

## The Market Value of Wind Energy

After the hurricanes in January 2015, there has been some public debate on the impact of the negative prices in the electricity spot market. Based on the Nord Pool spot prices, the average market values of electricity categories in Denmark were the following in 2014:

| 2014              | GWh    | €/MWh | Relative value |
|-------------------|--------|-------|----------------|
| Demand            | 33,470 | 32.21 | 100.0%         |
| Wind              | 13,076 | 27.64 | 85.8%          |
| Onshore           | 7,912  | 27.11 | 84.2%          |
| Offshore          | 5,165  | 28.05 | 87.1%          |
| Solar             | 596    | 33.76 | 104.8%         |
| Large CHP         | 12,976 | 33.05 | 102.6%         |
| Local CHP         | 3,966  | 33.67 | 104.5%         |
| Hourly net export | 2,661  | 23.29 | 72.3%          |
| Hourly net import | 5,518  | 35.57 | 110.4%         |

Source: energinet.dk

Nord Pool Spot has two price areas in Denmark, West (DK1) and East (DK2). For this calculation, it has arbitrarily been assumed that 85% of the offshore wind was connected to DK1.

The relative spot price differences are explainable with the demand value as reference. The demand profile is a heavy element of the spot price. The market value of a randomly varying supply profile such as wind power is lower than 100% because there is a certain correlation between high wind periods and low prices. Offshore wind energy is worth more than onshore wind energy due to a higher load factor. The value of solar energy is worth more than 100% because spot prices are generally high in daylight. Local CHP is worth more than large CHP because it is possible to concentrate production to hours of high prices.

The average values of export and import are of particular interest. The random nature of wind power causes periods of overflow of power, export and low spot prices and other periods of shortages, import and higher prices.

The market response to the wind power variations depends on the available resources, both in terms of dispatchable sources (both supply and demand) and transfer capabilities in the primary grid. The increasing share of fluctuating capacity in the neighbouring countries has a strong influence on the robustness of the market prices, particularly because the variations of wind power in Northern Europe has a high degree of simultaneousness.

### **A race between fluctuating power and balancing resources**

It remains to be seen if the balancing resources will be sufficient for keeping the Danish spot price volatility at a reasonable level. Several countries have rather ambitious plans for grid reinforcements. The plans for developing dispatchable production in accordance with the growth of fluctuating power are more uncertain.

The next few years will be a race between an increasing amount of fluctuating power and the available balancing resources. The spot price volatility will be an indicator. If the balancing resources are lagging behind the spot price volatility will increase.

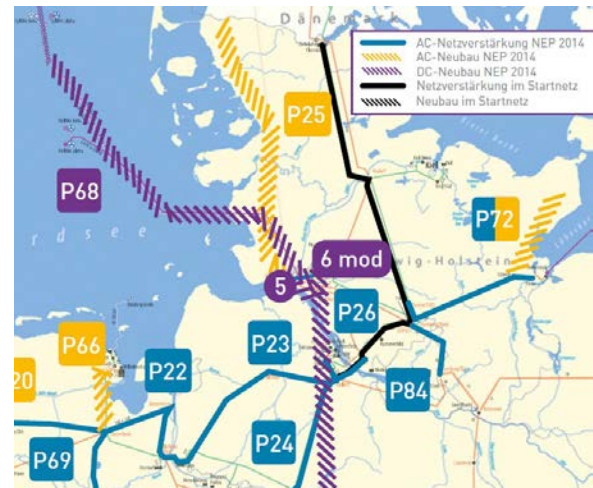
## Grid reinforcements and spot price volatility

Grid reinforcements often come too late. A Swedish comment<sup>1</sup> mentions that the transfer capability between Denmark (DK1) and Germany is insufficient because wind power in northern Germany has a first right in the German main grid. The Swedes do not forget that EU in 2010 forced Sweden to change its market design because internal Swedish transfers had priority to international exchanges. When will Germany have to divide the German electricity market into price areas?

For Schleswig-Holstein in North Germany, the 2014 grid plan<sup>2</sup> includes a new 400 kV line at the west coast (project P25) and a 400 kV line across the river Elbe (project P26).

Both projects are expected to be complete by 2021.

Even if the construction works proceed according to plan, the commissioning will be too late for preventing increasing congestion problems.

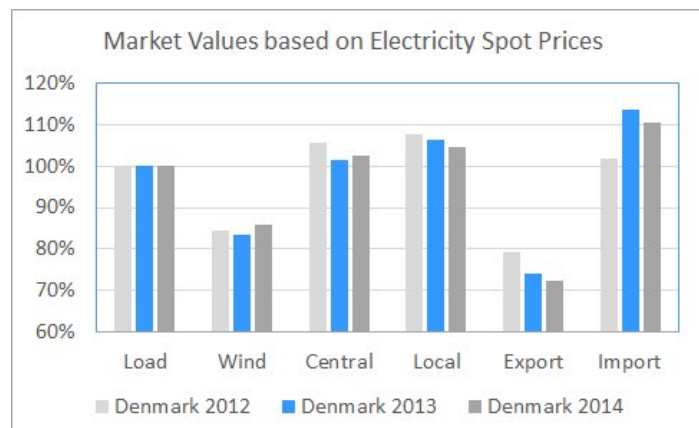


## Trend observations

I have made similar calculations for 2012 and 2013. The first complete year with separate profiles for solar power and for onshore and offshore wind is 2014.

The number of observations is insufficient for an identification of long-term trends.

The next few years until 2020 will be an interesting observation period.



If the development of fluctuating power in Germany and Denmark is faster than the integration measures, we will see decreasing market values of wind energy and electricity export together with increasing market values of electricity import. If the integration measures prevail, we will see stable or increasing market values of wind energy and electricity export.

## Decisive balancing resources

The total investment in renewable energy is considerable. The total cost of the transition programme depends on the market value of the renewable energy. Therefore, it will take a suitable amount of new balancing resources to prevent increasing spot price volatility and decreasing market value of the wind energy.

<sup>1</sup> <http://www.second-opinion.se/energi/view/2929>

<sup>2</sup> <http://www.netzentwicklungsplan.de/netzentwicklungsplan-2014-zweiter-entwurf>