

# JAPAN TAKES THE LEAD



SHARP ELECTRONICS CORP.

*The Land of the Rising Sun emerges as a world leader in renewable energy — and leaves the United States in the dust.*

By Dan Bihn

In 1994, as I was preparing to leave Japan after a four-year engineering assignment, I visited one of the country's only two homes powered by a net-metered photovoltaic (PV) system. It had taken a great deal of determination to actually find this house. Ten years later, in the summer of 2004, I was back in Japan on a four-week energy industry fact-finding visit. This time, however, it would have taken more determination to *avoid* seeing a PV-powered house.

Through aggressive government subsidies and policies, solar-

powered houses are now common in Japan, and Japanese manufacturers dominate the global PV market. By mid-2005, Japan expects to have more than 1 gigawatt (GW) of installed PV capacity, predominately in consumer-owned residential systems. The country is well on the way to achieving its goal of 4.82 GW of installed PV by 2010.

PV is an important part of how Japan is meeting the threat of global climate change through a progressive, profitable industrial strategy — a strategy that is igniting a vibrant, consumer-driven

market in which reducing greenhouse gases is not just the right thing to do, but the cool thing to do. The Japanese PV story is also a wake-up call for U.S. policymakers who, through skepticism of and indifference to the climate change threat, continue to lull all but the most visionary domestic businesses into complacency.

### Culture, Fossil Fuel Scarcity Drive Policy

Three issues dominate energy discussions in Japan: (1) because global warming is accepted as a real threat, carbon reduction is becoming part of the economic terrain; (2) 100 percent of fossil fuel used in Japan comes from increasingly volatile parts of the world; and (3) nuclear power is increasingly unpopular. PV is seen as a key part of the solution.

During the past decade, as the world's scientific community recognized the reality of global climate change, bureaucratic and industrial leaders in Japan came to terms with the inevitability of a carbon-constrained world economy. That culminated in Japan's signing of the Kyoto Protocol in 2002.

In the same year, the country's last coal mine closed. Virtually all of Japan's fossil fuels are imported. The memory of the oil shocks of the 1970s remains fresh in many people's minds; and that memory is continuously revived by costs of \$0.20 per kilowatt-hour electricity (about twice the average U.S. rate and amongst the highest in the world) and \$3.86 per gallon of gasoline. But as the automobile revolution that began in the mid-'70s

attests, Japan knows how to take a geophysical lemon and make globally profitable lemonade — and it is repeating history with PV.

In contrast to U.S. policymaking, typically driven by the executive branch and subject to 180-degree change every four or eight years, Japan's slow-moving bureaucracies guide and direct important policy decisions, giving enviable coherence to the country's long-term energy policy.

In 1974, after the first oil crisis, Japan's Ministry of International Trade and Industry (MITI, now METI) promoted the "Sunshine Project" to develop alternative energy sources. In 1993, the Japanese government upgraded to the "New Sunshine Project," focusing on PV. The new plan includes consumer subsidies to offset the initial cost of a residential PV systems; a net-metering policy that allows consumers to sell their excess energy back to the grid at the full retail rate; and significant funding for Japan's national R&D labs. (Scientists and engineers from industry routinely rotate through these labs on something

like a sabbatical — assuring that the research is practical and the resulting technology is successfully transferred.)

In 1994, when a typical 3-kilowatt (kW) PV system cost more than \$50,000, the government subsidized more than half the cost. Today, the same system costs a bit less than \$20,000 and central government subsidies are down to 6 percent. By the time these subsidies are phased out this year, the total public investment will have exceeded \$1 billion. (However, as the central government subsidies disappear, some regional and municipal governments are stepping in with subsidies as high as 15 percent.)

Have these policies been effective? In 1995, Japan was No. 3 in global PV production, with less than one-half the output of the United States, then the world's No. 1 producer. Less than a decade

later, Japan has catapulted itself into the No. 1 position with more than three times the production of the United States — now in a distant third place. About half of all the installed PV in the world is in Japan.

### Solar Power Market Transformed

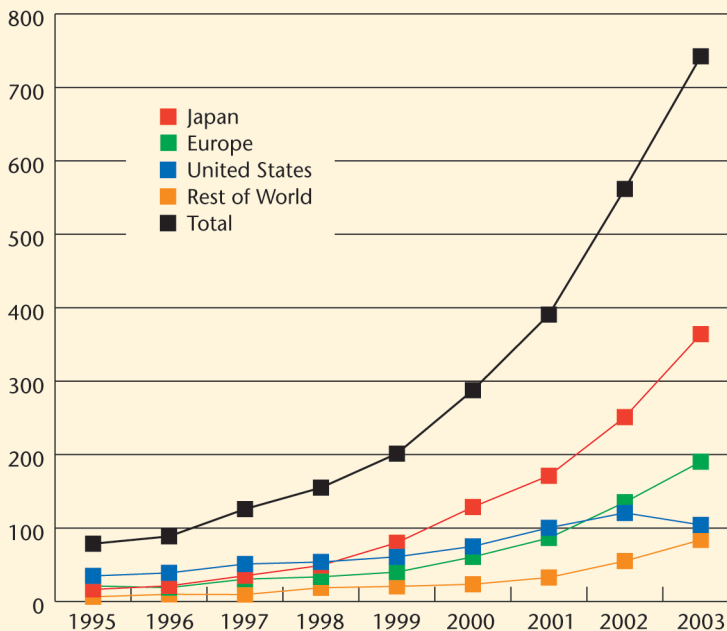
Traveling around the country by high-speed rail — powered in part by surplus PV-generated electricity, thanks to Japan's progressive net-metering policy — it was clear that the roof-scape had changed. I scarcely found a town or village that didn't have at least a few PV-powered homes visible from the train. Though only one of the six homes where I stayed on this trip was PV-powered (not including a university guest house that was connected to a 250-kW PV

system), I was always within a short walk of a PV home or two. Informed discussions were even closer at hand, never once beginning with "What is PV?" or "Why would you want to do that?" (Just for fun, try striking up a conversation about "PV" at your local sports bar.)

The family of the PV-powered home I stayed at was a bit hesitant to show me their system. They said their 3.5-kW system "wasn't very big" (I suspect it was really because their system was not one of the beautiful, architecturally integrated PV systems that fill the brochures and TV ads). And they were clearly embarrassed showing me their four-year-old inverter, apologizing for its lack of a graphical color display.

The Japanese PV market has "crossed the chasm" into the mainstream. Early adopters 10 years ago may have been content with industrial-looking PV retrofits, but marketers have figured out that ugly just doesn't sell. The Japanese architects and homebuilding industry have created integrated PV roofs that are

### Japan Leads in Production of Photovoltaic Panels Annual Production in Peak Megawatts



Source: PV News, published by PV Energy Systems Inc., Warrenton, Va.

## Japan Takes the Lead



SHARP ELECTRONICS CORP.

In less than a decade, Japan has capapulted to No.1 in global photovoltaic production.



DAN BIHN

This home in Matsue City, Shimane Prefecture, features a 10-kilowatt PV system.

### The Road to a Carbon-Free Economy

Three decades since Japan launched the Sunshine Project, reduced greenhouse gas emissions are a top priority.

**1973:** First oil shock, caused when OPEC refused to ship oil to supporters of Israel during the Arab-Israeli War

**1974:** Japan initiates Sunshine Project, aimed at developing new energy technologies

**1979:** Second oil shock arising in the aftermath of the Iranian Revolution

**1992:** Toyota Motor Corp. announces the Earth Charter, outlining goals to develop and market vehicles with the lowest emissions possible

**1993:** New Sunshine Project promoting PV and other renewable energy sources is launched

**1995:** *Science* magazine announces, “Global Change: It's Official: First Glimmer of Greenhouse Warming Seen”

**1997:** Kyoto Protocol, including U.S.-demanded flexibility mechanisms, drafted with goal of limiting greenhouse gas emissions

**1997:** Toyota delivers the world's first commercial hybrid electric car to the Japanese market

**1999:** Honda delivers the first commercial hybrid to the U.S. market

**2001:** U.S. rejects the Kyoto Protocol. According to *USA Today*, “President Bush backed out of it [in 2001], saying it would have cost the U.S. economy \$400 billion and 4.9 million jobs”

**2002:** European Union signs Kyoto Protocol

**2002:** Japan signs Kyoto Protocol

**2004:** Russia signs Kyoto Protocol

**2005:** Kyoto Protocol becomes legally binding for all signatories Feb. 16

**2005:** Japan is expected to exceed 1 gigawatt of installed photovoltaic capacity

**2020:** U.S. auto industry is projected to begin mass production of hydrogen-powered “Freedom CAR”

nothing short of beautiful. So successful have their efforts been that there is a market for faux-PV roof products — roofs that from a fast-moving train can hardly be distinguished from the real thing!

Discussions about PV in Japan are as much about “cool” as about kilowatts. Just like a Lexus sedan, PV isn't for everyone. It's still considered a luxury, rather than a strict economic purchase. Though people do indeed talk about an ultimate payback of 10 to 15 years (for the PV, not the Lexus), much of what the customer buys is intangible — a fashion statement, a status symbol and a hopeful statement about the future. And in a culture the frowns on ostentation, PV is one of the few luxuries that can be flaunted.

### Post-Carbon Economy Emerges

Since global climate change has become part of Japan's national agenda, renewable energy and energy efficiency are just two sides of the same coin: Getting the carbon out is Job One.

The energy industry — in some countries, anyway — seems like a natural enemy of change. How were they brought onboard in the transition to PV power? By emphasizing the potential new markets and revenues to result from carbon-reduction initiatives, policymakers won over many utility industry players.

The natural gas industry is actively promoting cogeneration, running TV ads touting the carbon-reduction benefits of using more than 80 percent of the fuel energy, as compared with less than 40 percent with conventionally generated electricity. Not to be outdone, the electric industry is promoting the use of ultra-efficient heat-pump-driven hot water heaters with a carbon footprint significantly smaller than the best gas-fired hot water heaters. And, of course, there is the nuclear power industry, which makes up 17 percent of Japan's energy supply and boasts, “Look mom, no carbon!”

While residential PV systems are one of the most visible parts of Japan's burgeoning low-carbon, environmentally friendly “Eco” industry (always pronounced “echo”), PV is just the tip of the proverbial melting iceberg. You only have to scan the newspaper ads to see how much fun you can have in a carbon-constrained world — and to see that it is serious business. Ads for



DAN BIHN

Tohoku University of Community Service and Science (Touhoku Koueki Daigaku), Sakata City, Yamagata Prefecture, features a 250-kilowatt photovoltaic system.

energy-efficient refrigerators boast estimated monthly energy savings and short payback periods, along with the latest color combinations and cool features. Downtown, a megaphone-wielding store employee harangues you and other potential customers with proclamations that energy efficiency is the new rage and that by purchasing their product you will be doing your part to reduce global warming. And it doesn't stop there.

In the market for a new home? Allow me to suggest a high-performance "Eco House." And to power that new home, you won't want to miss "Eco Will," the residential fuel-cell-powered cogeneration unit that heats your bath water while it generates electricity. (OK, only 31 prototypes of this one currently exist — and it will be awhile before they are in mass production — but, hey, that doesn't stop its makers from advertising the idea on TV!) Want it all? Pana-Home can set you up with an Eco-Life Home. In fact, the only thing I didn't see was an energy-efficient bathroom — an "Eco Chamber"?

Japan's auto industry also is poised to benefit from a carbon-constrained global economy, with two of its top manufacturers already dominating the global hybrid market. The new Ford Escape Hybrid alone has more than 200 hybrid-technology patents from Toyota under the hood. (This agreement does not seem to be part of a cross-licensing deal involving Ford's strategic cup-holder patents.)

Most of these first-generation products are, of course, made in Japan. Servicing the emerging carbon-constrained economy is part of the Japanese government's program to stimulate the country's sluggish economy. So far, it seems to be working. According to Japan's Environment Agency, the eco-business market in Japan was about \$55 billion in 1990 and is expected to reach \$238 billion by 2010 (*"Quality of the Environment in Japan 1995," Ministry of the Environment*).

### Lessons for the United States

Japan is showing the world that countering global climate change is not only possible, but can also be profitable.

By proving that energy consumption is a cost to be reduced, not a metric of economic health to be increased, Japan is developing a lean economy. Its experience with PV is evidence that developing renewable sources of energy is an opportunity to create an industry (and jobs) at home as well as an export market abroad. (Even in the unlikely event that predictions for global climate change turn out to be overly pessimistic, these emerging products, services and industries will still be more competitive than their high-energy, high-waste competition.)

Perhaps U.S. manufacturers will keep licensing the patents of the future, but sooner or later we must wake up and smell the carbon. The longer we ignore the threat of global climate change, the more outmoded our industries will become and the deeper we will be in the tar pit we are digging for ourselves.

This generation may never have to experience the full consequences of global climate change, but the threat of global economic irrelevance (not to mention geopolitical irrelevance) is staring us in the face today. The sooner we recognize that reality, the sooner we can get back to the business of living, competing and profiting. ●

As the automobile revolution that began in the mid-'70s attests, Japan knows how to take a geophysical lemon and make globally profitable lemonade.

*Dan Bihn is principal of Bihn Systems LLC, Ft. Collins, Colo. He has 20 years' engineering experience developing distributed controls and monitoring systems, including distributed-generation systems and intelligent energy management systems. He has studied and worked in Japan for more than seven years, is fluent in Japanese and can use chopsticks very well. Contact Bihn at 970.218.1962 or dan\_bihn@bihnsystems.com, or visit his website at www.bihnsystems.com.*