The Essential Role of Investment Markets in Electricity Market Design

Peter Cramton, University of Maryland

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www.cramton.umd.edu/papers/electricity

Based on joint work with Axel Ockenfels and Steven Stoft

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

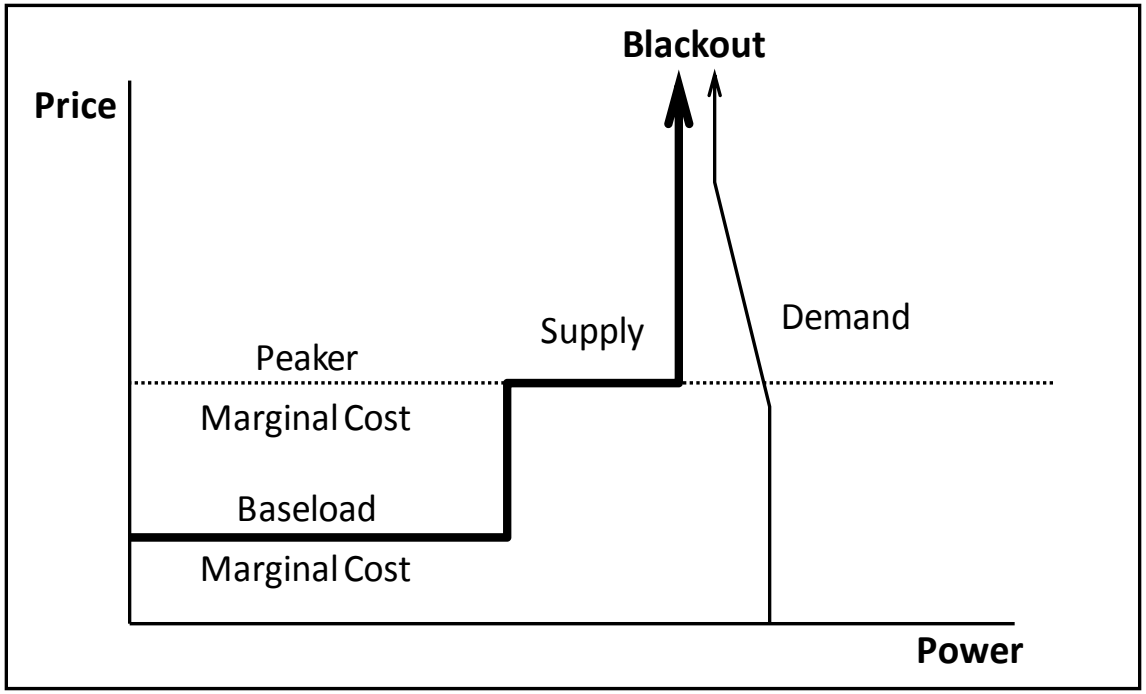
- Transformation to renewable
- Germany
  - Replace nuclear with renewable
  - 80% renewable (mostly wind) by 2050
  - Significant probability of multiple days with wind in-feed less than 5% of capacity
  - Must back-up wind with peaker capacity
  - Require additional 30 GW of peakers by 2030
  - *How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

Three Markets

- Short term (5 to 60 minutes)
  - Spot energy market
- Medium term (1 to 3 years)
  - Bilateral contracts
  - Forward energy market
- Long term (4 to 20 years)
  - Capacity market (thermal system)
  - Firm energy market (hydro system)
- 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

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

The four P’s to a successful design

- Planning
- Product
- Performance
- Pricing

Planning

- How much do you need?
  - Transmission and generation
- Rating of resources
  - Contribution of resource during scarcity events
- Planning by experts, not politicians
- Planning responsive to new information
- Planning optimizes reliability tradeoff: more capacity vs. more blackouts

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

Performance

- Strong performance incentives
  - For timely development of new resource
  - To provide energy and reserves as required
    - Penalties for underperformance
    - Rewards for overperformance
- Tend to be too weak, leading to
  - Contract defaults
  - Unreliable resources

Pricing

- Good price formation
  - Advance purchase before project costs are sunk
  - Descending clock auction to encourage price discovery
  - Downward sloping demand curve for price stability (buy more when price is low)

Example long-term markets

- United Kingdom and New England (thermal dominated)
  - Product
    - Capacity: Ability to supply energy during hours short of reserves
- Colombia and Brazil (hydro dominated)
  - Product
    - Firm energy: Ability to supply energy during dry periods
- Comparison of what load is buying
  - UK and New England: price coverage only during shortages
  - Colombia: price coverage during extended dry periods
  - Brazil: full price coverage from long-term contract with new entry and medium-term contracts with existing resources
- Supplier exposure to the energy price

  New England > Colombia > Brazil

Conclusion

Forward markets address key problems of wholesale markets

- Investment
  - Coordinated entry to have what is needed
- Risk
  - Lock in price for capacity
  - Both suppliers and demanders face less risk
- Market power
  - Suppliers/demanders in more balanced position entering spot

Conclusion

- Long-term market requires a sound market framework
  - Predictable and stable regulatory setting
  - Effective market rules that support efficient medium and short-term operation of existing resources
- With sound framework, capacity market can produce complementary benefits
  - Coordinated efficient investment
  - Reduced risk
  - Improved performance in periods of scarcity