Demand Response Programs: Configuring Load as a Resource for Competitive Electricity Markets

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Overview of Presentation

• Key Policy Questions
• Types of Demand Response Programs
• DR Program Results: 2001
• Lessons Learned
DR Programs and Electricity Markets - Policy Questions

• How much demand response is needed?

• What has been performance of markets in eliciting demand response?

• Is this response sufficient to improve system reliability or economic efficiency? (e.g., value & costs of DR “insurance”)
Demand Response Program Types

- **C/I Non-firm Rates**
  - Up-front payment; typically bill or rate discounts for curtailments to pre-set Firm Service Level

- **Direct Load Control**
  - Utility interrupts customer loads (e.g., a/c, water heating)

- **Demand Bidding - Call option**
  - Reservation and energy reduction payments
  - Customers selects Strike Price. LSE can “call” the customer, requiring them to reduce load or face penalties, when projected Mkt. Price > Strike Price

- **Demand Bidding - “Quote option”**
  - Purely voluntary. Customers pledge to curtail loads at specified time, price (“pay-per-interruption event”)

- **Dynamic Pricing (e.g., real-time pricing)**
Case Studies of DR Programs

Independent System Operators
- ISO NE, NYISO, PJM, CA ISO

Utilities
- Ameren, BGE, Cinergy, ComEd, Dominion Virginia, KCPL, Nevada, Otter Tail, NYSEG, PacifiCorp, PGE, PSE, SDG&E, Sierra Pacific, Xcel Energy, SCE, PG&E

Retail Energy Suppliers/Aggregators (e.g., CSP)
- AES NewEnergy, ConsumerPowerLine, Global Energy

Federal Power Marketing Authorities
- BPA
System Events and DR Market Activity: Summer 2001

- 14 programs operated once or not at all
- However, several programs played critical role in mitigating system emergencies
Summer 2001 Wholesale Prices ($/MWH)

- Maximum
- Average
- Post-Caps

East
Lower MW
Upper MW
West
Actual Performance of DR Programs: Summer 2001

- NYISO EDRP provided ~425 MW (L2)
- CAISO only called once (E1,E2)
Actual Performance of DR programs

Average Values for Case Study Programs

<table>
<thead>
<tr>
<th>Program Type</th>
<th>Number of Programs</th>
<th>Potential Curtailable Load (MW)</th>
<th>Actual Curtailed Load (MW)</th>
<th>Actual/Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contingency</td>
<td>8</td>
<td>158</td>
<td>84</td>
<td>62%</td>
</tr>
<tr>
<td>Market</td>
<td>10</td>
<td>204</td>
<td>21</td>
<td>17%</td>
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</tbody>
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- Load relief from “market-driven” DR programs is often less predictable than “contingency-related” DR programs
- Why?
  - Incentive Mechanisms (e.g., penalties)
  - Low wholesale electricity prices
  - Definitional issues: Potential curtailable load?
Back-up Generators: Balancing “reliability” and environmental concerns?

- BUGs are popular load curtailment strategy
- Environmental impacts are major concern, particularly for diesel-fired BUGs
What types of customers participate in DR programs?

- Industrial customers are backbone of current DR programs in our sample
- Increasing activity by commercial, institutional customers

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Industrial</td>
<td>50%</td>
</tr>
<tr>
<td>Commercial</td>
<td>23%</td>
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<tr>
<td>Manufacturing</td>
<td>14%</td>
</tr>
<tr>
<td>Institutional</td>
<td>9%</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
</tr>
</tbody>
</table>
Current DR Programs target largest C/I customers

- Why? - metering, savings potential, transaction costs, program design rules
- Challenge: tapping DR potential of medium/small customers
Customer Load Reductions rescued CA during 2001 Crisis

- 6-8% reduction in electricity sales; 10% reduction in monthly peak demand
- Data normalized for weather and economic growth (based on CEC analysis)
Contributing Factors to CA Demand Reduction: Role of EE (Summer 2001)

- Utility Energy Efficiency Programs (~300 MW)
- CEC Peak Load Reduction Program (~100 – 200 MW)
- Real Time Meters
- Voluntary Conservation and Curtailment Initiatives at Gov’t Facilities and Private Sector (~300 MW + ?)
- Additional Electricity Rate Increases (~30% average)
- 20/20 Rebate Program
- CAISO and Utility Demand Response Programs (~800 MW, 1 event)
- Flex Your Power & Media Campaign

~4000 MW
Performance of California Load Mgmt Programs during the Crisis

- Interruptible Rate Programs operated 23 times in 2000 and 30 times in 2001
- GOOD NEWS: Critical to avoiding rotating outages on at least five occasions in 2000
- BAD NEWS: Frequent operation caused many customers to refuse curtailment requests and drop out

Total Curtained Load (MW)

- Stage 3 Emergency
- Stage 2 Emergency
- No Emergency

CPUC Suspended Program Operation

[Graph showing total curtained load over time with different stages and emergency levels]
Summary: DR Industry at Crossroads

- ISO programs growing in importance; but need to work out ISO roles/responsibilities in DR market
- Near-term outlook for “Market-driven” DR programs is unclear
  - New capacity additions + slowing economy = lower wholesale prices forecast for 2002
  - Will there be much activity if customers require >$150-200/MWh to bid in large amounts of load
- Ambivalence & regional variations regarding role of backup and on-site generators (e.g., diesel-fired)
- FERC Regional RTO Rulemaking – key forum for defining “rules of the game”
DR Industry: Challenges & Opportunities

- Key role of Intermediaries for long-term viability of DR market
  - Utilities: Incentives to perform??
  - Retail energy suppliers: DR is not stand-alone business, so vibrant retail market is enabling condition
  - Curtailment Service Providers: niche players? Who will want to play – ESCOs?

- Reposition existing Utility Load Management assets

- Recognize that customers are NOT generators; loads are diverse & respond to multiple objectives

- Making the case for “Public Benefits” value of “demand response” market