

The Land of the Rising Sun

Despite dark clouds hanging over the Japanese and world economies, at Japan's annual solar power exposition the sun was shining, reports **Tony McNicol**.

Once the world's top solar power producer and consumer, Japan has been put in the shade by Germany and China in recent years. But Japan is determined to regain its reputation as the land of the rising sun. Photovoltaic power is one of twenty-one priority CO₂ reducing technologies identified by the government.

And to see the excited crowds at the second International Photovoltaic Power Generation Expo in Tokyo this February, you would never guess there was a world recession. The trade show featured 452 companies from twenty-two countries and attracted some 37,350 visitors over its three-day run—a third more than attended the previous year.

The big news at the expo was the

new “feed-in tariff” system in Japan. Presently, utilities voluntarily buy electricity from domestic solar panels at 24 yen per kilowatt hour. But Japan's Ministry of Economy, Trade and Industry plans to submit a Diet bill which will force them to pay 50 yen per kilowatt hour. In a system based on German legislation, power companies are expected to raise electricity bills to cover the additional expense. The price would be fixed for ten years. “Now, the quicker people buy the solar panels, the cheaper the power will be—that's the incentive,” says Taichi Ozawa, a senior specialist at the New Energy Foundation in Tokyo.

Only a few years ago Japan led the world in solar panel installation, but the rate peaked in 2005—perhaps not coincidentally around the time government subsidies for solar panel installation phased out. The intention was to subsidize installation until prices came down to affordable levels. “At the time the first subsidy ended, the government said that the price had come down enough, but sales haven't been strong since,” says Ozawa. In January this year the government brought in a new subsidy scheme. From April, 70,000 yen in support will be available for each kilowatt of solar panel installed in domestic homes.

Two other factors key to solar power adoption are cost and efficiency. The use of silicon is crucial to both. In recent years a run on polysilicon, a derivative of sand also used to make semiconductors, has strangled production and driven up prices. The challenge for manufacturers is to make cells thinner and cheaper with less silicon, while still maintaining efficiency.

At the PV expo, Mitsubishi Electric unveiled a polycrystalline solar cell with a record-breaking 18.9% conversion efficiency (the percentage of sunlight the cells convert to electricity). Kyocera had its own competing high-efficiency cell at 18.5%. Not far away, Sharp displayed a range of products including a solar cell module for residential use with a class leading efficiency of 14.4%. The company is the second largest solar cell producer in the world after Germany's Q-Cell, and has the lion's share of the Japanese domestic market.

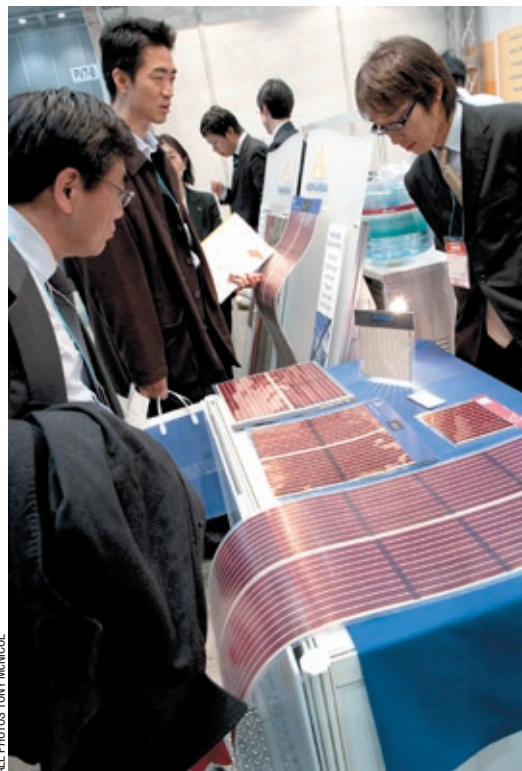
More exotic solar cells were also on show. Several stalls had CPV cells which use lenses to concentrate sunlight onto photovoltaic cells, and are motorized to follow the sun for maximum exposure. CPV are particularly suited to large scale generating plants, being more efficient, but also more expensive than regular cells. One such site was set up last year by Japanese steel manufacturer Daido Steel. The experimental 30 megawatt plant in Aichi Prefecture is the largest CPV system in Japan.

Another emerging technology is super-thin and transparent solar cells that can be built into walls and windows. Kyoto-based Evatech brought a large see-through solar cell to the expo. According to a spokesman for the company, such panels could one day generate electricity while disguised as tinted office windows.

Recession-defying

Japanese manufacturers have announced recession busting plans to boost solar cell production. Last November, Sharp unveiled a joint venture with Italy's largest power company, Enel, to develop solar power plants in Italy with an annual generating capacity of 189 megawatts by 2012. The two companies, plus a third unnamed partner, will also build thin-film solar cell factories for the European market.

Earlier this year Kyocera an-



Flexible thin solar cells on display at PV Expo 2009



Visitors examine a transparent solar cell at PV Expo 2009

nounced it would expand its solar module manufacturing factory in Tianjin, China. The company aims to quadruple production for the Asian market there by 2011. Meanwhile, Sanyo Electric and Nippon Oil Corporation (Eneos) announced in January that they would form a joint solar-panel producer, Sanyo Eneos Solar Co. They plan to output one gigawatt of solar cells a year by 2015.

Japanese companies are clearly determined to catch up with their international competitors. But why has Germany's solar power industry, for example, been so successful? Tobias Homann, on the Germany Trade and Invest GmbH stall at the PV expo, says the biggest success factor was the renewable resources act in 2000. Germany was one of the first countries to introduce a feed-in tariff and now fifty countries have followed their example.

The legislation guaranteed that consumers could sell their solar-generated electricity back to the grid at a price fixed for twenty years. In addition, five percent of electricity bills goes to support all renewable energy. "We have always had strong science and technology, and we have been researching photovoltaics for decades," says Homann. A lot of the innovation has been led by small and medium-sized companies based in eastern Germany, the so-called solar valley.

Japan looks set to follow Germany's example. One percent of Germany's electricity comes from solar power and other alternative en-

ergy sources are growing even more quickly. Six percent of Germany's energy comes from wind, and renewable energy provides 15% in total. In fact, Germany is one of the few developed countries on course to meet its Kyoto treaty targets.

Nor is the recession deflecting the nation from its green goals. "Germany has realized that our renewable energy industry—now that we have this recession in established industry—can be a

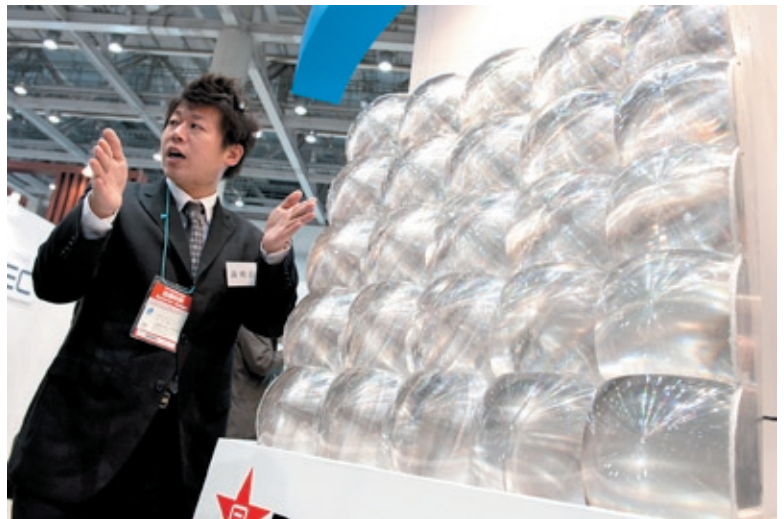
key industry for Germany's industrial future," says Homann. "German banks consider renewable energy projects as conservative investments." As for consumers, Homann says, "People would rather put their money on their roofs than invest in shares."

The Power of Technology

Japan's targets are ambitious and rely heavily on technological prowess—luckily the nation's strongest card. But, of the solar cells made today, the vast majority are based on a design unchanged in its basic principles since the 1950s. Such cells typically have an efficiency of 10% to 15%. Considerable improvement will be needed if solar power is to compete with fossil fuel.

The upper efficiency limit for silicon cells is probably around 20%, but in the prototype stage now are advanced cells which use innovative materials like organic dyes and quantum nanostructures. Such exotic designs could theoretically give efficiencies of up to 50%.

Japan is aiming for a ten-fold increase in solar power use from 2005 levels by 2020. In the longer term, the government hopes new technology could dramatically reduce the cost of solar power and make it a viable option to replace conventional energies. At present, a kilowatt-hour of solar power costs 46 yen. According to the govern-



An exhibitor shows off his company's CPV (concentrating PV) cells at PV Expo 2009

ment's road map for development, that could come down to 14 yen by 2020, and seven yen by 2030—the dirt-cheap price of thermal electricity today. ■

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