

**SUSTAINABILITY**

## **Solar power facing sunny times, in spite of some turbulence**

**The solar power business is presently going through a period of dynamic change. To learn more about what is happening on the market for this rapidly growing renewable energy source, we recently spoke with Jyrki Leppanen, Market Director of Solar Inverters at ABB, the global giant in power and automation technologies.**

Hugh O'Brian

ABB is deeply involved in the solar energy business and makes essentially all the major system components except solar modules, which have recently become more or less a commodity. Leppanen studied Nuclear and Energy Physics at the Helsinki Technical University and has since worked in the solar power business for more than 20 years. His career has covered R&D, product management, sales and market management with utility and energy companies before he joined ABB in 2009.

### **WHY IS SOLAR POWER BECOMING SO POPULAR?**

There are several key drivers at work, such as obviously rising energy prices, falling costs for photovoltaic (PV) systems and increasing demand for sustainable energy from renewable sources, as well as the gradual opening of energy markets. Looking at economics, the dual effect of rising electricity prices and falling PV system costs means that the much-discussed economies of scale for PV are starting to kick in. This triggers a positive spiral of accelerating popularity for further growth in new markets and countries. In some countries, we are approaching "grid parity" – where the cost of producing energy from rooftop solar modules equates to the cost of retail electricity from the grid.

In 2011 alone, newly installed solar energy capacity on a global scale rose by approximately 25 GW of nominal power, corresponding to three to four large nuclear power stations. This jump of 25 GW of new capacity in 2011 is 40% higher than new installations in 2010, which was around 18 GW of new PV capacity. In 2009 about 8 GW was added.

Thus the global capacity has now reached over 65 GW at the end of 2011. Although growth has been somewhat uneven, the increase in newly installed PV capacity over the past decade has averaged around 50% per year.

### **WHAT IS INVOLVED IN A PHOTOVOLTAIC SOLAR ENERGY SYSTEM?**

The key components are the solar modules, an inverter, some protective devices, switches, and connection boxes as well as cabling which connects these all to each other and to the electricity grid. The electrical grid is of course the regional interconnected network for delivering electricity from suppliers to consumers.

The most visible components are the solar modules that you see mounted on a roof or on the ground in some cases. These generate DC electricity using the photovoltaic effect. The DC power then needs to be converted to AC by the inverter.

The inverter is a very key component as it is both the heart and brain of the system. It sits between the array of solar modules and the electricity grid, so it needs to actively follow and today even support grid voltage and frequency. It also must be robust to resist disturbances from either the solar array or the grid.

Whereas earlier the inverter had the simple function of only converting DC to AC, it has now become much smarter and more sophisticated. Using advanced hardware and software, the inverter is responsible for running and optimizing the whole system, seeking the best uptime and conversion efficiency.

### **HOW DO COUNTRIES STIMULATE INVESTMENT IN SOLAR PV SYSTEMS?**

There are various schemes in various countries. The three most popular are direct subsidies, feed-in tariffs (FIT) and independent power producer (IPP) plans. Direct subsidies simply mean that a percentage of the investment cost is paid by the government. This is easy for the government to budget for but it doesn't guarantee the plant will work

optimally and for a long time, which was an issue in the early 1990s.

Feed-in tariffs essentially guarantee the owners of solar power systems a higher fixed price from the utilities for the electricity fed into the grid.

This premium was meant to reflect the fact that solar power does cost more to produce, at least initially, and the FIT would help compensate for that additional cost of renewable energy. The FITs are generally monitored and adjusted downward from time to time to reflect the decreasing solar module cost.

And then there is the IPP or Independent Power Producers plan, where an energy supplier makes an offer to supply electricity based on solar power at a certain price, with their margin built in.

### HOW HAS THE MARKET DEVELOPED?

The PV market has seen enormous changes and turbulence over the past 20 years or so. In the early-to-mid 1990s investments in solar power generation were often a sort of PR action. An example might be solar modules built into the facade of an office building, which would give the company a green image and also generate some electricity as well.

Feed-in tariffs, which were introduced in the 1990s, were initially limited by the project size and also by the total annual volume, which generally were fairly small. In recent years, however, total volumes have become much higher and systems are also bigger. This meant that the building of solar power generating plants became very much investment-driven, because investors saw this as an alternative to other investments. They could build a solar plant and take advantage of the feed-in tariffs to make a good profit on their investment. So we had a boom in new capacity, which is what was wanted.

### HAVE THINGS CHANGED RECENTLY?

Since 2010 solar module costs have dropped dramatically as there has been an explosion in production capacity, particularly in China. Module prices have fallen by 50-70% or more, from the range of €3.00 per watt now down to less than €1.00 per watt. Previously, modules had typically represented 70-80% of the total cost of the PV system, with the remainder being the inverter, cabling, mounting structures on which the modules are built, switching gear, etc. With module prices dropping, they now represent only 50% or even less of the investment. An investment boom followed as the feed-in tariffs were not reduced fast enough, but instead stayed high even though module costs had dropped. This meant that investments in solar became almost too profitable for a while in some countries.

Now, however, subsidies and feed-in tariffs have been ratcheted down to make PV solar less of an investment business and more of a real energy business. Thus, in some countries, the feed-in tariffs and subsidies are now very low and soon hardly needed any longer. This is especially true in countries with high solar insolation (solar radiation energy received on a given surface area during a given time) and high daytime electricity tariff price.

All this shows that solar has become attractive in itself. This is what we want to achieve: a price for PV solar on par with the grid price, meaning the price that the utilities offer electricity at. With system costs falling, it is clear that solar power will continue to grow rapidly, although the turbulence in the market will most certainly continue to exist as well until the product supply chain and support needed (such as subsidies and FIT) are in balance.

### WHAT COUNTRIES HAVE WORKED BEST WITH SOLAR POWER?

One of the first countries likely to achieve grid parity is Italy, mainly due to high solar insolation together with the high daytime electricity price. The Italian solar market has been booming dramatically during the last few years and became slightly overheated but at the same time the installed capacity has been increasing. The market has been driven by large central solar power plants but it is gradually shifting to medium sized systems installed on roofs of commercial and industrial buildings. Germany has been the best "planned" solar market in my opinion. It is a good example of having a vision, and then a mission and putting it into practice. This was started many years ago to systematically encourage investment with programs such as the "1000 rooftops program". They have learned as they have gone along and really grown the capacity of PV solar power in Germany. At the same time, Germany has built a very large industry out of supplying PV system components, and has created lots of new jobs in the solar power field as well. •

