For Want of A Nail...?

The Unrealized Potential of Focused Demand Response*

IAEE

NEW ENGLAND CHAPTER

February 18, 2004

Shiv Mani

ISO New England, Inc.

*** The ideas and concepts discussed in this presentation are exclusively those of the author and have not necessarily been endorsed by ISO New England, or any of the participants in the New England energy market. The author cautions that this presentation, if read outside of the context in which it was given, may be misleading and not fully representative of the ideas and concepts presented at the New England Chapter IAEE meeting on February 18, 2004.**

Description of Demand Response Programs

- ISO-NE's demand response programs fall into two broad categories; Reliability & Price:
  - Reliability (mandatory)
    - Real time (30 minute response and 2 hour response)
    - Profiled response
  - Price (voluntary)
    - Real time price response program
  - Day ahead demand response program in development

Note: Payments for interruptions are based on zonal price

General Criticisms of Demand Response

- Demand Response programs are not market based
- The programs involve subsidies
  - Minimum payments & double payments
- DR involves payments for reductions in consumption where the seller does not own the product:
  - A hypothetical reduction in consumption does not amount to ownership / entitlement of the associated MW
- The MW associated with DR are unreliable and difficult to measure with reasonable accuracy

How can the criticisms be addressed?

- Through a *focused approach to DR*, which requires:
  - Commercially viable programs
  - Integration of DR into the wholesale market design
- Supplementing and revising market rules, procedures and practices
- A robust market for aggregation of DR resources to make DR a valuable tool in supply portfolios

Focused Demand Response involves:

- Integrating Demand Response with Market Design
- Identifying opportunities for demand response in those instances where it brings maximum value
- Using DR when other resources are more expensive
- Removing subsidies and double payments
- Market Transformation:
  - Creating a market for Demand Response Providers (DRPs) and Aggregators
  - Taking a portfolio approach to using DR

Demand Response and Market Design

- The market design issues concerning DR can be broken into two categories - Reserves and Capacity. Each category can be further broken down into near term and forward markets

Market	Short Term	Long Term
Reserves	Operating Reserves	Forward Reserves
Capacity	Locational ICAP	Forward Capacity Market

- The following four slides discuss how DR adds value to each of the markets

Market Design initiatives and potential uses of DR

- Operating Reserves
  - ISO-NE developing co-optimized energy / reserve markets
  - DR resources ideally suited to provide 10 and 30 minute reserves - larger amounts of load may be available for provision of spinning reserves than is available for peak reduction
  - Load may be able to respond faster than generation

Market Design initiatives and potential uses of DR

- Forward Reserves

The market for Forward Reserves involves the advance purchase of Operating Reserve capability where sellers of Forward Reserves submit energy bids above a pre-determined strike price

Resources called 2% - 3% of the time. Providers of reserves set their offers in the Energy market at or above a strike price to assure that they are providing reserves 97% to 98% of the time. *These features of the market are especially suited to market based Demand Response*

Market Design initiatives and potential uses of DR

- Installed Capacity (ICAP)
  - The ICAP Requirement is the amount of installed capacity required by the pool to meet 1 day in ten years LOLE resource adequacy reliability criterion. The requirement is then translated to an ICAP obligation for load serving entities (LSEs) depending on their peak load
  - New England is implementing a market to reflect the value of locational capacity (LICAP)
  - DR resources in the mandatory programs are eligible to receive ICAP credits to the extent of their interruption – this credit can then be used to reduce their LSE's ICAP obligation or cashed in the monthly ICAP auction

Market Design initiatives and potential uses of DR

- Locational ICAP / Forward Capacity Market
  - ISO-NE is working on developing a market for forward capacity in the context of meeting resource adequacy
  - Capacity could be procured by auction, two or three years in advance, for a period of at least one year
  - DR resources may be able to participate in this market
  - DR resources may be able to participate across control areas, thereby being tradeable (like ICAP associated with generation)

Other instances where focused DR is valuable

- August 15th 2003 - the day after the Northeast blackout
  - 345 kV line connecting New England and New York control areas tripped, limiting ISO-NE's ability to support the NY area to 200 MW from a normal level of 400 MW
  - ISO-NE activated all of its DR programs for the CT zone at 8 a.m.
  - Two-thirds of the enrolled customers responded and produced a maximum response of 110 MW by 11 a.m.
  - The response averaged 75 MW per hour from 8:00 a.m. to 6:00 p.m.

Other instances where focused DR is valuable

- At the same time DR was playing a critical role in NY during system restoration
  - Load was restored step by step; however implementing the DR programs allowed other customers to receive electricity faster
  - Further, moderating the load that went online allowed system operators to restore power in more stable circumstances and to maintain a comfortable reserve margin
  - How much is this really worth and to whom?

Other instances where focused DR is valuable

- Reuters reported that the blackout cost New York City $36 million per hour – or $1.05 billion.[1]
  - Focused DR would involve developing programs where DR alleviates contingencies in circumstances or in areas with high Value of Lost Load
  - 1. Source: Forbes Online http://www.forbes.com/home_europe/newswire/2003/08/18/rtr1060409.html

Instances of focused DR

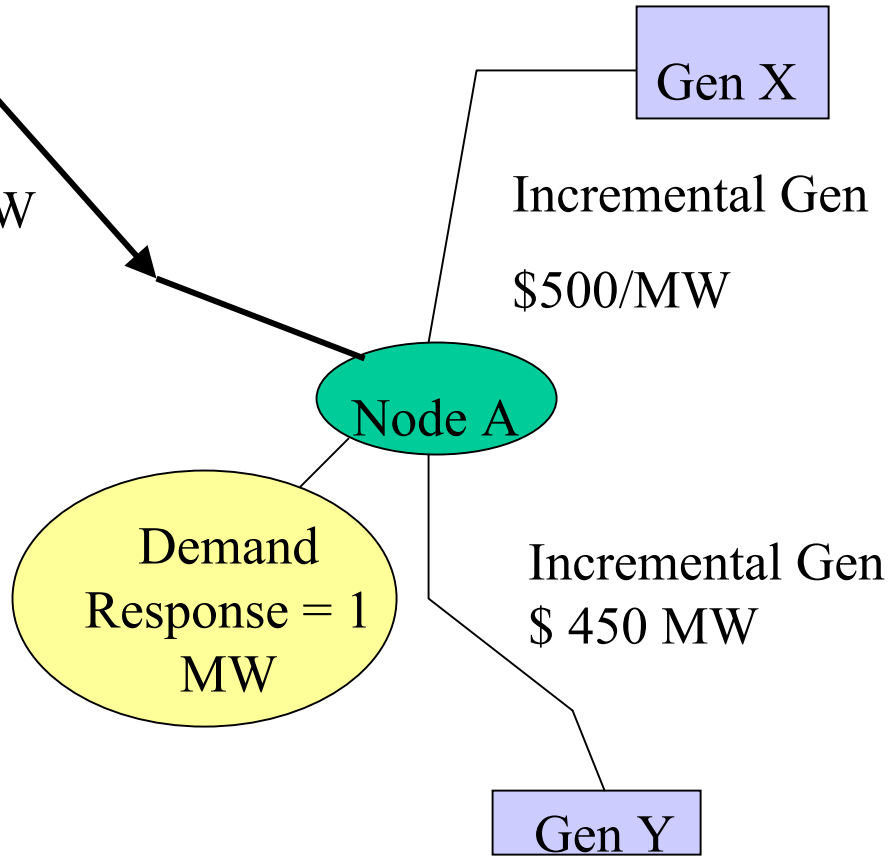
- Conceptual Example:
  - Some nodes on a system may regularly experience very high LMPs due to high levels of congestion at those locations
  - Congestion is high because limited transmission capacity results in increasing costs to serve incremental load, and because a nearby generator offers the next MW at a much higher price
  - In such instances, a small reduction in demand has the potential to dramatically reduce both congestion and LMP

Conceptual Example:

Transmission Line Capacity =105 MW

Load at Node A is 100 MW,
increasing the next hour to 106 MW

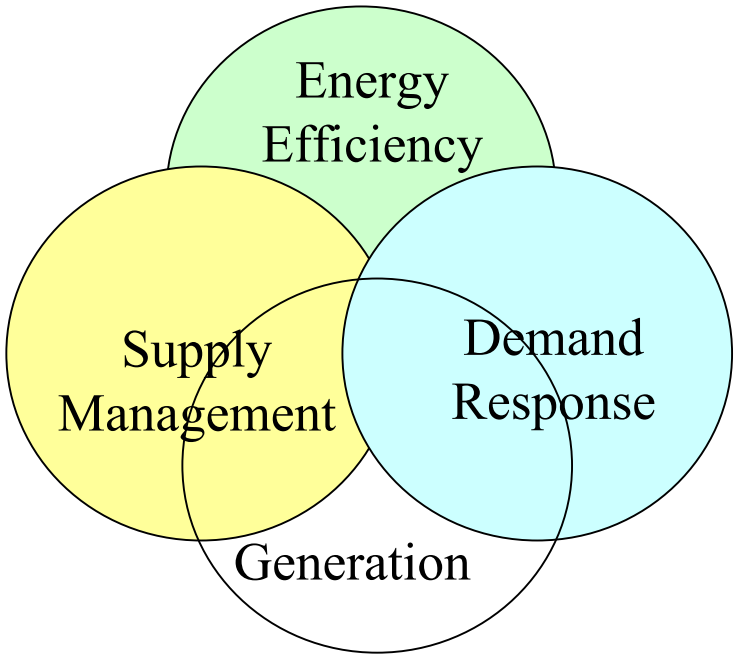
			Load →	
		100 MW		106 MW
			LMP	
Energy		$40		$40
Congestion		$0		$400
Losses		$10		$10
Total		$50		$450
DR Price anywhere between $50 and $450				



Focused DR - Conceptual Example

- Developing DR locationally may be more efficient because DR resources are focused mainly in those areas / circumstances where the DR resources are most needed
- Locational DR would compensate DR resources without any subsidy – therefore it is market based. Simultaneously, LMP will decrease
- Locational / Nodal DR would compete with incumbent resources at the node / location and effectively limit opportunities for the exercise of market power

Integrated Energy & Risk Management Strategy: A Portfolio Approach To DR



Use DR to:

- Hedge price risk
- Trade capacity credits
- Avoid congestion payments
- Tailor electricity products to meet supply requirements / customer needs
- Trade with other financial instruments such as FTRs

Technical issues & implementation of DR

- Load does not provide operators important information in real time that is comparable to the information generation resources provide
  - Load assets are dispersed with small amounts of potential curtailments that may not be reliably responsive
  - Load assets are not staffed 24/7
  - Loads do not have two-way communications delivery systems
  - Load data is not transmitted with the same resolution and accuracy as data from generating units
  - Load assets are not modeled into the energy network system
  - Load may not have the same dispatch flexibility as generation

Market issues & implementation of DR

- DR in the context of SMD is an emerging field. The energy market has not yet established a commercially viable method to incorporate DR in its calculus
  - Customers do not receive real time price signals. Many customers are on Standard Offer
  - Effective, market based DR requires aggregation. Participation by aggregators and marketers is limited
  - DR involves the development and introduction of new technologies. Acceptance takes time
  - DR involves new ways of doing business for customers, utilities, marketers / aggregators, and system operators

Market issues & implementation of DR

- Market based DR will require supplementing / revising market rules and reliability standards to allow broader resource participation
- DR is being developed in the context of competing interests, projects and resources & existing market software
- Economics of software development not favorable initially. If you build it, will there be DR customers? Example – Day Ahead DR
- Overall market design and terms of forward markets may not be suited for development of DR market

Conclusion: For Want Of A Nail…?

1. Focused DR can be extremely valuable to system reliability and simultaneously commercially viable
2. An example of focused DR is Nodal DR
3. Technologies, protocols, rules and market platforms need to be developed to *harvest* the value of DR
4. Market design and policy should allow for the development of DR aggregation by marketers, suppliers and aggregators
5. It is technically possible to integrate DR into wholesale market design. However, the *Market Transformation* activities in 3 and 4 need to be accomplished
6. Both technical and market transformation initiatives are costly but necessary to reap the long term efficiencies from DR