A Capacity Market that Makes Sense

Peter Cramton & Steven Stoft
University of Maryland
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“Good market design is keeping people from doing things that are really stupid.” – Preston McAfee
Traditional ICAP Market

"Pick the Biggest Number"

**Traditional ICAP Market**

**Price = $0**

**Quantity**

**True Supply**

**Demand**

**Traditional ICAP Market**

"Pick the Biggest Number"

**Price = $999**

**Quantity**

**True Supply**

**Bid Supply**

**Demand**
Traditional ICAP Market

• Pays based on average availability
• Available if you say you are, and there is no compelling evidence otherwise
• Result
  – Worst capacity gets highest payments
    • Resources that are never called get full ICAP
      – Slow start
      – Extremely high marginal cost
    – These resources do not contribute to reliability

Why capacity market at all?

• In almost all markets, capacity is rewarded based on inframarginal rents
  – You get paid a price greater than your MC
  – Price during shortages is set high by demand side's willingness to do without product
• Market failure
  – Demand side does not yet participate
  – Prices are capped at $1000/MWh ($250 in California)
  – Supply offers are “mitigated” if much over MC (PJM generators with market power must offer price less than MC + 10%)
  – Result: Generators cannot cover FC from energy revenues
The VOLL*-Pricing Benchmark

- Carrying costs paid by
  - Infra-marginal rents
  - Price spikes
- Big enough price spikes → reliability
- Infra-marginal + spikes → right generation mix

• Problems
  - $15,000 price spikes due to weather / outages too risky
  - Spike payments too sensitive to over/under capacity
  - Too tempting for the exercise of market power

*VOLL = Value of lost load

A Better Solution: Replace price spikes with LICAP

• Guidelines to make LICAP work correctly
  – Eliminate the bad aspects of price spikes
    • Extreme weather / outage risk
    • Super sensitive to capacity level
    • Market power in the spot market
  – Retain the good aspects
    • Enough investment incentive
    • Reward those who show up when most needed
LICAP demand curve

Price-Spike Revenue Curves

Note extreme sensitivity to capacity level

Weather / outage risk, year-to-year fluctuation

EBCC = expected benchmark carrying cost (annualized fixed cost of frame unit)

Let suppliers bid

• Supplier offers resource at a price
  – Able to express cost of LICAP obligations
• But price is based on iron in the ground
  – Can decide not to participate
  – Withholding (economic or physical) does not impact price
LICAP market clearing

- Suppliers bid as they wish
- Clearing price determined by actual iron in the ground

EBCC = expected benchmark carrying cost (annualized fixed cost of frame unit)

What if demand curve is too high?

- The long-run price is just right
- Too much capacity is built
- We can buy more or less capacity, but the long-run average price is set by the market

EBCC = expected benchmark carrying cost (annualized fixed cost of frame unit)
What if demand curve is too flat?

- **The LR price is just right**
- Too much or too little capacity is built
- Price is set by the market (at EBCC)
- The market knows EBCC, even if we don’t

$\text{EBCC} = \text{expected benchmark carrying cost (annualized fixed cost of frame unit)}$

What if demand curve is too steep?

- **The long run average price is just right**
- But LICAP price fluctuates too much
- This is risky for investors
- They charge a “risk premium,” which load must pay
- Average capacity is right
ISO’s job is to buy the right amount

- LICAP can buy too much or too little capacity
- Here’s how to buy the right amount
  - Make a reasonable estimate of
    - Target capacity
    - Carry cost of benchmark peaking unit
  - Use a reasonably steep demand function
- Capacity levels within –4% to +5% of the target cause inefficiency of less than 1%

LICAP hedges against price spikes

- LICAP payment = LICAP Price – “Energy Spike”
  - But LICAP payment is never negative
- “Energy Spike” = actual inframarginal energy rents of efficient peaker including shortage price (settlement adjustment).
  - Avoids controversy of estimating energy rents
  - No incentive for supply to create real-time shortages
  - Reduced risk for investors and load
  - Prevents supply from using threat of shortages to negotiate more favorable long-term contracts
  - Removes administrative shortage price from efficient long-term contracts
Reward the reliable

- **Availability** means “during shortage hours”
- If 60% available during shortages, get 60% of full LICAP price
  - Shortage hours: insufficient reserves (either 10 or 30 minute)
    - Shortage hours are weighted by energy price (including shortage penalty factor)
    - Since may only be a handful of shortage hours in a year, base performance on weighted moving average (exponential smoothing), much like “experience rating” in firm’s unemployment insurance payments
  - Available = providing energy and/or reserves in shortage hours
    - Slow-start offline resources are deemed “unavailable,” because these resources could not capture price spike
    - Prevents high-cost inflexible resources from collecting LICAP
    - Offline reserves are tested and paid based on estimated availability consistent with forward reserve market
    - **Load should not pay for “capacity” that cannot produce during a shortage—that does not contribute to reliability**

Price the zones right

- Use LMP: maximize economic surplus subject to transmission constraints
  - LICAP replaces peak energy prices, so price consistently with energy pricing
  - Price in A > Price in B if and only if
    - Zone A is import constrained, or
    - Zone B is export constrained
    - Recognizes substitution across zones if feasible
  - Congestion rents in constrained zones
    - Load pays more than suppliers receive (Load in congested zone pays high price for entire demand, but some is coming from low-price zone)
    - Rents distributed in same way as energy congestion rents
Conclusion: It makes sense

- **Economic LICAP** has these advantages:
  - Removes profit risk due to annual weather/outages
  - Reduces profit risk due to capacity fluctuations
    - Reduced investment risk premiums **lower cost**
    - Stabilized investment ➔ **improved reliability**
  - Reduces annual price risk to load
  - Improved incentive for efficient generation mix
  - Addresses market power (spot and LICAP)
  - No need to estimate next year's price spikes