CAPACITY MARKETS AND CAPACITY VALUE

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What Is the Reliability Problem?

- Traditional View - Shortage of Energy
  - Inelastic demand, need sufficient generation
  - Political constraints on load shedding
  - Political constraints on price spikes
  - Capacity subsidies as ad hoc solution
- Glosses over the Temporal Issues
  - Enough capacity when needed

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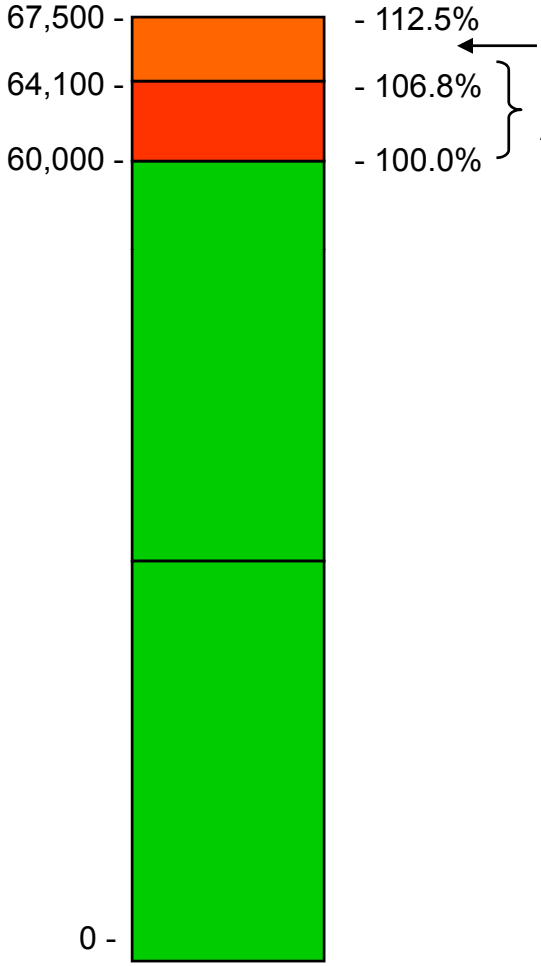
One Market or Many?

- Is Reliability Just an Energy Shortage?
  - Frequency control, too little OR too much
  - Timing is everything, no storage (for now)
- Won't Prices Solve Everything?
  - Volatile, Unpredictable Prices change quickly
  - Lag time in recognition
  - Lag time in response
  - Enough fast response resources?
- Practice v Theory – NERC Rules, etc.

Short Run to Long Run

- Planning Reserve v Operating Reserves
- A series of short-runs
  - Regulation (4 seconds), 5 Min ramp
  - 10 Minute Spinning Reserves / Nonspin
  - 30 Minute Nonspin
  - Hour ahead? Day-ahead? Emergency?
- Energy + Operating Reserves needed for minimum reliability
- Handle forced outages and Forecast Errors

Required Amount of Capacity



Market Reserve – 2,500 Mw or 4.2% (covers extreme peak)

Reserve for Forced Outages & LF Error – 3,400 Mw or 5.7%

Ancillary Services – 4,100 Mw or 6.8%

Reserves for Forced Outages & Load Forecast Error needed for 100 - 150 hours a year

Market Reserve Isn't Included in 12.5% Reserve Margin

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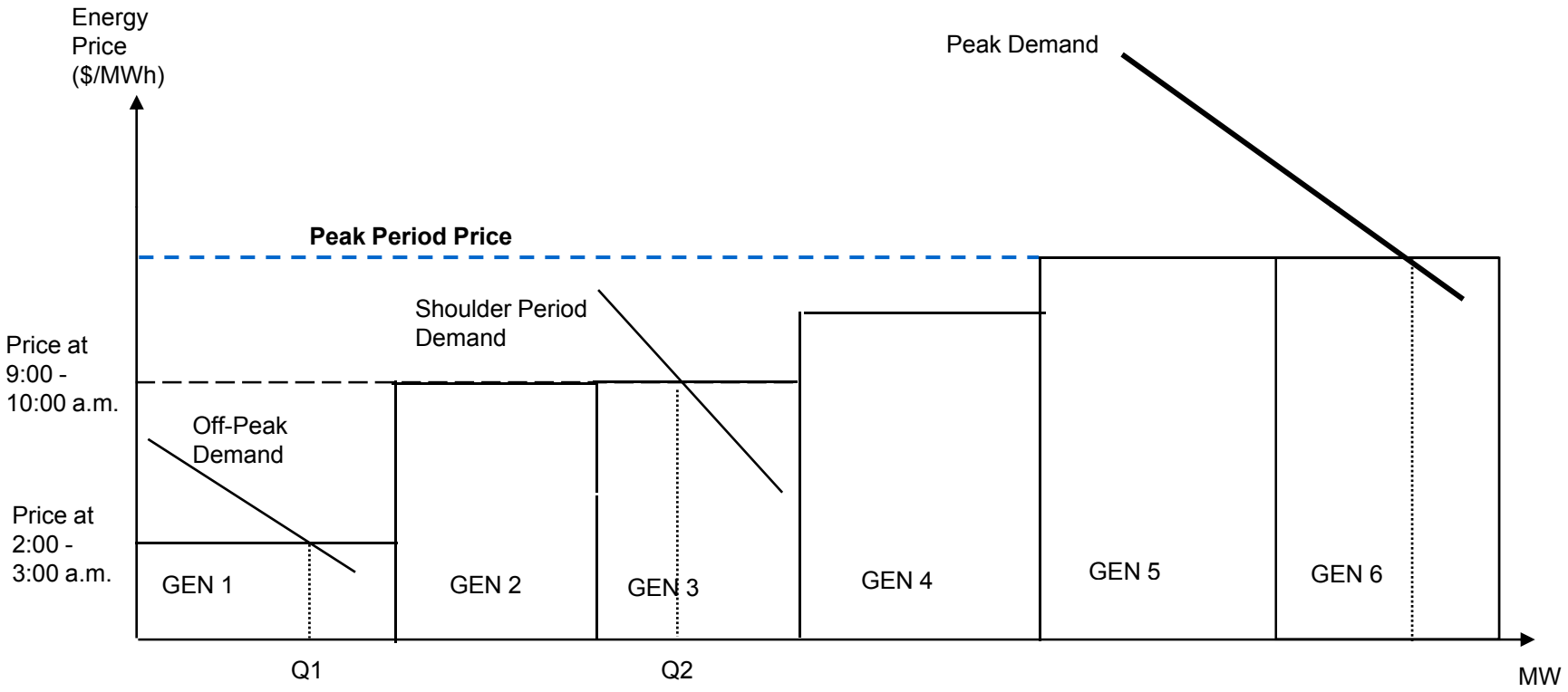
The Traditional Model

- Regulator Sets Reserve Margin
  - Integrated Utility
  - Generator (now includes DSM) IRP
  - Balance investment cost, operating cost, reliability – VOLL, once in ten years
  - Utility has economic incentive to optimize mix
- Goldplating and the Blame Game
  - Avery-Johnson, CEO self-interest and bias by regulators
  - Guess wrong and who gets blamed?

Brave New World of Wholesale Markets

- Price Caps Means “Missing Money”
  - Political constraints on high prices
  - Insufficient revenue for new generation
- Pay For Capacity
  - Installed Capacity (ICAP) Markets
  - Payment based on cost of new CT
  - In practice, binary results, $0 or near cap
  - Paying all capacity the same

The Traditional View – Price Solves Everything



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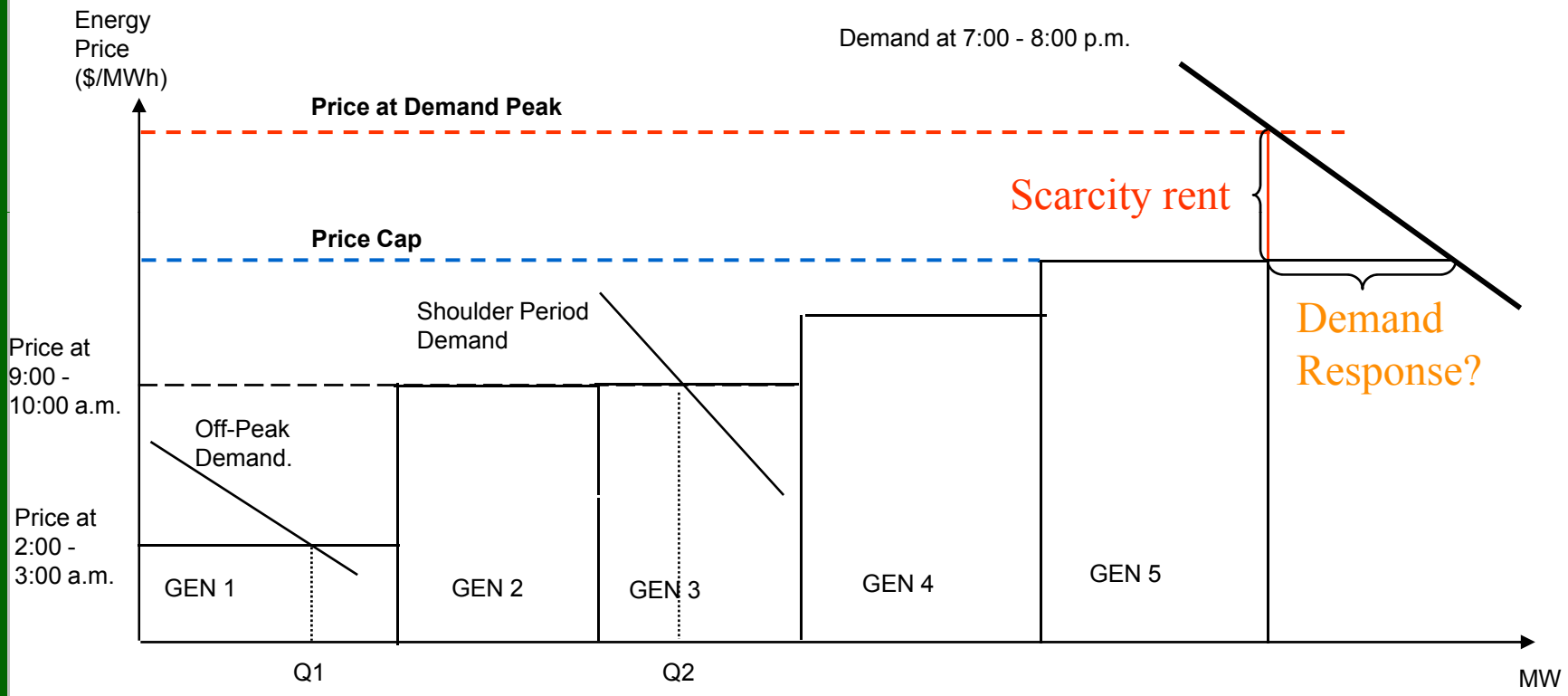
Price Gap Due to Price Cap



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New Fangled Capacity Markets

- ISO-NE, FCM
  - Pay for capacity in future
  - DR, LM, EE included in the auction
  - Also have future reserve auction
  - Still capped by CT cost
- PJM, RPM
  - Initially generation and DR
  - FERC has ordered EE to be included

ERCOT Energy Only Market

- ERCOT, based on Australian NEM
  - 60% of capacity owned by state in Aus
  - Texas is most deregulated retail market
- Has it worked?
- Margins > 14%
  - Partially due to lower growth
  - Coal, Nuclear, Brownfield CCs, a few CTs
- Older NG units reaching end of lives
  - Concern about right mix of generation

Short-run v Long-Run

- Why are capacity revenues below cost of CT?
  - IMM Reports in every market, almost every year
  - Price caps, regulatory pressure
  - Where are the capacity shortages?

- Capacity markets are Short-run markets
  - Generation decisions long-term, driven by projections of fuel costs
  - Capacity markets 1-5 years, can't finance new units, can retain old units

RELIABILITY AS "QUALITY" AND QUANTITY

- Energy and Reliability Not the Same Market
  - Many markets are closely linked
  - Enough energy, without control, insufficient
  - Frequency control has separate value
  - VOLL
  - Capacity ~ Reliability?

Different Resources with Different Capabilities

- Total cost, including increased probability of repairs and catastrophic failure
- Base-load units have high cost of cycling, large lost opportunity cost of energy sales
- CCs often with CTs with 1.5 hour ramp
- CTs that can ramp in 10 minutes cost more
- DR Resource also have wide range of costs and capabilities
  - Control, monitoring, legal assurance
  - DR is not the same as LM and EE

Investment Decisions – Base Load Units

- Based on projected fuel and market price plus risk
  - IPP boom of 2000 based on low NG
  - Nuclear, coal based on high NG
  - Capacity markets play limited role:
  - 8000 hrs x margin - $40/kW = $5/MWh = 50¢/MCF
- Asymmetric risk
  - Over-investment leads to low market prices
  - Under-investment costs short-run opportunity
  - Risk of changes in technology, fuel costs
  - Difficult to site in many regions
- Regulatory Risk for Coal & Nuclear

Investment Decisions – "Reliability Units"

- CTs based on peak prices and expected AS revenues
  - Few hours with high prices – hard to recover capital
  - Units may struggle to be eligible in AS markets
- Physical Hedge?
  - Directly finance by Load or long-term contract
  - Load has alternative hedge strategies
- Older plants (sunk costs) move up the stack
  - Operating costs paid by AS as well as Energy
  - Drive down capacity markets prices
  - Leave market when major investment required

Right Mix of Resources Required

- Capacity/ Energy Only Market – Sub-optimal Mix
  - Have to overpay base load to finance peakers/DR
  - Excessive base load generation drives down price

- Ancillary Service Markets – Pay for Service, not Steel
  - Pay for the Desired Attributes
    - Ramping capacity
    - Response time
  - Energy market sets opportunity cost for AS markets
  - Cap energy price, squeeze AS markets
  - What is efficient size of Reserve Markets?

CONCLUSION

- Perfect World, Price Signals Would Control
  - Requires consumers see and respond to prices
  - Capital intensive industries over and undershoot, years of low reliability? Acceptable?
  - Requires market allocating shortages – politics
- Politics Limit Market Forces
  - Market mistakes have major social repercussions, price and blackouts
  - Inventories buffer most markets, but not electricity
  - Regulators respond to current pressure

CONCLUSION

- "Third-best" World
  - All electricity markets are "ad hoc"
  - Market signals have value, but what signals? What Markets?
- Energy market and Reliability markets
  - Energy market is the core
  - Reliability markets are "insurance" markets
    - Socialize the risk, spillovers
    - Reliability services, not dumb capacity

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