

Large-scale PV power plants – new markets and challenges

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ABSTRACT

Despite the collapsed Spanish market and the general state of the world's economy, the past year was not a bad year at all from the perspective of installed power capacity of large-scale PV power plants. Installed power capacity surpassed expectations while also bringing new markets into the spotlight, which means that the traditional market leaders of Spain, Germany and the U.S. are no longer the only 'key' markets. With the exception of Germany, the past year's most noteworthy market boost was seen in the Czech Republic and Italy, with similar shake-ups seen in the Asian tiger countries of China and India. With many large-scale PV power plants recently brought into commission in these countries, China and India are brimming with potential for the near future.

Earlier this year, worldwide cumulative power capacity surpassed 6GW (taking into consideration only PV power plants >200kW DC). Europe still holds the largest market share at 87%, but in comparison with the figures scored in 2008 [1, 2], the U.S. increased its market share to 7%. Estimated annual installed power capacity worldwide for the period from 2000 to 2009 [3] is presented in Table 1. The data are based on detailed figures taken from more than 3,400 large-scale PV plants put into service in recent years that had cumulative peak power capacity of more than 6GWp.

Due to a shortage of reliable databases and national or international sources of statistical information concerning large-scale photovoltaic power plants, the statistical data presented here should be considered "conservative". However, some national statistical sources of note include those provided by some Italian [4] and German [5] agencies.

Annual and cumulative installed power output capacity

It is estimated that more than 1.7GW large-scale power plants were constructed and put into service in 2009 (Fig. 1) [3]. Market leader Germany has more than 650MW installed (see Fig. 5 for more details), followed by Italy with about 250MW and the Czech Republic with about 200MW installed power capacity. Fig. 2 shows a Europe-wide breakdown of installed cumulative power capacity as at December 2009.

The market share of large-scale grid-connected PV power plants has been increasing continuously in recent years

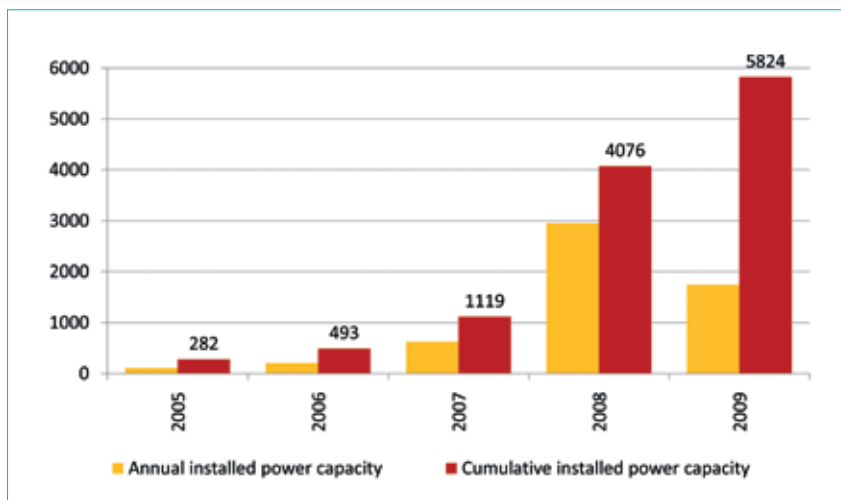


Figure 1. Annual installed power output capacity (MWp) from 2005 to 2009, taking into consideration PV power plants >200kWp.

(see Fig. 3) in comparison with total annual installed PV power capacity [6]. In 2005, market share comprised less than 10% of the annual installed PV power capacity, while in 2007 market share of large-scale PV power plants reached almost 25% of the annual installed power capacity. In 2009, this figure was close to 30%.

New markets

Significant progress was not restricted to the key markets of Germany and Italy, however. It is now estimated that the Czech Republic has about 200MW of new power capacity installed (large-scale PV power plants), with a resulting third-place ranking after Germany and Italy. Data for the most important new markets is presented in Table 2.

Belgium, one of the most interesting new markets, is a prime example of regionally-driven policy. While the Flemish region has seen more than 80MW (rough estimate) of large-scale PV power plants commissioned in 2009, other parts of the country have thus far only shown slow progress.

As expected, developments in Bulgaria and Greece have resulted in the commissioning of some large-scale PV power plants. Small markets like Slovakia and Slovenia have also made first steps toward joining the prestigious "MW-range Club".

Progress in the French markets was lower than expected, but with the recent commissioning of some large-scale power plants, cumulative power

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Annual installed	4.2	9.4	20.3	29.8	81.9	111	211	626	2957	1748
Cumulative installed	29.1	38.5	58.8	88.6	171	282	493	1119	4076	5824

Table 1. Estimated annual and cumulative installed power output capacity [3] worldwide of large-scale photovoltaic power plants (>200kWp) from 2000-2009.

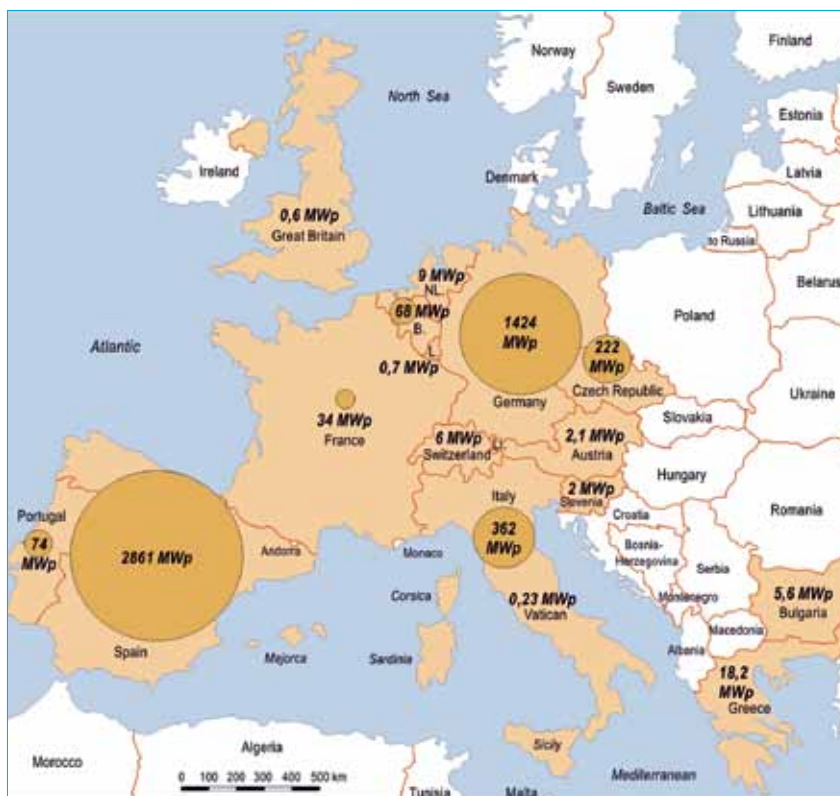


Figure 2. PV power capacity in MW (>200kW) installed in Europe as at December 2009.

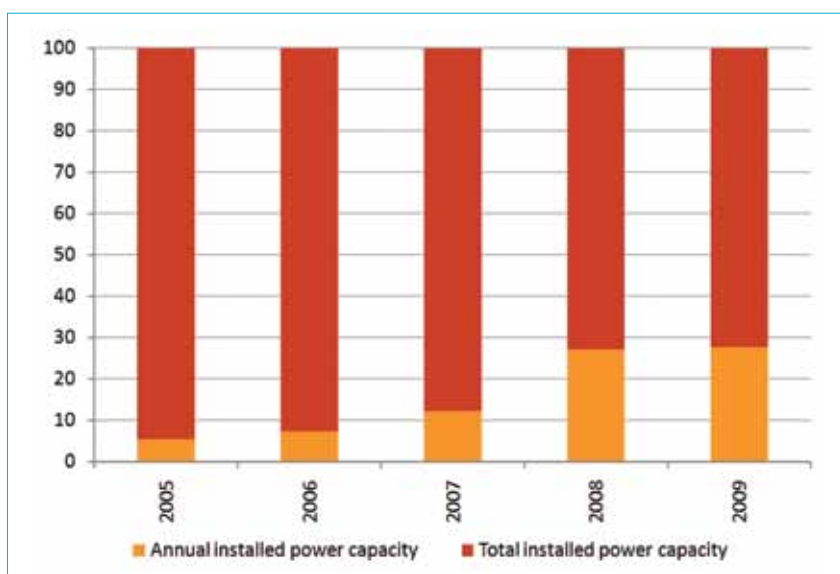


Figure 3. Large-scale PV power capacity as a percentage share of total PV power capacity installed.

capacity in France (including French overseas territories) is estimated to be more than 100MW. Some of these

French overseas territories have seen significant development in this vein, with plants like La Roseraie and La

Mangassaye on Reunion Island completed this year; Guadeloupe and Mayotte are also broaching the MW range in recent projects. PV market share figures for large-scale PV power plants in France and the French overseas territories are presented in Fig. 4.

Although Europe currently retains the number one region position, other regions and countries such as Canada, China and India have also been showing quite rapid developments. Canada has recently commissioned some very large-scale PV power plants. The 20MW Sarnia project has already undergone expansion, and following completion of the second stage at the end of the year, this particular plant will take pole position on the PV ranking list.

Asia's most important new market is China with some very large-scale power plants under construction, while some MW-range PV power plants were also commissioned in recent months in India and Thailand. From a short- and mid-term perspective, these Asian markets are the most promising markets worldwide; however, short-term opportunities are more plentiful in the European countries of Italy, France, Greece and Bulgaria.

Future challenges

With ongoing discussions in the EU in regard to the use of agricultural land (and similar areas) for PV power plants, the industry needs to always be on the lookout for new suitable locations. Large roofs hold significant potential for roof-mounted PV power plants, in particular the current state of play in Belgium where about 75% of PV power capacity is delivered by roof-mounted PV power plants. California's market share of roof-mounted PV power plants is also quite high. As shown in Fig. 5, Germany's share of roof-mounted PV power plants remains quite low – this is also the case in many other developed countries.

Roof-mounted power plants will undoubtedly have a much higher market share in the future in developed countries, whereas ground-mounted PV power plants will still dominate in desert areas and countries where scope is not an issue.

For ground-mounted PV power plants, sites such as abandoned waste-treatment facilities or waste-water treatment facilities should be used more

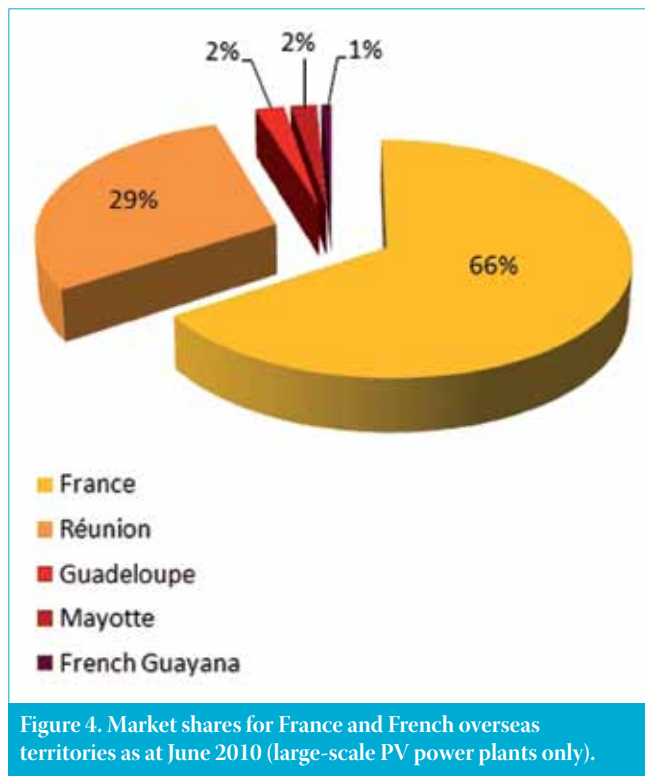
	Belgium	France**	Portugal	Bulgaria***	Greece	China*	India*	Thailand ***
Annual installed 2009	49	35	14	3.2	14	70	4	1.1
Cumulative installed	68	55	74	2.0	18.2	75	4.3	8.5

* Very promising new markets for the near future; significant progress expected this year.

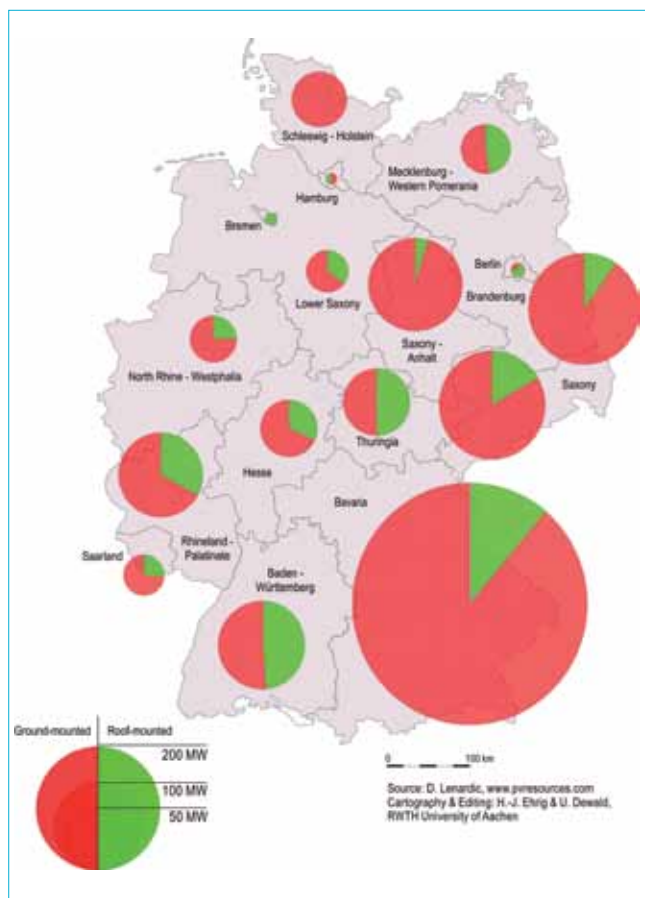
** Including overseas territories.

*** Significant progress observed in the first half of 2010, valid also for China and India.

Table 2. Large-scale PV power plants: annual and cumulative power capacity (MW) installed in 2009 for some new markets [3].



extensively: it is currently estimated that about 1% of the world's large-scale PV power plants is located on such areas [3]. Germany and some other countries have adapted abandoned military areas for the construction of large PV plants, such as Lieberose (53MW), Finsterwalde (42MW) and Brandis (40MW) in Germany, and the





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Courtesy of S.A.G. Solarstrom

Figure 6. The Střibro 13.6MW project, built on an abandoned military surface, is the largest Czech power plant put into service in 2009.

1.2MW Sault plant in France and the Czech Republic's 13.6MW Střibro plant (see Fig. 6).

“Other very important but often ignored issues are reliable and precise yield prediction and effective power plant monitoring.”

Several key issues will play major roles in construction and operation of PV power plants in the coming years. New markets for MW-range plants are completely different from those established European and U.S. markets that claim close to two decades of experience in the construction and operation of PV power plants. The first few large-scale PV plants in Europe commissioned about two decades ago had typical power outputs of 500kW and were usually the result of research projects. Those plants commissioned in new markets – China and India in particular – are very large-scale MW-range facilities that are anticipated to function reliably for at least the next 20 years. New markets require top-of-the-range project planning, financing and construction quality, as failed projects could essentially lead to significant financial losses. In the worst-case scenario, they could also have

negative impact on regional renewable energy policies.

Other very important but often ignored issues are reliable and precise yield prediction and effective power plant monitoring. In conjunction with some other activities such as precise maintenance cost estimation, attention to these issues is essential for accurate electricity price calculation. Possible investment price drops may end up lowering feed-in tariffs (or subsidies), and for owners and operators of PV power plants, the electricity price – especially once grid parity has been reached – will be the most important parameter for ensuring an economical plant operation. PV power plants that have implemented more precise monitoring and electricity price calculation measures will be more compatible in the long term with other renewable (and non-renewable) sources of energy.

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About the Author

Denis Lenardič holds a degree in electrical engineering from the University of Ljubljana, Slovenia. From 2004 to 2008 he served as chairman of the Slovene national section of the IEC »TC82« Technical Committee. He has been systematically collecting data regarding large-scale photovoltaic power plants for several years. The data that forms the basis of this article is available to the public free of charge at <http://www.pvresources.com/en/top50pv.php>.

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