

# Photovoltaics – entering new dimensions

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## ABSTRACT

Over the past two years the solar industry has shown itself to be incredibly resilient to general economic crisis. Supported by cost-cutting and efficiency improvements, the PV industry managed to achieve a growth rate of 120%, or 16.2GW, of newly installed capacity in 2010. Although individual companies are feeling the strong price and margin pressure and intensifying competition, the large, international and vertically-integrated companies are surviving. At least eight new PV markets with a potential annual capacity of 500MW are expected to be added over the next two years. The PV industry will therefore acquire the stability and political autonomy it needs to be able to grow unimpeded and to enter new dimensions. There might also be further tailwind for the PV industry from the catastrophic nuclear crisis in Japan.

## PV industry holding up well

PV companies have had to contend with difficult economic conditions over the past two years: the wake of the global financial crisis, mounting overcapacity, intensifying competition and reductions in feed-in tariffs. Last year the turnover of the global PV industry reached almost €40 billion. Total installed solar energy capacity worldwide has now passed the 35GW mark, which is enough to supply 12 million households with clean electricity.

## Constant price and margin pressure affects all companies

Falling prices have put pressure on companies' margins, but not to the same extent for all cell and module manufacturers. The reasons for this development are found in the rapid increase in the number of providers and the associated expansion of production capacities. Competitive pressure has also intensified due to the market entry of Asian (especially Chinese) companies that benefit from specific cost advantages compared to their European counterparts. The overall effect of this has been that companies have had to reduce their prices more rapidly than their production costs in order to expand their market share.

With the sudden change of a market supported by generous subsidies in 2008, to more stunted growth in 2009, almost every company has been forced to improve its cost structure. This has allowed some PV companies to increase their margins again in 2010. Margins of well over 20% seen in the boom years are virtually inconceivable now. In the longer term, however, we think margins between 10 and 15% are perfectly realistic. They should be attainable for both Western and Asian producers; compatible with the normal development of a mature industry with competitive mass production.

## Feed-in tariffs: what are the current parameters, and how much longer will they apply?

At present, seldom a week passes without a government somewhere announcing fresh cuts to feed-in tariffs. The aim is to cut back tariffs and prices to a reasonable level so as to prevent excessive returns. No politician wants to see an overheated solar energy market develop in his own country and be forced to defend rising electricity prices. Because of this, attractive remuneration is rapidly being adjusted to the relevant system prices. At the moment there is a vicious circle of intensifying cutbacks in individual countries.

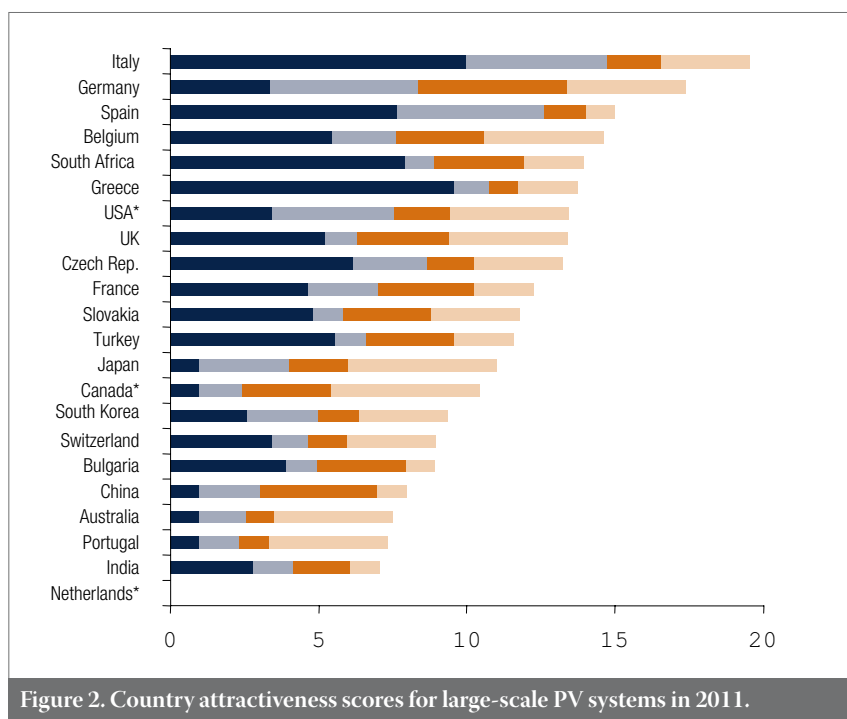
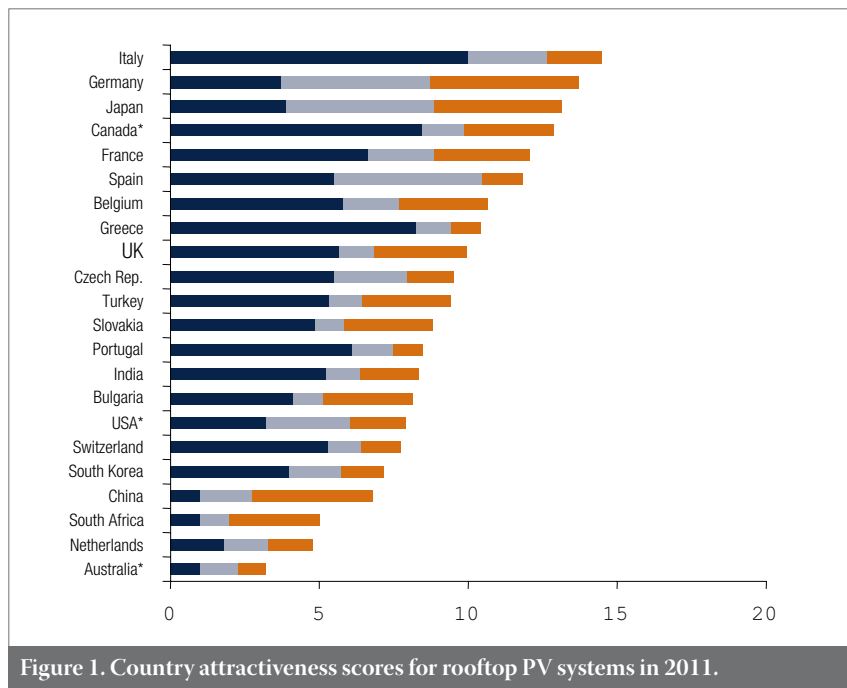
With so much criticism about costs, the many positive aspects of solar energy seem to have been forgotten about. For example, this growing industry provides a lot of jobs, wages and tax revenues at the communal level. Solar energy, along with other forms of renewable energy, also cuts the price of publicly traded energy due to the so-called 'merit order' effect. Since most energy from renewable sources is fed into the grid, large quantities of wind and solar power reduce demand for conventional electricity. The most expensive conventional electricity offerings can no longer be sold on the exchange, so the price drops. In 2010 many governments made adjustments to the national PV subsidy programs and in some cases implemented them. Some have also announced further cuts for 2011. This affects important markets such as the Czech Republic, Germany, France, Italy and Spain. The decisive question for industry is how this affects the appeal of these markets.

## Country attractiveness index

Our annual global forecast for the photovoltaic (PV) market is derived from the systematic and comparative assessment of the most important countries' potential in a country attractiveness index (CAI). This assessment has been developed in

close collaboration with the Clean Tech Department of Rabobank's *Food and Agribusiness Research and Advisory (FAR)* in the Netherlands. The CAI for 2011 shows which countries are most likely to attract PV projects. The evaluation is based on the following four criteria:

- **Financial attractiveness:** We use the internal rate of return (IRR) on a standard 1MW free-standing PV system project and a small 4kW roof-mounted PV system as an indicator for a market's financial attractiveness. Our calculations are based partly on the feed-in tariffs, local electricity tariffs and natural incidence of sunlight and are rated on a scale of one to 10. In order that the financial attractiveness can be compared over time and countries, the PV system costs (BOS, installation) are set at €2400/kW. It is assumed the company provides all its own financing.
- **Market maturity:** This criterion assesses to what extent the infrastructure and companies are available for the installation of PV systems. The scores are rated from one to five. The largest PV market receives the highest score (five), while the smallest PV market receives the lowest (one).
- **Growth potential:** Here we assess certain legal upper limits or caps stipulated for feed-in tariffs or overriding political goals that have been set for photovoltaics, as these determine the capacity potential that can be exploited in the long term. Countries with no annual cap and with ambitious long-term targets score five points. The lowest cap, combined with the absence of any politically motivated targets on photovoltaics, produces a score of one.
- **Effective administrative processes:** Here, the administrative and regulatory hurdles within a country are assessed. To this end the latest information from the PV LEGAL project supported by



the global PV industry even in difficult times. Other dynamic markets are now needed to provide effective support for Germany's PV market. It is definitely in the entire industry's interests to break into new geographical territory. By 2012, at least eight new markets will drive the industry's expansion, with newly installed PV capacity exceeding 500MW p.a. These include France, Italy, Spain, the US, Canada, China, India and Japan. They will provide a diversified regional platform for stable growth in future. Figs. 1 and 2 show the most 'attractive' countries for rooftop PV systems and large-scale PV systems.

### Further cutbacks, stiffer competition, and huge market potential

For the coming year and beyond, the industry has prepared itself for further cutbacks in subsidies for solar power. There will be a significant reduction in tariffs in Italy, Germany and also in the Czech Republic. The politicians responsible fear, amongst other things, a rise in energy prices and instability in their power distribution grids. This will intensify competition among module manufacturers across Europe.

### PV market forecasts up to 2015

Taking into account the attractiveness rating for each country, we anticipate the market trends shown in Fig. 3 for the period to 2015. Globally, our forecast for the period 2010 to 2015 produces annual average growth of 25%. This results in newly installed PV capacity of 16.2GW for 2010, 18.3GW for 2011 and 22.3GW for 2012. The growth rates for the individual countries and years vary enormously, however. Following 120% growth in 2010, we anticipate global growth of just 12% in 2011, rising to 22% in 2012.

In Europe, the strongest growth countries for the period to 2015 are primarily France (CAGR 2010 to 2015 of 41%), Portugal (39%), Greece (34%) and Spain (30%). The USA will grow by on average 62% per year over the same period, and will also gain massively in importance in terms of volume (an additional 11.3GW in 2015). Other important growth markets are China (CAGR 2010 to 2015 of 69%), India (62%), Japan (24%), the rest of Asia (30%) and other countries (59%).

### 205GW of newly installed PV capacity in 2020

An important trend which we mentioned last year can now be confirmed as fact. Several markets will achieve an annual volume of over 500MW of newly installed PV capacity this year or over the coming two years. This is a decisive factor, because it will

the European Photovoltaic Industry Association (EPIA) has been incorporated (see [www.pvlegal.eu](http://www.pvlegal.eu)); in practice, the average length of time required for implementing a project varies between 12 and 24 months. A short time span scores five points; a long period of time scores one point. This criterion reflects a certain medium-term perspective. One new aspect is an assessment of the general stability or effectiveness of the state authorities, with reference to the Worldwide Governance Indicators (WGI). This criterion is not taken into account for small rooftop systems, as it is very hard to assess accurately with such a small size, and the necessary permits are relatively easy to obtain.

By employing the broader scale of one to 10 when assessing the financial attractiveness, a higher weighting is deliberately given to the financial aspect rather than the other criteria (rated on a scale of one to five) in order to reflect the comparative importance of this criterion.

### New countries powering the PV industry forward

By introducing feed-in tariffs, Germany showed the way forward and played a pivotal role in making the enormous growth of the global PV industry possible. In the past, the German market has proven to be very elastic on the price front, making it the most important motor of

Source: Rabobank and Bank Sarasin, Nov. 2010

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Market Watch

	Newly installed PV capacity (MW)							CAGR*
	2009	2010	2011	2012	2013	2014	2015	10-15
Germany	3,845	7,400	6,500	5,500	4,500	4,635	4,681	-9%
Italy	723	2,300	3,450	3,795	3,985	4,264	4,903	16%
Spain	60	367	535	660	900	1,110	1,375	30%
Greece	36	159	225	326	440	529	645	34%
France	250	700	1,120	1,680	2,352	3,011	3,838	41%
Portugal	34	45	70	105	144	182	232	39%
Czech Rep.	411	1,400	230	120	140	176	225	-31%
Belgium	292	361	120	130	135	170	217	-10%
Switzerland	26	30	60	70	80	90	100	27%
Rest of Europe	43	300	600	1,170	2,223	4,113	7,403	90%
<b>Europe</b>	<b>5,720</b>	<b>13,053</b>	<b>12,910</b>	<b>13,556</b>	<b>14,900</b>	<b>18,269</b>	<b>23,619</b>	<b>13%</b>
<b>USA</b>	<b>473</b>	<b>1,000</b>	<b>2,000</b>	<b>3,600</b>	<b>5,760</b>	<b>8,352</b>	<b>11,275</b>	<b>62%</b>
China	165	377	778	1,458	2,500	3,685	5,159	69%
India	30	80	152	274	443	629	887	62%
Japan	483	800	1,040	1,300	1,599	1,951	2,360	24%
South Korea	84	130	160	204	256	319	394	25%
Rest of Asia	186	300	420	546	699	888	1,118	30%
<b>Asia</b>	<b>948</b>	<b>1,687</b>	<b>2,550</b>	<b>3,782</b>	<b>5,497</b>	<b>7,472</b>	<b>9,919</b>	<b>43%</b>
Rest of the World	261	500	800	1,360	2,244	3,590	5,027	59%
<b>Total newly installed</b>	<b>7,402</b>	<b>16,240</b>	<b>18,260</b>	<b>22,297</b>	<b>28,401</b>	<b>37,683</b>	<b>49,840</b>	<b>25%</b>
Annual growth rate	24%	119%	12%	22%	27%	33%	32%	

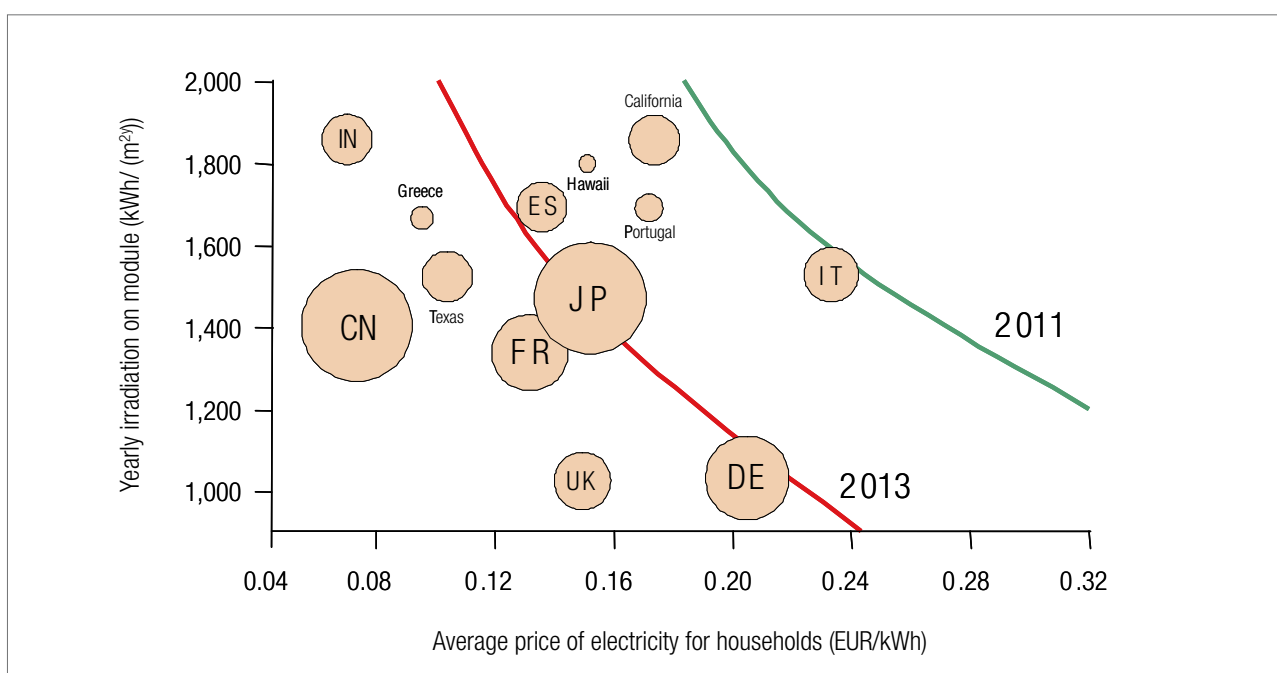
Source: Bank Sarasin, Apr. 2011; \*CAGR: compound annual growth rate

Figure 3. Sarasin PV market forecast to 2015.

mean that the PV industry is less susceptible to changes to the general operating conditions in individual key markets. A globally based PV industry of this kind will therefore grow in a more stable manner. We anticipate average annual growth of 29% for the period 2010 to 2020, which will produce newly installed PV capacity of 205GW in

2020. The tendency will be for sunny, non-European markets to grow more rapidly in the period to 2020, as they still have a great deal of catching up to do in terms of solar power generation. Over the past two years the solar industry has demonstrated that it can survive and continue to grow even in a challenging economic and political

environment. We are convinced that costs can also be reduced by an average of 10% per year over the coming years, and that our scenario can therefore be realised in practice. Scepticism resulting from the nuclear crisis in Japan in March may lead to the establishment of close to 220GW of additional PV installations by 2020.



Source: EPIA, REC, Bank Sarasin, Nov. 2010

Figure 4. Trend toward grid parity for private customers.

## Grid parity arriving sooner than expected

The solar industry has already achieved incredible feats. Since 2006, prices for solar electricity have fallen by 40% and, over the coming years, it will converge with the price level of retail consumer electricity tariffs. The key goal at present is to ensure an efficient and sustainable broadening of the photovoltaic market and to secure both the investments already made and those still required by this forward-looking industry. It will only take a few more years before the solar industry can survive without subsidy programmes in many key markets. Even in Germany, the electricity produced by solar panels on one's own roof will match the price charged for electricity by conventional energy suppliers or regional public utilities from 2013 onwards. This will mark an important milestone on the road to commercial competitiveness.

For this reason, the industry is currently developing a roadmap towards further successful development of the photovoltaic market, and in the course of this process will demonstrate ways in which this commercial competitiveness may be achieved in a speedy manner. In addition, the solar industry is making efforts to underline its positive economic and commercial achievements, and is increasingly bringing hard facts and figures to bear to counter one-sided arguments centred on cost.

Grid parity will be an important driver for demand in future. Compared with

feed-in tariffs, which are being continually reduced and forcing house owners and investors into rash decisions, where grid parity applies, the returns become better the longer one waits. A market with grid parity will therefore tend to see more gradual progress, and will not create a 'gold-digger' mentality as is the case in subsidized markets.

In sunny regions of the world such as Italy, California, Hawaii and Spain, we expect this household grid parity to be achieved as early as 2011/2012 (Fig. 4). In Japan, which was the highest electricity prices, PV systems on the roof of a private home will soon become the norm, simply because it makes economic sense. From 2013 onwards, solar electricity will be as cost-effective as conventional grid power even in the countries of central Europe.

## Environmental and social standards becoming increasingly important

From the start, Bank Sarasin has always tried to assess PV companies according to extensive sustainability criteria. For Sarasin it was never simply enough that the companies produced products for 'green electricity'. To begin with, it was very difficult to get hold of the necessary information. However, there are now a few PV companies which undertake comprehensive corporate social responsibility (CSR) reporting, for example, SolarWorld AG. In order

to raise the transparency and depth of the information provided by other solar energy companies, Bank Sarasin supports the Sustainable Solar Initiative from Henderson Global Investors. With invested assets of US\$1,500 billion, this initiative has huge investor power behind it, enabling it to exert sufficient pressure on the companies concerned.

### About the Author



**Dr. Matthias Fawer** is the director of Bank Sarasin & Co. Ltd and joined as a sustainability analyst in 2000. He is responsible for the renewable energies, oil, gas and utilities sectors. Since 2004 he has been the main author of Bank Sarasin's annual solar energy study. Matthias has a Ph.D. degree in biotechnology from the Swiss Federal Institute of Technology (ETH) in Zurich, from which he went on to work for the Ecology department of the Swiss Federal Materials Testing and Research Institute (EMPA) in St. Gallen, where he was senior expert in environmental impact projects on behalf of Swiss and European industry associations.

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