Photovoltaics: Boom of the Rising Sun

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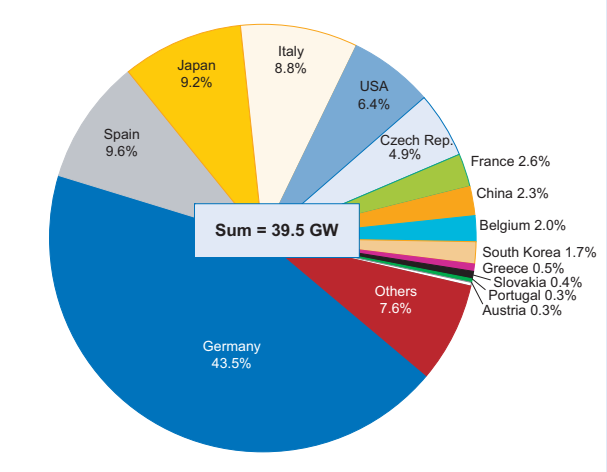
2010 was an extraordinary year for solar power. The global photovoltaic market reached a cumulative installed capacity of almost 40 GW (see EPIA 2011). This corresponds to the electrical output of 80 medium-sized coal-fired power stations. With a capacity of 17.2 GW or 43.5 percent of the global market, Germany was by far the most important location for solar power, followed by Spain (3.8 GW or 9.6 percent), Japan (3.6 GW or 9.2 percent) and Italy (3.5 GW or 8.8 percent). Photovoltaic capacity in the United States amounted to 2.5 GW (6.4 percent), while that of the Czech Republic reached 2 GW (4.9 percent) and France's capacity totalled 1 GW (2.6 percent). In China photovoltaic capacity remained fairly low and accounted for a mere 0.9 GW (2.3 percent) (see Figure 1).[1]

During the five preceding years Germany was also the leading country in new installations, accounting for 45 percent of annual added capacity of 16.6 GW in 2010. With an additional capacity of 7.4 GW, Germany's annual increase in capacity alone exceeded installations worldwide for the preceding year 2009 (7.3 GW). The second important market was Italy with new installations of 2.3 GW, three times higher than in 2009 (0.7 GW). The Czech Republic boosted its investment in solar power substantially with 1.5 GW in 2010, compared to 0.4 GW in 2009. However, Japan and the United States, which were ranked second and third in 2006 and 2007, dropped back in 2010, investing only 1 GW and 0.9 GW respectively. In France installations more than tripled to reach 0.7 GW, after starting

Figure 1

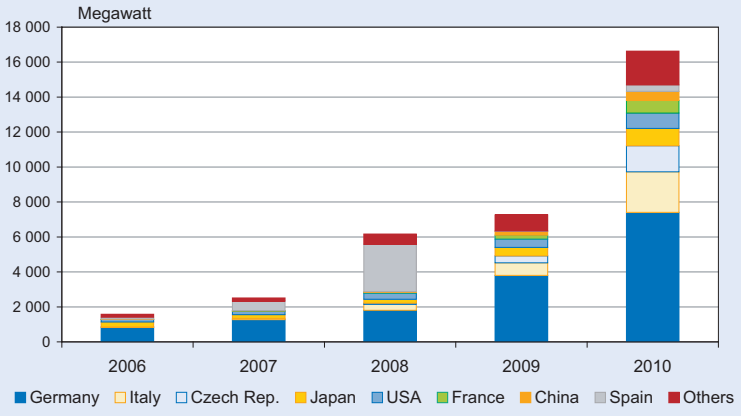
Worldwide Photovoltaic Capacity 2010



Source: Earth Policy Institute.

Figure 2

Annual Installed Photovoltaic Power by Country



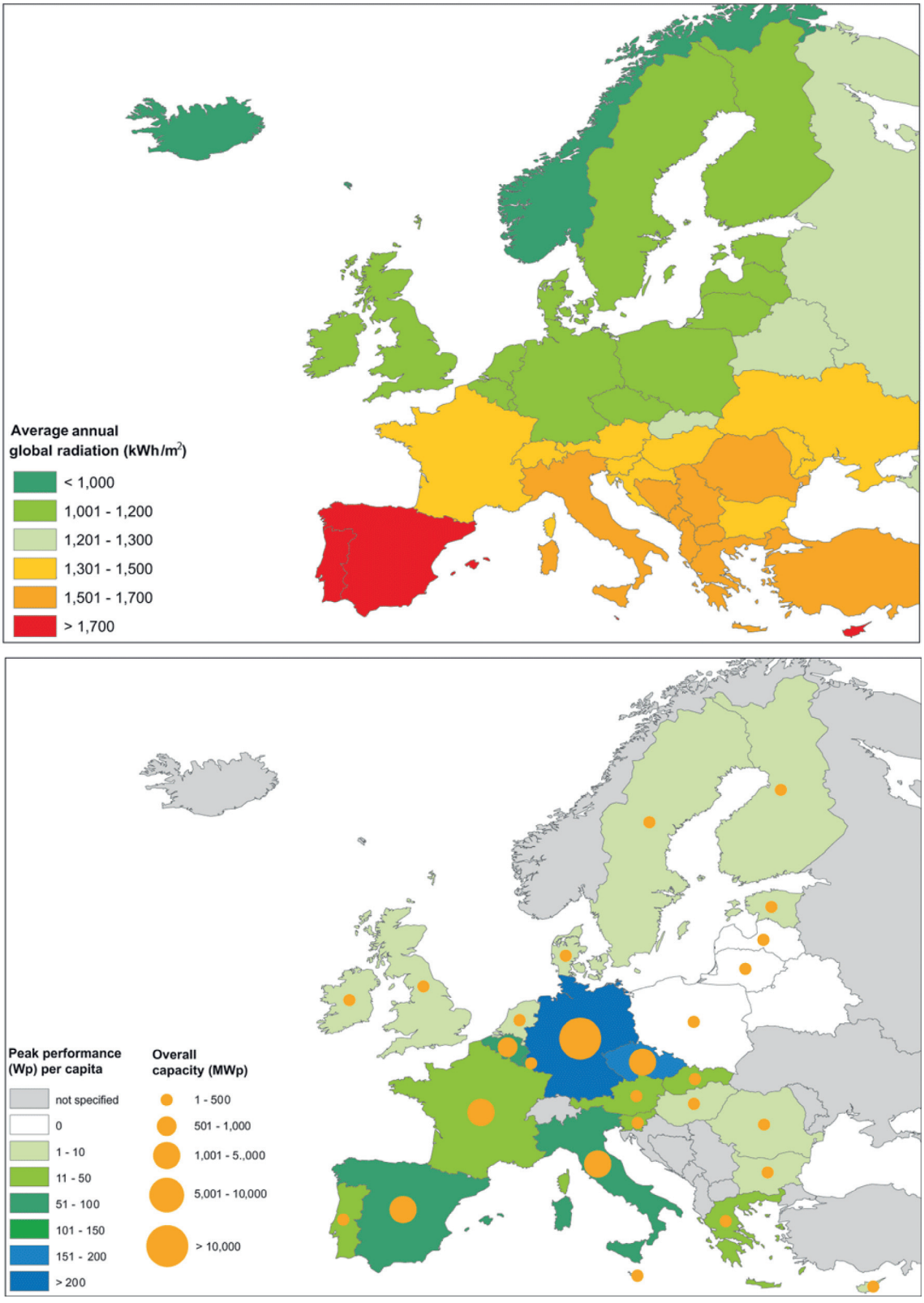
Source: Earth Policy Institute.

* Ifo Institute.

[1] In its domestic market China sets the priority on solar thermal heating. With 101.5 GW of solar thermal applications 59 percent of the world-wide capacity was located in China in 2009 compared to 19 percent in Europe (see Erneuerbare Energien 22(2), February 2012).

Figure 3

GLOBAL RADIATION AND PHOTOVOLTAIC POWER 2010



Sources: EurObserv'ER (2011); European Commission Joint Research Centre (2008).

from a low level of 0.2 GW in 2009. Spain, on the other hand, added only 0.4 GW in 2010 and saw a strong decrease in new installations compared to its 2.7 GW of 2008 (see Figure 2) after the government limited its subsidy of new installations to 0.5 GW per annum (see EPIA 2011). Overall, the European Union represented 78 percent of global new installed capacity in 2010 (see EurObserv'ER 2011).

The natural prerequisites for solar electricity production are illustrated in Figure 3 (upper map): within the European Union southern countries like Portugal and Spain are the most appropriate locations with an average annual global radiation[2] of 1,840 kWh/m² and 1,812 kWh/m², followed by Greece and Italy with 1,693 kWh/m² and 1,611 kWh/m², respectively. Global radiation is significantly lower in Germany at 1,147 kWh/m², while the corresponding value amounts to 1,169 kWh/m² for the Czech Republic and 1,386 kWh/m² for France. The density of photovoltaic capacity measured in terms of Watt peak (Wp) per inhabitant (inhab), on the other hand, is highest in Germany (212 Wp/inhab), followed by the Czech Republic (186 Wp/inhab). In sun-rich Spain the density of solar power installations amounts to 83 Wp/inhab, while Italy, another large country in the European sun belt, ranks only fifth with 58 Wp/inhab (see Figure 3 below).

The phenomenon of relatively high solar electricity production in regions with rather low sun exposure is closely related to the predominant way of promoting solar power in the EU: 18 of its 27 member states foster renewable energy, and especially solar power, by means of feed-in-tariffs (see REN 21). In this context the operators of photovoltaic installations enjoy a guaranteed price for each kWh produced, which covers their production costs that significantly exceed market prices. In other words, the promotion of solar power is not based on economic efficiency considerations and promotes a rather expensive method of reducing carbon dioxide emissions.

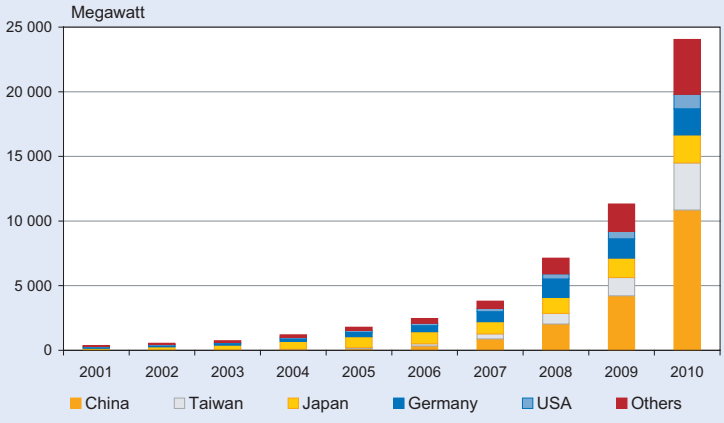
Over 40 countries worldwide have introduced such feed-in-tariffs for electricity gained from renewable energies (see EPIA 2011). In 2010 the global production of solar cells and modules doubled compared to 2009, reaching 23.9 GW solar cells and 20 GW of modules. At the same time, the prices of solar modules decreased by 38 percent in 2009 as a result of the rapid expansion of the production capacities for polysilicon and wafers in China and other Asian countries (see REN 21).

In recent years the production of solar cells and modules has predominantly taken place in countries with a low domestic use of solar electricity. In China, for example, no promotion of solar electricity exists on a national level, there is merely some local feeding remuneration (see EPIA 2011). China has nevertheless been the global leader in solar cell production since 2008. In 2008 Chinese manufacturers produced 2 GW, followed by their German competitors with a production of 1.4 GW and by Japanese enterprises with 1.3 GW. In 2009 Chinese production doubled to 4.2 GW, while German and Japanese production, on the other hand, increased only slightly to around 1.5 GW in each country, and photovoltaic companies from Taiwan achieved a healthy1.4 GW. In 2010 both China and Taiwan increased their production by a factor of 2.5 and reached peak values of 10.9 GW and 3.6 GW respectively, putting them a long way ahead of Japan with 2.1 GW and Germany with 2.0 GW. However, US manufacturers also nearly doubled their production in 2010 to 1.1 GW compared to 0.6 GW in 2009 (see Figure 4).

The largest discrepancy between the production of solar cells and domestic use of solar energy can be

Figure 4

ANNUAL PHOTOVOLTAIC PRODUCTION BY COUNTRY



Source: Earth Policy Institute.

[2] Global radiation is the total short-wave radiation from the sky falling onto a horizontal surface on the ground. It includes both the direct solar radiation and the diffuse radiation resulting from reflected or scattered sunlight. (see PIK research portal, available online at http://www.pik-potsdam.de/services/infothek/climate-weather-potsdam/climate-diagrams/global-radiation/index_html).

identified in China, where the production of solar cells was twenty times higher than photovoltaic installations in 2010. In the United States the production of solar cells was also around 30 percent higher than capacity extension in the same year. In Germany, however, only 27 percent of the new installed capacity was produced within the country in 2010, while the rest was imported. In 2009 this ratio reached 39 percent, and was even as high as 78 percent in 2008. This contradiction reveals the disadvantages of an environmental policy that subsidizes certain environmental technologies, instead of using market-based instruments corresponding to the polluter-pays-principle.

References

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