# PV sector outlook: an analyst's perspective

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ABSTRACT

Solar currently represents less than 0.5% of global electricity generation. However, as renewable electricity gains importance in the US$1 trillion global electricity market, we forecast solar photovoltaic shipments to rise at a compound annual growth rate of 50% for the next four years. We expect an increasing number of countries to promote solar energy as the cost gap between solar and fossil fuel-generated electricity closes. This paper provides an overview of what to expect from the PV market in 2010.

## Growth overview

After a challenging 2009, we expect potential resolution of financing/permitting bottlenecks to mark the beginning of the second growth phase of the solar era as we believe new incentives in multiple markets and greater supply of lower-priced panels should lead to accelerated shipment growth from 2010. The solar industry is currently transitioning from the first growth phase – where demand was driven by two to three major markets such as Germany, Japan and Spain – to the second growth phase. We expect grid parity to be achieved in several key markets by 2010–12, which could potentially mark the beginning of the third growth phase for the solar sector.

Solar industry growth over the past five years has always exceeded expectations. German market subsidies were the main driver for better-than-expected demand until 2007; Spain was the source of better-than-expected demand in 2008. Industry demand in 2009 is once again exceeding subdued expectations that were set at the beginning of the year as a result of the Spanish market's decline and financial crisis. Demand elasticity in the solar market has been historically quite significant. Small declines in prices have led to substantial pick-ups in demand, historically speaking.

This year was different for a number of reasons. First, access to cheap financing is the primary requirement for demand elasticity. Financing dried completely in a number of major markets including Germany. Second, the weakening economic and job outlook increased the liquidity risk premium – solar investments being highly illiquid caused a sharp decline along with several other illiquid investment classes. Third, panel prices had increased sharply during the 2007-08 timeframe and as prices started declining, primarily led by aggressive pricing strategies of Chinese companies, several installers decided to wait for price stabilization. We believe prices have now approached a level where the rate of price declines is much slower and as such that the waiting game may be over for a large number of installers.

As the global macroeconomic outlook continues to improve and credit conditions continue to ease, we expect more evidence of demand elasticity in markets with relatively low permitting constraints. After an approximately 15% annual decline in 2009, we estimate that solar industry shipments are poised to increase 50% annually in 2010 to reach 7.4GW. Germany is expected to lead industry demand this year and next with demand from other emerging solar markets excluding Spain, Germany and the U.S. likely to grow at the fastest pace this year and next. We estimate that demand in these emerging markets, such as Italy, Belgium, France, and the Czech Republic, accounted for 1GW and represented 18% of global market share in 2008. Demand is likely to increase 35% annually in 2009 and reach 1.4GW, and an increase of 100% annually in 2010 to reach 2.8GW. We expect the main demand drivers to be strong incentives, highly attractive investment rates of return (IRRs) and gradually easing financing/permitting constraints.

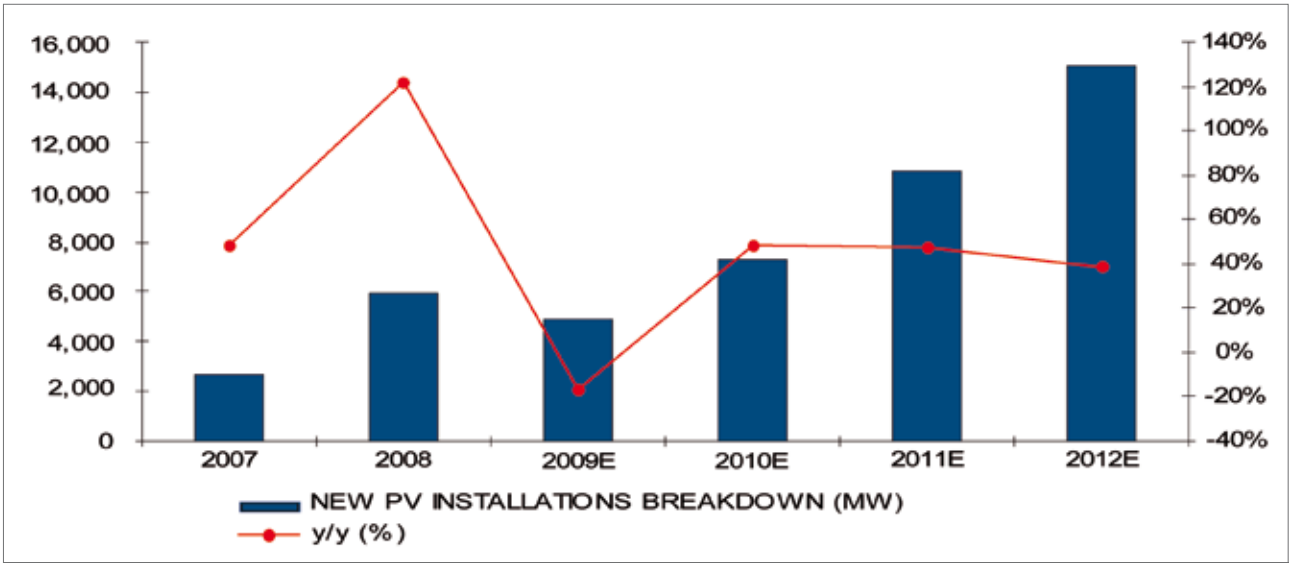


Figure 1. Forecast of new PV installations (MW).

Uncertainty with respect to 2010 demand in Germany remains high. The German government is considering a new subsidy program that is expected to be less generous than the existing subsidy program. Timing of implementation of this subsidy program is likely to define German market growth prospects. Implementation of a new subsidy program in July 2010 is likely to accelerate demand in the seasonally slower first half of 2010 and, although second half growth could likely slow down in a new subsidy scenario, we expect overall German market growth to still increase by 10% annually in 2010. In a scenario where the government introduces a new subsidy program in 2011, we expect the German market to show substantially stronger growth than in 2009, approaching 4GW, based on the current monthly installation run-rate.

Demand in the U.S. market is expected to improve from 2009 levels as some of the utility-scale projects are constructed, commercial segment demand recovers as a result of the DOE loan guarantee program, and the treasury cash grants program and solar project financing conditions continue to improve. An improving economic outlook is also expected to result in somewhat stronger residential demand. We expect U.S. solar industry shipments to increase from 360MW in 2009 to 750MW in 2010.

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Spain and Japan are also expected to show strong demand recovery in 2010. Spanish solar shipments look set to increase from 300MW in 2009 to 550MW in 2010, in line with the current subsidy program cap. We expect Japanese solar shipments to increase from 275MW in 2009 to 375MW in 2010 as new solar subsidies drive stronger-than-expected shipments growth in the residential segment.

We expect the solar industry shipments to accelerate beyond 2010 as several markets approach grid parity thanks to low panel prices. Our current forecasts call for overall industry shipments to increase from 7.4GW in 2010 to 15.1GW in 2012. We forecast German market shipments to increase from 2.8GW in 2010 to 4.1GW in 2012; U.S. market shipments to increase from 750MW in 2010 to 3.5GW in 2012; and Chinese market shipments to increase from 460MW in 2010 to 1.2GW in 2012. Development of the Chinese and German markets is contingent upon implementation or continuation of favourable solar subsidies. Most of the growth beyond 2010 is expected to come from the utility-scale/ground-based market segment. Both the U.S. and Chinese market policies support utility-scale solar generation over rooftop generation and we expect these two markets to lead industry shipments growth beyond 2010.

Several other markets such as India, Canada and Japan have the potential to emerge as strong growth markets over the next few years. Spain was a 200-300MW market until 2007 and the introduction of an attractive subsidy program in this market resulted in a tenfold increase in demand in just one year.

This second growth phase of the solar era and demand upside led by resolution of permitting/financing constraints is likely to continue over the next few years.

## Forecasting demand during second growth phase

Past experience shows that predicting growth in emerging technology sectors is very difficult. Several historical forecasts with respect to adoption of personal computers and telecommunications have proven to be very conservative. Predicting solar industry growth is even more difficult because demand is influenced by several factors, such as oil price movements, subsidy development and exchange rates.

So how do we forecast demand? Our demand forecasting framework is based on two primary growth drivers for solar: development of government subsidies and development of financing. We believe that as long as these two growth drivers are intact, the solar market (the entire value chain) in dollar terms should grow at a robust pace.

In our view, as long as solar is not at grid parity – i.e., as long as solar demand is driven by government subsidies – investors should focus on volume times price, not just on volumes or on price. The upper limit to market growth is likely to be defined by government subsidies: as long as government subsidies grow, solar market size should grow. If volumes increase rapidly, prices should decrease in a similar proportion, in our view, such that the overall market size is the same. Once solar achieves grid parity, the solar market is likely to be driven by the pure economics of supply/demand and is likely to have one less growth driver (no government subsidies).

We expect solar market growth to be determined by how quickly or slowly the solar value chain takes advantage of government subsidies. Growth would be faster if the subsidies are spent over fewer years and conversely, growth would be slower if the subsidies are spent in more years.

For instance, if a 1W solar system costs US$9 and the government incentives are approximately US$13/W, the net profit to the customer is approximately US$4/W. Although the US$13 government incentive is provided over a period of 20 or 25 years, the solar ecosystem receives US$7–9/W up front. Solar market growth is likely to depend on how quickly these solar incentives provided by the government are transferred to the solar value chain through the customer.

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In general, during the next five years, we expect the following factors to affect solar industry shipments:

1. Supply of silicon and solar cells. The supply of solar cells will likely increase rapidly as a result of an increase in production from new and existing silicon players, as well as successful commercialization by new thin-film solar manufacturers.
2. Government support in the form of improved levels of subsidies in existing and new markets. Although we believe Germany will remain an important market for solar energy demand, we expect increased support from new governments in the form of more attractive solar subsidies to drive demand.
3. Favourable solar system ASP trends. We expect solar ASPs to decline by approximately 50% in 2009 and another 30% in 2010, which should improve the economics of promoting solar for several prospective new governments. Moreover, we expect the development of a solar ecosystem in the form of better customer awareness, greater availability of solar modules, and the reduction of installation costs to drive additional solar demand.
4. Development of local fossil fuel-generated electricity rates. As the cost of oil, natural gas, and coal-based electricity increases from 2010, the gap between the solar electricity price and fossil-fuel-generated electricity price will narrow.
5. Development of interest rates and other financial instruments driving solar demand. The low interest rate environment should result in favourable economics for project developers, leading to strong demand.

Courtesy of First Solar.

**Figure 2. Large-scale installations such as Sempra Generation's 10MW plant in El Dorado, Nevada (using First Solar modules) look set to achieve superior growth.**

## How large is the potential solar opportunity in the second growth phase?

We estimate US$200 billion of government spending on gross subsidies in the second growth phase. These calculations are based on a what we believe is a conservative scenario, assuming that governments take note of the increasing subsidy burden and enforce an annual cap on installations. This scenario is used to calculate the minimum growth of installations during phase two of solar industry growth. Our scenario analysis does not take into consideration potential upside from solar programs in new markets and the possibility of no annual caps in several solar markets.

Recalling our demand-forecasting framework: subsidy equals customer profit plus solar industry revenue. We assume that US$50 billion of the US$200 billion incentives constitute profits for end customers and US$150 billion constitute solar industry revenue. In addition to the subsidized markets, we see at least 5GW of utility-scale market opportunity during the second growth phase. Most of this demand will come from U.S. utilities with some initial traction from European utilities. Although the subsidy number seems very large, we believe a more appropriate number for the government to consider should be "net subsidy burden" which takes into consideration factors such as local fossil fuel-generated electricity costs among other things. We estimate the net cost burden of solar subsidies assuming US$0.10/kWh of traditional fuel costs to be US$125 billion during the second growth phase.

> "The net solar subsidies as percentage of GDP are significantly less than health care and education spending in all of the countries supporting subsidies."

In our opinion, a $125 billion cost burden is not that large especially after taking into consideration that it would be shared by more than 12 different countries. We believe the net solar subsidies as percentage of GDP are significantly less than health care and education spending in all of the countries supporting subsidies. The bottom line is that we believe the net subsidy burden is insignificant for governments to potentially scale back solar programs. In our view, solar's job creation potential and the promise of producing electricity at lower prices than natural gas once grid parity is achieved should lead to continued government support during the second growth phase.

## Thin film versus silicon

In our opinion, silicon technology will continue to lead the growth wave for the following reasons: 1) capital intensity of thin-film players (US$2/W) is higher than that of silicon players (US$0.50–US$1/W). We expect relatively low levels of vertical integration in the silicon space especially since upstream/midstream segments have more than adequate capacity to support near- to medium-term growth; and 2) new thin-film technologies could find it difficult to scale and achieve bankability status. Companies such as Sharp that have strong balance sheets and have made significant technology advancements stand to potentially lead the thin-film growth wave along with First Solar. For other start-ups, particularly funded by equipment suppliers such as Applied Materials, we believe success would depend to a large extent on subsidy programs and manufacturing incentives of local governments.

## Where will growth come from: rooftop or utility-scale?

During the first growth phase, markets such as Japan and Germany led most of the installation growth. Growth was largely within the small/medium-size rooftop segment. Over the next three to five years, we see the potential for large commercial rooftops and ground-mounted systems to achieve superior growth as the U.S. utilities become more aggressive with solar PV programs. In the near term, until financing conditions improve, we expect growth to be limited to the small/medium-size rooftop segment. In addition to the traditional markets such as Germany, Italy, and Spain, we expect Japan, China, U.S., Canada, and India to be the key swing markets with potential upside surprise in the 2010-12 timeframe.

## Growth strategies

During the first growth phase, the focus of most companies was to procure as much polysilicon supply as possible. During the second growth phase, we expect the focus of most companies to be on identifying end markets for product deployment. To that extent, we expect execution strategies of companies to be defined by downstream acquisitions. Companies with larger contract wins should be able to scale their operations and increase market share. We expect more downstream M&A activity over the next three to five years as companies look to diversify geographically and establish new downstream channels.

There also seems to be potential for strategic alliances to emerge between large-scale solar power developers with strong financial backing and upstream polysilicon players with relatively strong balance sheets. Downstream players will most likely lead the industry transformation as the power development market is localized as inherently more complex industry constraints have shifted from upstream to downstream.

As cell/module players reach efficiency development limits, we expect scale to be the primary cost differentiator, resulting in the emergence of EMS-type business models in the mid-stream segment. Although it is early days yet to identify obvious winners in the race toward market leadership, we expect a combination of business models to dominate the sector over the next three to five years as: 1) midstream players aggressively diversify downstream through power developer M&A; and 2) large-scale downstream companies (there are only a handful at present) strike alliances with upstream players.


### About the Author

**Vishal Shah** joined Barclays Capital in September 2008 as the head of the Cleantech equity research team. Formerly, he was the lead Cleantech equity analyst at Lehman Brothers, covering U.S. and China-based solar stocks. Vishal has been an equity analyst covering solar and semiconductor equipment sectors since 2002 at firms such as Lehman Brothers, Needham & Company, and Morgan Stanley. In 2009, his team received top recognition in the Institutional Investor All America Research Survey. Before joining Wall Street, Vishal worked in the semiconductor equipment industry at Applied Materials. He earned a B.Tech. degree in chemical engineering from the Indian Institute of Technology, Bombay and an M.B.A. from INSEAD, France.

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