Recent Developments in Wind Power

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Cartographic representations map the world in a schematic way. Since the cartographer Mercator, many projections in different coordinate systems have been available that lead to a variety of maps offering different degrees of precision. A relatively new type of map generated by Michael Gastner and Mark Newman (2004) is the so-called cartogram. Cartograms represent map units as a function of a selected variable and thereby draw a more or less distorted picture (see Gastner and Newman 2004). In this illustration, the boundaries and their topology to one another can be maintained so that only their size and shape changes. Based on this technique, about 700 maps were published in 2006 in a large project at the University of Sheffield (see Worldmapper 2009).

Wind energy constitutes the fastest growing segment of renewable energies worldwide. This example describes the application of this map, based on global wind farms and their installed capacity. Figure 1 depicts the current wind farms around the world. However, the figures only give a brief general overview of the number of wind farms, but offer no details of the wind turbines installed there. The pioneering role played by Germany and Denmark in the development of wind energy is remarkable, especially the number of wind turbines installed in both countries. By June 2013 nearly 3,800 wind farms (onshore and offshore) were installed in Germany (see The Windpower 2013), followed by Denmark, the United States and Spain, each with 1,500, 985 and 955 wind farms respectively. Looking at the distribution of installed capacity worldwide, a different picture emerges (see Figure 2). In Germany, almost 33,000 Megawatts (MW) were installed as of 2013. By contrast, China already had over 75,000 MW of power capacity and the United States had around 62,000 MW available. Germany is followed by Spain, India and Britain. In Germany over 2,400 MW of additional electric power capacity had been installed by 2012. Further construction was estimated to boost this figure to 3,200 MW by the end of 2013, of which 400 MW was to be installed offshore (see Agrar heute 2013). The increase in the installed capacity is going to be achieved by exchanging existing plants for more efficient wind turbines, which is called repowering. Thus, the absolute number of plants in the wind parks can be reduced by

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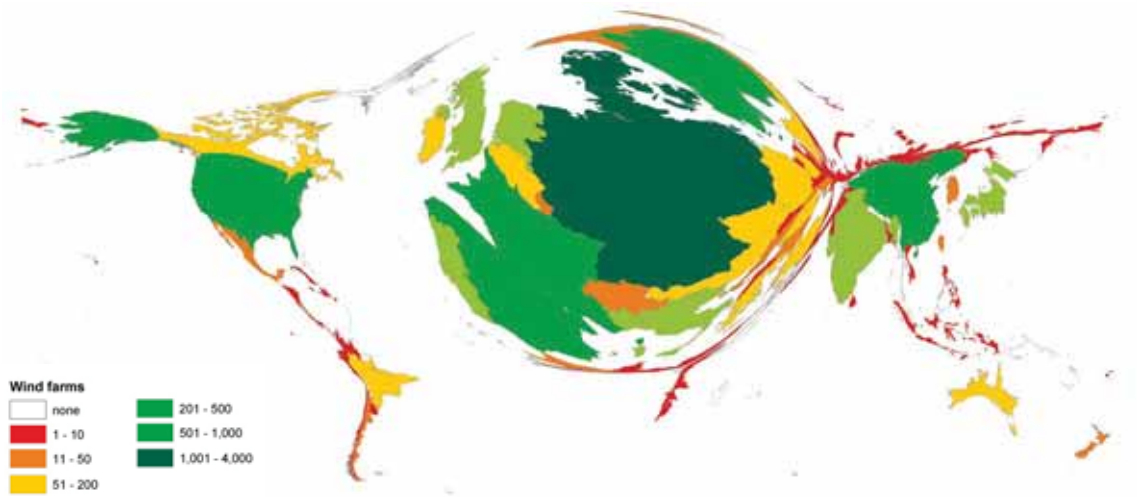
Figure 1

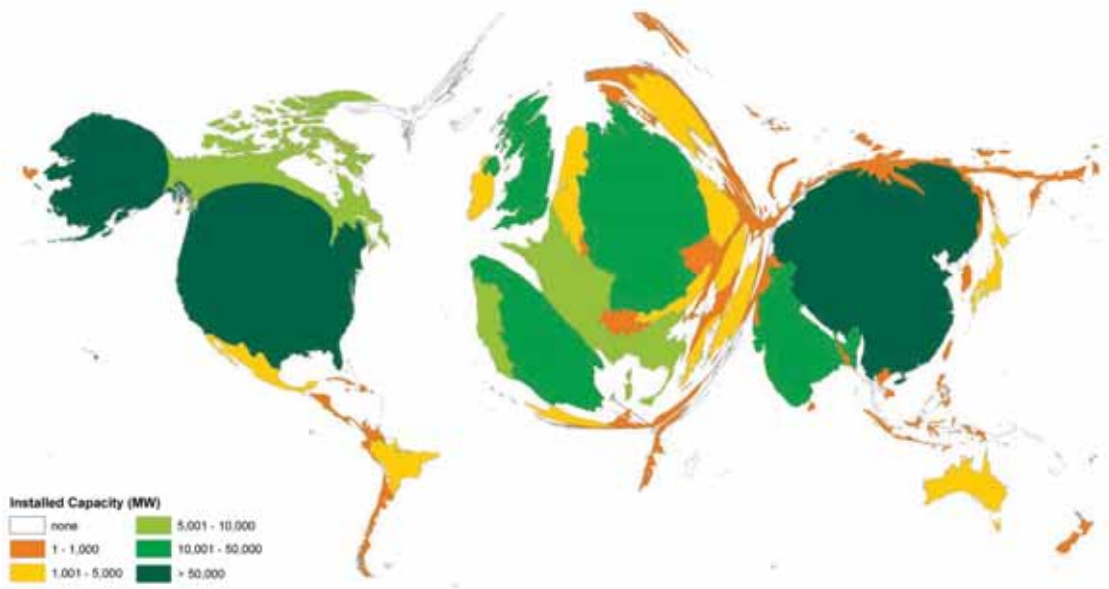
Wind farms worldwide



Date as of June 2013
Source: The Windpower (2013).

Figure 2

Worldwide installed capacity of wind energy



Date as of June 2013
Source: The Windpower (2013).

up to 50 percent, while achieving more than double the output power. This, in turn, should give rise to a more uniform landscape and enhanced environmental protection (see Bundesverband Windenergie 2013). In 2012, 325 old plants were replaced with 210 new plants, resulting in power almost tripling (from 196 to 531 MW – see IWR 2013b).

A total of 45 GW wind energy was installed worldwide in 2012, the total installed capacity was 828 GW at the end of that year (see World Wind Energy Association 2013). China and the United States continue to be the top leaders in the expansion of wind power. Eastern Europe and Latin America are currently among those regions with high growth rates. Even South Africa is regarded as a hopeful prospective for many companies because of its enormous wind power potential. Almost 30 percent more wind turbines than 2011 were installed in the United States in 2012. This was due mainly to the short-term extension of subsidies for wind power producers in late 2012. This caused the US wind energy industry to install about 8,000 MW in the last quarter of 2012, while a short time previously the expiry of these subsidies had been announced. In China, the development of wind power temporarily declined due to difficulties with network expansion and connection (minus 18 percent – see Klimaretter 2013). At the moment, wind power turbines from China are cheaper than European turbines, and four Chinese companies are among the industry top ten with market shares of 3 to 6 percent. Problems in China are mainly due to overcapacities and falling prices, and are similar to the difficulties encountered in the solar industry. However, threats to Europe are considered to be limited due to high transportation costs and the failure-prone nature of Chinese technology (see IWR 2013a). According to BTM Consult, the Danish company Vestas had a global market share of about 14 percent in 2012, followed by Siemens Wind Power and Enercon with 9.5 and 8.2 percent shares respectively. The world market shares were exceeded by the US GE Wind with a 15.5 percent market share (see Erneuerbare Energien 2013). In order to continue to hold their own against plant manufacturers from China, German and other European companies will have to expand and hold onto their technological advantage.

One of the current problems in the development of wind power in Germany is related to the recent completion of the first commercial offshore wind farm in the North Sea with 30 wind turbines and a total of over 100 MW installed capacity. To date the wind farm has no interconnection and power generation can, according to the operator TenneT, only be expected at the beginning of 2014 (see Süddeutsche Zeitung 2013). To avoid damages to the rotors, the plants need to be moved artificially with the help of diesel engines. The costs associated with the shutdown of power generation are passed on to consumers through the offshore liability apportionment, while the transmission

system operators (TSOs) are obliged to accept a maximum of 20 percent of the costs incurred.

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