



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

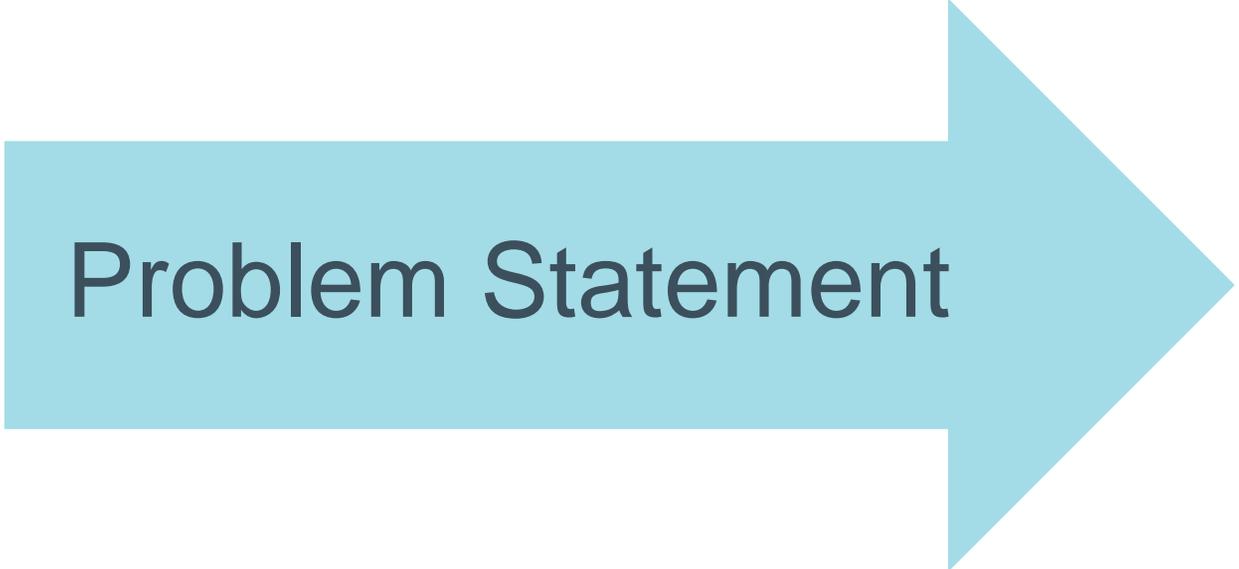
Residential DR in the Capacity & Energy Markets
Sampling to Determine Quantity

Design of the Pilot
Sampling to Verify Time Response

Results

Conclusion

Residential DR in the PJM Synchronized Reserve Market



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

Residential DR in the PJM Synchronized Reserve Market

- 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

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

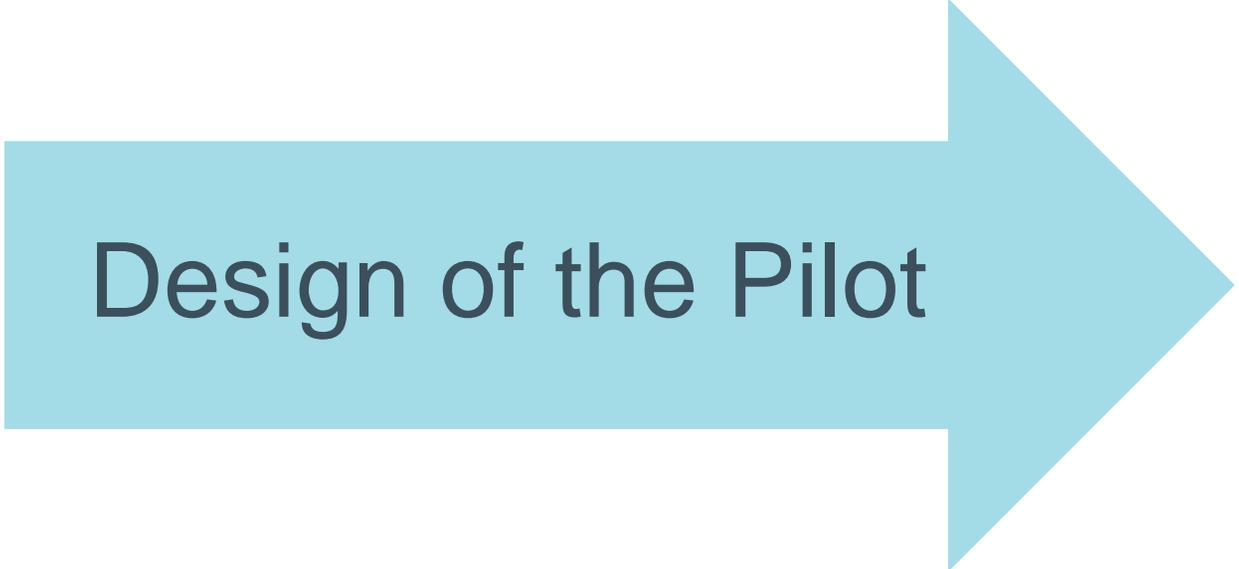
Statistical
sampling

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;

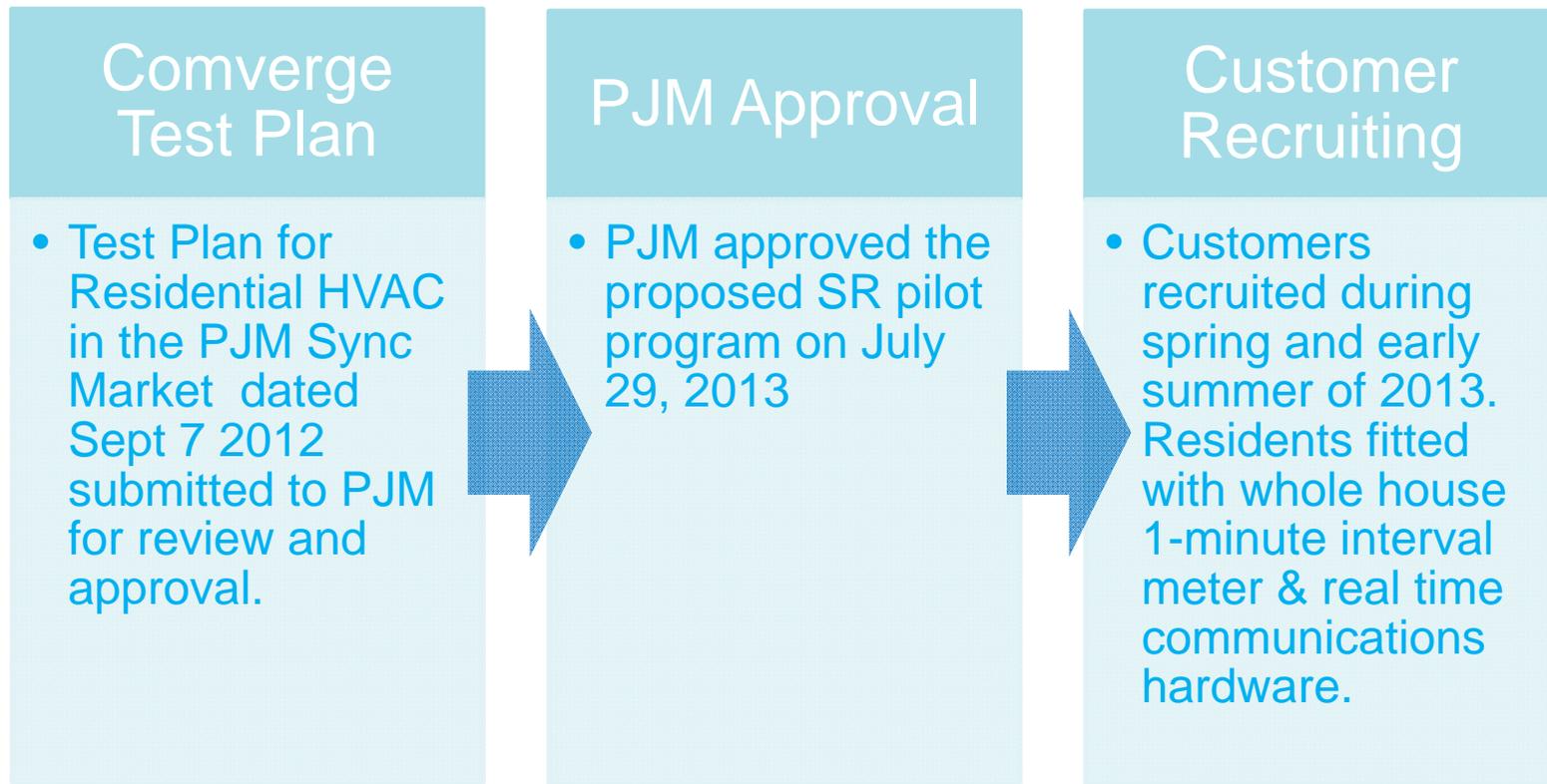
A Switch Operability Rate with a minimum accuracy of 90% confidence, 10% Error

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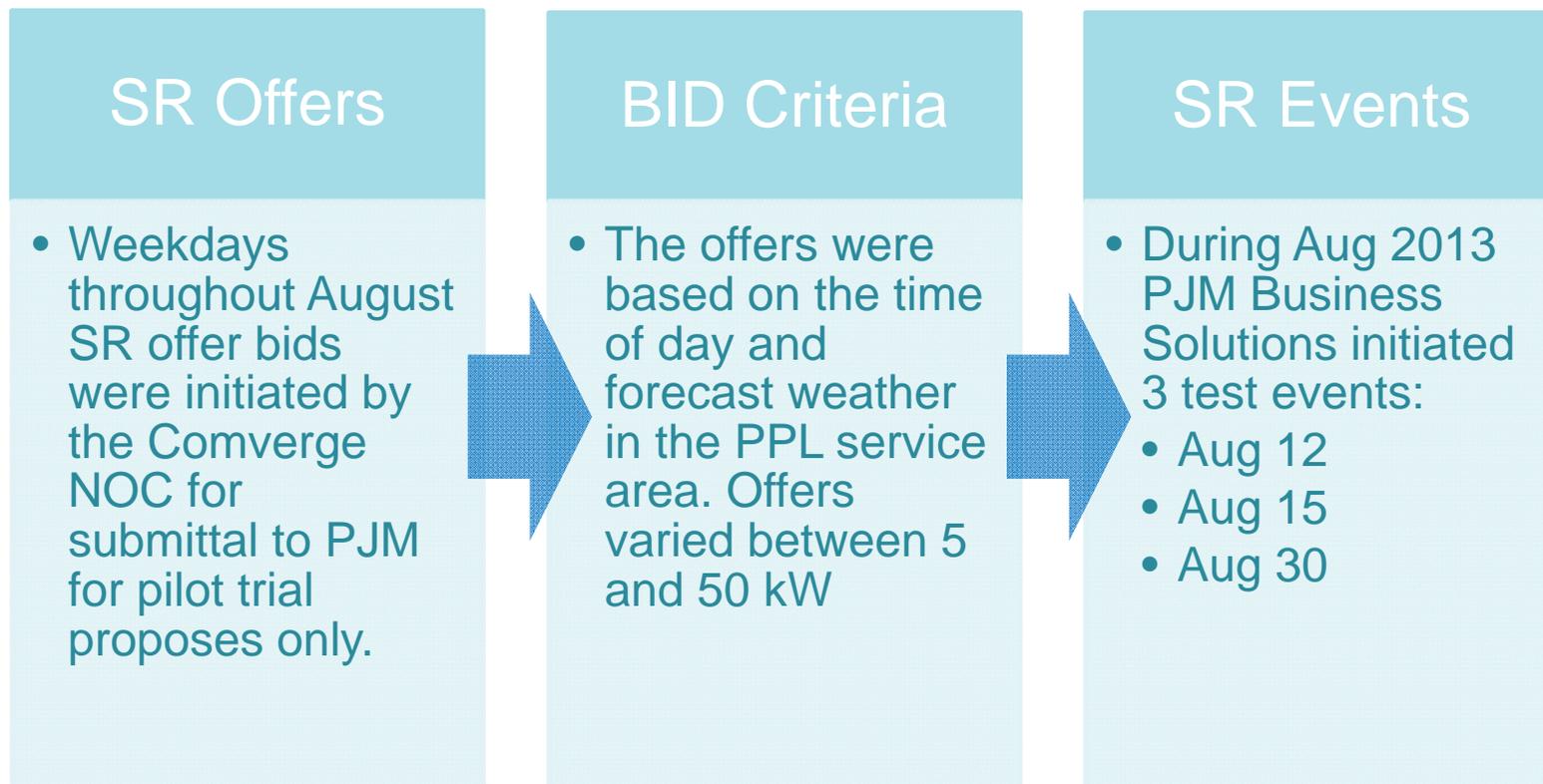
Design of the Pilot

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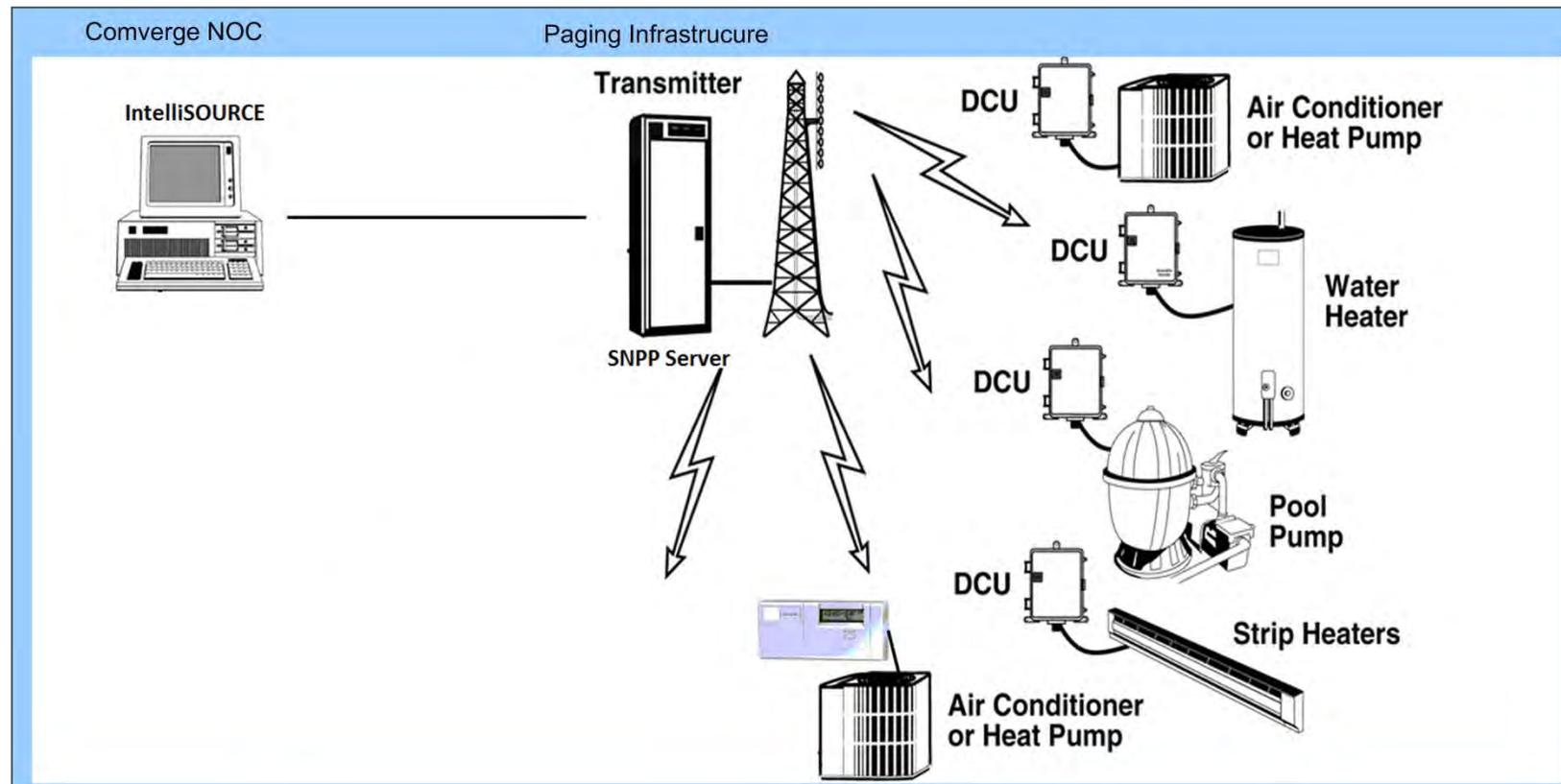


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The SR Pilot Process



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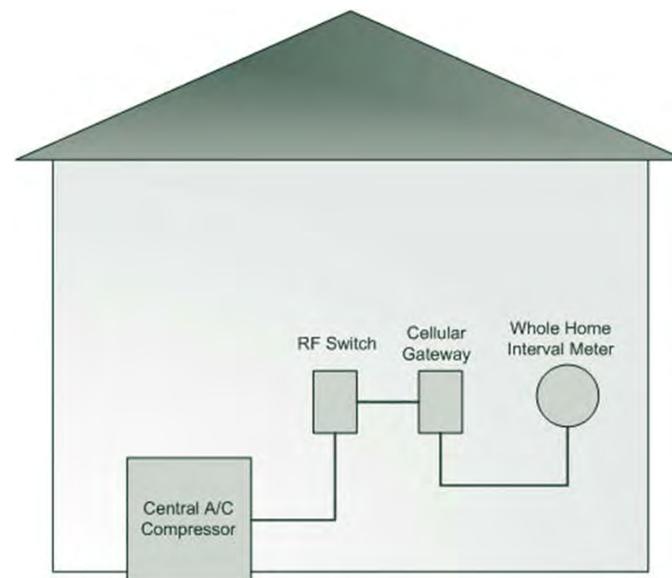
Dispatch from an Automated DR network

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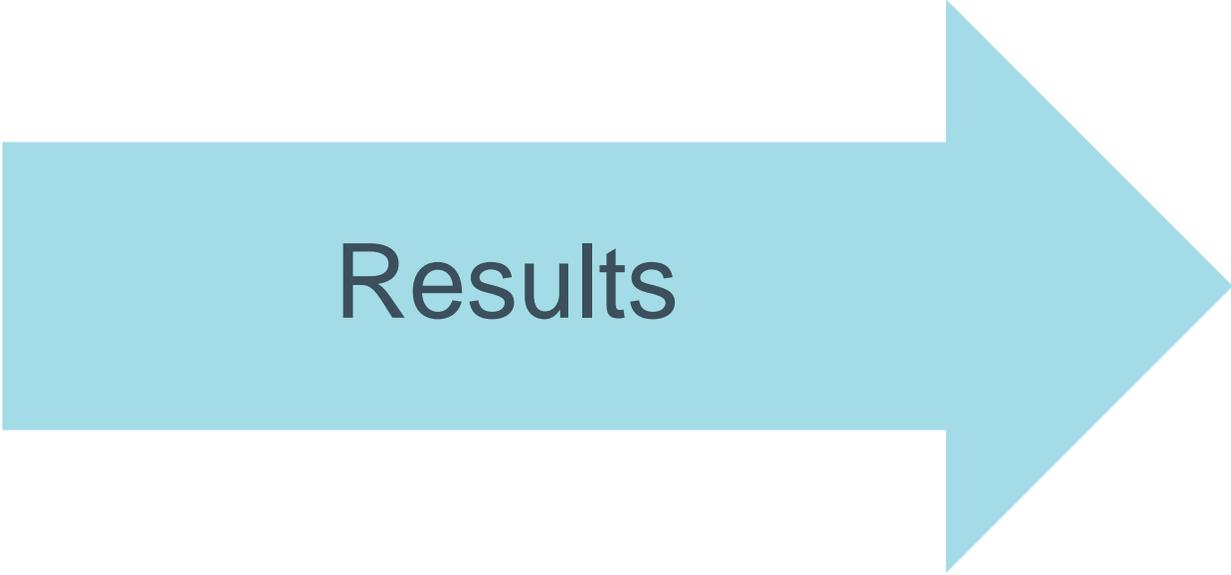
SR Pilot Program Configuration

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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Summary Results of PJM – Comverge SR Pilot Trial

SR test event	Event start time (hh:mm)	Event end time (hh:mm)	Average switch response time (mm:ss)
15-Aug	1:37 PM	1:50 PM	1:45
21-Aug	4:11 PM	4:22 PM	2:15
30-Aug	2:19 PM	2:32 PM	2:45

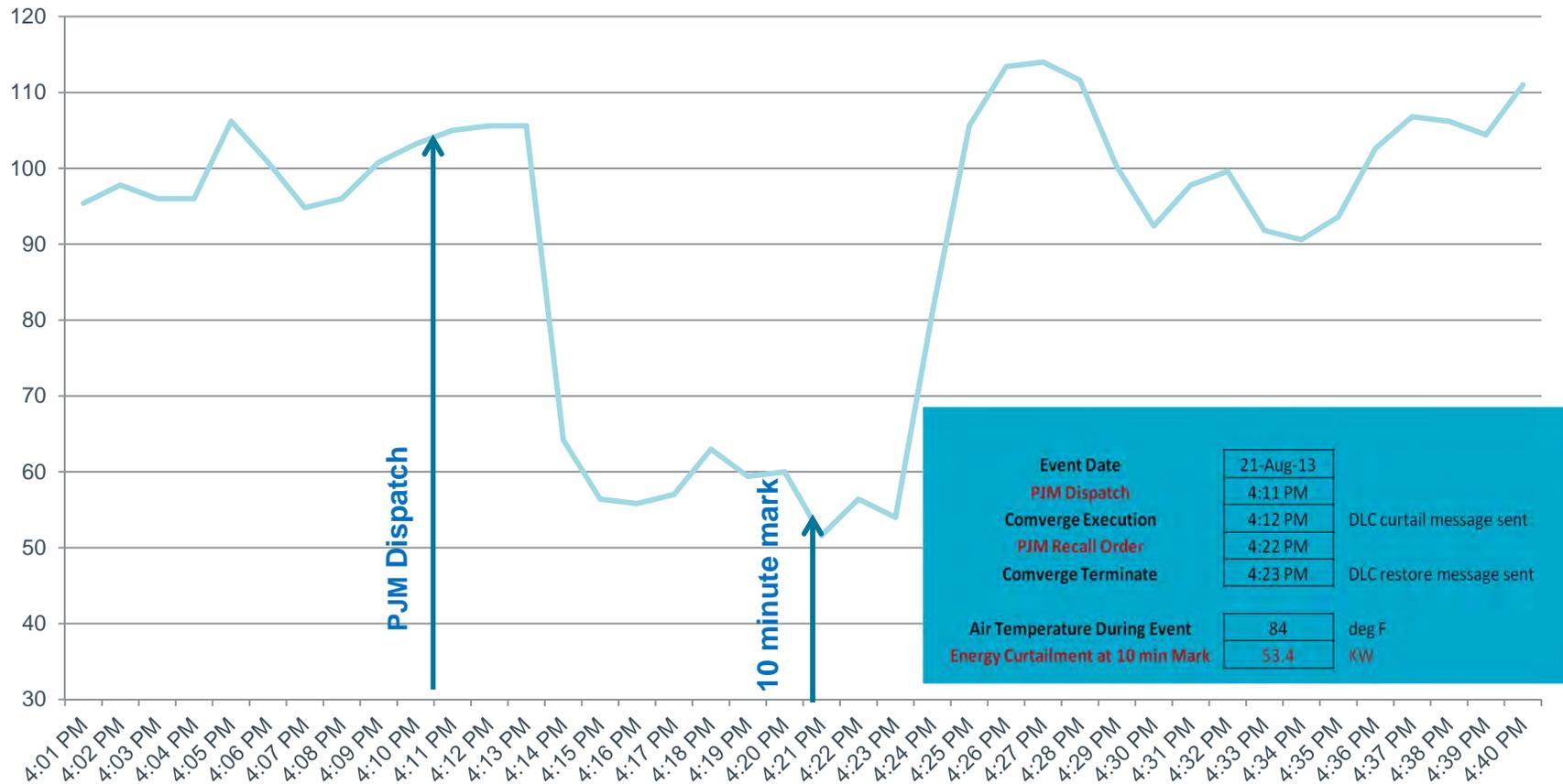
The Average switch response time was within the required PJM RTO Reserve Zone requirement response time of 10 minutes.

Temperature at start of event (deg F)	10-minute reserve curtailment (kW)	SR test event
72	6.6	15-Aug
84	53.4	21-Aug
78	21	30-Aug

10-minute reserve curtailment is a function of air temperature

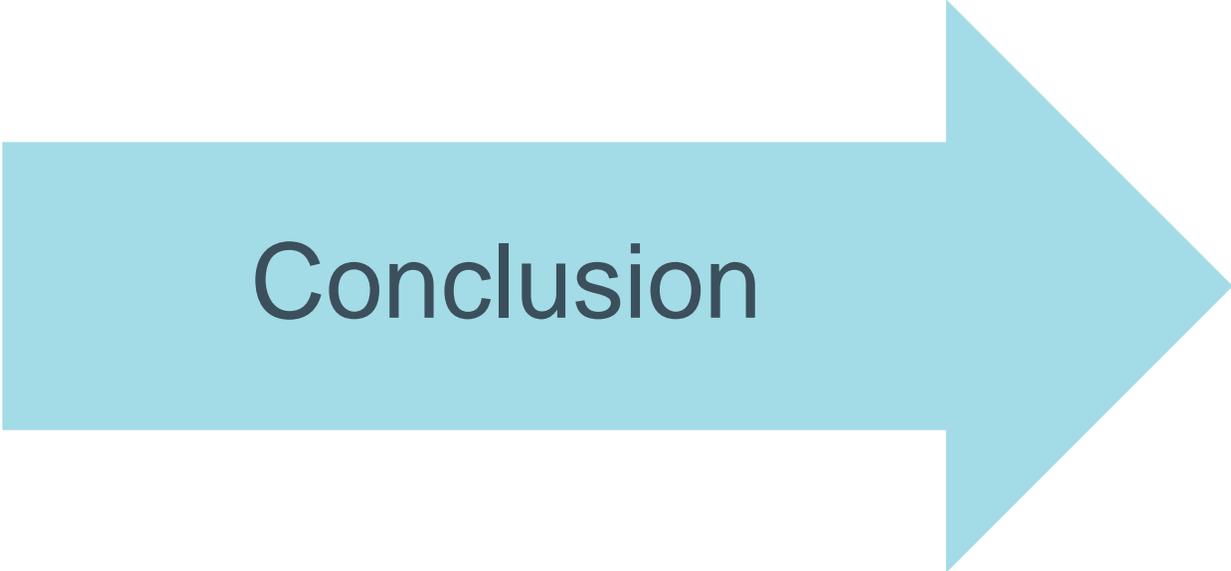
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PJM - COMVERGE SR Test Event 2 of 3 - Aug 21



Event Date	21-Aug-13	
PJM Dispatch	4:11 PM	
Comverge Execution	4:12 PM	DLC curtail message sent
PJM Recall Order	4:22 PM	
Comverge Terminate	4:23 PM	DLC restore message sent
Air Temperature During Event	84	deg F
Energy Curtailment at 10 min Mark	53.4	KW

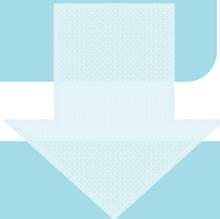
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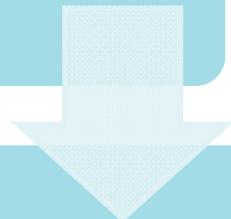
Conclusion

Residential DR in the PJM Synchronized Reserve Market

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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