

# Pay for Performance

## *The Essential Ingredient in Capacity Markets*

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# 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

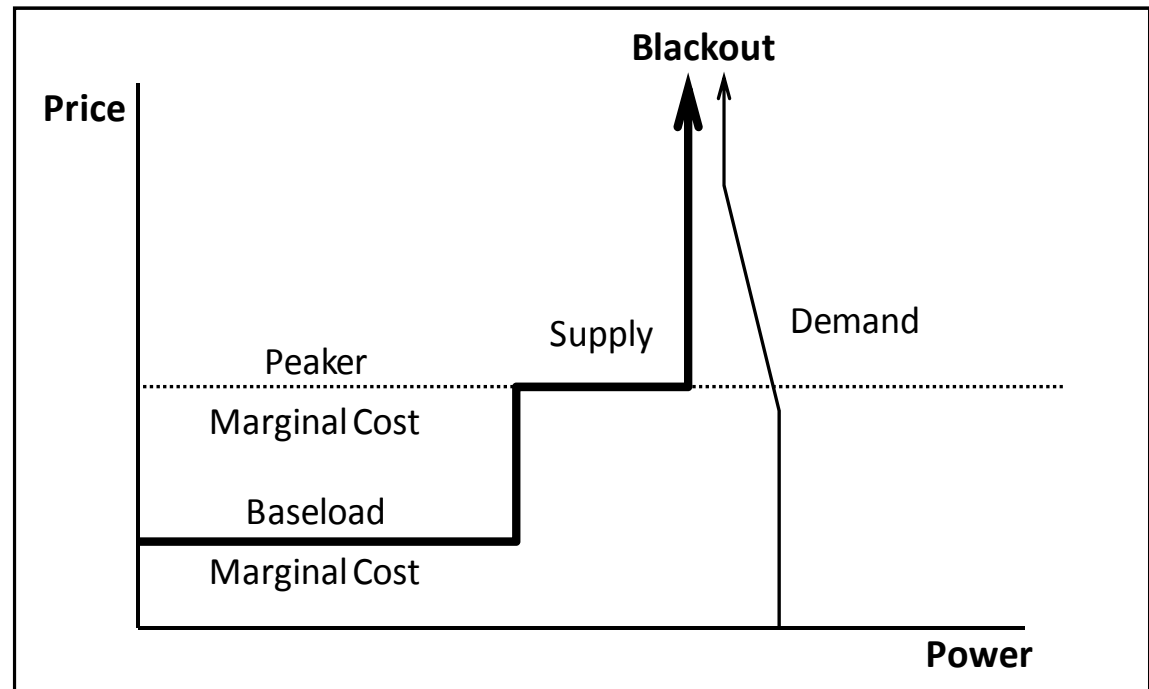
- Transformation to renewable
- Germany
  - Replace nuclear with renewable
  - 80% renewable (mostly wind) by 2050
  - Significant probability of multiple days with wind in-feed less than 5% of capacity
  - Must back-up wind with peaker capacity
  - Require additional 30 GW of peakers by 2030
  - *How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



# The four P's to a successful design

- Planning
- Product
- Pricing
- Performance

# 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

# Pricing

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

# *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: New England, PJM  
(and Texas within energy-only market)

# Example long-term markets

- Great Britain, New England, PJM (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
  - GB, PJM, 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
- Generator exposure to the spot energy price
  - Texas > PJM > New England > Colombia > Brazil

# New vs. existing

- New investment desires long-term commitment (5 or more 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



# 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

- 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