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## The Solar Supply Chain Will Continue to Struggle Between Under and Oversupply

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### Introduction

The solar industry will continue to struggle between over and undersupply as long as the end-user market is growing by double digits. The ramp rates of the different supply nodes are too different and will continue to be out of balance for the foreseeable future. iSuppli analyzes the solar industry independent from any industry consensus and develops leading indicators to forecast changes of demand.

This document summarizes recent findings on the supply and demand balance of Polysilicon, Cells, Modules as well as the forecast of PV systems.

### Polysilicon

In October 2008 iSuppli investigated the solar silicon supply and demand situation. The results were astonishing: "Solar silicon will soon become cheap with spot prices dropping from 450\$/kg in (Q2/2008) to less than 150\$/kg in 2009." When presented to the public (Tokyo, October 21, 2008), solar silicon was traded at 400\$/kg, wafers were being sold at 8\$/piece. Many found it hard to believe that prices would fall soon in only a few months, we stated in October 2008:

"Polysilicon pricing has peaked and will decrease from 2009 on. The spot market price will become volatile and could drop by 50% over 2009."

In February 2009 it had become reality. Polysilicon was being sold at 120\$/kg and less, the downward pricing dynamics were even stronger than expected.

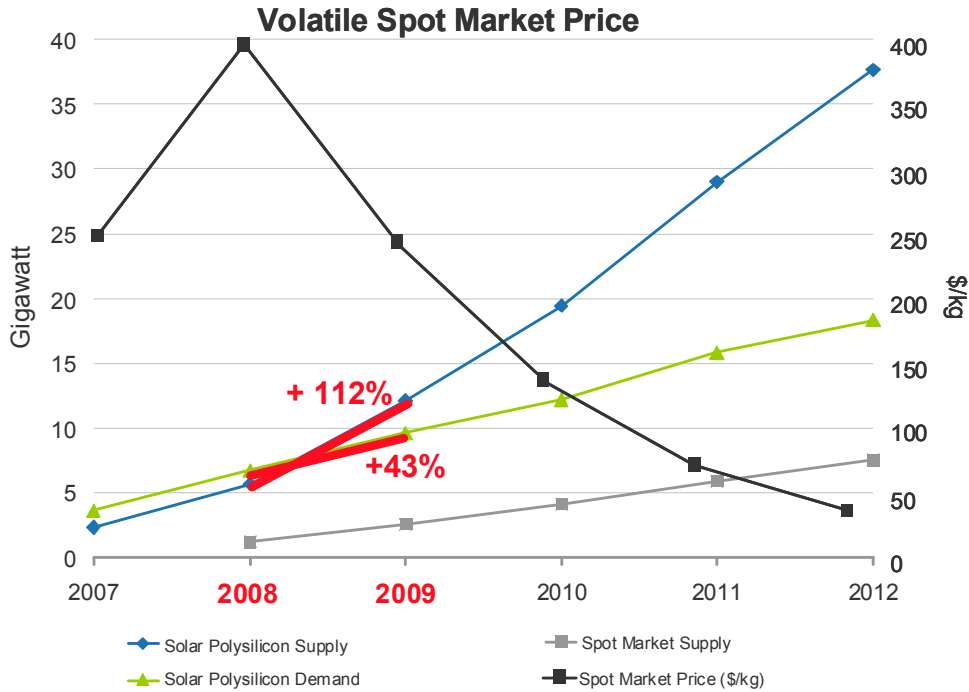
The Polysilicon price forecast is based on the iSuppli supply and demand model. This model analyses in detail the majority of silicon suppliers and assesses the polysilicon output per plant according to the supplier's production status, technology and financial viability of each plant. Assessing the multiple expansion projects in detail yields the following main findings:

- ▶ From the beginning of 2010, solar polysilicon supply will exceed demand.
- ▶ Significant polysilicon oversupply will build up through 2012.
- ▶ Different ramping rates of polysilicon and solar cell manufacturers will lead to continued supply chain imbalances. Solar polysilicon supply will double from 2008 to 2009, while demand will grow only by 34%.

iSuppli estimates that over 90% of the existing PV supply chain is characterized by fixed supply agreements that are incapable of adjusting to actual changes in end demand, with or without subsidies. The ramp of production throughout the PV supply chain is accelerating at an unprecedented rate. Supply and demand will not be able to maintain balance at the various supply chain nodes for any length of time, resulting in substantial swings in inventory and pricing over the next two years, at which point polysilicon supply will so far exceed demand that all contracts and sales channels will need to be redefined.

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Figure 1: Disconnected Supply and Demand



Source: iSuppli Corp. | April 2009

Cells and Modules

During November 2008 isuppli analyzed the cell and module market. Again the result was astonishing: In 2009 more than 10 GW of modules will be produced but only 4 GW are likely to be installed. Only one out of three modules will be installed, showing a 160% oversupply. In consequence solar module prices will drop drastically by 40% from 4\$/W in Q4/2008 to 2,50\$/W during 2009.

Reviewing this announcement in April 2009, we can confirm that the module prices are down to the 2,5 to 2,8 \$/W level.

The iSuppli forecast of January 2009 exceeded by large margin any announcement made by the industry itself announcing price declines of 10 to 15% during 2009. On January 16, 2009 we presented these finding in a public Webinar, stating: **“The module market has entered a period of substantial oversupply that, in fact, has been building up since early 2008.”**

This oversupply of modules did not impact pricing in 2008. The short-term heavy demand from Spain and Germany, as well as expectations that the United States would be the next boom market, kept project developers busy and module orders high.

In 2009, 11.1 GW of modules (crystalline and thin film) will be produced, compared to 7.7 GW in 2008 (Figure 1). iSuppli’s “Most Likely” scenario (Figure 2) for module demand calls for installations to reach 4.2 GW in 2009, up a very modest 9.6% from the 3.8 GW installed in 2008. Changes in Spain’s feed-in tariff as

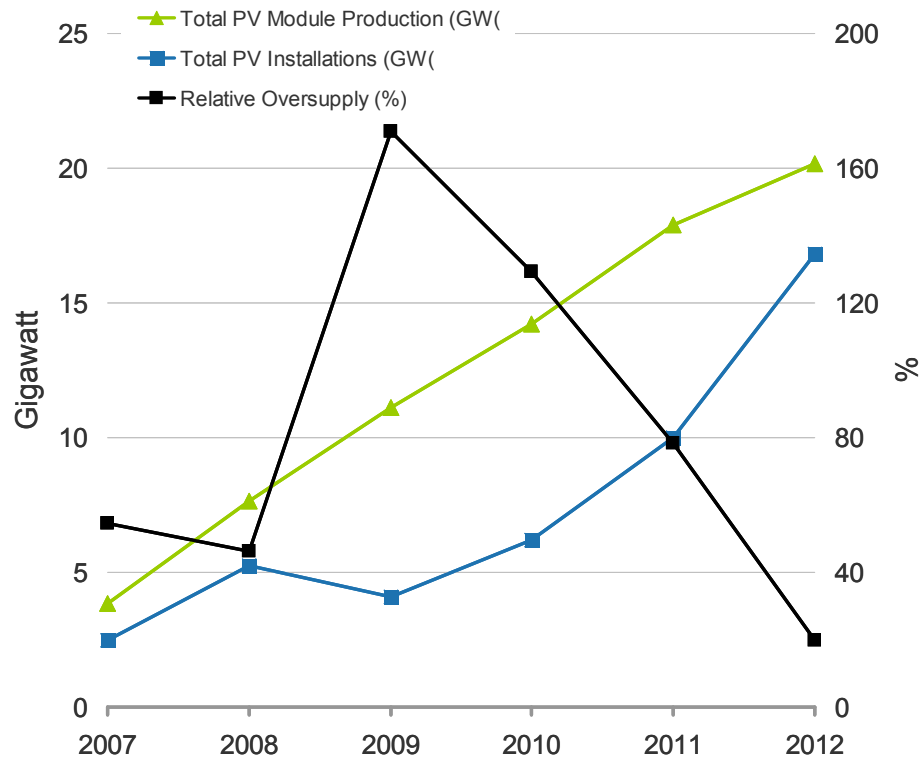
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well as the global economic slowdown are significant factors in the installation growth rate slowing in 2009. For every module that will be installed in 2009, one-and-a-half modules will be stored in inventory—not including the oversupply of 1 GW built up at the end of 2008.

**Despite a price drop in 2009, little room remains for an “Elastic Upside”**

Prices for panels will collapse for all new installation contracts from the current level of \$4.20/W to the \$2.50-\$2.75/W range. iSuppli estimates that overall panel ASPs will average about \$3.10/W in 2009, as a significant percentage of panel deliveries and pricing will be set based upon 2007 and 2008 contracts that had much higher pricing. iSuppli estimates 4.2 GW of panels will be installed in 2009, up from 3.8 GW in 2008. We note that upside demand for lower-cost solar panels is absolutely limited in 2009 by installation capacity to 6.0 GW, but financial uncertainty and promotional/contract lead times will bring practical 2009 elasticity of demand to near zero. The additional demand will not clear the market of excess inventory.

Figure 2: Photovoltaic Module Production, Installations and Oversupply



Source: iSuppli Corp. | April 2009

The individual success of companies will depend on how well they can reduce their prices to the clearing price of \$2.85/W while still remain profitable. In the second half of 2010, module demand will likely return to pre-2009 style growth rates as the demand picture improves, as some weak players are eliminated, and as price declines slow.

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Companies producing at “best-in-class” cost (e.g., First Solar, Q-Cells) are well positioned. Second, backward-integrated companies (e.g., SolarWorld, REC) can maneuver faster and make deeper price cuts. Third, companies that are integrated downstream (e.g., Conergy, REC, First Solar) will have big advantages because they can secure module sales directly with the end-customer and are able to recover margins with installation services.

The success of PV companies will depend on three waves they must surf to survive the module inventory tsunami:

- ▶ Lowest production cost per production level
- ▶ Reduced procurement prices/costs and ability to renegotiate supply agreements
- ▶ Downstream integration with installation and planning companies

By H2 2010 demand will accelerate through additional installation capacity, and internal rates of return (IRR) will improve due to low module prices and renewed and extended government incentives as a result of combating the economic slowdown. The strategy of photovoltaic cell and module companies will shift from production expansion to one of cost reduction and downstream integration. One of the first movers was Q-Cells, whose subsidiary, Q-Cells International, installs large PV projects. Other companies with integration efforts include First Solar, which invested recently in SolarCity; and Sharp, which is now partnering with ENEL in Italy. Many Asian (non-Japanese) companies appear to be missing this diversification trend and are focusing only on economies of scale and upstream integration (silicon, wafer).

### PV Systems Demand

In March 2009 iSuppli investigated the end user market for PV systems. We stated that: **PV system revenues at the point of installation grew to \$30.5 billion in 2008 but will decline by 40% to \$18.2 billion in 2009**

Solar revenues spiked in 2008 due to the extraordinary installation eruption of 2.6GWatts in Spain, which was stimulated by a looming drop in its favorable feed-in-tariff and associated capacity in 2009. From 2009 to 2011, the Spanish market will be limited to 500MWatts, the cap for projects qualifying for FIT incentives. Despite attractive investment conditions in France, Italy, Czech Republic, Greece, and other countries, these markets will not compensate for the decrease in Spanish investment over the next two years (see Figure 3).

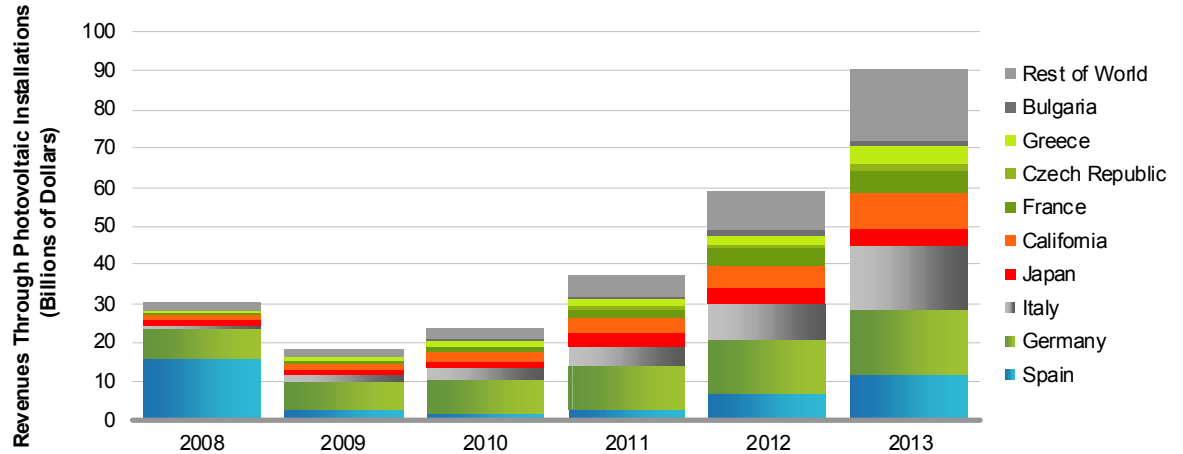
The credit crunch and the economic downturn are impacting solar investment decisions in all market segments and most geographies. For 2009, iSuppli forecasts worldwide installations, in terms of megawatts, will decline by 32%, while the average price of an installed solar watt will decline 12% to \$5.14.

Since many power production investors and commercial entities are at least partially dependent upon debt financing, as of Q1 2009, many large and medium solar installation projects are on hold as they wait for bank credit to begin flowing again.

Increased government incentives in the U.S., and those just announced in China, will help PV deployment in those countries, and act as a counter to the negative macroeconomics forces, but they will still remain a relatively small part of global demand until 2011.

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Figure 3: PV System Revenue Forecast, 2008-2013



Source: iSuppli Corp. | April 2009

As the PV industry navigates around the “bubble” left by the decrease in the Spanish market, the fundamental drivers of PV demand growth remain intact. Annual solar installations are forecasted to reach 26GWatts or \$90 billion in value by 2013.

PV continues to demonstrate a favorable ROI. Government incentives in the form of above market feed-in-tariffs and tax breaks are still needed to make the ROI equations viable through 2012.

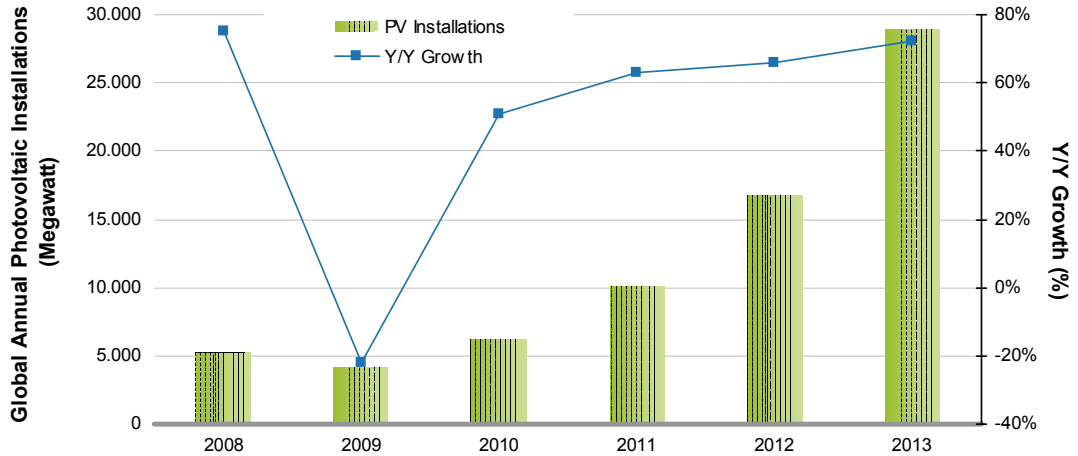
After 2012, the reduction in PV costs will lead to attractive ROI and payback periods even without governmental assistance.

Accelerated in part by the over supply mode of the PV market, module prices will decrease by 40% in 2009. System prices (which include the balance of system and installation service) will decrease by 10% to 15% per year through 2013.

Lower system prices will open up new markets by lowering incentives and subvention costs. The lower the PV system prices become, the lower the incentive schemes have to be. The “Rest of World” markets will be the big beneficiaries of this and as a result will grow faster than the average.

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Figure 4: Global Photovoltaic Installations, 2008-2013



Source: iSuppli Corp. | April 2009

Again, this forecast differs significantly from the industry consensus: while industry consensus is that 5 to 7 GW will be installed in 2009 our views are much different.

Companies should prepare for the worst. Some companies recently stopped their activity e.g Silpro a French silicon manufacturer stopped its activity due to a lack of follow up investment financing. Optisolar joined First Solar for a similar reason along with a lack of cash.

To survive this storm of oversupply, companies will have to rely on cash and equity generating in the short term. In parallel companies should try to develop individual niches to secure long term demand even going so far as to build and operate PV Power plants. Specialization and differentiation on the solar cell or module itself is difficult, solar producer have become commodities with little differentiation in quality and performance. Companies have to further develop the business models to succeed in this new reality.

Nearly all solar companies have been surprised by the fast changing conditions that turned the buyers market into a sellers market. Believing in the industry consensus fooled even the biggest, strongest and most experienced suppliers. It is our aim to provide independent solar information to support efficient production, capital spending and alert our clients when the market is forecasted to swing again.

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iSuppli Corporation is the global leader in technology value chain research and advisory services. iSuppli delivers vital information on the status of the entire electronics value chain - from diodes to displays and from application markets to emerging markets. iSuppli's Market Intelligence Services are designed to help industry participants improve the cost and performance of their supply chains by delivering the research, analysis, and tools that facilitate strategic and operational decision-making. More information is available at [www.isuppli.com](http://www.isuppli.com).

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