A Capacity Market that Makes Sense

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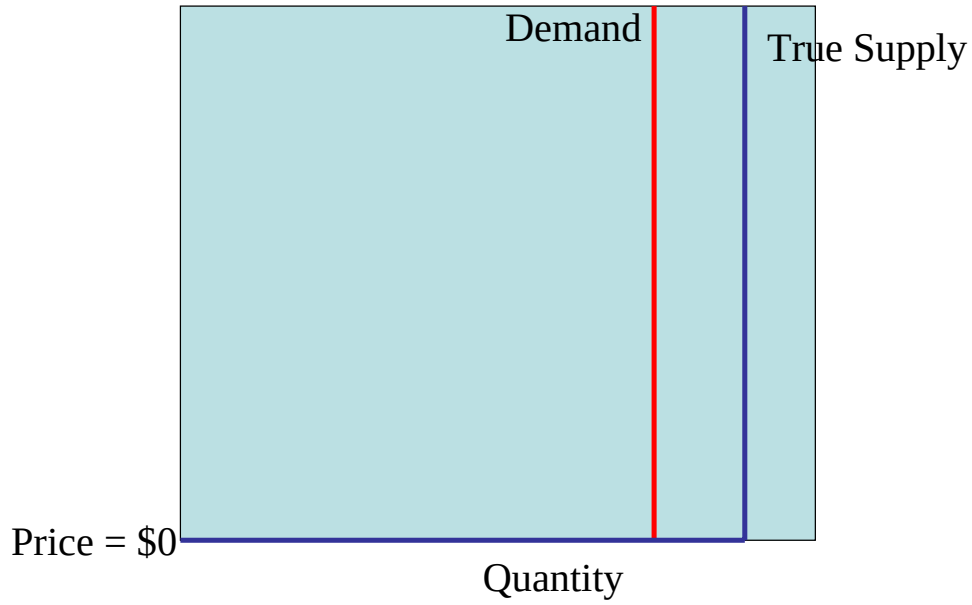
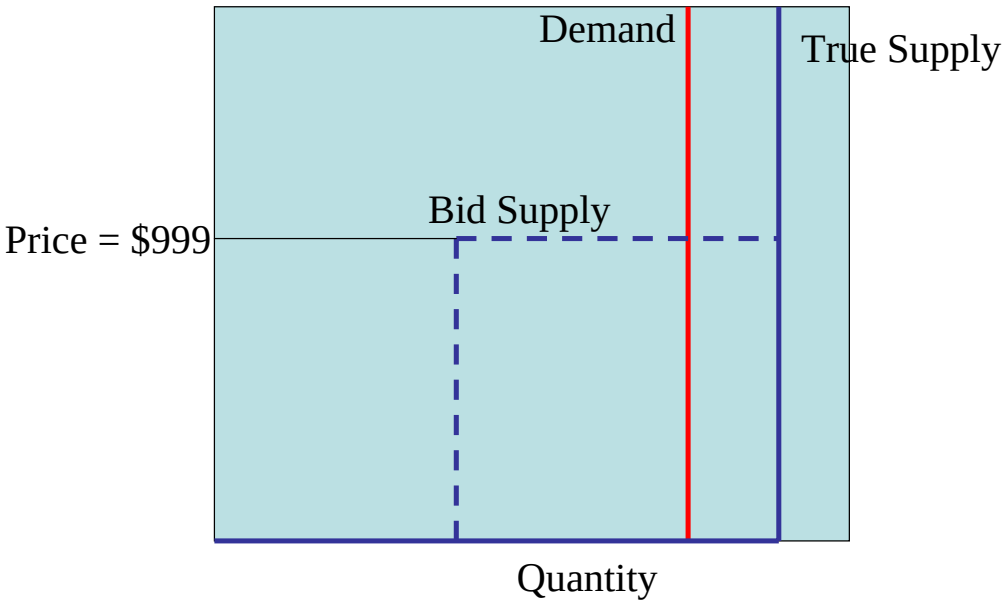
2 November 2004

"Good market design is keeping people from doing things that are really stupid." – Preston McAfee

Traditional ICAP Market



Traditional ICAP Market
"Pick the Biggest Number"



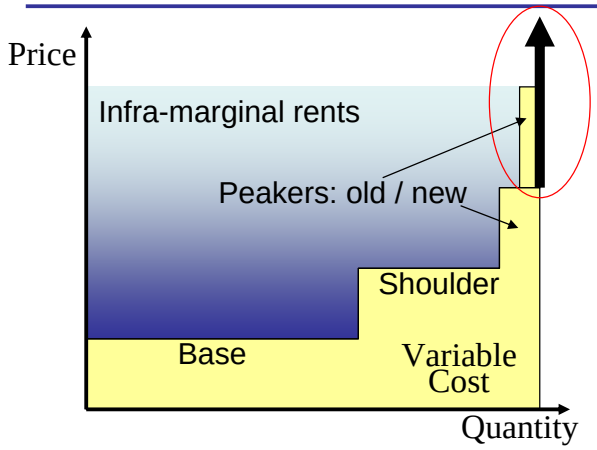
Traditional ICAP Market

- 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

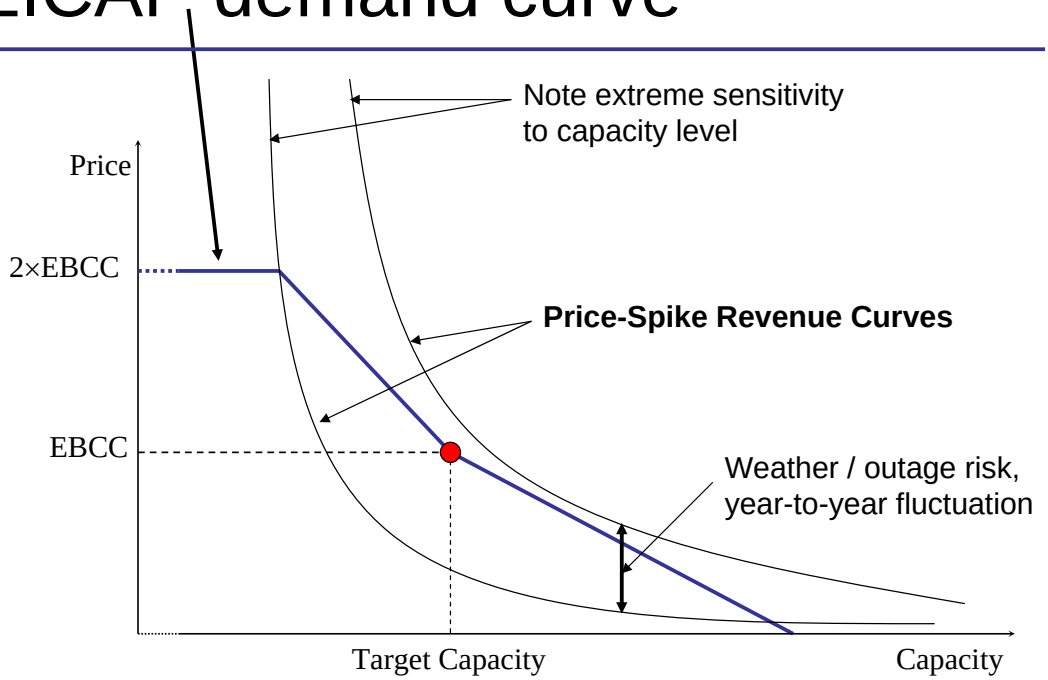
- Problems
  - $15,000 price spikes due to weather / outages too risky
  - Spike payments too sensitive to over/under capacity
  - Too tempting for the exercise of market power

***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



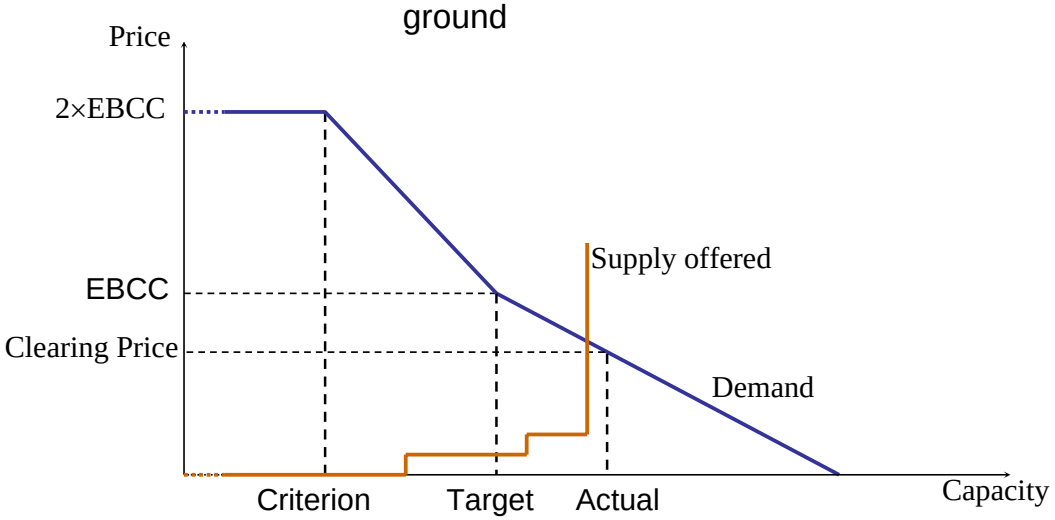
EBCC = expected benchmark carrying cost (annualized fixed cost of frame unit)

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

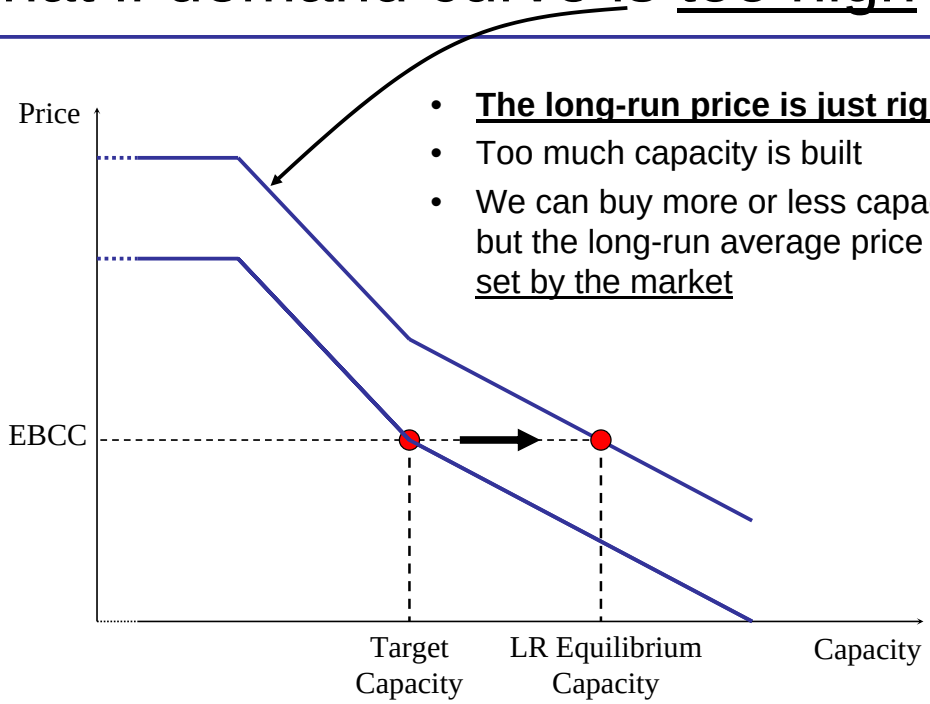
LICAP market clearing

- 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)

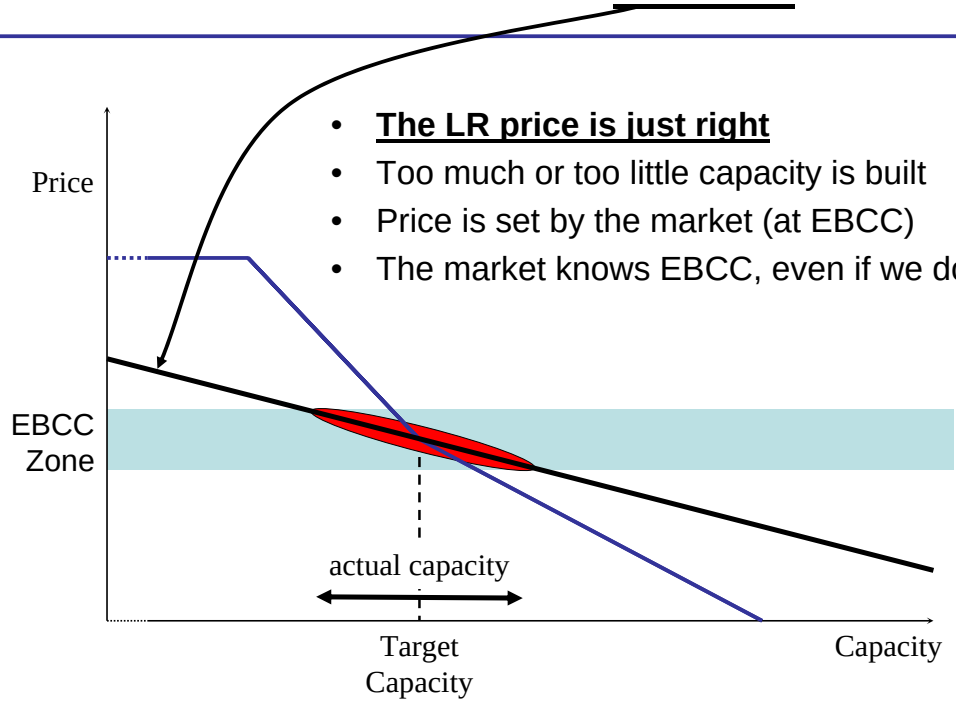
What if demand curve is too high?



- **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)

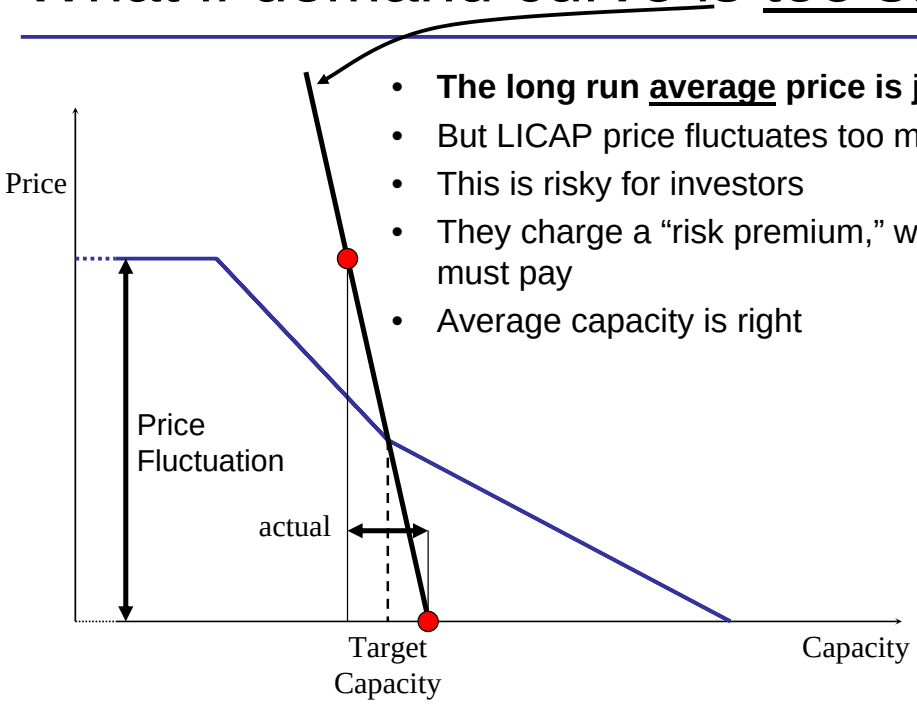
What if demand curve is too flat?



- **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

EBCC = 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