

US photovoltaics industry may be too small for Obama's big solar energy plans

But a government-industry consortium might provide a boost for US PV manufacturers.

As the Obama administration begins to invest billions in increasing solar power, the domestic manufacturers of photovoltaics (PVs), or solar cells, have nowhere near enough capacity to supply the necessary solar panels. Led by Energy Secretary Steven Chu, who has a passion for advancing renewable energy, the Department of Energy has set a target of adding 5 to 10 GW of new PV-generating capacity by 2015. To help the PV industry grow that fast, DOE is asking Congress to boost its cooperative R&D program with domestic PV producers by 83% in fiscal year 2010, to \$320 million. The goal is to make solar power more competitive with electricity generated from coal or nuclear fuel, DOE says. But even if costs can be lowered enough, US manufacturers still will be hard-pressed to grow quickly from the less than 500 MW of PV-derived electricity they can now supply annually to the kind of demand that DOE wants to induce.

DOE's solar R&D program is complemented by \$4.5 billion that has been appropriated through the American Recovery and Reinvestment Act for R&D, demonstrations, standards development, and other activities needed to begin installation of a modern "smart" electricity grid. Officials say the new grid will be required in order to accommodate the geographically broad distribution of solar- and wind-generation sites. The agency also has tens of billions of dollars in loan guarantees available to help finance new renewable energy installations, including solar.

US is a small player

The US share of the world's PV production output has plunged from 75% in 1980 to less than 10% last year, said Robert Margolis, a senior analyst at the National Renewable Energy Laboratory. On the demand side, Europe had 80% of the world's new PV power installations last year, according to the European Photovoltaic Industry Association (EPIA). Spain alone added 2.3 GW of new solar generation last year—41% of the new installations worldwide; the 2008 additions brought Spain's cumulative solar production capacity to 3.0 GW. Despite a climate that's less than op-

timal for solar generation, Germany leads all nations in terms of installed PV-generating capacity: 5.8 GW, including 1500 MW added last year, according to the Solar Energy Industries Association (SEIA). The US overtook Japan last year in new PV-generating capacity, but Japan still leads the US in cumulative capacity with 2.1 GW.

The DOE solar R&D program is working to help domestic manufacturers gear up and lower their production costs. Research is focusing on "full system solutions with the highest potential to reach cost competitiveness by 2015," according to agency budget documents. Over the past three years, DOE's Technology Pathway Partnerships program provided \$168 million for cooperative R&D efforts. The 50 US companies that participate put up another \$189 million. More than a dozen universities and several national laboratories are also involved in the program.

US PV production has grown in recent years—by 60% last year alone, according to the SEIA—but that growth is from a small baseline. Domestic expansions are expected to continue. Sanyo Electric Co Ltd, for instance, will open a plant in Salem, Oregon, later this year to produce the polysilicon solar ingots and wafers that are the building blocks of PVs. And First Solar Inc is expanding the yearly output of PV components from its Ohio factory by 57 MW, raising the plant's capacity to roughly 192 MW per year.

Big expansion in Europe

A recent survey of EPIA member companies found that they expect their PV production capacities to grow between 20% and 30% annually from now through 2013. Growth has been spurred by government policies and incentives, including binding targets established by the European Union, which require member states to produce 20% of their electricity from renewable sources by 2020. In the US, no comparable renewable target exists, though energy legislation now being crafted will likely include one. To date, 28 states have enacted their own renewable targets, but they vary widely in size and timetable.

Other nations have so dominated PV

production that some industry observers are suggesting that more concerted US government action will be needed for the beleaguered domestic industry. John Kelly, senior vice president for research at IBM, recounted how the industry-government consortium Sematech rescued the US semiconductor industry from near collapse in the mid-1980s. Like today's PV industry, US semiconductor manufacturers then faced fierce competition from low-cost and subsidized foreign manufacturers. National security concerns led the Department of Defense to put up \$100 million to form Sematech, with matching funds from industry. Today the US again has a highly competitive semiconductor industry and Sematech now welcomes members from throughout the world.

Roger Little, whose Spire Corp has been in the PV business for 20 years, believes that it's too late for a Sematech-like approach. He laments that Solar World AG, the largest US manufacturer of PVs, is actually German, and imports all the equipment it needs for building solar modules. That equipment is the market niche that Little's firm had staked out for many years. While Spire does sell some of its machinery abroad, Little says he faces "ferocious" Japanese and German competitors wherever he goes. "I'm scared to death of foreign competition in my backyard."

Little predicts that the growth of US PV manufacturing will be constrained as the demand soars. Given that a new production plant requires 18 months or more to build, there's little question that imports will be taking the lion's share of the US market in coming years—possibly as much as 4 GW of the expected new demand, Little predicts. For Little, limits on imports are the only solution. China, which wasn't in the PV business three years ago, already has a production capacity equal to that of the US. A 2008 study by the European Commission's Joint Research Centre says that by 2012 China may well become the largest PV manufacturer, capturing more than one-quarter of the world PV market.

Incentives have spurred growth

Nations that have rapidly embraced solar power have done so with the help

Florence fetes Galileo

It's no surprise that Florence, Italy, where Galileo lived much of his life, is hosting many activities in celebration of one of its most famous sons during the International Year of Astronomy 2009, which marks 400 years since Galileo first pointed a telescope at the night sky.

The city's Institute and Museum of the History of Science has created two major exhibitions. One—Galileo, the Medici and the Age of Astronomy—opened in April at Philadelphia's Franklin Institute as part of the IYA event "100 Hours of Astronomy" (see *PHYSICS TODAY*, April 2009, page 20) and will be on display through early September. The other, in Florence from March through August, is Galileo: Images of the Universe from Antiquity to the Telescope. That show's curator, Paolo Galluzzi, describes it as including "items of both science and art to tell the story of how man looked at the sky from the Egyptians to Galileo's age." It's at a temporary site because the museum is under renovation until later this year, when it will reopen as Museo Galileo. It holds the largest collection of original Galileo artifacts, including two telescopes, an objective lens, and home-built instruments.

About 80 km away in Pisa, Galileo's birthplace, an exhibition titled *The Telescope and the Brush* looks at "how interested

Galileo was in art, and how much his discoveries influenced art," says Galluzzi. As examples, Galluzzi points to a painting by Peter

Paul Rubens of the myth of Saturn devouring his child. "He portrayed Saturn made of three bodies, exactly as Galileo described them," says Galluzzi. And in a 1612 painting of the immaculate conception (at left) by Ludovico Cigoli, "for the first time, immediately after Galileo's discoveries, the Virgin is standing on a crescent Moon that was a Galilean Moon, with mountains and valleys."

An international conference held in Florence in late May re-examined Galileo's conflicts with the Roman Catholic Church in terms of history, philosophy, and theology. Topics ranged from the views of various popes through the ages to Galileo as seen during the Nazi time. Other activities include filming the sky with a replica of Galileo's telescope.

In Florence, says Galluzzi, "Galileo is a very important piece of our tradition, not only in science but also in literature—he is one of the greatest writers of Italian literature. And he was a very good musician, so there are also

musical events devoted to Galileo and to the polyphonic approach to music. He was a universal person." The IYA activities, he adds, have gotten "a very warm reception. People are enthusiastic."

Toni Feder



ARCHIVIO FOTOGRAFICO DELL'ISTITUTO E MUSEO DI STORIA DELLA SCIENZA FIRENZE

of subsidies and incentive programs. A tariff program used in Germany and Spain provides producers of renewable energy substantially higher rates than those charged by suppliers of conventionally generated power. Both countries are beginning to roll back their tariffs.

Stimulating demand for PVs may be the most important action that govern-

ment can take to nurture the US industry, said Eric Peeters, global executive director of Dow Corning Corp's solar solutions division. He noted that greater demand for PVs will spur companies to make the investments needed for higher-volume manufacturing processes, which will bring down unit costs. "The solar industry is very young and immature, which means that it is

very inefficient," Peeters said, pointing out that half the polycrystalline raw material used to make PVs is lost as scrap during the manufacturing process.

Demand for PVs can be stoked, Peeters said, with mechanisms such as renewable energy mandates for the utility side and tax credits, rebates, and other incentives for the consumer side.

David Kramer

Marburger calls for a new academic field of study in 'the science of science policy'

Science adviser to George W. Bush says researchers, models, and decision tools could bring more rationality to science budgets and policies.

Anyone following the year-to-year development of US science and technology (S&T) policy would have to conclude that the process is chaotic, ad hoc, and pays little heed to long-term planning. One need only look at the National Institutes of Health, whose budget, after a five-year doubling that

ended in 2003, steadily declined in inflation-adjusted terms for the next five years. Now, mainly as a result of funding provided by the American Recovery and Reinvestment Act (ARRA), NIH is getting a windfall of \$10 billion—a 38% increase over 2008.

A second disconnect between science

policy and its implementation occurred with the passage of the America COMPETES Act in 2007. In response to expert advice that the US lead was slipping fast in a variety of measures of science and innovation, the law authorized a 10-year doubling of federal R&D programs covering basic research in