

Wind Energy Policy in Denmark Status 2002

By Soren Krohn, Managing Director, Danish Wind Industry Association, 22 February 2002

This article reviews the status for Danish energy policy as it relates to wind energy in early 2002. It is not a review of all of the official Danish energy policy, but it answers most of the questions which our readers ask us about the current policy stance in Denmark.

The article does not cover research and development policies and the industrial implications of Danish energy policy past and present. This is dealt with in detail in the article *Wind Energy Policy in Denmark: 25 Years of Success - What Now?* Readers who are interested in the development of the Danish wind industry should read *Danish Wind Turbines: An Industrial Success Story*.

I Historical Background 1972-2002

Danish energy policy has been an area of very broad consensus in the Danish Folketing (Parliament) throughout the past 25 years, and there has been a remarkable consistency in this policy over the years.

During the two oil supply crises (1972-1979) energy policy was obviously directed towards security of supply. Strong fiscal incentives were put in place to encourage domestic oil and gas exploration in the North Sea (Denmark is today more than 100% self sufficient in oil and gas). The power generation system was changed from being largely oil fired to being coal-fired, and decentralised generation using CHP (combined heat and power generation, using the heat for district central heating) was encouraged strongly through fiscal incentives.

The conversion to coal-firing meant that Denmark had relatively large greenhouse gas emissions per capita, when environmental concerns became prevalent in the 1980s. Denmark's policy on greenhouse gas abatement has been very ambitious, and has been based on very extensive economic and technical analysis. "Energy 21" is probably the best documented national energy policy in the world.

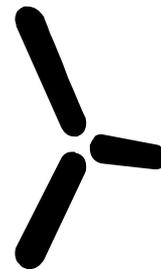
After the oil crises energy policy to a large extent became synonymous with environmental policy, largely because of concerns about direct local environmental damage from emissions, plus the problems of greenhouse gas emissions. Logically, the Energy Ministry was subsequently merged with the Ministry of the Environment.

The new right-wing government which came into power in 2001 moved energy policy to the Ministry of Economics and Industry, thus apparently signalling a less environmentally friendly and a more "old industry"-friendly policy than previous governments.

At the time of writing it is neither clear for the press, nor for political observers in this industry, whether the new right-wing Government actually has a (new) energy policy.

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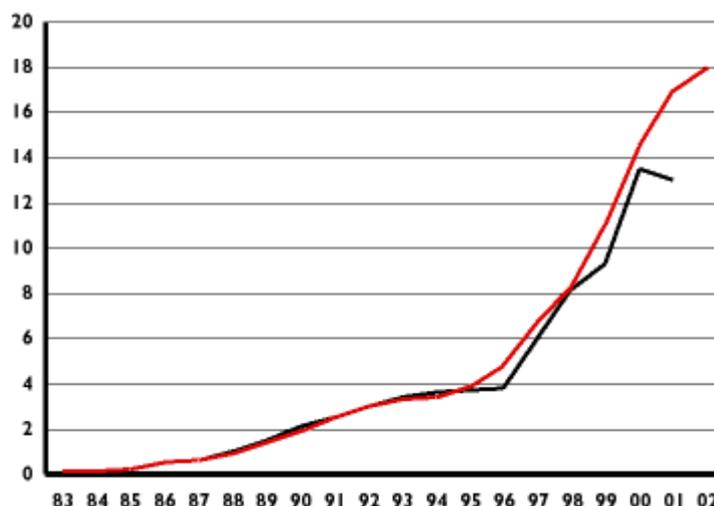


Due to 25 years of parliamentary consensus on energy policy, and a tax system which is very reliant on "green taxes" from energy, there is little leeway for radical changes in Danish energy policy. In some sense, that is a tribute to the very extensive analysis work which over the years has been carried out by the Danish Energy Agency, or commissioned from that agency to other institutions such as Risoe National Laboratory.

In short, the stability, the analytical base, and the adaptability of Danish Energy policy have been quite remarkable over the past 30 years. Whether the new right-wing Government heralds a fundamental change in this base still remains to be seen.

2 Wind Power Status and Targets 2002

Wind energy in 2002 is 18 per cent of Danish electricity consumption (based on an average wind year). Percentage of Danish Electricity Consumption from Wind



Energy 1983-2002

Red graph: Normalised data, i.e. electricity production from wind, if each year had been an average wind year.

Black graph: Actual data influenced by weather changes.

During the past 15 years changing Danish government coalitions have maintained a target of 10 per cent wind energy for the year 2005, a target which was subsequently adjusted to 16 per cent by 2003. In reality wind will supply some 21 per cent on Danish electricity consumption by 2003.

In the latest long-term scenario planning (Energy 21, published in 1996) from the Danish Ministry of the Environment and Energy, the long term targets are set even higher. In the year 2030 wind should account for some 40 to 50 per cent of electricity consumption.

3 Why Wind Energy in official Energy Policy?

The basic reason why wind energy has such a prominent place in Danish energy planning is the need to reduce greenhouse gas emissions. Denmark has a target of



reducing CO₂ emissions by 22 per cent between 1988 and 2005. More than one third of that target is being met using wind energy to replace coal-fired power generation.

4 Other Greenhouse Gas Abatement Policies

Biomass (largely straw-fired power generation) is also being used in energy planning, although to a much smaller extent, due to higher costs. Another part of the target is being met through energy savings. (Denmark has reduced the amount of energy used for space heating by 50 per cent in 20 years).

Finally, all new thermal power generation during the past 20 years has been built as CHP plant. Most of the CHP plant is gas-fired. In many cases even small villages have their own CHP plant. It has been outlawed to build district central heating systems without power generation, and even temporarily cutting of power generation is effectively discouraged though the government's indirect tax policy on energy.

There are no nuclear power installations in Denmark, and the only, very small nuclear test reactor at Risoe National Laboratory was shut down in 2001. (It is now being decommissioned at a cost of 1.2 billion DKK). Nuclear power was taken out of Danish energy planning by a parliamentary decision in the 1980s. It has not been an issue for public debate since.

5 Green Taxation

Danish energy policy relies to a very large extent on so called "green taxation", i.e. indirect taxes on energy to encourage energy savings.

Households generally pay an effective rate of tax of some 200 per cent on energy products, such as natural gas, petrol, or heating oil. Fuels used for electricity generation are not taxed, but there is an electricity tax plus a VAT of 25 per cent which effectively means a rate of taxation above 200 per cent. Households pay an electricity price of some 1.40 DKK/kWh (=0.19 EUR). Danish industry pays very low taxes on electricity used for manufacturing purposes, and has some of the lowest electricity prices in Europe, around 0.05-0.06 EUR/kWh, according to IEA statistics.

6 An Ambitious Offshore Wind Programme

More than 2,600 MW of wind power is currently installed on land in Denmark (against an official target of 1,500 MW by 2005). Subsequent (net) development is expected to take place offshore.

Two experimental wind farms have been built in Danish waters: Vindeby (1991) and Tunø Knob (1996). Middelgrunden next to Copenhagen is the first large pilot project (40 MW) offshore. It was commissioned in 2000.

Two wind farms of 160 MW each are being installed in the North Sea at Horns Rev (2002) and in the Baltic Sea at Rødsand (2003). The wind farms are built by the Danish power companies SEAS and ELSAM under an executive order from the Minister of the Environment and Energy.

In view of the fact that the Danish wind energy programme is several years ahead of schedule, the Danish government has recalled the executive order to the power



companies to build an additional three wind farms offshore during the period 2004-2008. (Some 27 per cent of Danish electricity consumption will be coming from renewables by 2003, against a target of 20 per cent).

7 Support Schemes for Wind Energy (and Other Renewables)

The basic support mechanism for wind energy in Denmark is basically a fixed price system with an environmental premium per kWh in addition to the market electricity price. Currently new wind turbines are paid 0.43 DKK/kWh for the first 12,000 "full load hours". (I.e. you multiply the rated power of the turbine in kW by 12,000 to get the number of kWh eligible for this tariff). For offshore wind turbines the tariff is 0.453 DKK/kWh for 25,000 full load hours.

The premium is financed as an addition to the electricity price per kWh, shared equally among all electricity consumers in relation to their electricity use. This is thus not in legal terms a state support mechanism (as decided by the European Court of Justice in its decision on the *Stromeinspeisungsgesetz*), but the excess cost of renewables has been internalised in the electricity price. The government has been studying a so-called green certificate market based scheme which would be combined with a Renewable Portfolio System (RPS) requiring electricity consumers to buy an increasing share of their electricity from renewable sources.

After a parliamentary hearing in September 2001 the government concluded that the scheme was impracticable for the time being, and its implementation has been postponed indefinitely.

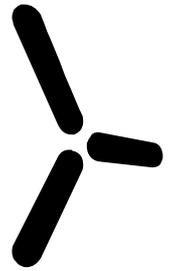
In reality this means that Denmark will probably continue to operate its system with an environmental bonus until the European Union may decide to opt for a harmonised scheme for support for renewables. According to the EU Directive on Electricity from Renewables this is not likely to be implemented before 2010. Currently the European Commission is studying the options available and the experiences with the different national support schemes in Europe.

8 Managing an Electrical Grid with Large Amounts of Wind Energy

Even if wind may occasionally account for up to 50 per cent of power generation in the western part of Denmark (on windy winter nights), the transmission grid operators have been able to cope with this. In a largely thermal power generation setting like the Danish power system, there is always a need for a spinning reserve of backup power for conventional large coal-fired (base load) power stations. This spinning reserve is usually around 20% of the load or at least the size of the largest power station online.

This spinning reserve is usually sufficient to counterbalance the variations in energy output from wind turbines, as well as counterbalancing the variations in electricity demand from minute to minute.

"Electricity Overflow", i.e. the risk of a larger electricity production than electricity consumption in the area of the grid can usually be dealt with through exports to



neighbouring countries. In this context the fact that neighbouring Norway has a 99.9% hydro-based electricity system is a large advantage. It is cheap and costless to adjust the outflow from a hydropower plant, thus the Norwegian and to some extent the Swedish power system is ideal complements to Danish wind energy.

There are certain implicit structural problems in the way the Danish thermal based electricity generation system is built on CHP generation. The problem partly stems from the fact that the use of electricity for heating is deterred by a draconian green taxation policy.

Windy winter nights can therefore become a problem, if the transmission capacity to neighbouring countries is insufficient. A new report from a group of experts, primarily from the power companies suggests that the government change its tax policy in order to be able to cut power generation during short intervals where there is a danger of electricity overflow.

The electricity systems operator has recently (February 2002) been mandated to cut power generation from a number of decentralised power generators in this case, compensating the independent power producers for their economic losses. The total size of this problem is currently less than 0.1 per cent of annual electricity consumption.