

# BCG

OPPORTUNITIES  
for ACTION

ENERGY



■ *The fundamentals driving the solar photovoltaic market have changed considerably. Gone is the tail wind of strong demand coupled with limited supply.*

■ *To negotiate this far more challenging environment, photovoltaic suppliers will need to refocus their attention on the basics: relative cost position, go-to-market effectiveness, and an understanding of key market segments and channels.*

■ *The most successful companies will work to simultaneously optimize all key fronts: specifically, sales and marketing, procurement, manufacturing, and the supply chain.*

## Back to the Basics

### How Photovoltaic Suppliers Can Win in Today's Solar Market

**T**he solar photovoltaic (PV) industry has seen a sharp swing in its fortunes. Growth surged from 2003 through 2008, driven by a swelling number of government incentive schemes designed to encourage investment and adoption. During that period, the number of new solar installations rose, increasing at an annualized rate of more than 50 percent. And growth would have been even stronger had the industry been able to fully match supply with demand: bottlenecks developed in the supply of both critical resources and manufacturing capacity.

But the backdrop has changed. The global economic downturn, coupled with shock waves from regulatory changes in Spain, has pushed the market into oversupply.<sup>1</sup> Gone is the tail wind of surging demand. Instead, the sources of competitive advantage for the next 12 to 24 months will be relative cost position, go-to-market effectiveness, and an understanding of key market segments and channels. In short, it's back to the basics for companies—both incumbents and new entrants—in the solar PV space.

#### Taking Action

In order to thrive in and not merely survive the harsh reality of today's market, PV suppliers need to take a critical look at their business model and operations. They should start by asking themselves fundamental questions about both the revenue and cost sides of the business. On the revenue side, those questions should include the following:

- ◇ Do our marketing and sales capabilities differentiate us and give us competitive advantage? Can we be more efficient?
- ◇ Are we pursuing the most attractive markets with the right product offerings and solutions? Specifically, ask the following:

1. As part of a general push toward renewable energies, Spain's government sought in 2005 to encourage investment in solar PV capacity by instituting an aggressive incentive scheme that was based primarily on guaranteed prices. The plan ultimately overshot its mark: new capacity surged, and in 2008, Spain accounted for fully 43 percent of the global PV market. In an effort to stanch the flow of investment, the government ratcheted down the incentives in 2008 and capped the generation capabilities of new installations.

- Have we effectively segmented the market, and is our sales and marketing strategy based on deep insight into customers' needs?
- Are our target markets and product solutions optimized for factors such as evolving subsidy schemes, increasing participation by power companies, stimulus plans, and disparities in supply and demand across regions?
- Are we applying world-class pricing strategies to maximize value?

The examination of costs should be equally comprehensive, addressing procurement, the make-versus-buy decision, manufacturing, and the supply chain. Questions should include the following:

- ◇ Have we adjusted our sourcing strategy for polycrystalline silicon (polysilicon) to reflect today's market environment?
- ◇ Do we need to reevaluate our design choices in light of the new cost realities?
- ◇ Is our make-versus-buy strategy optimal along all steps of the value chain?
- ◇ Do we have sufficient scale in all parts of the manufacturing value chain?
- ◇ Have we optimized our supply chain to minimize both inventory overstocks and shortages?

The winners will be those suppliers that are able to optimize their operations on the revenue and cost fronts simultaneously and cost-effectively. Below we offer thoughts on how these goals can be achieved.

## Revamping the Go-to-Market Strategy and Capabilities

Because demand exceeded supply for several years running, the sales forces of many solar PV companies focused more on taking orders and allocating available supply than on improving sales and marketing efficiency or on developing an understanding of customers' needs and demand generation. Now suppliers are forced to play catch-up. They need to aggressively revisit their go-to-market strategies and act on a range of fronts. They need to select and focus on the key segments and launch customer discovery efforts to better understand the needs of those key customers as well as the needs of

end users. They need to invest in upgrading the capabilities of their sales forces and making sales force effectiveness a priority, optimize pricing strategies to maximize revenue, and do a better job of targeting their marketing expenditures. In short, they must focus on the fundamentals of creating winning commercial strategies and tactics.

Suppliers also need to rethink their target regions and, in some cases, develop new market-entry strategies in response to recent dramatic changes to subsidy schemes and stimulus packages. In today's reality, the understanding of the expected evolution of subsidies and of the implications for associated products will be a core component of commercial success and enhanced profitability.

## Upgrading Procurement Management

Suppliers must urgently pursue procurement and sourcing actions that significantly improve their cost position. For instance, companies focused on polysilicon should reassess their supply strategy, as well as revisit their short- and medium-term sourcing options. In the short term, companies must engage in the make-versus-buy analyses required for various parts of the value chain to determine whether the company is better off continuing to use subscale facilities in high-cost countries or whether it should outsource production to facilities operating at optimal scale in low-cost countries (LCCs). In the medium term, suppliers must reconsider the design of their supply chains and assess the potential value of "virtual" approaches to vertical integration.

It is important to note that when demand exceeded capacity, many manufacturers did not have the time to design their modules to optimize costs. As a result, their modules frequently used customized components from a single source, leaving suppliers exposed to potentially significant cost increases that ranged from 20 to 500 percent. (The cost of a specialized power cable, for example, can be five times that of a standard industry cable.) Companies should redesign their products with an eye toward cost savings by using cross-functional teams that leverage the company's procurement, engineering, and marketing personnel. Simultaneously, procurement's role should be shifted from that of order taker to that of a partner whose input is a valued element of the design process.

## Optimizing Manufacturing

Leveraging scale advantages and the potential factor-cost savings afforded by LCCs—especially for labor and

energy costs—will be essential for competitive advantage moving forward, with best-in-class competitors enjoying a significant cost advantage over those with sub-scale facilities in high-cost countries. When combined with a focus on lean manufacturing, the cost advantages of scale and LCC manufacturing can be even more significant. Finally, a number of promising emerging technologies in manufacturing could provide considerable reductions in incremental costs.

**Leveraging Scale Advantages and Potential Factor-Cost Savings.** The impact of scale and low factor costs on each step of the value chain can be startling. (See Exhibit 1.) For example, The Boston Consulting Group estimates that scale effects in polysilicon manufacturing give a PV plant producing 20,000 metric tons of polysilicon a unit cost advantage of 5 to 15 percent over a plant producing 5,000 metric tons. Furthermore, leveraging the labor and energy factor-cost savings available in LCCs can lower those costs by 15 to 25 percent. Combining the two—that is, operating a plant at optimal scale in an LCC—can lead to unit cost advantages of 20 to 35 percent in polysilicon manufacturing.<sup>2</sup>

PV wafer manufacturers can achieve comparable savings. Scale effects give a 400-megawatt plant a unit processing-cost advantage of 15 to 25 percent over a 100-megawatt plant. In addition, the factor cost savings attainable in LCCs can range from 10 to 20 percent. Together, scale and factor cost savings can generate unit

2. In polysilicon, wafer, and module production, some overlap exists between scale effects and factor cost savings. For this reason, the total potential savings is slightly less than the sum of the savings achievable with each of the two approaches.

### Exhibit 1. Leveraging Scale Advantages and the Potential Cost Savings in Low-Cost Countries Can Deliver Considerable Savings

Type of supplier	Savings potential (%)		
	Scale advantages	Factor cost savings	Combined effect <sup>1</sup>
Polysilicon <sup>2</sup>	5–15	15–25	20–35
Wafers <sup>3</sup>	15–25	10–20	25–35
Cells <sup>3</sup>	20–30	10–20	30–50
Modules	<10	15–25	20–30

Source: BCG analysis.

<sup>1</sup>In polysilicon, wafer, and module production, some overlap exists between scale effects and factor cost savings. For this reason, the total potential savings is slightly less than the sum of the savings achievable with each of the two approaches.

<sup>2</sup>The figures represent the savings achievable by a plant producing 20,000 metric tons versus a plant producing 5,000 metric tons.

<sup>3</sup>The figures represent the savings achievable by a 400-megawatt plant versus a 100-megawatt plant.

processing-cost advantages of 25 to 35 percent in wafer manufacturing.

Although PV cell plants are more labor intensive and require less energy than polysilicon or wafer plants, the picture does not change for them: a 400-megawatt cell plant may offer a unit processing-cost advantage of 20 to 30 percent over a 100-megawatt plant. Labor factor-cost savings for cell plants in LCCs can also be 10 to 20 percent. As a result, cell plants operating at optimal scale in LCCs have a unit processing-cost advantage of 30 to 50 percent over smaller facilities in higher-cost locations.

Scale also offers cost advantages to PV module manufacturers—but to a lesser extent. The majority of costs associated with module manufacturing are the result of materials—such as glass, substrates, and metal—that offer limited potential for scale-driven-procurement savings. Yet the labor intensity of module manufacturing offers the potential for considerable labor-cost savings in LCCs. Indeed, module manufacturers that leverage LCCs can realize unit processing-cost savings of as much as 25 percent in labor alone.

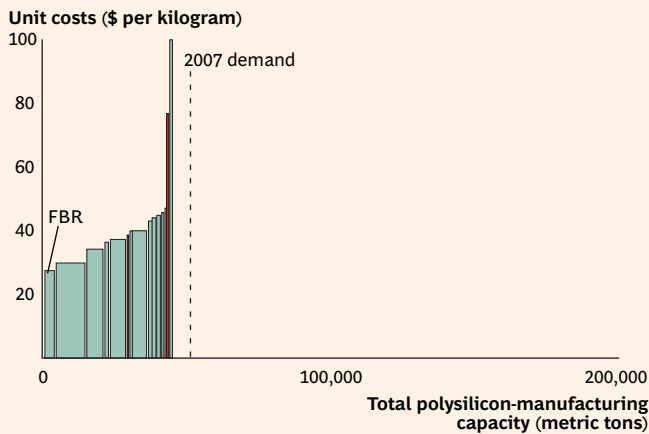
Leveraging scale advantages and potential factor-cost savings will be increasingly critical goals for all incumbents. Companies operating at optimal scale in LCCs will continue to lower their production costs, creating healthy margins for themselves while driving down market prices and putting pressure on incumbents. In polysilicon manufacturing, for example, we expect that by 2012, new entrants from countries such as China that have sufficient scale will generate profit margins of 36 percent and higher while smaller competitors and players in high-cost countries struggle to earn their cost of capital. (See Exhibit 2.) To survive, established players will need to develop their own world-class facilities or reexamine their value chains.

**Leveraging Lean Techniques.** Manufacturing costs can be reduced even further through the deployment of targeted lean initiatives. In our experience, well-executed lean programs can cut production cycle times and costs by half and increase productivity by up to 30 percent. Moreover, quick wins constitute a large share of the savings. And companies that have simultaneously embarked on lean-manufacturing transformations and consolidated production in facilities operating at optimal scale in LCCs have observed unit cost savings in excess of 40 percent.

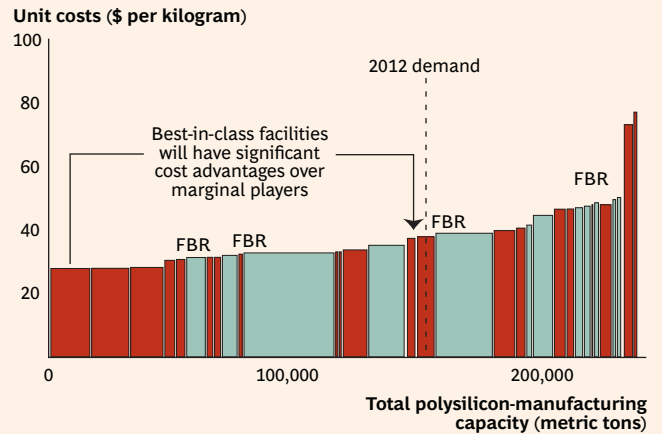
**Leveraging Emerging Technologies.** For PV suppliers, new manufacturing technologies have the potential to

**Exhibit 2. To Remain Competitive amid Rising Supply, Incumbent Polysilicon Suppliers Must Lower Production Costs**

**In 2007, demand outstripped manufacturing capacity, ensuring profitability for all suppliers...**



**...but by 2012, only world-class facilities will be profitable**



Source: BCG analysis.

Notes: Our projection of raw-material input costs for 2012 assumed an annual inflation rate of 2.9 percent. FBR denotes a supplier that uses fluidized-bed-reactor technology, which offers savings over conventional manufacturing methods and thus can enable smaller-scale facilities to achieve low costs.

change the game. For instance, in polysilicon manufacturing, fluidized-bed reactors offer significant savings in capital expenditures and can save as much as 90 percent of energy costs in the deposition process, an amount that is equal to a processing-cost advantage of 15 to 25 percent over conventional manufacturing methods. Successfully leveraging these nascent technologies, however, will entail balancing the potential upside from investments with careful management of the risks and challenges of implementing them. Having a superior manufacturing-strategy road map that takes all those factors into account will be another back-to-the-basics way to differentiate between the winners and losers in the solar market.

**Updating Supply Chain Processes**

As solar companies expanded their manufacturing footprint internationally over the past several years, the complexity of their supply chains increased dramatically. Companies were forced to hold inventory at each step of the value chain while also trying to minimize their time to market.

Now that supply exceeds demand, however, companies must redesign their supply chains to reduce system costs. In particular, because PV modules no longer sell immediately, companies must reevaluate their forecasting models and inventory-stocking patterns. Our experi-

ence indicates that companies that optimize their supply chains can reduce their inventories by 20 to 40 percent while simultaneously reducing shortages.

Finally, suppliers should also leverage the current economic environment to substantially reduce their net working capital by negotiating more favorable payment terms with suppliers.

**The Path Forward**

Over the longer term, success in the solar PV industry will hinge largely on innovation. But success, and even survival, over the next 12 to 24 months will depend on getting back to the basics—all the basics—and executing quickly and successfully. Admittedly, this is a tall order. But there is no choice. Suppliers must do what is necessary—or risk extinction.

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