Toward a New Design for EU Electricity Markets

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Market design

- Establishes rules of market interaction
- Economic engineering
  - Economics
  - Computer science
  - Engineering, operations research

Market design accomplishments

- Improve allocations
- Improve price information
- Reduce risk
- Enhance competition
- Mitigate market failures

Applications

- *Electricity markets*
- Spectrum auctions
- Natural resource auctions (timber, oil, etc.)
- Emission allowance auctions
- Financial securities
- Procurement

Objectives

- Efficiency
- Transparency
- Fairness
- Simplicity

Principle

“Make things as simple as possible, but not simpler” -- Albert Einstein

Electricity

Goals of electricity markets

- Short-run efficiency
  - Least-cost operation of existing resources
- Long-run efficiency
  - Right quantity and mix of resources

Challenges of electricity markets

- Must balance supply and demand
  at every instant
  at every location
- Physical constraints of network
- Absence of demand response
- Climate policy

Climate policy

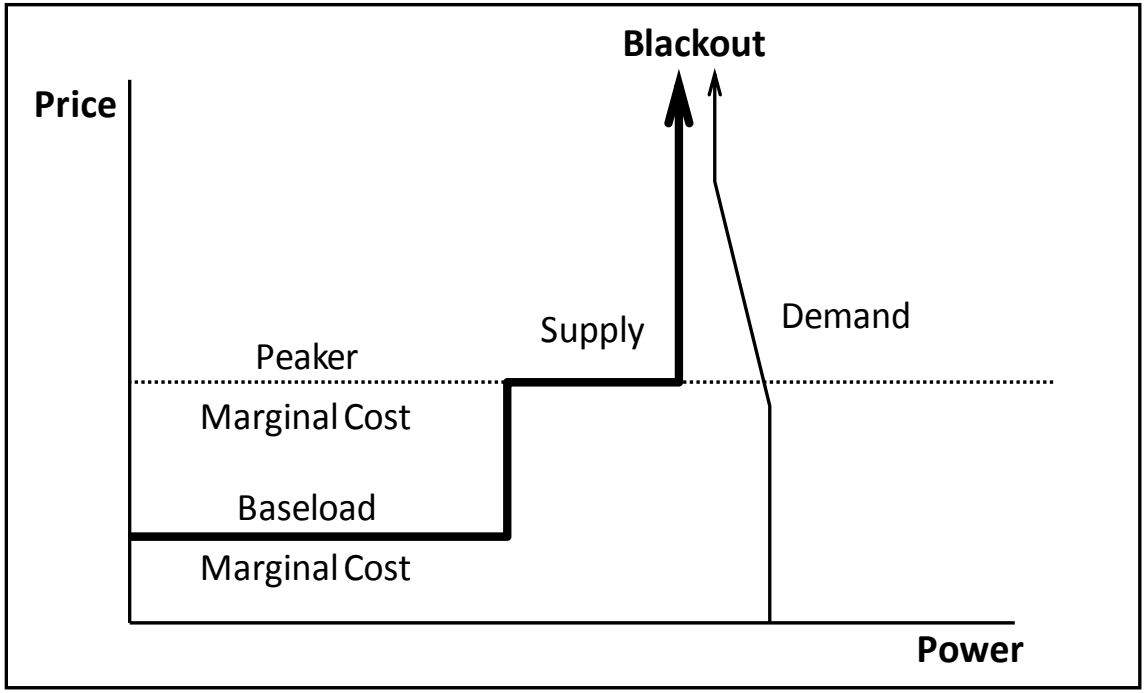
- Transformation to renewable
- Germany
  - Replace nuclear with renewable
  - 80% renewable (mostly wind) by 2050
  - Significant probability of multiple days with wind in-feed less than 5% of capacity
  - Must back-up wind with peaker capacity
  - Require additional 30 GW of peakers by 2030
  - *How to get this built?*

Three Markets

- Short term (5 to 60 minutes)
  - Spot energy market
    - Energy: day ahead, real time with congestion pricing
    - Reserves: 30m non-spin, 10m non-spin, 10m spin, freq. regulation
- Medium term (1 month to 3 years)
  - Forward energy market
  - Bilateral contracts
- Long term (4 to 20 years)
  - Capacity market (thermal system)
  - Firm energy market (hydro system)
  - Bilateral contracts (Texas, Nord Pool)
- Address risk, market power, and investment

Why not energy only?

- Market failure
  - Absence of demand side
- Practical realities
  - Price caps
  - Operator decisions
  - *Missing money*



Long-term market:
Buy enough in advance

Purpose of market

- *Operational reliability*
- Pay no more than necessary
  - Induce just enough investment to maintain adequate resources
  - Induce efficient mix of resources
  - Reduce market risk
  - Reduce market power during scarcity

Product

- What is load buying?
  - Energy during scarcity period (capacity)
- Enhance substitution
  - Technology neutral where possible
  - Separate zones only as needed in response to binding constraints
- Long-term commitment for new resources to reduce risk

Pay for Performance

- Strong performance incentives
  - Obligation to supply during scarcity events
    - Deviations settled at price > $5000/MWh
    - Penalties for underperformance
    - Rewards for overperformance
- Tend to be too weak in practice, leading to
  - Contract defaults
  - Unreliable resources
- Recent adopters: ISO New England, PJM (and Texas within energy-only market)

State aid issues

Pricing rule

- Single-price (pay-as-clear) vs. pay-as-bid
- Is paying the clearing price to low-cost units state aid?
  - Of course not!

New vs. existing

- New investment desires long-term commitment (5 to 20 years)
- Existing does not need long-term commitment (1 year is best)
- Can we have the same price?
  - Yes, existing gets same price in expectation
- But does existing need to be paid at all
  - Yes, if solution is consistent with long run market

Conclusion

- Never ignore essentials
  - Encourage participation
  - Demand performance
  - Make bids binding (deposits or letters of credit)
  - Avoid collusion and corruption
- Long-run market requires
  - Well-functioning spot market
  - Strong regulatory framework with manageable regulatory risk