Kaiser Permanente, Volkswagen, Walgreens, Target, Safeway, FedEx, Intel, L'OREAL, General Motors, Toys "R" Us, White Rose Foods, Toyota and Dow Jones & Company.

Combined, these Top 25 companies have deployed 400 MW of solar capacity, a 33 percent increase from one year ago.

“The list of companies moving to clean, affordable solar energy reads like a ‘Who’s Who’ of the most successful corporations in America,” said SEIA President and CEO Rhone Resch. “These iconic brands are leading the way when it comes to efforts to reduce our nation’s dangerous dependence on foreign energy sources. They’re also helping to create thousands of American jobs, boost the U.S. economy and improve our environment. At the same time, they’re reducing operating expenses, which benefits both their customers and shareholders.”

“For years, the promise of solar was always ‘just around the corner.’ Well, solar has turned the corner, and found itself on Main Street, USA. These companies — titans of American business — may have vastly different products, business models, and geographic locations, but they all have something in common: they know a good deal when they see one, and they are going solar in a big way,” said Adam Browning, executive director of Vote Solar.

Solar Means Business also ranks the Top 25 companies by number of solar energy systems, the Top 5 companies in the food services, health and beauty and automobile sectors and the Top

10 retail companies.

Like these companies, America supports solar. From coast to coast, solar is creating jobs, saving money and decreasing our reliance on outside energy sources. In total, the companies analyzed for this report have deployed systems in 30 states and Puerto Rico.

Solar growth among these leading businesses reflects the growth in the U.S. commercial solar sector as a whole. As of Q2 2013, the cumulative commercial solar deployment totaled 3,380 MW and was located at more than 32,800 facilities throughout the country, representing an increase of over 40 percent from last year.

SOLAR SURPASSED ONLY BY NATURAL GAS FOR NEW ELECTRICAL GENERATING CAPACITY

According to the latest “Energy Infrastructure Update” report from the Federal Energy Regulatory Commission’s Office of Energy Projects, renewable energy sources (i.e., biomass, geothermal, solar, water, wind) accounted for 30.03 percent of all new domestic electrical generating capacity installed in the first nine months of 2013 for a total of 3,218 MW.

That is more than that provided thus far this year by coal (1,543 MW — 14.40 percent), oil (27 MW — 0.25 percent) and nuclear power (0 MW — 0.00

percent) combined. However, natural gas dominated the first three quarters of 2013 with 5,854 MW of new capacity (54.62 percent).

Among renewable energy sources, solar led the way for the first nine months of 2013 with 146 new “units” totaling 1,935 MW followed by wind with 9 units totaling 961 MW. Biomass added 57 new units totaling 192 MW while water had 11 new units with an installed capacity of 116 MW and geothermal steam had one new unit (14 MW).

The newly installed capacity being provided by the solar units is second only to that of natural gas. The new solar capacity in 2013 is 77.36 percent higher than that for the same period in 2012.

Renewable sources now account for 15.68 percent of total installed U.S. operating generating capacity: water — 8.32 percent, wind — 5.18 percent, biomass — 1.31 percent, solar — 0.54 percent and geothermal steam — 0.33 percent. This is more than nuclear (9.19 percent) and oil (4.06 percent) combined.

bos

SECURE CONNECTIONS

As solar farms get bigger and more powerful, flexible cables can help meet the demands of these large-scale operations.

By **Sammy Germany**

WHILE CREATING A better power-management system at higher voltage levels, a solar power plant's balance of system (BOS) requirements place extraordinary demands on power cables that conduct electricity from the prime mover to power-gathering systems. The ability to meet these demands affects the safe operation of these solar systems.

Power cables enable the flow of electricity from power conversion equipment (through step-up transformers) to the grid interconnection switchgear and load centers, which monitor and protect the entire system. Due to the cost of concrete solar equipment pads, conduit, power cables and equipment, it is critical to ensure all power systems are within proximity to enhance power quality and reduce the cost of large cable runs and terminations. In some cases, this will require using conductors that are flexible, multi-strain, very high power and efficient.

In above- and below-ground applications and restricted spaces, flexible diesel locomotive (DLO) cable is recommended for its flexibility and capacity for maximum applied voltages to the grid interconnection. DLO will still keep the

flexibility of a smaller conductor in larger conductor configurations. Solar power farms are moving quickly from DC strings of 1,000 volts to those from 1,500 volts and higher for grid-tie interconnection. This trend of more power will require a perfect conductor and wire termination.

MATCHING CONNECTOR TO CABLE

Flexible-conductor cable (flex cable), like DLO, has become increasingly popular in the last few years for conducting solar-powered electricity. Flex cable is easier to maneuver in tight spaces — above or below grade — particularly with sizes beginning at 250 thousand circular mils (MCM), as well as when cable changes position frequently, as in underground applications.

There are many different flex cable classifications and strands, so it is important to match the termination to the proper conductor size or specification.

Regardless of whether connectors are manufactured for specific applications, or, like those from Thomas & Betts (T&B), are dual rated for both B- or C-Code and flex cable, they must be clearly identified for

the proper application, as required by UL standards.

There is a wide variety of compression connectors that includes, for example, one- and two-hole lugs, butt splices and H-taps and C-taps. There also are connectors available for copper, aluminum or copper-clad aluminum conductors. Compression connectors offer several advantages over mechanical connectors:

- When properly installed with the correct tooling, connections are permanent and cannot be loosened accidentally.
- Connections are irreversible, which is sometimes required for grounding applications.
- Low-profile crimps are easier to insulate.
- Some connectors are available with an oxide inhibitor.

The disadvantages are:

- Each conductor size requires its own connector.
- Crimp tooling is needed to make a properly calibrated connection.

CRIMPING STYLES OVERVIEW

Traditionally, there were two crimping methods for installing compression connectors: the indent-style crimp, made by compression tools without dies, or the hex-style crimp, made by compression tools equipped with interchangeable hex dies.

Indent-Style Crimp

The indent-style crimp offers reliable electrical performance and approved, calibrated pullout resistance, as long as it is correctly done with a proper tool that corresponds to the size of cable and connector. An indent-style crimp leaves the connector with rounded edges and the capability to produce an arc flash. The strands are formed tightly together inside the connector, which eliminates virtually all air gaps from the conductor. One disadvantage of an indent-style crimp is that it does not provide for the inspection of a proper crimp.



Hex-Style Crimp

The hex-style crimp has been the industry standard for crimping compression connectors onto B- and C-Code copper and aluminum/copper cables up to 1,000 MCM. The T&B Blackburn Color-Keyed system, for example, enables the installer to determine the proper die quickly, by matching the color code to the connector. The hex-style crimp results in superior electrical performance and calibrated pullout strength, while hex dies emboss the die code onto the connector for easy inspection and verification of a proper crimp after installation.



Hex-Flex Die System

A third method of attaching connectors to flexible conductors was recently introduced. It combines the best of the indent- and hex-style crimp: superior calibrated pullout ratings and the ability to inspect for a proper QA/QC measured and documented crimp. The T&B Hex-Flex Die System combines standard Color-Keyed hex die halves for color-coding and die embossing for easy identification and inspection, with an indenter, which is round and smooth, and produces the higher pullout values across all types of flex cables. The higher pullout values created also reduce the number of crimps required on most connectors.



4 STEPS

FOR PROPER CONNECTOR INSTALLATION

With the correct tools, the proper installation of compression connectors is quick and easy.

1 Prepare the cable in accordance with the appropriate quality procedures — Strip the insulation carefully and according to proper procedures to avoid damaging the conductors (Figure A). Strip the insulation to the proper length so the conductors can be fully inserted into the connector barrel without exposing bare wire or un-insulated cable (Figure B).

2 Select the proper connector — Consult the wire schedule for the correct design criteria for the cable's ampacity and voltage. Compression connectors include markings for the proper application, which are clearly visible on the connector, as well as on product packaging and enclosed literature (Figure C). The connector must match the application.

Connectors are marked with several important pieces of information that ensure safe installation and comply with all applicable codes and regulations associated with this procedure, including manufacturer, application by color and die code, wire size, crimp indicator bands and UL and/or CSA listings. There are different labels for specific installations (like copper or aluminum), so make sure to pay attention.

3 Select the tool and proper die — A wide range of tools, from manual tools to battery-operated hydraulic crimping tools, make installing compression connectors easier. The Color-Keyed method simplifies the selection of the proper installing die: colored bands or colored dots on the connector correspond to the colored markings on the dies (Figure D). Connectors and dies also have a die code number marked or stamped on them. Dies have a code number engraved on the crimped surface.

4 Making the crimp — Be familiar with all applicable procedures, codes and regulations. Locate the markings on the connector and die. Keep fingers away from the crimping mechanism. Insert the connector into the tool and align the die with the connector.



With the increasing use of fine stranded, flexible conductor cable in solar power applications, the selection of the proper connector and connection method is critical. Compression connectors are prefer-

able to mechanical connectors, but the installation must be properly executed. By following the steps outlined above, electrical contractors will be following NEMA- and UL-approved methods. ■

Sammy Germany is market development manager of renewable energy and power generation for Thomas & Betts, a wire and cable management company. Visit thomasbetts.com for more info.

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DPW SOLAR CELEBRATES **20 YEARS** IN THE “YOUNG” SOLAR BUSINESS

By Kelly Pickerel

THE FIRST SOLAR CELL may have been patented almost 70 years ago, but the real growth of the solar industry didn't happen until the last two decades. Growth has been encouraged by decreasing panel prices, which today hangs around \$0.75/watt, a big drop from \$75/watt in the 1970s.

Two entrepreneurs anticipated the potential growth in the industry

and partnered to take advantage of an open market. Kevin Goodreau and Jeff Randall formed Direct Power and Water in 1993 (now DPW Solar) and set up shop in Albuquerque, N.M., manufacturing small mounting systems. Goodreau, today DPW Solar's vice president of business development, and Randall, vice president of product development, believed they could

provide better solutions for the industry than what was available at the time. Twenty years later, the solar mounting market isn't as empty as it used to be. Walk through any solar exhibit hall and you'll easily pass at least 30 mounting companies. But DPW Solar considers its early start in the industry as a significant advantage over the competition.

MODEST BEGINNINGS ►

First known as Direct Power and Water, DPW Solar started small in the early '90s in Albuquerque, N.M.

"DPW Solar has been around for 20 years in the solar industry so that makes us ancient," jokes John Markiewicz, general manager. "This industry is so new. Many racking companies are unable to claim five or 10 years of industry experience, let alone 20.

"Our 20 years in the industry points to the reliability of our products," he continues. "We've supplied racking systems that continue to outperform harsh environments for upwards of 20 years. Our longevity is also an indication of DPW Solar's focus on customer service and support. Suppliers that add value and solve problems are counted on most by customers."

PRODUCT EVOLUTION

DPW Solar manufactures flat and sloped roof-mounts for both ballasted and penetrating installations, as well as pole mounts and various ground-mount structures including utility-scale systems. Mounting rails are aluminum for corrosion resistance, ease of use and strength. Steel is incorporated in the ground-mount designs typically into the fittings and connection points for additional strength. Stainless steel hardware is offered throughout DPW Solar's product solutions for increased

strength and corrosion resistance.

The company has come to this mix of aluminum, steel and stainless steel through 20 years of product development, engineering and testing. DPW Solar's engineering team has leveraged previous designs and field experience when developing the next generation of racking solutions.

"Early on, our products were designed primarily for off-grid applications," Markiewicz says. "These solar systems were small, typically less than 2 kW, and the racks were designed to mount only a few modules. When grid-connected systems emerged, the size of the PV systems exploded, and our products had to evolve as well. Single pole-mounting systems expanded into multi-pole then multi-structure systems. We quickly evolved from small, four- to six-panel flat roof ballasted racks to a third generation commercial roof-mount system that mounts thou-

sands of modules."

Markiewicz recalls that the sales office used to get excited about a 10-kW system, but today that seems puny. "Now we're dealing in megawatts!"

"When solar systems were much smaller, installers were not as concerned with part count or assembly time," he says. "Now when preparing to install a multi-megawatt ground-mount system, the racking design and manufacturing have a major impact on project costs. DPW Solar now offers site-specific engineered systems and pre-assembly in our factories to help the installers keep costs down and complete projects on time."

▼ PARTNER SUPPORT

DPW Solar and Baja Construction recently partnered on the new SR Series solar-ready shade structure, using both companies' construction and manufacturing expertise.



SEA OF PANELS ▶

Solar Builder editor Kelly Pickerel got up close and personal with a DPW Solar mounting system installed on a roof at Baldwin Wallace University in Berea, Ohio.

Preformed Line Products (PLP), a designer and manufacturer of cable anchoring and control hardware and systems for multiple industries (including solar) headquartered outside of Cleveland, took notice of DPW Solar's steady growth in the solar industry and acquired the company in 2007. Of PLP's 14 international subsidiaries spanning across six continents, eight are now active with solar programs. Not only has DPW Solar seen a successful 20-year run in North America, the company now has a global presence.

"Our mounting solutions have been installed coast to coast and globally," Markiewicz says. "We also offer customers one of the broadest product offerings in the industry. One reason is because over the last 20 years, we continued to develop new products and solve problems as the market evolved."

NEW AVENUES

Markiewicz says the future of solar mounting lies in ease of installation and pre-assembled solutions.

"I see the trend of more pre-engineered and integrated solutions [expanding]," Markiewicz says. "We're performing more pre-assembly in our manufacturing facility. It does create additional challenges because it's no longer a standardized product. But customers benefit with a lower installed cost."

One of DPW Solar's major pre-engineered solutions for the future comes in a partnership with Baja Construction, a carport and solar support manufacturer. At this year's

Intersolar show in San Francisco, the pair introduced the SR Series solar-ready shade structure. Baja Construction provides the structures and installation, and DPW Solar provides its Power Rail mounting system fully integrated into the structure.

The two companies had initially collaborated on a multi-megawatt project in New York. DPW Solar bid its mounting solution and Baja bid its shade structure. Both won the project, so they got together and optimized Baja's shade structure with the DPW Solar mounting solution.

"That project gave us the idea that the industry would benefit from a pre-engineered shade structure and module mounting system solution," Markiewicz says. "This solar ready shade structure comes complete with the DPW Solar rail mounting system. It's a proven mounting system, and it's integrated directly into Baja's field-proven shade structures."

The SR Series from Baja and DPW is delivered to the customer ready for module hook-up. This easy partnership between the companies provides an even easier experience for the end-customer.

"The solar industry is like the Wild West," Markiewicz says.

"Companies are trying different strategies and this industry is evolving quickly. We see the benefit of partnering because it provides an added value to the customer, providing a one-stop source and solutions that work well together."

STILL THRIVING

Twenty years in this business is truly a milestone, and DPW Solar is grateful for the customer relationships that have grown over the years. Markiewicz cites the long-lasting relationships DPW Solar has established with customers and distributors as the real answer to its success.

"We focus on differentiating our company in this overcrowded market with our engineering support, customer service, field-proven designs and manufacturing capabilities," he says. "We continue to do business with many of the same customers today that started with us long ago. We've helped each other out throughout the years and have grown together, which we deeply appreciate."

Cheers to 20 successful years, DPW Solar, and to many more in the ever-evolving solar business. ■

Kelly Pickerel is associate editor of *Solar Builder*.





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NEW MEANS OF SUPPORT

CONCRETE MAY STILL BE KING, BUT NEW SOLAR FOUNDATION OPTIONS ARE THREATENING TO TAKE OVER THE EMPIRE. By Charles W. Thurston



◀ DIGGING DEEP

The TerraSmart ground screw is installed for a 6-MW project in Bolton, Mass. More than 3,300 ground screws were used in the project.

FEATHER LIGHT ▶

The A+ Sun System uses wire rope instead of metal bars to suspend panels.



CHOICES FOR PV

solar system foundations are becoming more varied as balance of system (BOS) component manufacturers seek to lower total system costs and speed installation. New technology concepts using concrete and metal are on the market, and better engineering designs to minimize the use of all materials are continuously emerging. As a result, installers have available a much wider range of options for a specific client site, regardless of the soil type or weather conditions.

RETHINKING CONCRETE

Concrete foundations in solar systems used to be over-built and under-engineered, adding time and cost to the total system price. One new Californian concrete foundation system that also serves as a racking mount reduces mounting metal to a single strut. This system design by Alion Energy, based in Richmond, Calif., virtually does away with a traditional foundation. The company's solution employs a robotic cement extruder — Rover — that lays a continuous L-shaped form to support solar modules that are fixed into place with adhesive. Adjustment is made for inclination by means of a

single fold-down vertical metal strut.

Not only is the foundation and mounting combined into one unit, the entire system is installed by Rover the robot. Using Rover instead of man-power, utility-scale projects can be built twice as fast and use half the labor, calculates CEO Mark Kingsley.

The Alion system features 775-ft long rows with a cabling section in the middle. Each row supports 144 modules, and using 245-watt panels would provide a 35-kW system. The design is particularly useful in high soiling regions, since the company also invented a robotic module cleaning robot — Spot — that rides the mounting rail to get from panel to panel. A demonstration unit is under construction in California, Kingsley notes.

SCREWING IN

While new focus on customized site engineering has reduced the use of concrete monoliths, driven metal piles or screw options have become more popular to speed installation times. For example, Estero, Fla.-based TerraSmart's ground screws are widely in use. One recent 6-MW project developer in Bolton, Mass., chose TerraSmart screws because of

the rocky ground conditions. The company reckons that 150 of its large machine-driven ground screws can be installed in one day and inserted into solid rock with a pilot hole. The Bolton project used more than 3,300 TerraSmart ground screws.

Another specialized screw in use in locations with frozen ground is from AllEarth Renewables, based in Williston, Vt. Its screw is 8 ft long and about 1 ft wide, with widely spaced helical threads.

"We designed our screw for our tracker product and use it when ground conditions permit," says Andrew Savage, director of communications. "A little frozen ground is good because you don't get as much mud. But if there is too much frozen ground, you've just got to wait."

One metal-based foundation system that functions much as a monolithic concrete block is DEGERenergie's pyramidal "Steel-Root" metal base.

"You just dig a hole, put in the frame and refill the pit," says Adam J. Glapiak, the international sales manager for the company located in Horb, Germany. The metal frame rests on five flat plates at the base of the pit and the entire structure supports a metal post for a tracker.

SPOT CLEAN ▶

The Alion Energy cleaning robot “Spot” connects to the concrete foundation’s mounting rail to clean each module man-free.

WIRED

Some metal foundation systems are replacing the use of concrete and speeding installation, but sometimes metal is a higher cost. Reducing the volume of metal within these systems helps to cut costs. One new system from Italy cuts the amount of metal from a traditional post and bar structure by 50 percent. The SunNet ground system from A+ Sun Systems of San Bonifacio, Italy, uses horizontal runs of wire rope up to 200 m long, stretched between small anchor screws that can be driven with hand-held hammer-drills, says Alberto Di Gaetano, CEO of the company.

“We prefer to use several smaller screws than use one very large one that requires a heavy machine,” he says. “That gives us an advantage in more remote locations or difficult access locations.”

The wire rope is certified for use in elevators and can handle far more stress than the solar modules it supports, Di Gaetano notes. The A+ Sun System is not only good for very steep slopes, where only the top and bottom need anchors, but it can also be used in 100 percent vertical situations, like the side of a silo, tank or building.

When simple penetrating and ballasted mounts are just not enough, many new options are out there for project developers for foundation support. ■■

Charles W. Thurston is a freelance writer who covers solar energy from Northern California. Reach him at chazwt@gmail.com.

DEEP SECURITY ▶

AllEarth Renewables drives one of its helical screws into semi-frozen ground. Frozen ground has pros and cons: There is less mud but harsher conditions.



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01113

A photograph of a city skyline, likely San Francisco, with the Transamerica Pyramid visible. In the foreground, a large construction crane is lifting a component. Below the crane, a construction site is visible with workers and materials.

PROJECT — OF THE YEAR — AWARDS





We at *Solar Builder* are happy to announce our first annual Project of the Year awards. We had many submissions for our two categories — roof-mount and ground-mount — and these are ultimately the best of the best. Winners were chosen by our enthusiastic readers, and the turnout for voting was overwhelming. A big thanks to all who participated!

On the following pages you will see the winners, runner-ups and honorable mentions

for both categories. Many innovative practices were adopted for each project — some systems were built on uneven terrain or unstable roofs — and new technologies made a splash (one project has microgrid capabilities). We're excited to see what new systems will be built in 2014 and nominated for our next awards.

In the meantime, enjoy these fantastic projects that are encouraging the growth of solar across North America. Congratulations to our winners! ■■■

Stories by **Kelly Pickerel**, editor of *Solar Builder*





ROOF-MOUNT WINNER

CHANCES ARE YOU'VE

heard of Stone Brewing Co. The 10th largest craft brewery in the United States has distribution in 37 states and the District of Columbia. Its popular brews include Stone Pale Ale, Stone IPA and a wittily-named Arrogant Bastard Ale released in 1997 to challenge popular beer companies that were keeping Americans "chained in the shackles of poor taste."

Rightfully arrogant with its business model (Stone Brewing Co. is expected to produce 210,000 barrels of beer, a large increase from 25,000 barrels 10 years ago), the company

located in Escondido, Calif., is also a huge advocate for sustainability and doesn't shy away from its green attitude. Recycling, compositing, refurbishing and repurposing are priorities at the brewery, two Stone Brewing World Bistro & Gardens restaurants and Stone Company Stores. Electric car stations are at one restaurant, and biodiesel is used in distribution trucks. Evaporation cooling is used in all brewery process refrigeration systems. A 2008 installation of a 312-kW PV system on the brewery rooftop (which accounts for 25 percent of the energy used on-site) opened the door for a second PV

installation at Stone Brewing Co.'s brand-new packaging hall.

Roadblocks with wind loads and an east/west facing array almost halted Stone's rise to the most environmentally-friendly beer in the world. Instead, developer Independent Energy Solutions Inc.'s smart thinking and great design helped the 360-kW installation at the packaging hall win first place in the roof-mount category of *Solar Builder's* 2013 Project of the Year awards.

"At Stone Brewing Co. we are consistently looking to reduce our energy consumption," says Steve Wagner, president and co-founder of



Developer: Independent Energy Solutions Inc. — Vista, Calif.
Contractor: Independent Energy Solutions Inc.
Modules: Hyundai
Inverters: Refusol (now Advanced Energy/AE Solar Energy)
Mounting: Everest Solar Systems

Stone Brewing Co.'s Packaging Hall Escondido, California 360 kW

Stone Brewing Co. “We had a successful experience with the system on our brewery and the power demands at our new packaging hall justified the expense of the system. We are based in Southern California which affords us the opportunity to harness a lot of sunshine and use it to our advantage.”

Back in Aug. 2012, ground was broken on the new packaging hall. The nearly 60,000-sq ft building today houses all of Stone's bottling and kegging operations and a few offices and storage. It was decided to include a solar system on its roof while construction was still happening on the building. Independent Energy Solutions (IES) won the bid and had a tough road ahead of them. Brad Souza, vice president of business development of IES, says the

project was incorporated into the existing construction process without impacting the building's construction schedule, but there were already unfriendly solar issues with the roof when IES came in.

“The roof was designed to handle the weight of the PV system but not the uplift due to wind,” Souza says. “The Everest racking system eliminated uplift concerns. Although the system is not at the optimal tilt, Everest's low profile allowed us to increase the overall power capacity of PV on the rooftop.”

IES went with Everest Solar Systems' D-Dome mounting system — a double-sided, low-ballast system. Each row of modules is butted up against the next, eliminating shading between rows. The system is elevated at 10° on both sides, and its aerody-

amic optimization enables minimal ballast — thus making it a perfect fit for the packaging hall's roof. This unique design also helped with covering nearly every section of the roof with panels, something Stone Brewing Co. specifically requested.

“The overall PV capacity was increased to maximize the available roof area, meeting [Stone's] desire for the largest PV system that met their economic requirements,” Souza says. “[IES helped] our customer realize and benefit from the vastly renewable resource which the sun provides [that] has helped lower their operating costs. The east/west facing array design, coupled with a semi-ballasted sub-structure, helped utilize every square foot of space on the rooftop.”

Everest is fairly new to the U.S. market — European parent company



K2 Systems opened the U.S. division in late 2012 — but IES felt confident with the D-Dome product, especially since it was manufactured in nearby Oceanside, Calif.

“The IES team visited their facility and reviewed their product in detail,” Souza says. “IES takes this approach with all new products,

which also includes several quality control measures during construction to ensure that the system is installed correctly.

“The resulting system looks wonderful,” he continues. “From an aesthetic standpoint, the system is not visible from the surrounding properties or from the street, another key

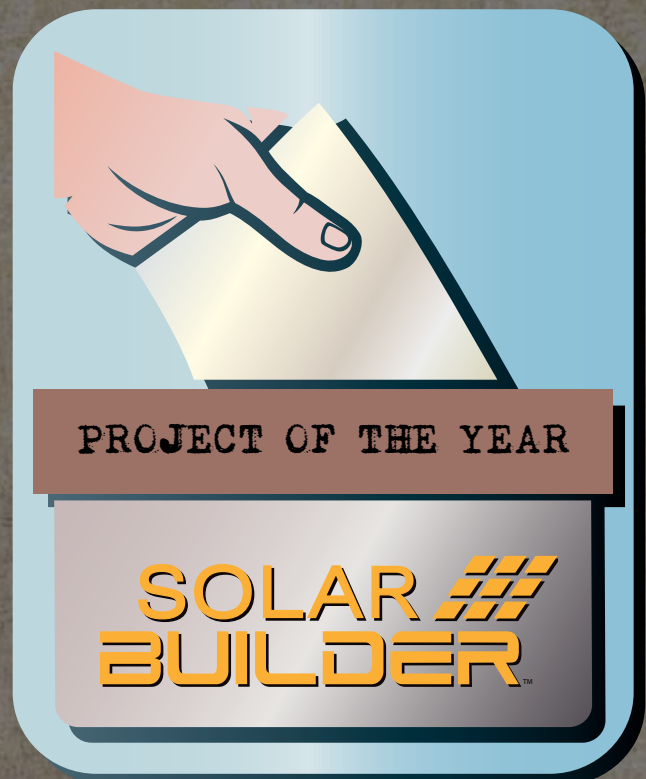
requirement in the design phase which was satisfied by Everest.”

IES — which finished the solar project in July 2013 — utilized a distributed inverter approach, locating 14 20-kW Refusol (now AE Solar Energy) string inverters on the rooftop. This eliminated long DC wire runs and the eyesore of large inverters at ground-level. A decentralized system removes the inverter as the single point of failure. If one inverter fails, the remaining inverters will continue to function. There is also no need for numerous combiner boxes, so the overall project is cheaper. With the inverters on the roof, it saved valuable space on the ground floor of the packaging hall.

“When Independent Energy Solutions enlisted our help, we realized the project posed several unique challenges, most notably limited rooftop space and the developer’s

Thank you
to our enthusiastic
readers for voting
in this year's Project
of the Year campaign.

**You chose
the winners!**



desire to minimize the amount of long DC wires running through the installation,” says Gordon Tredger, president of AE Solar Energy. “The key to addressing these challenges was the decentralized design built into the array of 14 three-phase string inverters. This distributed generation scheme will result in increased production, greater uptime and ultimately higher overall ROI for the Stone Brewing Co. We see this award as a reflection of AE’s commitment to providing customer flexibility and serving solar installations of all kinds.”

This year, *Inc. Magazine* named Stone Brewing Co. as one of its “5000 Fastest-Growing Private Companies,” for an impressive seventh year in a row. As a quickly and consistently growing company, Stone believes sustainability will assist them in their journey.

“Brewing can be a resource-intensive undertaking and we recognize we have a responsibility to minimize our impact on the environment and our community,” Wagner says. “We also find that introducing sustainable efforts is important to our team members and has a long-term financial benefit for the company as well.

“[The solar installation] transfers to every part of our business — not just the beer.” ■■



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ROOF-MOUNT SECOND PLACE

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50 kW

BESIDES THE UNIQUE opportunity of seeing Paul McCartney, Macklemore & Ryan Lewis, R. Kelly and Bob Saget in the same place, the Bonnaroo Music and Arts Festival gave attendees another reason to celebrate this year — solar power pumping through the speakers. A 50-kW system atop a backstage storage structure was largely funded by “opt-in” contributions from fans during the ticket-buying process. With sustainability and environmental-friendliness always being core values at the festival, 2013’s record-breaking attendance of 100,000 helped make the long-thought-out solar project a reality, and it has won second place in the roof-mount category of *Solar Builder’s* 2013 Project of the Year awards.

The annual four-day music and art extravaganza held in June in Manchester, Tenn., first began in 2002 with folk rock artists but today has an eclectic mix of music and entertainment, including hip hop, jazz, country, electronica and comedy acts. *Rolling Stone* named Bonnaroo one of the “50 Moments that Changed Rock & Roll,” and it’s often called the best festival and concert event of the summer as well as the greenest.

“Bonnaroo has been committed from Day 1 to being the most sustainable festival possible,” says Laura Sohn, sustainability coordinator for Bonnaroo. “Our sustainability work reflects the values of our lives, and we know that it is the right thing to do.”

Previous projects at Bonnaroo

encouraged by attendee contributions include a compost pad, carbon offsets and the Learning Garden.

“We have been exploring renewable energy options for the past five years or so,” Sohn says. “Last year, all the elements aligned to make the project happen.”

A chance alignment happened 1,100 miles away in Vermont. Encore Redevelopment, a project developer, was in a business organization with a construction company that builds sets for music festivals across the country, including Bonnaroo. The solar project idea was introduced to Encore, and the team took off.

“Our role was to communicate the financial aspects of the project,” says Chad Farrell, owner of Encore



Developer: Encore Redevelopment — Burlington, Vt.
Contractor: Sustainable Future — Knoxville, Tenn.
Modules: SolarWorld
Inverters: Enphase Energy
Racking: SolarWorld

Redevelopment. “That entailed doing a preliminary feasibility study to show them how the permitting processes would work, how the design process would work and most important for them, what the financial investment in the solar project would look like.”

Bonnaroo had introduced a \$1 fee to each ticket sold in 2012 to help generate money for green initiatives on-site. Along with the fee, additional contributions from attendees helped make the solar project a realization.

“Patrons have expressed support and interest in our sustainability work,” Sohn says. “We know that it is important to them, and we know that they are our biggest supporters of this work and not just financially.”

A yet-to-be-built backstage metal storage structure was chosen as the best location for a solar system. The system would be out of the way and avoid the dusty, high-traffic paths trekked by attendees. Knoxville, Tenn.-based Sustainable Future won the bid on the solar project and immediately made suggestions.

“They initially were going to do

a screw-down roof, but we recommended them to switch to a standing-seam roof,” says David Bolt, founder of Sustainable Future. “It made the installation a lot easier and provided a more durable product by not doing any roof penetrations and just attaching it to the standing seam.”

The project, finished in late 2012 and officially connected to the grid in January 2013 — well before the 2013 festival dates — contained 196 SolarWorld panels attached to SolarWorld racking and mounting systems. Sustainable Future went with Enphase microinverters for their flexibility in design.

“We really like microinverters,” Bolt says. “It gives you a lot more flexibility in terms of monitoring. You can see right at the panel-level what’s going on.”

The 50-kW solar power system will provide about 20 percent of Bonnaroo’s total electricity needs. When the 700-acre site is not consuming electricity (which is often the case), the power is sent to the grid, providing credits to Bonnaroo. The backstage structure is not visible to fans, but an

educational display in the festival’s Planet Roo allows patrons to monitor the power and learn more about renewable energy.

“Whenever we design arrays, we specify some type of data acquisition with a web-based portal to track production,” Farrell says. Bonnaroo designed a kiosk around the data provided to them by the microinverters and Encore Redevelopment.

Planet Roo features nonprofit organizations protecting the planet and promoting healthy lifestyles. While viewing the solar stats, attendees can peruse information on global warming and carbon footprints as well as find 100 percent compostable cups and sites to recycle old cell phones.

Working on the Bonnaroo solar project was an “honor,” Farrell says. “This is the first large-scale music festival with electricity needs addressed through a solar project.” Add that to Bonnaroo’s growing arsenal of ammunition against other U.S. festivals in the fight for best event of the summer. Fans know what one’s the winner, and now so does the solar community. ■



HONORABLE MENTION

ROOF-MOUNT

HONORABLE MENTION

MASSACHUSETTS MUSEUM OF CONTEMPORARY ART (MOCA)
NORTH ADAMS, MASSACHUSETTS
503 kW

ONCE a factory for printing textiles, the building that houses the Massachusetts Museum of Contemporary Art (MoCA) in North Adams, Mass., is now a factory for sun-powered electricity. Tecta Solar completed a 503-kW roof-mount project in May 2013, built on both sloped and flat roof types. The installation required a combination of custom racking systems from SI Distribution to ac-

commodate the different roof slopes.

The project spans six rooftops and ties into three interconnection points within the museum. Safety and ultimate care were essential, and Tecta was able to maintain the integrity of the roof that protects millions of dollars' worth of irreplaceable art. The system will offset approximately 39 percent of the annual electric usage of the buildings it is tied into.



Developer: Tecta Solar — Fort Washington, Pa.
Contractor: Tecta Solar
Modules: ET Solar
Inverters: Solectria Renewables
Mounting: SI Distribution (Solar Industry Distribution)



HONORABLE MENTION

ROOF-MOUNT

HONORABLE MENTION

SAN FRANCISCO EXPLORATORIUM
SAN FRANCISCO, CALIFORNIA
1.3 MW

SAN FRANCISCO'S Exploratorium learning museum moved to a new home in 2013 at Piers 15 and 17 on the historic Embarcadero. The Piers were extensively renovated, and Pier 15 came equipped with a 1.3-MW solar power system. The system should generate 100 percent of the electricity demand at the new facility, which opened in April 2013. System performance, updated every 15 minutes, is displayed in the lobby for museum-goers to witness.

Del Monte Electric installed the SunPower solar panels, and its biggest challenge was timing with weather, water and the barge crane that lifted the material to the roof. Planning was critical to saving costs by scheduling only two lifts with the extremely expensive barge crane, and Del Monte was successful in strategically getting the 30,000 ft of rail and 60,000 ft of wire lifted to the roof and installed before the second lift and installation of 5,900 PV panels.



Developer: San Francisco Exploratorium
Contractors: SunPower — San Jose, Calif.;
Del Monte Electric — Dublin, Calif.
Modules: SunPower
Inverters: Satcon
Mounting: DPW Solar



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GROUND-MOUNT WINNER

COMMUNITIES thrive when neighborhoods support their schools and children. The families of Bristol, Tenn., are enormously proud of their school district, which was evident when voting opened for *Solar Builder's* Project of the Year and one of their elementary schools was nominated. A 50-kW solar canopy was installed at Holston View Elementary and is intended for use

as an outdoor classroom and gathering area. Principal Jerry Poteat says the solar pavilion is not just for science, technology, engineering and mathematics (STEM) lesson plans; it's available for all to use and learn.

"The solar pavilion sends a message about the Bristol community as a neighborhood of problem-solvers, optimistically looking forward to more use of clean electricity and

teaching tomorrow's thinkers who will build a future that is better than the present," he says. "It belongs to and is expected to be used by our community."

Holston View's solar project has made a significant impact on the Bristol community, and that is why it is the winner in the ground-mount category of *Solar Builder's* 2013 Project of the Year awards.

Developer: EcoLogical Energy Systems — Bristol, Tenn.

Contractor: EcoLogical Energy Systems

Modules: MAGE SOLAR

Inverters: SolarBridge Technologies

Mounting: Schletter



Holston View Elementary

Bristol, Tennessee

50 kW

Holston View has never been your average elementary school. It was built 40 years ago as an intersection of six circular pods with open classrooms. From an aerial view, the school looks like a misshaped pentagon. Poteat says the original plans for the school were to take a multi-grade approach to teaching with the motto “Not for grades, but forever.”

Thankfully, things have changed since the '70s.

“Lately, our school has placed more

emphasis on higher achievement, STEM and project-based learning,” he says.

Holston View already had a number of outdoor classrooms, but the wooden structures were decaying and needed to be replaced. With the move toward being more STEM-like, the idea for a new outdoor classroom equipped with educational solar panels fit together “as naturally as peanut butter and chocolate,” Poteat says.

With the wheels already turning, Poteat stopped by a home show and saw renewable energy solutions provider EcoLogical Energy Systems displaying solar panels. The two parties really believed the idea was great, but finding a financing partner interested in the project proved to be difficult. After years of searching for a break, EcoLogical decided to proceed with the project on its own dollar.

“We never could find outsourced financing, so we went ahead and did

it ourselves,” says Pete Morenings, EcoLogical sales manager. “We own the system and once the system is paid for, we’re going to donate it to the school.”

With the finances squared away, construction happened very quickly. The project was finished in less than 30 days, just one month before classes began for the 2013/2014 school year. The parking structure, designed by Schletter, is 80 ft by 40 ft with about 200 MAGE SOLAR panels equipped with SolarBridge microinverters.

“There’s a lot of concrete,” Morenings says of the canopy structure. “There are five footers that are 3 ft wide, 3 ft deep and 40 ft long. It was a major amount of concrete.”

The size of the solar canopy was determined by the Tennessee Valley Authority (TVA), which is responsible for providing electricity to 9 million people, including the Bristol area. Holston View wanted the outdoor structure to be as large as possible, but TVA capped it at that 80 ft by 40 ft plot.

The system is massive — it can fit all 400 Holston View students (from Pre-K to 6th grade) with room to spare under the electrically-safe solar panels. Using the combined products from MAGE SOLAR and SolarBridge as a single AC module (and having one all-encompassing 30-year warranty), provides a safe alternative to DC systems.

“Our ACPV solution is a simple plug-and-play solution and definitely one of the safest and easiest ways to go solar,” says Joe Thomas, MAGE SOLAR USA president and CEO. “Since the microinverter is integrated into the frame of the module there is no wiring besides the branch connection and the regular row interconnections. Without exposed DC wiring,



the ACPV system eliminates any risks high DC voltage systems may have, making it an ideal environment for canopies like Holston View and similar structures. Students, staff and visitors can safely enjoy the shade the solar panels provide.”

If a DC-system had been used instead, direct interaction with the system would be minimal, Morenings says.

“If we went with anything other than microinverters, they were going to force us to put a 12-ft fence around it,” he says.

EcoLogical is working on solar energy curriculum to incorporate into the local school districts and community colleges. In the meantime, the AC modules provide a unique learning experience for the students at Holston View.

“From an education perspective each ACPV module is an ideal ‘learning lab’ since they are equipped with easy MPPT (maximum power point tracking) and monitoring,” Thomas says. “Students and teachers can observe in real time that each module is always producing at peak capacity even if there are isolated shading or cloud issues.”

Poteat and Holston View officials are formulating a STEM-influenced game to use with the solar canopy. A

game board with rectangular spaces will go around the perimeter of the concrete foundation, allowing students to learn about technology and science in a playful environment.

Morenings says the 50-kW installation at the elementary school is a good first step at changing the public’s perception of solar.

“Seeing solar, the kids are going to be used to seeing it by the time they leave elementary school and probably wonder why they don’t see it everywhere else,” he says. “To show that it’s something that’s viable — the price of solar has gone down so far that now it makes good financial sense for people to be installing solar. It seems the more we do, the more people see and the more they want it.”

“Solar is a reliable, proven and extremely efficient clean energy solution, especially in the U.S. with outstanding solar irradiation factors,” Thomas adds. “It can empower communities, schools and individuals with the capability of becoming a clean energy producer.”

Don’t be surprised when this country’s next generation of engineers and scientists come from supportive communities like Bristol, Tenn. — areas that are proud of their students and schools. ■■■



GROUND-MOUNT SECOND PLACE

KONTERRA SOLAR MICROGRID
LAUREL, MARYLAND
402 kW

ENERGY STORAGE is a fairly overlooked option when it comes to solar projects. Batteries are a necessary addition when the solar system is out in the wilderness and most definitely off-grid, but when it comes to larger commercial installations in urban environments, energy storage isn't often included in the plans. One game-changing project near Baltimore hopes to transform that mindset. The recently completed 402-kW carport installation at Konterra Realty's headquarters in Laurel, Md., not only has energy storage, it also has microgrid features, and its ingenuity helped it win second place in the ground-mount cate-

gory of *Solar Builder's* 2013 Project of the Year awards.

Developer Standard Solar initially talked with Konterra about a possible solar project without any battery storage or microgrid features. Around the same time, Solar Grid Storage had introduced its grid-integrated storage systems to Standard Solar. Solar Grid Storage manufactures storage systems that are co-located with the PV system but are separately owned and maintained by Solar Grid Storage. Thinking that Konterra would be an ideal site for a microgrid, Standard Solar approached Konterra about expanding the project to become a commer-

cial microgrid. The group of interested parties then applied for a Maryland Energy Administration (MEA) "Game Changer" grant and was one of four grant awardees.

"Integrating grid-integrated storage with the PV system has the potential to reduce PV project costs and offers new benefits including backup power, demand reduction and peak shaving," says Standard Solar CEO Tony Clifford. "Moreover, the system can enhance grid reliability by helping to balance the grid through frequency regulation, volt-ampere reactive (VAR) compensation and demand response services."

This grid-interactive energy stor-

Developer: Standard Solar — Rockville, Md.

Contractors: Standard Solar; Solar Grid Storage — Silver Spring, Md.; Solaire Generation — New York; Wanex Electrical Services — New Castle, Del.

Modules: Suniva

Inverters: Princeton Power Systems

Mounting: Solaire Generation



age system features two Princeton Power 250-kW inverters interacting with a 300-kWh lithium ion battery bank on the DC side. A 402-kW PV system — powered by 1,368 Suniva modules atop Solaire Generation carport structures — shares the inverters' power capacity with the batteries.

"The PV system will utilize only about 360 kW of the inverter capacity during peak hours, leaving 140 kW minimum capacity for the battery operations," Clifford says. "The battery system is an essential part of the storage system as it provides grid support through frequency regulation on the PJM regional transmission grid. The battery system's participation is very valuable due to its ability to respond extremely quickly to the grid's need to charge or discharge."

Once a battery is on-site with solar, energy storage can be used in very valuable ways. For instance, storage can be used for emergency power if the grid goes down. Normally PV systems are shut down during an outage, but having batteries there allows the systems to continue to operate. In extended outages, critical loads could be powered indefinitely

with this solar/storage setup.

Grid functions have value as well. Grid operators can use this storage situation to maintain power balance.

"[Grid operators] could charge or discharge a battery to help equalize frequency and power on the grid," says Solar Grid Storage CEO Tom Leyden. "By giving them access to that asset, they'll pay you for that. There is some new revenue and new values that you can get from the PV system that was not enabled before. It's really the beginning of this transformation of the utility grid and kind of the next big step in the solar industry to get even more value from these PV systems going in."

Construction on Maryland's first commercial-scale solar grid-interactive battery storage system began in June 2013 and finished three months later. Three Solaire canopies were installed double-wide to cover two parking spaces face-to-face, providing shade for around 130 total parking spots. The solar array also includes two electric vehicle charging stations with the infrastructure for four additional stations. The entire system is estimated to generate 20 percent of Konterra's annual power.

ABOVE:

Tom Leyden (CEO of Solar Grid Storage), Tony Clifford (CEO of Standard Solar), Maryland Governor Martin O'Malley, Council Member Roger Berliner and Abigail Ross Hopper (MD Energy Administration) at the ribbon cutting of Konterra's microgrid project.

Clifford predicts microgrid systems to soon become more of the norm.

"Going forward, the use of scalable distributed renewable energy generation technologies is expected to become common for microgrids," he says. "The increasing frequency of grid outages, especially as a result of catastrophic weather events like Hurricane Sandy, is the main driver in the rush to develop microgrids."

Standard Solar and Solar Grid Storage's project at Konterra's headquarters is a significant first step in changing the way people view large-scale solar installations.

"It's really the beginning of the next big phase of the solar industry," Leyden says, "where you can maximize and take full advantage of solar not just by creating kilowatt hours but by doing many more things with that incredible power." ■



HONORABLE MENTION

GROUND-MOUNT HONORABLE MENTION

BEACH CITY GROUND-MOUNT
BEACH CITY, OHIO
625 kW

ABOUT ONE-FIFTH of the homes in a small, 1,000-resident village in Ohio can now use electricity entirely generated by a 625-kW solar system built on old farm land. Beach City hooked up its 4-acre system in June 2013 with the help of AP Alternatives. The rural land is extremely hilly, and the solar

installation had differences in grade of more than 17 percent in more than one direction.

Rolling topography takes a lot of experience and skill to build on correctly, and it also takes a racking system that has the ability to roll along with the topography. AP Alternatives installed its standard 60-cell

ground-mount system in 29 rows to support 2,552 Renesola and Trina Solar modules over varying grades. When driving the post-installer from east to west, it was common to be going up in grade while also dropping grade from north to south. Even with these changes in grade, the racking was installed to the highest quality and is helping Beach City reduce its carbon footprint.



Developer: Solar Planet — Worthington, Ohio
Contractors: AP Alternatives — Ridgeville Corners, Ohio; Lake Erie Electric — Cleveland
Modules: Renesola, Trina Solar
Inverters: Nextronex
Mounting: AP Alternatives



HONORABLE MENTION

GROUND-MOUNT HONORABLE MENTION

CAMP SKY-Y YMCA
PRESCOTT, ARIZONA
54 kW

IN MARCH 2012 in the Phoenix area, Scout Solar announced it would be installing 1.6 MW of solar power at 16 Valley of the Sun YMCA locations with no out-of-pocket costs to the YMCAs. One of those 16 installs came at Camp Sky-Y YMCA in Prescott, Ariz. The 54-kW

project was mounted on a hillside at the 70-year-old camp in the Prescott National Forest and was finished in April 2013.

Prior to mounting the panels, Scout Solar had to clear the thick forest, grade it by hand down to a “manageable” 15 percent, dig 99 holes and

build a custom rack out of pipe to wrap around the hill.

“Sometimes our footings were on top of tree stumps, sometimes we found boulders,” says Scout Solar President David Spotts. “Mostly we had to deal with the root system which made it difficult.”

The grid-tied system using Centrosolar panels and Fronius inverters should reduce the camp’s demand by about 85 percent.



Developer: Scout Solar LLC — Tempe, Ariz.
Contractor: Scout Solar LLC
Modules: Centrosolar
Inverters: Fronius USA
Mounting: Custom-made

1



2



3



1

Chicago's Shedd Aquarium unveiled a 265-kW rooftop system Oct. 20 as part of an ambitious energy initiative aiming to cut energy consumption in half by 2020. The solar project is the largest on an Illinois cultural institution.

2

After more than two years of collaboration, 3M Renewable Energy and tenKsolar celebrated more than 200 installations of its combined module and mounting structure in North America, Europe and Asia just before SPI '13.

3

Dept. of Energy Secretary Ernest Moniz announced in October about \$60 million to support innovative solar energy research and development. As part of the Department's SunShot Initiative, these awards will help lower the cost of solar electricity, advance seamless grid integration and support a growing U.S. solar workforce.

More than \$12 million is being spread across 17 companies to help commercialize a wide range of technologies and services (see a complete list of awardees at solarbuildermag.com); \$16 million will go to four projects that will near the theoretical efficiency limits of single junction solar cells; \$7 million will develop stronger, more reliable solar components and dependable performance tests; \$8 million will help utilities forecast and integrate high levels of renewable energy generation into the grid, while ensuring reliable and affordable power; about \$15 million will develop power engineering curriculum and launch four regional training consortiums; and about \$1 million will be awarded to Delaware State University and the University of Texas at Austin to provide solar energy research and education opportunities to minority students.

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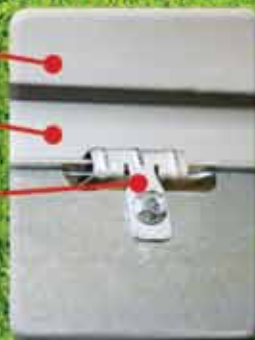
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