6 Denmark

WINDS OF CHANGE

Denmark has been producing electricity from wind since the 19th century, and continues to be a wind power world leader

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Danish wind power pioneer Christian Riisager, photographed in 2003. Photo courtesy of The Danish Film Institute / Stills & Posters Archive.

"On a windy day, my wife said: If you want to try to connect your wind turbine to the grid, now is the time! Everything went fine, the electric meter started to run backwards, and no fuses blew. I never dreamt of making a living out of my wind turbine interest. But people started to pass by to look at my turbine in the garden, and then I thought I may just as well take the chance."
Christian Riisager (1930-2008) *(Excerpt of interview with the Danish Wind Industry Association, 2000).*

An old Chinese proverb says: "When the winds of change blow, some people build walls, others build windmills." The Danish wind energy story is an example of the latter. The country has a long tradition of using wind to produce renewable electricity, and continues to be a world leader in harnessing and providing wind power.

December 2013 marked a significant milestone, when wind power provided an equivalent of 57.4 per cent of Denmark's electricity consumption – the first time ever that wind power supplied more than half of a country's electricity needs for a whole month. December 21 set another record, with wind turbines generating the equivalent of 102 per cent of Danish electricity consumption.

The Danish wind power story started in 1891, when the first electricity-generating wind turbine was built by Poul la Cour, a meteorologist and school principal. La Cour made many experiments with production and storage of wind power and was called "the wizard from Askov making light and power out of rain and wind". He also began to educate wind electricians.

In 1956, one of his former students, Johannes Juul, built the so-called mother of modern wind turbine design – a 200kW three-bladed turbine, which was subsequently connected to the nation's power grid. Juul's wind turbine was constructed as part of a wind programme conducted by the association of Danish power stations, but this was shut down in 1962.

In the 1970s, inspired by the oil crisis and a strong Danish anti-nuclear movement, individual pioneers led a wind power revival. Christian Riisager, a carpenter, made his own wind turbine and connected it to the electricity grid in secret, by plugging it into the wall outlet for his washing machine. Riisager began serial production of 22kW wind turbines, and several other Danish manufacturers including Vestas and Bonus Energy (Siemens Wind Power since 2004) did the same over the next few years.

Thanks to these early trailblazers, Denmark became a world-leading wind power manufacturer. In 2013 Danish companies supplied 25 per cent of the world's wind turbines. Danish expertise plays a major role in wind energy technology in the world. The wind industry makes an important contribution to the Danish economy, employing some 27,500 people, with exports amounting to about 50 billion Danish kroner (US$9.2 billion) in 2013 (Danish Wind Industry Association, 2014).

Strong interaction between public research institutions, regulators, industry and citizens has enabled Denmark to become not only an early innovator but also a world champion in wind energy. Various economic incentives have encouraged investment by private households, energy companies and other investors. Equally importantly, the national research centre Risoe (today part

of Technical University Denmark) established safety and quality standards for wind turbines as early as 1979.

Wind power development in Denmark has been led by civil society, with individuals and families taking up financial incentives to buy wind turbines or shares in cooperatives to invest in wind power in their communities. While most new investment today is from professional investors, cooperatives and local participation continue to play a role. Some 40,000 Danes are part-owners or individual owners of turbines; since 2009, 20 per cent of the capacity of each new onshore wind farm must be available for citizens of the local community to buy. Opinion polls show that about 90 per cent of Danes are in favour of wind power.

Continued support for wind power throughout changing governments has helped to stimulate demand, technological innovation and cost reductions. The results today are significant. In 2013, wind power provided an equivalent of a third of Danish electricity consumption – and the Danish parliament has committed to meeting half of the country's electricity needs with wind power by 2020. The Danish government's goal is to achieve 100 per cent renewable energy in the energy and transport sectors by 2050.

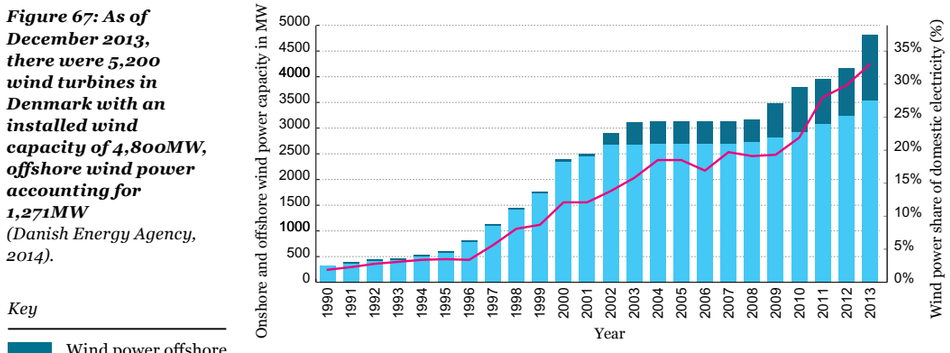
In Denmark, it's clear which way the winds of change are blowing.

Produce better: Wind power in Denmark displaces power production from fossil fuels, reducing carbon emissions.

Redirect financial flows: Danish wind power development has been characterized by long-term planning and political will to promote wind power investments through economic incentives for investors.

Equitable resource governance: Some 40,000 Danes are part-owners or individual owners of wind turbines. The Danish community-ownership model has been replicated in other countries, including Germany.

Figure 67: As of December 2013, there were 5,200 wind turbines in Denmark with an installed wind capacity of 4,800MW, offshore wind power accounting for 1,271MW
(Danish Energy Agency, 2014).



CONTINUED SUPPORT FOR WIND POWER THROUGHOUT CHANGING GOVERNMENTS HAS HELPED TO STIMULATE DEMAND, TECHNOLOGICAL INNOVATION AND COST REDUCTIONS. THE RESULTS TODAY ARE SIGNIFICANT. IN 2013, WIND POWER PROVIDED AN EQUIVALENT OF A THIRD OF DANISH ELECTRICITY CONSUMPTION. THE DANISH PARLIAMENT HAS COMMITTED TO MEETING HALF OF THE COUNTRY'S ELECTRICITY NEEDS WITH WIND POWER BY 2020