CEESA (Coherent Energy and Environmental System Analysis) Research Project

Danish Wind Power - Export and Cost

A comment on *Wind Power Variations are exported*

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In *Wind Power Variations are exported*[1], Paul-Frederik Bach (PFB) argues against the findings in the study *Danish Wind Power Export and Cost*[2]. Below is the response from the authors of *Danish Wind Power Export and Cost.*

1. The authors do not question the need for addressing how to integrate wind power into the energy system. Purporting that we have – and arguing against that – does not add to the discussion.
2. As opposed to the CEPOS[3] study, the authors of *Danish Wind Power Export and Cost* have presented the methodology as openly as possible to create transparency in the analyses and thus further the public debate.
3. Concerning markets, PFB writes *"The argument seems to be based on the understanding that the market is operated in two steps: In the first step domestic supply is determined and in the second step agreements on export are made.*" and later *"There is no special reservation for domestic consumers. Therefore section 1.2 in the CEESA report is based on a misleading assumption".*
   This is an erroneous and misleading interpretation of the market description in our report *Danish Wind Power Export and Cost*. Tables 1 and 2 illustrate how the market functions when separated into different pricing areas - and when combined into one pricing area. There is no sequential construction of the market and this is not an assumption.
4. PFB criticises the use of linear regression analyses. This is odd as the authors merely employ the same method of analysis as found in the CEPOS analysis – but expands the analysis to thermal power plants as well. The point, we make, is that the method of analysis used by CEPOS would give rise to the same conclusions on thermal plants being the cause of export. We wanted to show the weakness of this method of analysis and of the statistics used. A statistical correlation does not necessarily suggest a causal relation – for which reason we proceeded to establish the causal relation.
5. We acknowledge the correlation between wind power and export from a monthly perspective as exemplified by the graphs in *"Wind Power Variations are Exported"*. We have never argued against it and there is no contradiction to the causal relation we have established by referring to the functionality of international electricity markets (see below).
6. We do not acknowledge that based on these examples of correlations one may establish a general causal relation that may be condensed into *"the simple rule that the smaller of either a) wind power output or b) net export of electricity for each hour, is considered as wind energy export."* ("Wind Power Variations are Exported, page 6). A statistical correlation does not necessarily suggest a causal relation. Figure 4, page 3 in *Danish Wind Power Export and Cost* clearly illustrates why this simple rule is too simple and consequently the interpretation of statistics of the CEPOS report is wrong.
7. PFB writes *While the amount of exported wind energy is a matter of interpretational definition, and is dependent on perspective, it is clearly evident from the data that the irregular variations of Danish wind power are reflected in the exchange of electricity with the neighbouring countries. This much cannot be denied; the facts are clear.* ("Wind Power Variations are Exported, page 2). Later on page 6 PFB writes *"thermal power plants in Denmark with few exceptions are operated practically independently of the wind power output"*.
   However, one central point is missing here. The reason why the wind fluctuations to some extent are shared with neighbouring countries is that the remainder of the Danish electricity

[1] http://www.pfbach.dk/firma_pfb/wind_power_variations_2010_03_05.pdf
[2] http://www.energyplanning.aau.dk/Publications/DanishWindPower.pdf
[3] Wind Energy – The case of Denmark http://www.cepos.dk/fileadmin/user_upload/Arkiv/PDF/Wind_energy_-_the_case_of_Denmark.pdf

system is cost efficient in terms of market operation. Evidently it pays to keep up production on the thermal plants when the wind is blowing. Had Danish thermal power producers been less economically efficient than those of our neighbouring countries, then they would have shut down as a consequence of wind power production. Had this happened, then there would have been no export during those hours. In other words, we would not have had an export in hours of high wind if the Danish thermal power producers had had poor economy of operation. They are - as it is - generally competitive and wind power makes Denmark even more competitive and permits us to use the export potential of the other parts of the electricity system. PFB points out January 2009 in his criticism. However the average spot market price of this month was 315 DKK/MWh and relatively stable around this level throughout most hours of the month. This level is above the short-term marginal cost of producing electricity on thermal power plants – particularly when the CHP plants also have a heat demand to cover. This indicates an incentive to produce in spite of momentary wind power production.

A key message is: Denmark is exporting during periods of high wind, because we have a very efficient and cost-effective electricity system in general with a high degree of thermal power. Not because the system from any technical point cannot take the 20% wind power. In a *less* efficient system, there would be no export – and no-one could claim that we were not using our own 20% wind power. If our neighbours increased the cost-efficiency of operation of *their* system to exceed the Danish, there would be no export either.

In brief: we are not exporting during high wind, because we cannot absorb the wind power in our system, but because it pays. And further: we are not exporting the wind power, but the wind power allows the rest of our efficient system to export. In an interview published by IER[4], Martin Ågerup, director of CEPOS and High Sharman argues that Denmark is exporting most of its wind power and warns the US that this would not be possible in the US. This interpretation is seriously mistaken and misleading, as we hope to have made clear by now: It is the least cost-effective power plants that close down, when the wind blows. On the Nordic grid, they happen to lie outside Denmark. In the US, they would lie inside the US, and the US could by any judgement integrate the 20% wind.

Consequently the functionality of the electricity market establishes a causal relation leading to our conclusion that only approx. 1 percent of Danish wind power has been exported. And the correlation between wind power and export from a monthly perspective (which we acknowledge) does not contradict nor change such causal relation.

[4] http://www.youtube.com/watch?v=qgUsun3hIT0