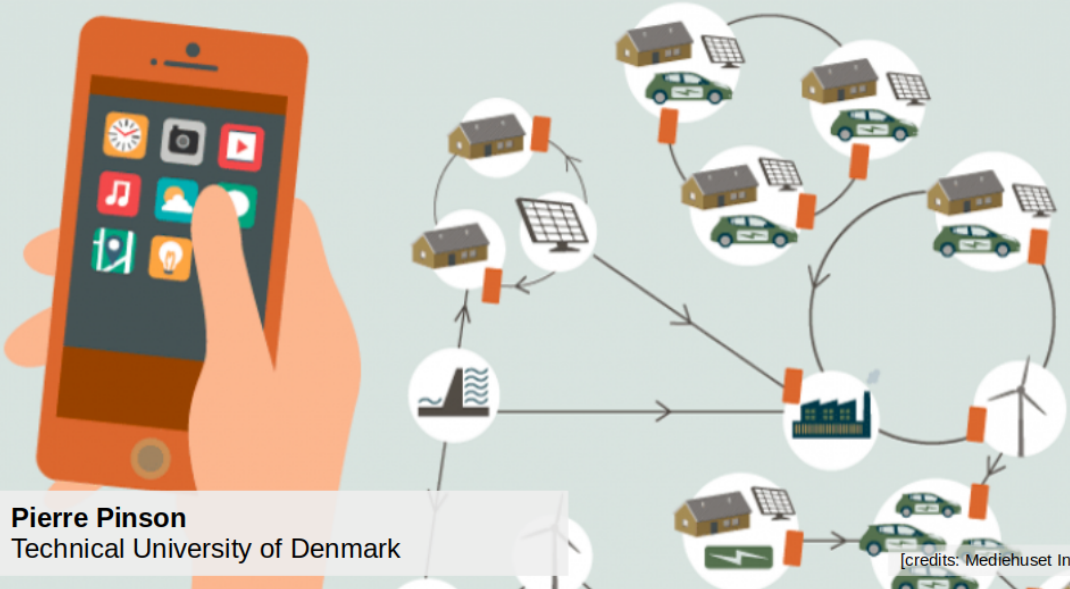
Module 5 – Impact of Renewables on Electricity Markets

5.2 What impacts wholesale prices?



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[credits: Mediehuset Ingeniøren]

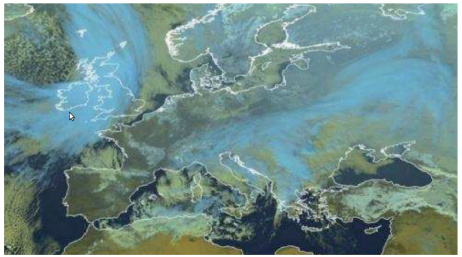
Making electricity demand weather-sensitive?

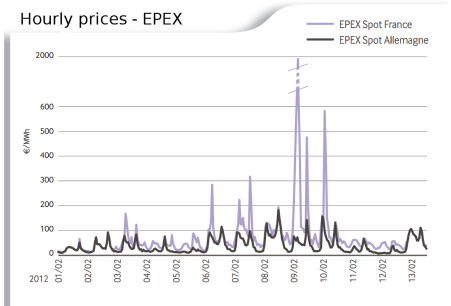
A French example...

- *Since 1974:* 63 GW of installed nuclear capacity (58 reactors)
- *Electric heating:* 36% of residential electricity consumption
- *2001-2011:* electric heating for more than 60% of new residential housing
- **Temperature lowering by 1°C = Demand increasing by 2.3 GW!**

Always looking to beat the previous winter record

Cold wave over Europe in Feb. 2012: Temperature down to -17°C on 7 Feb. 2012





- *8 Feb. 2012:* 100 500 MW (7pm)
- *9 Feb. 2012:* 101 700 MW (7pm)

- *Electricity prices on the European Power Exchange (EPEX):*
  - **300 euros/MWh** on the 6^{th} and the 7^{th},
  - **600 euros/MWh** on the 10^{th} and...
  - **2000 euros/MWh** on the 9^{th}!

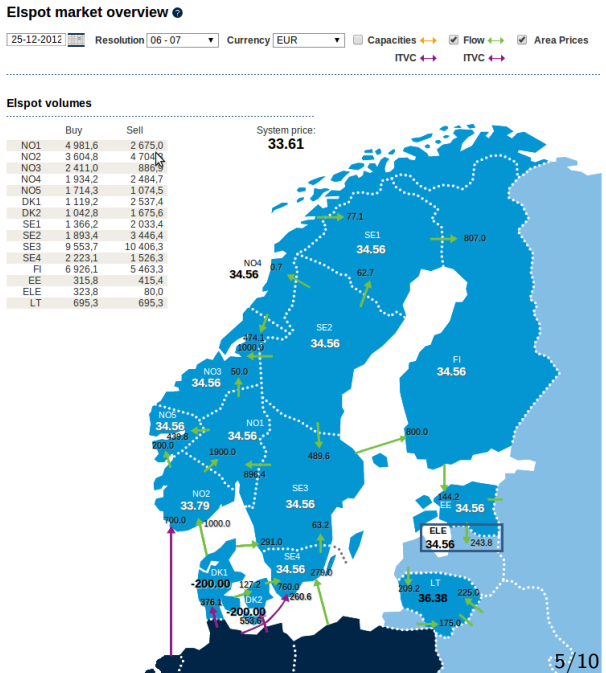
- These price spikes did not occur for the neighboring countries, e.g., Germany

So, it is that simple - is it?

(i.e., temperature drives demand, and then the price)

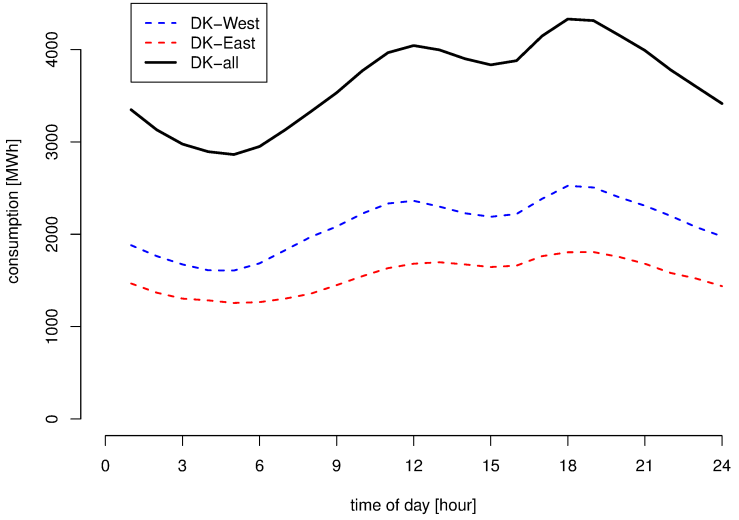
Go' morgen Danmark, og God Jul!

- 25 December 2012, between 6:00 and 7:00 in the morning
- The day-ahead electricity price is negative, and at the lowest cap value
- The system price is used for the neighboring countries...



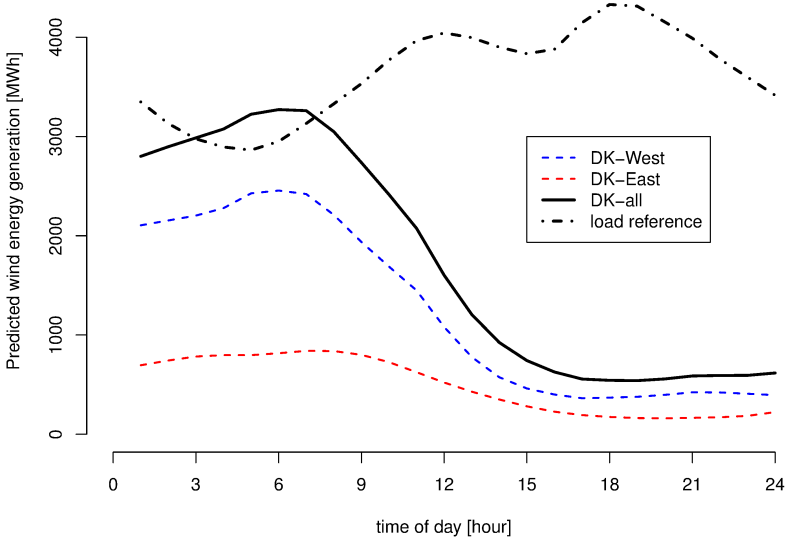
Consumption pattern on 25 December 2012

- Consumption seems to be normal for that period of the year
- Then we should look at the production side
- Could this result from our ambitious targets for wind power integration in Denmark?



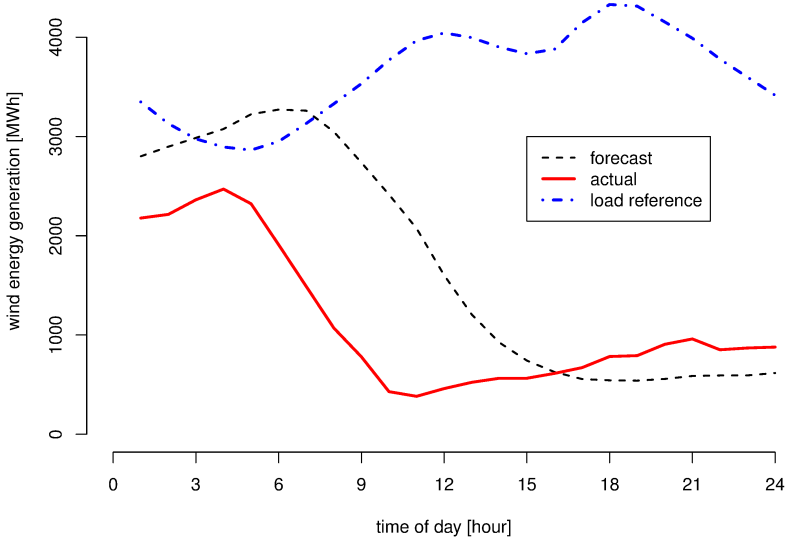
Predicted wind power generation: 25 December 2012

- The wind power forecasts was very high...
- Actually, it was predicted we would have more wind power generation than needed...



Actual wind power generation: 25 December 2012

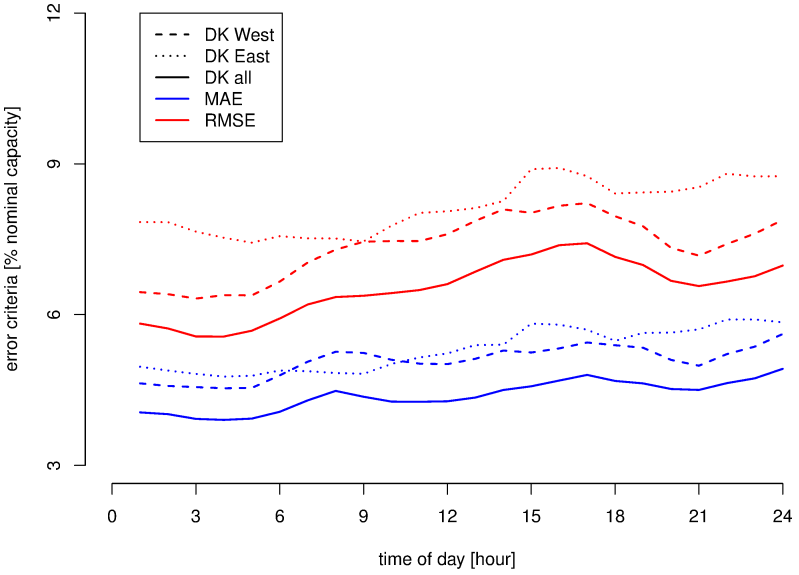
- This is not what exactly happened in practice
- **Balancing volume: 18 684 MWh(!)**
- This represents:
  - 45% of the daily predicted energy generation
  - (roughly) the yearly electricity consumption of 4000 Danish households)



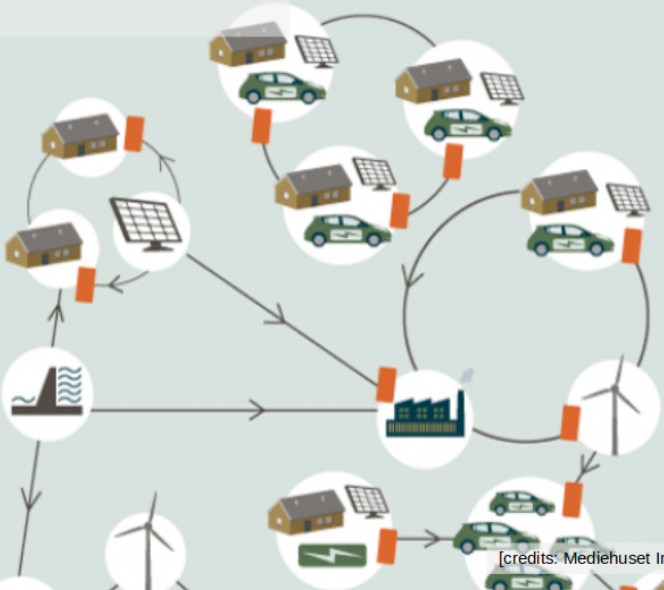
Predictability of wind power generation

Error criteria for 2011 - Danish wind power generation

- *MAE:* Mean Absolute Error
- *RMSE:* Root Mean Square Error
- *Lead times:* between 12 and 36 hours ahead
- *Over the year:* **1 336 179 MWh** to be balanced
  (roughly, the yearly consumption of 300 000 Danish households)



Use the self-assessment quizz to check your understanding!



[credits: Mediehuset Ingeniøren]