

Western's monthly energy efficiency and renewable energy newsletter dedicated to customer activities and sharing information on energy services.

## Nellis AFB credits teamwork for largest PV system in U.S.

It was a big day for a very large solar project completed by one of the nation's largest green power consumers—the U.S. Air Force.

In front of a crowd that included project partners; national, state and local officials; and members of the community, Nellis Air Force Base commissioned a 14-MW photovoltaic array on Dec. 17. Among the national VIPs were Nevada Governor Jim Gibbons; William C. Anderson, Assistant Secretary of the Air Force Installations, Environment & Logistics; and Paul Dickerson, Chief Operating Officer, Office of Energy Efficiency and Renewable Energy.

“The best way to secure a healthy and prosperous economy is to develop our affordable, reliable local resources,” said Governor Gibbons. “With these 14 megawatts, Nellis Air Force Base is leading the country in solar energy deployment, a move that is good for the environment and our nation's energy security alike.”

Governor Gibbons and Nellis Installation Commander Colonel Michael Bartley flipped the switch that connected the system to the grid. “Our base, and indeed, our entire nation will benefit from the predictable, secure supply of clean energy that this landmark power plant is now generating,” Bartley stated in a press release.



(left to right) William C. “Bill” Anderson, Assistant Secretary of the Air Force Installations; Nevada Governor Jim Gibbons and Major General Michael Lynch attended the commissioning ceremony for the nation's largest PV system at Nellis Air Force Base. (Photo by Audrey Colletti)

### Tracking panels

Nellis AFB will see the benefits quickly from the 14-megawatt, 70,000 solar-panel array covering 140 acres of desert outside of Las Vegas. At peak generation, the installation is expected to provide up to 25 percent of the base's annual power need and save about \$83,000 a month in energy costs.

Mounted on a single-axis tracking system, the solar panels follow the sun throughout the day producing up to 30 percent more electricity than fixed-position panels. The tracking component was not a part of the original request for proposals, recalled Base Energy Manager Michelle Price. “It specified the number of kilowatt-hours we expected, and the companies came back with designs. The original RFP called for an 18-MW array, but tracking maximized the generation from the smaller system.

SunPower Corp. designed and

built the ground-mounted array, part of which covers a retired landfill. The T20 trackers sit on top of the ground, so it was not necessary to pierce the landfill's cap to mount the units. “We were able to take a closed landfill and put it to use producing renewable energy, so we doubled the environmental benefit,” Price said.

MMA Renewable Ventures, LLC, owns and operates the system and sells the base the electricity it generates at a fixed rate. Nevada Power Company is also supporting the project by buying all the renewable energy credits from the system to help meet its renewable energy requirements.

### RPS advances plan

Senate Majority Leader Harry Reid of Nevada, who was unable to attend

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## Largest PV system

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the commissioning ceremony, sent a statement praising the Air Force for its continued leadership on clean power. However, state leadership also played a critical role in bringing the massive Nellis system online, said Price.

The idea of installing a PV system on the base had been floated as far back as 2004. "It was a good financial deal for the Air Force and for the contractors, but you have to have everybody's interest to get a system that size built," the energy manager said.

Nevada's aggressive renewable portfolio standard, initially passed in 1997, finally brought all the necessary parties to the table. In 2005, the state Legislature revised the RPS to require investor-owned utilities to increase renewable energy sales by 3 percent every two years to achieve 20 percent of retail sales by 2015. "That's one of the strongest RPFs in the country," said Price. "The renewable energy credit market finally supported the project."

## Collaboration succeeds

The size of the array precluded self-ownership, Price explained. "The base simply couldn't commit the personnel to maintain a system of that size."

Still, a smaller project was never under consideration. "Nellis has the demand and it has the space," Price observed. "Col. Bartley explains it as running a utility for a town of 12,000 people."

With a third party financing the array, however, there was no need to scale down. "Obviously, it's in MMA's best interest to sell as much power as possible, and the company gets the benefit of selling the RECs to Nevada Power, too," noted Price.

Federal tax subsidies for solar power will help the investors recoup part of the project's cost of about \$100 million. Nellis gets a 20-year fixed price from MMA on a significant portion of its energy needs, and Nevada Power is able to continue meeting RPS requirements. "I wouldn't say, 'the stars aligned' to make this project happen," Price asserted. "A lot of people worked very hard, and all the parties met each other part way."

## Nellis paves way

Hammering out a power purchase agreement was only the beginning of the hard work on the Nellis project. Solar construction, explains Price, is a fast process, and meeting all the requirements for building on a Federal installation takes time. "It was a challenge to make sure we dotted all our 'Is' and crossed all our 'Ts' and still kept things moving," she said.

The construction began in June and was finished by December. "You have to be prepared to commit the manpower to keep up with the private builders," is Price's advice to Federal facilities that are considering such projects. "It may mean putting extra people on the job. And it's definitely a learning curve," she added.

Other Federal facilities may have a shorter curve, thanks to Nellis Air Force Base. Assistant Secretary Anderson refers to the solar project as "the Nellis model," suggesting that the lessons can be used by any base for any renewable energy project. "It is replicable, and we are happy to make recommendations," agreed Price. ⚡

Want to know more?

Visit [www.wapa.gov/es/pubs/esb/2008/feb/feb081.htm](http://www.wapa.gov/es/pubs/esb/2008/feb/feb081.htm)

### Energy Services Bulletin

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# Colo. Springs Utilities rebate helps Old Town Bike Shop go solar

Taking his cue from the bicycles he sells, John Crandall of the Old Town Bike Shop in Colorado Springs, Colo., uses very little fossil fuel to run his business.

The bike shop, which gets 70 percent of its power from wind, recently became the first business to take advantage of Colorado Springs Utilities' solar incentive. "Our goal is to get our electricity from 100-percent renewable energy," the owner explained of the solar array in his shop's parking lot.

## Renewables advocate

That has been Crandall's dream ever since Jimmy Carter put PV panels on the White House. It took years, however, to make the project a reality. "The prices were prohibitive, and through the '80s and '90s, utilities weren't interested in promoting renewable energy," he said.

Like many who strongly believe in the potential of renewable energy, Crandall knew that would change someday. He continued to get involved locally in environmental issues, and became better acquainted with his city's power provider. While participating in Springs Utilities' resource planning process, Crandall learned about the Springs' customer rebate program.

In 2006, Springs Utilities created the solar rebate of \$3.75 per AC watt for business and residential customers. With that incentive in place, the time was right for the Old Town Bike Shop to take the solar plunge.

## Obstacles to overcome

Some of the more concrete aspects of the project didn't fall into place easily. As a pioneer, Crandall had to

work through the local permitting process.

"Businesses may have to get more permits than residences," said Deb Mathis, who now manages the Springs Utilities Renewable Energy Rebate program.

"That's especially the case for businesses like the bike shop located in historic districts."

The building did, indeed, pose a siting problem. Although the roof's unobstructed exposure made it the perfect place to mount panels, its age did not. True to its name, the building is almost a century old, and the steel trusses supporting the roof were fragile. Also, Crandall had put in a new roof with upgraded insulation in 2004, "So we wanted to keep the penetration to a minimum," he said.

Engineer Scott Harvey of Art of Engineering originally advocated for placing the array on the roof, said Crandall. "Then, after several months, he was the one who finally squelched the idea. He just couldn't guarantee the strength of the trusses," he recalled.

## Different site costly

Plan B—putting the array in the shop's parking lot—came with its own set of challenges. The panels were to be mounted on a big wing supported



The bike shop parking lot was the second choice for siting the solar array, but made little difference in system performance. (Photo by Gary Hoffmann)

by three I-beams. Drilling holes to set the I-beam, the auger struck cement just below the asphalt pavement. The crew dug out the cement and resumed drilling, only to have one hole hit a cement wall. "It was like an archaeological dig," recalled Crandall. "That day alone added \$1,100 to project costs."

The change of location turned out to have little effect on the system's operation. "The lowest edge of the array is 12 feet high—it would have been 14 feet on the roof," Crandall pointed out. "There's one tree that shades some of the panels this time of year, but that's not a big problem."

On the positive side, he added, the parking lot array is much more visible to the public. "Hopefully, it will get people thinking and asking questions about PV."

## Up and generating

Concrete barriers and antique building materials notwithstanding, the ground-mounted, 4.2-kilowatt array began generating power in

*See BIKE SHOP page 4*

## **Bike Shop** *from page 3*

November 2007. The first full month, it provided 28 percent of Old Town Bike Shop's electrical requirements. "Our goal was 30 to 35 percent, so we are close to that," said Crandall. "Our peak output has reached 4.6 kW, but it averages between 3.5 and 3.6."

Photovoltaic panels perform best in cold, clear weather typical of Colorado Springs winter days, Crandall noted. "But it will be interesting to see what the output is around the equinox when we get the most direct sunlight, and the shop's demand is the lowest."

Old Town Bike Shop's electrical requirements don't change much throughout the year. Instead of air conditioning, two big fans provide cooling in the summer. Efficient electric and gas radiant heaters warm the shop in the winter, so lighting represents most of the shop's demand.

### **Opening doors for others**

Crandall, who has an engineering degree, said he learned a great deal about solar power from Jeff Scott of Sol Source, a solar design and installation consultant. The team that installed Old Town's array included Sol Source; Art of Engineering; Jim Fladlund, a general contractor and bike shop customer; and Nick Ordahl, who installed the I-beam structure that supports the array.

Springs Utilities installed two meters on the array—an automated meter to measure the system's cumulative output and an analogue unit for net metering. "If the system produces more electricity than needed, the customer can watch the meter spin backward," said Mathis.

Both business and residential customers sign an interconnection agreement giving Springs Utilities the renewable energy credits for the system.

The project was a learning process for Crandall and his construction team, as well as Springs Utilities. "OldTown Bike Shop really paved the way with all the players," said Mathis. "We now have three more, fairly large commercial customers wanting to install solar. One is considering a 30-kW system."

### **Long-term investment**

Crandall enjoyed the experience of working with a committed team, noting that everyone involved gave up a little profit to get the array built. He admits that it will be a while before he sees a return on his investment, even with incentives. That shouldn't deter businesses from installing solar systems, however. "The cost of energy may dip, but it never really drops," said Crandall. "At today's utility rates, the return on a solar system is going to be around 5 percent. That's a very safe investment, even without figuring in the likelihood that energy prices will rise."

Mathis agrees that solar power can be a solid, long-term investment for businesses, and offers this advice. "Meet with a licensed contractor first to make sure the project is feasible—from a code standpoint as well as construction," said the program manager. "Then get at least a couple of estimates before choosing an installer."

Businesses have different—usually greater—electricity needs than homes,

so they may require more equipment, too, she added. "For example, a commercial facility may have a three-phase system, requiring multiple inverters,," Mathis said.

### **Energy efficiency, too**

Homes and businesses may have different electricity needs, but both types of consumers can use energy-efficiency measures to make the most of any resource. In addition to improving the old building's roof insulation, Crandall retrofitted the work area with high-efficiency radiant heaters and T-8 fluorescent lights. "That was 11 years ago, before Springs Utilities started offering rebates on efficient lighting. I've given them a hard time about that," he joked.

Rebate or not, the measures have paid off: The highest monthly utility bill Crandall has received is \$610. "That's pretty good for a 100-year-old, 6,000-sq.ft. building with no wall insulation," he said.

That's a good utility bill, and an even better example to the Colorado Springs business community. ⚡

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# Public outreach helps Riverside build solar generation

*Editor's note: This is the first of two stories on Western customers honored by the Solar Electric Power Association for outstanding solar programs. Roseville Electric, which received SEPA's award for innovation in solar programs, will be featured in the March Energy Services Bulletin.*

**M**any Western customers are leaders among utilities developing renewable energy, and we can't help but feel a surge of pride when the industry takes notice, as the Solar Electric Power Association did when it honored Riverside Public Utilities at Solar Power 2007.

The southern California municipal utility received the SEPA award for business achievement for its public outreach and communications program. Working with the city, RPU has completed such civic projects as the City Hall solar project and the Autumn Ridge apartment complex. The increased outreach efforts over the past year, however, were focused less on past achievements and more on future goals. "Mayor Ron Loverage, the city council and the utility board are fully committed to making Riverside a model solar city," said General Manager David Wright.

## Comprehensive program

While city government and utility leadership were important, said Wright, RPU was also responding to public interest. The community wants to know more about solar technology, how to install systems and what types of incentives are available.

To answer those questions, "We're using everything from the 'Utility Update,' our newsletter on the back of the bill, to an education program

that goes out to every fourth and fifth-grade class in Riverside," said Marketing/Communications Manager Mike Bacich.

The outreach program also employs RPU's Web site, billboards, direct mail, newspaper ads and a weekly radio show. "The key starting point is to engage the community in dialogue, to get everyone involved," said Bacich in an interview for a SEPA webcast.

## Reaching right customers

Involving everyone means targeting the message to the people most likely to respond to it. RPU's marketing committee commissioned a survey to find out not only how customers got their information about the utility, but also the types of media different groups were generally using. Bacich offered a simple example. "The survey showed that smaller homeowners and renters were less likely to install PV systems than larger homeowners," he recalled. "So when we sent a postcard promoting our residential PV rebate, we sent it to large residential customers. They were more likely to be interested in the information."

"The Green Power Report," airing on regional commercial station KTIE 590, Mondays at 8:30 p.m., is another example of targeting. "We had some 60-second spots on an FM oldies station, but research showed that listeners weren't likely to stick around for commercial breaks," said Bacich. "Talk radio, on the other hand, is the



**Placing solar panels in the parking lot of Riverside's Metrolink station educates commuters about renewable energy, while it generates clean electricity for a municipal facility. (Photo by Riverside Public Utilities)**

fastest-growing format in the market."

Bacich added that RPU is very pleased with the results. "Green' is a very broad topic. At first we were wondering if we would have enough to talk about. Now guests are lining up." The program also provides content for RPU's Green Riverside Web site, where past programs are posted for users to listen to. "Sort of like an audio brochure," the communications manager observed.

The education program reaches future RPU consumers with a presentation developed and taught by a licensed teacher. With Public Benefits funds, RPU hired a teacher in 2000 to come up with a curriculum, which has been approved by the Riverside Board of Education. "The teacher is in classrooms most of the week giving the presentation," said Bacich.

Students learn about electrons and neutrons with hula hoops, about water use with an aquifer-in-a-cup and about renewable energy with a solar-powered hand fan. "Kids love the hands-on style, teachers like having a ready-made science lesson

*See OUTREACH page 8*

## Web site of the month: Solar roundup

*If there is an energy- or utility-related Web site that you find especially useful, let us know. Contact the editor with your suggestion for Web site of the Month.*

**F**ebruary is solar month for Energy Services Bulletin, so, like the November 2007 wind issue, this month's profile of Internet resources will look at several useful Web sites dedicated to solar power.

### **DOE covers solar basics** [www1.eere.energy.gov/solar/](http://www1.eere.energy.gov/solar/)

Beginners can start with the Solar Energy Technologies Program, part of DOE's Office of Energy Efficiency and Renewable Energy. The site groups solar technologies into four categories. While concentrating solar power gets only one page with links to more extensive sites, the photovoltaics, solar heating and solar lighting sections all have several pages worth of information. Solar Frequently Asked Questions covers the basics and applications for each type of solar power, as well as benefits, financial considerations and education resources. A Solar Glossary defines basic terms and the Solar Timeline gives a history of solar power use dating back to the 7th century B.C.

### **CSP technology** [www.nrel.gov/csp](http://www.nrel.gov/csp)

The National Renewable Energy Laboratory is conducting research on concentrating solar power. Projects focus on parabolic trough solar and advanced concentrating solar power technologies. These promising, utility-scale applications are not yet cost-effective, but have many advantages and offer great potential for cost reduction.

TroughNet, another NREL Web site, is a technical resource for evaluating parabolic trough solar powerplant technologies. Utilities, particularly in the sunny Southwest, can learn what the future may hold from overviews of solar field, thermal energy storage and powerplant system technologies.

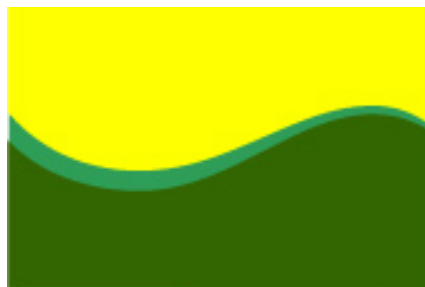
### **More on PV** [www.repartners.org/solar.htm](http://www.repartners.org/solar.htm)

Photovoltaic technology offers plenty of opportunity for quick and versatile development of renewable resources today. This type of solar generation is growing at 20 to 25 percent annually worldwide, much of that occurring in the United States. The Public Renewables Partnership solar section provides information on the different options for deploying solar arrays. Pages include an overview of PV technologies, cost factors and links to more resources.

### **Utility participation** [www.solarelectricpower.org](http://www.solarelectricpower.org)

Once a utility moves past the research phase, the Solar Electric Power Association offers a variety of tools to help power providers integrate solar electricity into their mix.

Utility Solar Programs provides case studies to give renewable energy managers ideas for their own programs. Want to know more about how a specific program works? Utility Peer Match connects utilities with peers that are already implementing similar solar programs. SEPA will give permission to non-member electric utilities (municipal, cooperative, investor-owned, etc.) to access Utility Peer Match.



**Public Renewables Partnership and Solar Living Institute are just a few of the Web sites available to educate power providers and the general public about solar energy. (Artwork by PRP and SLI)**

When it's time to evaluate options, decision makers will appreciate the Solar Programs Options Tool, an online tool that recommends and prioritizes solar electricity options for utilities. SPOT users provide basic information about their utility and then identify and rank their solar goals and objectives. Non-members have limited access to the tool.

### **Consumer questions** [www.dsireusa.org](http://www.dsireusa.org) [www.ases.org/askken/index.htm](http://www.ases.org/askken/index.htm) [www.solarliving.org/default.asp](http://www.solarliving.org/default.asp) [www.solarenergy.org/index.html](http://www.solarenergy.org/index.html)

Because solar arrays are relatively easy for consumers to install, utilities are likely to get a lot of questions from customers. The big one, of course, is "What kind of incentives are available for installation?" Find the answers, state by state, in the Database of State Incentives for Renewables and Efficiency. DSIRE also supplies the case studies for SEPA's Utility Solar Programs.

The American Solar Energy Society created The Home Energy Source

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## Technology Spotlight:

# What's new in using solar for lighting

Lighting is the largest consumer of electric energy in commercial buildings. Since sunlight has a higher ratio of light to heat than any type of electric lighting, using sunlight for lighting has the potential to reduce energy use for both lighting and cooling in well-designed buildings. Daylighting is the traditional technique for capturing the sun as a light source. Aerogel glazing systems and hybrid solar fiber optic lighting are two more technologies now commercially available, and recent advances in both fields promise to further reduce lighting energy use.

## Daylighting

“Daylighting” was a matter of course before the invention of electric lighting and has reemerged in recent decades as an energy-efficiency measure. The technique involves placing windows and reflective surfaces so natural light can effectively illuminate a building during the day. Energy savings are achieved if occupants leave electric lighting off or if photocells are used to dim electric lighting in response to light levels.

Reflective surfaces may be as simple as well-placed, light-colored walls, ceilings and window sills. Other strategies include the use of light shelves, clerestories, skylights and solar tubes. The Daylighting Collaborative provides examples and guidelines for incorporating these elements into a design. Light shelves, for example, can not only diffuse light deep into the space, but also reduce glare in perimeter zones. Solar tubes can “pipe” sunlight into interior spaces. In addition to saving energy,

well-designed daylighting contributes to an attractive, comfortable space and can improve productivity.

The impact of daylighting strategies on heating and cooling requirements must be taken into account to ensure lighting energy savings win over HVAC penalties.

## Building products

Aerogels (aka nanogels or nano-foam) were first produced in 1931 by replacing the liquid component of a gel with a gas. Low thermal conductivity, low density and high light transmission are among aerogel's many remarkable properties. Also, silica aerogel is the most insulating material known. Aerogel used in glazing applications has R-values of 7 to 8 sq. ft-degrees Fahrenheit-h/Btu per inch. Yet, it has light transmission of 75 percent and so is semi-transparent.

When used in glazing products, cells between the panes are filled with silica aerogel in granular form. Since aerogel is not transparent, but translucent, aerogel glazing systems cannot replace windows in all applications. Research is still underway to increase their transparency. But their diffuse “museum-quality” light is attractive in building façade, skylight and roofing applications. Aerogel glazing appears blueish against a dark background and whitish against a bright background. Material costs are reportedly competitive with high-performance, conventional glazing systems. Prefabricated glazed roofing systems save on installation costs.

Cabot Corporation manufactures granular silica aerogel and has teamed up with several companies to

produce aerogel building products, including Super Sky Products, Inc., Centerpoint Translucent Systems, Acralight International Skylights, Wasco Products, Inc. and Kalwall. Other companies that have worked on development of aerogels include BASF, Thermolux, Aerojet, Airglass and Aspen Aerogels.

## Hybrid solar fiber optics

There are essentially three components of a hybrid solar fiber optic lighting system: the solar collector, fiber optic cables and hybrid luminaires. The solar collector – either a parabolic mirror or lens concentrator – tracks the sun and focuses sunlight onto the ends of fiber optic cables that run to hybrid luminaires. Hybrid luminaires have both fiber optic illuminants and electric lamps (either incandescent or fluorescent). The electric lighting dims in response to light levels. A four-foot-diameter parabolic concentrator can illuminate approximately 1,000 square feet of floor area.

Fiber optic lighting can be run to interior spaces, provided the space is no more than about 50 feet from the collector. Light levels decrease with cable length and, according to Oak Ridge National Laboratory, 50 feet is currently the maximum practical length. Hybrid lighting systems are designed to transmit visible light through the cable, while filtering out other parts of the spectrum, such as UV light. The cable transmits very little heat, so the lights do not increase cooling loads.

At least three companies are manufacturing hybrid solar fiber optic systems:

1. **Sunlight Direct** in the U.S. is in the process of beta testing their HSL3010 solar lighting system.

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## Outreach *from page 5*

and even adult visitors enjoy the presentation,” Bacich noted.

### Solar going up

The efforts have paid off, and not only in recognition from national industry associations. The number of solar installations in Riverside has increased 300 percent over 2006, giving the city more than 700 kW of local generation. Another 200 kW

in development, design or construction should be online by July. The number of residential systems has almost doubled over the last year from 13 to 31. “And the calls keep coming,” Bacich pointed out.

RPU increased its residential solar rebate to up to 50 percent of the system cost including paying permitting and building fees. The utility is also developing a commercial and solar school rebate program. When asked if RPU is running out of

incentive funding, Bacich responds, “That would be great—it would mean that Riverside has become the model solar city we are all working to be.”

Riverside Public Utilities is working toward its goal by educating customers on the benefits of solar power. Roseville Electric’s award winning solar program has a different goal and a different approach. Read about it in the March Energy Services Bulletin. ⚡

Want to know more?

Visit [www.wapa.gov/es/pubs/esb/2008/feb/feb083.htm](http://www.wapa.gov/es/pubs/esb/2008/feb/feb083.htm)

## Web site of the month

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for the specific purpose of answering consumer questions. ASES Communications Specialist Ken Scheinkopf writes a weekly column that visitors can access on the Web site or read in newspapers or Solar Today magazine. Users can also send Scheinkopf their questions.

The Solar Living Institute and

Solar Energy International both offer workshops where participants can learn to build their own systems or just learn more about sustainability issues. SLI also provides a comprehensive links page that includes state solar organizations.

These are just a few of the resources available on the Internet to help power providers or consumers at any stage of their solar education. General renewable energy sites

such as the Interstate Renewable Energy Council, American Council on Renewable Energy and the Renewable Energy Project also have pages on solar energy. Some address very specific issues or projects while others cover a broad range of topics. In short, with so much information available about this versatile renewable resource, there is no reason for anyone to be in the dark about solar power. ⚡

Want to know more?

Visit [www.wapa.gov/es/pubs/esb/2008/feb/feb084.htm](http://www.wapa.gov/es/pubs/esb/2008/feb/feb084.htm)

## Technology spotlight

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2. **Parans** is a Swedish company that distributes their solar hybrid system through Huvco located in Maryland.
3. **La Foret Engineering** is located in Japan.

### For more information

- *Daylighting*; U.S. Department of Energy, Energy Efficiency and

Renewable Energy.

[www.eere.energy.gov/buildings/info/design/integratedbuilding/passivedaylighting.html](http://www.eere.energy.gov/buildings/info/design/integratedbuilding/passivedaylighting.html)

- *Translucent and opaque nanostructured thermal insulating materials in building facades* (PDF file); ZAE Bayern, Würzburg, Germany, 2006.

[www.zukuenftigetechologien.de/nanotecture/fricke\\_presentation.pdf](http://www.zukuenftigetechologien.de/nanotecture/fricke_presentation.pdf)

- *Hybrid Solar Lighting Illuminates Energy Savings for Government Facilities* (PDF file); U.S. Department of Energy, Federal Energy Management Program and Oak Ridge National Laboratory, April 2007.

[www.eere.energy.gov/femp/pdfs/tf\\_hybridsolar.pdf](http://www.eere.energy.gov/femp/pdfs/tf_hybridsolar.pdf) ⚡

Want to know more?

Visit [www.wapa.gov/es/pubs/esb/2008/feb/feb085.htm](http://www.wapa.gov/es/pubs/esb/2008/feb/feb085.htm)