



Almost Time for Anaheim

By David Brearley and Joe Schwartz

Products, trends and technology to look for at the 2009 Solar Power International Conference

If you have not already done so, it is time to make your reservations for North America's largest solar business-to-business conference and expo. Solar Power International (SPI) 2009 runs October 27–29 in Anaheim, California. Manufacturers build their calendars around SPI, targeting new products for release at the event. Think there is nothing new under the sun? Think again.

The sixth annual event was originally scheduled for San Jose. After unprecedented growth in 2008, however, event organizers—the Solar Electric Power Association (SEPA) and the Solar Energy Industries Association (SEIA)—relocated SPI to the Anaheim Convention Center. The conference is expected to attract in excess of 750 vendors and 25,000 attendees. Attendees can choose between more than 65 breakout sessions, featuring 200-plus expert speakers. Come early and stay late; dozens of pre- and post-conference training workshops are offered on Monday, October 26 and Friday, October 30. The new venue is also more family friendly, due to its proximity to Disneyland Park, which is hosting the official SPI party on Tuesday, October 27.

Despite the rollercoaster market conditions, event organizers expect this to be the largest conference ever. Though business is down in general in 2009, resist the temptation to skip Anaheim. At the Intersolar North America conference held in San Francisco earlier this year, few first-tier PV and inverter manufacturers were in evidence. However, overall attendance was up, with attendees lined up at the gates early

each morning. Despite the tendency for some big-name players to stay away, the number of vendors actually increased 111% over the previous year. Just as the soft market we are experiencing this year was forecast, so is a rebound in 2010. Where and how this will happen, and what technologies and business models will be favored, are all questions to answer in Anaheim.

With that in mind, here are some highlights of interesting technologies and trends that you will want to investigate for yourself.

MODULES

After years of consistent market growth and incremental product improvement, evidence of a shakeup is everywhere.

More seats, smaller table. Ironic, is it not? Just when demand contracts for the first time in some 35 years, there are more manufacturers than ever trying to bring solar modules to market. A quick survey of PV module vendors that attended the Intersolar event revealed some 100 manufacturers—from Advance Solar Photonics to Zytech—including 35 from China. Expect to see even more manufacturers at SPI.

Buy America Act products. There is some confusion around what programs receiving *Recovery Act* funds have *Buy America Act* provisions. Projects receiving a Treasury grant in place of the 30% ITC do not. Other programs, like solar on federal facilities, undoubtedly will. The good news is that the North American PV market in particular is expected to be a bright spot for the global solar industry. While BP Solar announced in March that it is phasing out module assembly in Frederick, Maryland, the general trend runs counter. Expect to hear more talk than usual from international PV manufacturers about opening US manufacturing or assembly facilities. In the meanwhile, the new SCHOTT Solar (us.schott.com) facility in Albuquerque, New Mexico, is online, and its SCHOTT POLY line of modules—210, CONTINUED ON PAGE 26

217, 220 and 225 W—are listed and available now through distribution channels. SolarWorld, another first-tier module manufacturer with US based production, continues to ramp up capacity output at its Hillsboro, Oregon, facility.

Direct sales to integrators. While also solar North America has not yet announced plans for US module manufacturing, the wholly owned subsidiary of aleo solar AG (aleo-solar.com) has opened its US headquarters in Westminster, Colorado. The German manufacturer of poly- and monocrystalline modules has indicated that its plans for coming to market in the US include direct sales to integrators. (Other companies are going still further, promising direct sales to end users.) This buyer's market will not last forever—certainly not to this extent—so consider building relationships at SPI with manufacturers like aleo solar and others. Just be sure to do your homework and choose your business partners wisely.

Out-of-the-box thinking. Perhaps no PV manufacturer represents the spirit of innovation more than Solyndra (solyndra.com). The CIGS panel manufacturer thought right out of the flat plate PV box when it developed its cylindrical module consisting of 150 series-connected CIGS cells. Each Solyndra panel consists of 40 parallel-connected cylindrical modules. Two positive and two negative leads are included for making series and parallel connections in the field. In

Courtesy solyndra.com



Solyndra CIGS cylindrical panel

the right application—commercial, low pitch, white membrane roof—the benefits from the ease of installation to the roof coverage and energy harvest are compelling. Because it is not a flat plate module, it does not have a sail effect, meaning that Solyndra panels mount on the roof via simple feet that do not need to be attached or ballasted in place for the system to achieve a 130 mph wind rating. More than one industry veteran has written the product off as a crackpot idea, but integrators familiar with the product respond that it is just crazy enough that it might work. The US Department of Energy is a believer, having offered Solyndra a \$535 million loan guarantee earlier this year.

INVERTERS

Look for an unprecedented range of inverters on display in Anaheim, with options ranging from 190 W to 1 MW.

Microinverters and ac modules. The smallest inverter generated perhaps the biggest buzz at SPI 2008. Much of the excitement surrounding Enphase Energy (enphaseenergy.com) was not about its microinverter per se, but rather about the Enlighten monitoring system. Using a powerline carrier to transmit and receive data over ac wiring, the Enphase data acquisition system provides unprecedented transparency into PV system operation. Some have dismissed microinverters as a mere fad, pointing out that micros have been in development for over a decade and have never gained traction or meaningful inverter market share. Nonetheless, the current generation of product may succeed where previous offerings failed.

Today's PV market is more mature, and microinverters are successfully exploiting opportunities that few would have imagined 5 years ago. At least two examples of this trend will be on display in Anaheim. First, Akeena Solar (akeena.com) has successfully integrated Enphase microinverters with its custom-framed, all-black modules that Suntech manufacturers for the company. The result is the integrated Andalay (andalaysolar.com) ac panel. Though not a true ac module per *NEC 690.2*, it is nevertheless a step in that direction. The Andalay system simplifies array siting and system design; it offers a minimum parts count; and it provides a low-profile installation. This system could be particularly useful to contractors who are new to solar, for new construction projects or for companies that are streamlining their operations.

Similarly, the microinverter company Petra Solar (petrasolar.com) has announced an alliance with Suntech with the goal of developing an ac module. Unlike startup GreenRay Solar (greenraysolar.com), which is developing an ac module for the residential market, Petra Solar is successfully marketing its SunWave product to utilities. In July the company announced that it had won a contract with New Jersey utility PSE&G to provide 200,000 utility-pole attachable PV generation systems. If each SunWave solution consists of a 200 W Suntech PV module and Petra Solar microinverter, the entire contract is good for some 40 MW of installed solar capacity. Like Enphase, Petra Solar offers more than just module level inversion; it also provides granular monitoring as well as command and control. Each microinverter from Petra Solar, for example, is capable of dispatching 100% reactive power on demand into the power distribution network. The company is marketing this as a tool to provide utilities with greater ac system stability.

Large scale inverters. For a variety of reasons—including changes to the solar investment tax credit, *Recovery Act* provisions and impending carbon tax legislation—the development of utility scale solutions, in many

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cases by utilities themselves, is expected to account for much of the installed PV capacity in coming years. For project developers who do not wish to install megawatts of solar exclusively using 200 W inverters, Anaheim will have much to offer.

The Satcon (satcon.com) PowerGate Plus product line, for example, now includes a 1 MW inverter option, as well as some 10 other power levels to choose from. According to the company, a 1 MW inverter block is the largest practical



Courtesy satcon.com

Satcon PowerGate Plus 1 MW inverter

size for PV applications due to the unavoidable wire losses associated with six- to eight-acre arrays. The company also offers the Satcon Prism for utility class applications; the Prism integrates a pair of 500 kW inverters inside a weatherized container along with a medium voltage transformer and switchgear. Xantrex (xantrex.com) also released a line of Solar Power Conversion Substations for large scale solar farms in 2009.

Fronius USA (fronius.com) and Kaco new energy (kaco-newenergy.com), which have historically not offered larger 3-phase inverter solutions in North America, made it clear at Intersolar that they were working toward the release of 100 kW inverters. The Kaco product appears to be on track for release at SPI.

Though SMA America (sma-america.com) did not participate in Intersolar, the company hosted an invitation-only event in San Francisco the day after the conference wrapped. Attendees were treated to a sneak peak at the Sunny Central 500U, which SMA will undoubtedly feature in Anaheim.

String inverters. The biggest string inverter release at SPI in San Diego last year was the IG Plus product line from Fronius. This year, look for Kaco new energy to feature its new 02xi series of string inverters. Kaco is also participating in plans to bring an optimized two-stage power management and inversion solution to market.

DISTRIBUTED POWER MANAGEMENT

To a certain extent, the trend toward distributed power management started with the release of the microinverter. One of the main benefits that module level inversion provides is the ability to optimize performance at its most granular level. This also requires locating an inverter on the back of every module, which undoubtedly fills some installers with dread. Several companies are offering designers a middle ground, two-stage solution: The first stage is module or string level MPPT; the second stage is inversion. The result is distributed, granular performance optimization and centralized inversion.

Module level MPPT. The poster child for module level maximum power point tracking is SolarMagic (solarmagic.com) from National Semiconductor (national.com). National is marketing its SolarMagic power optimizers, available now, for retrofit and new PV applications where the effects of shading or module mismatch are of concern. Since many cell phones and laptops use National's PowerWise circuitry products, perhaps SolarMagic power optimizers will soon be built into PV modules. Its initial product, however, lacks monitoring and datalogging capabilities and does not provide visibility into system performance. This limitation, along with SolarMagic's MSRP of \$199, may provide an opening for competing products.

Tigo Energy (tigoenergy.com), for example, is developing a similar product that it calls the Module Maximizer-ES. Tigo maximizers provide not only per-module MPPT but also module-level monitoring and control. Though the Module Maximizer-ES is suitable for retrofit applications and works with conventional inverters, Tigo is working with Kaco to develop an inverter that is specifically designed to work

with its new product. This could result in a more streamlined, less expensive inverter, as MPPT circuits will no longer be required. The Tigo product has an MSRP of \$59.

Both SolarEdge (solaredge.com) and Xandex Solar (xandexsolar.com) are also bringing module-level power optimizers to the US market.

String level MPPT. The Satcon Solstice uses a utility-class approach to provide fine-grained energy harvesting. Instead of module



Courtesy tigoenergy.com

Tigo Energy Module Maximizer-ES

level MPPT, string level MPPT is performed in Solstice smart combiner boxes located throughout the array field. These smart combiners monitor and log system performance, as well as provide command and control throughout the array. Since combiners are already a service point in the PV system, from a maintenance point of view this new circuit architecture does not change things much. Also included in the combiner boxes are string level microconverters that boost PV source circuit voltage close to 600 Vdc. This high dc voltage reduces wire sizes in the array, and the high dc bus voltage makes it possible for Satcon to employ a transformerless inverter architecture, meaning the Solstice inverter itself can be smaller and more efficient than conventional inverters. According to Dr. Leo Casey at Satcon, the Solstice system promises 4% to 5% improved yield for only pennies more per watt, which is a compelling value proposition for large scale PPA projects.

COMBINERS AND RECOMBINERS

A high profile PV array fire on a Target store in Bakersfield, California, this spring brought the need for dc disconnects in the array field to the forefront of many integrators' minds. One of the recommendations of the post-fire investigation report was: "Provide dc disconnects at the output of all combiner boxes on the roof. The firefighters were looking for disconnects that were not there." Segmenting disconnects at the array enables first responders to better react during an emergency situation, and they also streamline ongoing system maintenance and troubleshooting efforts.

Integrated disconnects. Three manufacturers develop and market combiner products that include an integrated dc disconnect. Blue Oak PV Products (blueoakpvproducts.com) was the first to market with a listed line of five combiner models that include a load break rated disconnect. AMtec Solar (amtecsolar.com) and SolarBOS (solarbos.com) have also introduced disconnecting combiner products. The Blue Oak and SolarBOS disconnecting combiners are listed to 600 Vdc, while the AMtec products are pushing the voltage ceiling with 1,000 Vdc ratings.

Recombiners and monitoring. Additional combiner innovation will be on display at SPI 2009. AMtec will be launching its new Equinox series recombiners, available in three sizes from 4 to 20 circuits with 750 A to 2,000 A ratings. All Equinox recombiners will be available with or without monitoring capabilities. Somewhat of a

disconnect previously existed between PV equipment and third-party monitoring solutions that left installers scratching their heads while they waited on their cell for technical support. To ease their pain, SolarBOS has teamed up with new-to-the-field DECK Monitoring (deckmonitoring.com) to develop a standardized, seamless string- and system-level monitoring solution.

RACKING

Photovoltaic racking system manufacturers have been developing a myriad of approaches to reduce component count, speed installation, ensure leak-free attachments in pitched roof mount applications and ultimately drive down installed cost per watt. Quick Mount PV (quickmountpv.com) and S-5! (s-5.com) will be exhibiting their expanding lines of flashing and attachment systems at SPI 2009; Unirac (unirac.com) will show its recently introduced CLICKSYS product for flush mount applications. Among the dozens of racking manufacturers that will be sporting product innovations at the event, put the following two on your Do Not Miss list.

Simple and adaptable. Only a 0.5-inch wrench is required for assembling AEE Solar's (aesolar.com) SnapNrack PV mounting system. The rail based mount starts on the roof with either flashed L-foot or flashed post attachment options. The latter allows for slight tilting or an increased standoff from the roof deck. Standoff adjustability allows you to straighten out the array plane over irregular roof surfaces.

The system's thread inserts (used to secure top-down mounting bolts, rail splices and post or L-foot attachments) can be installed along the entire rail section, saving you a lot of back and forth work on the roof. Mid-clips are 0.5-inch wide to keep layout math simple. The rack's rail profile includes a wire management channel for securing and covering module leads. If you are not working on pitched roof

projects, SnapNrack's posts can also be used in non-ballasted low-slope roof applications. A pipe-to-rail option makes the system compatible with ground mounted installations.

Reenvisioning the module frame. We recently traveled to San Rafael, California, to review a new, no-rail mounting system that was pitched as "the MC connector of PV racking development." We were not disappointed. In Anaheim inventor Jack West and cofounder Daniel Flanigan CONTINUED ON PAGE 32



SolarBOS Disconnect Combiner

Courtesy solarbos.com

will be launching their patented mounting system, designed and manufactured by the newly formed Zep Solar (zepsolar.com) in partnership with groSolar.

When you first see the system, your likely reaction will be “Really? No rails?” Zep Solar took a forward-looking approach: customize the module frames to directly accept the racking components and engineer the composite system to support the design loads—without increasing the dimensions of the frame. Initially, Zep Solar will be launching its product for use with Evergreen laminates.

The frames are designed with tapered channels (Zep Grooves) that accept the core components of the racking system—the Interlock and the Leveling foot, each containing the Zep, a device that locks into the groove and grounds the module frame (auto-grounding) using a specialty tool. With the first row of modules in place, each successive module drops in at a 15° angle and lowers into position with a pivot-lock action.

So what are the advantages? Reduced materials, parts count and shipping costs (no rails); auto-grounding of all module frames; and *extremely* rapid installation. You can even straighten the plane of the array from the top with a drill-driven adjustment of the Leveling Foot. Zep Solar’s obvious challenge will be building relationships with module manufacturers that are willing to customize frames with Zep Grooves. However, this general degree of customization has been accomplished before and variants on module frames are becoming more common. Zep Solar plans on full commercialization of its innovative product in Q1 2010, but make sure to check it out at the groSolar booth at SPI 2009.

Courtesy zepsolar.com



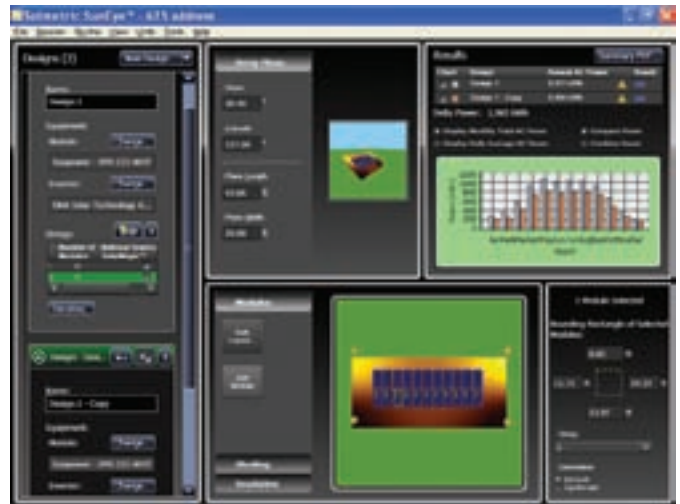
Zep Solar’s Zep Mount

DESIGN AND COMMISSIONING

You are probably familiar with the SunEye shade measurement tool from Solmetric (solmetric.com). However, you may not be familiar with the suite of products that Solmetric is developing to improve PV system design and commissioning. The PVDesigner software program, for example,

will enable system designers to lay an array out virtually, identify individual strings, import SunEye readings from the field and then, with the push of a button, generate detailed energy harvest estimates. Early reports are that the software interface is slick and user friendly, and PVDesigner will likely win many fans in the industry.

On the back end of projects is commissioning and acceptance, which are not only time consuming—preparing forms and templates, performing tests and documenting the results—but also warrant a third party seal of approval. Solmetric believes that its PV System Performance Analyzer is the solution. The PV analyzer is basically a portable I-V curve tracer that includes a remote control, remote irradiance and cell temperature sensors, and PC software. Its purpose is to measure, model and log system performance at the string level. The device models performance by comparing string



Courtesy solmetric.com

Solmetric PVDesigner

level I-V curve measurements with a Sandia model. It is capable of identifying a variety of manufacturing or installation defects. The device is used with a PC, preferably a ruggedized one, and as the technician gathers measurements in the field, the PV analyzer builds a database that can be used later to inform acceptance documentation. ☺

Look for product innovations and more at Solar Power International 2009 in Anaheim, California, October 27–29, 2009.

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