Solar tracker: This array of solar modules was built by Semprius for testing. The modules are mounted on a two-axis tracker that keeps them aimed at the sun.
Semprius

ENERGY

Concentrated Solar Startup Sets a New Efficiency Record

Semprius makes solar modules using tiny cells that need less cooling.

FRIDAY, FEBRUARY 3, 2012 | BY KEVIN BULLIS

Audio »

Semprius, a startup that makes miniscule solar cells capable of capturing concentrated sunlight without costly cooling systems, announced this week that it had made the world's most efficient solar panel.

The company's solar panels use tiny solar cells made of gallium arsenide—the record-breaking solar module contains hundreds of such solar cells, each about the width of a line drawn by a ball-point pen, arranged under lenses that concentrate sunlight 1,100 times.

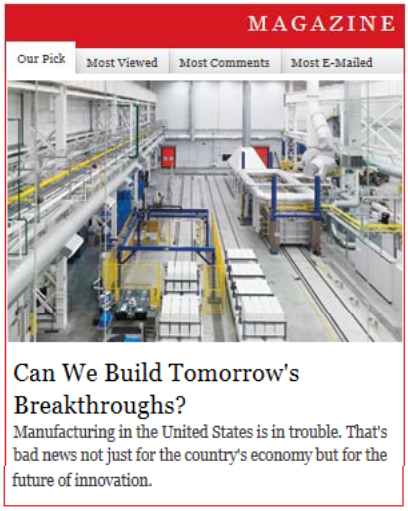
Gallium arsenide is far better at absorbing sunlight than silicon, the material used in most solar cells, but it's also more expensive. Furthermore, although concentrated solar modules use less semiconducting material, they usually require expensive optics, cooling systems, and tracking systems to keep them aimed at the sun. Semprius's microscaled solar cells are inherently much better at dissipating heat, making them cheaper.

Semprius's modules have another advantage: whereas a silicon solar cell only efficiently absorbs a narrow band of sunlight, the solar cells in this module are made of three layers of gallium arsenide, each modified to convert a different part of the solar spectrum into electricity.

Tests by a third-party certified the efficiency of Semprius's solar panel at 33.9 percent, marking the first time any solar module has been able to convert more than one-third of the sunlight that falls on it into electricity. Conventional silicon solar panels typically convert less than 15 percent of light into electricity, and the record for a silicon solar panel is 22.9 percent. The previous record for any solar panel was 32 percent, Semprius says.

One-off, experimental modules have achieved higher efficiencies, but Semprius's record-setting module is designed for commercial use. It was made with the same type of equipment that the company is installing in a small factory in Henderson, North Carolina, that it will open this summer. "It's a good indication of the efficiencies our customers can expect," says Joe Carr, Semprius's CEO.

Semprius's process forms tens of thousands of tiny solar cells on a single wafer of gallium arsenide, and uses chemical etching and a robotic system to transfer each layer to an inexpensive substrate. The same gallium-arsenide wafer can be reused many times, reducing costs. The approach is based on a method for transferring small electronics from a wafer to other substrates that was developed by John Rogers, a professor of materials science and engineering at the University of Illinois at Urbana-Champaign.

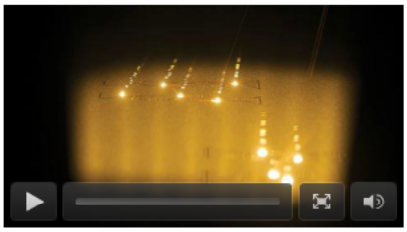


Can We Build Tomorrow's Breakthroughs?

Manufacturing in the United States is in trouble. That's bad news not just for the country's economy but for the future of innovation.

VIDEOS

Printing Parts



Making Silicon Solar Cells Cheaper

Cheap, Efficient Solar

MORE

NEWSLETTERS

Click here to subscribe to Technology Review newsletters

Energy feed

ENERGY

Concentrated Solar Startup Sets a New Efficiency Record

(Page 2 of 2)

FRIDAY, FEBRUARY 3, 2012 | BY KEVIN BULLIS

Power pack: Each Semprius solar panel is made of an array of 660 lenses that focus light on 660 tiny solar cells.
Semprius

Concentrated solar panels use tracking systems to follow the sun. These are expensive and can be unreliable, and they can't be mounted on most roofs, limiting their application. They also only work in very sunny areas, since overcast skies can cause their power output to drop far more than with a conventional solar cell.

But as the cost of tracking systems comes down, and the efficiency of multilayer solar cells increases, concentrated photovoltaics are beginning to look more attractive. Large installations of this type of solar module have been increasing in recent months.

Semprius is building its factory at a particularly difficult time for the solar industry. An oversupply and a reduction in manufacturing costs has led to a rapid drop in prices for solar panels, making it difficult for new companies to enter the market, and forcing some existing manufacturers out of business.

In response to falling prices, many solar companies, including Semprius, are focusing on improved efficiency. As long as manufacturing can keep costs down, increased efficiency lowers the cost per watt of solar panels. More importantly, it also lowers the cost of installation and related equipment, which can account for over half of the cost of solar power. Semprius is also leaning as much as possible on proven manufacturing technology, which could make it easier to scale up production and lower development costs.

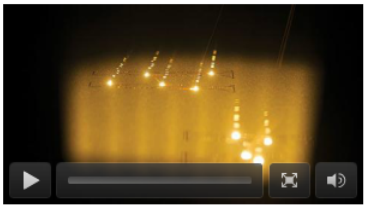
Semprius has another advantage: a partnership with Siemens. In addition to providing direct financing (Siemens has a 16 percent stake in the company), Siemens provides experience in manufacturing and in building complete solar farms, and the partnership makes it easier to secure financing from banks.

The small factory that Semprius plans to open this summer will have the capacity to produce 30 megawatts of solar panels a year. Semprius expects panels produced there to be cost-competitive for some applications, Carr says. Increasing production to 100 megawatts would bring down costs enough for the technology to compete with cheap solar panels made in China.

Ultimately, the cost per kilowatt-hour for solar power depends on a number of factors, such as financing costs, the cost of land, how close transmission lines are, local labor rates, and so on. But Carr thinks Semprius can generate solar power for less than 10 cents per kilowatt -hour, low enough to get a share of the utility market in many areas. What's more, he says it can do this without the help of government subsidies.

MAGAZINE
Our Pick | Most Viewed | Most Comments | Most E-Mailed

Can We Build Tomorrow's Breakthroughs?
Manufacturing in the United States is in trouble. That's bad news not just for the country's economy but for the future of innovation.

VIDEOS
Printing Parts

Making Silicon Solar Cells Cheaper
Cheap, Efficient Solar
MORE

NEWSLETTERS
Click here to subscribe to Technology Review newsletters
Energy feed

TECHNOLOGY REVIEW LISTS
TR50 Companies | TR35 Innovators | TR10 Technologies
TR50
Our list of the 50 most innovative companies, including the following: