Accomplishments and Lessons Learned – NRECA/CRN ARRA Demonstration Grant

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## COMPARABLE CHALLENGES – SG & SUBSTATIONS

<table>
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<th>SMART GRID</th>
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<tr>
<td>Customer Acceptance</td>
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<td>Data Volume &amp; Complexity</td>
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<td>Determining ROI</td>
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<td>Resiliency</td>
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# NRECA/CRN DEMO PROJECT SCOPE

<table>
<thead>
<tr>
<th>Participants</th>
<th>Demand Response</th>
<th>Distribution Automation (DA)</th>
<th>Enabling Technologies</th>
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<tbody>
<tr>
<td></td>
<td>IHD/Web Portal Pilots</td>
<td>DR over AMI</td>
<td>Prepaid Metering</td>
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<tr>
<td>Adams Electric Co-op, IL</td>
<td>45</td>
<td>46</td>
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<tr>
<td>Adams-Columbia Electric Co-op, WI</td>
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<tr>
<td>Blue Ridge Electric, NC</td>
<td>71</td>
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<tr>
<td>Clarke Electric Co-op, Inc., IA</td>
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<tr>
<td>Corn Belt Power Co-op, IA</td>
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<td>Calhoun Co. ECA</td>
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<tr>
<td>Humboldt Co. REC</td>
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<tr>
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<td>Delta Montrose EA, CO</td>
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<tr>
<td>United Energy</td>
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<tr>
<td>Flint EMC, GA</td>
<td>56</td>
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<tr>
<td>Kauai Island Utility Co-op, HI</td>
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<td>Kotzebue Electric Assn., AK</td>
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<td>58</td>
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<td>Menard Electric Co-op, IL</td>
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<td>Great River Energy, MN</td>
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<td>Lake Region Electric Co-op., MN</td>
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<td>Owen Electric Co-op, Inc., KY</td>
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<tr>
<td>Salt River Electric Co-op Corp., KY</td>
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<tr>
<td>Snapping Shoals EMC, GA</td>
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<tr>
<td>United REMC, IN</td>
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<tr>
<td>Washington-St. Tammany EC, LA</td>
<td>12</td>
<td>23</td>
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**Total Listed:** 85
Customer Acceptance

• More than 70% of co-ops identified customer acceptance as a barrier to smart meter deployment at start of project
• Rationale:
  – Invasion of privacy
  – Fear of radiation
  – Fear of higher cost
  – General resistance to change
• Of 23 co-ops:
  – Minor issues everywhere
  – Major resistance in Kauai
• All issues resolved
• Only 6% of co-ops site resistance as barrier
• NRECA developed kit to help utilities to communicate to the members (customer) about their smart meters
Data volume and complexity

• Original concern was projections of $10^4$ to $10^5$
• This volume of data has not materialized and data management has not yet become an issue
• Emergence of cloud-based solutions
• Question about value of higher-frequency data
• Demonstrated need for advanced analytics
  – OMF, most powerful grid analytic tool deployed
  – Initiation of massive loud based analytics project
  – Selected as a test-bed for Interent2, IOT, and Smart American Challenge
Communications

• Much larger problem than we expected
• Solved everywhere, but it took serious work
• No general solution
• Long term solution likely lies in distributed information architecture
Cyber Security

- Still a problem, but a problem with no symptoms
- NRECA approach addresses CS in four layers, 8000+ downloads, classes, policies
- Participation in NIST Framework, ESC2M2
- New effort on “non-prescriptive” cyber Security
Interoperability

Waiting for Godot (CIM)
IEC standards have too little coverage
MultiSpeak® is easily the most practical
Project extended MultiSpeak®
Project added cyber security extensions
Work continues:
  Extension in application layer integration
  Extension to other layers
Expanded Model for Integration

Data

Information

Analysis

Decision

Action

Common Data Collection and Distribution rather than data collection for different applications
Return on Investment

Big Winners:

• Conservation Voltage Reduction
• Smart metering (where there was no AMR)
• Pre-paid metering
• Smart feeder switching
# Resiliency – Matrix and Examples

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<tr>
<th></th>
<th>Operational</th>
<th>Technical</th>
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<tbody>
<tr>
<td><strong>Before disaster</strong></td>
<td>Vegetation Management</td>
<td>Microgrids</td>
</tr>
<tr>
<td><strong>During Recovery</strong></td>
<td>Mutual Assistance</td>
<td>Drones</td>
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</table>