

## Danish Wind Power Variations are still exported

In the wake of the CEPOS study<sup>1</sup> in 2009, there was a rather unconstructive debate on the causal relationship between the wind power output in Denmark and the net export of electricity. Were Denmark exporting wind energy or CHP electricity?

On one side, the time series indicated a covariation of wind power output and net export. On the other side, it could be argued that the variations were results of international market conditions, and that thermal electricity production in Denmark under other circumstances could have outbalanced most of the wind power variations.

At that time, the production of wind energy in Denmark was about 20% of electricity demand. In 2014, the wind power output has increased to about 40% of the electricity demand. That level of wind power cannot be outbalanced by local thermal power plants, and the export of electricity still clearly reflects the wind power variations (see annex 1 and 2).

Daily load variations have some influence on the electricity export. The daily variations can be seen in the export curves in annex 1. In order to eliminate this influence, annex two shows wind power and electricity export as fractions of the electricity demand.

The trend of the spot market prices in Denmark and Germany is decreasing due to the inflow of subsidized power. Several thermal power plants have closed down already, and the gap between average market values of import and export of electricity seems to be increasing. This gap can be seen as an indicator of the cost of the balancing services, provided by neighbouring countries.

Danish Exchange of Electricity Market values in €/MWh		
	Export	Import
2011	48,17	49,00
2012	32,01	39,24
2013	30,90	45,35
2014	24,80	35,15

Table 1

The wind power related export variations would not have been there without the wind power. Therefore, it is obvious that wind power variations have caused the export variations. Consequently, also wind energy has been exported. A debate on the causal relationship is meaningless.

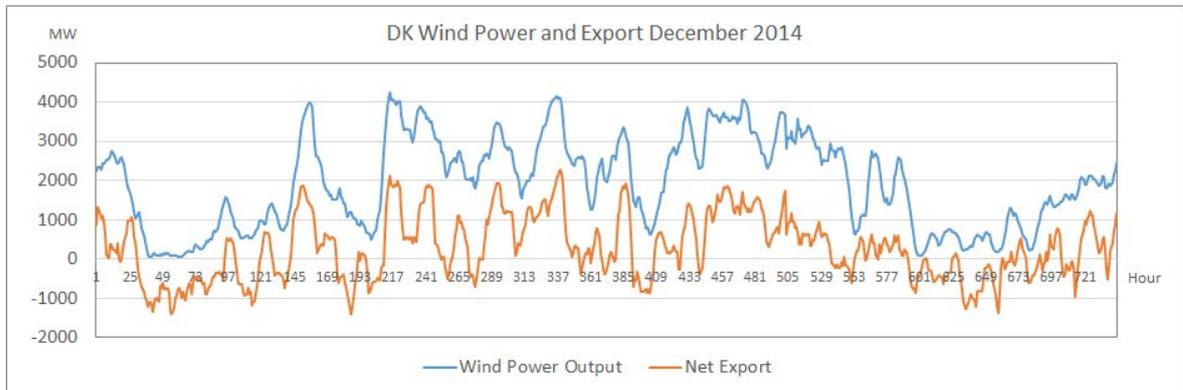
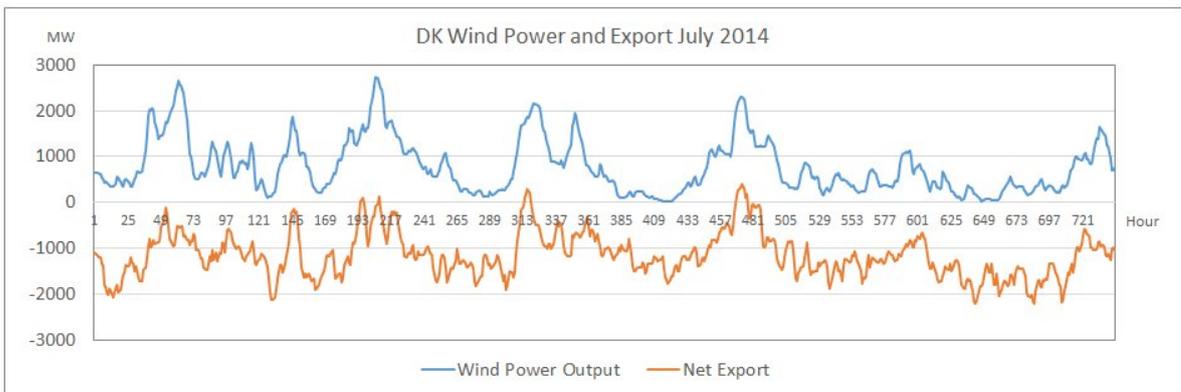
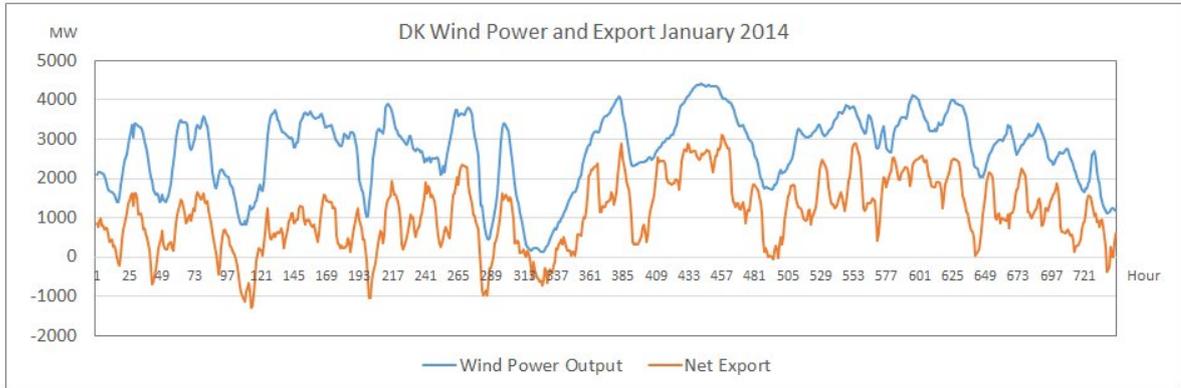
The real problem is to maximize the market value of the energy from fluctuating power sources such as wind power and photovoltaics. It is widely accepted that new flexible utilizations of the unstable power must be developed. Besides, also a suitable amount of dispatchable capacity for balancing services based on non-fossil fuels must be available.

So far, the construction of wind power turbines has been much faster than the implementation of a flexible response. Very little has happened on the demand side so far. The market values of the Danish power exchanges for the next few years will indicate if the balance is improving.

The cost of foreign balancing services will probably increase in a future with an increasing share of wind power and photovoltaics in all neighbouring countries. The development and implementation of domestic flexible resources in time could be decisive to both economy and security of energy supply in Denmark.

<sup>1</sup> [http://www.cepos.dk/fileadmin/user\\_upload/Arkiv/PDF/Wind\\_energy\\_-\\_the\\_case\\_of\\_Denmark.pdf](http://www.cepos.dk/fileadmin/user_upload/Arkiv/PDF/Wind_energy_-_the_case_of_Denmark.pdf)

### Annex 1: Wind Power Variations and Electricity Export in 2014



Annex 2: Relative Wind Power Variations and Electricity Export in 2014

