

# How and Why Customers Respond to Electricity Price Variability:

## *A Study of 2002 PRL Program Performance*

NYISO PRL WG

Albany NY

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Lawrence Berkeley National Laboratory

Battelle Pacific Northwest National Laboratory



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## Presentation Outline

- ✓ Performance details and comparisons
- ✓ A detailed look at who responds and why
- ✓ Moving forward



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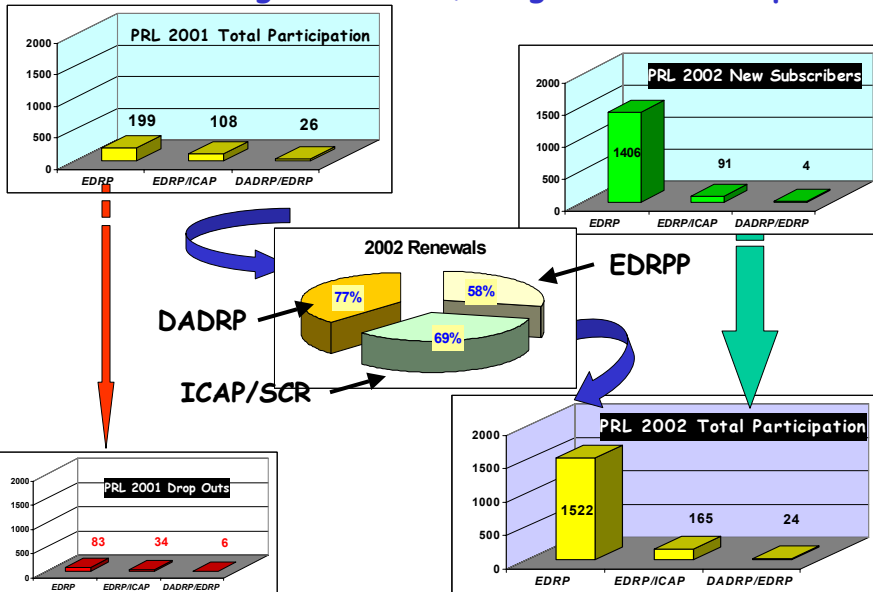


## Overall Program Performance

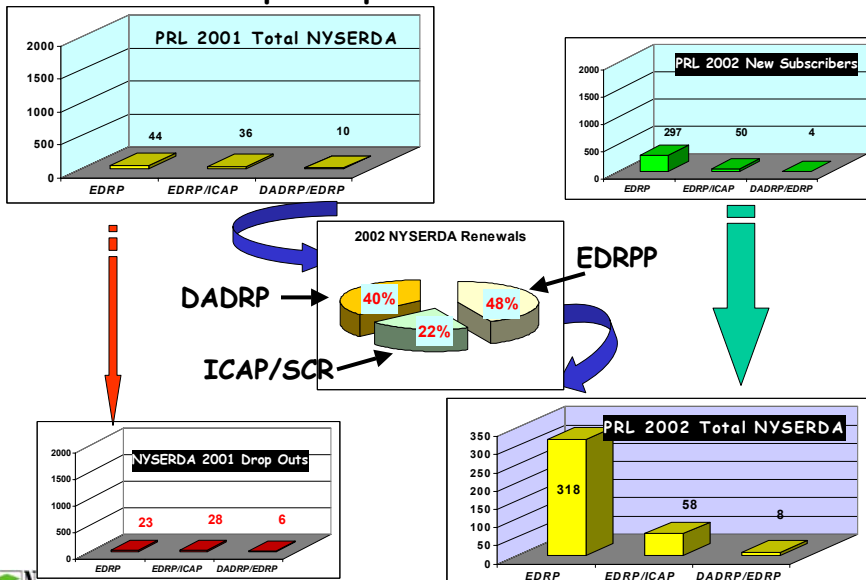
## New York: Summer 2002 Experience

	Participants/ MW	Events	Load Curtailed	Payments
<b>EDRP 2002</b>	1711 1481 MW	22 hr Downstate 10 hr Upstate	~668 MW 34% of CBL (summer)	\$3.3 mil
<b>2001</b>	<b>292/712</b>	<b>23/17</b>	<b>425/38%</b>	<b>\$4.2</b>
<hr/>				
<b>DADRP 2002</b>	<b>24</b>	1486 MWH scheduled	~14 MW (average)	\$0.1
<b>2001</b>	<b>16</b>	<b>2694</b>	<b>8</b>	<b>\$2</b>

## Overall - High Retention, Large New Subscriptions

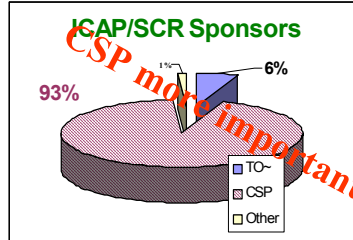
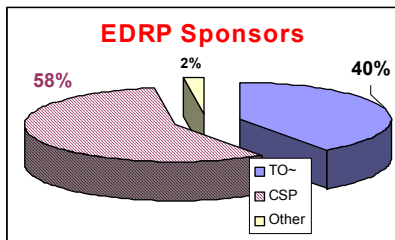


## NYSERDA - Lower retention, but strong new participant contribution

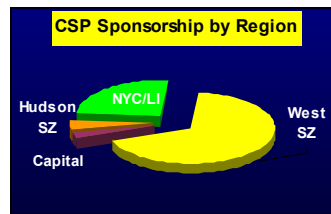
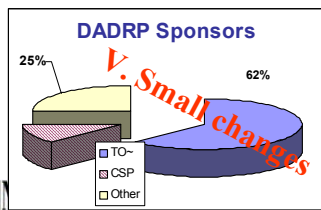


# The Role of CSPs in 2002

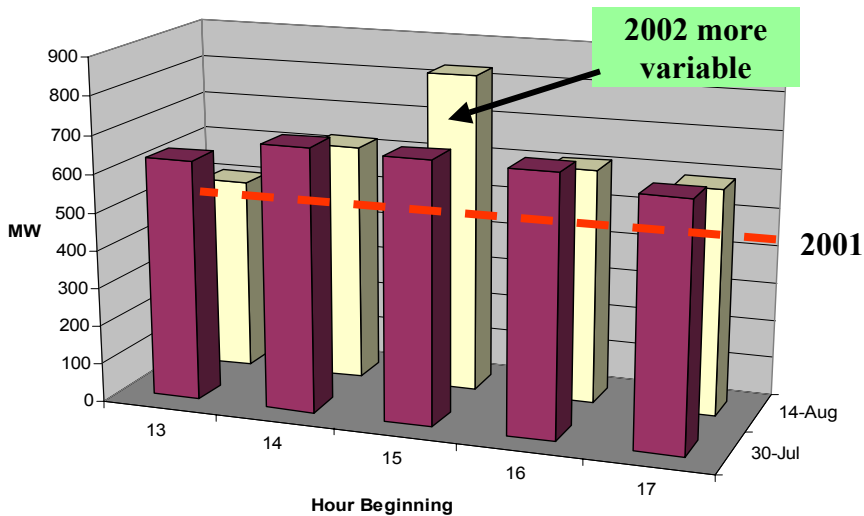
*Excluding LIPA*



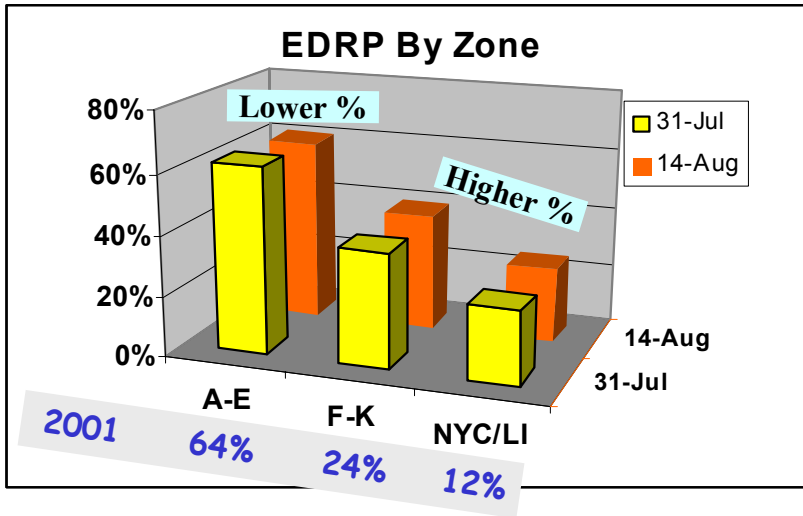
- EDRP: TO's increased MW subscribed by 112%, CSPs by 95%
- ICAP/SCR: CSP increased MW by 130%, TO load stayed the same



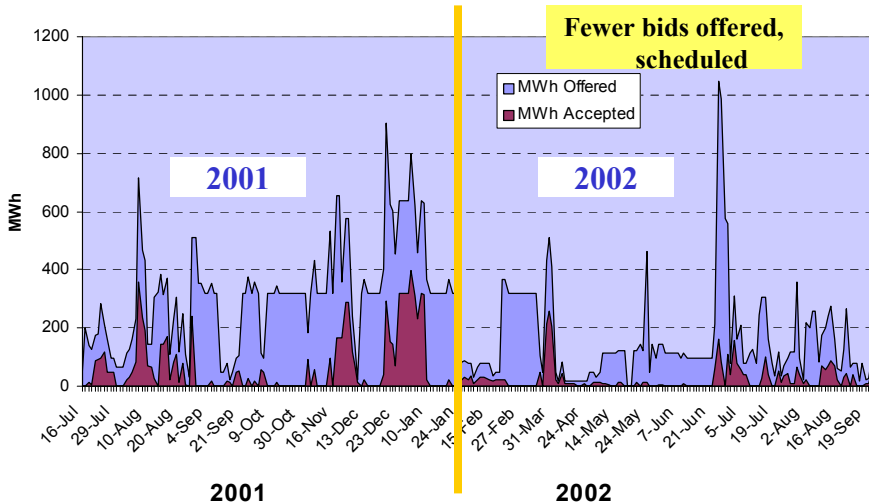
# EDRP Summer 2002 Performance



## EDRP More Load Curtailments still predominate in Western NY and Capital Region



## DADRP Bids and Scheduled Load



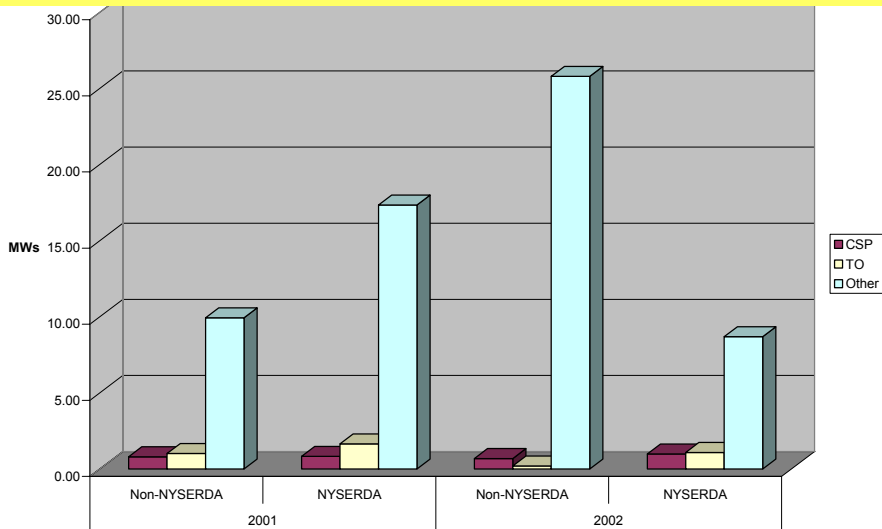
## Participant Program Performance Comparisons

### Summer 2002 Performance of NYSERDA-funded EDRP Participants vs. Non-NYSERDA Participants (cumulative)

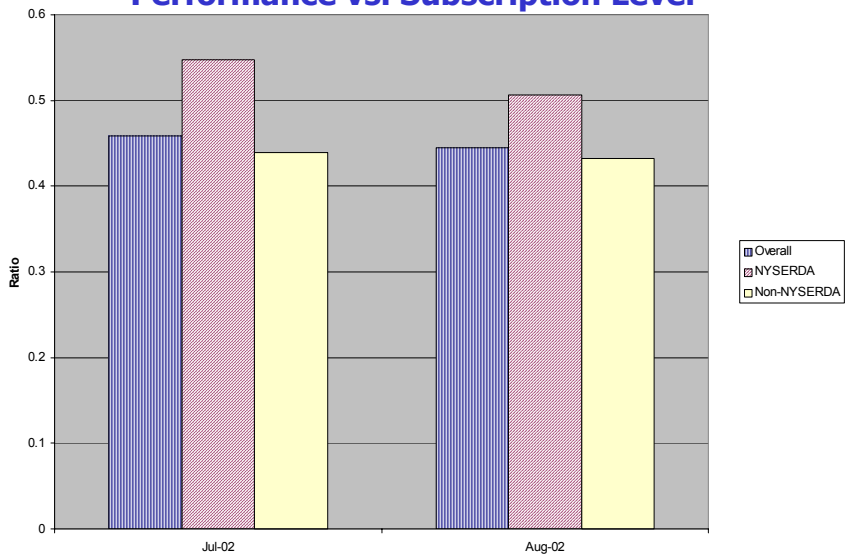
All EDRP Subscribers				
	Overall Total Number of EDRP Subscribers	Total Pledged Hourly MW Reduction	Total Average Hourly MWH Performance	Wgt. Performance Ratio
Non-NYSERDA	1,368	1,167.1	493.2	0.42
Peak-Load Only	146	102.5	51.9	0.51
Enabl. Tech Only	185	187.8	110.9	0.59
Both	10	19.7	12.8	0.65
<b>Totals</b>	<b>1,709</b>	<b>1,477.0</b>	<b>668.8</b>	

Subset of All EDRP Subscribers with positive EDRP Performance								
	Number of Customers	% of Total Analyzed	Total Pledged Hourly MW Reduction	% of Total Analyzed	Total Average Hourly MWH Performance	Wgt. Performance Ratio	Total Summer 2001 MW Performance	Total Summer 2002 Program NYISO Payments
Non-NYSERDA	1,138	83%	988.6	85%	493.2	0.50	4,855.0	\$2,427,479
Peak-Load Only	40	27%	73.4	72%	51.9	0.71	518.8	\$259,377
Enabl. Tech Only	130	70%	170.5	91%	110.9	0.65	1,109.3	\$554,673
Both	9	90%	19.5	99%	12.8	0.66	128.2	\$64,093
<b>Totals</b>	<b>1,317</b>	<b>77%</b>	<b>1,252.0</b>	<b>85%</b>	<b>668.8</b>		<b>6,611.2</b>	<b>\$3,305,622</b>

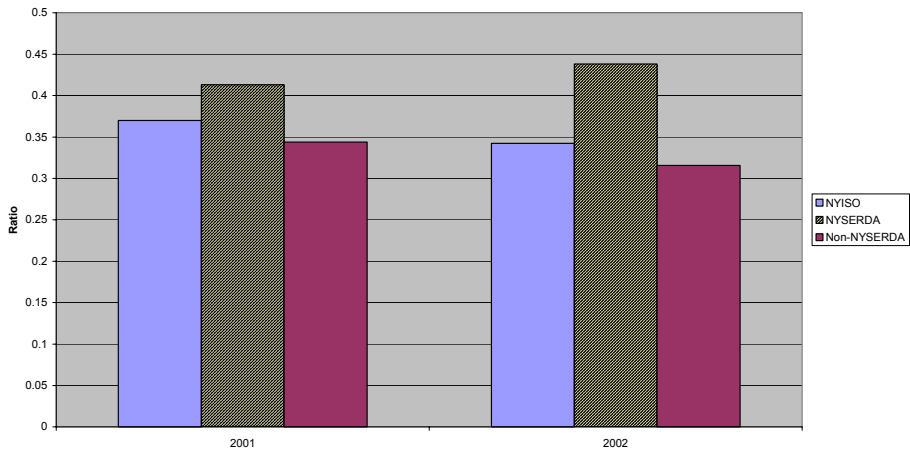
## Average Hourly EDRP Curtailments by CSP Type



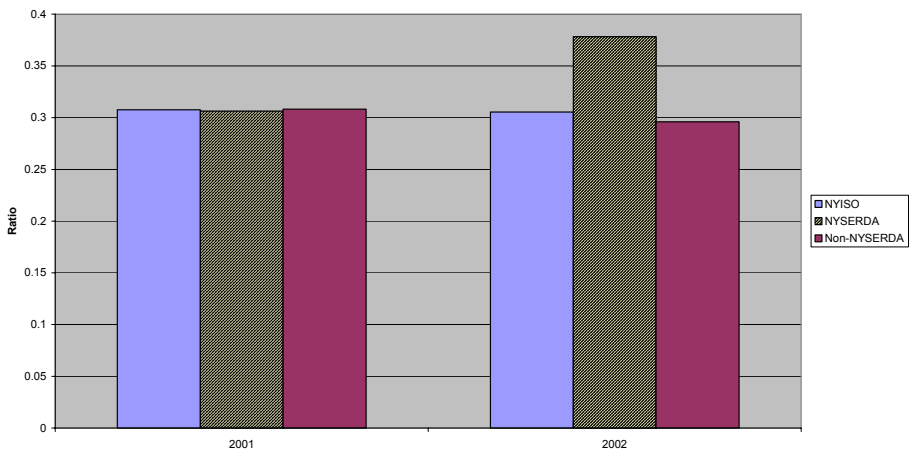
## EDRP Participant Actual Performance vs. Subscription Level



## Annual EDRP Curtailments Divided by CBL

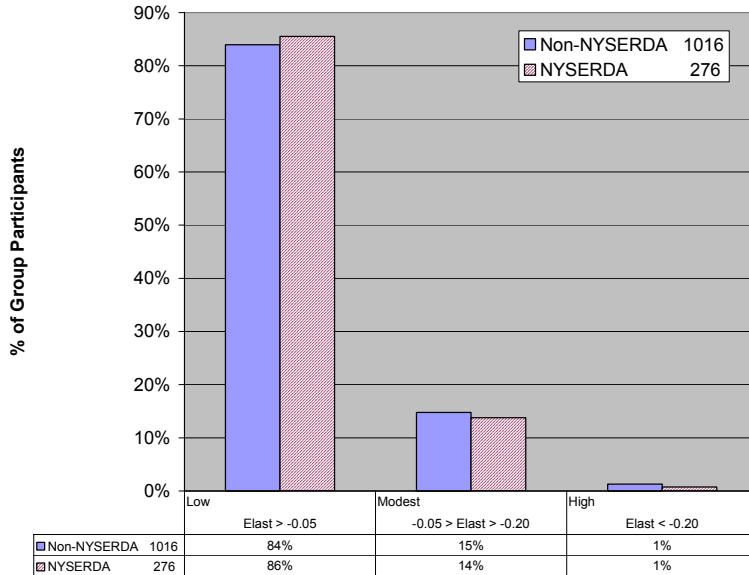


## Average Hourly EDRP Curtailment Divided by Hourly CBL

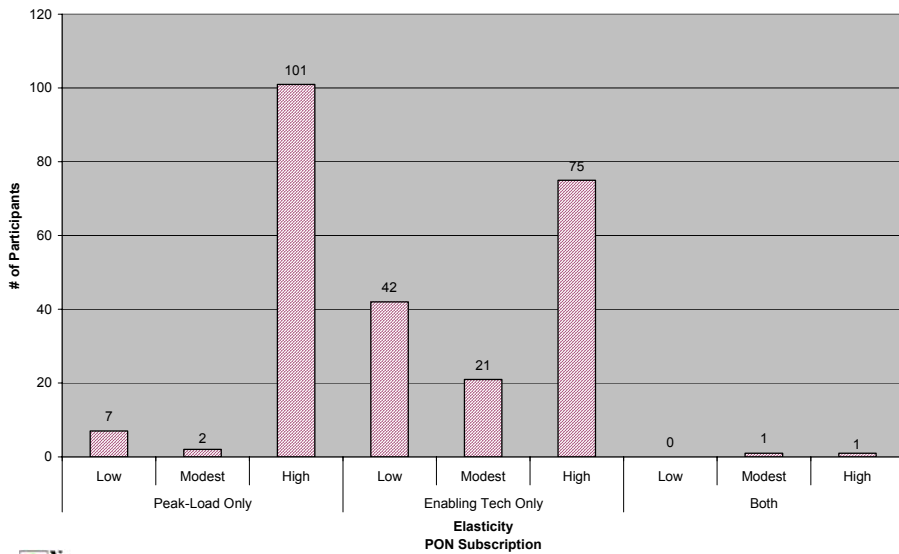




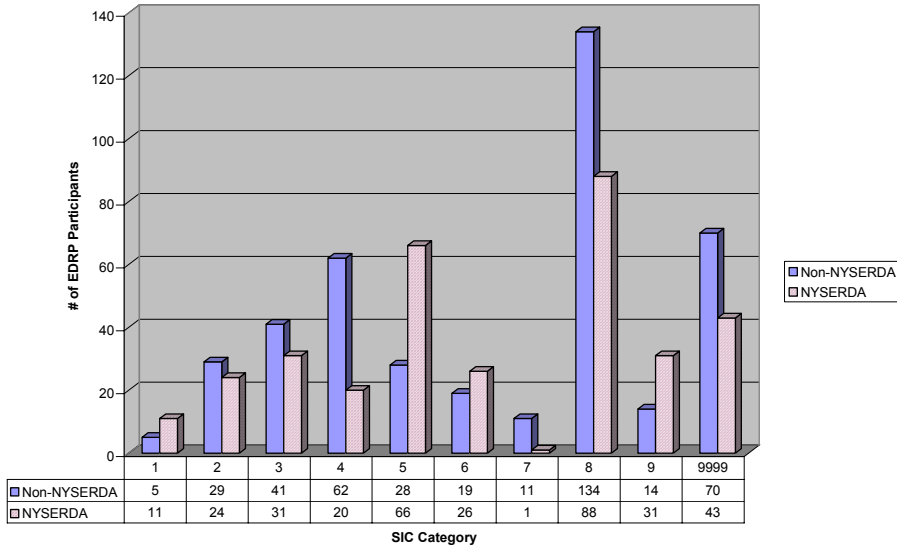
## EDRP Distribution of Response Elasticities



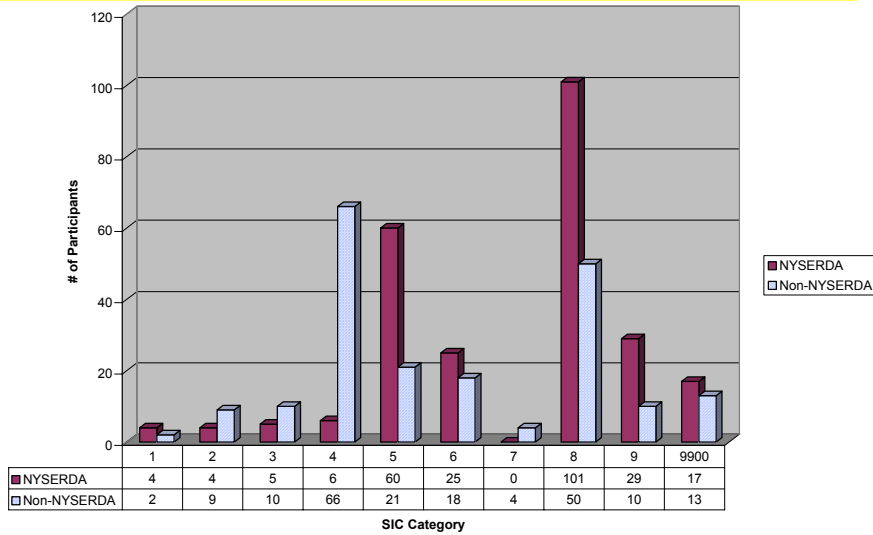
## Distribution of EDRP Elasticities by PON



## SIC Participation: NYSERDA vs. nonNYSERDA



## Multi-Site Participation by SIC, NYSERDA vs. Non-NYSERDA



## Key Drivers to Participation:

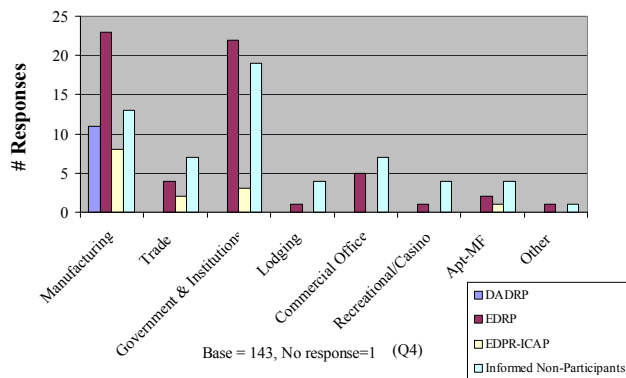
**Survey and PRL Audit Results**  
**Value of Enabling Technologies**  
**Barriers to DADRP: What's Wrong**

*Chuck Goldman*

## Summary: Customer Survey & PRL Audit

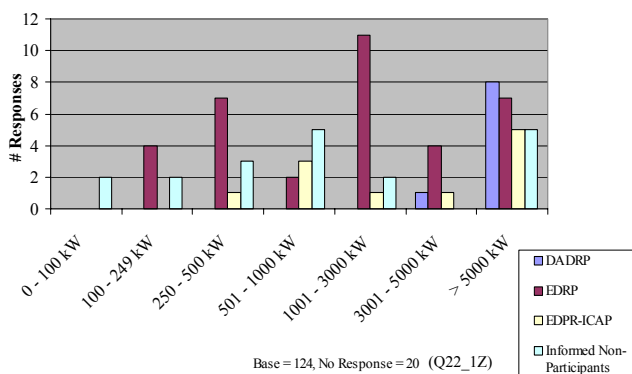
- **144 Respondents: 18% response rate**
- **Characterize “typical” customer group**
  - **NP** have lower median summer peak demand (750 kW) vs.. DADRP (14 MW) and EDRP (1.7 MW)
  - **DADRP** are manufacturing firms
  - **NP** are Govt/institution (32%), manufacturing (22%), trade and comm. Office (~12% each)
- **Impediments to Shifting Electricity**
  - ~90% of commercial and ~60% of institutional customers identified occupant comfort
  - ~75% of industrial customers identified production schedules

## Major Activity of Respondents



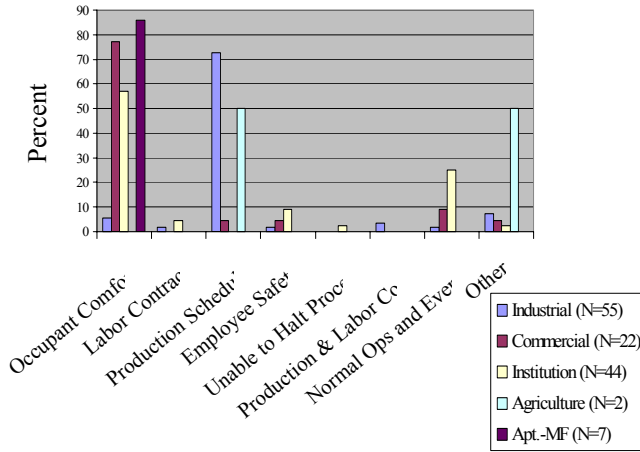
- **manufacturing (38%)**
- **govt./institutional/ many hospitals (33%)**
- **Non-participants are quite heterogeneous: govt./institutional (32%), manufacturing (22%), trade and commercial office (~12% each)**

## Summer Peak Demand



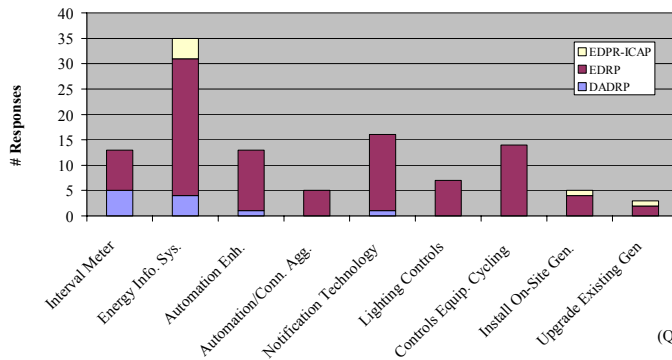
- **Median summer peak demand is significantly lower for non-participants (750 kW) vs. program participants**
  - DADRP (14.5MW)
  - EDRP only (1.7 MW)
  - EDRP/ICAP (5 MW)

## Impediments to Shifting Electricity Usage during noon-6 pm



- **Comfort largest impediment:**  
~80% commercial,  
~85% MF,  
~55% institutional
- **Production schedule:**  
largest impediment  
for ~75% of  
industrial customers
- **Other barriers:**  
Rate Design,  
Equipment Life,  
Other

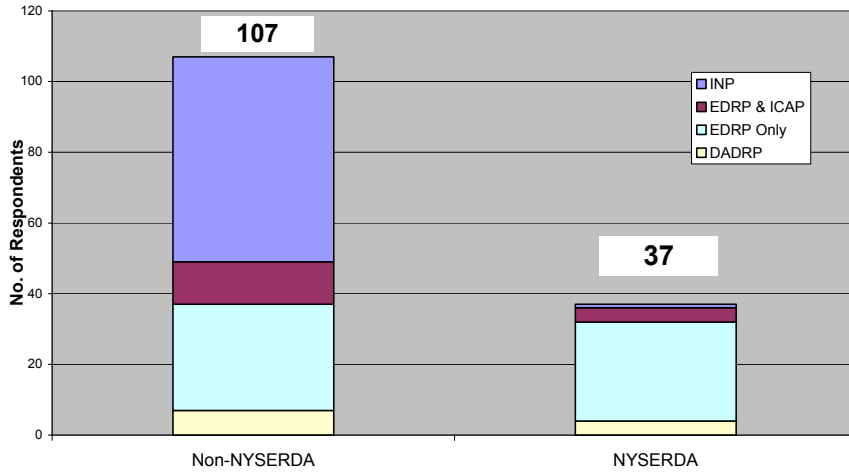
## Customer Survey: DR Enabling Technologies Installed



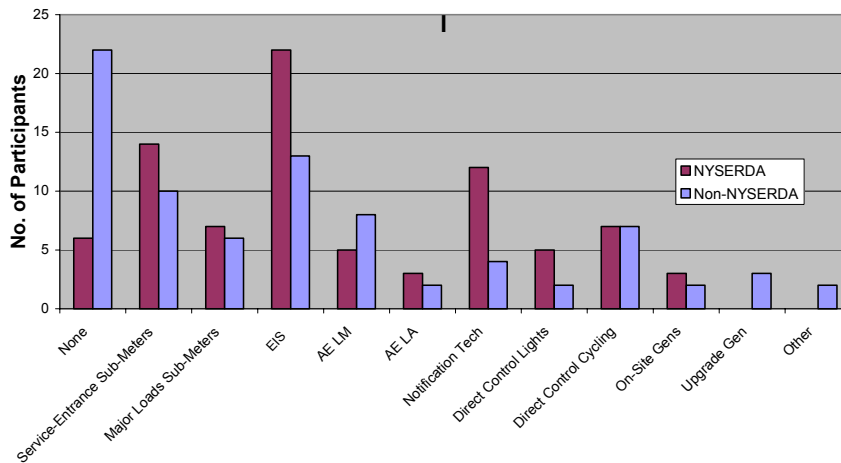
(Q32)

- **Most popular technologies:**
  - Energy information & management systems (63%)
  - Notification/communications technologies (29%)
  - Automation for load mgmt and aggregation (30%)
  - Direct Load Control for lighting (13%) or equipment cycling (25%)

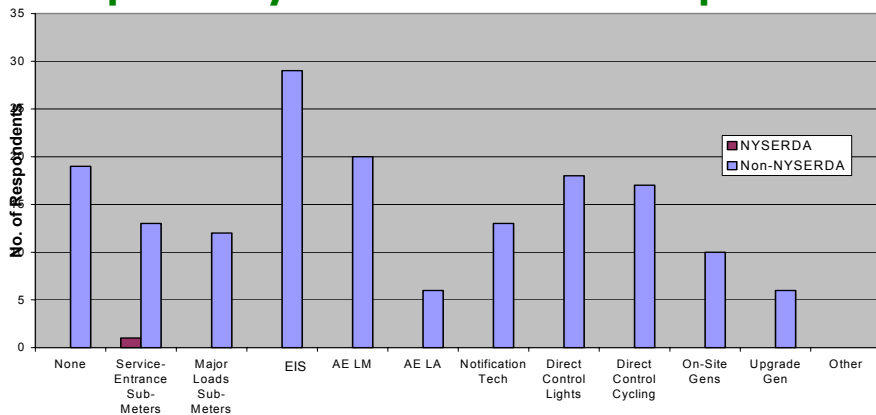
## Survey Respondents with NYSERDA PON Funding



## Impact PONs on Installation of Enabling Technologies among NYISO Program Participants



## Installation of DR Enabling Technologies reported by Informed Non-Participants



- INPs report installing DR technologies at comparable rates to Program Participants -- WHY?

~~• ~9% of installed DR technologies supported by NYISERDA funding~~

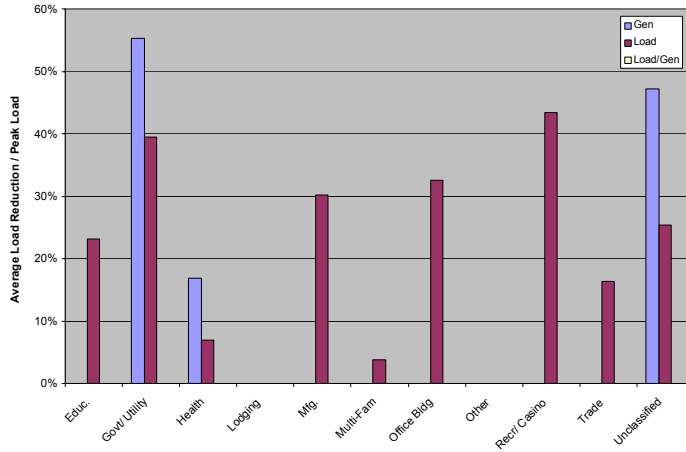
## Value of Enabling Technologies

*Chuck Goldman (LBNL/CERTS)*

*Michael Kintner-Meyer (PNNL)*

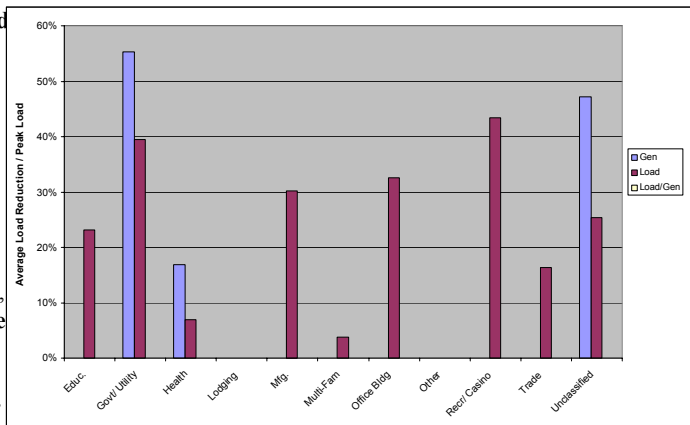
## DR Peak Performance Index (PPI) by Market Segment

- PPI = Actual Load Reduction/CBL
- Average values are 50-55% for On-site Generation
- Average values for Load Reduction only ranges from 5% (MF, Health) to 20-30% (Educ., Govt, Mfg)
- Under-served Markets = Comm. Office, MF, Lodging



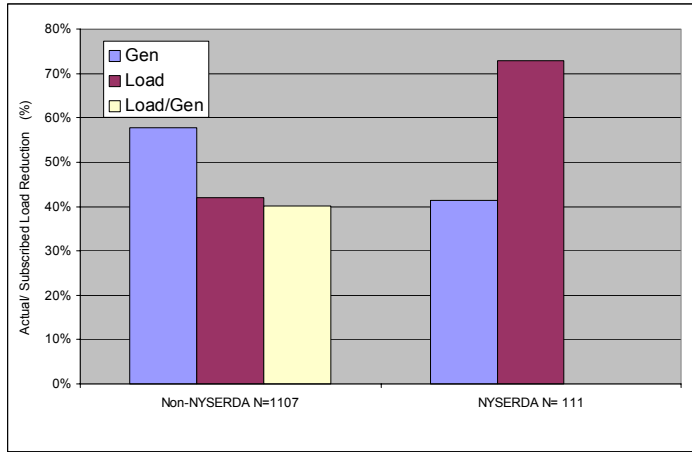
## Subscribed Performance Index (SPI): a customer reliability index?

- SPI (actual/subscribed load reduction)
- For on-site generation, avg. SPI ranges between 50-60% for health care, LIPA/NYPA and 80% for govt
- For load reduction, avg. SPI are more variable across markets (20-120%): ~60% for mfg. and ~95% for govt.





## Subscribed Performance Index (SPI) for NYSERDA vs. non-NYSERDA customers



- NYSERDA-funded customers out-performed non-NYSERDA customers during EDRP events, particularly those using load reduction only strategies

## EDRP/ICAP customers have superior performance compared to EDRP only

	N	Mean	Median
EDRP only	1105	42%	25%
EDRP/ICAP	113	96%	51%

- On average, EDRP/ICAP customers performed well when called (96%)
- EDRP customers delivered 42% of subscribed load reduction when called

SPI = Average Load  
Reduction/Subscribed Load  
Reduction



## Barriers to DADRP: What's Wrong

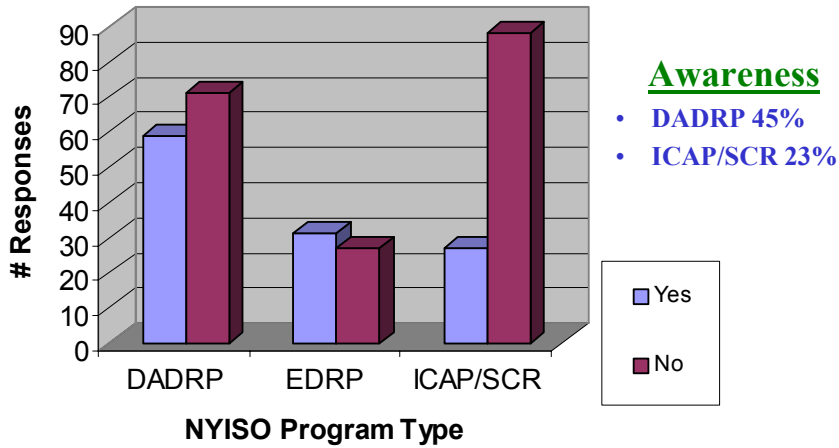
*Chuck Goldman (LBNL/CERTS)*

## Barriers to DADRP Participation

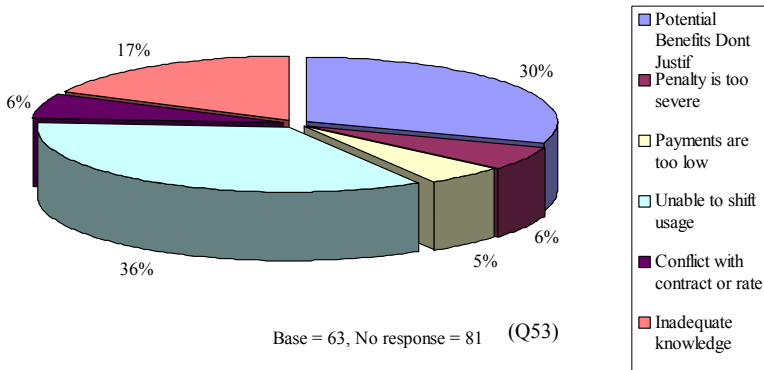
- **Organizational/institutional**
  - Low Program Awareness Levels (\*)
  - Information/knowledge barriers (\*)
  - Ancillary benefits of technologies not recognized (\*)
  - Concerns about occupant comfort
- **Economic/program-design related**
  - Potential benefits don't justify risks (\*)
  - High bid price thresholds short payback periods for DR investments (\*)
  - Perceived program design problems
- **Technology-related**
  - Limited assessments of DR enabling technologies

# Low Awareness Levels Limit Participation

NYISO Program Awareness  
(Summary by Program)



# Primary Reason for Not Participating in DADRP



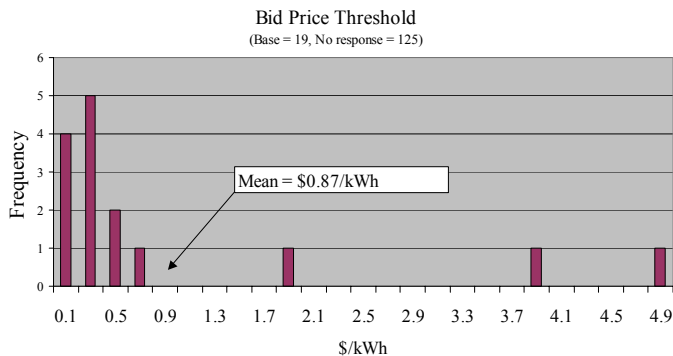
- Potential benefits don't justify risks (30%), inability to shift usage (36%) and inadequate knowledge of program requirements (17%) given as primary reason for not participating in DADRP

## Lack of bid price strategy is a key barrier to DADRP

	Creating Curtailment Plan		Monitoring Energy Prices		Determining Bid Prices	
	DADRP	Other	DADRP	Other	DADRP	Other
Not Comfortable	1	6	1	12	1	17
Comfortable	9	14	9	7	9	3
<b>Total</b>	<b>10</b>	<b>20</b>	<b>10</b>	<b>19</b>	<b>10</b>	<b>20</b>

- Confidence level of DADRP vs. EDRP participants
  - 85% not comfortable determining bid prices
  - 63% not comfortable monitoring energy prices
- Need education/training on market price formation so customers can develop and execute bidding strategy

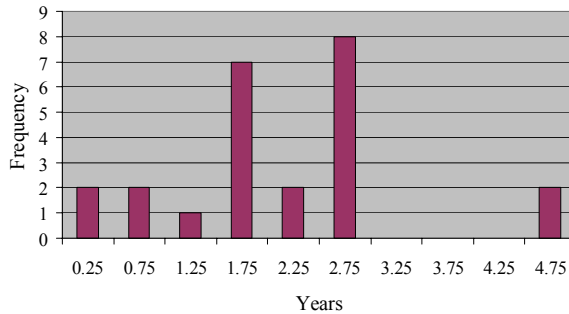
## Bid price thresholds are high for many customers



- Customers asked about their bid price minimum threshold
- Bid prices ranged from \$0.05 - 5.00/kWh with median value of ~\$0.50/kWh

## Customers require short paybacks on DR investments

Simple Payback Time  
(Base = 24, No response = 120)



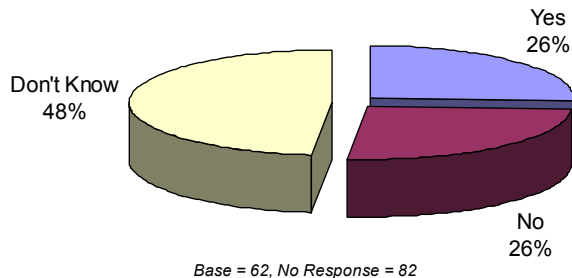
- ~80% of respondents were only interested in < 3 year payback for DR technologies

## Customers don't recognize ancillary benefits of DR enabling technologies

- Asked to value benefits on 1(low) to 5 scale (high)
- Energy information tools ranked highest (3.5); Customers give mid-range values to benefits of other technologies

Technology	Benefit	Mean
1. Interval meters with two-way communication	Better manage peak energy and demand charges with day-after access to facility interval data	2.78
2. Load Control	Shed load and/or initiate on-site generation, in order to reduce demand charges	2.87
3. Upgrade switchgear for on-site generation	Increase load mgmt. flexibility to modify load profile for more desirable energy procurement	2.61
4. Upgrade on-site generation for dual-fuel capability	Fuel flexibility to mitigate fuel price volatility	2.23
5. Enhanced energy management or control system	Ability to schedule and/or automate load mgmt., and reduce labor for facility operations, increase reliability to integration with maintenance procedures	2.97
6. Energy information tools	View individual and multiple facility interval electricity data, increase understanding of loads for lower cost energy procurement	3.47

## More Flexible Approach to Submitting Bids May Help Mitigate Program Design Barriers

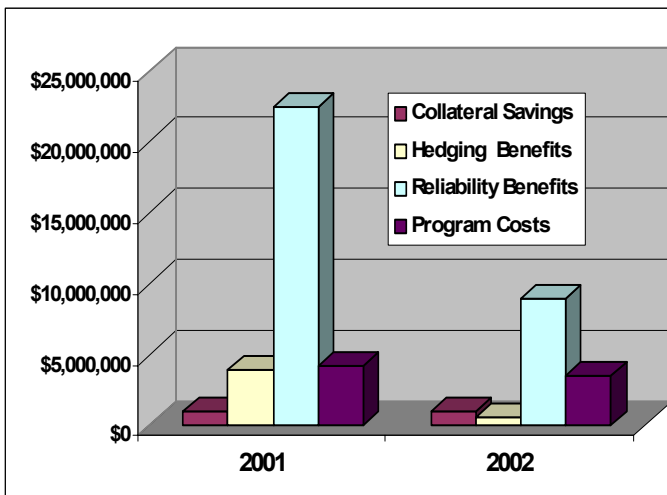


- Respondents asked whether they preferred to submit bids daily, weekly, or monthly; and whether they would participate if preferred method adopted
- 16 of 62 respondents said YES (26%); 50% unsure

## Summary: DADRP Evaluation Results

- **Barriers** are primarily organizational, institutional, information/knowledge, & customer economics
  - customers are skeptical: wary of investments with long paybacks and reluctant to undertake behavioral changes
  - most customers not yet comfortable bidding into “economic” program (but will respond to system emergency defined by ISO)
  - customers not yet convinced of “spill over” benefits of DR enabling technologies
- **Role of DR enabling technologies:** necessary but not sufficient condition to elicit sustained customer participation
- **Lack of stable DR market structure/program** rules limits interest by DR market makers and customers

## EDRP Benefits



### Why Lower?

- Events in 2002 not as severe
- Discount for excess curtailments

## Changing Market Landscape for PRL



*Bernie Neenan*

## Criticisms of NYISO PRL Programs

- Can't sell what you don't own  
• DR should not be considered a resource → ISO should not pay customers to curtail
- Net welfare benefits are very small  
• Rent transfers are transient – generators will get their money in the long run → Any subsidies are unwarranted and ineffective
- Avoiding the high cost is enough to get customers to participate → Only naturally occurring DR is desirable

## Changing Market Character

- FERC is leaving DR details to to states and localities → We'll remain pioneers in DR design and implementation
- EDRP now the last resource dispatched → EDRP benefits lower, ICAP higher
- Renovations to ICAP under consideration → Bidding adds new complexity, risk
- ISO emphasis on final-gavel pricing → PRL must be full integrated into ISO Scheduling and dispatch