


[Print this article](#)
[Close](#)

Industry execs hear about bright days ahead in energy

by Bob Haavind, Editorial Director, Solid State Technology

Middle

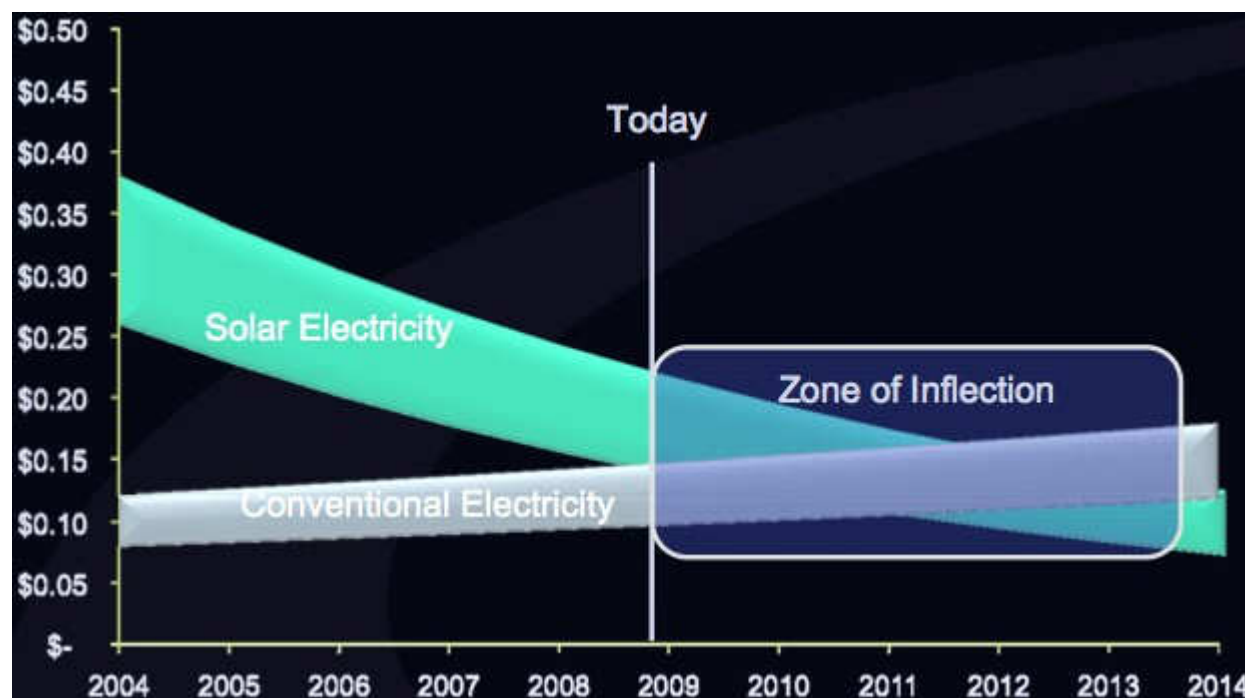
Through murky clouds of economic gloom, one beacon of light shone through brightly at ISS '09 in Half Moon Bay, CA -- the tremendous opportunity emerging in energy, especially solar power.

In total, the energy market "offers a \$1 trillion opportunity over the next 10 years," rhapsodized Alain Harrus, partner, Crosslink Capital. Already semiconductors are playing a large role in energy, but it will become much larger, Harrus predicted.

Several speakers cited the bright promise in energy, especially for photovoltaics (PV), but T.J. Rodgers, CEO of Cypress Semiconductor, trumped them all by showing how his company was already seeing the payoff. After a chance meeting in a coffee shop, Rodgers pushed his board to acquire SunPower, which makes a more efficient silicon solar cell. The surface facing the sun is a tangle of sharp reflective crystals rather than being smooth, greatly increasing light trapping, and all wiring is on the backside. "Watts per square meter is just as important as dollars per Watt," Rodgers explained.

The first SunPower plant -- an abandoned factory in the Philippines to keep costs low -- cranks out 32M wafers/month for a total capacity of 100MW/year. The company will soon open a new 400MW plant to meet growing demand for panels, not just for homes but also for huge panel arrays such as a major installation at Nellis Air Force Base in Nevada.

So far, Rodgers said, all the solar power generated in the world is about equal to the output of four coal-powered generating plants. But he sees solar matching the cost of coal power by 2012. Harrus showed a chart with the solar cost crossover in the 2012-2015 timeframe. Costs for electricity vary widely over the US and around the world, as does the cost for different types of PV cells and systems, so Harrus showed grid parity as an intersection of bands rather than lines.



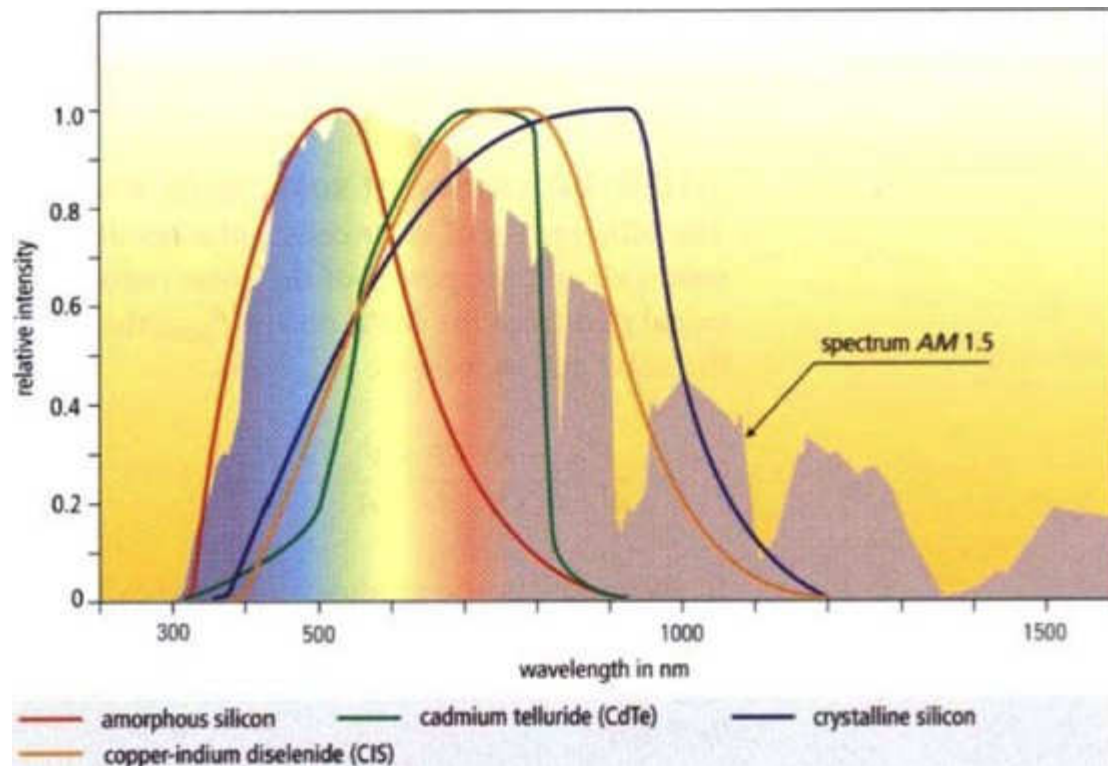
Solar is near grid parity. (Source: Crosslink Capital, ISS)

[CLICK HERE to view larger image](#)

While there is no Moore's Law to help solar, there is a learning curve, Harrus pointed out, with new, more efficient cells, multilayer cells, thinner films, and improved panel and system designs. Rodgers, for example, cited SunPower's low cost 2-axis and 3-axis sun trackers.

As an example of the improvement, Harrus cited the copper-indium-gallium-diselenide (CIGS) cell which at $2\mu\text{m}$ is 90x thinner than a $180\mu\text{m}$ -thick silicon cell. The difference is that CIGS is a direct bandgap (BG) semiconductor, making it much easier to get current flowing than in an indirect-BG material like silicon. The most advanced thin-film cells, such as those of SunPower and First Solar, have reached 22.4% cell efficiency, Harrus reported.

He also showed a curve of the energy density across the solar spectrum, along with the sensitivities of various materials, with CIGS giving a superior match. Multi-layers of films with varying spectral sensitivity help maximize the efficiency of extracting solar energy, he explained, citing Boeing's triple-junction cells for spacecraft that achieve 40% efficiency.



Spectrum of power. (Source: GE, Earthscan; Crosslink Capital, ISS)

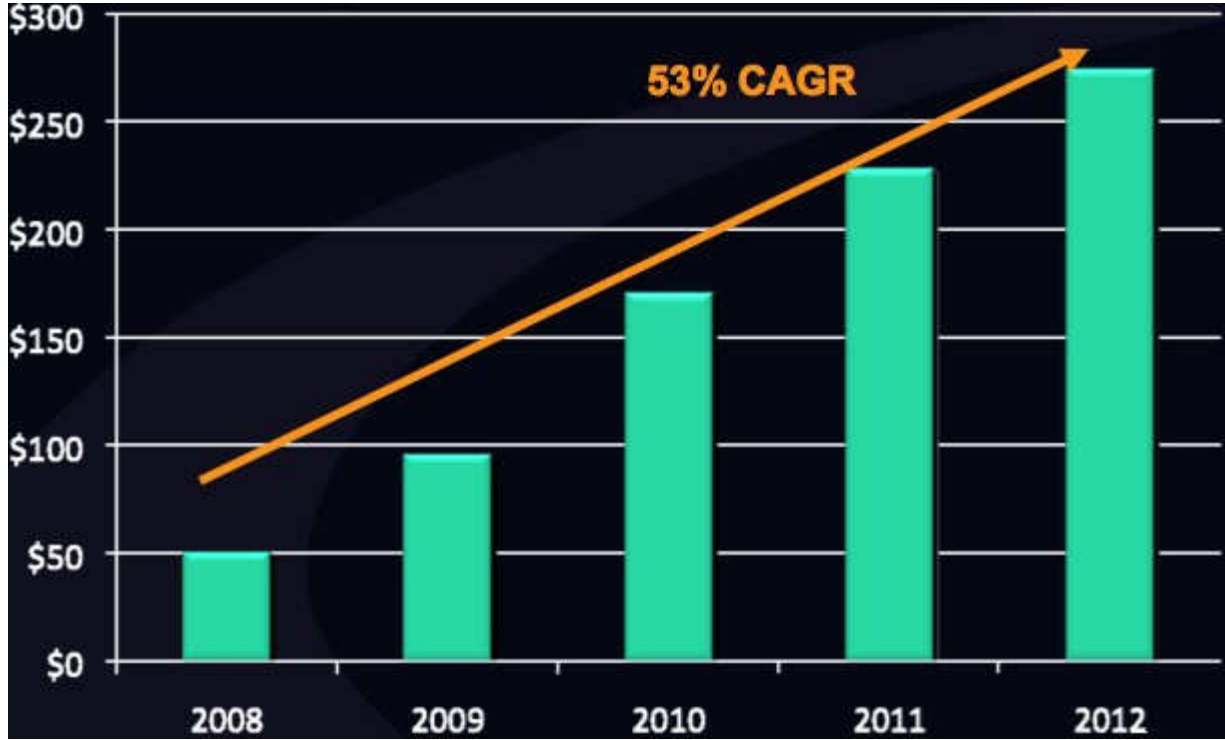
[CLICK HERE to view larger image](#)

A third generation of cells could use organic semiconductors or sensitive dyes that can be used as paint pigments. This would allow PV coatings all over the exterior of a building rather than just putting solar panels on the roof. Harrus also showed solar panel material being made in huge rolls that can be sliced up, adding to manufacturing efficiency.

Already a public utility has used an array of 167,000 panels to boost the output of a "peaking" plant, which is the most expensive form of generation, of 24¢-39¢/kWh, Harrus said, but the transmission line infrastructure was already in place and the government provided a 30% rebate. He recommended a Web site, www.dsireusa.org, which tracks the various subsidies and incentives for each state.

Harrus estimates that solar power will drop from about \$2.60/W to \$1.44/W by 2013, which would greatly increase the solar market even without incentives. Places in the world with higher electricity costs than the US, such as Japan, Denmark, and Germany, already have extensive alternate energy programs.

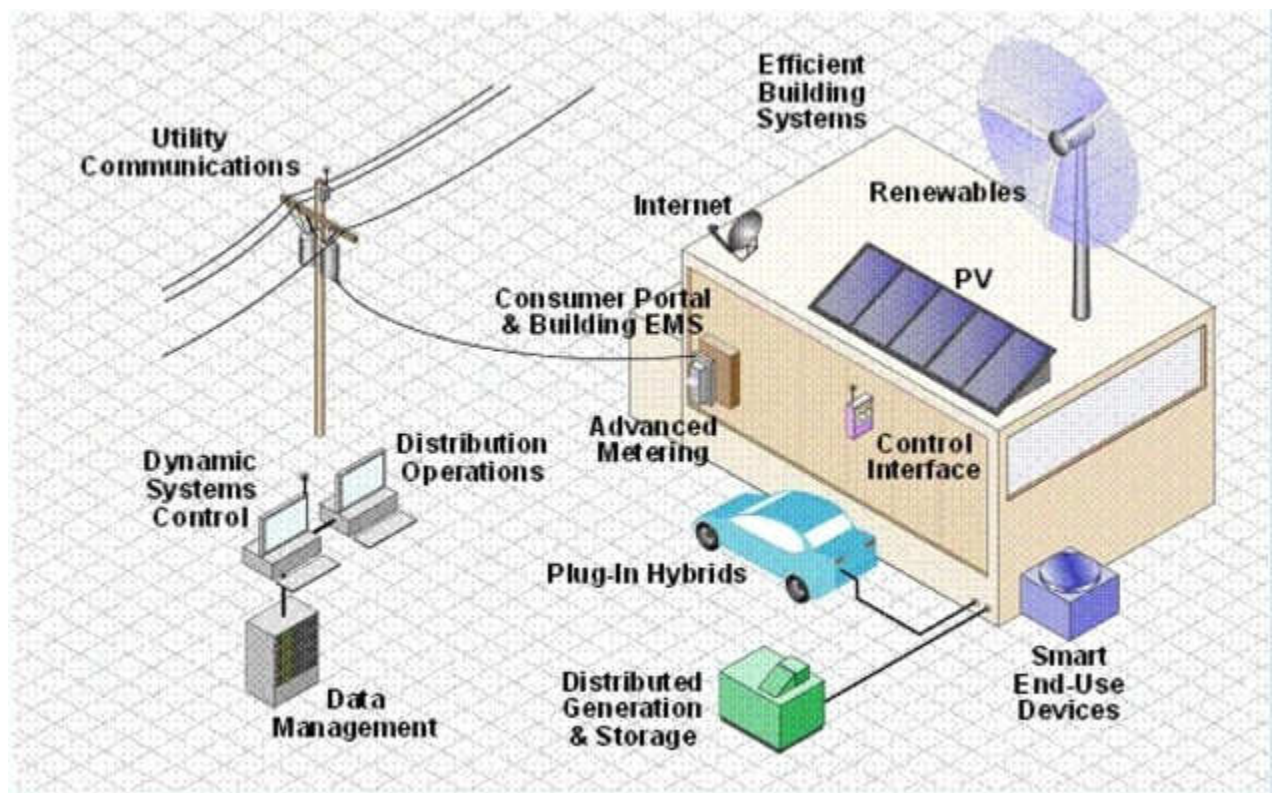
[Harrus slide 32]



Projected solar market growth in US \$B, 2008-2012. (Source: Crosslink Capital, ISS)
[CLICK HERE to view larger image](#)

The drive for clean energy will be a strong, sustainable trend for the semiconductor industry, believes Randy Bane, VP and chief economist for Applied Materials. PV will grow even during the down cycle, and should rise rapidly from a few hundred MWs now to GWs by 2011, he believes.

"Manufacturing scale will become very important for PV," Bane said, adding that 6x the amount of silicon for semiconductors was already going into PV cells. By 2011, he expects production of 10M m² of thin-film on glass as costs reach parity with grid electricity. Bane sees a big future for "smart grid technology," pointing out that hybrid cars could build up energy during the day, and possibly feed some back into the smart grid at night.



Smart grids and local energy networks. (Source: Electric Power Research Institute, Applied Materials, ISS)
[CLICK HERE to view larger image](#)

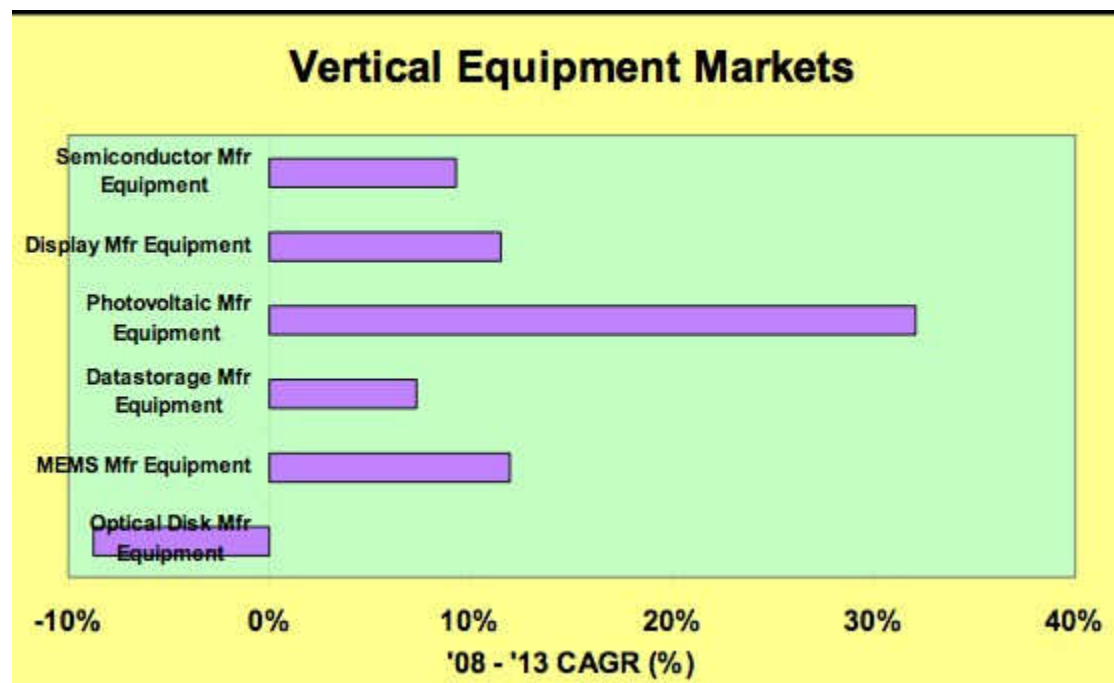
"Is PV the next killer app?" asked Jim Feldhan, president, Semico Research. The solar market is already growing 20%-25% a year and the new Obama administration is talking about additional incentives -- though it appears that grid parity could be reached even without incentives, he suggested. California's peak summer rate is \$0.53/kWh, already close to PV cost, he noted.

Feldhan cited a number of promising developments, including:

- Q-Cells planning to cut system cost by 2010.
- SunPower achieving 23.4% cell efficiency on a 5-in. wafer.
- Nanosolar developing a thin-film panel costing \$0.99/W.
- U. of Tel Aviv in Israel developing a new type of PV cell that is said to cost 100x less than today's cells.

He pointed out that while biomass (basically, garbage) now produces about 5% of US power, PV only generates about 0.1%, so the potential is great.

Risto Puhakka, president of VLSI Research, agreed that PV should continue to grow through the downturn, but at a slower rate. He pegs PV growth at 115% in 2008, declining to 28% in 2009. He also expects that PV manufacturing equipment should grow at a 33% CAGR over the 2008-2013 period, compared to about 9% CAGR for semiconductor manufacturing equipment.



Average growth ~12%-15%, 5%-10% better than semiconductor equipment alone. (Source: VLSI Research, ISS)

[CLICK HERE to view larger image](#)

Jerry Cutini, CEO, Aviza Technology, expects that \$150B will go into renewable energy through government-backed projects over the next 10 years, with the solar energy investment tax credit extended for eight more years.

Harrus of Crosslink Capital sees a "massive opportunity" in PV control systems and in adding sophistication to the electric grid over the next few years as advances in storage technology will enable PV to become a base load for electric supply. One factor that may slow the pace as compared to the growth of the Internet, however, Harrus warned, is that the government and utilities are involved. Yet he sees an immense global need for renewable energy over the next 30 years, requiring investments of up to \$45 trillion as 3TW of power generation is added.

Much of this will be what he calls "manufactured energy," vs. "constructed energy" with centralized nodes and long transmission lines. In the energy business, as in the early days of semiconductors, the attitude was that "real men build power plants." But the present grid is so unsophisticated that when excess electricity is being generated, since there is nowhere to store it, it is simply pumped into the ground!

In the future, by contrast, he sees a very decentralized grid with lots of "silver buckshot" rather than the current "silver bullets" like coal, gas, nuclear, and hydro plants. This would include, for example, many solar batteries along with distributed sources such as solar and wind.

Harrus stressed that many types of electronic devices will be needed to upgrade the grid as well as to improve the performance of solar systems. Central inverters will be needed with solar installations, but panel electronics will also be required to monitor output, detecting failures or cells that are dirty or in shade, and to help provide optimal energy yield.

Electronics will also be widely used in smart grid development and storage, providing critical grid information, allowing load shifting, and providing better grid efficiency and reliability.

T.J. Rodgers said the opportunity is so great that his company has launched Cypress EnviroSystems to provide an array of solutions for power savings as well as management and control of grid systems. He said that power line communication (PLC) will evolve to enable smarter, more efficient transmission and distribution.

Rodgers showed devices that can be used to control air conditioning for whole floors or building sections rather than requiring individual thermostats to be reset. Honeywell will distribute these devices for Cypress. Other controls would improve the efficiency of steam traps common in power generation.

What about jobs in alternate energy? Harrus explained that it could be labor intensive, and that solar power has the advantage of quick installation compared to conventional power plants. A nuclear facility might take eight years to build, including all the regulatory requirements and permitting as well as complex technology. By contrast, a 50MW solar generating facility can be installed in four months. He cited a small area of Germany where 168 jobs for five years were created for solar installation. Most solar manufacturing startups, Harrus said, are in Silicon Valley. In order to make assembly simple in the field it will take lots of assembly jobs at the manufacturing plant.

The ISS '09 speakers agreed that solar, and other forms of alternative energy, will be driven by economics even without government subsidies and incentives. But the promise of jobs, and quicker additions to the energy supply, may help speed the process. -- **B.H.**

To access this article, go to:

http://www.solid-state.com /display_article/350771/5/none/none/APPLI/Industry-execs-hear-about-bright-days-ahead-in-energy

© 2009 PennWell Corporation, Tulsa, OK; All Rights Reserved.

Top



Delivering **surface conditioning technology**
for **real-world advantages**

www.fsi-intl.com