Developing the Correct Tools: Robust Pilots

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Chris Ivanov
Power System Engineering, Inc.
Web Site: www.powersystem.org
ivanovc@powersystem.org

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About the Presenter

Chris Ivanov is the Leader of DSM and Load Forecasting in Power System Engineering’s Economic and Market Research group. He has prepared, evaluated, and managed electric load forecasts, surveys, and economic analyses for a wide range of clients including distribution and G&T utilities. His current focus is on assisting utilities with load forecasts and DSM studies such as the NRECA Smart Grid Demonstration Grant project. Chris has a Masters in Applied Economics and an MBA.
Objectives

- Many utilities have DSM programs or are interested in establishing new ones.
- But DSM programs are not one size fits all.
- Today’s discussion will center on determining the correct tools to help your Utility make the best decision from both a customer satisfaction and financial perspective.
DSM Program Options

- Myriad of options we need to sort through together.

DEMAND-SIDE MANAGEMENT (DSM)
Programs, beyond the consumer’s meter, aimed at altering the end-use of electricity with the goal of reducing costs.

DEMAND RESPONSE

- Direct Load Control
  - Water Heater
  - Air Cond.

- Dynamic Pricing
  - Peak Time Rebate (PTR)
  - Time of Use (TOU)

ENERGY RESPONSE

- Conservation
  - Customer Engagement Programs
- Energy Efficiency
  - Rebates and Promotions

DEMAND RESPONSE

- Dynamic Pricing
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ENERGY RESPONSE

- Conservation
  - Customer Engagement Programs
- Energy Efficiency
  - Rebates and Promotions
What are Your Utility’s Objectives?

- DSM Goals
  - Generation Planning
  - Power Purchases
  - Distribution Planning
  - Transmission Planning
  - DSM Programs
  - Power Dispatch
  - Revenue Projection
  - Rates

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What are Your Cooperative’s Objectives? What are You Willing to Give Up to Meet these Objectives?

- What will it cost?
- What technology is needed?
- How effective can these programs be at changing behavior to impact load?
- Can programs impact load during peak?
1. What program should we do?

YES

Cost-Benefit (best estimates)

2. How best to implement it?

Incentives?
Timing?
Recruitment?

3. What results are we actually getting?

M&V Analysis

4. How can we improve the program?

Concentrate recruitment?
Expand it?
Keep it as is?
Shut it down?

No or Not Yet

Consider alternatives or wait for more information

Reexamine program with updated impacts and inputs

Update Cost-Benefit Analysis
So, What Tools can You Find or Develop to Answer These Questions?

• Get educated! …with a careful eye.
• Talk to your neighboring utilities.
• Develop pilots at your utility.
Why Pilot?

• All systems are different, even neighboring co-ops

• Get specific data for your system:
  – Weather
  – Customer class make up
  – Avoided costs (Power Supply, Wholesale, T&D)
  – Customer reaction
  – Geographic differences
  – Appliance saturations
Steps of a Pilot

- Define program goals and objectives
- Program selection
- Rules of the program
- Data review and baseline determination
- Sample selection
- Determine sample size
- Program execution
- M&V of the program results
- Program adjustment based on M&V results
Step 1: Define Program Goals and Objectives

- Program goals and objectives should be based on load, cost, and other characteristics of each participant.

Load Shape vs Price Shape

Index
- 0 5 10 15 20 25

July Peak  July Ave  Hourly LMP
Step 1: Define Program Goals and Objectives - Key Issues

- Specific conditions (load profiles, wholesale rates, member willingness, current or past program experiences, etc…)

- Technology and rate options should be based on these goals

- Consumer Satisfaction: Will this program enhance or detract from consumer satisfaction?
Step 3: Rules of the Program - Key Issues

Guidelines for establishing a DSM program
Step 4: Determine Sample Size of Test Groups

- You want to have groups that reflect your entire system.
  - The point of a pilot is to be scalable to a system-wide deployment.
Step 4: Sample Size and Composition of Test Group

Special care is needed to ensure that the number of participants in each strata is at the designated number or higher throughout the course of the pilot. Keep in mind possible drop-outs and data issues. You will also define groups or ranges.

<table>
<thead>
<tr>
<th>Annual kWh Range</th>
<th># of Participants</th>
<th>% Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 – 12,000</td>
<td>47</td>
<td>31.9%</td>
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<tr>
<td>12,001 – 18,000</td>
<td>23</td>
<td>15.5%</td>
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<tr>
<td>18,001 – 28,000</td>
<td>42</td>
<td>28.4%</td>
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<tr>
<td>28,001 – 125,000</td>
<td>36</td>
<td>24.2%</td>
</tr>
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</table>
Step 5: Sample Selection

• “Opt out” vs. “Opt in”
  – Extremely important issue; consumers that “opt in” will likely have different behavior changes than the system at large.
  – Also requires large recruitment strategy versus a mandatory program with an opt out.

• System survey and customer characteristic data
  – Will allow differences in consumers to be described and help to explain different observed behavior changes
  – Assist in knowing appliance saturations and other data relevant to full-system deployment
Step 5: Sample Selection - Key Issues

• Assure sample accurately reflects entire system
  – Stratified random sampling (with adequate sample size) will enable test groups to be reflective of entire system
    • Important for future business cases and in understanding pilot results
    • Stratified random sampling reduces sampling error by as much as 300%! 
Step 5: Sample Selection - Key Issues

- Ensure that you capture all the data that you for M&V as you enroll participants. Survey is a great tool for this purpose!

- This will assist your cooperative in determining the character of your participants and what is driving your program

<table>
<thead>
<tr>
<th></th>
<th>Level of awareness about using less energy</th>
<th>Willingness to pay more to use less energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jane</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>Jill</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>Joe</td>
<td>high</td>
<td>high</td>
</tr>
</tbody>
</table>
Step 6: Data Review and Baseline Determination

Data Review

• Can your current data and IT department handle the needs of the program?
  – How is data saved?
  – Do you need additional data from other sources?
  – What are staffing resources like?
  – Does your cooperative need outside assistance?
Step 6: Key Issues: Why Baseline?

- Baseline = Determine starting point. (Where are we before the pilot?)
- An accurate baseline is key for a successful pilot.
  - Key input to future DSM business cases, including how this program can be extended at your co-op.
  - Performance of system and participants without the pilot.
Step 6: Choice of Baseline Categories

• Depends on your project and studies.
  – Test and control comparison groups
  – Historical data and forecasts

• Test and control comparison groups are most robust to determine program impact

• However, limited data may require other approaches such as historical data and forecasts
Step 6: I: Test and Control Comparison Groups

• Most reliable

• Need to make “apples to apples” comparisons
  ✓ If set properly, can yield the most robust results
  ✓ Also can provide confidence intervals
  ✓ Assists in evaluating the “extendibility” of the program
Step 6: Test and Control Comparison Groups....(Cont’d)

- Requires sample sizes for test and control groups that are representative of the system

Results that are applicable to the entire system
Step 6: Test and Control Comparison Groups....(Cont’d)

- Uses econometric analysis
  - Allows analysis of independent variables to test what is driving the impacts
  - Expanding to the rest of the system
    - Target specific member categories
    - Set recruitment strategies
Step 6: Historical Data and Forecasts

- Decision process for using this baseline:
  - Programs implemented on a statistically insignificant number of entities OR
  - Systems where granular data (such as AMI data) is not available before project implementation for test and control group participants
Step 6: Historical Data and Forecasts

• “Before” and “After” analysis
  – Peak Demand and Energy Use By substation
  – In DSM, some direct load control participants will be an example of this without AMI data
Step 7: Program Execution
Step 8: M&V of Program Results

- Estimates of program reductions per participant
- Characteristics driving customer response
- Updated cost-benefit analysis of the program (if applicable)
- Key lessons learned
- Recommendations for future DSM activities
Step 9: Program Adjustment and Possible System-wide Roll-out

1. What program should we do?
   - Yes
     - Cost-Benefit (best estimates)
   - No or Not Yet
     - Consider alternatives or wait for more information

2. How best to implement it?
   - Incentives?
   - Timing?
   - Recruitment?

3. What results are we actually getting?
   - M&V Analysis

4. How can we improve program?
   - Concentrate recruitment?
   - Expand it?
   - Keep it as is?
   - Shut it down?

Update Cost-Benefit Analysis

Reexamine program with updated impacts and inputs
Questions?

Input from You!

Questions?
PSE would like to thank you for your time and the opportunity to speak at this event.

Thank You

Christopher Ivanov
Lead Economist, DSM & Load Forecasting
Direct: 608-268-3516
Mobile: 608-335-7858
Email: ivanovc@powersystem.org
Website: www.powersystem.org