Enhancing Price Response Programs Through Auto-DR: California’s 2007 Implementation Experience

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Auto-DR Implementation Team

- California IOUs
  - PG&E
  - SCE
  - SDG&E
- Global Energy Partners, LLC
- Lawrence Berkeley National Laboratory’s Demand Response Research Center
- Akuacom
- Electric Power Research Institute
- Technical Coordinator Vendors:
  - ACCO Engineered Systems
  - C&C Building Automation
  - Energy and Power Solutions
  - RTP Controls
- California Energy Commission
Presentation Overview

- Auto-DR Overview
- 2007 Results Statewide
- PG&E’s Auto-DR Program
- Next Steps for Auto-DR
A New Approach to DR – Automated Demand Response

- Automated Demand Response (Auto-DR) is a communication and technology platform designed to:
  - Provide customers with automated, electronic price and reliability signals
  - Provide customers with the capability to identify and automate site specific demand response strategies
  - Transition demand response toward being on the same operational foundation as conventional generation resources
- Auto-DR can support all DR and pricing options
- Auto-DR is not a program but rather a platform for enabling existing and proven technologies
Auto-DR Regulatory Objectives – As Established by the CPUC

- Objective #1: Accelerate Implementation
- Objective #2: Expand Auto-DR to a Variety of DR Program Offerings
- Objective #3: Expand the Role of Auto-DR Technical Providers
- Objective #4: Improve DR Peak Reduction Performance
Current Auto-DR Program Efforts in California

- **Pacific Gas & Electric**
  - Nearly 23 MW of developed capability
  - $5.5 million expended in program development and rebates
  - Auto-DR platform established for Critical Peak Pricing and Demand Bid programs

- **Southern California Edison**
  - Over 2 MW of capability under development
  - Pilot program targeting 10-20 customers
  - Focus is on industrial process loads
  - Auto-DR platform established for Critical Peak Pricing program

- **San Diego Gas & Electric**
  - Over 2 MW of developed capability
  - Pilot program targeting DR aggregator programs
## Statewide Results of Auto-DR Implementation (updated results)

<table>
<thead>
<tr>
<th>CPUC ACR Objectives</th>
<th>2006</th>
<th>2007 Installed</th>
<th>2007 In-Process</th>
<th>2007 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Accelerate Implementation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Commercial participants</td>
<td>13</td>
<td>141</td>
<td>0</td>
<td>154</td>
</tr>
<tr>
<td>• Industrial participants</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>• Peak Load Reduction</td>
<td>1 MW</td>
<td>25 MW</td>
<td>2 MW</td>
<td>28 MW</td>
</tr>
<tr>
<td><strong>2. Expand Auto-DR beyond CPP to other DR options</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• CPP only</td>
<td></td>
<td>CPP, DBP, CBP</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3. Expand the role of Technical Providers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• none</td>
<td></td>
<td>8 industry participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4. Improve DR performance (Peak Reduction)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Commercial</td>
<td>13%</td>
<td>20%</td>
<td>NA</td>
<td>20%</td>
</tr>
<tr>
<td>• Industrial</td>
<td>--</td>
<td>52%</td>
<td>54%</td>
<td>52%</td>
</tr>
<tr>
<td>• Aggregate All Participants</td>
<td>--</td>
<td>33%</td>
<td>54%</td>
<td>33%</td>
</tr>
</tbody>
</table>
PG&E’s 2007 Auto-DR Program

- Program Goals:
  - Achieve peak demand reduction of 15 MW (increased to 20 MW late in the season)
  - Improve PG&E’s demand response program effectiveness through automation
  - Commercialize Auto-DR program delivery

- 2007 Auto-DR program open to customers on Critical Peak Pricing (CPP) and/or Demand Bidding (DBP) programs

- Nearly 23 MW recruited, tested and ready for program deployment

- All 12 CPP events were held this summer (between 6/13 and 8/31)

- One DBP test event (4 hours) held on 8/30
Auto-DR 2007 Participant Success Story

2007 Automated Demand Response Program

Participant Success Story

Produced by: Tech Closeup TV
www.techcloseup.com
(408) 807-5119

◆ Customer load shed communications and achievement
◆ Customer satisfaction
◆ Comments from Demand Response champions
Auto-DR System Architecture – End-to-End Automation
### PG&E 2007 Auto-DR Program -- Data Summary

- A total of 82 PG&E service accounts
- Baseline peak demand representing over 72 MW
- Estimated reduction amounts nearly 23 MW
- Average reduction of 32% (mainly driven by large industrial participants)
- Average facility reduction of 18% (for non-industrial participants)

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Number of Service Accounts</th>
<th>Estimated Load Reduction (kW)</th>
<th>kW Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biotechnology</td>
<td>3</td>
<td>172</td>
<td>0.8%</td>
</tr>
<tr>
<td>Data Center</td>
<td>2</td>
<td>842</td>
<td>3.7%</td>
</tr>
<tr>
<td>Healthcare</td>
<td>2</td>
<td>276</td>
<td>1.2%</td>
</tr>
<tr>
<td>High Tech</td>
<td>20</td>
<td>1,670</td>
<td>7.3%</td>
</tr>
<tr>
<td>Industrial Process</td>
<td>4</td>
<td>15,275</td>
<td>66.9%</td>
</tr>
<tr>
<td>Government (state, local)</td>
<td>16</td>
<td>934</td>
<td>4.1%</td>
</tr>
<tr>
<td>Museum</td>
<td>1</td>
<td>24</td>
<td>0.1%</td>
</tr>
<tr>
<td>Retail</td>
<td>32</td>
<td>3,608</td>
<td>15.8%</td>
</tr>
<tr>
<td>School District</td>
<td>2</td>
<td>34</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>82</strong></td>
<td><strong>22,835</strong></td>
<td></td>
</tr>
</tbody>
</table>
PG&E Auto-DR Participant Makeup

Program Participants by Industry Type

- Biotechnology: 39.0%
- Data Center: 24.4%
- Healthcare: 4.9%
- High Tech: 2.4%
- Industrial Process: 2.4%
- Government (state, local): 19.5%
- Museum: 1.2%
- Retail: 4.9%
- School District: 1.2%
PG&E Auto-DR Participant Makeup (cont.)

Estimated kW Demand Reductions by Industry Type

- Biotechnology: 0.1%
- Data Center: 0.8%
- Healthcare: 3.7%
- High Tech: 1.2%
- Industrial Process: 7.3%
- Government (state, local): 15.8%
- Museum: 4.1%
- Retail: 0.1%
- School District: 66.9%
PG&E Auto-DR Participant Makeup (cont.)

Estimated kW Demand Reductions by DR Program Type

- Critical Peak Pricing (CPP): 11.2%
- Demand Bidding (DBP): 88.3%
- CPP/DBP Combined: 0.5%

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Estimated kW Demand Reductions by Type of DR Measure

- HVAC Adjustments: 14.7%
- HVAC Adjustments and Lighting Reductions: 18.4%
- Process System Adjustments: 66.9%
### PG&E 2007 Results – CPP Events

17 facilities participated in all 12 events this year

1.1 MW of actual average shed for the 12 CPP held events this summer

Reduction represented 67% of the original estimates

<table>
<thead>
<tr>
<th>Date of CPP Event</th>
<th>Number of Participating Sites</th>
<th>Estimated Load Shed (kW)</th>
<th>Actual Load Shed (kW)</th>
<th>Actual as Percent of CPP Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>12pm-3pm</td>
<td>3pm-6pm</td>
</tr>
<tr>
<td>6/13/07</td>
<td>17</td>
<td>1,568</td>
<td>-361.08</td>
<td>154.08</td>
</tr>
<tr>
<td>7/3/07</td>
<td>17</td>
<td>1,568</td>
<td>1,232.92</td>
<td>1,413.12</td>
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<tr>
<td>7/5/07</td>
<td>17</td>
<td>1,568</td>
<td>545.00</td>
<td>680.66</td>
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<tr>
<td>7/6/07</td>
<td>17</td>
<td>1,568</td>
<td>1,150.81</td>
<td>1,552.00</td>
</tr>
<tr>
<td>7/9/07</td>
<td>17</td>
<td>1,568</td>
<td>1,770.77</td>
<td>1,879.22</td>
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<tr>
<td>8/1/07</td>
<td>17</td>
<td>1,568</td>
<td>1,849.30</td>
<td>2,117.08</td>
</tr>
<tr>
<td>8/21/07</td>
<td>17</td>
<td>1,568</td>
<td>485.99</td>
<td>881.49</td>
</tr>
<tr>
<td>8/22/07</td>
<td>17</td>
<td>1,568</td>
<td>361.84</td>
<td>755.94</td>
</tr>
<tr>
<td>8/28/07</td>
<td>17</td>
<td>1,568</td>
<td>844.72</td>
<td>1,157.01</td>
</tr>
<tr>
<td>8/29/07</td>
<td>17</td>
<td>1,568</td>
<td>189.39</td>
<td>497.18</td>
</tr>
<tr>
<td>8/30/07</td>
<td>17</td>
<td>1,568</td>
<td>137.21</td>
<td>564.35</td>
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<tr>
<td>8/31/07</td>
<td>17</td>
<td>1,568</td>
<td>471.90</td>
<td>1,017.88</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>17</strong></td>
<td><strong>1,568</strong></td>
<td><strong>723.23</strong></td>
<td><strong>1,055.83</strong></td>
</tr>
</tbody>
</table>
### PG&E 2007 Results – DBP Events

- 11 facilities participated in 8/30 test event
- 10.85 MW of bids received by 3:30PM day-before for the event
- 10.67 MW provided load reductions for at least 2 hours (drawing upon the CPUC-approved 3/10 baseline method)
- The achieved reduction represented 98% of the bid amounts

<table>
<thead>
<tr>
<th>Date of DBP Event</th>
<th>Number of Participating Sites</th>
<th>Estimated Load Shed (kW)</th>
<th>Actual Load Shed (kW)</th>
<th>Actual as Percent of DBP Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/30/07</td>
<td>11</td>
<td>10,850</td>
<td>10,674.57</td>
<td>10,416.02</td>
</tr>
<tr>
<td>Average</td>
<td>11</td>
<td>10,850</td>
<td>10,674.57</td>
<td>10,416.02</td>
</tr>
</tbody>
</table>
PG&E Load Shape Impacts for July 3rd CPP Event

7/3/2007

Whole Building Power (kW)

OAT Baseline
CPP Baseline
CPP MA Baseline
PG&E Load Shape Impacts for August 30th CPP and DBP Events

- Reductions represented nearly 12 MW!
Auto-DR Effectiveness

Average CCP
Peak Load Reduction
- 8% w/ Auto-DR
- -1% w/o Auto-DR

- Auto CPP
- Non-Auto CPP

Retail-Inland
Retail-Valley
Retail-Coast
Office-Inland
Biotech-Coast
Public-Inland
Indus-Inland
School-Inland

Percent Shed

8% w/ Auto-DR
-1% w/o Auto-DR
Next Steps for Auto-DR

- **PG&E**
  - Technical assistance for current program participants to ensure continued functionality of automation systems
  - Continue offering TI Incentives (up to $300/kW) offered to new participants who join the program
  - Expand automation into other emerging DR program options
  - Emphasis on distribution and feeder congestion management through Auto-DR

- **SCE**
  - Expansion into automated Demand Bidding Program
  - Continued emphasis on industrial DR adoption

- **SDG&E**
  - Continue pursuit of third party implementation through Capacity Bidding program

- **DRRC**
  - DR Automation Server Standards being developed by industry consortium including national standards groups
Thank You!

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