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The Unraveling of a Solar Star

Applied Materials was supposed to revolutionize the thin-film solar business, just as it had spurred chip and display makers to new heights. Instead, it was out of the game in three years. What happened?

By Jennifer Kho

Photograph by Mauricio Alejo

Cameras flashed and fans crowded around, packed shoulder-to-shoulder, straining to get a closer look. At a sleek, huge solar panel. If there has ever been a sexy solar panel, this was the one. "It was a very exciting time," says Jim Cushing, global solar product manager at Applied Materials. He was part of the company's entourage that summer of 2008, soaking up the praise at one of the top solar expos in one of the world's biggest solar markets, Germany. Cushing was squiring the largest panel the world had ever seen, made by customers who had Applied Materials' equipment. Those customers were happy. Installers were practically pressing checks in their hands to buy panels. "One guy told me he could have sold his capacity four times over," Cushing says.

Of course, Applied was accustomed to success. The company had revolutionized the semiconductor industry with high-tech tools that dramatically lowered costs for chip makers. As Applied rose to be the No. 1 supplier of manufacturing equipment to the likes of Intel and AMD, its machines helped drive the growth of a $300 billion industry. Applied also had successfully transferred its expertise to the $100 billion flat-panel display business, becoming the top supplier of manufacturing tools to LCD-panel makers in 2006.

When the company, then pulling in almost $10 billion annually, set its sights on solar, it sent a thrill of excitement throughout the community. Applied developed equipment to make conventional panels, but it got the most buzz for its machines to make a thinner type of panel using amorphous silicon, known colloquially as "thin film." Applied execs believed thin film could slash costs and disrupt the market with panels more than four times larger than conventional ones, giving Applied's customers the same economies of scale that helped lower the cost of LCD displays by a factor of 20.

Combining its amorphous-silicon machines with the best tools it could find, Applied launched a "turnkey" factory called SunFab in 2007. Would-be solar manufacturers loved the idea that they could essentially buy a factory in a box. Applied's sales goals grew from $200 million to $400 million to $600 million. By the time those first SunFab panels were unveiled in Germany, Applied had amassed $1.5 billion worth of orders. That year, VLSI Research named the company -- which had posted zero solar sales in 2006 -- the world's largest seller of solar-electric cell-manufacturing equipment.

But now the thrill is gone. In July, Applied Materials shut down its SunFab business, saying it would spend as much as $425 million to restructure its environmental division. Two of its biggest customers are bankrupt. Though the company blames the economic crisis and subsequent market conditions, the truth is more complicated: Applied took risks and made choices that left it vulnerable. The company's story is a cautionary tale that's emblematic of the solar industry's woes and a prime example of how a big, successful company can fail when it enters a new market.

As it prepared to install SunFab factories back in 2007, Applied ran headlong into trouble. It planned to roll out its first four factories one at a time, for tech giant Moser Baer in India, Signet Solar and SunFilm in Germany, and T-Solar in Spain. But delays in production as well as delays in construction of facilities forced the Silicon Valley-based Applied to set up four far-flung factories simultaneously. "It was a real strain on our resources," Cushing says. "We had to grow our startup team significantly to ramp up four plants."

The plants were slow to reach full capacity and kept missing production deadlines. In October 2009, after Applied's customer, Masdar PV, began shipping its first panels from its German factory, then-CEO Rainer Gegenwart complained: Applied "is not really shipping turnkey. That means the production line just comes and starts." Cushing says the idea that a thin-film solar factory would start without any glitches is unrealistic. "Anyone who starts up a new factory with a new technology for the first time and doesn't think it's going to be hard has probably never started up a new factory before," he says, pointing out that even with well-established technology, it can take months to ramp up a factory to volume production.

But Masdar, which was spearheading the $22 billion green-city initiative in the United Arab Emirates, was new to this game. Cushing acknowledges that he and his team should have done a better job setting expectations. Oerlikon Solar, a direct competitor in thin-film manufacturing equipment, has been more discerning, says Jenny Chase, lead analyst in high-tech manufacturing industries at Bloomberg New Energy Finance. It has picked customers who have more financial strength and more industry-related experience.

Solar, Big and Lean: An installation in Germany of thin-film solar panels, each measuring 18.7 square feet. | Photograph Courtesy of Applied Materials

Although installations may have eventually sped up -- Applied's flat-panel customers can start a new factory in four to seven months -- the company missed a critical window of opportunity. While Applied ramped up those SunFab factories, competitors opened long-planned factories and many traditional solar-panel manufacturers came online, causing the price of silicon and conventional panels to plunge. That greatly reduced the relative savings that the technology offered, making it harder for thin-film entrants to compete.

Customers found themselves in a double bind, because, according to Greentech Media analyst Shyam Mehta, a SunFab factory also cost about 30% more than standard solar-manufacturing equipment. The $80 million to $160 million price tag for a single line exacerbated the financial pressure just as the economic crisis essentially froze bank financing for solar at the end of 2008. By 2009, the same customers who had been overrun with buyers in 2008 found themselves unable to sell their panels.

Applied's strategic mistakes compounded the problems. Cushing says that in the LCD-display industry, Applied had seen that every time the glass grew larger, the industry was able to cut costs dramatically. "That's why you're about to buy 55-inch televisions today for less than the cost of 20-inch TVs a few years ago." Applied thought that bigger would be better for solar as well: Large glass would mean faster throughput, with fewer pieces delivering the same capacity, lowering the cost per watt and installation costs. That's why SunFab's panels were four times as large as most others in the business.

But glass that large is hard to handle, and few equipment manufacturers had tools that could deal with it. According to a Masdar customer, at first, there was a lot of broken glass coming off the line. "All turnkey companies have to bring together [other manufacturers]," says Kirk Hasserjian, who was the VP for SunFab factory operations at Applied, "and you're not always getting the best of breed of all of them." The company had hoped to improve the tools in SunFab over time.

Applied's extra-large panels had been designed to target the utility market. Executives looked at aggressive renewable-energy goals set by states and anticipated a windfall when U.S. power companies installed solar farms. Those farms never materialized. More crushingly, the Spanish solar market -- by far the largest for big solar farms, representing 41% of the world's installations in 2008 -- collapsed when the government cut its 2009 incentive to a fifth of its 2008 size. "We were saying, 'Where's the next Spain?' " Cushing says. "But it became, 'There isn't even Spain.' "

When Best Solar slashed its $1.9 billion SunFab order to $250 million in April 2009, analysts wondered whether this signaled more cancellations to come and noted that the solar business, which had helped Applied soften the blow from the semiconductor downturn in 2008, had now become "a drag." In April 2010, Applied customer SunFilm filed for bankruptcy in Germany. Two months later, Signet Solar declared insolvency.

When Applied reported its second-quarter earnings this past May, it noted $184 million in negative backlog, mainly from its thin-film solar division, and wrote down $83 million in SunFab equipment that it didn't expect to be able to sell. CEO Mike Splinter said the environmental division would miss the company's goal of profitability in 2010 because of the "well below expectations" performance of its thin-film business. Two months later, the company announced it was pulling the plug on SunFab.

Applied says it will continue to sell upgrades, services, and new factories to existing customers and continue to improve its own thin-film solar machines, which it plans to sell individually rather than rolled up into a "factory in a box." But for all intents and purposes, the company is out of the thin-film solar business. "The decision is a major blow to Applied Materials ... and could be disastrous for the 12 or so purchasers of the SunFab systems," wrote Mark Burger, a principal consultant at the Kestrel Development Co., in a research note.

Applied's failure doesn't doom amorphous-silicon solar technology. Oerlikon's more stable customers appear to be faring better than Applied's, Chase says. Sharp, which began shipping commercial amorphous-silicon panels from a 160-megawatt factory in Japan in 2008, opened a 1-gigawatt factory earlier this year. Even Cushing believes the technology can become cost-competitive in the future, once supply chains are more developed, though he is quick to add, "It's not there yet." And if it ever does get there, this much is sure: Applied won't be leading the way.

Thin Slicing

The economic downturn and Applied Materials' failure in the thin-film solar business were a one-two punch to the thin-film solar industry. Here's how the big players look heading into 2011.

SHARP

Sharp Solar

The No. 3 manufacturer of solar panels in 2009, Sharp produces conventional crystalline-silicon panels. Increasingly focusing on amorphous silicon, the company has 320 megawatts online compared to 430 megawatts of crystalline-silicon capacity, says Greentech Media analyst Eric Wesoff.

First Solar
The No. 1 thin-film solar manufacturer was the world's largest solar manufacturer in 2009, with production capacity expected to be 2.7 gigawatts by 2012. It makes cadmium-telluride panels, which are more efficient than the amorphous silicon Applied Materials bet on. Annual revenue is in excess of $2 billion.

Energy Conversion Devices
The company produces the Uni-Solar brand of amorphous-silicon panels, which is foil based and flexible and can be attached to roofs like a sticker. ECD, which generates about $300 million in annual revenue, said in August that it was moving some of its 150-megawatt capacity to Mexico.

Oerlikon Solar
One of Applied Materials' only direct competitors in manufacturing has the tools to produce amorphous-silicon panels. VLSI Research ranks this subsidiary of the Swiss industrial Oerlikon as the No. 1 solar turnkey supplier and named its line the "best technical product for thin-film manufacturing" last year.

Solar Frontier
This subsidiary of the Japanese oil company Showa Shell Sekiyu began researching its copper-indium-selenium technology in 1993. It expects to ship more than 100 megawatts of panels this year and reach more than 1 gigawatt of capacity by 2011. In October, it signed a deal to supply General Electric-branded panels to GE.