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The Impact of Low-Carbon Generation on Market Design

Walter Boltz

Vienna, 29th March 2012

Agenda

- Motivation for this workshop
- Central planning and security of supply
- Capacity elements and current market design
- Policy options – the road ahead

Energy systems are complex.



New technologies and integration of renewables
Environment and long-term sustainability

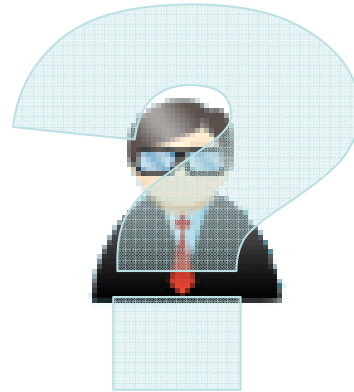


Competition, pricing and the IEM
Efficiency and profitability
Consumer protection



Security of supply and network stability
Investment in “smartness”

Who could get it right?

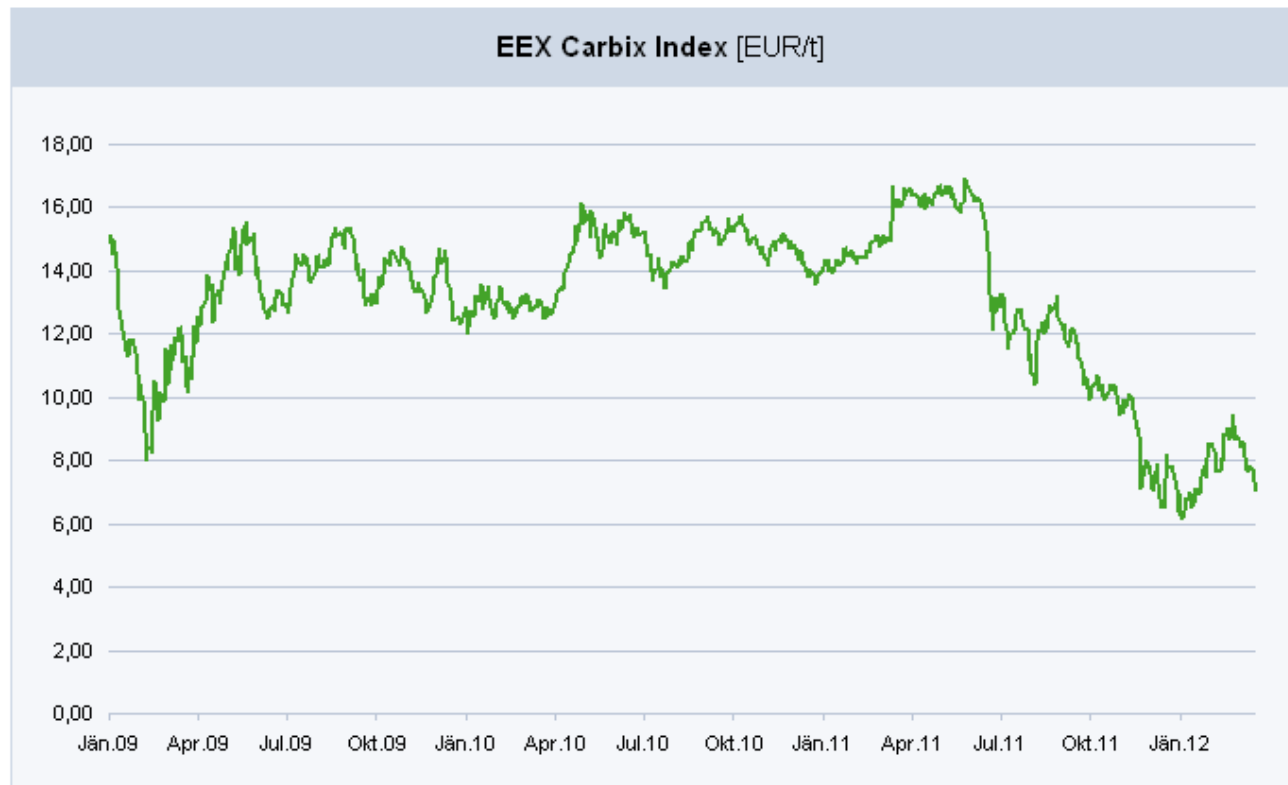


- Or which super technical/mathematical model or algorithm?



Central planning and the vision of perfect foresight

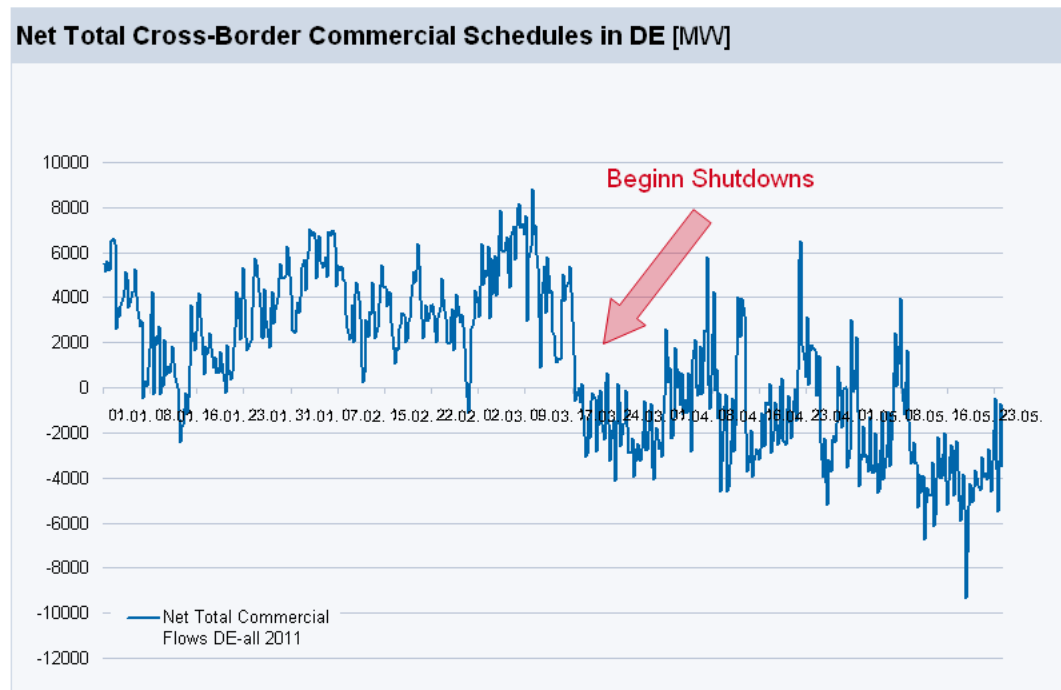
- Even if we consider only a single aspect it may be difficult to get it right



Quelle: EEX

The market can react

- Closure of nuclear power plants in Germany
 - Decrease in generation capacity of around 8.500 MW
 - Germany became an importer



Source: ENTSO-E, Bundesnetzagentur

Are national solutions efficient?



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- Renewables:
 - Feed-in tariffs
 - Fixed subsidies for investment
 - Market premiums
 - A mixture of the above
- Market design
 - Energy only markets
 - Capacity payments, capacity obligations
 - Strategic/operating reserves
 - Different balancing energy markets

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Security of supply

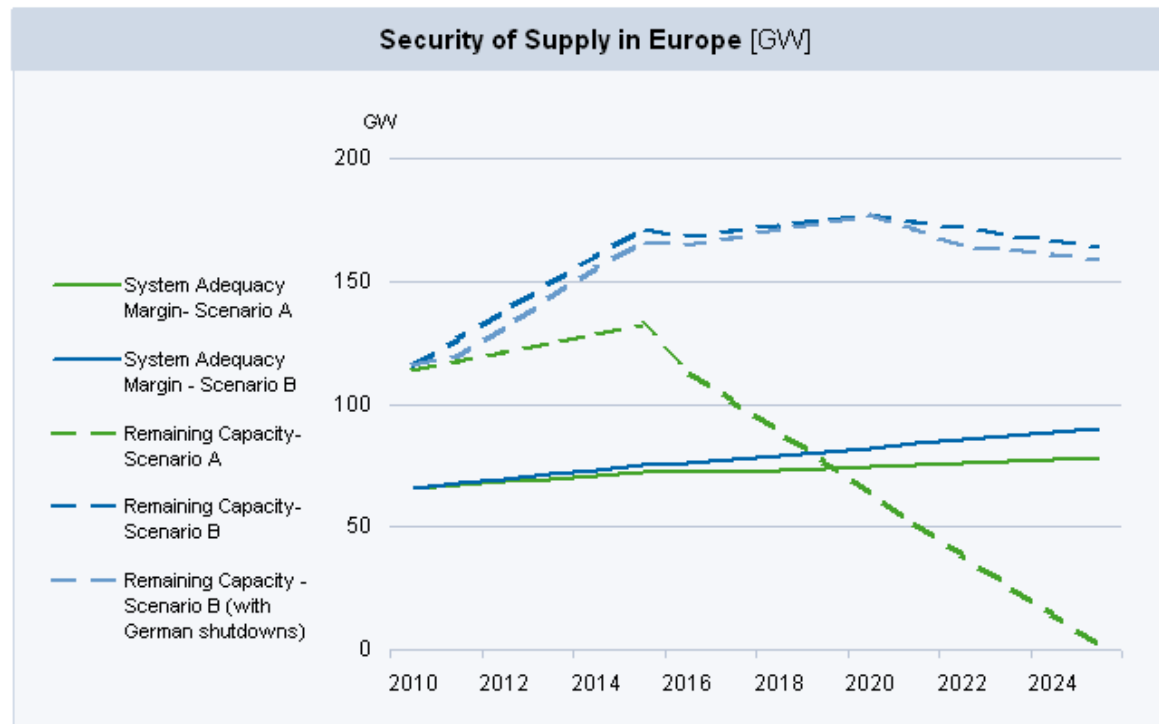
- The importance of security of supply is clear



- Concerns voiced recently:
 - Effect of German nuclear shutdowns on system adequacy
 - Increasing intermittents changing the merit order: Gas-fired plants no longer profitable, back-up missing
 - Economic climate adversely affecting investment in generation capacity

System adequacy forecasts by ENTSO-E

- Scenario A makes conservative assumptions: Problems possible from 2018 – Scenario B does not forecast problems until 2025



Source: ENTSO-E, calculations E-Control

The winter outlook usually depends on weather conditions

- During severe weather conditions import grows in importance



Source: ENTSO-E Winter Outlook 2011/2012

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Capacity mechanism \neq capacity mechanism



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- Strategic reserve (Sweden, Finland, France)
- Operating reserve, similar to extending balancing energy mechanism (Norway)
- Capacity payments (Ireland, Spain, Chile)
- Capacity certificates
- Capacity options (ISO New England, Brasil, Columbia)

- To be effective they usually require central coordination (generally setting demand or demand curve for capacity) or obligations to buy/sell

Information requirements for coordinator are not negligible

- A study by BET (2011) suggests
 - a coordinator will calculate the rolling need for capacity five years ahead taking into account all factors on the generation as well as load side and capacity additions for renewables

“

⇒ Ein Koordinator berechnet und veröffentlicht rollierend den Kapazitätsbedarf für heute in fünf Jahren („t+5“) und berücksichtigt hierbei last- und erzeugungsseitige Optionen sowie den Ausbau EE.

”

- In more decentralised approaches there is an obligation for large industrial users/suppliers to buy forecasted quantities with ex-post comparisons to actual demand – under-supply leads may lead to fines (e.g. Brazil)

Capacity options as a solution?

- Capacity options have been described as an option to avoid problems of existing/earlier systems

Q

Quantity of desired options are planned centrally (e.g. New England) or there are obligations for suppliers to participate (e.g. Brazil)

P

Strike price in principle set centrally or might be negotiated (Brazil); Premium determined by descending clock auction

Holder of call option could be coordinator or supplier

Capacity mechanism as a result of price limits?

- PJM justifies its use of capacity mechanisms (Reliability Pricing Model) with
 - wholesale prices limited which creates “missing money” problem

Whatever the reasons, RTO rules tend to limit wholesale spot prices during hours of shortage. The lost revenue effect is sometimes called the “missing money” problem, in which wholesale market revenues prove insufficient to support the level and types of investments deemed necessary to support reliability objectives, while administrative price caps during hours of shortage reduce the incentives needed to encourage appropriate levels of supply and demand-side responses when they are most needed and valuable.

- Commitment to let markets determine prices is missing
- PJM limit 1000\$/MWh is subject to reduction based on market power concerns

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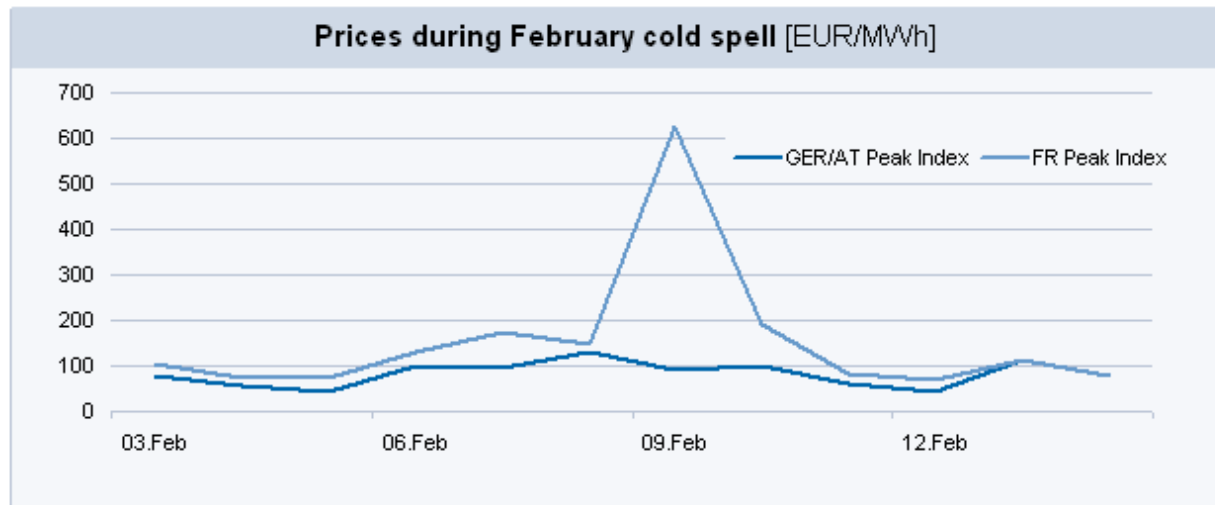
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- Solution in PJM?

It uses an administratively determined, downward sloping “demand curve” that defines the demand for capacity resources in each sub-regional market; the shape of the curve helps determine the price winning suppliers will receive;

Price spikes in energy only markets

- Are a reaction of the market to supply and demand conditions (if they reflect fundamentals)
- System limits do exist in most markets, e.g.
 - EPEX Day-Ahead 3000 EUR/MWh
 - EPEX Intraday 9999 EUR/MWh



Source: EPEX Spot

Capacity elements do exist in energy only markets.



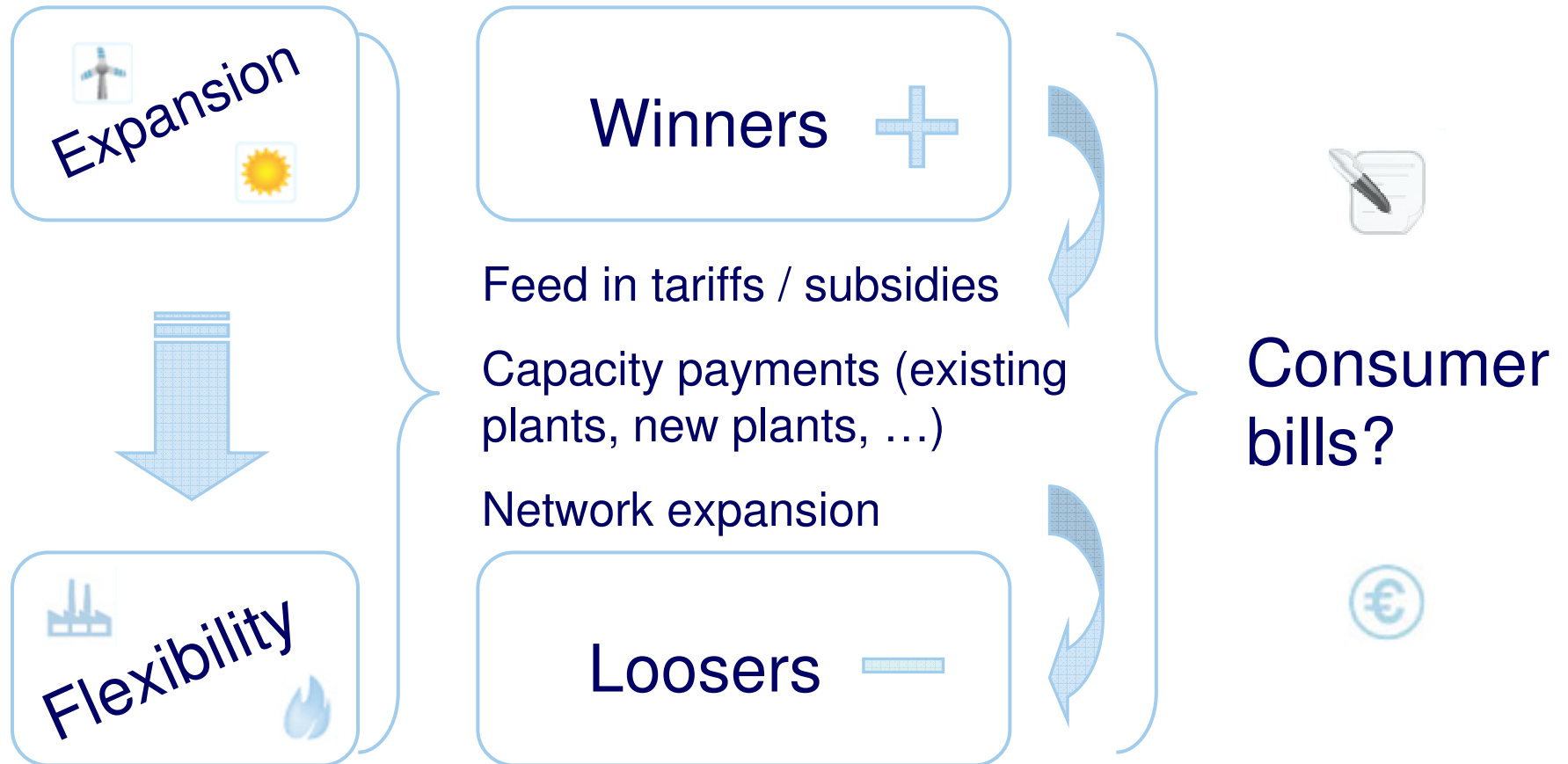
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- Balancing energy markets have capacity payments
- Revenue generated there usually not taken into account when looking at power plant profitability
 - Too risky? (Prices are volatile and difficult to predict)
 - Not open to new entrants (technical restrictions or market power)
- These arguments might not hold in all countries
- If this would be “artificially” extended it would be similar to operating reserve

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Ultimately market design will have an impact on consumer bills.



The road ahead – careful exploration of different options necessary.

- Investment in infrastructure
 - Network expansion necessary to integrate intermittents
 - Key: Speed up decisions made by authorities on go ahead of new infrastructure
- Shorten lead time for new power plants
 - Green light for certain sites could be given ahead of time
 - If need for (strategic) reserve should arise these power plant sites could be auctioned off
 - Could decrease lead time for gas-fired plants to a year or two
- Integration of renewables into the market
 - See for example introduction of market price top up in Germany
 - Investigation into future role of EU ETS and relation to national feed in tariffs
 - Harmonisation of subsidy schemes towards IEM



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Selected References



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