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