Residential Demand Response Participation in the PJM Synchronized Reserve Market

A presentation by Comverge to the PJM DR Subcommittee

20 MAR 2014
Residential DR in the PJM Synchronized Reserve Market

Presentation Overview

- Problem Statement
- Current SR Market Rules
- Residential DR in the Capacity & Energy Markets
  - Sampling to Determine Quantity
- Design of the Pilot
  - Sampling to Verify Time Response
- Results
- Conclusion
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Problem Statement
Residential DR in the PJM Synchronized Reserve Market

✓ Problem / Opportunity Statement
Demand Response is a capable Synchronized Reserve resource. Aggregations of residential demand response customers could potentially be a synchronized reserve resource. Today, the requirement to install, maintain and store the 1-minute metering infrastructure that is required to participate in that market is cost-prohibitive.

✓ The situation to be improved
The ability of residential demand response customers to participate in the ancillary service market, particularly, the sync reserve market.

✓ Document if the new work is to address specific technical issues and/or to address broader policy issues
This issue is purely a technical issue.

✓ Issue Source
Enerwise, an energy services company and a CSP registered as a PJM market participant is bringing this issue forward. Enerwise through its parent company, Comverge, is the leading provider of residential demand response services.
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Current SR Market Rules
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- Existing residential assets currently participate in the capacity and energy markets at PJM
- Rules for participation in the Synchronized Reserve market are different
- SR participation requires:
  - Metering of the asset at the premises level (not a sub meter)
  - Meter intervals of 1 minute
  - Individual facilities or an aggregation of facilities with a combined load in excess of 100 kW
  - Response to a dispatch signal in less than 10-minutes after transmission of the dispatch command
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Residential Demand Response in the Capacity & Energy Markets
Residential DR in the PJM Capacity & Energy Market

➢ Synopsis of PJM Manual 19 DLC Guidelines

PJM Manual 19 Load Forecasting and Analysis, Attachment B: Direct Load Control Load Research Guidelines:

Requires current DLC programs to use the existing “Deemed Savings Estimates for Legacy Air Conditioning and Water Heating Direct Load Control Programs in PJM Region” or;
Residential DR in the PJM Capacity & Energy Market

 Synopsis of PJM Manual 19 DLC Guidelines

- Statistical sampling

PJM Manual 19 Load Forecasting and Analysis, Attachment B: Direct Load Control Load Research Guidelines:

- Requires current DLC programs to use the existing “Deemed Savings Estimates for Legacy Air Conditioning and Water Heating Direct Load Control Programs in PJM Region” or;

- A DLC load research base per impact study designed to achieve a minimum accuracy of 90% confidence with 20% uncertainty and;

- A Switch Operability Rate with a minimum accuracy of 90% confidence, 10% Error
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Design of the Pilot
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**Comverge Test Plan**
- Test Plan for Residential HVAC in the PJM Sync Market dated Sept 7 2012 submitted to PJM for review and approval.

**PJM Approval**
- PJM approved the proposed SR pilot program on July 29, 2013

**Customer Recruiting**
- Customers recruited during spring and early summer of 2013. Residents fitted with whole house 1-minute interval meter & real time communications hardware.
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The SR Pilot Process

SR Offers

• Weekdays throughout August SR offer bids were initiated by the Comverge NOC for submittal to PJM for pilot trial proposes only.

BID Criteria

• The offers were based on the time of day and forecast weather in the PPL service area. Offers varied between 5 and 50 kW.

SR Events

• During Aug 2013 PJM Business Solutions initiated 3 test events:
  • Aug 12
  • Aug 15
  • Aug 30
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Dispatch from an Automated DR network
SR Pilot Program Configuration

45 measurement sites in the Comverge DR service territory were randomly sampled as representative of the larger population of network switches.

- The pilot program consisted of three test SR events.
- In all tests the device subject to curtailment was a residential central air conditioning compressor.
- 1-minute energy usage was successfully acquired from a whole house interval meter.
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Results
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Summary Results of PJM – Comverge SR Pilot Trial

<table>
<thead>
<tr>
<th>SR test event</th>
<th>Event start time (hh:mm)</th>
<th>Event end time (hh:mm)</th>
<th>Average switch response time (mm:ss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-Aug</td>
<td>1:37 PM</td>
<td>1:50 PM</td>
<td>1:45</td>
</tr>
<tr>
<td>21-Aug</td>
<td>4:11 PM</td>
<td>4:22 PM</td>
<td>2:15</td>
</tr>
<tr>
<td>30-Aug</td>
<td>2:19 PM</td>
<td>2:32 PM</td>
<td>2:45</td>
</tr>
</tbody>
</table>

The Average switch response time was within the required PJM RTO Reserve Zone requirement response time of 10 minutes.

<table>
<thead>
<tr>
<th>Temperature at start of event (deg F)</th>
<th>10-minute reserve curtailment (kW)</th>
<th>SR test event</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>6.6</td>
<td>15-Aug</td>
</tr>
<tr>
<td>84</td>
<td>53.4</td>
<td>21-Aug</td>
</tr>
<tr>
<td>78</td>
<td>21</td>
<td>30-Aug</td>
</tr>
</tbody>
</table>

10-minute reserve curtailment is a function of air temperature
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PJM - COMVERGE SR Test Event 2 of 3 - Aug 21

Event Date
- 21-Aug-13
- 4:11 PM
- DLC curtail message sent

Comverge Execution
- 4:12 PM
- DLC restore message sent

PJM Recall Order
- 4:22 PM

Comverge Terminate
- 4:23 PM

Air Temperature During Event
- 84 deg F

Energy Curtailment at 10 min Mark
- 53.4 kW
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Conclusion
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Comverge in conjunction with the PJM Business Solutions team completed a pilot project during August of 2013 demonstrating 1-minute sampling for residential demand response (DR).

The PJM - Comverge pilot successfully demonstrated dispatch of a residential Direct Load Control (DLC) resource for the SR market.

The pilot fulfilled its SR market obligation in less than 3 minutes, significantly under the 10- minutes reserve response allowed by PJM for SR generation resources.
Thank You

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