

# Global Market Review of Solar Photovoltaic Power Generation

2009 Edition



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## **Preface**

This report is intended to provide an overview of the global solar photovoltaic power generation market, providing some detailed information on the main drivers, trends, opportunities and challenges facing the sector. One of the key issues for photovoltaic market is to reduce the ratio of manufacturing cost to power output, and more specifically for solar modules, the manufacturing cost per kWh. As the market continues to grow and develop, cost reductions will be achieved through improvements in technology, economies of scale and increased efficiency in all parts of the value chain.

Today, the photovoltaic market is characterised and driven by a variety of government subsidies and policies. Europe is the world's largest photovoltaic market with 22 countries currently offering feed-in tariffs. While Germany, Japan and the US represent the largest markets for photovoltaics, other countries are entering the market with ambitious plans as the industry extends its global reach. Indeed, the solar photovoltaics industry has seen the entry of a number of new players, especially from China. This report considers the current status and prospects of the major national solar markets, namely Germany, Spain, Japan and the US. It also explores the prospects for solar markets in France, India, Italy and South Korea.

The scope of this report therefore includes:

- Global trends in the demand for thin film photovoltaic alongside current production capacity.
- Investments being made by manufacturers in terms of technology and R&D focus.
- Encapsulation materials being used for solar photovoltaics, including EVA (Ethylene Vinyl Acetate) and PVB (polyvinyl butyral).
- Current commercial status and future viability of the silicon photovoltaic industry.

Although the solar power industry faces promising prospect for growth, it must address some major challenges in commercialising organic photovoltaics. Included in the report are comment and coverage of a range of manufacturers, setting out how they are overcoming the major hurdles to commercialisation.

## **Executive summary**

### **As fossil fuel resources become depleted—**

While fossil fuels are limited resources that are gradually being depleted, the demand for energy continues to rise. That, and the unpredictable nature of the global oil and gas market, suggests that a long-term increase in the price of fossil fuels is unlikely. Concerns about the availability and environmental impact of fossil fuel energy supplies are therefore driving demand and investment in alternative sources of energy such as solar power. Indeed, a combination of government incentives, interest by investors in ‘green and clean’ technology coupled with growing demand from consumers for cheaper alternatives to fossil fuels have ignited a boom in all forms of solar energy.

### **--interest in solar power gathers momentum--**

Over the past few years, the photovoltaic market has been growing rapidly, reflecting concerns of increasing prices of oil and other materials, as well as increased environmental awareness arising from international activities aimed at reducing carbon dioxide to help reduce the affects of global warming.

### **--driven by a variety of government incentives**

The photovoltaic market today is characterised and driven by a variety of government subsidies and policies. Europe is the world’s largest photovoltaic market with 22 countries currently offering feed-in tariffs thereby contributing to this regional market’s expansion. The market is also expanding rapidly in the US with incentives having been implemented in 38 states.

Residential subsidies were introduced in Japan in 1995. The German EEG Act was enacted in 1998 and subsequently reviewed in 2003. The California Solar Initiatives Programme was brought into effect in 2006. Implementation of such policies has contributed to rapid market expansion.

### **As the global economy slows down, a new industry flourishes—**

Meanwhile, the number of new solar photovoltaic system manufacturers has increased considerably in the past three years on the back of rapid market growth and production expansion by material manufacturers. In addition to small and medium sized manufacturers, a number of larger companies from other industrial sectors are beginning to enter the solar industry, for example, Intel, GE, Hewlett Packard, Samsung, LG and Bosch.

## **--yet challenges lie ahead**

Despite the economic climate in developed nations, the solar photovoltaics industry is growing at an unprecedented rate. Growth is set to soar as interest and demand for renewable energies gathers momentum.

Yet the industry still faces some major challenges in commercialising organic photovoltaics. Steps are being taken to improve manufacturability, efficiency and durability. Solar energy is still unable to compete with fossil-based energy sources. The main goal of manufacturers is therefore to bring the price of photovoltaic energy down to the same price level as energy from traditional sources within the next few years.

The two biggest requirements for solar photovoltaic products are total system cost reduction, including installation costs, and reliability in continuing to generate stable output over the long term. The factor with the biggest impact on cost is conversion efficiency. As conversion efficiency increases, cost decreases.

As the cost of photovoltaic technology has fallen significantly since the early 1970s – as much as 90% -- photovoltaics have become an increasingly attractive option for a variety of both small -- and large-scale uses. They are in use in outer space, at the polar caps, and are a desirable source of electricity in rural areas of developing countries. Although photovoltaics is still a small part of the energy make-up of any given country, more and more homeowners are turning to photovoltaic systems to supplement their conventional power utility.

According to the EPIA (European Photovoltaic Industry Association<sup>1</sup>), scaling factors, improvement in efficiency (from 6% – 12% today to 10% - 15% in the coming years, with a potential of more than 20% efficiency in the long term) and development of new production technologies can significantly contribute to further reduce thin film module manufacturing costs to €1/Wp and below in the near future. Future material developments include further optimisation of the different cell concepts (a-Si, a-Si/ $\mu$ c-Si, CI(G)S and CdTe) but also the development and commercialisation of new concepts such as polymer solar cells and other types of organic solar cells (dye sensitive solar cells). The EPIA adds that improvement in the lifetime of solar modules is another step to further reducing solar electricity prices. The standardisation of components and manufacturing processes is also a key element towards mass production and industry maturity.

Without a doubt, the global financial crisis has not improved the framework conditions. Nevertheless, we see only a few signs of the slowdown in demand as yet. The limiting factor in the growth of the industry is likely to continue to be the supply side throughout 2009.

### **Bright future**

As part of the European Photovoltaic Conference in Valencia in September 2008, Anton Miller, CEO of Q-Cells SE, stated on behalf of the European Photovoltaic Industry Association, how the industry views the future: in 2020, 12% of the electricity in the EU is to be generated by photovoltaics. That signifies some 350 GWp output being installed by then. This is many times the output installed today and it will require an enormous effort to achieve this target. But it is based on a simple calculation, says Q-Cells. Given rising electricity prices and falling photovoltaic costs, grid parity will be achieved in 80% - 90% of the European electricity market by 2020. This means that electricity from one's own solar system will be cheaper than that provided through the grid. This will make solar electricity competitive in economic terms. In view of existing electricity generation capacity, a share of 12% is feasible on this basis, says Q-Cells.

It is generally anticipated that the global expansion for renewable energy sources and thus photovoltaic systems will increase considerably. Rising energy prices worldwide and the increasingly visible impact on climate change have also made the need to make greater use of renewable energies become more than obvious in 2009.

<sup>i</sup> With 170 members drawn from across the entire solar electricity sector, the European Photovoltaic Industry Association represents 95% of the European photovoltaic industry. EPIA members are present throughout the value chain of the photovoltaic industry: from silicon, cells and module production to systems development.