From 140% Wind Power Record to Calm

The happy message that Danish wind power production reached 140% of the electricity demand was distributed by several international media, for instance with these headlines:

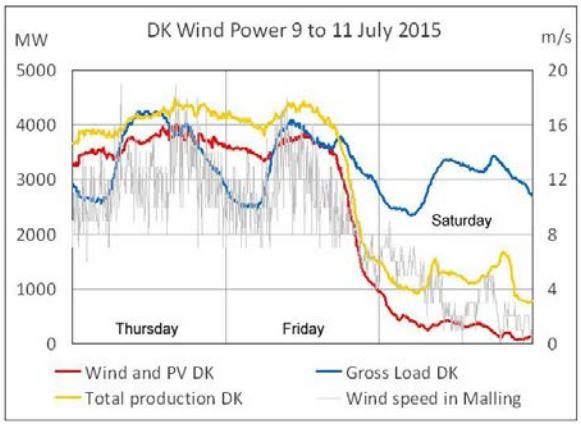
> **Wind power generates 140% of Denmark's electricity demand**
>
> Unusually high winds allowed Denmark to meet all of its electricity needs - with plenty to spare for Germany, Norway and Sweden too

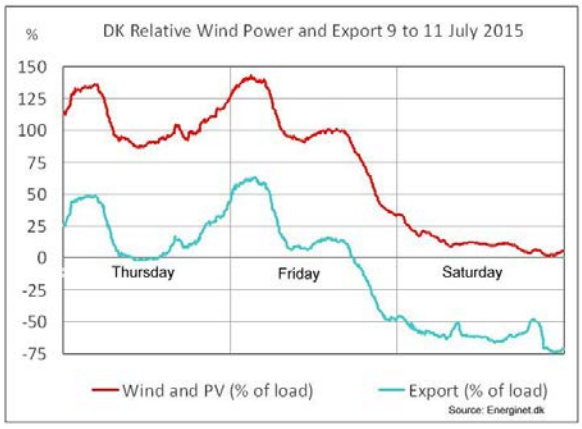
The Danish Broadcasting Corporation (DR) boosted the success by claiming that wind has covered 140% of Denmark's energy demand:

> 12. JUL. 2015 KL. 13.37
>
> **Voldsom blæst dækkede 140 procent af Danmarks energibehov**
>
> Natten til fredag producerede danske vindmøller så meget strøm, at der var nok til at eksportere til Sverige, Norge og Tyskland.

On the other hand some people have claimed that the surplus electricity was exported at very low prices, while Denmark had to pay high prices for the import.

This note presents facts on production and exchange of electricity in Denmark from 9th to 11th July 2015. The note is based on data, which are published daily by www.nordpoolspot.com and energinet.dk.

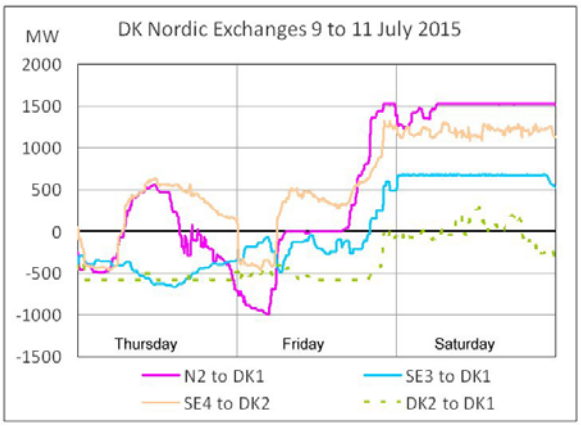


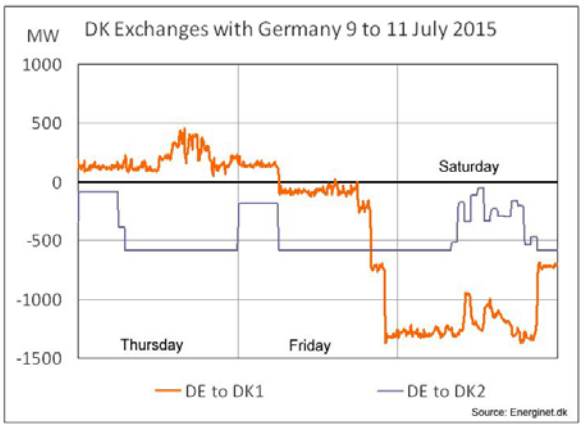


The 140% record was observed during the night of Friday 10th July. The wind and the wind power disappeared nearly completely from Friday to Saturday. The export/import graph shows that other countries balanced most of the Danish wind power variations.

A limited number of thermal units must be connected to the grid for security reasons. There is practically no heat demand in July. Therefore, these units could be operated at minimum production during the first 36 hours of the three days.

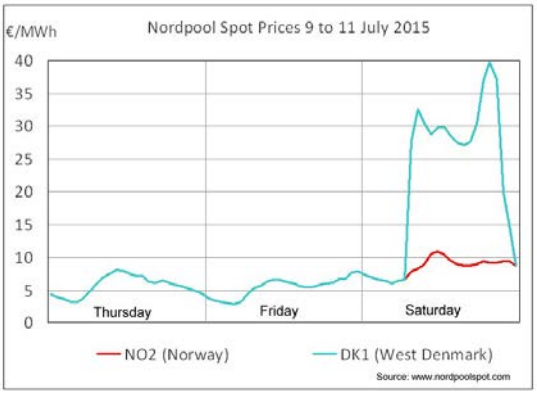
The exchanges with the neighbouring countries are results of a German and Danish demand for balancing services and the Norwegian and Swedish capacity to supply such services.





The left chart shows that exchanges with Norway and Sweden followed the wind power variations while the thermal units in Denmark were running at minimum production. During the Saturday there was a rather steady import at about 3,400 MW from Norway and Sweden while Danish thermal units balanced Danish load variations.

The background of the exchanges with Germany in the right chart is less obvious without knowing more details about the operational situation in Germany. The decreasing wind must have created a considerable demand for electricity. On Saturday the Danish grids had to carry up to 1,900 MW transit from Norway and Sweden to Germany.



The Nordpool spot prices reflect the changing power balance.

All Nordic spot prices were equal during the two days with low prices. The interconnectors were running at part load and there were no bottleneck fees.

The demand for electricity created high spot prices in Denmark and Finland on Saturday. The interconnectors from Norway and Sweden were running at full load and the price differences created bottleneck fees for the grid owners.

The Nordpool spot prices were used for an estimate of the cost of the balancing services during the 72 hours. For 38 hours Denmark had a net export of 28,707 MWh at an average value of 4.36 €/MWh. For the remaining 34 hours Denmark had a net import of 48,740 MWh at an average value of 20.98 €/MWh.

DK	9 July	10 July	11 July
Net export MWh	14,283	8,413	-42,729
Spot value €	64,935	17,368	979,508
Average €/MWh	4.55	2.06	22.92

These figures could lead to exaggerated conclusions. For at full year the differences between average values are less dramatic, but still a matter of concern, see for instance[1].

The high spot price level on 11 July was expensive to Danish market participants. On the other hand Energinet.dk could collect a share of the bottleneck fees. The estimated total congestion income for the links with Norway and Sweden is € 1.1 million. The congestion income for the links with Germany is unknown for the time being.

It is not yet possible to estimate a cash flow between nations for the three days, but the congestion income should be included. The next step could be a specification of Danish cash flows between commercial market participants and Energinet.dk.

The wind power volatility creates increasing market price volatility. The development causes problems to owners of Danish thermal units. The average price level is decreasing and the price peaks cannot create sufficient income for maintaining operation with the CHP units (combined heat and power).

Extreme price peaks are always results of grid congestion. Therefore, it is an Energinet.dk policy to expand the interconnections. Considerable investments are required for this purpose.

To Danish consumers of heat and electricity there must be an optimal policy, but this consideration has been ignored in favour of a policy aiming at reducing the use of fossil fuels. The result is a decreasing use of CHP and a rapidly increasing cost of subsidies for renewable energy (the PSO tariff).

[1] http://pfbach.dk/firma_pfb/pfb_the_market_value_of_wind_enrgy_2015_02_10.pdf