# NATURE AND ROLE OF PJM CAPACITY MARKETS

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## Capacity Market Evolution

- Reliability prior to introduction of competition
  - PJM capacity requirements for member utilities
  - Utility commission requirements to maintain capacity
- Historical PJM capacity accounting
  - Penalty = peaker cost
  - Incentive to maintain capacity
  - Mechanism to spread lumpiness of capacity additions
  - Non-transparent market in capacity credits
- Retail choice
  - Capacity credit market implemented (January 1, 1999)
  - Transparent, open daily capacity markets
  - Facilitate purchase and sale of capacity by retail competitors
  - Reduce entry/exit barriers
## Capacity Market Evolution

- **Energy market design**
  - Competitive market April 1, 1999
  - Offer cap = $1,000
- **PJM ISO responsibility for reliability**
  - Reliability is a system concept with current technology
  - Costs/benefits cannot be linked to individual customers
  - Definition: 1 day in 10 years
  - Implemented via capacity obligations
- **Alternative method of maintaining reliability**
  - Energy market prices with higher cap (or no cap)
  - Associated cycles including periods of shortage

## Capacity Obligation Basics

- LSEs required to have rights to capacity
- Capacity requirement = peak load plus reserve margin
- Meet capacity requirement:
  - Owned physical capacity
  - Bilateral purchase
  - Capacity credits
- **Unforced capacity**
  - Derate capacity by historical forced outage rate
  - Reduces available capacity
- **ALM offset**
  - Obligation reduced by active load management
### Capacity Definition

- Recall rights to energy in "emergency"
  - Call option at the market
  - Emergency: expected load > economic offers
- Capacity resources must be offered into day ahead market on a financially firm basis
- No availability requirements
  - Unforced adjustment is limited incentive
  - Periodic checks of capability
- Deliverability requirement
  - Transmission
- No limitations on sale of energy off system

### Capacity Market Dynamics

- Daily and monthly markets
- Penalty payment if LSE is deficient
- Capacity can be sold within or outside PJM (delisting)
  - Firm energy
  - Relative prices
  - Obligations
- Marginal cost of capacity
  - Direct costs close to zero
  - Opportunity cost: external energy markets (firm, LD)
## Capacity Market Benefits

- Reliability
  - Energy recalls in 1999
- Incentives for low outage rates
  - Outage rates reduced since introduction of market
- Incentive to construct new capacity
  - PJM capacity queues
- Net revenue stream
  - Energy market
  - Ancillary services
  - Operating reserves
  - Capacity market

## Capacity Market Impacts

- Existence of capacity market does not necessarily change energy market dynamics under non-emergency circumstances
  - Capacity may delist
  - Energy sold to highest price market
- Capacity market does not necessarily change probability of scarcity in real time
  - Load > economic offers in real time
  - Capacity resources not required to make offers in real time market
- Capacity market does change duration of scarcity
  - Recall of energy from capacity resources
- Capacity market does change price results of scarcity
  - Reduced duration of high prices
Capacity Market Issues

- Market power
  - Inelastic demand
  - Supply/demand balance
  - Incentives are a function of relationship between obligations/capacity
  - Divestiture (functional/actual) affects incentives

- Market design
  - Incentives to sell capacity off system
  - Incentives to sell high quality capacity (energy production)
  - Incentives to maintain capability
  - Relevant obligation period

- Variations of ICAP
  - ACAP
  - Required call options

Capacity Market Issues

- Capacity market does not guarantee reliability
  - Capacity demand can exceed supply at market clearing price
  - Result is scarcity of capacity on high demand days
  - Energy related reliability issues can result
  - Payment of penalties by LSEs does not ensure adequate capacity
  - Good market design required

- Capacity market incentives required for reliability
  - Requirement imposed on LSEs
  - Penalty is incentive to purchase capacity
  - Incentives must be aligned with alternative market opportunities for capacity
Capacity Market Results

- Supply and demand for capacity
- Prices
  - Supply and demand
  - Market power
- Outage rates
- Net revenue
- Incentives for entry

Capacity Supply

Figure 4: Capacity and Obligation
January through December 2009

Legend:
- Installed Capacity
- Uninstalled Capacity
- Obligation
- Net Exposed
Capacity Supply and Prices

January 2000 Through February 2001
Daily vs Monthly Capacity Credit Market Performance

Forced Outage Rates

Equivalent Demand Forced Outage Rate
1994 - 2000
Net Revenue


Annual Net Revenues

- CT at $50/MWh
  - 2000: $27,000/MW-year from energy market
  - 2000: $23,000/MW-year from capacity market
  - 2000: $6,000/MW-year from ancillary services and operating reserves
  - 2000 Total: $57,000/MW-year

- Summary
  - 1999 net revenues from all sources greater than adequate to cover annual fixed costs of peaker
  - 2000 net revenues from all sources almost adequate to cover annual costs of peaker
IF YOU HAVE QUESTIONS

Contact the PJM Market Monitoring Unit

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