

Petra Solar

Innovation in Renewable, Grid-Smart and Grid-Reliable Utility-Grade Power

By Frederick F. Butler

When I stepped down from the regulators' bench and chose to continue working in the energy field, I was fortunate to have offers from a number of companies. As a state utility regulator for more than a decade, and as president of the National Association of Regulatory Utility Commissioners (NARUC), I had delved into many cutting-edge energy issues. As a private citizen, however, I determined that I should only offer my services to one client per energy sector.

When it came to solar power, I selected New Jersey-based Petra Solar.

Why? My reasons boil down to the company's leadership, product and business plan. I think these reasons should prove as compelling to you as they were to me.

The Plan

Let's start with the business plan. Petra Solar has chosen to focus its initial efforts on utilities — rather than on the residential or commercial market. Thus, the company fills a unique niche in the field of solar generation.

I'll have more to say on the product later, but suffice it to say that Petra Solar's *SunWave*™ photovoltaic (PV) systems are pole-mounted and feed distributed energy directly into the electric grid — again a unique application in the solar field. Additionally, Petra Solar's *SunWave* systems not only turn streetlights and utility poles into solar generators, they also function as a power management system. They serve as "intelligent" units that communicate with each other and with the grid, offering smart grid connectivity. The *SunWave* systems can also improve distribution reliability through their ability to provide real-time communications between the solar generators in the field and a utility's control center. They monitor the grid and provide reactive power compensation.

Clean energy, smart grid communications and grid reliability.

This is a combination that many utilities are finding very attractive, whether they are looking to comply with Renewable Portfolio Standards (RPS), improve grid reliability — or both. A further attraction of



***SunWave* photovoltaic systems mount to streetlights and utility poles and function as a power management system connected to the smart grid.**

Petra's model of distributed solar generation is that it leverages existing infrastructure. Utilities already own poles and street lamps, and have the linemen to deploy the systems, which are consistently being installed in less than 30 minutes. As opposed to "solar farms," pole-mounted generation eliminates the need to buy or lease acreage and deal with zoning or thorny Not in My Backyard (NIMBY) issues.

Currently, in the largest PV solar construction project in the country, one utility is investing \$200 million to

add Petra Solar's combination of clean energy, smart grid technology and grid reliability to its power generating arsenal.

New Jersey's largest utility, PSE&G, is in the midst of installing 200,000 *SunWave* systems in the state's six largest cities and some 300 rural and suburban communities in the utility's service area. PSE&G has installed approximately 25,000 *SunWave* systems to date. When it is completed in 2013, the 40 megawatts of PV will have been installed on poles in PSE&G's service territory without any additional investment required to upgrade the grid. This 40 MW distributed power plant will represent half of the utility's projected solar-generated power under its *Solar 4 All* initiative, which began in August 2009.

“Clean energy, smart grid communications and grid reliability — the combination that utilities are finding very attractive.”

In addition to its contract with New Jersey's PSE&G, Petra Solar currently has several demonstration projects up and running. Two other projects are in New Jersey and are complemented by projects in Florida, Hawaii, Ohio, Texas, New York and Ontario, Canada. My work with Petra Solar is exclusively focused on the more than 40 additional utilities around the country and the world that have expressed interest in the *SunWave* systems.

Investors have demonstrated confidence in Petra Solar's business model. Just this past February, Petra announced that it had raised \$40 million to expand its operations. This is on top of an initial investment of \$14 million that capitalized the company in 2007, a year after it opened shop.

Government agencies have also looked favorably on Petra Solar. In 2009, the company was the first business to be awarded funding under New Jersey's Clean Energy Manufacturing Fund (CEMF), a program designed to support companies looking to establish or expand renewable energy or energy-efficient manufacturing facilities in the state. Through this program, Petra Solar received a total of \$3.3 million to support the purchase of equipment and its planning/design process.

Also in 2008 and 2009, Petra Solar received \$3.1 million from the U.S. Department of Energy in Solar Energy Grid Integration System (SEGIS) money to capitalize on its smart grid and grid reliability technologies. This contract was awarded to support the development of technology that will improve grid reliability and resiliency to facilitate adding high levels of PV integration seamlessly to the U.S. electrical grid — a critical step in bringing more solar power on line. Petra Solar is collaborating with the University of Central Florida and 15 utilities in eight states in pursuing these goals. Petra Solar is also currently in the running for a third DOE SEGIS grant.

DOE earlier recognized Petra Solar with its Energy Innovator Award and, in 2009, New Jersey's Clean Energy Leadership program named the company Market Innovator of the Year. Also in 2009, the New Jersey Technology Council named Petra Solar winner of the Clean/Green Company of the Year. This selection was based not only on the *SunWave* system's unique technology, but also on the company's impact on the industry, its contribution to industry standards, its success in the marketplace and its growth rate.

The Leadership

Innovation starts at the top. An award-winning and growing company is testament to the people who run it. At Petra Solar, this principle is epitomized by Dr. Shihab Kuran, the company's founder, President and CEO.



Dr. Shihab Kuran
President and CEO
Petra Solar

When it came to choosing Petra Solar as a client, the business plan and the product captivated me, but it was the people behind them, and Dr. Kuran in particular, who closed the deal. Kuran, who holds a Ph.D. in



Electrical Engineering from the City University of New York, has spent nearly two decades of his life pursuing commercial applications of “clean tech,” with an emphasis on solar energy and water purification. His efforts are fueled by a sincere vision of a world with universal access to clean and sustainable sources of power and water. Prior to founding Petra Solar, Dr. Kuran held a variety of technical, executive and board positions in the semiconductor and clean-tech industries. He is an inventor and has published more than 40 papers.

Dr. Kuran has surrounded himself with an all-star management team, including engineers with NASA satellite experience, veterans of the telecommunications, semiconductor and power conversion industries, and numerous engineering Ph.D.s. It’s a heady and diversified mix.

Another measure of the quality of the man is Dr. Kuran and the company’s commitment to giving back through the creation of good-paying jobs in the communities in which Petra Solar operates. With just 15 employees in spring 2009, Petra Solar’s hyper-growth has resulted in an almost tenfold increase in staff a year later. The

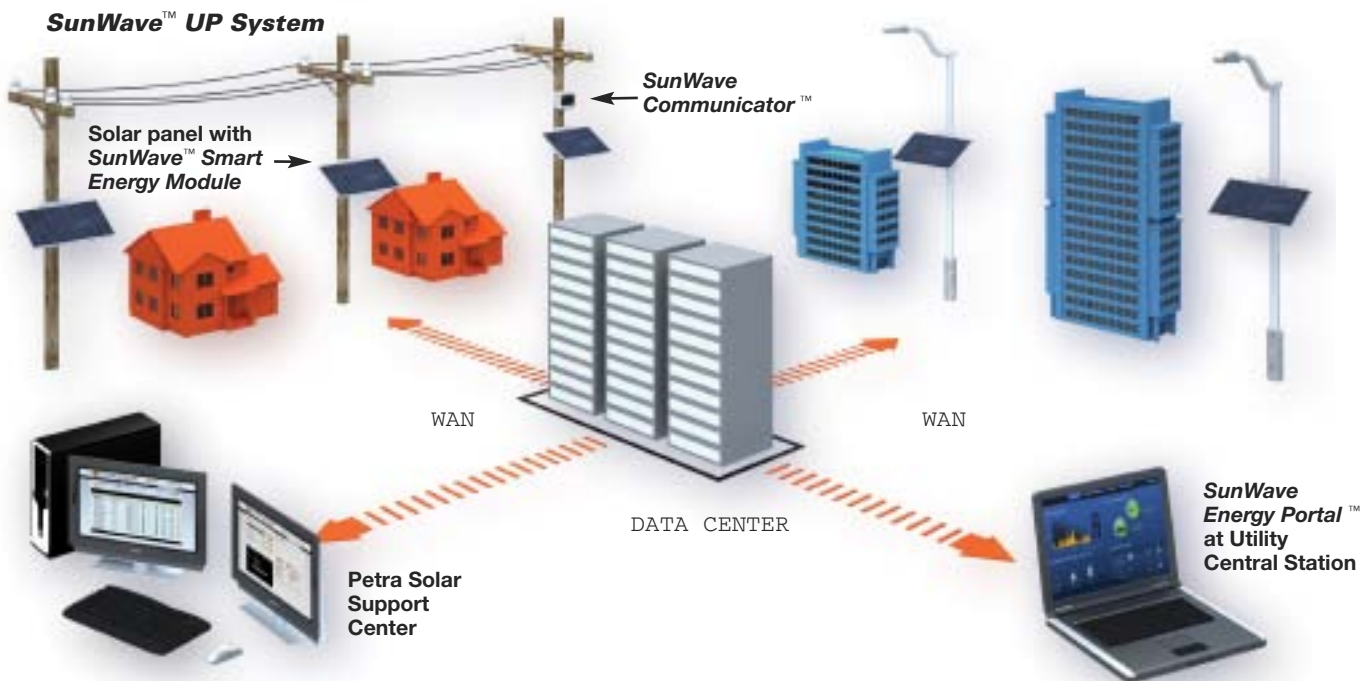
employee roster is projected to swell to 165 by the end of 2010, and employees are spread among a range of skills — from manufacturing to engineering to marketing. Furthermore, Petra stands committed to replicating its patented manufacturing facility, now based in South Plainfield, N.J., wherever utilities adopt its grid-tied model. Thus, new local jobs will be tied directly to adoption of the new technology.

The Product

The centerpiece of Petra Solar’s business is its unique *SunWave™ UP System*. Originating from space satellite power system technology, the *SunWave* system, as I have already mentioned, combines solar power generation, smart grid communications and grid reliability functions in one package.

Clean power generation

Each *SunWave* unit integrates a solar panel, mounting system and a *Smart Energy Module (SEM)*. The SEM has three basic functions; power conversion device that transforms raw energy from a solar panel into usable electricity, smart grid communications and grid reliability enhancement functions. A traditional inverter is designed to convert power from



several solar panels connected to one another. Petra Solar's SEM, on the other hand, optimizes the generation of each solar panel. This one-to-one relationship between the SEM and the solar panel provides several benefits, including increased system efficiency and simplicity of installation. This innovative design most importantly enables new applications such as utility ownership of solar energy generation systems on power and streetlight poles.

Smart grid communications

The *SunWave's* smart grid communications system functions through a wireless mesh communications network which has three main functions:

- Petra Solar's *SunWave* units are equipped with a wireless communications system which enables utilities to monitor the operation and health of the units and of the electric grid by recording how much energy is being generated and by sending maintenance and repair alerts to a utility's control center.
- The communications system provides a tool to maintain higher grid reliability by enabling remote command and control of the *SunWave* systems. A remote command can, for instance, enable the generation of reactive power, a feature that increases power efficiency and helps stabilize voltage levels on the power lines.
- The communications system provides the foundation for other smart grid applications such as Advanced Metering Infrastructure (AMI) and load management or demand response programs.

Grid reliability

The *SunWave* technology also provides utilities with grid reliability tools. The systems constantly monitor the grid and provide updates on critical operating parameters such as voltage and frequency. As such they enable automatic power outage detection and faster response time. As utilities adopt a growing number of solar and other clean energy systems and bring them onto the electric grid, the *SunWave* systems provide the tools needed to manage the intermittency of those distributed generation systems and maintain overall grid stability.

The Bottom Line

One factor that unites the company's plan, people and product is a clear commitment to "green" job creation. The generation of green jobs and their significant effect on a locality and regional economies are hardly restricted to Petra Solar. Research has shown that there is a six-times multiplier effect for every dollar invested in the *SunWave* systems, based on research about secondary benefits of investment. This means that, as the systems are installed in more

locations, the utility that adopts the pole-mounted, grid-tied PV system will generate an increase in local green jobs in manufacturing, installation, service and maintenance. This obviously has a very beneficial effect on local economies and working people's wallets — at the same time it bolsters the environment.

To sum it up, Petra Solar has a powerful product, pioneering people and a strong business model. The work the company is doing is good for the earth, good for jobs and the economy and good for its own financial future. Obviously, I am sold on Petra Solar. The more you find out, the more you will be too. ■



Fred Butler is a former member of the New Jersey Board of Public Utilities (NJBP), where he served two terms and more than 10 years as a commissioner. During his tenure, he served as President of both the National Association of Regulatory Utility Commissioners (NARUC) and the Mid Atlantic Conference of Regulatory Utility Commissioners (MACRUC). At NARUC he also served as chairman of the organization's International Relations Committee, Committee on Water, Ad Hoc Committee on Climate Change, and chaired the NARUC Smart Grid Collaborative. He also has served as an advisor to the Michigan State University Institute of Public Utilities, the New Mexico State University Center for Public Utilities' Advisory Council and the advisory council to the University of Florida's Public Utilities Research Center.

Prior to his work as a utilities regulator, he served as Executive Director of the New Jersey General Assembly Democratic office, Deputy Director of the New Jersey Department of Treasury's Commission on Capital Budgeting & Planning, and research faculty member of the Center for Legislative Research and Service at the Eagleton Institute of Politics at Rutgers, the State University.

Petra Solar Facts

- Founded in 2006
- Pioneer of *SunWave*™ systems – grid tied, pole mounted, distributed solar generation system
- Petra Solar's success is the culmination of more than 16 years of research and development