

100GW of commodity PV

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ABSTRACT

The PV industry stands on the verge of an enormous achievement – an installed base of PV plants with 100GW of energy generation capability. This milestone has come about because of the contributions of a fully global industry that has blossomed in the past decade. Yet even though the PV industry traces its heritage to before the space programme, as with any dynamically growing industry most industry members have joined in the past five years. And each generation often makes the same mistakes that a previous generation made. Sometimes the same people move from one industry to another and repeat the same mistakes there. The PV industry is rediscovering ultra-competitive market dynamics that have previously been seen in other high-technology commodity markets. This paper begins with a discussion of one such market – the dynamic random access memory (DRAM) industry – and then looks at the current PV market and the industry outlook.

Volatility and consolidation in the DRAM market

The DRAM market serves as a history lesson whose key points apply very well to the PV market. A large number of companies invested in the development of a technologically complex memory chip that was a core contributor to the computer industry. Yet despite that core contribution, the DRAM industry has suffered severe volatility. Fig. 1 shows the revenue and shipments on a megabyte basis for the past 20 years.

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The DRAM industry experienced several major periods of volatility and turmoil. Prices have been severely affected by this turmoil (sound familiar in the PV market?) as well as by continued technology development. The list of firms exiting the market was a ‘who’s who’ of the technology arena, ranging from Intel and IBM to NEC and Mitsubishi. The characteristics of the winners may be familiar – they have the ability to invest in manufacturing capacity and market development in a downturn, possess a good technology base and excel at high-volume manufacturing.

These elements are useful in considering the dynamics of the current PV market, starting with demand, pricing, the competitive landscape and the implications for the market.

100GW of installed PV by 2013

Fig. 2 highlights the amazing run that the industry has had so far. Worldwide,

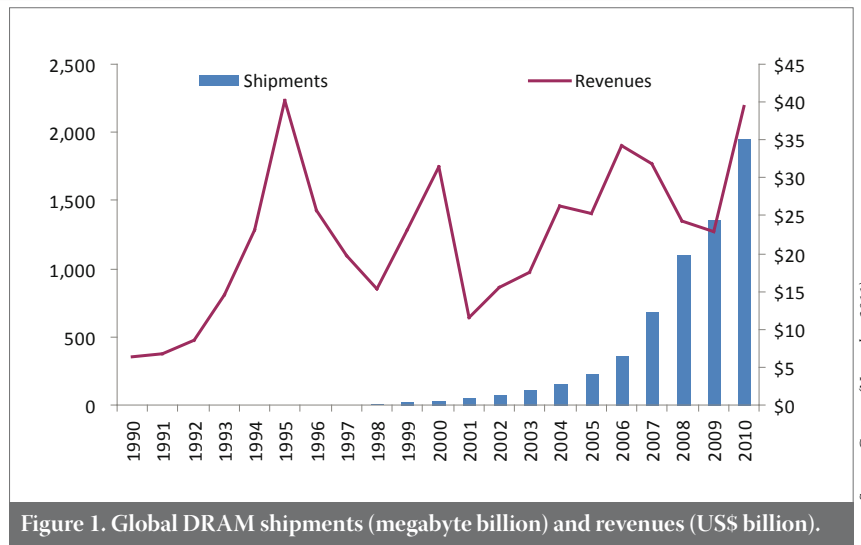


Figure 1. Global DRAM shipments (megabyte billion) and revenues (US\$ billion).

installations are approaching a cumulative installed base of 60GW of energy generation capability by the end of 2011, facilitated by huge step functions in demand in 2008 and 2010.

What is even more impressive is that there is the potential to reach 100GW of installed systems by 2013. Even in the exuberant 2008 market, a high probability

would not have been assigned to reaching this milestone so soon, given pricing and financing trends.

As a caveat to any discussion on a PV industry forecast, it should be remembered that 12 months in the PV industry often resembles 3 to 5 years in other industries, so PV forecasts have bigger error bars than other markets. Looking at global

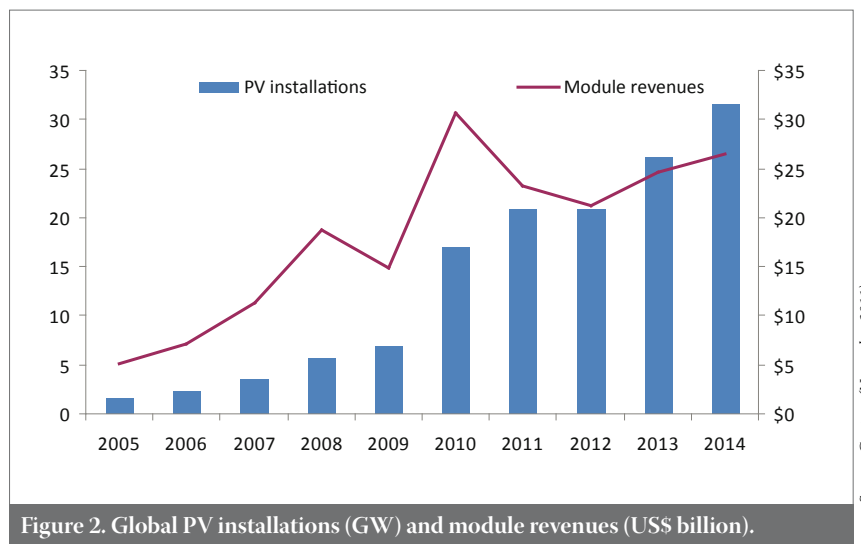


Figure 2. Global PV installations (GW) and module revenues (US\$ billion).

PV markets, Gartner forecasts PV panel installations will reach 34GW in 2014, in the most likely scenario. This represents a compound annual growth rate (CAGR) of 16% from 2010 to 2014. This growth rate reflects the scale reached by the market, particularly the widespread adoption of PV around the world. But like all good things, as adoption has grown, growth rate has slowed down, particularly given the historic CAGR of 66% from 2006 to 2010.

Fig. 2 also highlights the fact that the PV market has had one of the shortest industry cycles possible. Its revenue recovered from the down cycle of late 2008 and early 2009 to reach another record high in 2010, and then got hit by demand and price uncertainty again in 2011. Revenue for the PV panels from installations is forecast to contract by a compound annual rate of 4% through 2014 to \$26 billion.

Yet given the steep fluctuations seen in demand, it is worth discussing this forecast from the perspective of two sets of core building-block assumption areas. The insights that these provide will help in understanding the numbers in the most likely scenario.

Shift of PV demand's centre of gravity

PV demand remains dependent on government incentives. While European economies were strong and the PV market

relatively small, governments provided generous incentives to meet their altruistic commitments. Investors funded these PV plants to reap attractive rates of return, creating a boom in the market.

“PV demand remains dependent on government incentives.”

But the macroeconomic uncertainty of the past 3 years has taken a strong toll on these incentives, with some governments, such as Spain, gutting their incentive programmes. Fortunately, other governments limited their reductions or set more predictable schedules. This, combined with falling PV project costs, enabled investors to find attractive returns, even as risk premiums fluctuated during the most recent set of macroeconomic crises. Fig. 3 illustrates Gartner's view of the attractive national markets.

Germany remains an attractive market for PV and has established streamlined processes and procedures for PV project construction, permitting and interconnection. The country has a strong commitment to renewable energy resources: with its stated goal of reducing nuclear energy plants, PV is an attractive option. The German government has instituted stepped reductions in its incentives programme, including its

most recent announcement of a 15% reduction in January 2012. Gartner's view of PV price points (see the next section) indicates PV will remain an attractive market for investors and developers. Note that, given its large installed base of PV systems, time of use and time of supply are increasingly important factors in Germany, especially given weather-based fluctuations. The incentive programmes there will increasingly take account of either back-up fossil fuel generation plants or storage technologies.

Data about installations in Italy indicate it will be the largest market in 2011 for PV plant activations and connections to the electric grid, although almost half of these may have been built last year but not connected until this year. However, this magnitude of installations is not expected to be sustainable given development complexity in Italy and uncertainty about its incentives.

Finally, the US, Japan and China form very attractive growth markets, driven by government incentives and/or price considerations. Japan's energy crisis after the tsunami led the government to institute increased support for PV systems. This favours domestic Japanese PV firms in an extremely competitive market. The US continues to have a mix of incentives for PV systems, although the tax grant programme is unlikely to be renewed in this political environment. However, US

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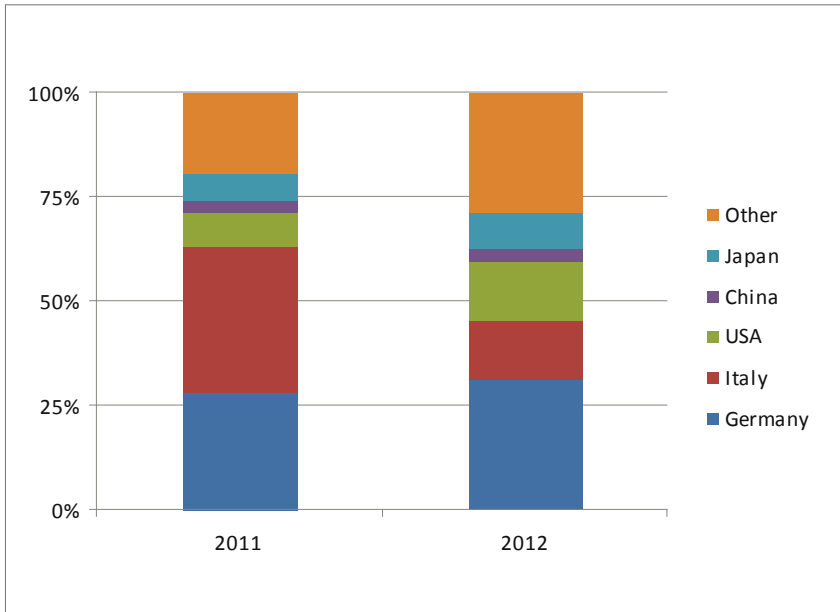


Figure 3. PV installations by country (% based on GW forecast).

Source: Gartner (November 2011)

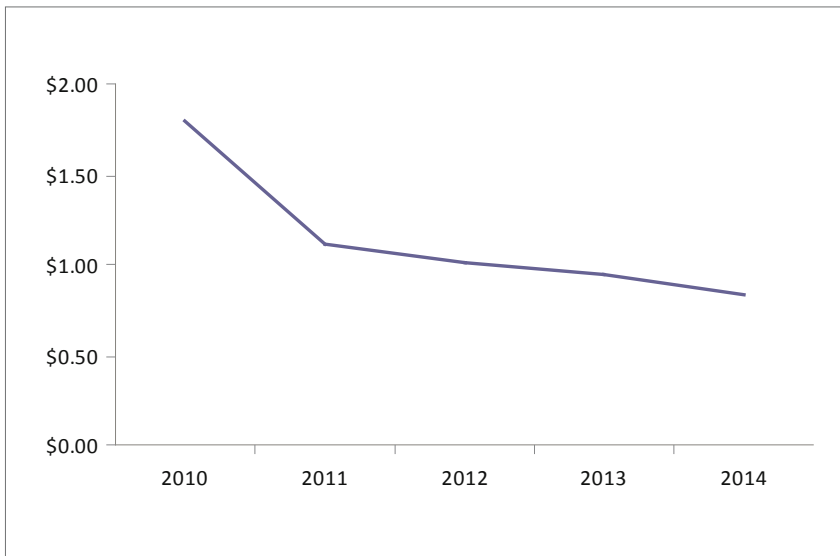


Figure 4. Average selling price of PV modules (US\$/W).

Source: Gartner (November 2011)

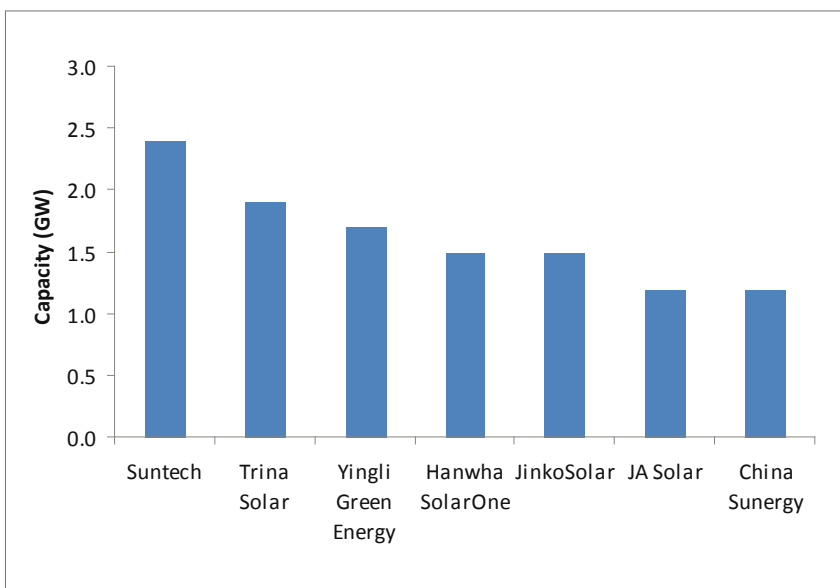


Figure 5. Planned module manufacturing capacity of key Chinese PV firms to end of 2011.

Source: Company reports (September 2011)

utilities are increasingly commissioning PV power plants or signing power purchase agreements (PPA) from PV plants, driven by their public utility commission requirements. Note that the prices for these PPA contracts are extremely aggressive, with 1–2MW projects at \$120 per MWh plus an additional time of use price supplement and large projects at much less.

China rounds out the list of attractive markets. As part of China’s 12th Five-Year Plan, support for PV was announced, with a target of 20GW by 2020. China will need to invest the next couple of years in developing the processes and procedures for site identification, financing, permitting and grid interconnection. Therefore Chinese domestic demand will continue to ramp up for the next two years as it develops its processes. However, its long-term potential does make China a very attractive opportunity for PV value-chain members.

The fundamental assumption here then remains that the price relationship to existing or stepped-down government incentives is good enough to incentivize investors to build more power plants. This leads to the next topic – price.

Downward pressure on PV system prices

The dynamics of the revenue contraction presented in Fig. 2 are reflected in the price trends for PV modules as shown in Fig. 4. The 2011 revenue contraction in particular reflects the hangover in current module pricing, with current lows of \$1.00 to \$0.85 per watt for very large utility-scale installations. These October pricing levels are spurring demand as investors work to ensure that they lock in 2011 incentives, either from FiTs in Europe or from the US tax grants. Unfortunately, the market volatility that has driven price cuts will remain in 2012, with continued uncertainty in government incentives and inventory levels, and macroeconomic levels still being a factor in investor confidence.

Yet just like the bankruptcies and consolidation in the DRAM industry, the bankruptcies of Solyndra, SpectraWatt and Evergreen highlight the fact that pricing is affecting PV companies that are unable to reduce their price structures. And note that there are an unknown number of tier 3 Chinese PV firms that either have gone bankrupt or are desperately searching for financing. The good news is that it is unlikely that the 2011 price decline rates will be replicated in 2012, given current industry cost structures, but competition and lower government incentives will continue to have an impact on pricing.

The top-tier companies can be expected to maintain their price competitiveness by increasing their investments and focusing on:

- Economies of scale
- Technological R&D
- Flexible cost models
- Access to capital

A crowded, competitive PV module field

Yet given these statements on price competitiveness, there continues to be an excess of manufacturing capacity relative to projected demand. The difference covers the entire spectrum of the PV value chain, starting on the silicon side and going through the module side. This reflects the nature of business investments that have been made during the recent market peaks and partly reflects the industry's use of low-cost government funding or incentives for manufacturing capacity.

It is particularly instructive to look at the Chinese volume leaders. Fig. 5 highlights the scale of the manufacturing capacity of key Chinese firms. Few other firms apart from Sharp and First Solar can match the scale of the Chinese firms or have the ability to access low-cost financing sources. This will be a critical influencing factor in making the scale, R&D and cost control investments that will determine competitiveness in the industry.

With a large number of smaller firms competing in this market, the previously discussed characteristics of the winners remain critical. They have the ability to invest in manufacturing capacity and market development in a downturn; they have access to low-cost capital; they have a good technology base; and they excel at high-volume manufacturing. In particular, the larger players will be able to invest in the necessary R&D to improve their products at price points beyond what the competition can match.

Conclusion - a stabilizing commodity module market

The PV module market has reached enormous heights, with 100GW of installed systems just around the corner. However, it also appears to be entering a low-price, low-margin phase, where few of the module vendors will have significant profitability under current business models and pricing. The large vendors who have the capacity and technology will consolidate their power in this market, as has been the case in other markets. A wave of consolidation will probably be seen as the normal slow seasonality of the first half of 2012 combines with these low-price points and margins to hit the weakest players in the market.

This does mean, however, that a market

in which there will be attractive work with and around PV is on the horizon. Project development will be a growth market, as electricity from large PV generation plants is reaching a price point that brings them close to being competitive with other generation plants. First Solar, SunPower and Sharp have made aggressive moves in this direction, and traditional energy firms, from EDF to NextEra Resources, are making more and more aggressive investments in this arena.

The excitement of the module industry's growth phase has waned a bit, but continued investments are expected in technology that improves module efficiency and lifetime quality. Nevertheless, just as PCs, servers and other markets innovated and leveraged DRAM price trends, a significant energy and excitement exists in the end markets that use PV modules. Project development, consulting and financing will be poised to grow significantly, as will complementary markets such as energy storage.

About the Author

Alfonso Velosa is a research director with the semiconductor team at Gartner. In this role, he focuses on sustainability topics such as photovoltaic systems and smart cities.

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