New York ISO 2002 Demand Response Programs:

Evaluation Results

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Overview of Presentation

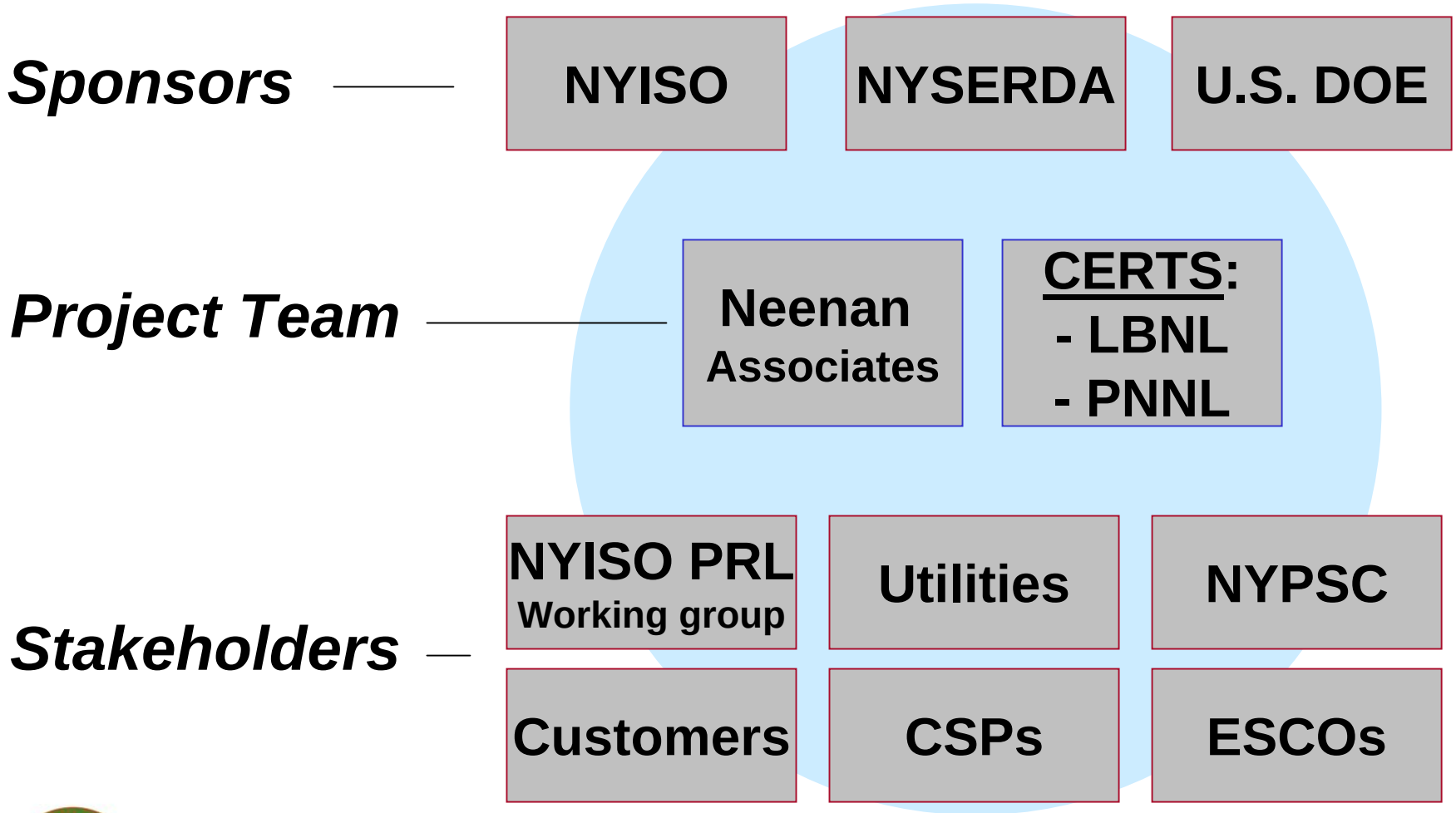
- **Evaluation of NYISO 2002 Demand Response Program:**
  - **Project Objectives**
  - **Stakeholders**
  - **Accomplishments**
    - **Approach**
    - **Key Findings**
  - **Significance**
    - **Impact of evaluation results on NYISO & NYSERDA Pgms**
  - **Deliverables**

Project Objectives

- **NYISO:**
  - **Assess Reliability and Market Impacts of DR program(s)**
  - **Understand Customer Performance in a Voluntary Emergency DR Program (EDRP)**
  - **Understand Barriers to Participation in Day-Ahead Market (Economic) Demand Response Programs**

- **NYSERDA:**
  - **Assess Impact and Role of DR Enabling Technology**
  - **Assess Sustainability of DR Providers from a Business Perspective**

Key Stakeholders and their Involvement



Evaluation Approach and Objectives

1	**Customer Survey** - Base Survey - PRL Audit - Conjoint Survey - Behavior Choice Models	Characterize Participants Analyze Drivers and Barriers to Participation Identify Preferences for Alternative Program Designs
2	Curtailment Performance Analysis	Portfolio and Individual Customer Performance
3	Reliability Benefit and Market Impact Analysis	Analysis of Program Benefits ($)
4	Business Case Analysis for Demand Response Providers	Sustainable business models for DRPs?

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NYISO Electricity Markets

Customer-Supplied Resource Programs

- **Generation Assurance** - **ICAP** ← **ICAP / SCR**
- **Energy** - in two sequential markets:
  - **Day-Ahead Market (DAM)** ← **DADRP**
  - Real-Time (RTM)
- **Direct-bid Ancillary Services**
  - Operating Reserve
  - Regulation
  - **Emergency** ← **EDRP**
- **Cost Based Ancillary Services**
- **Congestion Protection** - the "TCC"

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NYISO PRL Program Features

	Market Function	Eligible	Event Notice	Payment
ICAP	Installed Capacity	> 100 kW	Day-ahead advisory, 2 hour notice	$/kW Market value of ICAP
EDRP	Emergency Capacity	> 100 kW	2 hour notice	Greater of $.50/kWh or RTM LBMP
DADRP	Economic Energy	1 MW increments	Bid by 5am, day-ahead, notice by noon	Greater of Bid $/kWh or DAM LBMP

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DR Program: Market Impacts

Program	Participants (Enrolled MW)	Events	Load Curtailed
EDRP 2002	**1711 (1481 MW)**	**22 hr Downstate; 10 hr Upstate**	**~668 MW**
2001	***292 (712 MW)***	***23/17***	***425 MW***
DADRP 2002	**24**	**1486 MWH scheduled**	**~14 MW (average)**
2001	***16***	***2694 MWh***	***8***

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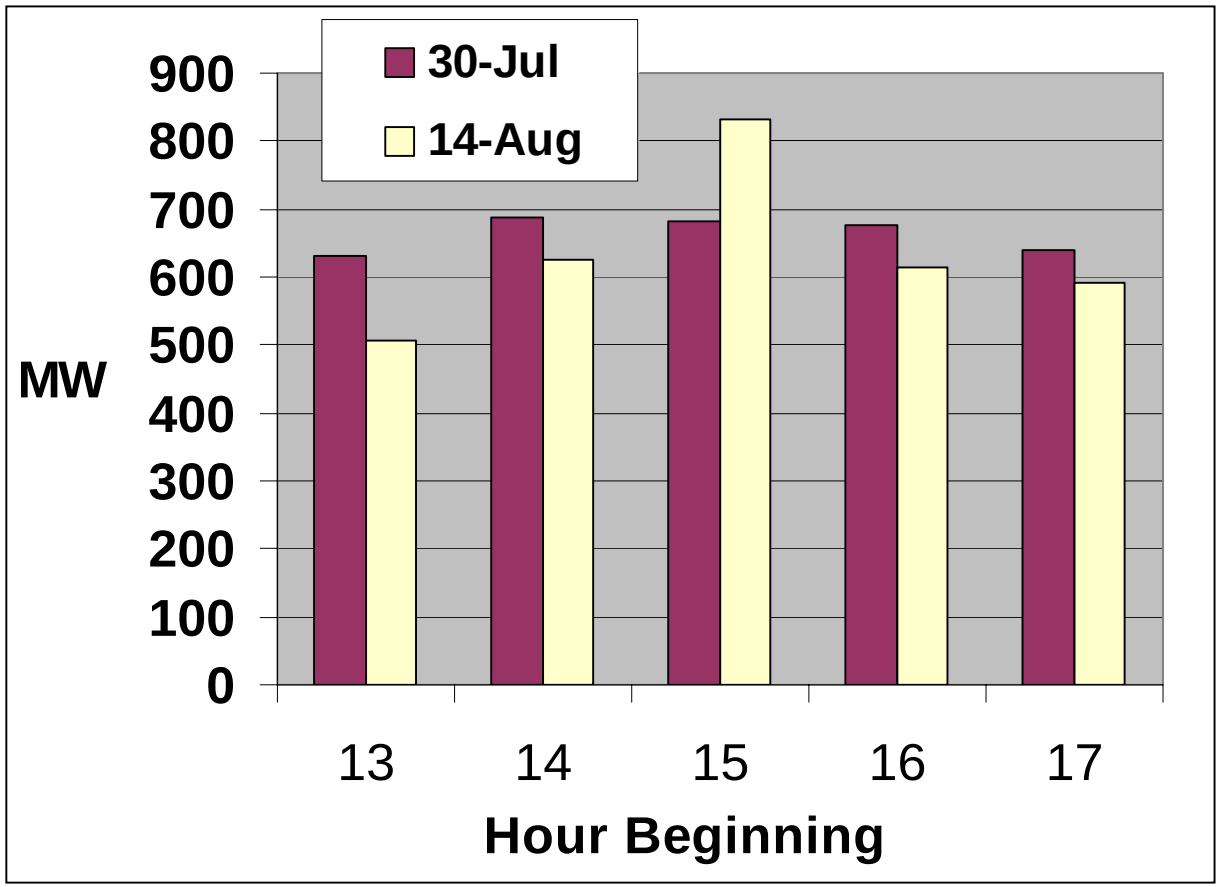
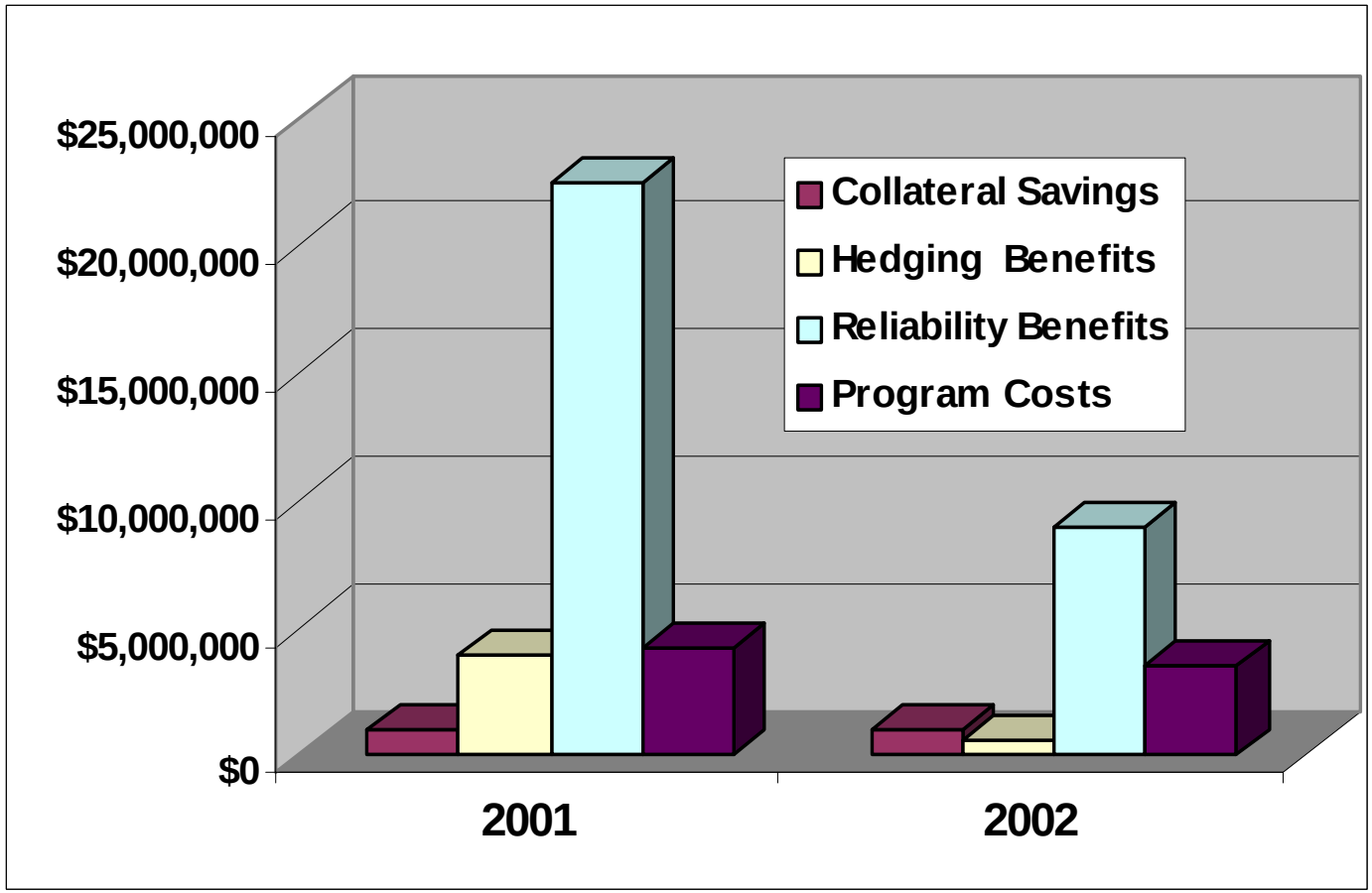
EDRP Summer 2002 Performance

- **Location: NYC/LI (~20%), Western NY (55~%), Capital (~25%)**



- **1,711 enrolled participants (1,481 MW)**
- **Actual Load Curtailed = ~668 MW (avg.)**
- **~75% load curtailment; onsite generation ~20%**
- **ISO payments = $3.5M**

EDRP Reliability Benefits and Market Price Impacts



- **Reliability benefits: reduction in LOLP valued at $5.00/kWh**

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Understanding Customer Response: Performance Metrics

- **Subscribed Performance Index** (SPI): ratio of customer's *actual* average hourly load reduction to their *subscribed* load reduction
  - Indicates customer's actual performance relative to their commitment
- **Peak Performance Index** (PPI): ratio of customer's *actual* average hourly load reduction to their non-coincident peak demand
  - Characterizes customer's relative technical potential when compared to similar facilities
- **Implications**:
  - ISO system operators – how reliable a resource?
  - ESCOs/CSP and Public Benefits Administrators – who to target?

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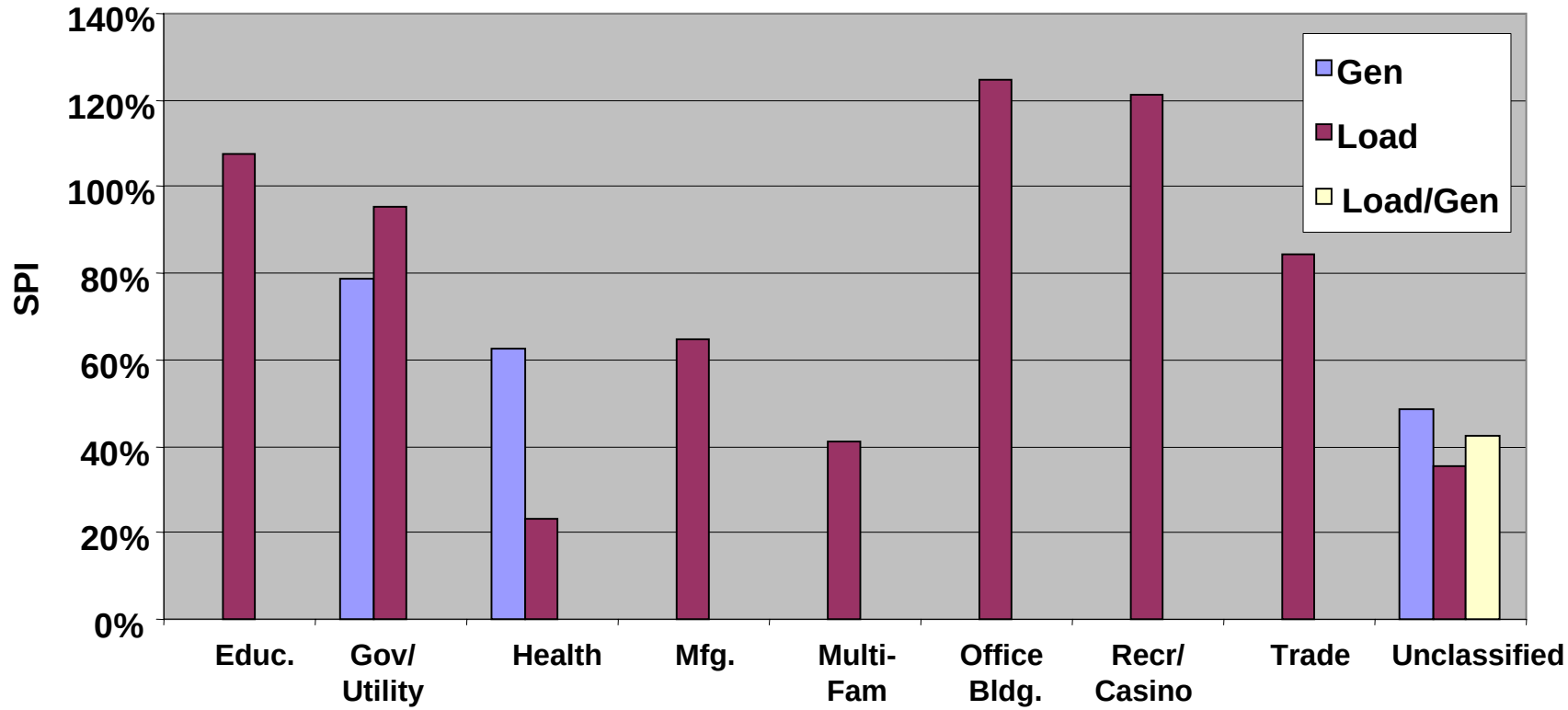
Performance (SPI) by Business Type and Curtailment Strategy



	Educ.	Gov/ Utility	Health	Mfg.	Multi-Fam	Office Bldg.	Recr/ Casino	Trade	Unclassified
Subscribed MW Active Participants	9	90	13	502	3	5	2	13	246
Subscribed MW All Participants	30	123	28	558	9	8	5	26	551

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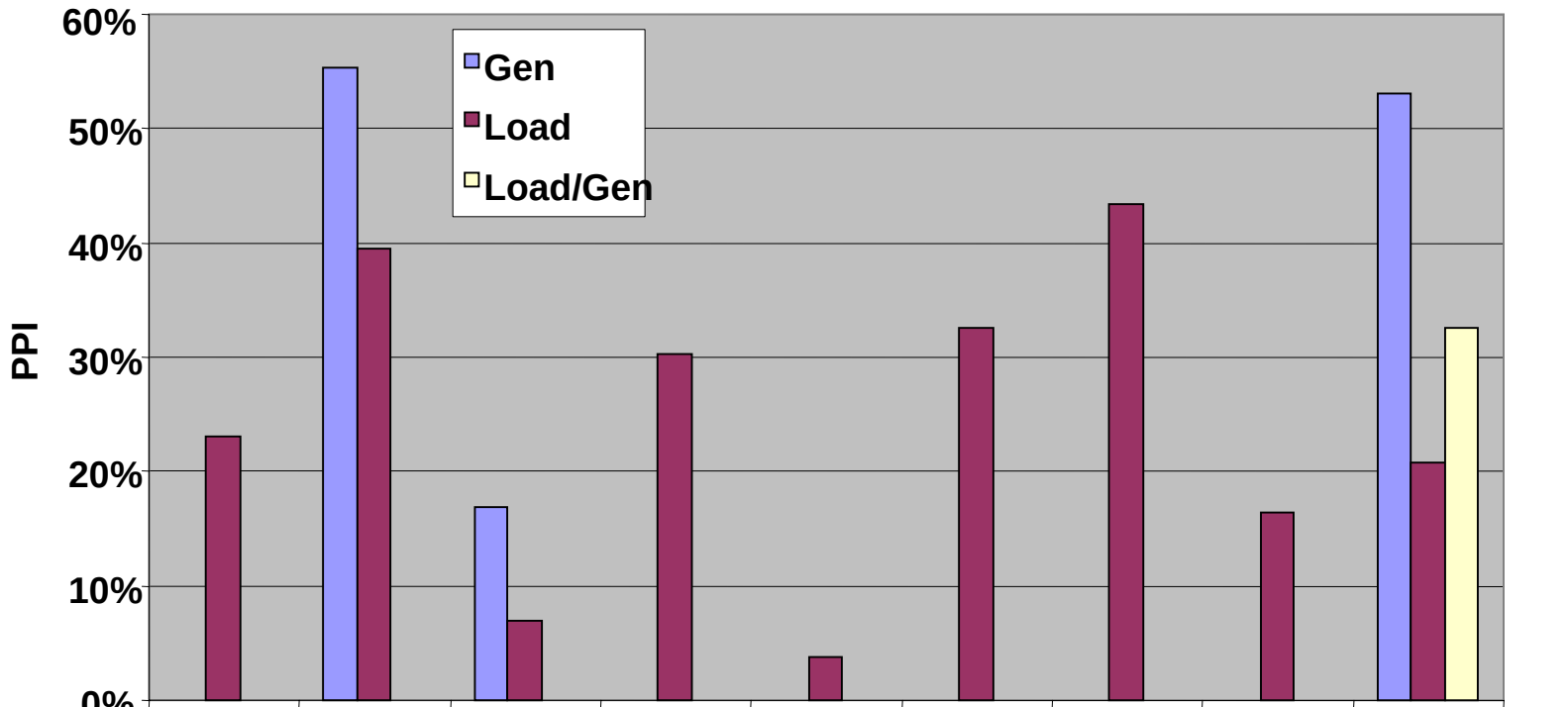
Curtailment Potential (PPI) by Business Type and Curtailment Strategy



Subscribed MW Active Participants	Educ.	Gov/ Utility	Health	Mfg.	Multi-Fam	Office Bldg.	Recr/ Casino	Trade	Unclassified
	9	90	13	502	3	5	2	13	246

- **Avg. load curtailment = 34% of CBL**

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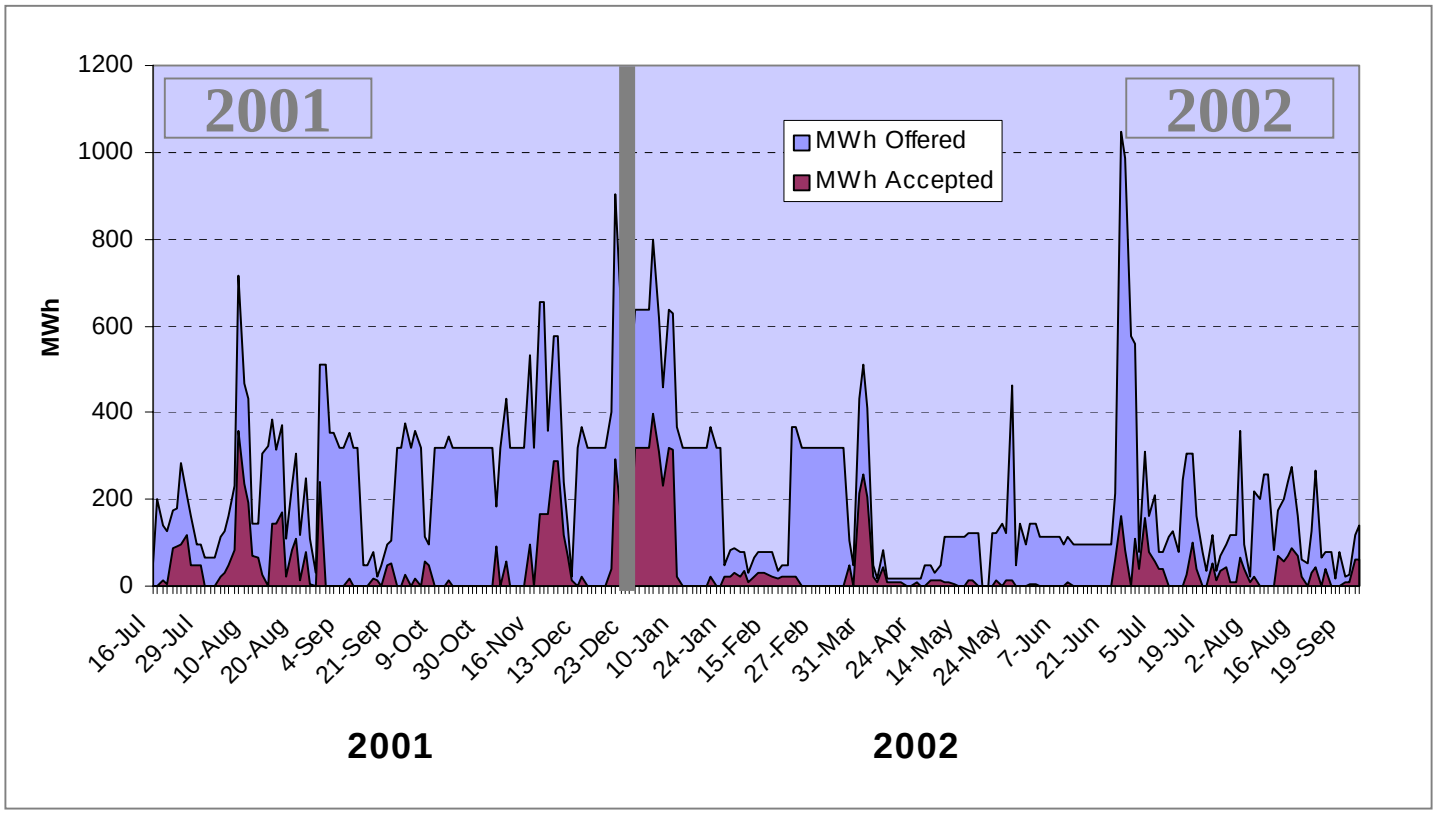
Day-Ahead Market "Economic" DR Program: Low Participation and Bidding Activity



- **Fewer customer bids accepted and scheduled in 2002 (~7 MW average) vs. 2001**
- **Customer offer prices generally low ($50-150/MWh), given DAM price environment**

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Customer Market Survey and PRL Audit

- Base survey: 144 respondents (~17% response rate)
- PRL Audit: 35 in-depth telephone interviews conducted by CERTS engineers
- Questions on cust. characteristics, enabling technologies, load curtailment strategies, & barriers to DADRP participation

Customer Segment	Base Survey	PRL Audit (sub-set)
EDRP only	58	19
EDRP/ICAP	16	6
DADRP	11	10
Informed Non-Part.	59	0
Total	144	35

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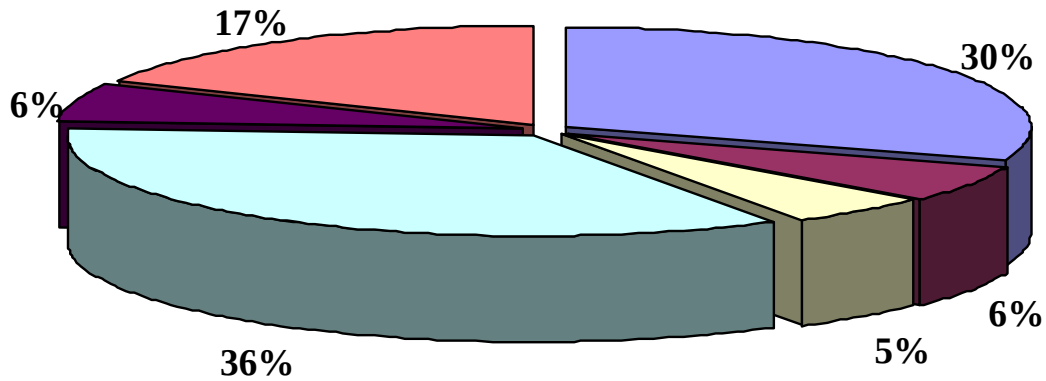
Primary Stated Reason for Not Participating in DADRP



Base = 63, No response = 81

- Potential Benefits Don't Justify Risk
- Penalty is too severe
- Payments are too low
- Unable to shift usage
- Conflict with contract or rate
- Inadequate knowledge

Barriers

- *Organizational/institutional*
  - Low program awareness levels
  - Inability to shift usage (36%)
  - Inadequate knowledge of requirements (17%)
  - Concerns about occupant comfort
- *Economic/Program-design Related*
  - Potential benefits don't justify risks (30%)
  - High bid price thresholds (5%)
  - Short payback periods for DR investments

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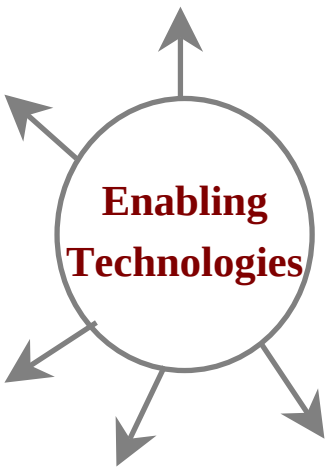
Enabling Technologies for Demand Response

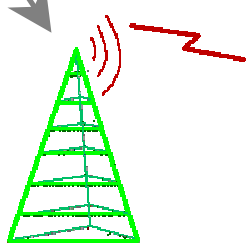
Interval Metering

Energy Information Tools

Backup Generation



Load Control



Communications/ Notification

- **Long-term persistence and sustainability of customer load curtailments depends on**:
  - Automated load response with “Permission-based” control by customer
  - “Clean, environmentally acceptable” on-site generation
- **Web-based near-real time load monitoring seen as very useful**
- **Multiple notification channels facilitate timely response**

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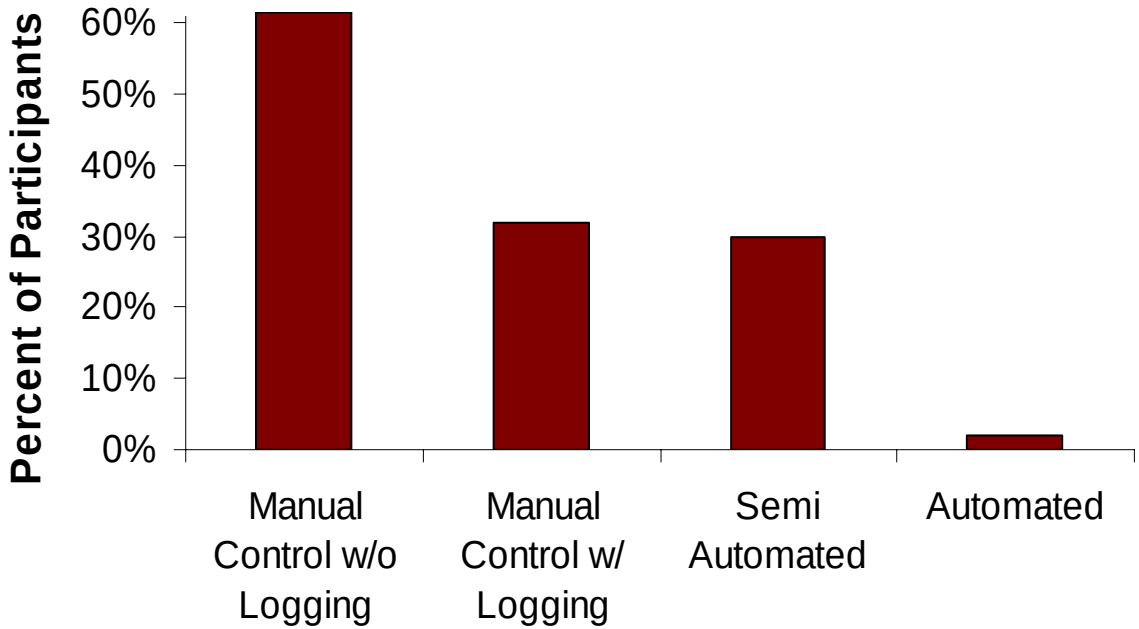
Few Customers Utilize Automated Load Curtailment Strategies



- **60% of customers relied on manual approaches during load curtailments**
- **Most manual control without logging, suggesting no integration into O&M procedures**
- **Semi-automated LR more prevalent at larger facilities (>1 MW)**
- **Customers want "Permission-based" load control**

Significance: Impacts on NYISO

- **Improved DR Program Design and Rules**
  - ICAP/SCR program called before EDRP and receive energy payment if called to curtail
  - Eliminated 10% penalty provision for DADRP
- **Expanded customer outreach/information program (with NYSERDA and NYPSC)**
  - Subscribed Load increased by 15% in 2003 in ICAP/SCR and EDRP (~1780 MW)
- **Improved confidence in Load As A Resource among NYISO System Operators**
  - 2003: DR Programs called to help restore grid after Northeast blackout (Aug. 15 and 16)
  - Over 850 MW of load curtailed on Aug. 15 (ICAP/SCR ~360 MW; EDRP ~497 MW)
  - Market impacts: ~$53M in reliability benefits vs. ~7.5M in payments

Significance: Impacts on NYSERDA

- **Targeting of public benefits funding**
  - More emphasis on customer training and education (e.g., bidding strategies, load curtailment plans)
  - Priority for DR projects serving certain geographic zones (NYC/LI) and smaller customer markets
- **Emphasize role of Load Aggregators: assess DR "business models"**
- **Program integration, marketing and strategy**
  - Integrate DR with EE program strategies in various market segments
  - Develop long-term DR strategy (getting beyond "crisis")

Significance: Implications for DOE Transmission Reliability Program

- **DR enabling technologies: Role and Design Criteria**
  - Role: Necessary but not sufficient condition to elicit sustained customer participation
  - Large Industrial: process controls already in place; EIS/notification technologies provide incremental value
  - Comm'l/institutional bldgs: DR needs to be automated, seamless, energy-manager friendly, with minimal impact on occupant comfort
- **Institutional, market and information barriers also need to be targeted and overcome**
  - Institutional/Organizational: most customers not yet comfortable bidding into "economic" DR program but will respond to system emergency defined by ISO
  - Market:
    - Load aggregators: DR products are non-standard
    - Customers: wary of investments with long paybacks, DR is not their "core business" and reluctant to undertake behavioral changes
  - Information: Many customers have *limited information* on load curtailment potential, optimal DR strategies, methods to value DR investments, and "spill over" benefits of DR enabling technologies

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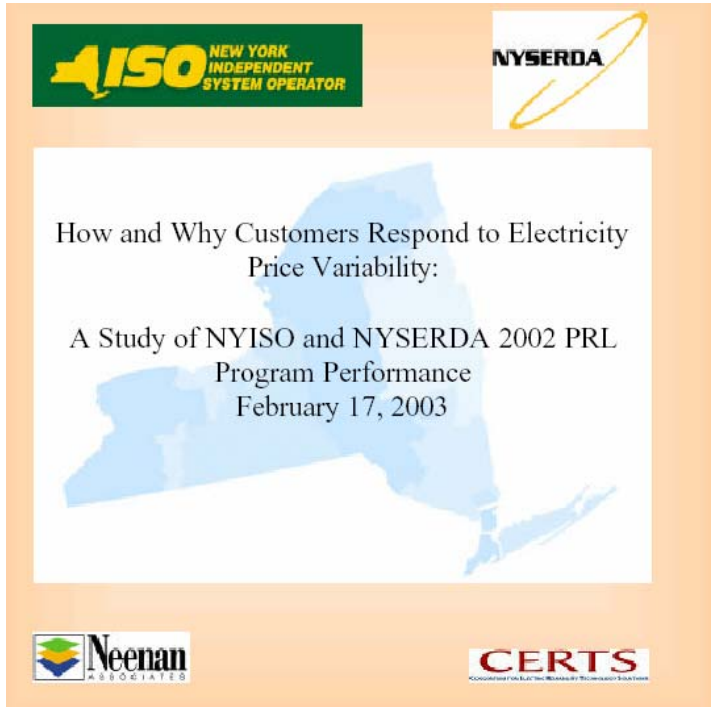
Deliverables

- **Publications**:
  - Neenan Associates and CERTS (2003), "How and Why Customers Respond to Electricity Price Variability: A Study of NYISO and NYSERDA 2002 PRL Program Performance," LBNL-52209.
  - Goldman, C. *et al*, (2002), "Do 'Enabling Technologies' Affect Customer Performance in Price-Responsive Load Programs?" LBNL-50328.



- **Technical Briefings**
  - Technical briefing to NYISO Price-Responsive Load Working Group (Nov. 2002).
  - Technical Briefings to NYISO and NYSERDA on DR program evaluation results (Nov. & Dec. 2002).

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