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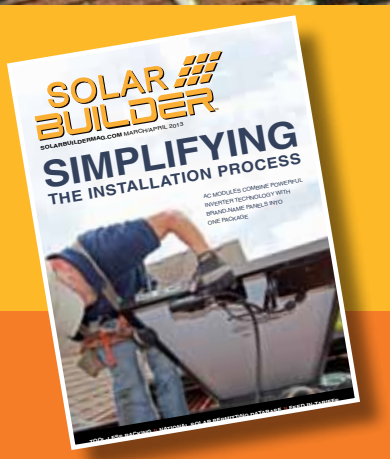

☼ ON THE COVER

The SolarBridge Pantheon microinverter is shown on a SunPower module. An AC module is easier and safer to install when compared to a DC system. *Photo credit: Scott Von Osdol*

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MIDWEST POWER

Here in the Midwest (*Solar Builder* is based just outside of Cleveland), it's always a treat to see a solar installation up close. That's why when we heard about Bold Alternatives's project at Baldwin Wallace University, we had to check it out. The 105-kW install atop the school's Center for Innovation and Growth will help offset almost 50 percent of the power consumed by the building. I climbed up on the roof and talked with some great guys at Bold Alternatives about the project. They even let me take some pictures in the middle of it all. I think this means I'm officially a solar nerd, and that's fine!

Even though solar installations in the Midwest are picking up, it's still sometimes a struggle to gain solar acceptance in an area where "brown" power is so cheap. Just ask Third Sun Solar, an installer based in Southern Ohio (see page 36). But progress is definitely being made, and Third Sun expects things to continue to improve throughout the region in the coming years.

Straightforward permitting will help make projects in the Midwest (and throughout the country) a reality. Clean Power Finance is working on a national solar permitting database to help installers reduce time and costs spent on permitting. An easy permitting process will rid confusion and allow installers to build a portfolio more quickly, increasing solar awareness in communities. Check out Clean Power Finance's progress on the database on page 34.

We again want to thank Baldwin Wallace University and Bold Alternatives for allowing us the opportunity to check out a solar rooftop installation up close. And we thank all the companies involved in making the Midwest a growing solar-powered region.

Until next time,

Kelly Pickerel

Kelly Pickerel, Associate Editor

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2013 PV AMERICA RECAP

Show Attendees Encouraged to Drive Solar Growth

PV AMERICA EAST 2013, WHICH concluded on Feb. 7, provided the solar PV industry with the opportunity to see the products and services that will help drive business forward in the Mid-Atlantic and Northeast. The show also offered an extensive conference program highlighted by the inaugural interactive PV Power Sessions that focused on business growth. PV America East took place in Philadelphia and was presented by the Solar Energy Industries Association (SEIA) and the Solar Electric Power Association (SEPA).

Glenn Thayer moderated a wide ranging discussion about the challenges facing the PV industry with Julia Hamm, president and CEO of SEPA, and Rhone Resch, president and CEO of SEIA, covering topics including industry consolidation, policy and marketing. Hamm encouraged the industry to work closely with utilities to find ways to collectively look for win-win policy solutions for utilities, manufacturers and consumers and to understand the perspectives of the utilities. "Look past the challenges and see if you can bring policy solutions together and this will move the needle faster," she stated.

"In the coming years, we think solar will be the largest source of new electricity in the United States and by 2015 or 2016 we will have 10 GW installed," Resch remarked. "There is long-term sustainable growth and you should position your company to take advantage." Resch also urged the audience to be knowledgeable about policy and stressed that it is an important part of their business models.

Companies exhibited at PV America to showcase new products, generate new business leads and meet with customers and colleagues. The feedback for the three-day event was extremely positive.

For ReneSola, PV America's Terawatt sponsor, the show was a great venue to do business. "PV America East was a very good show for ReneSola America," said Brian Armentrout, director of marketing. "We met with several key accounts and the show setting was intimate, making for a much more productive environment. ReneSola believes strongly in the efforts and initiatives set forth by SEIA and SEPA, which is a big reason why we chose to serve as the show's Terawatt sponsor. We believe their work will be key in growing the domestic solar PV industry and better familiarizing installers and developers with ReneSola's full line of high efficiency modules and microinverters."

Solar mount supplier Unirac exhibited at PV America to meet with colleagues in the industry. "PV America East offered Unirac the opportunity to connect with energy leaders from across the country in the dynamic Mid-Atlantic region," stated Peter Lorenz, president and CEO. "Offering valuable insight

Generating Clean Horizons, a 16.1-MW project at Mount St. Mary's University in Emmitsburg, Md., received one of PV America East's 2013 PV Projects of Distinction Awards. *Photo courtesy of Mount St. Mary's University.*

to the marketplace, the Mid-Atlantic/Northeast region represents one of the biggest opportunities in the country with more than 3 GW of new PV by 2015. At this year's event, Unirac was pleased with the high-quality booth traffic and new business leads."

PanelClaw, introduced a new solar racking and mounting product at PV America. "PanelClaw was pleased by the turnout this year at PV America East," said Daniel G. Day, marketing associate. "The show was well attended and provided an excellent opportunity for networking. It was an excellent venue to showcase our new product offerings for our East Coast partners."

The third Photovoltaic Projects of Distinction Awards were presented during PV America by SEIA and SEPA, to celebrate major achievements of companies, individuals and projects in the U.S. solar energy market. The winners were Generating Clean Horizons Solar Project (Emmitsburg, Md.), Keystone Solar (Lancaster, Pa.) and the Union County (N.J.) Solar Initiative. For the first time, nine additional projects were awarded honorable mentions in recognition of their impressive accomplishments.

PV American East 2014 will be in Boston, June 23-25, 2014.

IMS RESEARCH RANKS POPULARITY OF PV INVERTER BRANDS

A survey conducted by IMS Research (now part of IHS Inc.) of more than 400 PV inverter purchasers has revealed that the most preferred PV inverter brand globally in 2012 was SMA Solar Technology. IMS Research's report *PV Inverter Customer Survey – World – 2013* analyses the results of the survey and reveals the reasons behind PV inverter customers' choice of supplier and product.

In total, 74 brands were mentioned in survey responses, which was a significant increase from the number mentioned just one year previous. SMA Solar Technology received almost one-third of the votes and ranked as the No. 1 preferred brand in Germany, Italy, the U.K. and the United States. Globally, the Top 4 brands have not changed over the past year. However, there were several new entrants to the Top 10, including two U.S. suppliers — Advanced Energy and Enphase.

The survey also highlighted the importance of warranty and aftersales service plans for customers, with more than 90 percent of respondents indicating they are "important for most projects" or "critical for all projects." According to the customers surveyed, the most important service offered from a manufacturer was extra fast response time in service cases, followed by remote system monitoring.

"Considering the highly competitive nature of the PV market, attractive warranty and service offerings and a good reputation for offering excellent after-sales support is becoming a highly important way in which PV inverter suppliers can strengthen their brand and gain market share," commented Sam Wilkinson, manager of IMS Research's PV inverter and BOS research and analysis.

PV inverter suppliers were also ranked by respondents as to which suppliers offer the most attractive warranty and service plans. Once again, SMA Solar Technology ranked first with more than 35 percent of the votes, followed by Fronius. New entrants in the Top 10 included U.S. microinverter supplier Enphase and Kostal.

In total, more than 400 purchasers of PV inverters including distributors, installers, integrators, EPCs and wholesalers were surveyed by IMS Research to understand more about their requirements when choosing an inverter and a supplier. The results have been published in IMS Research's new report, which is available immediately online.

PHOTOVOLTAIC MODULE SHIPMENTS SURGE IN THE FOURTH QUARTER OF 2012

After a disastrous third quarter of 2012 featuring extremely low factory utilization rates across the entire PV supply chain, a surge in demand was seen in the final quarter of the year for PV modules. A new PV module shipment record of 11 GW was reached in the fourth quarter according to the IHS Solar Integrated Market Tracker from information and analytics provider IHS. Despite this positive sign, the situation of the global PV industry remains critical and a substantial recovery of the supply-demand balance is not expected to occur before the second half of 2013.

PV MARKETS REBOUND SHARPLY IN THE FOURTH QUARTER OF 2012

The third quarter of 2012 dealt another blow to the global photovoltaic industry. After a relatively strong second quarter resulting in global installations of 7.8 GW, markets softened again. "Installations in the third quarter amounted to just 7.5 GW. Wholesalers, EPCs and PV suppliers were forced to carefully control their inventory levels due to falling prices and low shipment levels and production cuts were the consequence," commented Principal Analyst Stefan de Haan.

In the third quarter of 2012, average module capacity utilization fell to 49 percent, cell capacity utilization to 56 percent, wafer capacity utilization to a record-low 55 percent and polysilicon capacity utilization to 63 percent. In parallel, prices continued their slide in the third quarter of 2012 resulting in module industry revenues of only $6 billion — the lowest value since the second quarter of 2009. These difficult conditions were reflected in an increasing number of suppliers exiting the market.

"In the fourth quarter of 2012, global PV markets rebounded sharply. Very strong demand from Asia, with the surge driven largely by China and Japan, helped to compensate for sluggish demand in Europe. IHS estimates that global PV installations were 10.1 GW in the fourth quarter of 2012. In particular, leading Chinese module suppliers benefited from the uptick in demand and shipped much more than previously expected," explained de Haan. In total, 11 GW of global module shipments are estimated for the fourth quarter of 2012 — a new record for the industry. As anticipated by IHS, average market pricing for crystalline modules declined to $0.65 per watt at the end of 2012, down from $0.70 at the end of September. Importantly, however, the price decline lost momentum in the course of the fourth quarter. Toward the end of the year, some module prices even increased. Record-level shipments paired with stabilizing prices drove a profound recovery of revenues. According to the IHS Solar Integrated Market Tracker, 4Q 2012 module revenues grew by a stunning 42 percent quarter-over-quarter, reaching $8.5 billion.

SUPPLIERS WILL EXPERIENCE SEASONAL WEAKNESS IN THE FIRST QUARTER OF 2013

In the first quarter of 2013, suppliers are predicted to experience the usual seasonal weakness of global solar markets. Global PV installations are forecast to drop to 6.7 GW in this quarter. As a result upstream shipments and revenues will temporarily come under pressure again. With prices forecast to decrease by another 4 to 5 percent in the first quarter of 2013 (compared to the fourth quarter of 2012), module revenues will fall back to the critical levels of the third quarter of 2012 — or even below. This will force more suppliers to review their business models and eventually leave the solar market.

2013 WILL BE THE YEAR OF THE TURNAROUND

After a tough first quarter, a substantial increase in global demand is forecast to drive increasing revenues and stabilizing prices in the second half of 2013. IHS forecasts 35 GW of global installations in 2013, up 10 percent over 2012. Although this level of growth is lower than previous years, it will drive a continuous improvement of shipments and revenues in the polysilicon to module supply chain throughout 2013. Recent positive signals from authorities in several key markets like China and France raise hopes for the recovery of the PV industry to happen even faster.

"Whilst it's too early to give the all-clear for the PV supplier industry, there is increasing indication that the year 2013 will mark the turnaround," concluded de Haan.

U.S. RESIDENTIAL SOLAR FINANCING TO REACH $5.7 BILLION BY 2016

Third-party financing of solar PV has become the predominant business model in some of the largest residential markets in the United States; today, third-party financed residential installations comprise greater than 50 percent of new residential solar capacity in California, Arizona, Colorado and Massachusetts, with the model gaining greater market share in other states such as Connecticut, Delaware, Maryland, New Jersey, New York, Oregon, Texas, Vermont and Washington.

GTM Research, the leading solar market analysis and advisory firm in the United States, released *U.S. Residential Solar PV Financing: The Vendor, Installer and Financier Landscape, 2013-2016* in early February. This 21-page report provides an integrated look at the vendors, installers and financiers offering residential solar financing across the United States. The report analyzes the leading vendors and their business models, the strategic relationships and market shares of third-party residential installers as well as the financiers that are capitalizing on the market. In addition, the brief examines the total addressable residential market in the United States with forecasts through 2016.

"Prior to 2010, there were few residential third-party ownership (TPO) vendors," said Shayle Kann, vice president of research at GTM and the report's author. "Since then, the success of companies such as SolarCity, Sunrun and SunPower has led to a spate of new entrants into the market. Today, we count at least 10 TPO companies operating, and a number of others still getting off the ground.

"Each company has introduced its own unique version of the residential financing model," Kann added. "These vendors differ in their services, their relationships with solar installers, their geographic footprints, their financing sources and their customer acquisition strategies. As a result, there is now a vibrant competitive market for third-party owned residential solar in the U.S."

KEY FINDINGS FROM GTM RESEARCH'S U.S. RESIDENTIAL SOLAR PV FINANCING REPORT

- Residential solar leases are now available in 14 states.
- The residential solar financing market is forecasted to rise from $1.3 billion in 2012 to $5.7 billion in 2016.
- SolarCity was by far the largest residential installer in the country in 2012 with a market share more than double that of the next largest player.
- There have been 28 individual funds raised for residential solar projects totaling more than $3.1 billion. U.S. Bancorp has been the most prolific investor, providing 14 funds and more than $1.35 billion to the market. Eight other financiers have been active in the market.
- The four largest providers of residential solar leases in 2012 in California were Sunrun, SunPower, SolarCity and Clean Power Finance.

PV INDUSTRY TO ENJOY ROBUST INSTALLATION GROWTH IN 2013, BUT REVENUE DIP POSES CHALLENGES FOR SOLAR COMPANIES

GLOBAL PV INSTALLATIONS will rise this year in a continuing pattern of solid growth, but the industry will nonetheless suffer a decline in overall revenue due to lower volume growth and decreasing system prices, according to an IHS Solar white paper from information and analytics provider IHS.

PV installations are projected to reach 35 GW this year, up from 32 GW in 2012. In comparison, industry revenue — measured as the system price multiplied by total gigawatts installed — will retreat to an estimated $75 billion, down from $77 billion last year, and exhibiting an even steeper fall from the market's peak revenue of $94 billion in 2011.

"The conflicting trend of growing PV installation volumes accompanied on the other hand by falling revenues will challenge solar companies to continue to reduce their cost structures," said Ash Sharma, director of syndicated solar research for IHS. "While solar installations have grown every single year without fail since we started analyzing the industry in 2006 — and will continue to do so until at least 2017 — the picture is much more sobering when one looks at industry revenue, especially as PV component prices continue downward. And installation growth, although positive, is also slowing, further affecting the industry's overall top line."

Along with slightly diminished prospects this year, an equally imposing problem for solar companies will be the rapid globalization of the industry, Sharma noted. Europe accounted for more than 80 percent of solar demand in 2010, but its share is on the wane — contracting to 53 percent in 2012 and forecast to slide further this year to 39 percent. Meanwhile, Asia is on track to replace Europe as the world's largest source of solar installations moving forward.

"Historically, solar companies could rely on Germany and a few other European countries to support their business," Sharma noted. "But these same companies need to now quickly accelerate their entrance into emerging markets around the world."

After years as the world's top solar market, Germany will fall to third place in 2013, behind China and the United States. Japan and Italy follow in fourth and fifth, respectively.

More important than the change in ranking is the geographic fragmentation expected to escalate this year. Although the Top 5 accounted for nearly 75 percent of total solar demand in 2012, the group's combined share this year will drop to 65 percent. Mid-sized markets, like South Africa and Romania, are anticipated to gain increasing importance on the world solar stage, even with installations of just a few hundred megawatts per year that will end up eating into the share of the majors.

Despite the resulting market fragmentation, the good news is that more stability will result for an industry swinging perpetually from bust to boom, Sharma said. In particular, the policies emanating from a single government will now have less of a monolithic impact on the overall global solar market.

Stability comes at a price, however, according to Sharma. A steadier market also means more intense challenges will be in store for solar companies, as firms are forced to undertake actions large and small in order to globalize their business. Such measures could entail setting up new sales and service networks, compliance with local requirements and grid codes and navigating past the "quick-hit" markets that are present one year and gone the next.

Sunnier prospects are in store on the whole starting next year, when solar industry revenue expands in the double digits from 2014 to 2016. Revenue will then soar past the high watermark of 2011, climbing to $115 billion by 2016.

In a League of its Own

DynoRaxx went about finding what sets it apart from the competition and found it in tool-less, fiberglass mounting and racking systems.

By **Kelly Pickerel**

IN AN INDUSTRY AS COMPETITIVE AS solar, it's important to find your niche. DynoRaxx has established its niche among racking and mounting manufacturers by producing a product that is universal, lightweight and easy to assemble. The DynoRaxx Evolution system is 100 percent fiberglass and requires no tools to install — a combination that no other ballasted racking/mounting system can claim.

The idea for DynoRaxx started eight years ago when Nathan Rizzo — president of the Buffalo, N.Y.-based company — and some colleagues first started as an installation company and found ballasted system installation manuals "as long as encyclopedias." Most of their installations were at 10-degree tilts on flat rooftops, so a simple installation method was needed. In 2006, they started to get serious about producing an easy system.

First generations of the DynoRaxx system were made of galvanized steel. After installing about 5 MW of systems, Rizzo found that the DynoRaxx system was quick to install, but it wasn't unique.

"There are a few metal racking companies on the market, and we needed to differentiate ourselves, not just by being another metal system that requires no tools to install," he says. "We started looking at com-

BASKET-STYLE
The DynoRaxx Evolution system can be seen on a flat rooftop. The four-legged basket acts as a spacer in between rows.

60 SECONDS FLAT
Installation of the DynoRaxx system is quick and effortless. Each module takes less than 1 minute to lock into place — no tools needed.

posite materials, and fiberglass is ahead of the pack as far as the benefits versus using a plastic material."

Fiberglass is a light-weight material, but it's pound-for-pound stronger than steel and aluminum. It also doesn't expand and contract, which is an issue that concerns roofing manufacturers. On systems in warmer climates — like the Southwest — mounting and racking systems can expand and contract nearly 6 in. throughout the day, causing a lot of movement and potentially digging into the roof membrane, roofing manufacturers told Rizzo at a recent conference.

"Roof membranes weren't made to host a solar system. They were just made to sit up there and account for any snow or rain and not allow it to get into the building," Rizzo says. "It wasn't designed to have the pressure that solar put onto the roof. With fiberglass, it doesn't expand or contract, so this system can be installed in New Mexico and you're never going to have to worry about the roof warranties. It's not giving that extra stress on the roof."

Finding that fiberglass provided more benefits than problems for solar racking, DynoRaxx then made plans to produce a universal design that could fit most modules.

"A lot of racking systems are custom, meaning they have to know what project it's going into," Rizzo says. "Our baskets and our rail assemblies work with a wide range of modules. We feel that that is a necessary step for racking manufacturers to take, simply because they can mass produce their equipment and it makes the equipment itself that much more cost-effective."

BASKETS AND LEGS

The 100 percent fiberglass DynoRaxx Evolution system was introduced in 2011, and things took off. It consists of three major components: a two-legged basket, a

four-legged basket and a rail set. The two-legged basket sits under the southern edge of the array, while four-legged baskets act like spacers between rows, with its taller legs in front. At the completion of an array, a four-legged basket is spun around so it sits underneath the module, taller legs in back. The baskets are then connected using fiberglass rays.

Both basket-types are fiberglass with titanium dioxide and carbon black to stop UV rays from damaging the system's surface. UV rays deteriorate plastic quickly, but fiberglass is able to withstand the sun's damage. Fiberglass also provides no corrosive properties, so it is able to handle heavy snow and salty moisture in coastal areas. The DynoRaxx system is also slightly elevated to compensate for air circulation.

The system sits only underneath the modules and in between rows. It doesn't protrude past the end-modules. On the very outside of an array, the baskets are pushed underneath the module. Otherwise, one basket shares two modules, sitting in between.

"Module manufacturers have always stated they want to make the most efficient module. Well, we want to make the most efficient racking system," Rizzo says. "With our system not protruding out on the north and south edges, you can actually get one more row of modules in comparison to other racking systems."

STACK 'EM UP >>
The DynoRaxx system is palletized, and 60 baskets can stack to a pallet. This saves money in shipping costs and saves space on the roof when preparing to install.

SLIDES AND PINS

Rails attach to the basket using a DynoPin — a cross between a spring-pin and a cotter-pin — that springs and locks into place. Modules attach securely to the racking system through the use of the company's stainless steel DynoSlide device, which is mounted to each rail using rivets as opposed to a nut and bolt assembly, thus requiring no tools to install.

"When you get out on jobsites, a lot of contractors aren't watching every installer torque down every nut and bolt. They never know if they have them all securely fit on that module," Rizzo says. "With our riveted design, the rivets are done by a machine and every one is exactly the same. You know you're getting the same pressure on every module."

The DynoSlide clamping mechanism holds the module in its grasp — the top plate slides over the bottom lip flange of the module and the bottom plate slides underneath.

"As the day progresses for an installer and as they get more worn out, they're not necessarily checking torque in the bolts," Rizzo says. "We wanted to make sure they had a sure-fire method of checking to see if the module is secure. As soon as they see the [DynoSlide] handle protrude out the side of the module, they know each and every module is secure."

QUICK AND EASY

Ultimately, Rizzo and the DynoRaxx crew are pleased with their universally simple racking system. The tool-less product cuts down tremendously on installation times.

"When we were studying the ergonomics of an installation, each panel had four top clamps that required four nuts and bolts, and then the rail attached to the basket required an additional four nuts and bolts," Rizzo says. "Through our time study, we saw that each nut and bolt took approximately a minute and a half to install. Typically, for one panel, we were spending about 12 minutes to mount that. No longer having to fumble around with nuts and bolts and assemble everything, we're able to mount a module in less than a minute, which makes for a very quick installation."

It's also much cheaper and easier to ship the DynoRaxx Evolution system because of its lightweight fiberglass

material. The product is palletized, not oblong or bulky like other racking systems.

"Our baskets stack like cups, and we stack 60 baskets to a pallet," Rizzo says. "Typically, racking systems are hoisted up to a roof with a forklift with a telescopic arm. An installation company can 'blow' [the DynoRaxx system] up to the roof and then two installers on the roof can grab the pallet and carry it to where it's going on the roof, or they could put it on a wagon with pneumatic tires and wheel it wherever it has to go. It's not a lot of trips across the roof. They're able to bring it right to where the modules are going to be placed and unload from that point."

While the product is lightweight, it's still effective on a rooftop. The lightness of the product is really a benefit during installation.

"The lightness of the system translates into a quick and easy installation," Rizzo says. "We're doing the same as other racking manufacturers — setting the modules at 10 degrees, seeing the same wind dynamics. We're compensating for that lightness by using the same amount of ballast. Our system was wind tunnel tested, and we have the data to back that up."

DynoRaxx has carved out a niche with its fiberglass mounting and racking system and has the stats to prove it. Since the introduction of the DynoRaxx Evolution system in 2011, 15 MW have been installed worldwide, and that number is growing. DynoRaxx's position in the solar industry is firmly cemented, and it didn't need any tools to get there.

Kelly Pickerel is associate editor of *Solar Builder*.

four-legged basket and a rail set. The two-legged basket sits under the southern edge of the array, while four-legged baskets act like spacers between rows, with its taller legs in front. At the completion of an array, a four-legged basket is spun around so it sits underneath the module, taller legs in back. The baskets are then connected using fiberglass rays.

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"When you get out on jobsites, a lot of contractors aren't watching every installer torque down every nut and bolt. They never know if they have them all securely fit on that module," Rizzo says. "With our riveted design, the rivets are done by a machine and every one is exactly the same. You know you're getting the same pressure on every module."

The DynoSlide clamping mechanism holds the module in its grasp — the top plate slides over the bottom lip flange of the module and the bottom plate slides underneath.

"As the day progresses for an installer and as they get more worn out, they're not necessarily checking torque in the bolts," Rizzo says. "We wanted to make sure they had a sure-fire method of checking to see if the module is secure. As soon as they see the [DynoSlide] handle protrude out the side of the module, they know each and every module is secure."

QUICK AND EASY

Ultimately, Rizzo and the DynoRaxx crew are pleased with their universally simple racking system. The tool-less product cuts down tremendously on installation times.

"When we were studying the ergonomics of an installation, each panel had four top clamps that required four nuts and bolts, and then the rail attached to the basket required an additional four nuts and bolts," Rizzo says. "Through our time study, we saw that each nut and bolt took approximately a minute and a half to install. Typically, for one panel, we were spending about 12 minutes to mount that. No longer having to fumble around with nuts and bolts and assemble everything, we're able to mount a module in less than a minute, which makes for a very quick installation."

It's also much cheaper and easier to ship the DynoRaxx Evolution system because of its lightweight fiberglass

material. The product is palletized, not oblong or bulky like other racking systems.

"Our baskets stack like cups, and we stack 60 baskets to a pallet," Rizzo says. "Typically, racking systems are hoisted up to a roof with a forklift with a telescopic arm. An installation company can 'blow' [the DynoRaxx system] up to the roof and then two installers on the roof can grab the pallet and carry it to where it's going on the roof, or they could put it on a wagon with pneumatic tires and wheel it wherever it has to go. It's not a lot of trips across the roof. They're able to bring it right to where the modules are going to be placed and unload from that point."

While the product is lightweight, it's still effective on a rooftop. The lightness of the product is really a benefit during installation.

"The lightness of the system translates into a quick and easy installation," Rizzo says. "We're doing the same as other racking manufacturers — setting the modules at 10 degrees, seeing the same wind dynamics. We're compensating for that lightness by using the same amount of ballast. Our system was wind tunnel tested, and we have the data to back that up."

DynoRaxx has carved out a niche with its fiberglass mounting and racking system and has the stats to prove it. Since the introduction of the DynoRaxx Evolution system in 2011, 15 MW have been installed worldwide, and that number is growing. DynoRaxx's position in the solar industry is firmly cemented, and it didn't need any tools to get there.

Kelly Pickerel is associate editor of *Solar Builder*.

UNDERGROUND NETWORK

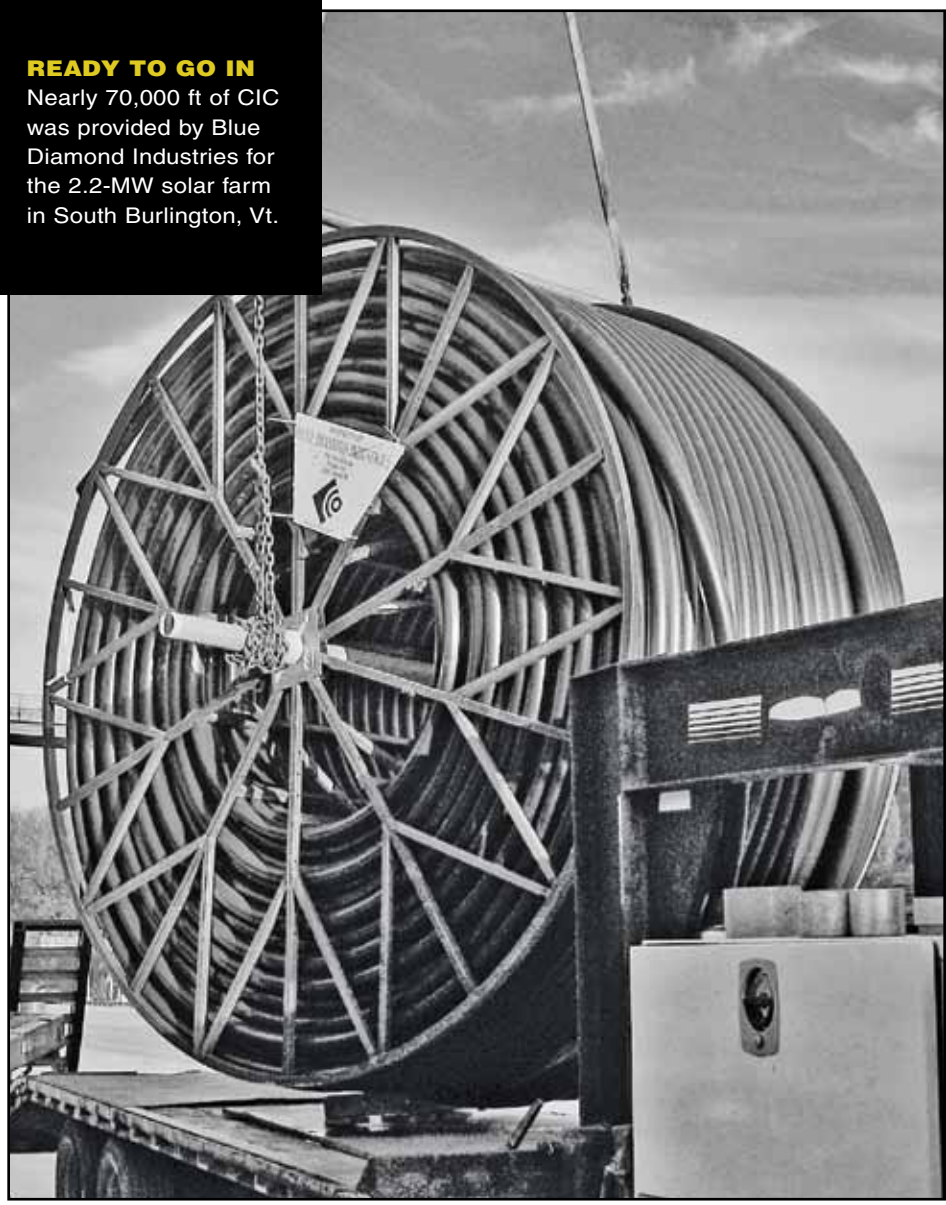
Wiring pre-installed in HDPE pipes and installed under a solar farm speeds construction, increases efficiency and extends the solar system's lifetime.

By **Stephen C. Cooper**

For solar farms, installers are finding that using underground cable in conduit (CIC) made from high-density polyethylene (HDPE) speeds construction and increases the life of the facility. CIC allows for either open trench or horizontal directional drilling (HDD) to be used.

"Before, most solar farms used underground PVC pipe," says Doug MacDonald, project engineer for AllEarth Renewables Inc., manufacturer of the AllSun Tracker in Williston, Vt. "Wire is pulled onsite after conduit installation. HDPE conduit saves in multiple ways that include less labor to install. It comes preloaded with the wire, so it's just a one-step process after digging the trench. It also enables us to use a smaller conduit size, reducing the cost of materials."

Projects can become very labor-intensive with other types of conduit because a trench must be



READY TO GO IN
Nearly 70,000 ft of CIC was provided by Blue Diamond Industries for the 2.2-MW solar farm in South Burlington, Vt.

dug, the conduit installed and a pull rope blown through so the wire can be pulled back through. With HDPE conduit, the wire can be installed while the pipe is being extruded and arrive to the jobsite ready to go.

"Custom lengths can be ordered and sometimes a single reel will hold thousands of feet, which puts more conduit at the site to further expedite installation," says Tony Radoszewski, executive director of the Plastics Pipe Institute Inc. (PPI), the major trade association representing all segments of the plastic pipe industry. "Installing the cable in the conduit at the factory ensures that a clean and damage-free cable is delivered to the field. CIC also eliminates the added expense of pulling the cable onsite under muddy and dusty field conditions which aren't the best for a good, clean installation."

AllEarth has used CIC on a number of projects, including a ski resort and a youth center, with future projects in the works. In 2011, the company built a large solar farm and decided to locate power and control cables in underground CIC conduit made from HDPE as a way to increase the life of the facility. The 2.2-MW solar farm in South Burlington, Vt., covers 25 acres and includes 382 AllSun Trackers. All low voltage wiring used UL-1990 certified CIC provided by Blue Diamond Industries of Lexington, Ky. Blue Diamond is a member company of the PPI.

The AllSun Tracker conduit included nearly 70,000 ft of 3/4-in. CIC pipe with three 6AWG cables — black, green and white — and 5,000 ft of 2.5-in. diameter CIC with 4/0 wiring for the panel feeder lines. Blue Diamond supplied CIC on reels ranging from 2,000 to 10,000 ft. The company is listed by UL for specification UL 1990, Nonmetallic Underground Conduit with Conductors and its CIC is manufactured under ASTM D 3485.

Total power produced by the South Burlington Solar Farm is estimated to be approximately 3,000,000 kWh a year. The project is owned and operated by the Chittenden County Solar Partners. The value of the electricity generated by the farm has been tagged at $924,000 a year and is enough to power more than 400 homes.

While most of the installation was accomplished using cut and cover, the HDPE cable in conduit product also provided the solution to go under a heavily forested section of private property and a section of wetland.

"We directionally drilled two, 400-ft runs of 5-in. diameter HDPE pipe used for the main power feed and communication cables," explains Aaryn French, project manager for Engineers Construction Inc. of Williston, Vt.

French agrees that having CIC was a benefit. It took his four-person crew just a month to dig all the trenches and install the low- and medium-voltage conduit at an average depth of 3 ft. "The trenching, which was the majority of the work, went very smoothly. The conduit was nice because we'd just start pulling the wire out and leave the proper length at the end and just lay it right in the ground. This was more efficient than using sticks of PVC — probably five to 10 times faster," French says. "And because we had the

ALL CONNECTED
The completed solar farm consists of 382 AllSun Trackers with wiring installed underground in HDPE pipes.

cable already in the conduit, it saved us a lot of time. We were killing two birds with one stone — installing the pipe and wire at the same time. That was a huge benefit.

"This is probably one of the biggest applications of using CIC in this specific manner. In this application it was cost efficient, time efficient and it just worked really well," French continues. "That's because we weren't trying to put together PVC, and putting a pull string in and pulling the wire. This was a one-shot deal. You complete the trenching, you know your two end locations, tie it in, backfill and you're done."

Another installer, Dan Sabia, president of Built Well Solar on Long Island, N.Y., says that the CIC helps his crew with cable runs especially on commercial and school buildings. "We find that on some of our larger jobs, the cable in conduit can be used to run the lines from the panels on the roof to the inverter which can be even hundreds of feet away. Plus, because the wire is fully incased in the conduit, it will be protected from the elements for a very long time."

"From a sustainability standpoint, HDPE pipe and solar power are a unique partnership," states PPI's Radoszewski. "Like solar, a plastic pipe system is a sustainable and environmentally responsible choice that will serve generations to come. The HDPE conduit is ecologically efficient during manufacturing. The conduit is also strong, durable, light-weight and flexible while providing excellent protection for the power and fiber cables inside, and requires significantly less energy to fabricate, transport and install than other pipe products. And in Vermont for example, HDPE conduit is the perfect choice to stand up to the extreme cold weather and frozen earth, plus it was the key to a successful trenchless run in one section."

Stephen C. Cooper reports on industry activities for SCA Communications based in New York. For more information about PPI, visit *plasticpipe.org*.

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LOW VOLTAGE HIGH POTENTIAL

The AC module combines a powerful solar panel with a microinverter, joining both pieces at the factory and selling it as one. Instead of solely being a microinverter manufacturer, SolarBridge Technologies sees itself as an AC module enabler. By **Kelly Pickerel**

AC modules are a simple and attractive option for the residential solar market, and their quick adoption could help promote rapid residential growth. When discussing the potential impact solar can have on the homeowning market with individuals at companies like SolarBridge Technologies — a manufacturer of AC module technology — you can hear the initial frustration with the slow-moving adoption rate of solar but then the excitement of what simpler technology could bring.

"There are about 200,000 [U.S.] homes that have put solar on their roofs compared to the total population of nearly 70 million single family homes. It's really the tip of the iceberg," says Craig Lawrence, vice president of marketing for SolarBridge. "Our belief is that to grow this market to its potential, an enormous workforce of solar contractors need to be trained, and that AC modules represent the most simple, safe, and effective means to mobilize that workforce."

Using microinverters to quickly switch DC power over to AC at the panel level isn't a foreign concept. But integrating that microinverter directly with the module and offering it as one product is becoming more of the norm, thanks to companies like SolarBridge.

PLUG IN AND GO
The SolarBridge microinverter comes pre-installed on the solar panel, providing a quick and easy installation.

BUILDING PARTNERSHIPS

The idea for SolarBridge Technologies was born in 2004 when University of Illinois at Urbana-Champaign professors and researchers started commercializing power electronics products. The team packed up and moved to Austin, Texas, and decided to focus exclusively on solar and microinverters in 2008, and that's when things started to take off. The company today has about 85 employees and continues to have a close R&D relationship with the university.

SolarBridge produces the Pantheon microinverter (now on its second generation) and monitoring system but partners directly with module manufacturers to offer customers a full package with one extended warranty. Modules usually have much longer warranties than inverters, so to have a microinverter on the same level as the module, an all-encompassing warranty is an ideal situation for the end-customer.

"Modules are robust and reliable devices, with a greater than 25-year life expectancy," Lawrence says. "For a module manufacturer to integrate a microinverter on their panel and include it in their warranty, we need to prove to them that the microinverter can withstand the same harsh conditions that their modules are designed to handle. We have proven that to every module manufacturer we have partnered with."

SolarBridge tests its inverters to the same standards as modules — something that is not required for certification. This extra step by SolarBridge ensures its partner companies (SolarBridge boasts eight partnerships, including SunPower and MAGE Solar) that the Pantheon microinverter is the real deal.

"Our competitors focus on selling a detached microinverter; the reason is we don't think their product has the reliability needed to make it onto an AC module," Lawrence says. Having a single warranty for the panels, microinverter and cabling is considerably more valuable to project owners.

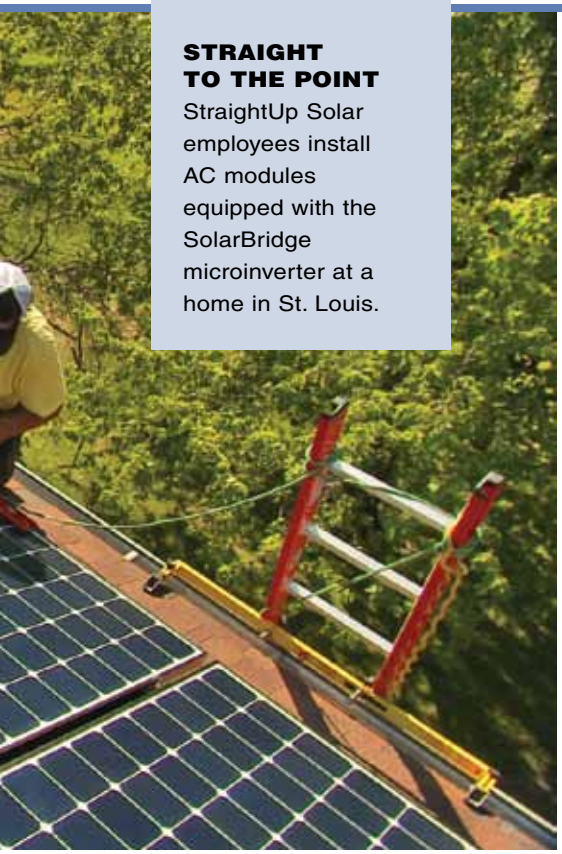
"There's nothing stopping other microinverter companies from hooking up with panel manufacturers to produce AC systems, but SolarBridge's lengthy warranty really sets them apart," says Terence Parker, applications engineering manager. "We're passionate about reliability. We redesigned the inverter and put it through extensive reliability testing before we decided we could offer a 25-year warranty."

HOW SOLARBRIDGE DOES IT

1 MANUFACTURE A POWERFUL MICROINVERTER THAT IS GUARANTEED TO WITHSTAND THE HARSHEST CONDITIONS FOR 25 YEARS.

2 PARTNER WITH 8 MODULE COMPANIES WHO AGREE TO SELL THEIR PANELS WITH THE SOLARBRIDGE MICROINVERTER PRE-INSTALLED.

3 TRANSFORM THE RESIDENTIAL AND SMALL COMMERCIAL MARKET WITH AN EASY-TO-INSTALL, ALL-ENCOMPASSING AC MODULE.



STRAIGHT TO THE POINT
StraightUp Solar employees install AC modules equipped with the SolarBridge microinverter at a home in St. Louis.

INSTALLER-FRIENDLY

St. Louis-based contractor StraightUp Solar has installed more than 2 MW of solar power systems around the great Gateway Arch in the last six years. In 2012, StraightUp started installing SunPower modules with the SolarBridge technology.

"We continue to install DC systems; however, many customers choose and enjoy the benefits of AC," says StraightUp President Dane Glueck. "Our goal is to optimize the customer's goals and provide a solar array that maximizes their investment over the long term. This means providing a solar array that is designed with their input and goals, that maximizes their usable solar space and meets their financial parameters. SolarBridge's AC technology allows us more freedom to customize the design and feel good that we're offering a dependable product that maximizes solar production."

Homeowners get the usual microinverter-related benefits from an AC system — better production when shading and location are issues — but the real difference in an AC system is for the installer. There is no exposure to any shock hazard, a greater speed on roof installation because of integrated grounding and cabling and a quicker commission.

"This product, this AC module, was an inevitable milestone that had to be obtained for the PV industry," Parker says. "High voltage DC systems turned a lot of well-trained electricians off. It really took the roofers completely out of the game. You really need experience to put in these high voltage DC systems that dominate the industry today."

A standard AC module system runs on 240 volts, which is a safer alternative than DC systems and easier for the average electrician to understand.

"These systems are more familiar to inspectors. They're more common as far as the components that go with them — besides the panels, these parts can be found at Home Depot," Parker says. "It is the new installation paradigm. It's a new product that will allow more homebuilders, electricians [and] roofing trades to get into this business and start saturating, making the dream of distributed generation come true."

No specialized training is needed in string size and design. An average electrician already has enough knowledge to install an AC module.

"You wire these up as you would any other AC appliance in your home — an oven or a dryer," Lawrence says. "If you want to go from 200,000 homes to 2 million homes, think of the number of installers and system designers that are going to need to be trained. They'll want to be trained on this solution because they already know how to do it. There are very little new, specialized skills. An AC module is a true appliance — it's designed to plug into standard home wiring as anything else."

ROOM TO GROW

Once more homeowners and installers are shown that difficult solar plans are made easier with the AC module, SolarBridge believes there will be a shift in AC vs. DC acceptance. StraightUp Solar is spearheading that effort in St. Louis.

"We're primarily utilizing AC modules on small and larger residential projects ranging from 2 to 10 kW," Glueck says. "We, and our customers, really believe that this is where the AC systems provide the best combination of benefits: freedom in system design, mitigating shade, maximizing production and sharing the data on the benefits of the solar production via the web-based monitoring systems."

As in all residential solar systems, the upfront costs are surprising, but in the case of ACPV, long-term considerations are more important. String inverters usually have to be replaced over the life of the system, while a microinverter keeps on kicking. And with SolarBridge's warranty guarantee, that's a promise. Also, BOS costs (like wiring and conduit) are reduced with a pre-assembled AC module system, as is installation time and energy.

"Consider this: Your SUV provides you a service. It takes the kids to school, you drive it on vacation. But it's just going to continue to suck money throughout its entire life," Parker says. "With a solar system, eventually it will have paid for its capital costs and start making you money. It truly does have a payback period. It's good for family cash flow. It's good for that monthly bill reduction. And it's safe — a mother can feel safe that the [AC] solar system on the roof is very similar to every other electrical system in the home.

"I feel very confident and bullish about why these systems will begin to dominate the markets."

Kelly Pickerel is associate editor of *Solar Builder*.

ROOF LEASES
Solar Impact has worked on roof lease plans for public schools and libraries throughout the Gainesville-area — including this 100-kW installation at the Millhopper Branch Library.

COMMUNITY IMPACT

The feed-in-tariff program in Gainesville, Fla., has provided many leasing and building opportunities for local installer Solar Impact.

By **Kelly Pickerel**

IN JANUARY, THE LOS ANGELES

Department of Water and Power (LADWP) voted to implement a feed-in tariff (FIT) program for 100 MW of solar PV generation. The announcement was significant because Los Angeles is now the largest municipality in the United States to pass an FIT program, something that is more common in Europe. But Los Angeles was not the first to transform a community with an FIT program; that award goes to Gainesville, Fla. Gainesville Regional Utilities (GRU) instituted a 7-MW FIT in 2009 in attempts to make a small section of the Sunshine State actually live up to its name.

A feed-in tariff is a long-term guarantee that owners can "feed" the electricity they generate (in this case by their solar power systems) into the grid and get paid by the utility at a set rate for an extended period of time. This guarantee helps to offset the initial up-front investment and makes projects less risky.

The GRU FIT was capped at 7 MW and was quickly met. The utility has developed a new 4-MW program for 2013 to continue to encourage the building of more solar projects. Nearly one-third of the 7 MW already produced has come from small installations. Solar installers in the Gainesville-area have been kept busy as excitement for the program has grown. One installer, Solar Impact, has been in the middle of the intensified development throughout the region and sees even bigger plans in its future.

AFFORDABLE SOLAR

Solar Impact started out as a "weekend project that got out of hand." Company founders Barry and Elaine Jacobson were considering purchasing a solar power system for their home in 2006 and were quoted at a price that the payback didn't make sense. They chose to install a system themselves and saved almost $20,000 in the process. This experience led to the formation of Solar Impact in 2007, and the two have been assisting those in the Gainesville-area with solar power decisions ever since.

The name "Solar Impact" came from the company's aim to provide a way for homeowners to make environmentally-conscious decisions.

"People wanted to impact," says Don Ryan, director of sales and marketing. "They felt powerless. They said, 'What can I do to try and do my part to make the world a little better place?'"

The company's mission statement is to "make solar affordable." Knowing that if solar wasn't affordable, it would continue to be a niche product, the Jacobsons entered the market at $6.50 per Watt while their competitors were at $10 per Watt. Solar Impact didn't need to live on fat margins. Six years after forming, the company only has seven employees and runs a lean, mean business.

"Barry knew that if you have a quality product at a good price and continue to drive that price down, that would lead to wide-scale use of solar," Ryan says. "He just came up with a different business model and worked on lower margins and showed people it could be affordable."

In the early days, Solar Impact was heavily involved in residential installations. Today, the large majority of installs are commercial. Ryan says this is because small businesses are easier to convince of the benefits of installing solar.

"Here in Gainesville, a small business is paying some of the highest electricity rates in Florida, and the higher the electricity rate, the more solar makes sense," he says. "Most good business owners know that owning something is always better than renting. It costs more money up front to own something, but over the long term, the cost of ownership is always less than renting. And yet they continue to rent their electricity from a utility. What we try to show them is that they own everything else, why not your electricity? If you own it, over time it's going to cost you less."

But still, most businesses just don't have the money to support the building of a solar power system. When the FIT program was introduced in Gainesville, things started to change.

SUPPORTIVE LEASING

One day, as Barry Jacobson drove down the same streets of Gainesville he covers every day, he looked at the vast amount of roof space schools and libraries have just sitting unused. Wouldn't it be great to install solar on top of these buildings?

The FIT program opened up many more doors for situations like this. Solar Impact developed a roof lease option for non-profits and public agencies that allowed them to reap the benefits of having solar installed on their rooftops.

For businesses that cannot receive tax benefits from installing solar (such as schools and libraries), the FIT program allows private investors (who can use tax benefits) to come in, rent the rooftops, make a profit for themselves and give building owners some much needed cash for unused roof space. The Alachua County Public Schools took advantage of Solar Impact's roof leases, renting out 12 rooftops and receiving a large sum of money in the process.

SOLAR LEADERS
Company founders Elaine and Barry Jacobson have been the brains behind some big projects for Gainesville.

"Barry sees all these public school roofs and they're wide open and just perfect, but the schools have no cash," Ryan says. "Along comes this FIT which allows a private investor to sell all of the electricity to the utility and lease the roof space from the school board. As soon as the FIT came along, Barry was the architect to design a project in which the school board does not have to put one penny of their own money into this."

The final agreement between the schools and the leasing arrangement gives the school district $123,000 each year for 20 years, or close to $2.5 million total.

"For doing absolutely nothing and using roof space that otherwise would just be sitting there — this is found money," Ryan says.

Solar Impact designed, developed and installed 1.23 MW of systems across the 12 school buildings. While the schools won't directly see a reduction in their electric bills, the lease checks they receive each month can be put to electric bills or wherever else they see fit. There was only one stipulation — a portion of each yearly payment to the schools must be used toward renewable energy curriculum. The curriculum had already been developed, but the schools had no money to buy books or pay a teacher to teach it.

"As much as we love solar and renewable energy, the reality is that it's not a priority because school districts are just dying for money," Ryan says. "We thought that was very cool that this project is going to allow kids from K-12 to actually learn about renewable energy at their school. They're going to be able to see the monitoring data from the system. There are a lot of educational components to this that are cool, in addition to the cash."

SOLARPOWER STATE

Capped FIT programs eventually run out of building power, and Solar Impact has begun to look into surrounding areas for opportunities. But the only way Florida will become the solar producing powerhouse it is capable of being is if significant changes are made now.

"PPAs as of today are illegal in the state of Florida. It's embarrassing," Ryan says. "I'm a native Floridian, and it's absolutely embarrassing that [almost all] states have PPA laws on the books, and Florida does not. It's going to take a legislator or a politician to stand up. PPAs by themselves will be the game changer in Florida. No one wants to say that our state motto is the Sunshine State and here we are in the dark ages when it comes to solar."

Barry Jacobson says Gainesville's FIT program has helped bring a greater acceptance of solar to the area and brought business to Solar Impact.

"[The FIT program] really helped us. I'm not saying we wouldn't have thrived without it, but it definitely has been a help to us," Jacobson says. "We've hit that tipping point where we have enough projects behind us and people have seen enough solar go in locally that they've become quite comfortable with the financials and how to work with it."

Regardless of the financial situations in Florida related to solar, Jacobson says he's confident solar projects will continue to have a home in the state and Solar Impact will be around to build it.

"Additional incentives would of course speed things along, but I'm actually quite happy to see solar work without additional incentives," Jacobson says. "That means it's going to work. We don't want it to be a flash in the pan and the incentives go away and then it's all going to die off. I really see it here to stay."

Kelly Pickerel is associate editor of *Solar Builder*.

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RA
THE R

Traditional roofers are migrating toward solar with the help of finance providers.

By **Kirk Mulligan**

HIGH HOPES
OneRoof Energy has received more than $50 million in funding from key investors, providing flexible financing options to traditional roofing companies to get them started in solar.

ISE
OOF

AS SOLAR PRICES HAVE DROPPED in recent years, traditional roofers are increasingly turning to solar to boost revenues and diversify their business models. Solar systems are in demand today more than ever before, with all signs pointing toward future growth as homeowners seek relief from rising electricity costs and pursue innovative, eco-friendly energy solutions.

The Solar Foundation's third annual National Solar Jobs Census (released in November 2012) found that the U.S. solar industry employs approximately 119,000 workers, representing a 13 percent rate of growth over 2011. More efficient business models and dropping equipment costs are helping organizations go solar at a much lower cost, resulting in faster adoption to support this job growth. Those numbers should continue to rise, supporting the nation's economic recovery, as the industry gains better access to capital investment and continues to add more new jobs than other industries.

As roofers migrate to solar from traditional service offerings, new revenue-generating solar divisions are cropping up with support from solar leasing companies. For example, San Diego-based OneRoof Energy, a solar finance provider, offers roofers and installers powerful financing backed by U.S. Bank and working capital, along with co-branded marketing support.

This collaboration connects reputable contractors with experienced project managers and smart financing tools, allowing roofers to upsell solar services to homeowners when replacing their rooftops. OneRoof Energy's turnkey approach is grounded with innovative technology designed to automate workflow processes and considerable staff training.

"Solar roofing has dramatically increased our revenues and profitability, and the impact of this technology has been tremendous," says Kevin Dennis, CEO of Champion Domestic Energies, an alternative energy solution provider based in Glendale, Ariz. Dennis's company also services residential solar installations

in Tennessee, North Carolina, Kentucky and Georgia.

Champion Contracting & Restoration, a national company specializing in residential and commercial roofing systems — it completed more than 4,000 roofing installations nationwide last year — launched Champion Domestic Energies almost two years ago in response to increased demand among homeowners for smarter energy solutions amid rising energy costs. For example, the California Solar Initiative (CSI) reports that more than 70 percent of all solar installations throughout California in 2012 was expected to be the direct result of a lease agreement.

To that end, according to research released by the California Energy Commission, approximately 91 percent of Californians view energy efficiency as an important factor when considering the purchase of a new home. About 70 percent of those surveyed said the cost of the monthly electricity bill impacted their decision to buy a new home. About 81 percent believed that a solar electric system allows homeowners to start saving on monthly living costs immediately.

Partnering with OneRoof Energy has resulted in greater sales for Champion as residents appreciate the long-term protection of a fully guaranteed lease. Through OneRoof Energy's SolarSelect Financing Agreement, homeowner customers can finance aesthetically pleasing solar electric systems with an industry-leading, 20-year warranty for as little as zero down, removing the high up-front capital investment and ongoing maintenance.

"We're seeing about 80 percent of our solar sales in retrofitted installations, not just new roofs. We help residents lock in an affordable energy rate with a single unified warranty and help them achieve energy independence," Dennis says. "By using historic data from local electric companies to demonstrate the significant energy

savings that solar delivers, we're showing homeowners how to set themselves apart if they ever want to sell their homes down the road."

According to a 2011 study by Lawrence Berkeley National Laboratory, solar installs can increase home values and shorten the sales cycle. The data shows that, on average, a home solar system adds about $5.50 per watt to a home's resale value. On existing homes, solar panels increased resale value by more than $6 per watt. On new homes with pre-installed solar, the solar panels increased resale value by approximately $2.30 to $2.60 per watt. Additionally, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy shows that solar homes sell twice as fast as homes without panels, even in depressed markets.

Through its collaborative model, OneRoof Energy has created alliances with hundreds of roofers and installers in markets across the country. The company has received more than $50 million in funding from key investors, including long-time partner Hanwha International, and expanded staffing by 400 percent at its headquarters in recent months. Roofing partners like Champion Domestic Energies are also experiencing economic growth, made easier by OneRoof Energy's flexible financing options.

"Many new markets are opened that we previously could not access, and we're planning to target seven additional states during the next 12 months," says Dennis, noting that his new solar division had sold about 48 solar systems in the past two months alone. "By the end of 2013, we're projecting that 50 percent of our entire annual revenue will come from solar roofing."

Kirk Mulligan is vice president of business strategy and development for OneRoof Energy. Find more information at *oneroofenergy.com*.

feature

Headache Remedy

Solar permitting can be a pain, but Clean Power Finance is working on a database to help.

By **James Tong**

ASK SOLAR INSTALLERS about their profession, and you'll get a lot of passion and pride. Ask them about solar permitting, and you'll get a lot of passion… and maybe some four-letter words. The permitting and interconnection process can be horribly complex — varying from one Authority Having Jurisdiction (AHJ) to the next and creating unnecessary and costly roadblocks for installers. Imagine playing for the NFL when each stadium had different rules regarding first downs, offsides, holding, etc., and then getting penalized each time you missed a rule variation, which (you learn after the game has started) can also vary depending on the referee. This is the playing field that solar PV installers face.

A recent nationwide survey of 273 installers, conducted by Clean Power Finance, supports this. The survey, the largest of its kind, found that:

- More than 1 in 3 installers avoid an average of 3.5 jurisdictions because of associated permitting difficulties.
- 23 percent of installations saw permitting costs exceed original expectations.
- 13 percent of installations had agency requirements change during the job.
- 1 in 9 installations encountered jurisdictions that had not even set requirements.

In other words, government bureaucracy is holding back solar. Installers frequently report having to educate AHJs on their own rules or discovering an obscure requirement (such as a need for a glare study) after driving miles to submit a permitting packet that took hours to complete. The confusion breeds frustration and adds costs, which are mostly absorbed by end consumers and installers. Independent studies have calculated that permitting adds $0.22 per watt to a system, or even $0.50 per watt if you factor in other associated cost like lost sales or referrals, wasted labor time and unnecessary rework.

The ideal solution would be to

have all AHJs adopt the same standards, much like how in every city green, yellow and red traffic lights all mean the same thing.

Unfortunately, most jurisdictions are not even aware that solar permitting is a problem, much less understand how they can make things easier. The surge in solar installations is a relatively new phenomenon, and the policies and processes of AHJs have lagged behind. And despite dramatically increasing numbers of solar installations, residential solar remains a relatively small portion of the energy mix: In a nation with 130 million households and more than 18,000 AHJs, there are fewer than 300,000 residential solar systems across the country. For most AHJs, solar is not even a blip on the radar.

A NEW HOPE

There is hope for the frustrated solar installer who lacks the resources to take on the local AHJs alone, who has to endlessly update internal records about various permitting rules and who has to avoid Jeff at the building department because he finds it much easier to work with Suzie. With support from a $3 million grant from the Department of Energy's SunShot Initiative, Clean Power Finance is building the National Solar Permitting Database (NSPD) that will help installers reduce the time and costs spent on solar permitting and interconnection.

The free community-based tool compiles permitting requirements and recommendations from solar professionals and AHJs across the United States in one single online location. The database will operate similarly to the website Wikipedia. But instead of finding answers for trivia night at the local bar, users will be able to search the NSPD to find important tips and information about AHJ requirements before starting a project. Users will also be able to add or update information and get automatic notifications when a new rule is applied, thus avoiding costly last-minute surprises.

SIMPLIFYING SOLAR PERMITTING, TOGETHER

But the NSPD will be more than just a go-to source for solar permitting needs. It will be a collective voice of the solar community — a vehicle for change. Currently, each solar company must maintain its own permitting information and take on any stubborn AHJ by itself. Thousands of solar businesses throughout the nation replicate this same painful permitting work over and over again. By enabling installers to share their insights and knowledge, the NSPD will reduce everyone's workload and headaches. Moreover, by providing information such as which AHJs have easy processes, which AHJs have excessive fees or which AHJs simply don't understand solar, the solar industry and policymakers can then pinpoint which cities need help and what exactly can be improved (e.g., the length of the permitting application, the wait times for inspections, etc.). The NSPD will provide actionable data to support improvements and unite individual voices into a cohesive call for change. Cities are more likely to change their policies when they know enough people demand change, they can identify what exactly they should change and they can borrow proven practices from other cities. The NSPD facilitates all of this.

A beta prototype of the NSPD can be found on *www.solarpermit.org*. Clean Power Finance is currently incorporating feedback from its beta testers and will launch the redesign before summer 2013.

Ultimately, the impact of the NSPD will depend on the solar community's involvement. The more information solar installers, solar advocates and solar-friendly cities contribute to the database, the faster the country can drive toward standardization of permitting requirements and lower the cost of solar. Ideally, solar permitting would be so simple someday that the NSPD will no longer be necessary.

James Tong is senior director at Clean Power Finance. For updates on the NSPD or to provide feedback on its development, e-mail *permitting@cleanpowerfinance.com*.

INCUBATING THE MIDWEST SOLAR MARKET

Ohio developer Third Sun Solar has seen many changes in the industry in the last 15 years and likes where things are heading. By **Kelly Pickerel**

IN 1804, OHIO UNIVERSITY became the first university established in Ohio. The ninth oldest public university in the United States, OU set up camp in Athens, Ohio, and the 20,000 students who call it home each year swell the population of the city only to leave once summer arrives.

But not Geoff and Michelle Greenfield. After completing their master's degrees at OU, the couple decided to make Athens their home. They installed some solar systems on their off-the-grid home in 1997, and the community took notice. People started inquiring about how they did it and if they would help on new projects. What started out as a hobby job grew organically into a small solar business for the Greenfields.

Third Sun Solar was officially founded in 2000, and one of its first major projects was for the university that fueled the Greenfields' love for Athens in the first place. Ohio University's Innovation Center wanted solar installed on its rooftop. After the project was completed, OU invited Third Sun to move out of the Greenfields' home and into its small business incubator, a place where tech-based businesses could get office space and support services to grow. Third Sun spent nine years at the university before "graduating" in November 2012 to a building all of its own.

"We saw the most rapid growth from 2008 to 2011. The company grew very quickly," says Gerald Kelly, communications director for Third Sun. "We're now trying to strengthen our position among solar installers in our region, looking at expanding into some market segments that we have served before but not focused on so much."

Today the company employs around 25 people and does a mixture of residential and large commercial-sized projects. Its natural home base is Ohio, but Third Sun has done projects in Pennsylvania, Michigan, Kentucky, New York and Florida. Some of its customers include Kent State University, the Kentucky National Guard, Cincinnati Parks and, most recently, specialty insurance provider Assurant. Third Sun completed construction on Assurant's 1.76-MW project in Springfield, Ohio, earlier this year.

"Assurant [was] considering entering the renewable energy insurance market," says Jeanne Schwartz, vice president of new venture commercialization for Assurant. "To learn more about the solar energy industry, we decided to install a test project on one of our office locations."

Assurant sent out a request for information to solar developers, asking them to recommend the best Assurant sites for installation. Every vendor came back with the recommendation to develop a project at Assurant's specialty property call center campus in Springfield, just outside of Dayton.

"The installation process allowed us to learn about the industry," Schwartz says. "It became clear to us how important solar insurance could be in helping lending institutions get comfortable about the long-term viability of a project. We learned how difficult it can be to get a solar project deal to completion, how important solar insurance can be to securing a project's cash flows and why that can be critical to investors and lending institutions."

BUSY CREWS
Third Sun Solar has installed more than 300 projects in the last 15 years.

The 1.76-MW project consists of 6,200 panels on the site's rooftop and 15 new solar carports in the parking area. Assurant worked through a PPA offered by Tangent Energy Solutions who, in turn, hired Third Sun for the project.

"For a complex project such as this where we were closing areas of our parking lot down on a weekly basis for the construction of the carports, Third Sun was very cooperative with working around our needs and ensuring that the site remained in a safe condition at all times for our employees," Schwartz says. "Safety is a top priority for Assurant, and Third Sun has supported and embraced this culture during the project."

ENCOURAGING PROJECTS

Third Sun has grown from doing very small, mostly off-grid residential systems to a wide range of commercial jobs in different market segments — nonprofits, hospitals, corporations, parks. Kelly says business has been steady in the commercial sector, but finding residential projects is a struggle in the Midwest, where energy prices are already low.

"The low cost of energy in Ohio works against solar," he says. "Most investor-owned utilities in Ohio generate most of their power from burning coal. When you have low utility rates, when brown power is cheap, solar and renewables are obviously a much tougher sell. The payback is longer, the return on investments is further out, it's tougher to cost-justify projects."

The large majority of residential projects Third Sun takes on has been for customers who are very dedicated to being green and understand the initial poor financial return. But Kelly is hopeful that this trend will change for the better.

COVERED PARKING
Third Sun Solar completed a 1.75-MW project for specialty insurance provider Assurant earlier this year.

"Looking into the future, natural gas is going to be a huge factor in this part of the country. That will put pressure on utility rates, and we think that will help make the financial case for solar more appealing," he says. "As we begin to see the combination of upward pressure on utility rates and downward pressure on system components prices, as we've seen with solar panels, then the financial picture overall will make it an easier case [for residential solar installations]."

In the meantime, Third Sun is actively looking for opportunities to bid on jobs.

"We try to emphasize wherever we can with potential big jobs and customers [that] with something like solar, when you're putting an electrical power plant on your roof or parking lot, the low price isn't necessarily the best value," Kelly says. "Sometimes we

do have the low price, but we want to build good, highly productive systems that exceed our forecast for electrical production. Part of that battle is getting customers to understand that the low price isn't always the best value."

PROGRESS IS NOW

With nearly 15 years of experience, those at Third Sun have seen different products come and go in the industry but they're pleased with how things are progressing.

"We're finding improvement in quality and cost," Kelly says. "We've been kind of conservative in terms of jumping on new technologies. We don't want to be on the bleeding edge. The market for panels has become much more competitive and so the price and cost for panels have gone down dramatically. We've seen improvements across the board in some of the BOS components, like inverters. We see now many more opportunities as a company."

The future looks promising as young minds continue to evolve into a greener way of thinking.

"Think about this millennial generation," Kelly says. "Your next generation of employees and your next generation of customers are people who have come up from kindergarten on, taught that the earth must be saved and it's your job to do it, and the answer to every question is technology. I think those things are baked into the emerging generation much more so than 10 years before. I think the world in that way is ready for solar."

Kelly Pickerel is associate editor of *Solar Builder*.

INVOLVED IN EVERY STEP

The United States' largest panel manufacturer also dabbles in construction services.

Interview by **Kelly Pickerel**

DID YOU KNOW SolarWorld does more than just produce solar modules? The company also designs and installs large-scale projects. *Solar Builder* had a chance to speak with Dave Wallerstein, manager of business development, and Julie Ungerleider, head of systems, about SolarWorld's growing involvement in the construction side of business.

HOW LONG HAS SOLARWORLD BEEN DIRECTLY INVOLVED WITH BUILDING SOLAR PROJECTS?

"We've been North America's largest manufacturer of flat-plate silicon material for a long number of years, dating all the way back to 1979," Wallerstein says. "We've continued to be what we like to think of as a recognized leader in PV from a product quality, product performance and product longevity point of view. We have participated in many and pioneered many of the industry's firsts throughout this long history. Not only have we been a developer and manufacturer of the technology itself, but [we're] also an integrator and have been developing a capability for the design, the engineering and the construction of large-scale systems.

"It was about the time when the industry transformed from an off-grid business to an on-grid business (2000-2001) that we began to really increase our construction and engineering resources. More recently we've directed our attention to the larger utility-scale efforts."

THEY'VE COME A LONG WAY
The world's first 1-MW grid-tied solar installation was constructed by SolarWorld (then called ARCO Solar) in 1982 at Southern California Edison's Lugo Substation (photo on left). One of SolarWorld's most recent projects for the Los Angeles Department of Water and Power (an 11.4-MW project completed in July 2012) is shown at right. *Photos courtesy of LADWP and SolarWorld.*

HOW MUCH OF SOLARWORLD'S BUSINESS COMES FROM EPC SERVICES?

"We have approximately 500 MW of U.S.-based production and about 700 MW of European production, so about 1.2 GW of annual [module] production capacity," Wallerstein says. "Our worldwide direct product installation activity probably represents only about 5 percent of that. Our objective for the next few years is to increase that to about a third of our business."

WHY IS IT IMPORTANT FOR SOLARWORLD AS A MODULE MANUFACTURER TO BE INVOLVED IN THE CONSTRUCTION AND INSTALLATION OF PROJECTS?

"One of the primary reasons that we think it is invaluable for us to do turnkey systems direct to end-users is to continue to innovate a core product, that being the solar module," Wallerstein says. "By being able to understand its use in projects — whether its roof-mount, ground-mount, trackers, carports — by doing those types of installations and understanding the construction aspects of utilizing the product in the field, we're able to innovate the product itself to provide benefits to the wide variety of contractors that we supply our products to."

WHAT SERVICES DOES YOUR EPC DIVISION OFFER?

"Our engineering group is comprised of in-house engineer capabilities," Ungerleider says. "We have mechanical, civil and electrical engineers that can design the whole system, as well as project managers and construction managers. For the most part we do the design internally. We also have our own mounting systems for both ground and rooftop systems. We have an R&D group that works on the evolution of those systems and is constantly improving their design. Depending on the project, depending on the site, we utilize our mounting solutions."

DO YOU THINK SOLARWORLD'S MANUFACTURING PRESENCE HELPS YOU FIND CONSTRUCTION JOBS?

"We, like many other EPC companies, have a long-standing capability and understand the various aspects of system design and system performance," Wallerstein says. "We believe that, coupled with the solar modules we produce, would be an attractive combination for the ultimate investor in these projects."

IS SOLARWORLD'S INVOLVEMENT IN DIFFERENT AREAS OF THE SOLAR INDUSTRY BENEFICIAL TO CUSTOMERS?

"We think that we can offer superior value to our customers through a re-definition of what vertical integration means," Wallerstein says. "We start with the raw material, produce our own ingot material, we do our own ingot shaping and wafering and cell processing and module assembly. But now taking that all the way through system design, engineering and construction — we can really control all elements of quality control and system performance and deliver to a customer superior value because of that.

"Our ultimate goal is to provide an adequate return to our shareholders through providing high-quality, high-performing solar products through the complete value chain of the solar industry."

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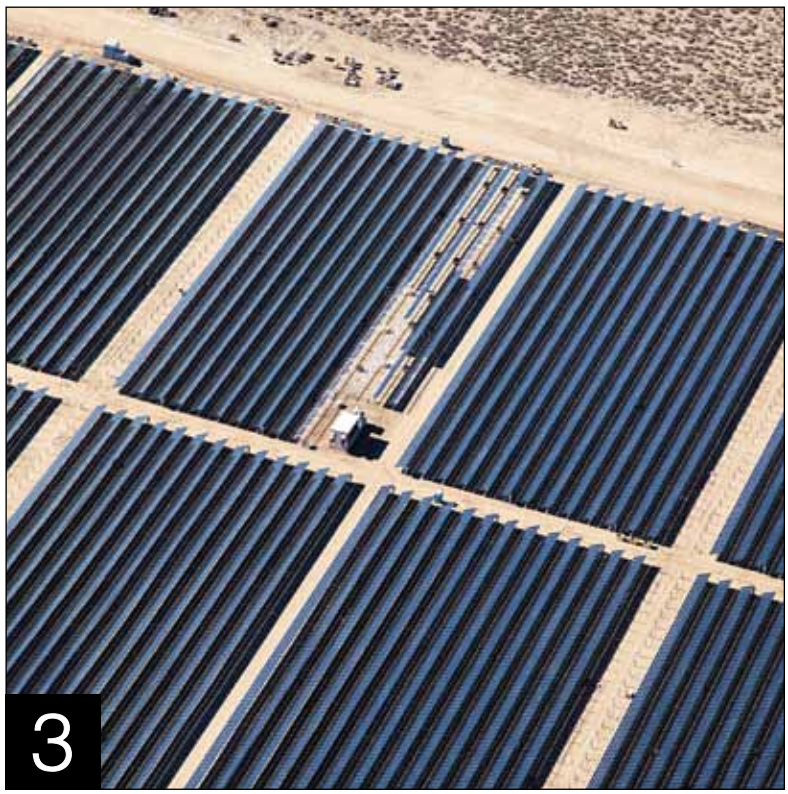

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1 Super Bowl XLVII runner-ups the San Francisco 49ers will play at a new stadium in 2014 equipped with solar power. NRG Energy plans to install three solar-covered bridges and other arrays totalling 400 kW.

2 Construction on the largest planned airport solar farm in North America has begun at the entrance to the Indianapolis International Airport. The 75-acre project is expected to produce 15 million kWh once completed.

3 First Solar Inc. announced in late February that the Antelope Valley Solar Ranch One project has achieved a peak generating capacity of 100 MW-AC connected to the electrical grid. The project, which is under construction in northern Los Angeles County, Calif., will have a generating capacity of 230 MW-AC upon completion, expected later this year.

Initial construction on the solar project began in Sept. 2011 and module installation started in June 2012, providing an average of 400 jobs during the construction phase. Power from the plant is being purchased by Pacific Gas and Electric Company under a 25-year contract.

"We are proud to achieve this important clean energy milestone for California, which was made possible by the tireless efforts of hundreds of individuals working together," said Lou Moore, First Solar senior vice president of engineering, procurement and construction.

When fully operational, the facility will generate enough power for 75,000 average California homes and will displace about 140,000 tons of carbon dioxide per year, equivalent to taking 30,000 cars off the road.

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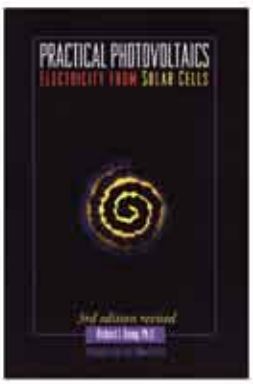

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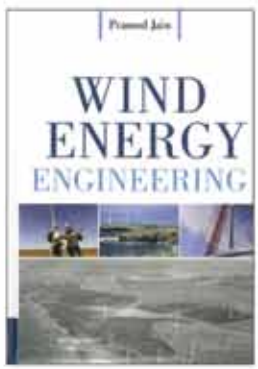

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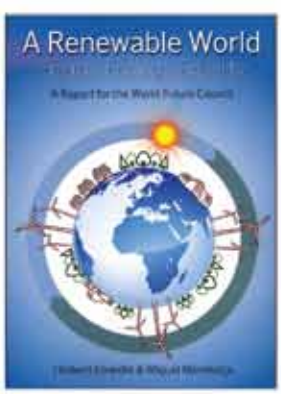

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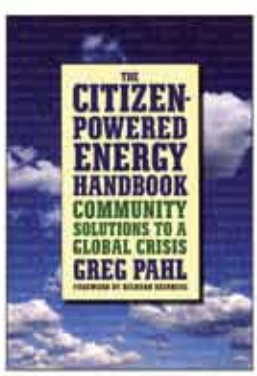

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