

Denmark – Commercial Success

Denmark's wind energy industry is a major commercial success story. From a standing start in the 1980s to a turnover of \$2.6 billion in 2001, its growth rate challenges that of the internet or mobile phones. Danish wind turbines dominate the global market, and the country has forged itself a position at the head of the fastest growing energy source in the world.

Over the past 15 years the Danish wind turbine industry has grown into one of the heavyweights in machinery manufacturing. Alongside the major turbine manufacturers - Vestas, NEG Micon, Nordex and Bonus - there are a score of large component companies and dozens of smaller suppliers. From a few hundred workers in 1981 the industry now provides jobs for 20,000 people in Denmark and a further 8,000 in component supply and installation work around the world.

The last eight years in particular have seen a dramatic increase in the production capacity of Danish turbine manufacturers. Annual output, mainly for export around the world, has increased almost tenfold from 368 MW in 1994 to 3,000 MW in 2001. Despite the emergence of competing manufacturing countries, almost half the wind turbine capacity being installed globally today is of Danish origin.

Government commitments

One reason for the Danish wind industry's success is the commitment from successive governments to a series of national energy plans aimed at reducing dependency on imported fuel, improving the environment and moving towards greater sustainability. Nuclear power has been rejected as an option and the government has decided to phase out coal completely as a fuel in power stations. No new coal-fired capacity will be installed. These domestic policies have in turn helped spawn a thriving export industry for wind turbines.

In 1981, the first Danish government energy plan envisaged that 10% of electricity consumption should be met with wind power by 2000. The government then expected that this could be reached by installing 60,000 wind turbines with an average capacity of 15 kW. The 10% target was reached three years early with less than 5,000 turbines with an average size of 230 kW. The main thrust of the latest plan, called Energy 21 (published in 1996), is for a major reduction in carbon dioxide emissions. The target now is for a 20% cut in the 1988 level of emissions by 2005 and a 50% cut by 2030. To achieve this, more than a third of all energy will have to come from renewable sources. Most of this will be wind power.

By 2030 wind is expected to be supplying up to half of the country's electricity and a third of its total energy. To reach this level, a capacity in excess of 5,500 MW will need to be installed, a good proportion of it offshore.

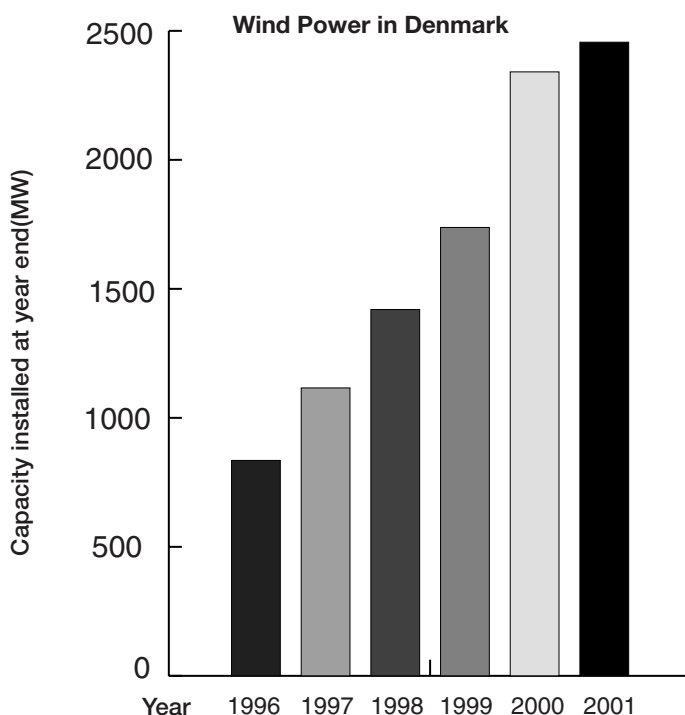
Record proportion

Denmark is already well on the way to achieving these objectives. By the end of 2001 installed wind energy capacity had risen to 2,417 MW. In an average wind year these turbines will produce 18% of the country's electricity. The Danish Wind Industry Association anticipates that Denmark will be able to satisfy more than 20% of its demand from wind generated electricity by 2003. This is a higher proportion than any other nation in the world.

Through the use of wind power, Denmark has already achieved one third of its required reductions under the Kyoto Protocol. This reduction is equivalent to about 7% of all Danish greenhouse gas emissions.

Engineering innovation

An important element in the Danish success story has been technological innovation. At a time in the 1980s when wind turbine design was locked in a "biggest is best" approach, the Danes went back to basics, using skills partly from agricultural engineering to construct smaller, more flexible machines. The



(Source BTM Consult)

familiar three-bladed design with the rotor and blades set upwind (on the windy side of the tower) is now the classic concept against which all others are judged.

More recently, Denmark has led the world in the development of proposals to build large wind farms of turbines in its coastal waters. Working with the country's two main electricity companies, the Danish Energy Agency has elaborated plans for five offshore parks with a total capacity of about 750 MW before 2008. The Government has so far approved the first

two parks. The eventual aim is for up to 4,000 MW of offshore schemes by 2030.

Another feature of Danish development is that 80% of the turbines erected are owned by individuals or specially established wind co-operatives. Over 150,000 Danish families now either own themselves, or have shares in, wind energy schemes. Even the large 40 MW wind farm in the sea just outside Copenhagen is partly owned by a co-operative with 8,500 members