The Rise of China's Solar Industry: How Bright Is its Future?

The meteoric rise of China's solar technology industry is well known. Chinese solar manufacturers first entered the limelight when Suntech Power launched its IPO on the New York Stock exchange in 2005. Its stock went through the roof, and founder Shi Zhengrong became one of China's richest men. Since then, a group of other Chinese PV companies, including Yingli Green Energy, Solarfun and Canadian Solar, have followed Suntech in listing overseas. (PV stands for photovoltaic, the name of the hardware used to turn solar energy into electricity.)

Trina Solar, a Changzhou-based Chinese company listed on the New York Stock Exchange in December 2006, took the number one spot in the "Deloitte Technology Fast 50 China" list last year.

Meanwhile, with worldwide demand for solar soaring and some predicting that solar will make up as much as 10% of the global energy mix by 2030, the industry looks set for a bright long-term future. Yet, as China Knowledge@Wharton heard from experts, investors and solar technology makers, Chinese manufacturers' progress has not been entirely smooth, and further bumps in the road may lie ahead. In addition, despite Beijing's newfound enthusiasm for renewable energy sources, a number of observers do not foresee strong growth ahead in the solar domestic market.

A Bright Start

Though Chinese PV manufacturers rely almost exclusively on overseas demand for their products, the origins of China's solar technology boom lie closer to home. Frank Haugwitz of the EU-China Energy Environment Program says that one of the main drivers of the boom was the Brightness Program initiated by China's National Development and Planning Commission in 1996.

The program is a huge project with ambitious goals. By 2010, it aims to bring electricity to 23 million people who currently have no access to power in western China. During the Township Electrification phase from 2002 to 2005, small PV power stations, together with small-scale hydropower plants, were installed in the sunlight-rich Western regions to electrify 1,000 townships. More than 700 small village solar plants were built to transmit electricity to households directly within roughly a one kilometer radius. About 1.3 million people benefited.

Despite its successes, the Brightness Program has run into problems. Even with relatively high tariffs, local operators have not been able to cover the costs of maintaining the plants or replacing the batteries used to store the electricity the plants produce, says Andreas Oberheitmann, a professor at Tsinghua University. The batteries have a lifetime of five to eight years. "This is a major problem."

A question mark now hangs over the next stage of the Brightness Program, which is supposed to bring power to between 20,000 and 25,000 unelectrified villages, says Frank Haugwitz, who worked on the Brightness Program as a technical advisor for the German Technical Cooperation (GTZ), which provided assistance to the project. Nevertheless, a way out of the impasse may be at hand, he adds. If all goes according to plan, rural energy service companies will be launched later this year to maintain the local solar plants for the next 15 years.

On top of the government-supported programs, the growth in European demand between 2003 and 2005 gave added impetus to the sharp pickup in Chinese production, according to a “China Solar PV Report 2007” jointly produced by the World Wildlife Fund, Greenpeace, and European and Chinese renewable energy industry associations last year. Germany, which still accounts for half the global demand for PV, was especially important.

Haugwitz says that, at the point where solar power reaches “grid parity” (that is, when the costs of solar power reach parity with other sources of electricity), solar will experience “unlimited demand.” The program also brought a realization of how much catching-up domestic technology had to do. The upshot, Haugwitz says, was that Chinese manufacturers’ interest in solar technology took off.

They have been playing catch-up ever since. At first, aspiring Chinese firms concentrated on the (relatively easy-to-make) final link in the PV supply chain -- the modules made up of a collection of solar cells. After that, Chinese firms worked their way back up the supply chain, taking on the cells, the wafers that make the cells, and the manufacture of purified polysilicon from sand, tackling increasing levels of technical difficulty along the way. Until recently, most Chinese companies were still engaged in module making, says Haugwitz, but today cells are about to dominate “because that’s where you have the greater profit margin.” He adds that it also coincides with manufacturers’ efforts to integrate their supply chains.

Silicon Shortage and Rising Costs

Despite Chinese solar companies’ progress, the going has not all been smooth. According to Haugwitz, indigenous Chinese PV technology still lags “way behind.” Moreover, domestic R&D capabilities are “limited,” although Haugwitz adds that the situation is “gradually changing.” In addition, Chinese manufacturers have to import over 80% of their production technologies, he says. Skilled labor is also lacking.

But there is no secret about PV makers’ biggest headache to date. “The bottleneck is the supply of polysilicon,” says Haugwitz. According to figures published in December 2007 by QY Research Solar Energy Research Center, a Beijing company, global demand may have significantly exceeded supply last year. Silicon prices have spiraled upwards. Between 2001 and 2003, it cost about $25 per kilogram. Now, QY Research reports, the average price of silicon in China has hit $230-$330 per kilogram. By pushing up costs, the shortage of polysilicon works against the industry’s efforts to achieve grid parity.

China’s big PV players are trying to insulate themselves from rising supply-side costs in a variety of ways. One cost-cutting trend among large-scale PV producers is to move towards integrating the supply process, or “vertical integration.” This gives PV makers greater independence, and allows them to shift costs across the whole production process, says Frank Haugwitz. At full integration, PV manufacturers would be able to make everything from polysilicon to complete solar modules. On the technological front, moreover, companies are improving cell efficiency and cutting wafer thickness, which simultaneously cuts costs.

Furthermore, even against the backdrop of a global polysilicon shortage, the giants of the industry have been able to increase capacity thanks to their ability to netotiate long-term supply agreements at a steep discount to those in the spot markets. Indeed, China’s PV production tripled in 2006, and is believed to have

more than doubled last year. It is on course to become the number one producer this year, according to the Earth Policy Institute. Suntech is planning to boost production from 540MW in 2007 to 1GW this year. Yingli, one of several Chinese producers vying for the number two spot, aims to double its capacity to 400MW.

As the bigger fish get stronger, however, the recent trends at the top of the Chinese PV industry may spell bad news for the smaller players. Without the luxury of being able to secure long-term supply contracts or invest in greater capacity, they face going out of business or being bought or swallowed by bigger fish, comments Haugwitz. “What’s occurring now is a consolidation among manufacturers,” he says. Moreover, he suggests, overseas IPOs may not be a viable option. “There is no distinction now between IPO one and 15.” And recent IPOs by PV makers are not attracting as much money as before, he adds. In fact, some companies have announced IPO plans, only to pull back from the brink.

From an investor’s perspective, Gerry Ge, vice president of Origo Sino-Indian, a private equity and consultancy firm based in Beijing, says that solar is now a more difficult area for private equity firms. “If you do pre-IPO investment, there are not many good companies there, especially for overseas listings.” Moreover, to support China’s secondary market, Chinese regulators have raised the barriers for domestic firms looking to list abroad. Origo is just beginning to invest in renewables, Ge says. It has not yet bought into solar.

Still, Patrick Tam, from Tsing Capital’s China Environment Fund, which backed China Sun Energy and LDK, suggests that while most IPOs so far have focused on cells and wafer makers, “there are still other opportunities within the solar space.” One example might be turn-key systems for solar, he says, adding that so-called “thin film” technology is also receiving a lot of attention. (While the vast majority of PV production uses wafers of crystalline silicon, lighter and cheaper-to-make thin film involves depositing silicon or other chemicals on a low-cost surface.) Thin film is seen as a way for PV manufacturers to protect their margins in the face of fierce competition, Tam says, noting that “whether there will be new IPOs or not depends a lot on the market situation.”

New Cloud on the Horizon

Optimists believe that relief from the polysilicon shortage may be just around the corner. Currently, China imports more than 95% of the silicon from which cells are made, but this looks set to change. On top of PV manufacturers’ own efforts to produce polysilicon, China is currently experiencing a rush of domestic firms scrambling to get into the polysilicon business. Haugwitz says he has looked at 60 or so companies that claimed to be entering the field. Of these, only around a third are actually following through, and the quality of their silicon is “remains to be seen.”

Nevertheless, market-watchers have begun to fret that, with all the new capacity coming online, a new problem may be about to arise: oversupply of PV. Though global demand for solar is growing, based on a statistical analysis of predicted future supply and demand for cells over the next few years, Jerome Ball, an equities trader, has concluded that “The PV industry is heading for at least 50%-100% capacity oversupply.” He points out that, in addition to the high cost of silicon, oversupply may put further pressure on PV manufacturers’ profit margins by lowering sales prices.

The question is, which fall faster, the prices of cells or silicon? The answer, in Ball's opinion, is that in 2008-9 cell prices will drop more rapidly, meaning tighter margins for PV makers. Though optimistic about PV's long-term prospects, he foresees a boom-bust cycle for PV until solar reaches grid parity. Ball also points to uncertainties in international demand in the coming years. Tariffs in Spain, for instance, which thanks to its progressive government policies and abundant sunshine has recently been a paradise for PV, are expected to decline.

Light at the End of the Tunnel?

One solution to the problem of domestic PV supply outstripping foreign demand, argue some Chinese renewable energy industry and environmental groups, is to encourage the growth of China's home market. China is the global leader in solar thermal: Look out the window in any low-rise Beijing residential area, and you are likely to see solar water heaters gracing the roofs of nearby buildings. However, with an installed PV capacity of only around 80MW (or 0.08GW) out of total energy installation of 713GW in 2007, China's use of solar energy for power remains miniscule.

What's more, despite the government's aim of generating 15% of its total energy from renewables (including hydropower) by 2015, the 2020 target for solar is a mere 1.8GW. By this time, Oberheitmann estimates that China's total installed energy capacity may have reached 1500GW. The "China Solar PV Report 2007," quoted earlier, labeled Beijing's objectives for solar "not ambitious," and called for greater government support for China's PV market development. "To encourage better development in the PV industry in the long term, a sustainable domestic PV market is essential," argues Greenpeace energy and environment campaigner Liu Shuang. "To fully realize RE [renewable energy] potential in China, the government needs to set proper targets for renewable energy, enact supportive pricing mechanisms and prioritize the reform of the energy structure."

Experts broadly agree on the key measure necessary to make solar power commercially feasible in China: The government must follow solar leaders like Germany and Spain in introducing an incentive in the form of a feed-in tariff. Oberheitmann points out that China's Renewable Energy Law, which came into force in 2006, legislated a feed-in tariff for renewables and obliged the state grid to allow 100% feed-in of electricity from renewable sources. However, while bio-mass received a specific tariff, and wind power has received support, tariff levels have not been set for solar. Is solar likely to get the push it needs in the near future? Haugwitz doesn't think so. "It's too expensive," he says. Dirt-cheap coal, which supplies the lion's share of China's total power, sets the benchmark for any feed-in tariff for solar, he notes. Based on current prices, the solar tariff would have to be a multiple of 10 to 12 times that for coal power. While the expert consensus is that grid parity may be 10 to 15 years off in Europe, China may have to wait until 2030 before it reaches the holy grail. China's National Development and Reform Committee is looking at the long-term potential of solar, says Haugwitz, but not as an immediate priority. Despite the many hurdles, Haugwitz is optimistic about solar energy's long-term future in China. A 1% increase in cell technology cuts 5% off the costs of production, he says, nudging solar power closer to feasibility. At the moment, Haugwitz admits, PV is by far the most expensive means of generating electricity. "But in five or 10 years' time," he adds, "it may look different. It will look different."

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