Efficient Reliability

Demand-Side Resources and New Electricity Markets

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September 21, 2000

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The Setting: What FERC and States Now Face

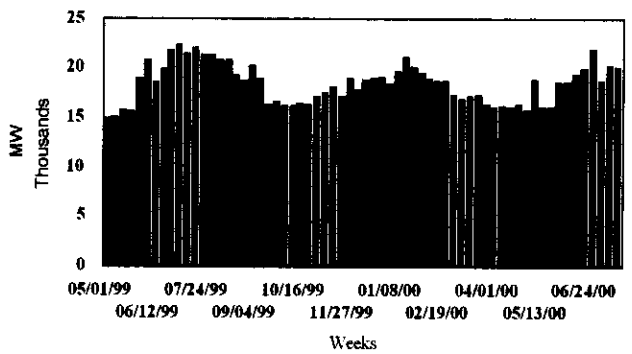
- **New Regional Power Markets**
  - **Regional power markets and T grids**
  - **RTOs, ISOs and regional reliability rules**
- **Reliability problems, market power, and price spikes are regional in scope**
- **BUT: Retail rates and services are state-regulated**
- **Retail rate structures drive demand, and thus wholesale markets, while wholesale market structures determine whether demand management has a market role.**

Regional Power Markets -- Emerging Patterns

- Rapid demand growth
- Generally low prices, punctuated by highly volatile periods with high prices
- Price spikes are associated with reliability challenges & tight supply margins
- Market power evident; gaming?
- Substantial excess costs associated with price spikes drive up annual costs

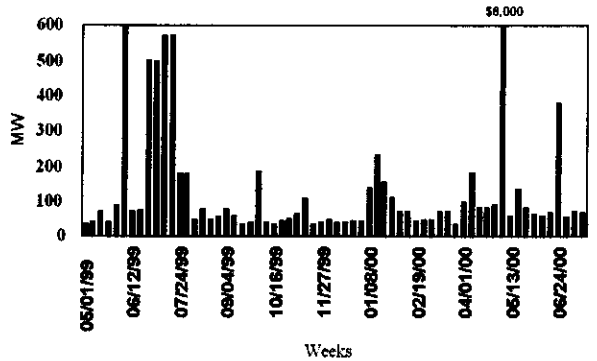
Weekly peaks vary by 50%

NEPOOL Weekly Peak Loads
May 1, 1999 through July 21, 2000



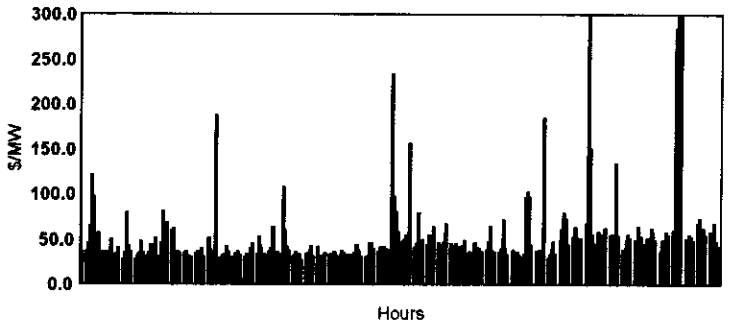
While weekly peak PRICES vary by 10,000%!

NEPOOL Weekly High Spot Prices
May 1, 1999 through July 21, 2000



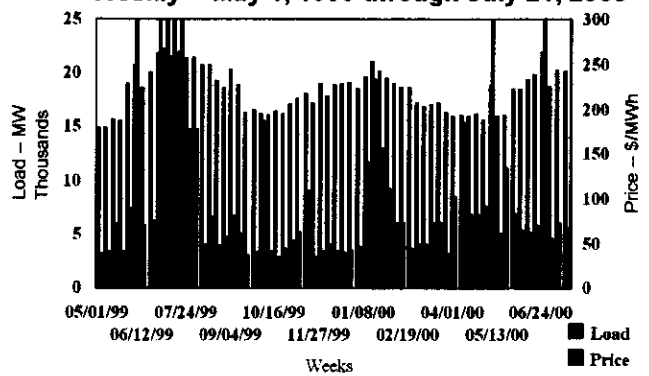
New Problem #1: Price Spikes

Daily Maximum Spot Market Prices
ISO-NE, 12 Months Ending 7/21/00, Weekdays



Prices spike with thin generating margins

New England Peak Loads and Prices
Weekly -- May 1, 1999 through July 21, 2000



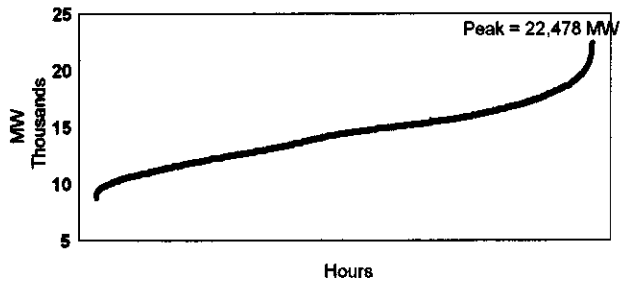
New Problem #2: Market Power

Forced Outage Rates
Trends in New England

1996-97	7.2%
1997-98	8.2%
1998-99	13.0%
5/99-12/99	19.8%

Typical Load Duration

New England Loads
May 1, 1999 through July 21, 2000

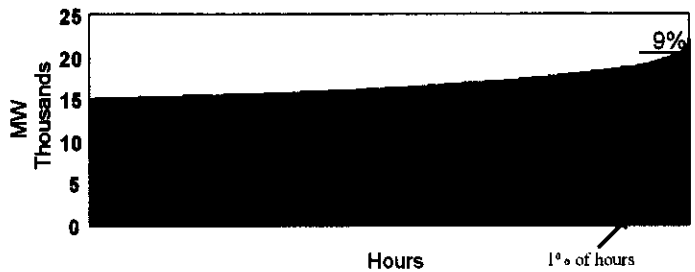


New Problem #3: Reliability

- **Sales up 31% in a decade**
- **Peak loads growing rapidly**
  - summer peak up 56,000 MW in 4 years
  - records set and reset in several regions
- **DOE forecast: adding the equivalent of Japan and Germany to the US grid by 2020**
- Power quality demands rising too
- Outages, warnings, close calls in several regions
- Causes vary, but distribution, transmission, and generation adequacy are ALL enhanced by lighter peak loads

1% of hours = 9% of peak load

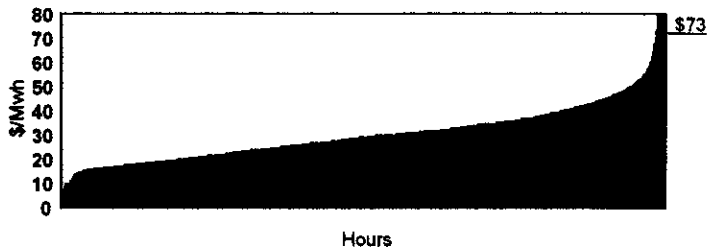
New England Loads
12 Months Ending July 21, 2000



Existing 12 Month Peak = 21,992 MW
Top 1% of hour above 19,950 MW
Difference Equals 9.29% Reduction (2042 MW) in Load

1% of hours = 16% of annual spot power costs

New England Spot Energy Prices
12 Months Ending July 21, 2000



Max = $6000/MWh, May 8, 2000
1% of hours above $73/MWh
Top 1% of Prices equal 15.8% Wholesale Costs (weighted by load)

Efficiency -- A Proven Resource

- Utility DSM programs delivered 29,000 MW savings at a grid cost of 2 to 3 cents per kwh
- Modular, dispersed, many technologies
- Efficiency lower customer bills, and lowers the price spikes for everyone
- Lowest in pollution
- Efficiency relieves stressed distribution AND transmission constraints
- Programs can be tailored for each market

The Public Value of Efficiency

- **Tracking CA PX Prices** (98-99)
- 1 MW baseload reduction saves participating customers $219,000
- AND it also saves non-participating customers $658,000 by lowering market clearing prices in the PX for everyone
- "Public savings" $.075/kwh, or three times the direct savings!
  - (Rich Ferguson, CEERT 2000)

Can we capture EE and LM savings in new energy markets?

- Efficiency and load management are often superior solutions
- Breakup of the integrated utility & disintegration of IRP
- Will new entities have the power and responsibility to consider least-cost solutions?
- Will new energy markets value the contribution of EE and LM options?
- History, tradition, law (FPA):
  - focus on **supply** (efficiency and adequacy)
  - focus on wholesale markets

Solution Menu (so far...)

- (1)Multi-Settlement Market System
- (2)Demand-Side Bidding
  - Day-Ahead demand bidding
  - "Dispatchable Load" bidding into an integrated reserve market
- (3)Congestion Management Pricing
- (4)Pricing Reliability
- (5)Regional Uplift Charges --what for?

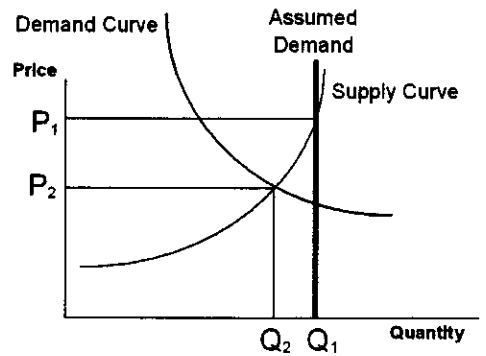
Demand-side responses

- **Type 1: Simple demand response**
  - **ISO posts expected day-ahead prices**
  - **Load-Serving Entities (LSE's) bid load while Generators bid supply**
- **Type 2: Price-sensitive demand bids**
  - Example: "I'll run 50 MW up to 4 cents/kwh; at 5 cents, I'll ramp back to 40 MW"
  - Q: will this alter the day-ahead stack and curve?
- **Type 3: "Dispatchable Load"**
  - Make the Reserve Market an integrated market; both supply and load can bid to provide reserve resources
  - Load must be controllable and meter-able in real time
  - All providers of reserve resources receive the market clearing price for reserves of that type

Demand-Side Bidding -- what's the idea?

- Avoiding price spikes and thin reserves
- Mandatory real time pricing for most customers is not an option --
- Equipment cycling, rescheduling, on-site generation are often less expensive
- Beyond traditional interruptible contracts:
  - For economic value, not just reliability reasons
  - Broad-scale (e. g., radio controlled) options
  - Customer-specific deals
  - Buy-back with resale can clear the market and make money for customers and LSEs
  - Abdoo: "This was a heck of a good deal"

Discovering the Demand Curve



Multi-Settlements

- Traditional, single-settlement:
  - Resource stack, market clearing price
  - Bidders are not obligated to perform
  - Invites gaming (esp.strategic witholding)
- Multi-settlements:
  - If a unit bids successfully, it must perform, either physically or by buying equivalent production on the market;
  - "Resettlement" at end of month
  - Makes bidding real, dampens gaming

Why Doesn't Load Respond to Real-time System Cost?

- **Customers see average prices, and they see them long after consumption**
- **Few customers on interval meters or real-time prices**
- **Default service prices** -- low, fixed prices have two negative effects:
  - Inhibit new LSEs and thus, agile load management innovations
  - Insulate customers from market costs
  - Result -- increased peak demand, more volatile wholesale market

Why doesn't load respond? (2)

- **Default Service Rate Plans**--rarely reward providers for success in efficiency and load management
  - **Lost profits math:** wires companies are throughput-addicted
  - **Pass-through of power costs (e.g. CA PX costs):** no incentive for EE or LM
  - **Rate caps or freezes:** no incentive if savings offset stranded costs
  - **Revenue caps:** would encourage cost-effective EE and LM

Why doesn't load respond? (3)

- **Load profiling by pools or RTOs**
  - An LSE charged for usage on a customer profiled basis will not benefit from high-value peak-load reductions unless a new profile is created for those customers
- **Reliability rules and practices favor turbines and wires solutions--**
  - "Dispatchable load" often cannot compete fairly with generation in ancillary services markets
  - Demand-side options not permitted to compete with generation and wires for uplift and other "socialized" support.

Cost of Ancillary Services

- **Utilities spend 4 to 8 times as much on ancillary services as on DSM**
- DSM: peaked at $2.7 Billion, now much lower
- Ancillary services: cost about $12 Billion per year, or 4 mills per kwh*

--(from Kirby & Hirst, "Ancillary Service Costs for 12 U. S. Electric Utilities," Oak Ridge National Laboratory, 1996)

Uplift Charges

- Uplift charges are a common element in pool rules and new markets
- Examples: spreading out the costs of congestion; paying for reliability measures that have widespread value
- Question: If the new RTO/ISO/Pool has power to assess "uplift" for imports, reserves or transmission to enhance reliability, why not for efficiency, load management, or DG?

Efficient Reliability Decision Rule

- Before "socializing" the costs of a proposed reliability-enhancing investment through uplift or tariff, the proponent must demonstrate:
- (1) that the relevant underlying tariffs are cost-based (including congestion costs);
- (2) that a market failure remains; and
- (3) that the proposed investment is the lowest cost, reasonably available means of resolving that market failure.

Lessons Being Learned

- **Efficiency & load management can improve reliability at all levels** -- from distribution all the way to generation adequacy.
- **When margins are thin, even small savings are critical to reliable service.**
- **When markets are thin, the supply curve is very steep!** 1% of the hours can raise annual spot market power costs 16% -- Savings can be very large.