



# The impact of renewable energy on the electricity markets

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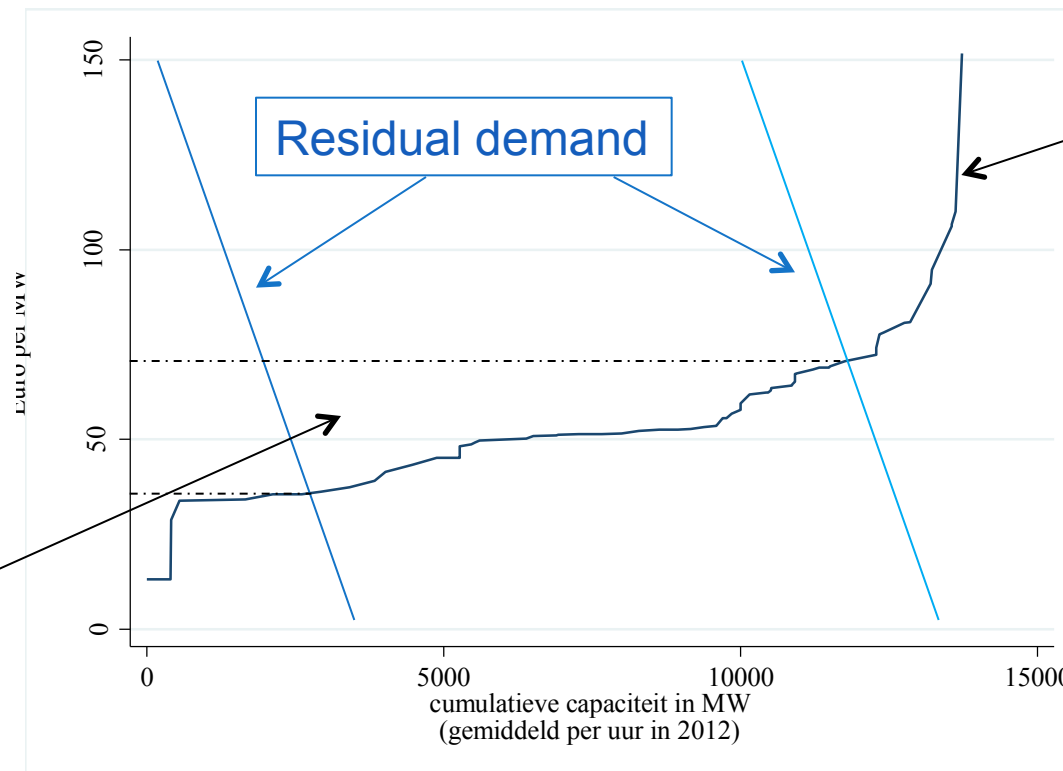
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## How is the electricity price determined?

‘Energy-only market’:

- Only price for the commodity ‘electricity’
- Price is determined by system-marginal costs

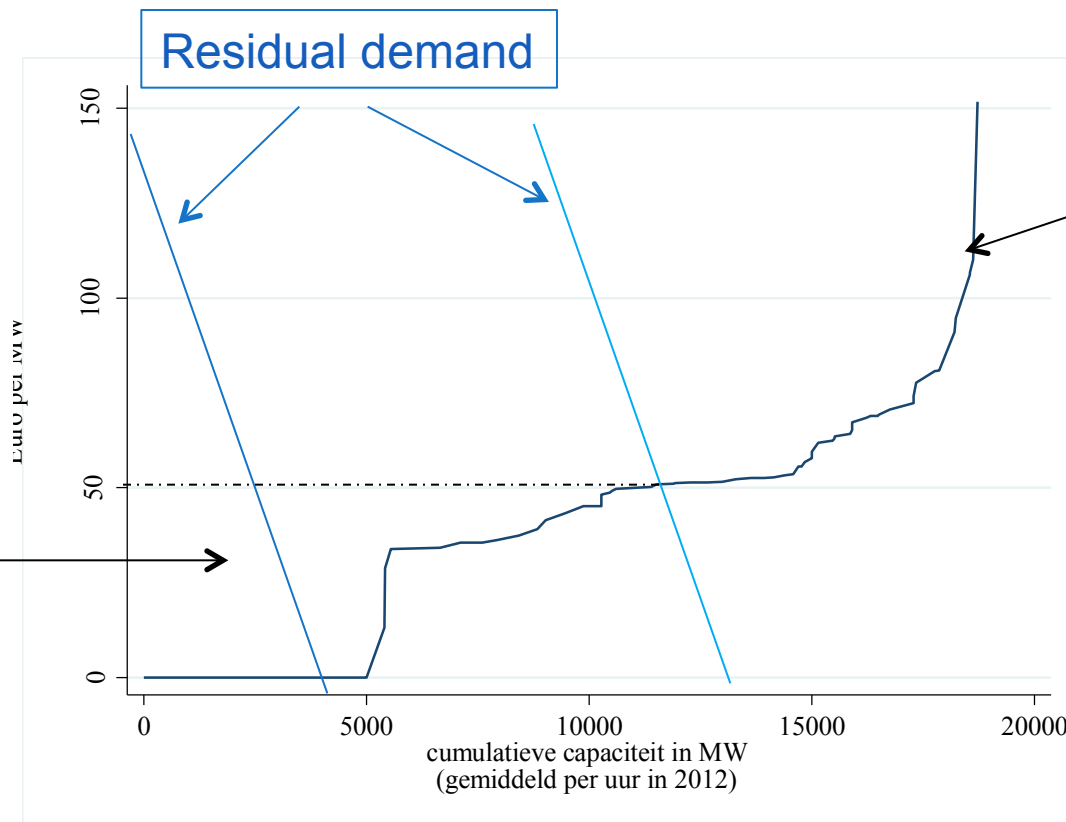


merit-order  
 based on  
 centralised  
 producers

Inframarginal  
 profit to cover  
 fixed costs

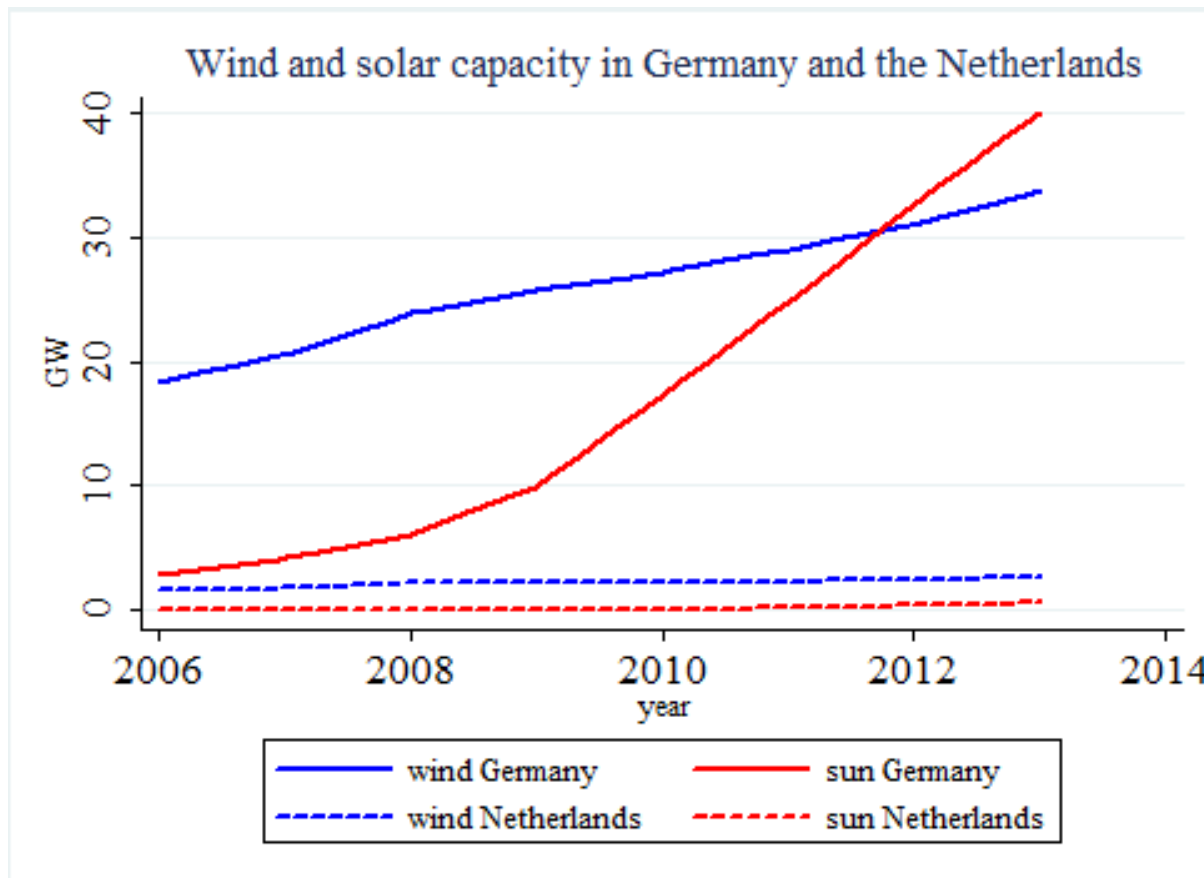


# What happens if more renewable capacity is installed?





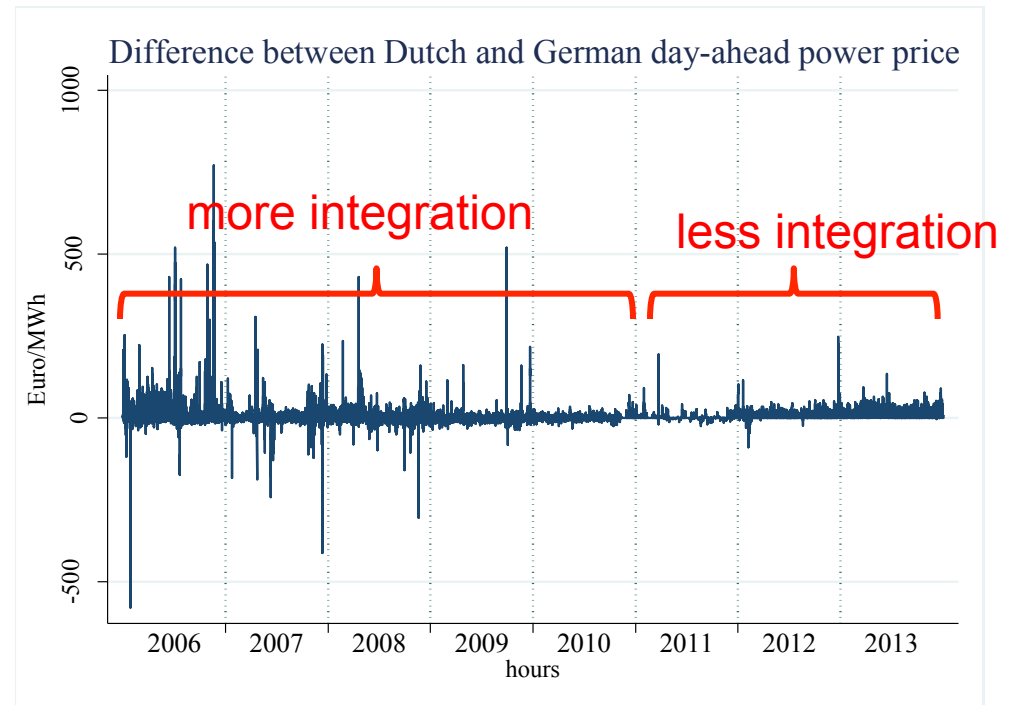
# Renewable energy has increased strongly in Germany





# Dutch and German electricity market are connected, but cross-border capacity is increasingly constrained

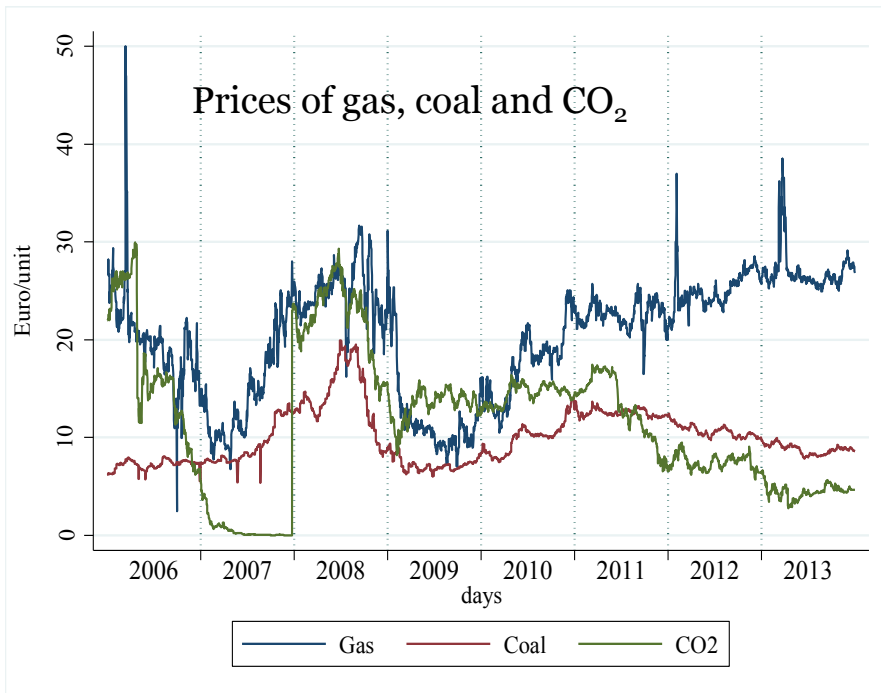
Cross-border capacity  
 Dutch-German markets  
 is about 3.5 GW  
 (20% of installed Dutch capacity)



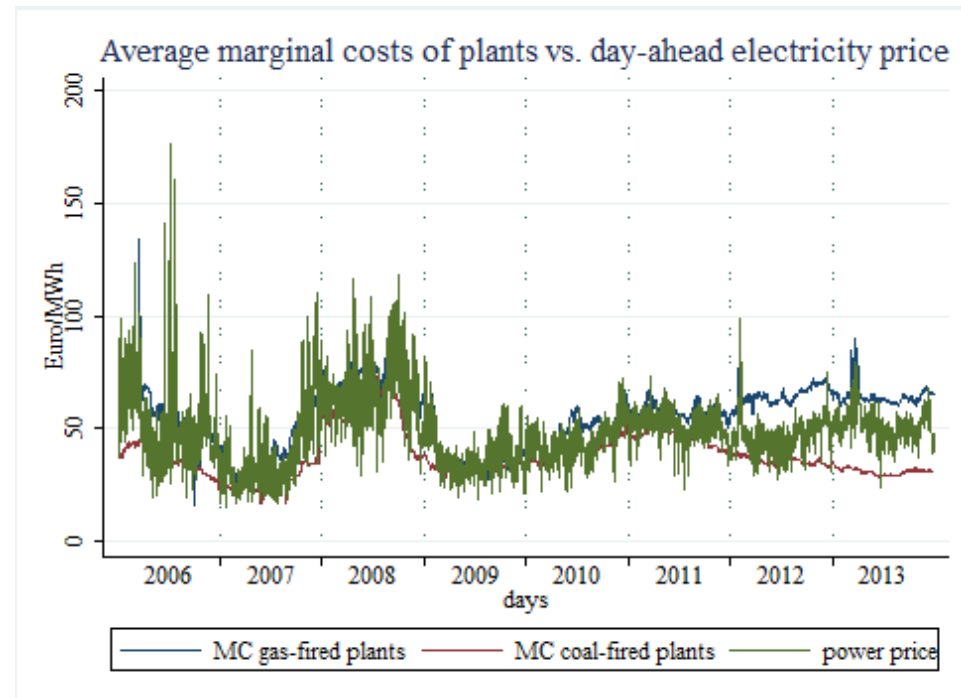


# In addition to the surge in German renewables: changes in fuel prices have changed relative positions of plants in the merit order

many gas-fired plants are not in the money anymore



Source: Bloomberg



Source: ACM; see my paper in the The Energy Journal, 36(2) for a description of data and methodology.



# Explaining Dutch power price

Dutch day-ahead price APX)	2006/2008	2012/2013
Demand (-1)	0.9 ***	0.6***
Residual demand index (RSI)	-0.2***	-0.1***
Price of gas (-1)	0.4***	0.8***
Price of coal(-1)	0.5***	0.1
Price of CO2(-1)	0.05***	-0.1***
Wind speed in Netherlands	-0.01***	-0.01***
Wind supply in Germany	-0.08***	-0.02***
Wind supply in Germany x dummy for constraints on border	0.03	0.02***
Sunshine Germany	0.001	-0.05***
Sunshine Germany x dummy for constraints on border	0.02	0.04***

Constant, Time dummies , AR terms; all variables in logs



## Conclusions

- > The influence of German *Energiewende* on the Dutch electricity market has reduced because of the full utilisation of the cross-border capacity
  - supply of German wind and solar do less influence Dutch power prices
  
- > The dramatic changes in the Dutch market are more related to changes in fuel prices
  - the high gas price compared to the low coal price has made many gas-fired power plants uneconomic