Here comes the sun: How solar can become a serious infrastructure play

The market for solar power is growing faster than ever, but profitability has been lagging. The keys to improvement are better capital and operational efficiency.

David Frankel

Partner, Southern California
McKinsey & Company

Dickon Pinner

Partner, San Francisco
McKinsey & Company

Solar energy is becoming a force to be reckoned with.

Last year, China and the United States installed a record 34.5 and 14.6 gigawatts (GW) of solar, respectively, and in 2015, investors poured $161 billion of capital into the sector, the largest amount for any single power source.

The world is building more solar-power plants because they are getting cheaper. Since 2009, the total installed costs of solar have fallen by more than 60 percent around the world. New power-purchase agreements frequently fall below $100 per megawatt-hour, with some reaching less than $30. That price puts solar at or below the cost of a new natural-gas plant.

Although the future is bright, in the present, many solar companies are struggling, with falling valuations and dull profits; relatively low oil and gas prices have not helped. In terms of technology, the solar industry has done well and will only get better. As we see it, the larger challenges have to do with project finance and development.

Project development. Solar system design can be sadly unsystematic, typically designed from the bottom up. Each power plant or roof gets the perfect answer, a process that translates into high costs for labor and production. It doesn't help that the solar supply chain is immature, and the technology itself is still evolving rapidly. As the industry scales up, players should develop systems based on prefabricated components that are a very good, but not perfect, fit for a wide range of sites and that will integrate easily in the field—an approach known as "design for constructability." In addition, automation and aerial site assessments can speed up design prototyping and help firms make more accurate estimates before they put boots on the ground—or the roof.

In the case of large utility-scale projects, better up-front assessments of ground conditions can minimize rework for pile driving or trenching. Developers could prefabricate off-the-shelf units, making it possible to install them in hours rather than days for rooftops, or in weeks instead of months for large ground-mounted systems. To achieve this goal, firms will have to overhaul their supply chains to ensure that components can work with one another and should collaborate closely with engineering, procurement, and construction companies to create and deploy cost-saving ideas. The automotive industry, which uses standard designs over and over for different models, is a helpful analogy.

In general, solar players need to manage costs better. A detailed cost road map can help to reduce costs and develop a realistic forward cost curve against which developers and sales teams can bid for future projects. An effective cost analysis begins with setting goals, based on the levelized cost of energy for each market. Then, each cost component should be mapped, targets set, and a portfolio of improvement initiatives developed and tracked. It would also be more than helpful to shorten the cash cycle. The lag time from order to installation to grid connection to cash can be six months or more for a job that takes a day for residential customers and, at most, a few weeks for commercial or industrial ones. Project-delivery models, built on standard designs and construction excellence, must be developed and then scaled up.

Project finance. There's a Catch-22. Prudent solar companies cannot afford to scale up beyond the strength of their balance sheets but most have relatively weak ones. Only by getting bigger and thus having more collateral in the form of projects can they bolster their financial positions and scale up. Solar companies must therefore find new ways to attract long-term capital from institutional investors (through either public markets or private placements), improve capital efficiency, and forge prudent growth strategies.

One approach is to unlock long-term capital markets. Completed solar projects are attractive for investors seeking dependable long-term cash flows. The challenge is how to resolve the lower cost of capital (less equity, more debt) for an operating plant with the higher cost of capital (more equity, little debt) for developers. One approach has been the use of "YieldCos"—entities that purchase completed projects and have balance sheets separate from the development company. Assuming they are focused on delivering low- risk, stable cash flows, these entities should enjoy a much lower cost of capital and higher levels of leverage, and thus could provide the liquidity that developers need to grow. Similarly, solar-development companies, or "DevCos," should be equity focused, with low levels of debt.

But for various reasons, YieldCos have not met the needs of institutional investors, and many are valued well below their initial-public-offering levels. Similarly, when DevCos take on significant levels of debt, problems can occur, because the cash flows associated with project sales are inherently less predictable.

Institutional investors want a healthy yield at low risk; solar developers want a dependable way to liquidate higher-cost equity capital to reinvest it in the next project. A "YieldCo 2.0" should be developed to meet the needs of both parties, with a transparent, simple governance structure that provides both an attractive home for long-term capital and sufficient flexibility to project developers. Similarly, a pure-play "DevCo 2.0" should be focused on equity, without a great deal of debt.

Several new ideas, including private "PoolCos" that invest on an asset-by-asset basis, look promising but have yet to be fully tested. Such innovative solutions to the industry's financing challenges could bring substantial rewards. We believe markets will test and scale new ways to meet the industry's capital needs.

Another priority is to improve capital efficiency: every dollar deployed needs to achieve maximum impact. Companies that hope to succeed must carefully choose the parts of the value chain and the customer segments and geographies they want to play in, so that capital doesn't get locked up in low-margin uses for long periods. They should also pursue forms of low-cost financing, such as project debt and trade credit (for example, from module manufacturers) to leverage equity returns.

At the same time, solar developers must manage their cash and overall cash-to-cash cycle—a task not for the faint of heart. For example, companies should track expected

cash inflows and outflows at a very detailed level and resist the temptation to push out payment dates, particularly if smaller vendors may not be able to cope with stretched-out payments. Finally, it's important to have a systematic yet flexible approach. For example, utility-scale developers may find that some projects earmarked for long-term ownership should be sold earlier to fund equity checks needed to complete other projects.

Getting back to fundamentals

Meeting these challenges will not be easy, but it is essential if solar is to live up to its potential not only as a source of power but also as an infrastructure asset to be reckoned with.

In 2015 and 2016, the solar industry saw significant value erosion, and matters could get worse before they get better. But the sector has proved its resilience before, and the trends that favor the continued growth of solar power—falling costs, improving technology, and regulatory support—are gaining strength. It is certainly possible that before too long, investors will see solar as routine a feature of their infrastructure portfolios as roads, bridges, and power plants. For that to happen, though, developers will need to be as disciplined and creative on the capital and finance dimensions of the industry as they have been on the technology.

The authors wish to thank Matt Rogers and Humayun Tai for their contributions.