New York ISO 2002
Demand Response Programs:
Evaluation Results

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DOE Office of Electric Transmission and Distribution
Transmission Reliability Peer Review
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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

**Sponsors**
- NYISO
- NYSERDA
- U.S. DOE

**Project Team**
- Neenan Associates
- CERTS:
  - LBNL
  - PNNL

**Stakeholders**
- NYISO PRL Working group
- Utilities
- NYPSC
- Customers
- CSPs
-ESCOs
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?
NYISO Electricity Markets

- Generation Assurance - ICAP
- **Energy** - in two sequential markets:
  - Day-Ahead Market (DAM)
  - Real-Time (RTM)

- **Direct-bid Ancillary Services**
  - Operating Reserve
  - Regulation
  - Emergency

- **Cost Based Ancillary Services**

- **Congestion Protection** - the “TCC”

Customer-Supplied Resource Programs

ICAP/SCR

DADRPM

EDRP

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## NYISO PRL Program Features

<table>
<thead>
<tr>
<th>Market Function</th>
<th>Eligible</th>
<th>Event Notice</th>
<th>Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity</td>
<td>&gt; 100 kW</td>
<td>Day-ahead advisory, 2 hour notice</td>
<td>$/kW Market value of ICAP</td>
</tr>
<tr>
<td>Emergency Capacity</td>
<td>&gt; 100 kW</td>
<td>2 hour notice</td>
<td>Greater of $.50/kWh or RTM LBMP</td>
</tr>
<tr>
<td>Economic Energy</td>
<td>1 MW increments</td>
<td>Bid by 5am, day-ahead, notice by noon</td>
<td>Greater of Bid $/kWh or DAM LBMP</td>
</tr>
</tbody>
</table>

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## DR Program: Market Impacts

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

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EDRP Summer 2002 Performance

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

![Bar chart showing MW usage from 13 to 17 hours]

- 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
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?
Performance (SPI) by Business Type and Curtailment Strategy

<table>
<thead>
<tr>
<th>Category</th>
<th>SPI</th>
<th>Gen</th>
<th>Load</th>
<th>Load/Gen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educ.</td>
<td></td>
<td></td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Gov/Utility</td>
<td></td>
<td>75%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td></td>
<td>60%</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>Mfg.</td>
<td></td>
<td>60%</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>Multi-Fam</td>
<td></td>
<td>50%</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Office Bldg.</td>
<td></td>
<td>90%</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Recr/Casino</td>
<td></td>
<td>100%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Trade</td>
<td></td>
<td>75%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Unclassified</td>
<td></td>
<td>60%</td>
<td>40%</td>
<td></td>
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</table>

Subscribed MW
Active Participants

<table>
<thead>
<tr>
<th>Category</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educ.</td>
<td>9</td>
</tr>
<tr>
<td>Gov/Utility</td>
<td>90</td>
</tr>
<tr>
<td>Health</td>
<td>13</td>
</tr>
<tr>
<td>Mfg.</td>
<td>502</td>
</tr>
<tr>
<td>Multi-Fam</td>
<td>3</td>
</tr>
<tr>
<td>Office Bldg.</td>
<td>5</td>
</tr>
<tr>
<td>Recr/Casino</td>
<td>2</td>
</tr>
<tr>
<td>Trade</td>
<td>13</td>
</tr>
<tr>
<td>Unclassified</td>
<td>246</td>
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</table>

Subscribed MW
All Participants

<table>
<thead>
<tr>
<th>Category</th>
<th>MW</th>
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</thead>
<tbody>
<tr>
<td>Educ.</td>
<td>30</td>
</tr>
<tr>
<td>Gov/Utility</td>
<td>123</td>
</tr>
<tr>
<td>Health</td>
<td>28</td>
</tr>
<tr>
<td>Mfg.</td>
<td>558</td>
</tr>
<tr>
<td>Multi-Fam</td>
<td>9</td>
</tr>
<tr>
<td>Office Bldg.</td>
<td>8</td>
</tr>
<tr>
<td>Recr/Casino</td>
<td>5</td>
</tr>
<tr>
<td>Trade</td>
<td>26</td>
</tr>
<tr>
<td>Unclassified</td>
<td>551</td>
</tr>
</tbody>
</table>
Curtailment Potential (PPI) by Business Type and Curtailment Strategy

- Avg. load curtailment = 34% of CBL

<table>
<thead>
<tr>
<th>Business Type</th>
<th>PPI</th>
<th>Subscribed MW</th>
<th>Active Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educ.</td>
<td>10%</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Gov/Utility</td>
<td>60%</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Health</td>
<td>20%</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Mfg.</td>
<td>30%</td>
<td>502</td>
<td>502</td>
</tr>
<tr>
<td>Multi-Fam</td>
<td>0%</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Office Bldg.</td>
<td>5%</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Recr/Casino</td>
<td>30%</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Trade</td>
<td>20%</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Unclassified</td>
<td>10%</td>
<td>246</td>
<td>246</td>
</tr>
</tbody>
</table>

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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
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

<table>
<thead>
<tr>
<th>Customer Segment</th>
<th>Base Survey</th>
<th>PRL Audit (sub-set)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDRP only</td>
<td>58</td>
<td>19</td>
</tr>
<tr>
<td>EDRP/ICAP</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>DADRP</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Informed Non-Part.</td>
<td>59</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>35</td>
</tr>
</tbody>
</table>
Primary Stated Reason for Not Participating in DADRP

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

Base = 63, No response = 81
Enabling Technologies for Demand Response

- 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
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 DADR

- **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”)

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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
Deliverables

- **Publications:**

- **Technical Briefings**
  - Technical Briefings to NYISO and NYSERDA on DR program evaluation results (Nov. & Dec. 2002).