Does RTP Deliver Demand Response?:
Case Studies of Niagara Mohawk RTP and
~43 Voluntary Utility RTP Programs

Charles Goldman
Lawrence Berkeley National Laboratory

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Outline of Talk

• Case Study of NMPC RTP Tariff
  – Customer Satisfaction and Choices
  – Does RTP deliver demand response?
  – How do RTP and DR programs interact?
  – Policy Implications

• Review of Voluntary RTP Programs
### Voluntary vs. Default Service RTP: Overview of Key Design Issues

<table>
<thead>
<tr>
<th></th>
<th>Voluntary</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
<td>Customer retention, load growth, DSM</td>
<td>Encourage switching; minimize risk for default service provider</td>
</tr>
<tr>
<td><strong>Tariff Design</strong></td>
<td>Two-part with CBL; day-ahead price quotes</td>
<td>RTP for commodity with unbundled T&amp;D charges; real-time price quotes</td>
</tr>
<tr>
<td><strong>Marketing</strong></td>
<td>Targeted to largest customers, often through account reps</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Customer Education</strong></td>
<td>Occasionally offered by utilities (e.g., workshops or meetings with account reps)</td>
<td>Incorporated into more general informational campaigns about retail choice</td>
</tr>
<tr>
<td><strong>Financial Hedging Options</strong></td>
<td>CBL and/or utility-sponsored financial risk mgmt. products</td>
<td>Potentially offered by competitive retailers</td>
</tr>
<tr>
<td><strong>Tech. Assistance &amp; DR Technologies</strong></td>
<td>Occasionally offered by utilities</td>
<td>Potentially offered by competitive retailers</td>
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</table>
Project Objectives

• Characterize customer response to and satisfaction with a RTP tariff in a retail competition environment
• Quantify price response
• Assess interactions between RTP and ISO/utility DR programs
• Provide input to CA and NY regulators/stakeholders developing DR and RTP options
NMPC Market Situation

- **RTP is the default tariff for the “SC-3A” class** (large C/I customers >2MW) **since late 1998**
- **Unbundled charges for T&D, CTC, etc.**
- **Customer Choices for Electric Commodity Service**
  - **NMPC Option 1:** RTP indexed to NYISO DAM – default option
  - **NMPC Option 2:** fixed rate contract – one-time availability at program inception (now expired)
  - Competitive retail supplier (ESCO)
- **Several ISO-based DR programs**
  - **Emergency Demand Response Program (EDRP):** pay-for performance
  - **Installed Capacity (ICAP):** reservation payment
  - **Day-Ahead Demand Response Program**
## Survey Respondent and Population Characterization

<table>
<thead>
<tr>
<th>Customer Characteristics</th>
<th>Survey Respondents</th>
<th>All SC-3A Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(53 customers; 60 accounts)</td>
<td>(130 customers; 149 accounts)</td>
</tr>
<tr>
<td><strong>Business Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>40%</td>
<td>32%</td>
</tr>
<tr>
<td>Commercial</td>
<td>21%</td>
<td>23%</td>
</tr>
<tr>
<td>Government/educational</td>
<td>40%</td>
<td>46%</td>
</tr>
<tr>
<td><strong>Average monthly maximum demand</strong></td>
<td>3.0 MW</td>
<td>3.4 MW</td>
</tr>
<tr>
<td><strong>Option 2</strong></td>
<td>9%</td>
<td>18%</td>
</tr>
</tbody>
</table>

The survey response rate was about 40%.

Industrials are over-represented in the survey sample; institutional customers are under-represented.
Declining Volatility, Increasing Average Prices

- Similar trends in all NMPC load zones; although prices are somewhat higher in Capital zone (Central zone shown here)

*On-Peak defined as 7am-11pm on weekdays*
Customers Have Seen Occasional High Prices

Number of Hours at Indicated Prices:
1999-2003, Summer Weekdays (8am-6pm), Capital zone

- 137 hours over 4 summers with prices above $0.15/kWh
- Prices exceeded $0.50/kWh for 16 hours
Customer Satisfaction and Choices
• Customers are relatively satisfied with the tariff
• Interviews reveal greater disappointment with limited offerings by competitive retailers
Supply Choices of SC-3A Population
(December 2002)

- 57% of SC-3A customers indicated that they had taken competitive supply at some time since 1998
- But does switching mean hedged?

**Late 2004 Update:**
- >60% of customers have now switched to competitive suppliers
- Driven in part by sunset of Option 2 hedge

N=141

- NMPC Option 1 (default) 57%
- Competitive Supplier 33%
- NMPC Option 2 10%

Residual Power:
- 29% NMPC Option 1
- 71% Competitive Supplier
Customer Survey: Competitive Supply Arrangements

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<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Number of customers reporting</td>
<td>44</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td>Number of contracts that are...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEDGED:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat Rate</td>
<td>7</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>TOU</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Volumetric Collar</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL HEDGED</td>
<td>15</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>NOT HEDGED:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price Index</td>
<td>2</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>NMPC SC-3A(Option1)</td>
<td>27</td>
<td>27</td>
<td>24</td>
</tr>
<tr>
<td>TOTAL NOT HEDGED</td>
<td>29</td>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td>Percent of contracts that are hedged</td>
<td><strong>34%</strong></td>
<td><strong>27%</strong></td>
<td><strong>25%</strong></td>
</tr>
<tr>
<td>Percent with Financial hedge</td>
<td>15%</td>
<td>29%</td>
<td>30%</td>
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Trend is away from physical supply hedges

Trend toward financial hedges
Key Findings: Hedging

• In 2003, at least 65% of customers were fully exposed to RTP

• Why do customers not hedge more? Possible explanations:
  – Customers are sophisticated – they understand risks and still choose not to hedge
  – Customers are discouraged – retail market offers are hard to find or too expensive
  – Customers are not fully aware of the risks – declining volatility in recent years
  – Customers have chosen not to choose – default RTP service

• Tariff Design and Retail Competition
  – Unbundled RTP tariff design is appropriate for a competitive market structure, so long as there is a robust market for hedges
  – A utility-offered hedge (e.g., Option 2) is an appropriate transition strategy
Does RTP Deliver DR?
Price Response: What Customers Told Us

- 31% say they FOREGO usage (mainly govt/education customers)
- ~15% say they can SHIFT from on-peak to off-peak
- 54% of survey respondents claim they CANNOT CURTAIL
  - but 30% of them were enrolled in NYISO DR programs
- Customers may make a distinction:
  - RTP is price response
  - ISO programs are a call to keep the lights on (civic duty)

Unresolved
Do customers make a distinction between RTP price response and responding to ISO-declared curtailment events?
Price Response: Estimated Substitution Elasticities

- Large range in average customer elasticities:
  - Gov’t/educational customers are most price responsive
  - Industrial sector response is moderate
  - Commercial sector is unresponsive

Average elasticity over all customer types: 0.14
How do RTP and DR Programs Interact?
### NYISO Demand Response Program Enrollment (2001-2003)

<table>
<thead>
<tr>
<th>NYISO DR Program</th>
<th>Survey Respondents</th>
<th>All SC-3A Customers</th>
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<tr>
<td></td>
<td>(53 customers; 60 accounts)</td>
<td>(130 customers; 149 accounts)</td>
</tr>
<tr>
<td>EDRP (emergency)</td>
<td>38%</td>
<td>28%</td>
</tr>
<tr>
<td>ICAP/SCR (reliability-capacity)</td>
<td>13%</td>
<td>9%</td>
</tr>
<tr>
<td>DADRP (economic)</td>
<td>4%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Survey respondents were 30-40% more likely to participate in NYISO DR programs than the SC-3A study population.
- DR potential of SC-3A customers is ~100MW – about 18% of their total maximum demand
- SC-3A customers in NYISO Emergency DR program, mainly industrials, provide ~15MW of load curtailment
Do Enabling Technologies Help?
Customer Survey: Technology Adoption

- Technology adoption prior to 1998 was heavily efficiency oriented – reflecting aggressive NMPC DSM expenditures.
- 45% of customers have invested since 1998 – emphasis toward load management-oriented devices – reflecting NYSERDA program incentives.
- Customers are not fully aware of response strategies, even when they have equipment.
## Actions Taken in Response to High Prices

### Actions Taken by 24 Customers with Response Capability

<table>
<thead>
<tr>
<th>Action Description</th>
<th>N</th>
<th>Stated Response Capability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Shift</td>
</tr>
<tr>
<td>None</td>
<td>3</td>
<td>●</td>
</tr>
<tr>
<td>Started onsite/backup generation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Asked employees to reduce usage</td>
<td>17</td>
<td>●</td>
</tr>
<tr>
<td>Turned off or dimmed lights</td>
<td>10</td>
<td>●</td>
</tr>
<tr>
<td>Reduced/halted air conditioning</td>
<td>15</td>
<td>○</td>
</tr>
<tr>
<td>Reduced/halted refrigeration/water heating</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Reduced plug loads (e.g., office equipment)</td>
<td>3</td>
<td>○</td>
</tr>
<tr>
<td>Shut down plants or buildings</td>
<td>3</td>
<td>○</td>
</tr>
<tr>
<td>Halted major production processes</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Altered major production processes</td>
<td>4</td>
<td>○</td>
</tr>
<tr>
<td>Shut down equipment</td>
<td>12</td>
<td>○</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>●</td>
</tr>
</tbody>
</table>

- Relatively **low-tech** responses, mostly shutting off equipment or asking users to reduce usage
- Only one customer indicated using onsite generation
Key Findings

• Customers are generally satisfied with default day-ahead RTP
  – Despite views expressed by some that hedging options are expensive relative to perceived risks
  – ~45% of customers remained on default RTP; many others fully or partially exposed to day-ahead prices

• Price response is modest overall
  – Government/educational customers are most responsive
  – Average elasticity (0.15) comparable to other studies’ results
  – Aggregate DR potential is ~100MW at high prices
  – Most response involves reducing discretionary loads – technology has a limited impact

• ISO DR programs complement RTP
  – Industrial customer response to DR programs is greater than for RTP
Implications for Other States

• Results challenge conventional wisdom about which customers are most likely to respond
  – Institutional customers can provide significant price response
  – Some customers respond to *day-ahead* hourly prices

• RTP is best implemented as part of a portfolio of options
  – Emergency DR programs can complement RTP
  – Ensure adequate hedging options exist, at least initially

• Targeted customer education and technical assistance are needed to realize customers’ inherent price response potential
  – Many customers are not aware of available price response technologies and strategies
  – Even more important if RTP is extended to smaller customers
Implications for Other States (cont’d)

• **It will take time to develop RTP price response**
  – Initial response for most customers is discretionary (not shifting), which limits:
    • The number of customers willing to participate
    • The amount of peak demand participants will curtail
  – How many customers already have the capability to shift load? At what price?

• **Probably quicker to build DR capability with utility or ISO DR programs**
  – Limited, voluntary exposure is a big plus to many customers
  – Easier to sell because of public duty aspect of ISO-declared events
Survey of Utility Experience with Voluntary RTP Programs

- Summarized 43 voluntary RTP programs offered in 2003
  - “voluntary RTP” defined to exclude default service rates
  - Investor-owned and large publicly-owned utilities
- Interviewed utility program managers and reviewed publicly available sources (program evaluations, tariff sheets, regulatory filings, etc.)
- Identified key trends related to:
  - Utilities’ motivations for offering RTP
  - Tariff design features
  - Program participation
  - Participant price response
  - Program status and outlook
- Developed recommendations for policymakers interested in voluntary RTP as a strategy for developing demand response
The Geography of Voluntary RTP

• Voluntary RTP offered by:
  – Most IOUs in the Southeast and TVA
  – All IOUs in Illinois and NY, per statutory/ regulatory requirement
  – First Energy-owned utilities in OH (4) and PA (3)
  – Several other Midwestern IOUs: Cinergy, Xcel, KCPL
  – All CA IOUs in 2003, but two programs since cancelled

• Voluntary RTP not offered by many utilities in:
  – The West
  – New England
- **Mid-1980s**: RTP introduced by several utilities as novel DSM strategy
- **1990s**: RTP adopted by many utilities in Southeast and Midwest
  - Interest subsided in late-90s, as restructuring takes center stage
- **2000-2003**: RTP “rediscovered” as a tool for DR and a remedy for ailing electricity markets
Utility Motivations for RTP

- Concern about customer satisfaction/retention driven by competitive pressures in the early- and mid-90s
  - Competition from other utilities (electric and gas), onsite generation, unregulated suppliers
  - Give large customers “early access” to the market
- Reducing peak demand rarely the sole motivation
  - Often an alternative to interruptible rates, allowing customers to “buy through”
- Load growth achieved by providing low prices in off-peak periods AND by allowing customers to add load without incurring additional demand charges

*Some utility program managers identified multiple motivations; thus, percentage values for all categories add to more than 100%*
RTP Program Outlook

- ~34% of utilities report continuing active commitment to voluntary RTP
- Many programs “just coasting” or on their way out
  - Many programs never actively pursued
  - For others, outlook reflects lack of customer interest and/or changes in utility role associated with industry restructuring (e.g., divestiture)
Voluntary RTP: Participation Levels

- 2,700 non-residential customers and 11,000 MW enrolled in 2003
- Although several programs have achieved a significant level of participation, most have not.
  - Three programs account for 80% of customers and 80% of load enrolled
  - One-third of programs had no participants, and another third had fewer than 25
Voluntary RTP: Market Penetration Rates

- Low market penetration for most programs: only two have >25% of eligible customers enrolled
- RTP tariffs typically restricted to non-residential customers larger than a specified size
  - 50% of programs restricted to customers > 500 kW
- Most programs not pro-actively marketed, or targeted to narrow sub-set of eligible customers (typically largest industrials)
Percentage of Participants that Respond to Prices

- Among programs with >10 participants, typically <60% of participants are price responsive.
- Many customers enrolled expecting to save on their energy costs without responding on a daily basis:
  - Arguably a consequence of marketing strategies and program goals.
Maximum Load Reductions

- Among programs with >20 participants, most have achieved maximum load reductions of 12-22% of participants’ combined load
  - Higher prices did not necessarily correspond to larger percentage load reductions across RTP programs
- Aggregate load reductions are modest for nearly all RTP programs
  - Only two programs (Duke and Georgia Power) reported load reductions > 100 MW
  - All other programs with load reduction data had < 60 MW enrolled
Prospects for Voluntary RTP as a Strategy for Developing Demand Response

- Two essential elements to success:
  - Customers must enroll
  - And must respond “significantly” in aggregate
- Several programs have successfully enrolled a sizeable number of customers, but most have not.
  - This could be indicative of customers’ calculated choices: too much risk for the potential benefit
  - But customer acceptance not yet thoroughly tested
- Existing programs have also demonstrated that, in aggregate, customers on RTP can drop their load by 20-30%
- Difficult to extrapolate from demonstrated levels of price response:
  - Small populations of quite large industrial customers
  - On-site generation a significant fraction of load response in most programs
  - Low-tech response strategies
  - Many customers enrolled without intending to monitor or respond to hourly prices
Recommendations for Improving Design and Implementation of Voluntary RTP

• Sufficient resources must be devoted to developing and implementing a customer education program
• Customers need help understanding and managing price risk (e.g. risk management products, two-part CBL)
• Coordinate RTP implementation with other demand-side activities
• Include provisions for rigorous analysis of customer acceptance and price response
Aligning Policy Objectives and RTP Program Design

- Utilities interests must be aligned with program goals
- Costs and benefits of obtaining incremental amounts of price responsive load from RTP must be weighed against those of other types of DR programs.
- Account for the potential environmental and market impacts of the increased use of on-site generation resulting from RTP