

Generation Adequacy through Call Option Obligations: Safe Passage to the Promised Land

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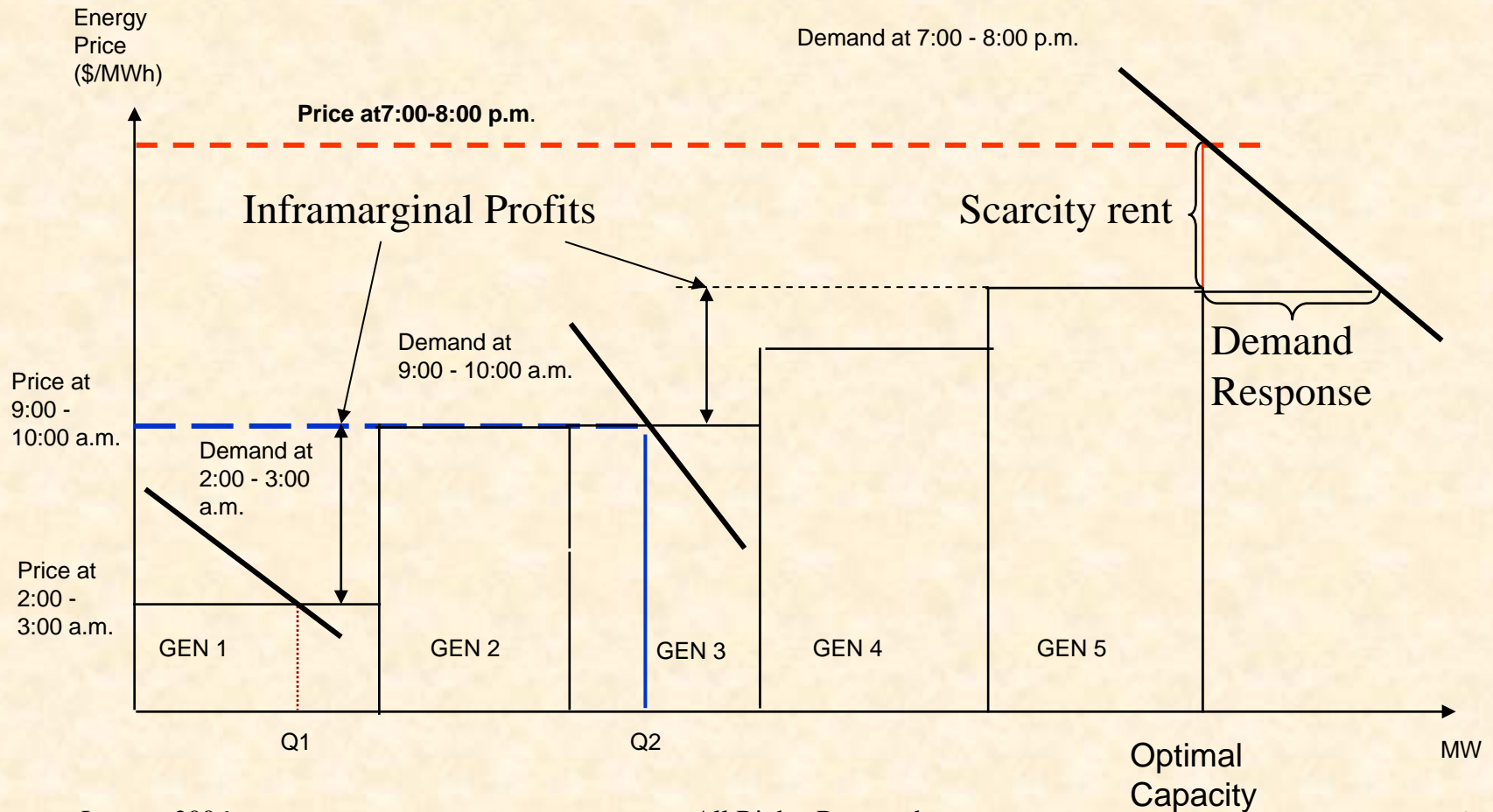
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The Promised Land

- In a competitive electricity market generation companies bear all the investment risk and consumers (LSEs) bear all the price risk.
- Customers and suppliers are free to choose levels of exposure to price risk through risk management and contractual agreements.
- Forward markets and hedging instruments enable parties to manage their risk exposure
- Competitive forces drive generation capacity, technology mix and prices toward a long term equilibrium that reflect supply and demand choices for reliability and cost.
- Fixed costs of generation capacity at long run equilibrium are exactly covered by **inframarginal** costs and **scarcity rents**

Long Run Market Equilibrium in an Energy – Only Market



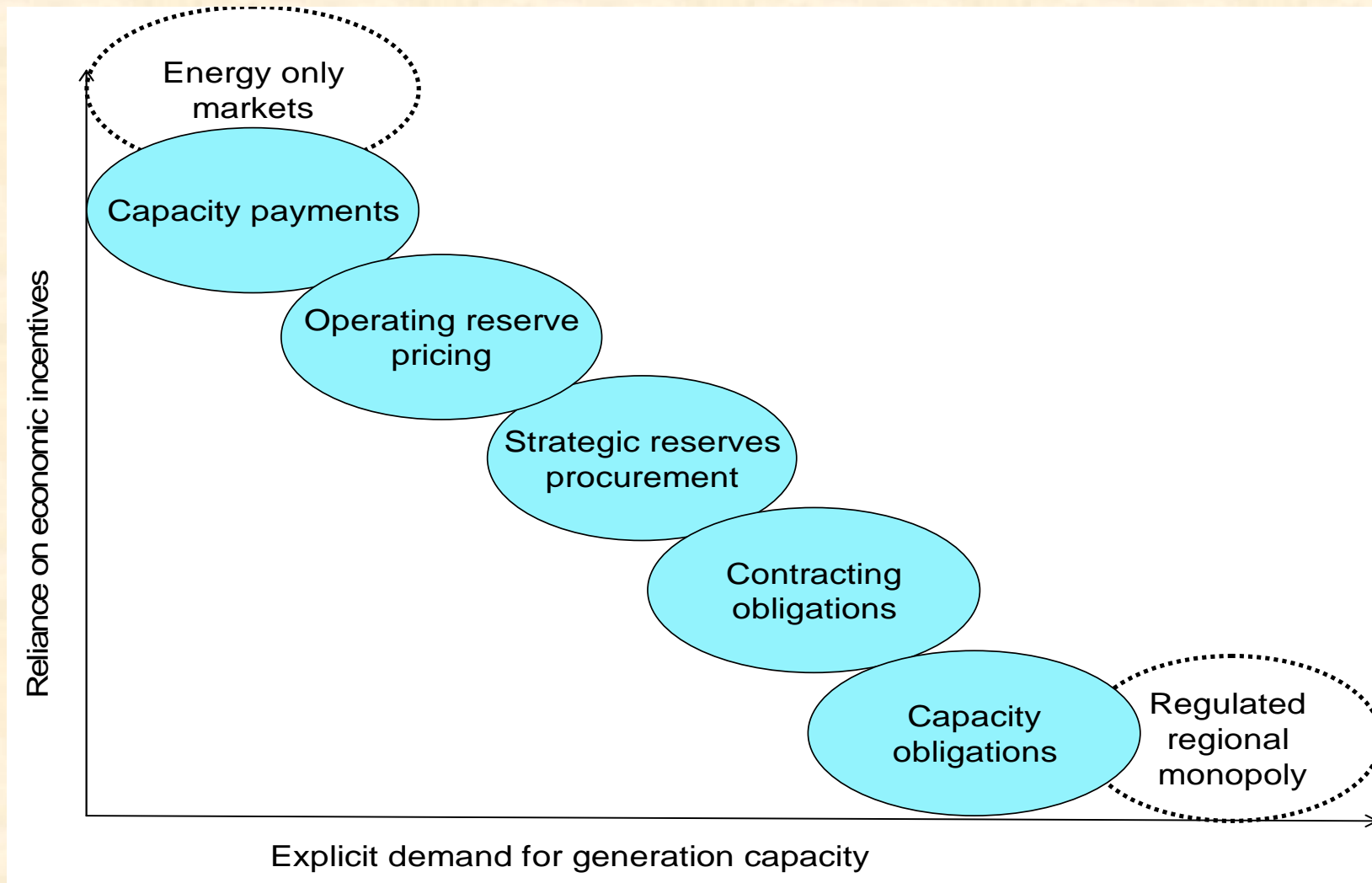
Issues that Must be Addressed in Energy Only Markets

- Who will pay for reserve capacity that is required to assure supply reliability.
- Steep supply function and uncertainties make scarcity rents highly volatile and sensitive to market error in determining the optimal capacity
- It is practically impossible to differentiate legitimate scarcity rents from inflated prices due to exercise of market power.
- Demand response is limited by technological barriers and operational practices

Issues in Energy Only Markets (Cont'd)

- Very high scarcity rents even if they are legitimate are politically unacceptable (reason for price caps)
- Low levels of reserves foster collusive behavior and market power
- Capacity shortages cannot be resolved overnight and while the entry occurs the persistent scarcity rents result in wealth transfers from consumers to producers.
- Exposures in the electricity supply chain are not properly allocated to insure voluntary, socially efficient risk management practices by the market participants (free riders)

Classification of Capacity Mechanism



Shortcomings of Traditional ICAP

- Artificial product – Demand derived from administrative requirement and not based on intrinsic value
- “Bipolar” short term prices because supply cannot respond
- Short term product does not allow contestability by new investment (can be fixed by extending product term and lead-time)
- Disconnect from energy market
- No intrinsic deliverability requirement (location and price of energy produced)
- Implicit strike price at CAP preempts a natural economic penalty for nonperformance, eliminates spot price advantage for unsubscribed capacity and discourages demand participation.

Implemented and Proposed Fixes to ICAP

- Demand function for capacity (first adopted by NYISO)
- CRAM (Centralized Resource Adequacy Market-developed by NERA)
- LICAP (Locational ICAP – proposed by NEISO)
- RPM (4 year forward market for capacity – proposed by PJM)

Properties of a Good Capacity Mechanism

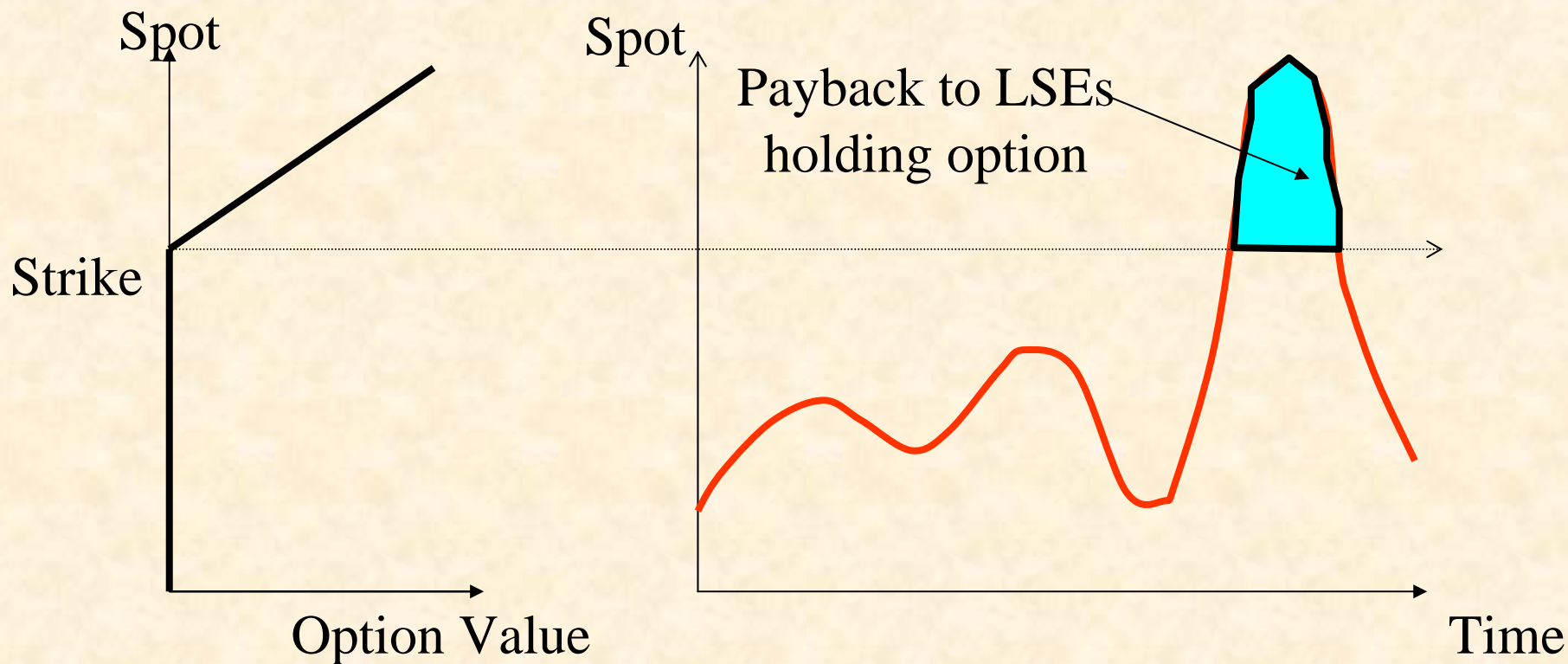
- Replicate investment incentives in functional energy only market (forward contracting)
- Facilitate risk sharing between consumers and producers
- Provide intrinsic value to consumers in exchange for risk sharing (not subsidy to generators)
- Incent new investment and enable direct participation by new entrants (avoid the “missing money” paradigm)
- Provide stable income to generators to reduce cost of capital in exchange for windfall profit potential
- Incent performance and have meaningful penalties for non-performance
- Enable generators to opt out by increasing spot price potential income in exchange for risk taking

Desired Properties (cont'd)

- Enable load to opt out (self-insure) by avoiding capacity payment in exchange for taking spot price or curtailment risk
- Not interfere with risk management practices
- Allow self-provision through bilateral contracts
- Mitigate credit problem
- Obligation by LSE should reflect customer base (follow the load)
- Easy phase out when market provides sufficient insurance through contracting and load response

Call Options as Price Insurance

Definition: A call option is the right but not obligation to purchase one unit of power over the contract duration at an agreed upon strike price



Option Obligations

- Load serving entities (LSEs) required to hold at the beginning of each month hedges in the form of forward contracts and/or call options (with verifiable physical cover) totaling $(100+X)\%$ of their next month forecasted peak load.
- Qualifying hedges must be at least three year forward looking with forward or strike prices at or below a mandatory level set by the regulator
- Mandatory strike price shall be high enough so as not to interfere with risk management activities but significantly below the energy price cap. (For example if the energy price cap is \$1000/MW then the mandatory strike price can be around \$600/MW).

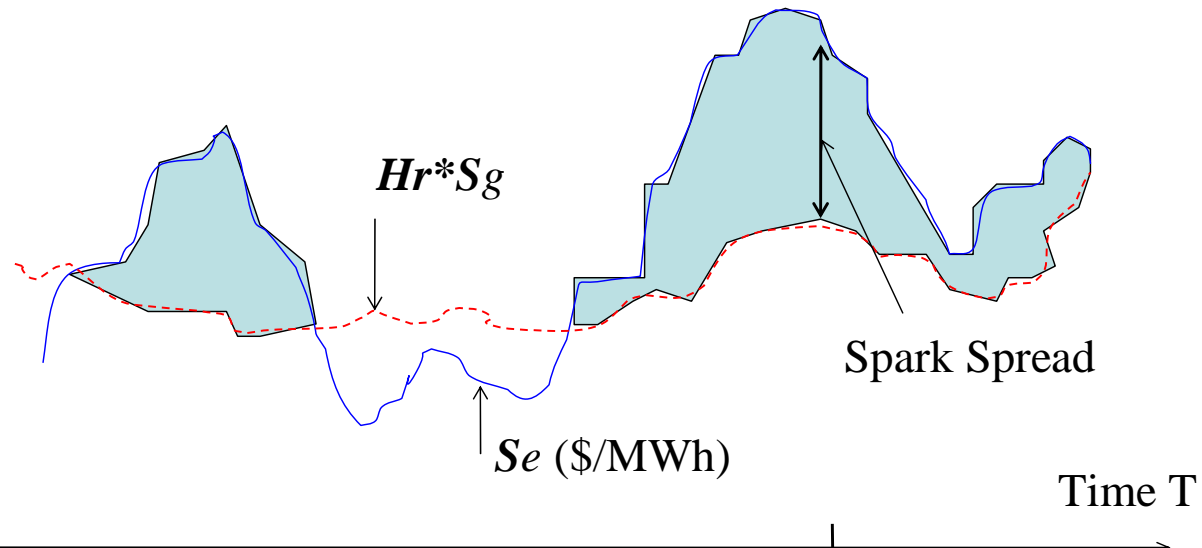
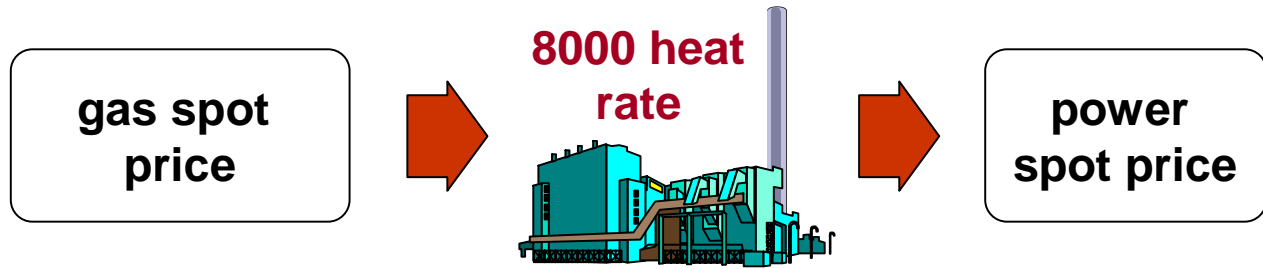
Call Option Mechanics (cont'd)

- Nonperforming capacity liable for difference between market price and strike price (liquidation damages) plus penalty.
- Obligation may be locational with LMP-based settlement so that option value (for the same strike price will be locationally dependent)
- Uncommitted capacity can sell energy at market price above strike but no higher than cap. (incentive for speculative entry and uncommitted imports)
- Private contracts that meet the duration and strike price requirement will count toward the LSE hedging obligation.
- Hedging obligations can be met by a portfolio of supply contracts and curtailable loads (committed demand response).

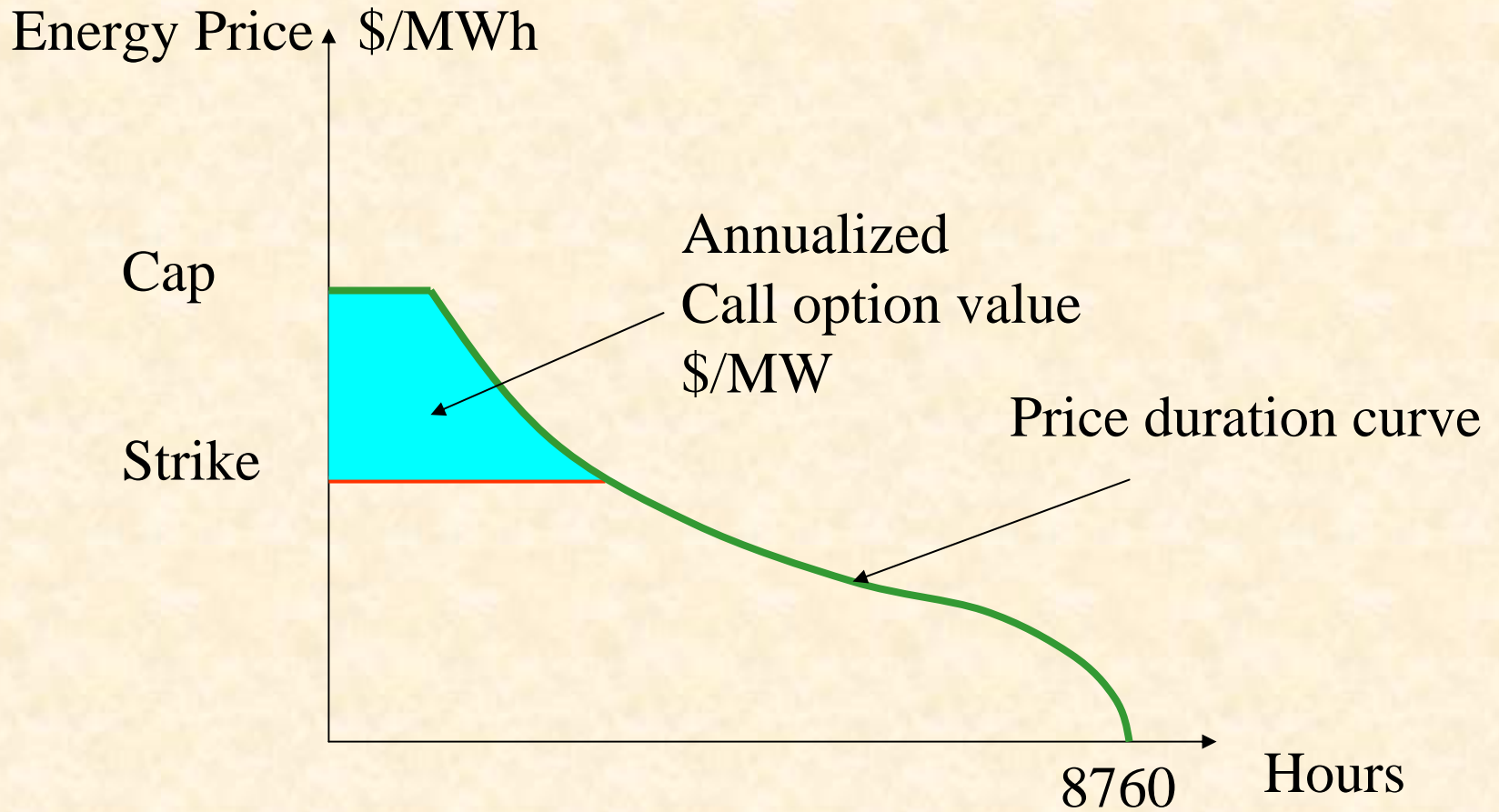
Call Option Mechanics (cont'd)

- Call options may be, self provided, procured bilaterally or procured through a voluntary auction hosted by the ISO.
- Load can Opt out by offering a call option at the strike price covered by a curtailable service contract (interrupt when spot reaches strike)
- Deliverability can be assured by making call option obligations zonal. LMP based settlement with same strike price makes option prices locationally dependent (like LICAP but without administrative prescription)
- Generator risk (and consequently the cost of options) may be reduced by indexing the strike price to fuel cost or by using “spark spread” call options
(spark spread=electricity price-heat rate adjusted gas price)

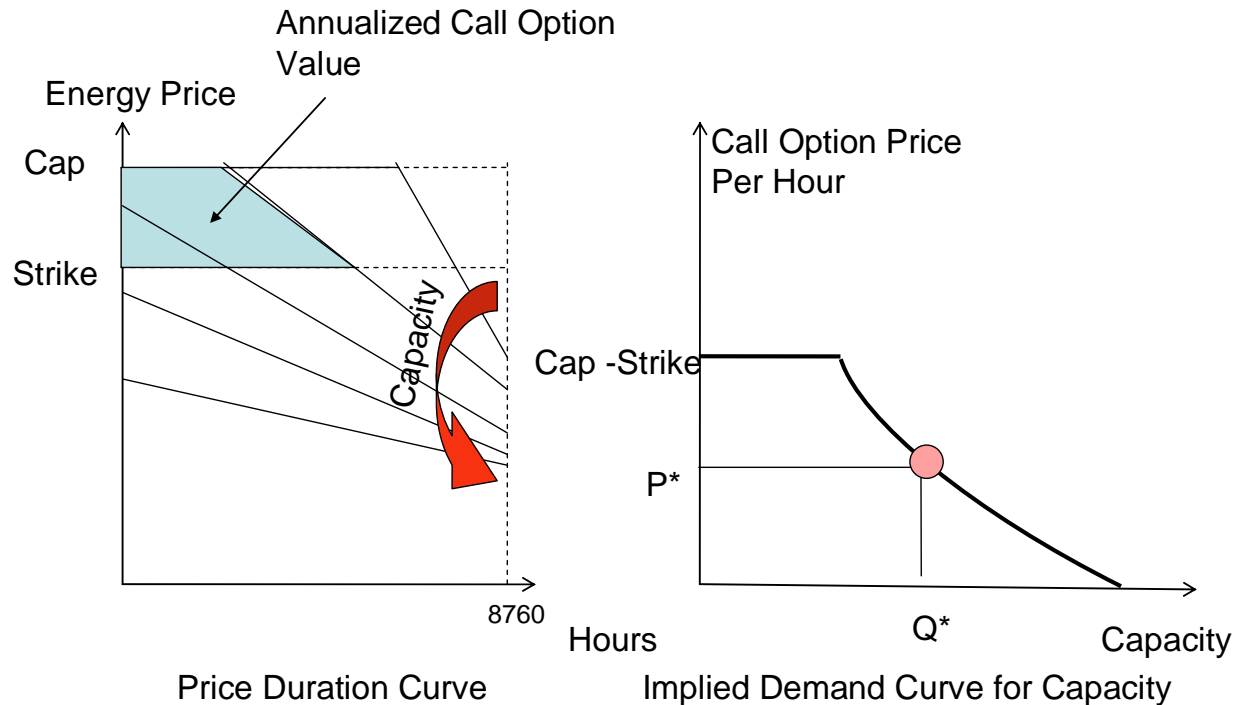
Spark Spread Option



Call Option Value in a Price-Capped Energy Market



Call Option Prices as Function of Generation Capacity based on Opportunity Cost of Selling at Spot



At optimal capacity Q^* the call option price
 $P^* = \text{Average Hourly \{CT fixed cost - CT energy profit with price capped at Strike\}}$

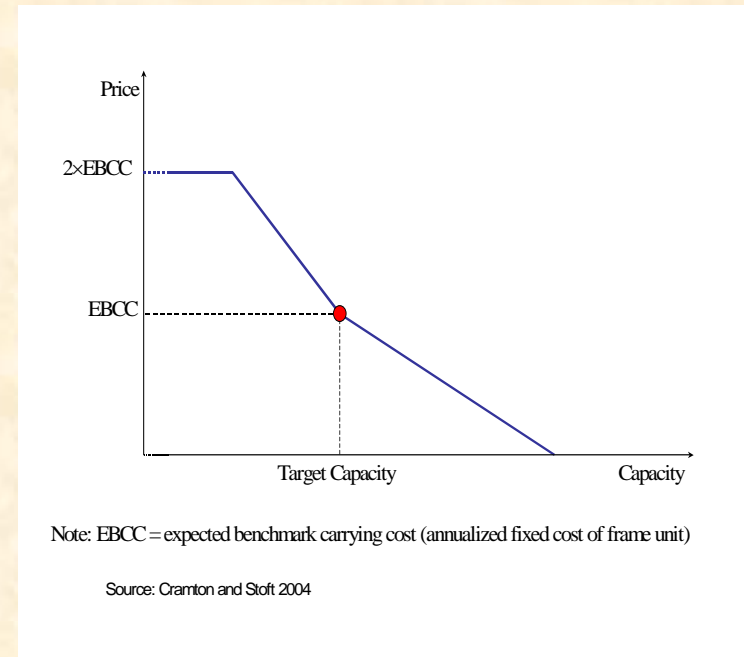
Demand Function in NE

LICAP

- Demand curve is explicit – administrative
- ISO procures all available capacity and adjusts LSE obligation accordingly (discourages self-provision)
- Disincentive for self provision
- No opt out for load

Call Options

- Strike price below cap and ability to sell above strike for non committed units creates intrinsic market value for option. (non delivery = financial liability)
- Gens selling option are liable for providing energy at reduced rates (strike)
- Option price is implied by opportunity cost of selling energy above strike (market based)
- Option obligations never exceed target capacity-capacity beyond target assumes risk of cost recovery



The Time Step Misalignment Dilemma

- LSEs want hedging obligations to be short term (load varies, no long term contracts with customers, credit requirements)
- Generators want call options to be long term (can take it to the bank as collateral for investment loans)
- How do we bridge the gap?

Central Procurement

- Works like an ancillary service product
- ISO conducts an annual central auction for annual three year forward call options on energy with a specified strike price
- Procured quantity is based on forecasted load and reserves requirements which may be zonal
- Option offered must be covered by existing capacity, three year forward interruptible contracts or bilateral contract with min three year duration and price at or below strike price.
- LSEs holding long term contracts and curtailable load contracts with appropriate duration and price can self provide by offering call options against these contracts into the auction.

Central Procurement (cont'd)

- LSE obligation (and share of cost) determined Monthly based forecasted monthly peak load.
- Cost of options allocated on a per MWh basis and over time based on monthly LOLP calculation.
- Payment to sellers and allocation of cost to LSEs at performance time (ISO passes payment through).
- For LSEs who self-provided their full obligation option revenues offset costs.
- Providers of options required to offer contracted capacity at contract strike price and offer any additional balancing energy (beyond contracted capacity) at market clearing prices.
- Failure to perform entails financial liability for the difference between market price and strike price times the amount of undelivered energy (liquidation damages) plus penalty.

Implementation in Brazil

- A central procurement auction for energy call options with physical cover was conducted in Brazil in December 2005
- Generators were allowed to submit option premium offers for 15 year call options at self-selected strike prices (ideally reflecting their fuel cost)
- Offers were selected based on a cost/benefit index accounting for the offered premium and the corresponding strike price.
- Procurement cost is passed on to DISCOs who must have contract cover for 100% of their load.
- Under the call option contract the DISCO has the right but not the obligation to purchase the energy at the strike price, thus enabling consumers to benefit from low spot prices (below the strike price) when hydro power is plentiful.
- **Reference:** “**Energy Call Options Auctions for Generation Adequacy in Brazil,**” Bezerra, Barroso, Granville, Guimarães, Street and Pereira. January, 2006, Submitted to IEEE PES Toronto meeting.

Summary

- Self provision option enables smooth transition to voluntary insurances. As the market matures individual hedging obligation may be relaxed if the market as a whole proves to be properly hedged.
- Multiple means of meeting hedging obligation ensures balance between investment, demand response and risk management
- Hedging products are long term to facilitate new investment response by transferring risk from the investor to consumers (represented by the LSE)
- Enables reserve generation capacity to secure a stable income stream for fixed cost recovery in exchange for a tangible obligation to produce energy at a reasonable price when needed.
- Unlike forward contracts, call options do not have a “take” obligation so the LSE can be required to hedge a larger quantity than expected peak demand.

Summary (cont'd)

- LSE obligations can be revised monthly to reflect changes in customer base.
- Call option obligation functions as mandatory insurance where capacity product is linked to energy production capability and deliverability.
- Market price of option is driven by opportunity cost of selling energy above strike price and it will decline naturally with increased generation capacity (no need for administrative demand curve and procurement does not need to extend beyond target capacity)
- Self-provision through prudent risk management practices by LSEs and demand response will lead to natural sunset of the regulatory obligation.

Ultimately, demand response and risk management practices will evolve to the point where the Promised Land can be reached.

