



Solar Industry's Bright Future

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The solar industry has evolved into one of the key investment fields worldwide, and market forecasts continue to project double-digit growth for the coming years.

While today Germany and Spain are by far the largest markets for solar installations, the United States is expected to take on that role within the next few years. Some of the main U.S. market-drivers have been relatively generous incentives schemes and high electricity prices, especially in California, where solar power is already competitive with electricity from the grid at peak hours of the day. As a result, California currently makes up about 85 percent of the entire U.S. solar market. However, other states have also introduced public support schemes and solar electricity generation is increasingly viable in less sunny climates. This is largely due to the growing economies of scale in manufacturing of solar panels, which the industry has been observing over the past few years.

The production of solar photovoltaic (PV) modules and components is now an industry with an annual market volume of more than \$20 billion (2008). Manufacturing is no longer dominated by small start-ups and university spin-offs. Instead industry leaders with global standing, such as Q-Cells, REC, or First Solar have emerged. Additionally, established large corporations like GE, Sharp, and Intel are increasingly active in the field or have recently entered into

this highly attractive business.

Given the strong medium- and long-term fundamentals of the solar industry, companies will continue to expand their capacities, invest in new production sites, and establish a truly global footprint. This results in excellent prospects for individual regions to position themselves as manufacturing locations of choice.

Leading companies have started to establish manufacturing locations in each of the three current main regions — America, Asia-Pacific, and Europe — to fully cover the global market and optimize their cost structure as the industry becomes more and more competitive.

Challenges for PV Manufacturers

PV manufacturers are currently faced with an increasing geographical diversification of their industry: Dependency on a small number of (heavily subsidized) core markets is decreasing, and market growth is taking place on an ever-wider scale. This means companies will have to choose their locations in a geographically fragmented market, with many centers of growth in almost all parts of the world.

Like sales markets, companies themselves are also changing. Founder-managed companies are turning into medium-sized enterprises, and established

market participants are going public. This naturally influences the decision-making process and the formulation of corporate strategy. In addition, the scale of investment projects in photovoltaics is also constantly increasing. Whereas, until recently, the manufacturing process was fragmented into the various steps in the value chain (silicon, wafers, cells, modules), and corresponding investment amounts for each individual project were relatively small, the industry is quickly turning to a more and more integrated production process, with larger volumes and projects now easily reaching several hundred millions of dollars in investment and the creation of at least a few hundred jobs.

Increasing Demands on Locations

As a result, the demands on respective locations, especially in terms of labor availability and infrastructural development, have also increased to such an extent that it is considerably harder for a potential site to meet all the criteria and, thus, for an investor to implement a project without incurring problems and risks. Alongside technical innovations in products and production processes, finding an optimal location for new production facilities represents a major strategic aid

SPECIAL REPORT

for PV companies to confront the increasing cost pressure in the industry.

For this reason, low-cost locations

such as Malaysia and the Philippines have benefited from major PV investments in the last year or two. These two countries have become destinations for large-scale offshore solar manufactur-

ing; this is particularly due to their existing background in semiconductors and electronics, where similar production processes are used and similar skills, suppliers, and infrastructure are needed.

But production is not always moved to the cheapest possible locations. Especially — but not only — in the thin-film sector, other factors often play a bigger role, such as the availability of skilled labor, the reliability of power supply and process materials sourcing, relative proximity to the target market, and logistical access because of the size of the products, as well as proximity to equipment suppliers. These are some of the reasons why thin-film investments continue to be made in locations such as Germany (Signet Solar, Sunfilm), Spain (T-Solar), and Switzerland (Pramac). Moreover, products are still far from commodization and production processes far from mature at almost all steps of the PV value chain. Innovative companies, therefore, continue to locate in established, lower-risk environments.

The choice of locations does not, however, need to be restricted to the regions that have so far been the top locations for the PV industry. The conditions and the investment environment of potential locations are in constant flux. Consequently, making a sustained investment decision involves not just backing the tried and tested, but also securing a competitive advantage from a location tailored as closely as possible to the company's own goals and requirements, as First Solar, for example, initially demonstrated in eastern Germany and then in Malaysia.

One of the main determinants of a location choice for a solar company is, of course, what it intends to produce at the new facility. The main location criteria differ considerably depending on the part of the value chain in which a company operates. This is also why sites in regions as different as Quebec, Morocco, France, Saudi Arabia, and

Chart 1

Example: Success Factors for Eastern German Solar Cluster
1. Ambitious targets as well as attractive and reliable feed-in tariffs have created a strong domestic market.
2. Investment incentives have attracted investors.
3. Once manufacturers have settled, others have followed attracted by an established supply chain.
4. A fully established infrastructure has proven to be essential for a smooth production process.
5. Stable and — compared with western Germany — decisively lower labor cost have contributed to the success.
6. A high density of research institutions and universities has enabled knowledge transfer and facilitated specialist recruiting.
7. A strong public awareness on energy and climate concerns has supported renewable energy efforts.
8. Investment promotion on federal, state, and local levels provides industry-specific information and management support.

Chart 2

Sample Project Parameters of a Large-Scale Integrated PV Fab and Location Requirements	
Company Project Parameters	Location Requirements
Necessity to hire > 1,000 employees with different skill sets	<ul style="list-style-type: none"> ◆ Diverse, high-capacity local labor market in terms of quantity and quality ◆ Favorable accessibility of site
High size requirements for building plot	<ul style="list-style-type: none"> ◆ Large-scale industrial park/special economic zone ◆ Dependable commitment for shovel-readiness of site by planned start of construction
High utilities demand (especially electricity, cooling water)	<ul style="list-style-type: none"> ◆ Reliable power grid with redundant supply ◆ Dependable commitments for local utility upgrades ◆ Ability to construct cogeneration plant on site for improved utility situation and cost savings
Time-to-market	<ul style="list-style-type: none"> ◆ Demonstrable experience of location with similar large-scale projects ◆ Transparent and clearly defined permitting process ◆ Commitment from government to remove red tape
High consumption of chemicals for production process	<ul style="list-style-type: none"> ◆ Ability to store large quantities of toxics on site and state-of-the-art infrastructure to enable optimal chemical logistics ◆ Proximity of suppliers of production materials (especially TCS for silicon production and HF for integrated fab)

Florida have been able to attract PV investments in recent months.

Industry Hot Spots

Although they have not yet attracted large PV investments and are still to a certain extent “insider tips,” “budget

becoming the world’s largest PV market within the next few years. Growth centers for photovoltaics have already developed in California, Oregon, New Mexico, and Ohio, for example, although other states should not be overlooked as possible investment locations.

“Solar Valley,” as it has come to be called, is the biggest of its kind in the world. Within a decade it has been established in the previously economically depressed region of eastern Germany. All stages of the value chain in production and all thin-film technologies as well as R&D institutes and equipment suppliers are represented. This acts as a powerful magnet, attracting further projects.

Out of the top four production locations throughout the world — China, Japan, Germany, and Taiwan — Germany has attracted by far the most foreign investments in the PV sector. However, partly because of the nature of the incentive programs, which grant large amounts of direct funding especially to small and medium-sized projects, the really large production volumes will, in the future, probably be realized mainly in Asia, where investors are attracted by the availability of substantial long-term tax breaks. ■

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options” in particular have the potential to become future hot spots for the photovoltaic industry. They offer an interesting mixture of proximity to the main markets (e.g., Mexico to the United States; the Czech Republic and Hungary to Germany; Turkey and Portugal to southern Europe), coupled with an inexpensive production environment, and yet stable and reliable general operating conditions.

Projects in the United States are profitable for foreign investors for the foreseeable future, especially in view of the low dollar exchange rate. However, the main location factor is without doubt the prospect of the United States

Countries and regions with cheap electricity prices — such as some Canadian provinces, Australia, and the Middle East — are principally of relevance where investments in the silicon, ingot, and wafer sectors are concerned, because of the high energy requirements involved. Although these areas are certainly of interest for individual projects, they are, however, no more likely to develop as principal locations for the industry in the next few years than pure low-cost locations with no local market at all.

Eastern Germany is likely to maintain its position as one of the most attractive investment locations for the PV industry.

Chart 3

