

## **Attachment B**

# **U.S. Smart Grid Case Studies**

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**September 28, 2011**

**Prepared by SAIC**



**Prepared for the  
Energy Information Administration**

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## Table of Acronyms

### General Acronyms

|             |  |              |  |
|-------------|--|--------------|--|
| <b>AMI</b>  | Advanced Metering Infrastructure       | <b>ISO</b>   | Independent System Operator              |
| <b>AMR</b>  | Automated Meter Reading                | <b>IT</b>    | Information Technology                   |
| <b>ARRA</b> | American Recovery and Reinvestment Act | <b>kW</b>    | Kilowatt                                 |
| <b>BPL</b>  | Broadband Over Power Lines             | <b>kWh</b>   | Kilowatt-hours                           |
| <b>CFL</b>  | Compact Fluorescent                    | <b>MW</b>    | Megawatt                                 |
| <b>CPP</b>  | Critical Peak Pricing                  | <b>MWh</b>   | Megawatt-hours                           |
| <b>CPR</b>  | Critical Peak Rebate                   | <b>PEM</b>   | Personal Energy Management               |
| <b>DG</b>   | Distributed Generation                 | <b>PSC</b>   | Public Service Commission                |
| <b>DLR</b>  | Dynamic line rating                    | <b>PTR</b>   | Peak Time Rebates                        |
| <b>DOE</b>  | Department of Energy                   | <b>PUC</b>   | Public Utility Commission                |
| <b>DR</b>   | Demand Response                        | <b>PUD</b>   | Public Utility District                  |
| <b>DSM</b>  | Demand Side Management                 | <b>REC</b>   | Renewable Energy Credit(s)               |
| <b>EIA</b>  | Energy Information Administration      | <b>RF</b>    | Radio Frequency                          |
| <b>FAQ</b>  | Frequently Asked Questions             | <b>RFP</b>   | Request For Proposal(s)                  |
| <b>FCC</b>  | Federal Communications Commission      | <b>RTP</b>   | Real Time Pricing                        |
| <b>FERC</b> | Federal Energy Regulatory Commission   | <b>SCADA</b> | Supervisory Control and Data Acquisition |
| <b>GW</b>   | Gigawatt                               | <b>SGIC</b>  | Smart Grid Information Clearinghouse     |
| <b>GWh</b>  | Gigawatt-hours                         | <b>SGIG</b>  | Smart Grid Investment Grant              |
| <b>HP</b>   | Hourly pricing                         | <b>TGB</b>   | Tower Gateway Base station               |
| <b>IM</b>   | Instant Messaging                      | <b>TOU</b>   | Time of Use                              |
| <b>IOU</b>  | Investor Owned (Electric) Utility      | <b>VOIP</b>  | Voice Over Internet Protocol             |
| <b>IP</b>   | Internet Protocol                      |              |  |

### Utility Specific Acronyms

|                 |  |                  |  |
|-----------------|--|------------------|--|
| <b>BGE</b>      | Baltimore Gas & Electric                   | <b>LIPA</b>      | Long Island Power Authority                        |
| <b>BPA</b>      | Bonneville Power Administration            | <b>PEPCO</b>     | Potomac Electric Power Company                     |
| <b>CL&amp;P</b> | Connecticut Light & Power                  | <b>PGE</b>       | Portland General Electric                          |
| <b>CPUC</b>     | California Public Utility Commission       | <b>PG&amp;E</b>  | Pacific Gas & Electric                             |
| <b>CVPS</b>     | Central Vermont Public Service             | <b>PSE</b>       | Puget Sound Energy                                 |
| <b>DP&amp;L</b> | Dayton Power & Light                       | <b>SDG&amp;E</b> | San Diego Gas & Electric                           |
| <b>HECO</b>     | Hawaiian Electric Company                  | <b>SRP</b>       | Salt River Project                                 |
| <b>ISO-NE</b>   | Independent Service Operator – New England | <b>WUTC</b>      | Washington Utilities and Transportation Commission |

## Introduction

Smart grid pilot projects have been rapidly increasing in number in the United States over the last several years. A recent report by IDC Energy Insights predicts that U.S. smart meter installations will exceed 80 million by 2015, up from about 2 million in 2007.<sup>1</sup> Distribution automation and demand response (DR) projects are also on the rise. A large part of this increase is due to the disbursement of almost \$4.5 billion of ARRA funding targeted specifically to smart grid initiatives since 2009. However, even without federal funding, utilities and partner entities are proceeding with smart grid projects. One reason for this phenomenon is that utilities are finding a business case for replacing costly mechanical meters and updating the reliability and efficiency of their systems. Another reason is that Federal mandates are promoting smart grid projects, specifically EISA Title XIII, which establishes a national policy for grid modernization and provides incentives for stakeholders to invest in smart grid initiatives.<sup>2</sup>

The smart grid is growing rapidly and several companies are expanding their initial programs and/or adapting their strategies. This document provides an update to 23 case studies of smart grid pilots and programs that were originally researched and documented in March 2011 under subtasks #2.1.1.1 and 2.1.1.3. Six of the case studies were specifically requested by EIA in the Performance Work Statement under subtask 2.1.1.1; they include the Gridwise Initiative in Washington, PowerCents DC in the District of Columbia, and pilot projects sponsored by San Diego Gas & Electric, Pacific Gas & Electric, Xcel Energy, and Oncor. The remaining case studies were identified through several channels, including work on smart grid under the prior contract as well as targeted research. Each case study begins with a table that outlines important elements of the project and presents quantitative results and metrics when available. The tables are followed by more detailed descriptions of the projects, along with further supporting information. The information in the tables that accompany each case study has been updated if the data has changed since the original research was conducted. An additional section in the text portion of each case study, titled UPDATES AS OF SEPTEMBER 2011, contains an overview of the updates and any new information if available. Note that no calls were made to any utilities.

The case studies are divided into two distinct sections: the first, “Successful or Progressing Projects,” comprises 13 case studies, and the second, “Cancelled or Postponed Projects,” comprises ten case studies. The first section provides examples of projects that have been completed successfully or are in progress with no significant delays or difficulties having been encountered. The second section covers examples of projects that have been completely cancelled or significantly postponed, or that have suffered serious setbacks, due to any number of factors, including technological difficulties, customer complaints, funding problems, etc. In most cases, the public utility commissions (PUCs) or other bodies overseeing the projects have stipulated that these programs may continue as long as certain criteria are met, such as modifying a dynamic pricing structure or solving technical difficulties. The project case studies in the second grouping contain additional information, including a discussion of the key drivers associated with the cancellation or postponement of the project. Of the six case studies specifically requested by EIA, two are included in the “Cancelled or Postponed Case Studies” group. They are the PG&E Smart Meter program in California and the Xcel Energy SmartGridCity project in Boulder, CO.

This collection of case studies is not meant to be a comprehensive list of smart grid projects in the United States. Instead, it provides a sample of projects ranging across a variety of smart grid applications

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<sup>1</sup> IDC Energy Insights, [http://www.idc-ei.com/getdoc.jsp?containerId=IDC\\_P21522](http://www.idc-ei.com/getdoc.jsp?containerId=IDC_P21522), accessed September 21, 2011

<sup>2</sup> Energy Independence and Security Act of 2007, Title XIII, [http://www.oe.energy.gov/DocumentsandMedia/EISA\\_Title\\_XIII\\_Smart\\_Grid.pdf](http://www.oe.energy.gov/DocumentsandMedia/EISA_Title_XIII_Smart_Grid.pdf), accessed September 21, 2011

and approaches that comprise various technology types, pricing programs, and funding mechanisms. Standard acronyms are used throughout the document. A list of acronyms and definitions is included for reference at the start of the document.

Table 1 provides a list of included case studies; it identifies the State or region where the project takes place, the main utility or entity overseeing the project, and the type of activity occurring between March and September 2011.

- **Additional Meters:** Additional meters have been installed as part of the project under review.
- **Non-Meter Progress:** Not including smart meter deployment, other aspects of the project under review have moved forward or been altered.
- **New Partnerships:** The utility/entity has entered into new smart grid partnerships with other entities, either for the project under review or for other smart grid projects.
- **Delays or Setbacks:** The project under review has experienced new delays or significant setbacks.
- **Other SG Projects:** The utility/entity has moved forward with planning or implementing additional smart grid projects other than the project under review.
- **No major updates:** There have been no significant updates related to smart grid projects undertaken by the utility/entity.

Tables 2 and 3 provide summary views of the main elements of the successful or progressing projects and the cancelled or postponed projects, respectively. Table 4 provides a summary of the cancelled and postponed projects and identifies the main drivers leading to postponement or cancellation.

**Table 1. Updates to Smart Grid Case Studies Included in this Document as of September 2011**

| Utility/Entity                            | State/Region           | Project Name  | Additional Meters | Non-Meter Progress | New Partners | Delays or Setbacks | Other SG Projects | No Major Updates |
|---|------------------------|---|-------------------|--------------------|--------------|--------------------|-------------------|------------------|
| <b>Successful or Progressing Projects</b> |                        |   |                   |                    |              |                    |                   |                  |
| Austin Energy                             | Texas                  | Pecan Street Project                                    |                   | X                  | X            |                    |                   |                  |
| BPA                                       | Washington             | Pacific Northwest GridWise                              |                   |                    |              |                    |                   | X                |
| Duke Energy                               | North & South Carolina | Grid Modernization Project                              |                   | X                  |              |                    |                   |                  |
| Duke Energy                               | Ohio                   | Grid Modernization Project                              | X                 | X                  |              |                    |                   |                  |
| FirstEnergy                               | Ohio                   | Smart Grid Modernization Initiative                     |                   |                    |              |                    |                   | X                |
| Georgia Power                             | Georgia                | PowerRewards  |                   |                    |              |                    | X                 |                  |
| ISO-NE                                    | New England            | Demand Response Reserve Pilot                           |                   |                    |              |                    |                   | X                |
| Oncor                                     | Texas                  | Smart Texas Program                                     | X                 |                    |              |                    |                   |                  |
| PEPCO                                     | DC                     | PowerCentsDC  | X                 |                    |              |                    |                   |                  |
| PGE                                       | Oregon                 | Critical Peak Pricing Pilot                             |                   |                    |              |                    |                   | X                |
| PG&E                                      | California             | Smart Meter Program                                     |                   | X                  | X            |                    | X                 |                  |
| SRP                                       | Arizona                | Smart Grid Project                                      | X                 |                    |              |                    |                   |                  |
| Xcel Energy                               | Minnesota              | Saver's Switch  |                   |                    |              |                    |                   | X                |
| <b>Cancelled or Postponed Projects</b>    |                        |   |                   |                    |              |                    |                   |                  |
| BGE                                       | Maryland               | Smart Grid Initiative                                   |                   | X                  |              |                    |                   |                  |
| CL&P                                      | Connecticut            | Plan-It Wise Energy Program                             |                   |                    |              | X                  |                   |                  |
| Consumers Energy                          | Michigan               | SmartStreet Pilot and Full Scale Smart Meter Project    |                   | X                  |              | X                  |                   |                  |
| DP&L                                      | Ohio                   | Customer Conservation and Energy Management (CCEM) Plan |                   |                    |              |                    |                   | X                |
| HECO                                      | Hawaii                 | Smart Meter Pilot Program                               |                   |                    | X            |                    | X                 |                  |
| LIPA                                      | New York               | BPL and Wireless Communications Demonstration           |                   |                    |              |                    | X                 |                  |
| PG&E                                      | California             | Smart Meter Program                                     | X                 | X                  |              | X                  | X                 |                  |
| PSE                                       | Washington             | Personal Energy Management (PEM) Program                |                   |                    |              |                    |                   | X                |
| Snohomish County                          | Washington             | Smart Grid Project                                      |                   | X                  |              |                    |                   |                  |
| Xcel Energy                               | Colorado               | SmartGridCity   |                   | X                  |              | X                  |                   |                  |

Additional Meters: Additional meters have been installed as part of the project under review.

Non-Meter Progress: Not including smart meter deployment, other aspects of the project under review have moved forward or been altered.

New Partnerships: The utility/entity has entered into new smart grid partnerships with other entities, either for the project under review or for other smart grid projects.

Delays or Setbacks: The project under review has experienced new delays or significant setbacks.

Other SG Projects: The utility/entity has moved forward with planning or implementing additional smart grid projects other than the project under review.

No major updates: There have been no significant updates related to smart grid projects undertaken by the utility/entity.



**Table 2. Successful Project Case Study Highlights**

| Project Name                                     | Dates               | Budget                      | # of Customers            | Technology |     |          |                |                 |                 | Status      |          | ARRA Funds |
|--|---------------------|-----------------------------|---------------------------|------------|-----|----------|----------------|-----------------|-----------------|-------------|----------|------------|
|  |                     |                             |                           | AMI        | AMR | Dist Gen | Energy Storage | Smart Appliance | Dynamic Pricing | In Progress | Complete |            |
| Austin Energy Pecan Street Project               | 2009-15             | \$24 million                | 1,000 Res<br>75 Com       | X          |     | X        | X              | X               |                 | X           |          | X          |
| BPA Gridwise Initiative                          | 2006-07             | N/A                         | 150                       |            |     |          |                | X               | X               |             | X        |            |
| Duke Energy Carolinas Grid Modernization Project | 2009 - present      | \$7.5 million               | 17,000                    | X          | X   | X        |                | X               | X               | X           |          | X          |
| Duke Energy Ohio Grid Modernization Project      | 2008 - present      | \$100 million <sup>A</sup>  | 700,000                   | X          | X   | X        |                | X               | X               | X           |          | X          |
| First EnergySmart Grid Modernization Initiative  | 2010 - present      | \$72.2 million              | 44,000                    | X          | X   |          |                | X               | X               | X           |          | X          |
| Georgia Power PowerRewards                       | 2008-09             | N/A                         | 1,000                     | X          |     |          |                |                 | X               |             | X        |            |
| ISO-NE Demand Response Reserve Pilot             | 2006-10             | N/A                         | 109 assets                | X          | X   |          |                |                 | X               |             | X        |            |
| Oncor Smart Texas Program                        | 2009-12             | \$7.3 million (pilot only)  | 3.4 million               | X          |     |          |                |                 | X               | X           |          | X          |
| PEPCO PowerCentsDC                               | 2008-09;<br>2010-13 | \$44.6 million <sup>A</sup> | 280,000                   | X          |     |          |                | X               | X               |             | X        | X          |
| PGE Critical Peak Pricing Pilot                  | 2011 -13            | \$2 million                 | 1,000 Res                 | X          |     |          |                | X               | X               | X           |          |            |
| SDG&E Smart Meter Program                        | 2009-11             | \$572 million               | 1.4 million               | X          |     | X        |                | X               | X               | X           |          | X          |
| SRP Smart Grid Project                           | 2003-13             | \$114 million               | 935,000                   | X          | X   |          |                |                 | X               | X           |          | X          |
| Xcel Saver's Switch                              | 1990 - present      | \$8.5 million               | 314,000 Res<br>13,000 Com |            | X   |          |                | X               |                 | X           |          |            |

Notes: <sup>A</sup> = ARRA funding; Res = residential; Com = commercial; Dist Gen = distributed generation

**Table 3. Cancelled or Postponed Project Case Study Highlights**

| Project Name   | Dates          | Budget                | # of Customers   | Technology |     |          |                |                 |                 | Status      |                    |           | ARRA Funds |
|--|----------------|-----------------------|------------------|------------|-----|----------|----------------|-----------------|-----------------|-------------|--------------------|-----------|------------|
|  |                |                       |                  | AMI        | AMR | Dist Gen | Energy Storage | Smart Appliance | Dynamic Pricing | In Progress | Delayed/ Postponed | Cancelled |            |
| BGE Smart Meter Pilot Program                                      | 2009 - present | \$835 million         | 1.2 million      | X          | X   |          |                | X               | X               | X           |                    |           | X          |
| CL&P Plan-it Wise Energy Program                                   | 2009 - present | \$863 million         | 1.2 million      | X          | X   |          |                | X               | X               |             | X                  |           |            |
| Consumers Energy SmartStreet Pilot, Full Scale Smart Meter Project | 2008 - present | \$200 million (pilot) | 7,000 (pilot)    | X          | X   |          |                |                 | X               |             | X                  |           |            |
| DP&L Customer Conservation and Energy Management Plan              | 2009-11        | \$482.9 million       | 500,000          | X          | X   | X        |                | X               | X               |             |                    | X         |            |
| HECO Smart Meter Pilot Program                                     | 2006-10        | \$115 million         | 430,000          | X          | X   |          |                |                 | X               |             | X                  |           |            |
| LIPA BPL and Wireless Communications Demonstration                 | 2006-07        | ~ \$1 million         | 100 Res<br>5 Com |            | X   |          |                |                 |                 |             |                    | X         |            |
| PG&E SmartMeter Program  | 2006 - present | \$2 million           | 5.3 million      | X          | X   |          |                | X               | X               | X           |                    |           |            |
| PSE PEM Program  | 2000-03        | ~ \$9 million         | 300,000          | X          | X   |          |                |                 | X               |             |                    | X         |            |
| Snohomish County PUD Smart Grid Project                            | 2010-13        | \$31.6 million        | 320,000          | X          |     | X        |                | X               | X               |             | X                  |           | X          |
| Xcel Energy SmartGridCity  | 2009 - present | \$44.8 million        | 23,000           | X          | X   |          |                | X               | X               |             | X                  |           |            |

Notes: Res = residential; Com = commercial; Dist Gen = distributed generation

**Table 4. Drivers for Smart Grid Project Postponement or Cancellation**

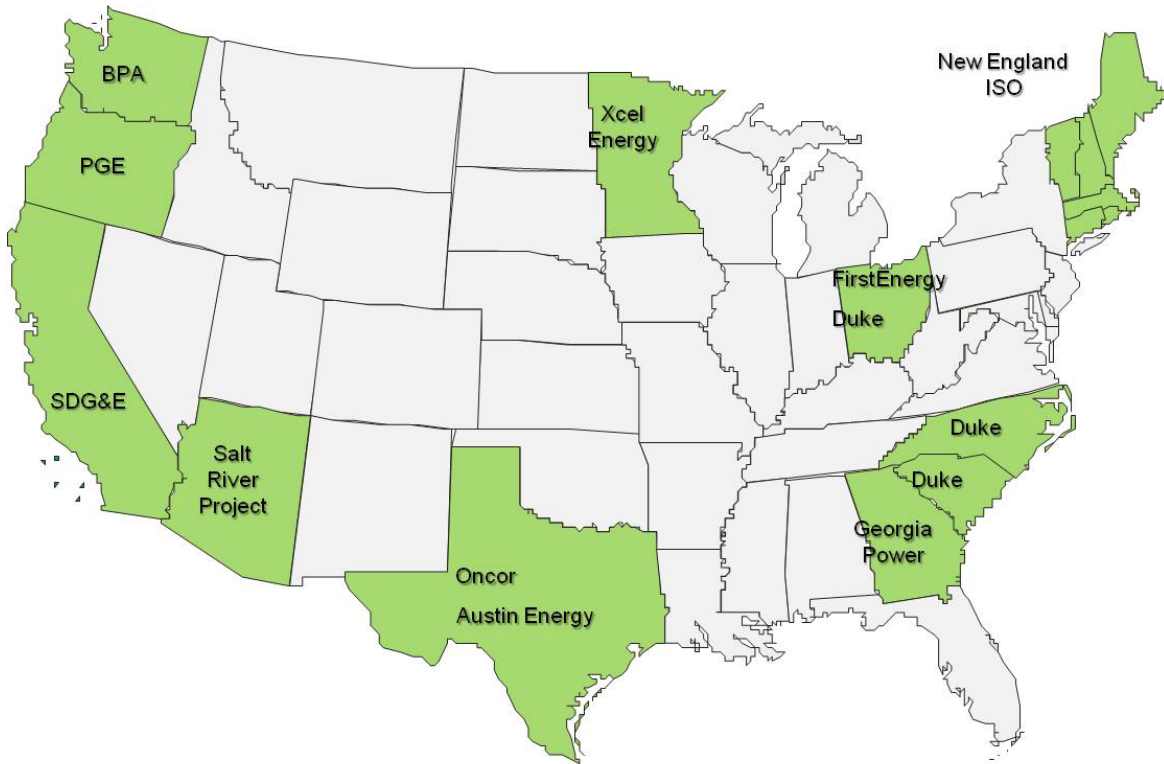
| Project Name  | Lack of Funding or Cost Issues | Customer Issues |                  |                                     |  |                         | Technological Issues                       |  | State/Local Regulatory Orders Causing Delays | Observing Other Pilot Projects before Proceeding |
|---|--------------------------------|-----------------|------------------|-------------------------------------|--|-------------------------|--|--|--|--|
|   |                                | Health Concerns | Privacy Concerns | Negative Response to Rate Increases | Inadequate Customer Education for Effective System Use | Customer Service Issues | Equipment or Construction Related Problems | Waiting for Technological Advancements |  |  |
| BGE Smart Meter Pilot Program                                 | ●                              |                 |                  | ◐                                   | ●  |                         |  | ◐                                      | ◐  |  |
| CL&P Plan-it Wise Energy Program                              | ●                              |                 | ◐                | ◐                                   |  |                         |  |  | ◐  |  |
| Consumers Energy SmartStreet Pilot and Full Scale Smart Meter | ●                              |                 |                  |                                     |  |                         |  | ◐                                      | ◐  | ◐  |
| DP&L Customer Conservation and Energy Management Plan         | ◐                              |                 | ◐                | ◐                                   |  |                         |  | ●                                      |  | ◐  |
| HECO Smart Meter Pilot Program                                | ◐                              |                 |                  |                                     |  |                         | ●  |  | ◐  |  |
| LIPA BPL and Wireless Communications Demonstration            | ●                              | ◐               |                  |                                     |  |                         | ●  |  |  |  |
| PG&E SmartMeter Program                                       |                                | ●               | ◐                |                                     | ◐  | ◐                       | ●  |  | ◐  |  |
| PSE PEM Program   | ◐                              | ◐               |                  | ●                                   | ◐  |                         |  |  | ◐  |  |
| Snohomish County PUD Smart Grid Project                       |                                |                 |                  | ◐                                   |  |                         |  | ●                                      |  |  |
| Xcel Energy SmartGridCity                                     | ●                              |                 | ◐                |                                     | ◐  |                         | ◐  |  | ◐  |  |

Notes:

- Key Driver for Postponement or Cancellation
- ◐ Other Driver for Postponement or Cancellation

# Case Studies of Successful or Progressing Smart Grid Projects

Figure 1. Locations of Successful/Progressing Smart Grid Project Case Studies



Source: SAIC

| <b>Austin Energy Pecan Street Project</b> |               |                      |                |
|---|---------------|----------------------|----------------|
| <b>Location:</b>                          | Austin, TX    | <b>Dates:</b>        | 2009-2015      |
| <b>Primary Utility/Entity:</b>            | Austin Energy | <b>ARRA Funding:</b> | \$10.4 million |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To define, test, and implement strategies to keep Austin at the forefront of clean technology innovation and job creation.</li> <li>• To investigate the technical, economic, and policy implications of an energy system that relies on better energy efficiency, locally generated renewable energy, and a new economic model for electricity utilities.</li> <li>• To integrate multiple smart grid technologies over the next five years.</li> </ul>  |
| Status                         | In progress  |
| Number of Participants         | <ul style="list-style-type: none"> <li>• 1,000 residents in the Mueller community</li> <li>• 75 businesses in the Mueller community</li> </ul>   |
| Participating Entities         | <ul style="list-style-type: none"> <li>• Representatives of the City of Austin</li> <li>• Austin Energy</li> <li>• The University of Texas</li> <li>• The Austin Technology Incubator</li> <li>• The Greater Austin Chamber of Commerce</li> <li>• Environmental Defense Fund</li> </ul>   |
| Program Budget                 | <ul style="list-style-type: none"> <li>• \$10.4 million smart grid demonstration grant from DOE</li> <li>• More than \$14 million in matching funds from project partners</li> </ul>   |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> </ul>  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Distributed clean energy</li> <li>• Energy storage technologies</li> <li>• Smart grid water and smart grid irrigation systems</li> <li>• Smart appliances</li> <li>• Plug-in electric vehicles</li> <li>• Advanced meters and home energy management systems</li> <li>• Green building</li> <li>• New electricity pricing models</li> </ul>   |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• Austin Energy website</li> <li>• Customer calls</li> <li>• Postcards</li> <li>• Door hangers</li> <li>• Local news coverage (television and newspaper)</li> <li>• Special newspaper insert spread</li> <li>• Notification of all Austin Energy personnel</li> <li>• Work with community coordinators to make special arrangements for life support customers</li> <li>• Notification of partnering social-service agencies that assist low-income clients and provided a presentation with the details</li> </ul> |

| <b>PROGRAM RESULTS</b>    |   |
|---------------------------|---|
| Key Findings              | N/A (Pilot study commenced February 2011.)  |
| Other Outcomes            | N/A   |
| Customer Feedback         | N/A   |
| Current Deployment Status | First phase of pilot (100 homes) commenced February 2011  |
| Future Implications       | N/A   |
| <b>IMPACTS/BENEFITS</b>   |   |
| Consumers                 | N/A (first phase commenced February 2011)   |
| Utilities                 | N/A (first phase commenced February 2011)   |
| Metrics Used              | First phase achieved an installed cost per home of \$341 (\$241 for equipment plus \$100 for installation)  |
| <b>RESOURCES</b>          |   |
| Program Website           | <a href="http://www.pecanstreetproject.org/">http://www.pecanstreetproject.org/</a>   |
| Full Program Report       | N/A   |
| Presentations             | N/A   |
| News Articles             | <ul style="list-style-type: none"> <li>• Pecan Street Project, News Feed, <a href="http://www.pecanstreetproject.org/news/">http://www.pecanstreetproject.org/news/</a>, accessed September 21, 2011</li> <li>• Cichon, Meg, "Can the Utility and Consumer Collaborate To Solve the Peak Problem?", RenewableEnergyWorld.com, <a href="http://www.renewableenergyworld.com/rea/news/article/2011/06/can-the-utility-and-consumer-collaborate-to-solve-the-peak-problem">http://www.renewableenergyworld.com/rea/news/article/2011/06/can-the-utility-and-consumer-collaborate-to-solve-the-peak-problem</a>, accessed September 21, 2011</li> </ul> |
| Other Resources           | Pecan Street Project, Working Group Recommendations, March 2010, <a href="http://www.sgiclearinghouse.org/node/3197">http://www.sgiclearinghouse.org/node/3197</a> , accessed September 21, 2011  |

### **PROGRAM DESCRIPTION**

The Pecan Street Project is a new smart grid project that went live February 1, 2011. It began in 2008 as a community collaboration to reinvent the energy system. The founding members enlisted several private companies to investigate the technical, economic, and policy implications of an energy system that relies on better energy efficiency, locally generated renewable energy, and a new economic model for electricity utilities. In August 2009, the founding partners joined together to create a separate non-profit corporation called Pecan Street Project, Inc. In March 2010 a report that included a narrative of the deliberations, assumptions, conclusions and recommendations of the Pecan Street Project team was shared with the Central Texas community. The Pecan Street Project will help define, test, and implement strategies to keep Austin at the forefront of clean technology innovation and job creation.

The first phase of the project went live at Austin's Mueller community in February 2011 and will integrate multiple smart grid technologies over the next five years. The home smart grid systems being used in this phase capture minute-to-minute energy usage for the whole home and six major appliances or systems. The first phase achieved an installed cost per home of \$341 (\$241 for equipment plus \$100 for installation).<sup>3</sup> The first phase included 100 homes at Mueller, all of which are green built and 11 of which have rooftop solar PV systems. During the spring of 2011, Pecan Street Project deployed the same systems in a second group of 100 homes outside Mueller that are at least 10 years old. Eventually, the

<sup>3</sup> Pecan Street Project, Best Buy, Freescale, Intel, Landis+Gyr, LG Electronics, Sony and Texas Gas Service Join Pecan Street Project Industry Advisory Council, <http://www.pecanstreetproject.org/2011/02/pecan-street-project-goes-live-with-first-phase-of-smart-grid-deployment/>, accessed September 21, 2011

installation and testing of smart meter technology will take place in a larger group of up to 1,000 residential and 75 commercial customers.

Austin Energy is focusing on customer education and service throughout the meter exchange, which is resulting in a low percentage of customers calling with questions and requesting accuracy tests. Customer services have included: (1) a call center with top performing employees who completed program-specific training, and (2) customer notification including postcards, customer calls, door hangers, local news coverage, special newspaper insert spreads, notification of partnering social-service agencies that assist low-income clients, along with other notification methods, all of which address the installation process and meter accuracy.

#### **UPDATES AS OF SEPTEMBER 2011**

Pecan Street Project has undertaken a variety of initiatives to promote collaborative research with other organizations. On June 28, 2011, Pecan Street Project announced the formation of its Industry Advisory Council, composed of a collection of member companies that will collaborate with Pecan Street Project and University of Texas researchers. Its founding member companies are Best Buy, Freescale, Intel, Landis+Gyr, LG Electronics USA, Sony and Texas Gas Service.<sup>4</sup>

Pecan Street Project announced on April 26, 2011 that it had acquired a site for a smart grid interoperability research facility in Austin's Mueller community. Known as the Home Research Lab, it will serve as a neutral, third-party research facility where researchers from Pecan Street Project, the University of Texas, the National Renewable Energy Laboratory, multiple utilities, and other private sector companies will be able to perform smart grid testing. Construction was set to begin September 2011, with operations commencing in March 2012.<sup>5</sup>

Pecan Street Project researchers are also planning to work with Austin Energy in 2012 to investigate consumer responses to various pricing scenarios, possibly including time of use (YOU) rates, flat rates, and a "cell phone" rate under which consumers first purchase a bundle of energy, then pay for additional use.<sup>6</sup>

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<sup>4</sup> Pecan Street Project, <http://www.pecanstreet.org/2011/06/best-buy-freescale-intel-landisgyr-lg-electronics-sony-and-texas-gas-service-join-pecan-street-project-industry-advisory-council/>, accessed September 21, 2011

<sup>5</sup> Pecan Street Project, Pecan Street Project, NREL and UT begin design of Home Research Lab, <http://www.pecanstreet.org/2011/04/pecan-street-project-nrel-and-ut-begin-design-of-home-research-lab/>, accessed September 21, 2011

<sup>6</sup> Cichon, Meg, Can the Utility and Consumer Collaborate To Solve the Peak Problem?, RenewableEnergyWorld.com, <http://www.renewableenergyworld.com/rea/news/article/2011/06/can-the-utility-and-consumer-collaborate-to-solve-the-peak-problem>, accessed September 21, 2011

| <b>BPA Pacific Northwest GridWise™ Demonstration Project</b> |   |                      |             |
|--|---|----------------------|-------------|
| <b>Location:</b>   | Washington  | <b>Dates:</b>        | 2006 – 2007 |
| <b>Primary Utility/Entity:</b>                               | Bonneville Power Administration (BPA), PacifiCorp, Portland General Electric (PGE), City of Port Angeles, Clallam County PUD #1 | <b>ARRA Funding:</b> | No          |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• Project consisted of two separate demand-response studies, the Grid Friendly Appliance Project and the Olympic Peninsula Project, conducted concurrently</li> <li>• To test whether smart grid technologies and consumers could have a significant impact on the electricity grid</li> <li>• To search for potential hurdles and to measure the potential effect of nationwide adoption of smart grid technologies and processes</li> </ul> |
| Status                         | Completed, successful  |
| Number of Participants         | <ul style="list-style-type: none"> <li>• 150 - Grid Friendly Appliance Project (GFAP)_</li> <li>• 112 - Olympic Peninsula Project</li> </ul>   |
| Participating Entities         | <ul style="list-style-type: none"> <li>• BPA</li> <li>• PacifiCorp</li> <li>• PGE</li> <li>• City of Port Angeles</li> <li>• Clallam County PUD #1 (municipal utility)</li> <li>• Pacific Northwest National Laboratory (PNNL), managed programs</li> <li>• IBM Research</li> <li>• Whirlpool Corp. (in-kind software/appliance contributions)</li> <li>• DOE</li> <li>• Gridwise Alliance (MOU allowed for development of Gridwise Initiative)</li> </ul>                           |
| Program Budget                 | N/A  |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential (both programs)</li> <li>• Commercial</li> <li>• Industrial</li> <li>• Municipal water pumps (Olympic Peninsula Project only)</li> </ul>  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Grid-friendly appliances/Smart Appliances: dryers, water heaters, thermostats</li> <li>• Internet-based event-driven software established, allowing “shadow” two-way clearing market with 5-minute intervals</li> </ul>   |
| Consumer Education Measures    | Provided materials to help with automated responses and voluntary actions to obtain greater benefits and contract information on three pricing plans   |
| <b>PROGRAM RESULTS</b>         |  |
| Key Findings                   | Olympic Peninsula Project: savings were realized and participants were satisfied; however, much of the energy savings were a result of the automation technologies used, with relatively few savings resulting from active behavior on the part of participants. For GFAP, short-term load reduction was successful, but a larger-scale experiment may be desired in order to measure potential savings.   |



|                           |  |
|---------------------------|--|
| Other Outcomes            | Automatic settings rarely changed by participants unless settings fail, after which some resistance occurs to control actions.   |
| Customer Feedback         | General satisfaction with programs. Most participants would sign up for a TOU pricing plan in the future. GFAP load reduction was barely noticed.  |
| Current Deployment Status | Project has been completed   |
| Future Implications       | Additional TOU pricing pilots and programs have been developed and implemented since the Gridwise Initiative data collection period. Use of GFAP technologies has been less widespread.  |
| <b>IMPACTS/BENEFITS</b>   |  |
| Consumers                 | Substantial dollar savings on electricity bill possible without active behavior; even more savings possible by actively managing demand. Future utility bills could be lower as a result of lower aggregate peak demand.   |
| Utilities                 | Possible savings from decreased need for new capital investments in generation, transmission, and distribution as result of lower peak demand.   |
| Metrics Used              | <p>Olympic Peninsula Project:</p> <ul style="list-style-type: none"> <li>• Peak Demand Savings: Mean peak reduction measured by feeder constraint period: 29.7 percent for 500-kW (fall), 19.0 percent for 750-kW (winter). No measurement provided for 1500-kW (summer) period, which did not need peak management.</li> <li>• Energy Savings: Measured as mean daily energy consumption per home, versus control group. Only TOU customers had less mean overall energy use than control group (37 vs. 47 kWh/day).</li> <li>• Customer Savings: Customers saved an average of 10 percent from previous year's electricity bill. For the control group, monthly savings averaged between 2-30 percent, with median monthly dollar savings ranging from \$1.98 to \$40.64.</li> </ul> <p>GFAP:</p> <ul style="list-style-type: none"> <li>• Load Reduction: 3-30 kW of load reduction for clothes dryers and 5-35 kW of load reduction for water heaters</li> </ul> |
| <b>RESOURCES</b>          |  |
| Program Website           | N/A  |
| Full Program Report       | <ul style="list-style-type: none"> <li>• Pacific Northwest GridWise™ Testbed Demonstration Projects, Part I: Olympic Peninsula Project, <a href="http://www.pnl.gov/main/publications/external/technical_reports/PNNL-17167.pdf">http://www.pnl.gov/main/publications/external/technical_reports/PNNL-17167.pdf</a>, accessed September 21, 2011</li> <li>• Pacific Northwest GridWise™ Testbed Demonstration Projects, Part II: Grid Friendly Appliance Project, <a href="http://www.pnl.gov/main/publications/external/technical_reports/PNNL-17079.pdf">http://www.pnl.gov/main/publications/external/technical_reports/PNNL-17079.pdf</a>, accessed September 21, 2011</li> </ul>  |
| <b>RESOURCES</b>          |  |
| Presentations             | PNNL, GridWise Demonstration Project Fast Facts, <a href="http://www.sgiclearinghouse.org/Resources?q=node/1346&amp;lb=1">http://www.sgiclearinghouse.org/Resources?q=node/1346&amp;lb=1</a> , accessed September 21, 2011   |
| News Articles             | N/A  |
| Other Resources           | GridWise Alliance and DOE, GridWise Action Plan, <a href="http://www.smartgridnews.com/pdf/GridWiseAction.pdf">http://www.smartgridnews.com/pdf/GridWiseAction.pdf</a> , accessed September 21, 2011   |

## PROGRAM DESCRIPTION

The Pacific Northwest GridWise Demonstration Project, known as the Gridwise Initiative, was a test of DR concepts and technologies. The project consisted of two separate demand-response studies, the Grid Friendly Appliance Project (GFAP) and Olympic Peninsula Project. The studies were conducted concurrently by PNNL in conjunction with local utilities and industry partners. The data collection period was April 2006 through March 2007. Financial support came from DOE, resulting from a 2004 MOU between DOE and the Gridwise Alliance, an organization made up of utilities and other stakeholders to promote smart grid initiatives.

The GFAP installed controllers on 150 clothes dryers and 50 water heaters in various locations in Washington and Oregon. When the controller recorded an AC signal frequency below 59.95 Hz, this was considered a high-demand “event” and, in response, the controller shut off some of the appliance functionality. Roughly one event per day occurred in the year of the program, ranging in length from 16 seconds to 10 minutes. Overall curtailment ranged from 3-30 kW of load reduction for the clothes dryers and 5-35 kW of load reduction for the water heaters, and customers were hardly inconvenienced. However, the study was conducted at such a small scale that PNNL recommended a larger study to gauge the potential energy savings of the technology tested.

With the Olympic Peninsula Project, 112 participants from the Port Angeles area in Washington State were provided with a choice of pricing plans for the one-year duration of the program. The three pricing plans, as shown in Table 5, were: fixed price, real time price (RTP), and TOU with critical peak price (CPP). A virtual “shadow” energy market was created, allowing for electricity prices to change every five minutes. Participants were assigned to one of the three pricing plans along with a fourth control group in roughly equal numbers. Users were given an average of \$150 (which could be more or less depending on energy savings) for participation.

**Table 5. BPA Olympic Peninsula Project Price Reduction by Price Group**

| Price Group | Mean Monthly Consumer Savings | Median Monthly Consumer Savings (\$/month) |
|-------------|-------------------------------|--|
| Fixed       | 2%                            | \$1.98                                     |
| TOU/CPP     | 30%                           | \$28.62                                    |
| RTP         | 27%                           | \$40.64                                    |

Source: Pacific Northwest GridWise Testbed Demonstration Projects. Part I. Olympic Peninsula Project, [http://www.pnl.gov/main/publications/external/technical\\_reports/PNNL-17167.pdf](http://www.pnl.gov/main/publications/external/technical_reports/PNNL-17167.pdf), September 21, 2011

Although there were a few hiccups (electricity use exceeded the agreed threshold once, water heater technology did not work as expected), the program was deemed successful. Participants were satisfied, peak usage declined, and bills were lower, particularly for the RTP and TOU groups. Interestingly, much of the decline in peak demand can be attributed to automated responses from the smart appliances installed. Default settings, which would shut off appliance usage at critical high-price times, were rarely overridden. The greatest median price reduction, relative to the control group, was seen in the RTP group, but the mean reduction was higher among the TOU/CPP group.

## UPDATES AS OF SEPTEMBER 2011

There are no significant updates to this case study as of September 2011.

## Duke Energy Carolinas Grid Modernization Project

|                                |                          |                      |              |
|--------------------------------|--------------------------|----------------------|--------------|
| <b>Location:</b>               | North and South Carolina | <b>Dates:</b>        | 2009-Present |
| <b>Primary Utility/Entity:</b> | Duke Energy              | <b>ARRA Funding:</b> | \$4 million  |

| PROGRAM INFORMATION            |   |
|--------------------------------|---|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To implement distribution automation to help prevent and shorten outages.</li> <li>• To enable AMR and reduce the need for estimated bills.</li> <li>• To enable remote service connections and disconnections for faster customer service.</li> <li>• To capture and post daily energy usage data online so customers can make wiser energy decisions.</li> <li>• To incorporate more renewable, distributed generation into the grid.</li> </ul>   |
| Status                         | In progress   |
| Number of Participants         | <ul style="list-style-type: none"> <li>• Approximately 17,000 digital smart meters and other automated equipment in parts of North Carolina and South Carolina.</li> <li>• 100 residents included in in-home energy management system pilot in North Carolina. Will be expanded to 8,300 customers.</li> </ul>  |
| Participating Entities         | <ul style="list-style-type: none"> <li>• Duke Energy</li> <li>• Echelon Corporation</li> <li>• General Electric</li> <li>• Ambient Corporation</li> <li>• Cisco (home energy management system)</li> </ul>  |
| Program Budget                 | <ul style="list-style-type: none"> <li>• Cost of pilot projects: up to \$7.5 million.</li> <li>• Parent company has allocated \$1 billion through 2015 for smart grid technology in North Carolina, South Carolina, and other service territories.</li> <li>• \$204 million in smart grid stimulus funds received:               <ul style="list-style-type: none"> <li>○ \$4 million will support the installation of digital transmission system upgrades in the Carolinas.</li> <li>○ \$200 million to support the modernization of power distribution system throughout Ohio, Indiana and Kentucky.</li> </ul> </li> <li>• Also received \$3.5 million for workforce development and training from DOE</li> </ul> |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> <li>• Industrial</li> </ul>   |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Echelon smart meters capable of two-way communication; PLC technology.</li> <li>• New distribution automation equipment including electronic breakers, digital sensors, 45 new phasor measurement units, and automated switching devices. Some equipment will operate automatically to restore power.</li> <li>• New distribution system communications nodes.</li> <li>• Cisco Home Energy Management Solution on an IP-based, open system network platform.</li> <li>• Development of dynamic pricing programs.</li> <li>• Support for the deployment of plug-in electric vehicles.</li> </ul>   |
| Consumer Education Measures    | FAQ page on company website devoted to smart grid questions.  |

| <b>PROGRAM RESULTS</b>    |  |
|---------------------------|--|
| Key Findings              | Home energy management system pilot conducted in North Carolina needs significant investments in customer education for effective use.   |
| Other Outcomes            | N/A  |
| Customer Feedback         | <ul style="list-style-type: none"> <li>Customers found the usability of the home energy management system in the North Carolina pilot less than optimal, as showcased by the many customer calls to the utility's call center.</li> <li>North Carolina and South Carolina pilots in progress; customer feedback not found in the identified sources.</li> </ul>  |
| Current Deployment Status | <ul style="list-style-type: none"> <li>Installed approximately 17,000 digital smart meters and other automated equipment in northern Greenville County in South Carolina and in Charlotte in North Carolina.</li> <li>Over 150 residential customers received in-home energy management systems installed in North Carolina in 2009 and 2010. In 2011, 50 residential customers are receiving next-generation systems.</li> <li>Working through regulatory process with PUC in North Carolina and South Carolina to finalize full-scale deployments in service areas.</li> </ul>   |
| Future Implications       | N/A  |
| <b>IMPACTS/BENEFITS</b>   |  |
| Consumers                 | 150 residential customers in home energy management system pilot in North Carolina. Large number of customers needed assistance with system after deployment.  |
| Utilities                 | Duke Energy received feedback that more customer education measures were needed prior to deployment.   |
| Metrics Used              | Customer calls received by call center: five to eight calls received each month which totals to an average of 78 calls during the year of testing.   |
| <b>RESOURCES</b>          |  |
| Program Website           | Duke Energy, Smart Grid FAQ, <a href="http://www.duke-energy.com/about-us/smart-grid-faq.asp">http://www.duke-energy.com/about-us/smart-grid-faq.asp</a> , accessed September 21, 2011.  |
| Full Program Report       | Residential Energy Management System Pilot Program in North Carolina: <a href="http://www.duke-energy.com/pdfs/NCREMS.pdf">http://www.duke-energy.com/pdfs/NCREMS.pdf</a> , accessed September 21, 2011  |
| Presentations             | KEMA Consulting and Duke Energy, Duke Energy's Utility of the Future Project, <a href="http://www.sessionview.com/data/postevent/GI-07/Will-McNamara-25558886.pdf">http://www.sessionview.com/data/postevent/GI-07/Will-McNamara-25558886.pdf</a> , accessed September 21, 2011.   |
| News Articles             | <ul style="list-style-type: none"> <li>Business Courier, Duke Energy Wins \$200 million smart grid grant, October 28, 2009, <a href="http://www.bizjournals.com/cincinnati/stories/2009/10/26/daily21.html#">http://www.bizjournals.com/cincinnati/stories/2009/10/26/daily21.html#</a>, accessed September 21, 2011.</li> <li>World Economic Forum, Accelerating Successful Smart Grid Pilots, <a href="http://www.smartgridnews.com/artman/uploads/1/WEF_EN_SmartGrids_Pilots_Report_2010_1.pdf">http://www.smartgridnews.com/artman/uploads/1/WEF_EN_SmartGrids_Pilots_Report_2010_1.pdf</a>, accessed September 21, 2011</li> <li>St. John, Jeff, Integral Analytics: Orchestrating Duke's 'Virtual Power Plant,' Green Media Quarterly, June 18, 2009, <a href="http://www.greentechmedia.com/articles/read/integral-analytics-orchestrating-dukes-virtual-power-plant/">http://www.greentechmedia.com/articles/read/integral-analytics-orchestrating-dukes-virtual-power-plant/</a>, accessed September 21, 2011.</li> </ul> |

|                 |  |
|-----------------|--|
|                 | <ul style="list-style-type: none"> <li>• Duke Energy, Duke Energy Reaches Agreement with DOE to Accept \$204 Million in Stimulus Funds to Support Grid Modernization, May 13, 2010, <a href="http://www.duke-energy.com/news/releases/2010051301.asp">http://www.duke-energy.com/news/releases/2010051301.asp</a>, accessed September 21, 2011.</li> <li>• Downey, John, Duke energy to team with wireless carriers on smart grid, Charlotte Business Journal, <a href="http://www.bizjournals.com/charlotte/print-edition/2011/08/19/Duke-to-team-with-wireless-carriers-on.html?page=all">http://www.bizjournals.com/charlotte/print-edition/2011/08/19/Duke-to-team-with-wireless-carriers-on.html?page=all</a>, accessed September 21, 2011</li> </ul> |
| Other Resources | Smartgrid.gov, Duke Energy (PMU Deployment in the Carolinas with Communication System Modernization), <a href="http://www.smartgrid.gov/project/duke_energy_pmu_deployment_carolinas_communication_system_modernization">http://www.smartgrid.gov/project/duke_energy_pmu_deployment_carolinas_communication_system_modernization</a> , accessed September 21, 2011.   |

### PROGRAM DESCRIPTION

In 2009, DOE awarded Duke Energy \$200 million in ARRA funding for smart grid projects in the Midwest and another \$4 million for projects in the Carolinas. The projects in each State include the development of an open, interoperable, two-way communications network, deployment of smart meters, distribution system automation, dynamic pricing programs, and deployment of supporting technologies for plug-in electric vehicles.<sup>7</sup> In North Carolina and South Carolina, the company is implementing pilot programs.

Through the company website, Duke Energy reiterates that the smart meters are mandatory for all customers and the company reassures customers that all meters have been thoroughly tested through an enhanced testing procedure. The procedure includes, at a minimum, testing a percentage of all meters received from the vendor before installation, and in some cases, all meters in a shipment are tested. The company also conducts meter testing after installation. Duke Energy indicates that the meters will not have the capability of immediately alerting the utility when there is a power outage; customers still must call to report outages.<sup>8</sup>

In a 2009 pilot program conducted in Charlotte, North Carolina, Duke Energy tested the capabilities of its home energy management system with 100 residential customers, though up to 200 volunteers could participate. The home energy management system allows the customer to manage consumption according to pre-set energy usage settings and preferences, alterable at any time through a web portal.<sup>9</sup> Duke Energy account executives had assisted industrial customers individually with energy management in the past, including capital investment decisions, and the company was ready to increase the scale of these services to residential customers. This would scale the number of one-on-one customer relationships up from the thousands to millions.<sup>10</sup> The call center established by Duke Energy to provide support for the system received roughly five to eight calls each month from customers with questions about using the system. It was discovered that customers needed more robust training to use the system effectively.

In the summer of 2010, Duke Energy expanded its home energy management pilot to include more customers with smart meters in North Carolina, implementing the first-generation Cisco Home Energy

<sup>7</sup> DOE, Recovery Act Selections For Smart Grid Investment Grant Awards – By State, <http://energy.gov/oe/downloads/recovery-act-selections-smart-grid-investment-grant-awards-state>, accessed September 21, 2011

<sup>8</sup> Duke Energy, Smart Grid FAQ, <http://www.duke-energy.com/about-us/smart-grid-faq.asp>, accessed September 21, 2011

<sup>9</sup> Duke Energy, Residential Energy Management System Pilot Program (NC), March 10, 2009, <http://www.duke-energy.com/pdfs/NCREMS.pdf>, accessed September 21, 2011

<sup>10</sup> Geschickter, Chet, Wanted: Chief Customer Officer for Utility Rolling Out Smart Grid, Greentech Media, Inc., <http://www.greentechmedia.com/articles/read/wanted-chief-customer-officer-for-utility-rolling-out-smart-grid/>, accessed September 21, 2011

Management Solution. The system consists of a countertop, touch screen device, supported on an IP-based, open system network. Duke Energy further planned to include manufacturers of household products like appliances, electrical outlets, air conditioners, water heaters and plug-in electric vehicles to create a suite of products compatible with the Cisco Home Energy Management Solution.<sup>11</sup> Altogether, more than 150 residential customers tested Duke Energy's first-generation home energy management system in 2009 and 2010.

In updating the grid infrastructure in its service territory, a key component of the system is the transmission system communications node. These nodes are located at the ground level beneath electric power transformers. Communication nodes are a crucial part of the billing and power grid management systems because they collect information from numerous digital devices in the area, and transmit the information over a telecommunications network to the utility.<sup>12</sup> Additionally, the project includes installation of 45 phasor measurement units in substations and upgrades to communications infrastructure at the corporate control center.

#### **UPDATES AS OF SEPTEMBER 2011**

Following up on its 2009 and 2010 pilot program, Duke Energy reported that 50 residential customers are receiving next-generation home energy management systems in 2011. These next-generation systems feature handheld, touch-screen devices.<sup>13</sup>

Duke Energy is planning to present its proposed smart grid architecture at conferences in Washington and Raleigh in September and November 2011 respectively. The company plans to rely on wireless carriers and other existing infrastructure, rather than building its own proprietary network.<sup>14</sup>

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<sup>11</sup> Duke Energy, Duke Energy Signs Agreement with Cisco to Deliver Smart Grid-Enabled Home Energy Management Solution, June 29, 2010, <http://www.duke-energy.com/news/releases/2010062901.asp>, accessed September 21, 2011

<sup>12</sup> Duke Energy, Duke Energy Takes Steps to Further Advance Its Smart Grid Communications Architecture, Sept. 2, 2010, <http://www.duke-energy.com/news/releases/2010090201.asp>, accessed September 21, 2011

<sup>13</sup> Duke Energy, Charlotteans Testing Advanced Energy Technologies, <http://sustainabilityreport.duke-energy.com/innovative-products-and-services/charlotteans-testing-advanced-energy-technologies/>, accessed September 21, 2011

<sup>14</sup> Downey, John, Duke Energy to team with wireless carriers on smart grid, Charlotte Business Journal, <http://www.bizjournals.com/charlotte/print-edition/2011/08/19/Duke-to-team-with-wireless-carriers-on.html?page=all>, accessed September 21, 2011

| <b>Duke Energy Ohio Grid Modernization Project</b> |             |                      |  |
|--|-------------|----------------------|--|
| <b>Location:</b>                                   | Ohio        | <b>Dates:</b>        | 2008-Present   |
| <b>Primary Utility/Entity:</b>                     | Duke Energy | <b>ARRA Funding:</b> | \$100 million<br>(estimated allocation for Ohio project) |

| <b>PROGRAM INFORMATION</b>     |   |
|--------------------------------|---|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To implement distribution automation to help prevent and shorten outages.</li> <li>• To enable AMR and reduce the need for estimated bills.</li> <li>• To enable remote service connections and disconnections for faster customer service.</li> <li>• To capture and post daily energy usage data online so customers can make wiser energy decisions.</li> <li>• To incorporate more renewable, distributed generation into the grid.</li> </ul>   |
| Status                         | In progress   |
| Number of Participants         | <ul style="list-style-type: none"> <li>• 700,000 customers in Ohio.</li> <li>• ~ 140,000 new smart grid meters have been installed since 2008 in Ohio.</li> </ul>   |
| Participating Entities         | <ul style="list-style-type: none"> <li>• Duke Energy</li> <li>• Echelon Corporation</li> <li>• Ambient Corporation</li> <li>• Cisco (home energy management system)</li> </ul>  |
| Program Budget                 | <ul style="list-style-type: none"> <li>• Parent company has allocated \$1 billion through 2015 for smart grid technology in Ohio and other service territories.</li> <li>• \$204 million in smart grid stimulus funds received (total): <ul style="list-style-type: none"> <li>○ Duke Energy Ohio estimates around \$100 million of the grant will be used in Ohio to support the modernization of the power distribution system.</li> <li>○ Estimated \$100 million to support power distribution system upgrades throughout Indiana and Kentucky.</li> <li>○ \$4 million will support the installation of digital transmission system upgrades in the Carolinas.</li> </ul> </li> </ul> |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> <li>• Industrial</li> </ul>   |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Echelon smart meters capable of two-way communication; PLC technology.</li> <li>• New distribution automation equipment including electronic breakers, digital sensors and automated switching devices. Some equipment will operate automatically to restore power.</li> <li>• New distribution system communications nodes.</li> <li>• Cisco Home Energy Management Solution on an IP-based, open system network platform.</li> <li>• Development of dynamic pricing programs.</li> <li>• Support for the deployment of plug-in electric vehicles.</li> <li>• Communications nodes to transmit, locally aggregate and manage data.</li> </ul>   |

|                             |   |
|-----------------------------|---|
| Consumer Education Measures | <ul style="list-style-type: none"> <li>Customers are notified via mail and door hangers when the new meter is installed. Additional letters to customers confirm that Duke Energy can read the meter remotely.</li> <li>FAQ page on company website devoted to smart grid questions.</li> </ul>   |
| <b>PROGRAM RESULTS</b>      |   |
| Key Findings                | <ul style="list-style-type: none"> <li>Success of in-home energy management system deployment has led to an expansion of the program into Ohio.</li> <li>Duke Energy chose the Echelon NES System due to its open framework, to maximize compatibility with future technologies.</li> </ul>   |
| Other Outcomes              | N/A   |
| Customer Feedback           | N/A   |
| Current Deployment Status   | As of February 2011, Duke Energy Ohio has installed 139,000 smart meters in its service area (Cincinnati and Warren County).  |
| Future Implications         | <ul style="list-style-type: none"> <li>Ohio PUC opened a case in February 2011 to discuss data privacy issues. Duke Energy supports the initiation of workshops to bring all stakeholders together to work through issues.</li> <li>Proceeding with full-scale smart meter installations in Ohio.</li> </ul>  |
| <b>IMPACTS/BENEFITS</b>     |   |
| Consumers                   | <ul style="list-style-type: none"> <li>Improved accuracy of billing.</li> <li>Energy use information available in near real time.</li> </ul>  |
| Utilities                   | <ul style="list-style-type: none"> <li>Decreased billing calls due to reduced bill estimates.</li> <li>Reduced outage time.</li> <li>Reduction of system losses due to improved modeling.</li> <li>Improved data for investment planning.</li> </ul>  |
| Metrics Used                | <ul style="list-style-type: none"> <li>Outage duration</li> <li>Customer calls</li> <li>Number of estimated bills</li> </ul>  |
| <b>RESOURCES</b>            |   |
| Program Website             | Duke Energy, Smart Grid FAQ, <a href="http://www.duke-energy.com/about-us/smart-grid-faq.asp">http://www.duke-energy.com/about-us/smart-grid-faq.asp</a> , accessed September 21, 2011.   |
| Full Program Report         | Duke Energy, Echelon E2L, April 23, 2008, <a href="http://www.puco.ohio.gov/emplibrary/files/util/RFPs%5C10-2326-GE-RDR%5CAttachments%201-5.pdf">http://www.puco.ohio.gov/emplibrary/files/util/RFPs%5C10-2326-GE-RDR%5CAttachments%201-5.pdf</a> , accessed September 21, 2011.  |
| Presentations               | N/A   |
| News Articles               | <ul style="list-style-type: none"> <li>Business Courier, Duke Energy Wins \$200 million smart grid grant, October 28, 2009, <a href="http://www.bizjournals.com/cincinnati/stories/2009/10/26/daily21.html#">http://www.bizjournals.com/cincinnati/stories/2009/10/26/daily21.html#</a>, accessed September 21, 2011.</li> <li>World Economic Forum, Accelerating Successful Smart Grid Pilots, <a href="http://www.smartgridnews.com/artman/uploads/1/WEF_EN_SmartGrids_Pilots_Report_2010_1_.pdf">http://www.smartgridnews.com/artman/uploads/1/WEF_EN_SmartGrids_Pilots_Report_2010_1_.pdf</a>, accessed September 21, 2011.</li> <li>St. John, Jeff, Integral Analytics: Orchestrating Duke's 'Virtual Power Plant,' Green Media Quarterly, June 18, 2009, <a href="http://www.greentechmedia.com/articles/read/integral-analytics-orchestrating-dukes-virtual-power-plant/">http://www.greentechmedia.com/articles/read/integral-analytics-orchestrating-dukes-virtual-power-plant/</a>, accessed September 21, 2011.</li> <li>Duke Energy, Duke Energy Reaches Agreement with DOE to Accept \$204 Million in Stimulus Funds to Support Grid Modernization, May 13, 2010,</li> </ul> |



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|-----------------|--|
|                 | <p><a href="http://www.duke-energy.com/news/releases/2010051301.asp">http://www.duke-energy.com/news/releases/2010051301.asp</a>, accessed September 21, 2011.</p> <ul style="list-style-type: none"> <li>Duke Energy, Echelon E2L, <a href="http://www.puco.ohio.gov/emplibrary/files/util/RFPs%5C10-2326-GE-RDR%5CAttachments%201-5.pdf">http://www.puco.ohio.gov/emplibrary/files/util/RFPs%5C10-2326-GE-RDR%5CAttachments%201-5.pdf</a>, accessed September 21, 2011.</li> </ul>   |
| Other Resources | <ul style="list-style-type: none"> <li>SGIC, Smart Grid Projects, <a href="http://www.sgicclearinghouse.org/ProjectList?voc_18=802&amp;voc_36=All&amp;submit=Apply">http://www.sgicclearinghouse.org/ProjectList?voc_18=802&amp;voc_36=All&amp;submit=Apply</a>, accessed September 21, 2011.</li> <li>Duke Energy, 2010   2011 Sustainability Report, Delivering Today. Investing for our Future, <a href="http://www.duke-energy.com/pdfs/10-11-sustainability-report.pdf">http://www.duke-energy.com/pdfs/10-11-sustainability-report.pdf</a>, accessed September 21, 2011</li> <li>Masters, David, Duke Energy: Developing the communications platform to enable a more intelligent electric grid, <a href="http://www.duke-energy.com/pdfs/OP-David-Masters-SmartGrid-Comm-Platform-02-01-11.pdf">http://www.duke-energy.com/pdfs/OP-David-Masters-SmartGrid-Comm-Platform-02-01-11.pdf</a>, accessed September 21, 2011</li> </ul> |

### PROGRAM DESCRIPTION

In late 2008, Duke Energy received approval from the Ohio PUC to implement smart electric meters, smart gas meters and new transmission system communication nodes in the State. In 2009, DOE awarded Duke Energy \$200 million of ARRA funding for smart grid projects in the Midwest and another \$4 million for projects in the Carolinas. The projects in each State include the development of an open, interoperable, two-way communications network, deployment of smart meters, distribution system automation, dynamic pricing programs, and deployment of supporting technologies for plug-in electric vehicles.<sup>15</sup>

Through the company website, Duke Energy reiterates that the smart meters are mandatory for all customers and the company reassures customers that all meters have been thoroughly tested through an enhanced testing procedure. The procedure includes, at a minimum, testing a percentage of all meters received from the vendor before installation, and in some cases, all meters in a shipment are tested. The company also conducts meter testing after installation. Duke Energy indicates that the meters will not have the capability of immediately alerting the utility when there is a power outage; customers still must call to report outages.<sup>16</sup>

By 2009, Duke Energy Ohio installed 60,000 smart electric meters, 40,000 smart gas meters, and 4,000 communication nodes in Ohio. By 2014, a total of 700,000 smart electric and 450,000 smart gas meters will be installed.<sup>17</sup> The PUC approved a rate increase of 49¢ more per month for residential customers to pay for these projects.<sup>18</sup>

In the summer of 2010, Duke Energy expanded its home energy management pilot to include customers with smart meters in Ohio, using the first-generation Cisco Home Energy Management Solution. The home energy management system allows the customer to manage consumption according to pre-set

<sup>15</sup> DOE, Recovery Act Selections For Smart Grid Investment Grant Awards – By State, <http://energy.gov/oe/downloads/recovery-act-selections-smart-grid-investment-grant-awards-state>, accessed September 21, 2011.

<sup>16</sup> Duke Energy, Smart Grid FAQ, <http://www.duke-energy.com/about-us/smart-grid-faq.asp>, accessed September 21, 2011.

<sup>17</sup> Ibid.

<sup>18</sup> Nolan, John, Duke Energy customers paying for smart meter deployment, Middletown Journal, May 19, 2010, <http://www.middletownjournal.com/news/middletown-business-news/duke-energy-customers-paying-for-smart-meter-deployment-716340.html>, accessed September 21, 2011

energy usage settings and preferences, alterable at any time through a web portal.<sup>19</sup> Duke Energy account executives had assisted industrial customers individually with energy management in the past, including capital investment decisions, and the company was ready to increase the scale of these services to residential customers. The system consists of a countertop, touch screen device, supported on an IP-based, open system network. Duke Energy further plans to include manufacturers of household products like appliances, electrical outlets, air conditioners, water heaters and plug-in electric vehicles to create a suite of products compatible with the Cisco Home Energy Management Solution.<sup>20</sup>

In updating the grid infrastructure in its service territory, a key component of the system is the transmission system communications node. These nodes are located at the ground level beneath electric power transformers. Communication nodes are a crucial part of the billing and power grid management systems because they collect information from numerous digital devices in the area, and transmit the information over a telecommunications network to the utility.<sup>21</sup> Additionally, the project includes installation of 45 phasor measurement units in substations and upgrades to communications infrastructure at the corporate control center.

In Ohio, Duke Energy chose the Echelon NES System as the backbone for its automated distribution network communication nodes. This equipment is installed at the “edge of the grid,” also known as the “last mile” of the distribution grid where the electricity distribution network connects to customers. With this platform developers can quickly create new software-enabled services via an open application framework tailored to the utility’s needs, in a system classified as self healing. The ability for the system to adapt to new technology through its open design is an attractive attribute for utilities, particularly since smart grid standards have only recently been put in place.<sup>22</sup>

In February 2011, the Ohio PUC opened case number 11-0277-GE-UNC, to begin a discussion of customer privacy protection and customer data access issues associated with the smart grid. Duke Energy Ohio submitted comments on March 4, 2011 recommending the launch of workshops to help inform and encourage discussion among utilities, customers, and other stakeholders regarding customer energy usage data privacy standards including storage, formatting, and third party access. In addition, Duke Energy requested such workshops to address the option of eliminating the ability for consumers to opt out of sharing customer energy usage data with their electric utility.<sup>23</sup>

#### **UPDATES AS OF SEPTEMBER 2011**

Duke Energy reported in its 2010 | 2011 Sustainability Report that the company has installed approximately 140,000 smart meters in its Ohio service territory since 2008. The company is currently installing distribution automation equipment, such as relays, circuit breakers and sensors. This equipment is designed to shorten and prevent power outages, while improving the electric system’s efficiency. Duke Energy is set to install over 1 million smart electric and gas meters and other components over the course of the next five years.<sup>24</sup>

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<sup>19</sup> Duke Energy, Residential Energy Management System Pilot Program (NC), March 10, 2009, <http://www.duke-energy.com/pdfs/NCREMS.pdf>, accessed September 21, 2011

<sup>20</sup> Duke Energy, Duke Energy Signs Agreement with Cisco to Deliver Smart Grid-Enabled Home Energy Management Solution, June 29, 2010, <http://www.duke-energy.com/news/releases/2010062901.asp>, accessed September 21, 2011

<sup>21</sup> Duke Energy, Duke Energy Takes Steps to Further Advance Its Smart Grid Communications Architecture, Sept. 2, 2010, <http://www.duke-energy.com/news/releases/2010090201.asp>, accessed September 21, 2011

<sup>22</sup> Echelon, An Energy Control Network for Distribution Automation, <http://www.echelon.com/metering/>, accessed September 21, 2011.

<sup>23</sup> Ohio PUC, Case No. 11-277-EL-UNC, Comments of Duke Energy Ohio, Inc., March 3, 2011, <http://dis.puc.state.oh.us/TiffToPdf/A1001001A11C04B43259A90260.pdf>, accessed September 21, 2011

<sup>24</sup> Duke Energy, 2010 | 2011 Sustainability Report, Delivering Today. Investing for our Future, <http://www.duke-energy.com/pdfs/10-11-sustainability-report.pdf>, accessed September 21, 2011

On August 8, 2011, Duke Energy publicly released a February 1, 2011 white paper outlining the company's smart grid vision for the future. According to the white paper, Duke Energy will use communications nodes to locally aggregate and manage data from various applications including distribution automation, plug-in electric vehicles, smart metering and customer energy management. The communications nodes will be designed to work with a variety of wireless and wired communications technologies, and will support wide area networking, local area networking and node-to-node communications.<sup>25</sup>

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<sup>25</sup> Masters, David, Duke Energy: Developing the communications platform to enable a more intelligent electric grid, <http://www.duke-energy.com/pdfs/OP-David-Masters-SmartGrid-Comm-Platform-02-01-11.pdf>, accessed September 21, 2011

## FirstEnergy Smart Grid Modernization Initiative

|                                |                         |                      |                |
|--------------------------------|-------------------------|----------------------|----------------|
| <b>Location:</b>               | Cleveland, Ohio         | <b>Dates:</b>        | 2010 - Present |
| <b>Primary Utility/Entity:</b> | FirstEnergy Corporation | <b>ARRA Funding:</b> | \$36.1 million |

| PROGRAM INFORMATION            |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To test and validate the integration of smart grid technology with existing distribution infrastructure.</li> <li>• To analyze system life-cycle costs for cost recovery investments.</li> <li>• To examine how aging infrastructure will perform alongside smart grid technology.</li> <li>• To evaluate benefits to customers and the environment.</li> </ul>   |
| Status                         | Pending regulatory approval; AMI tariff (cost recovery tariff) not yet approved by PUC.  |
| Number of Participants         | 44,000 customers in Cleveland pilot project  |
| Participating Entities         | <ul style="list-style-type: none"> <li>• FirstEnergy Corporation</li> <li>• Ohio Edison Company</li> <li>• Cleveland Electric Illuminating Company</li> <li>• Toledo Edison Company</li> <li>• Technical Support: EPRI, IBM, SAIC, BPL Global</li> <li>• Vendors: Verizon, Itron, SEL, Current, Zigbee</li> </ul>  |
| Program Budget                 | <ul style="list-style-type: none"> <li>• \$72.2 million total for Cleveland area pilot:               <ul style="list-style-type: none"> <li>○ \$36.1 million in SGIG funding</li> <li>○ \$36.1 million recovered through an AMI rider</li> </ul> </li> </ul>  |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> </ul>  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Wireless smart meters</li> <li>• Bellweather meters for voltage detection</li> <li>• IP-enabled communications network for all systems. Wide area network with public and private fiber optic cable/Ethernet, and wireless radio components</li> <li>• Meter data management system</li> <li>• Peak time rebate (PTR) pricing/CPP for select customers (voluntary)</li> <li>• Distribution automation technology, including SCADA, across 34 feeders</li> <li>• Advanced voltage controls on 21 feeders</li> <li>• Communications network (backhaul and wide area network)</li> <li>• Cyber security components</li> <li>• Load control options (e.g. programmable thermostats).</li> </ul> |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• FirstEnergy Corporation will formulate a comprehensive communications program to educate customers about program responsibilities and benefits.</li> <li>• Customers will be notified on critical peak events via an electronic message sent to the customer owned phone, email, facsimile, or pager.</li> </ul>  |

| <b>PROGRAM RESULTS</b>    |  |
|---------------------------|--|
| Key Findings              | The PUC has been slow to approve cost recovery for the project.  |
| Other Outcomes            | N/A  |
| Customer Feedback         | N/A (pilot not yet initiated)  |
| Current Deployment Status | In spring 2011, the company will begin installing 5,000 smart meters in the Cleveland area, with another 39,000 possible between 2012 and 2013.  |
| Future Implications       | If the initial 5,000 smart meter installations are successful, the company will proceed in installing the other 39,000 meters.   |
| <b>IMPACTS/BENEFITS</b>   |  |
| Consumers                 | FirstEnergy expects: <ul style="list-style-type: none"> <li>• Reduced frequency and duration of outages</li> <li>• Increased level of control over energy use</li> <li>• Reduced energy consumption during peak periods for cost savings</li> <li>• Improved electricity reliability</li> </ul>  |
| Utilities                 | FirstEnergy expects: <ul style="list-style-type: none"> <li>• Better asset utilization</li> <li>• Increased customer satisfaction</li> <li>• Minimized transmission losses</li> <li>• Increased data availability</li> <li>• Increased workforce productivity</li> </ul>   |
| Metrics Used              | Planned Impact Metrics: <ul style="list-style-type: none"> <li>• 3% reduction in peak load (up to 120 MW of peak load reduction)</li> <li>• Improved average power factor of 0.05</li> <li>• Reduction in peak demand of greater than or equal to 5 percent</li> <li>• Time for line crew to detect faults in system</li> </ul>  |
| <b>RESOURCES</b>          |  |
| Program Website           | <a href="http://www.firstenergycorp.com">http://www.firstenergycorp.com</a> .  |
| Full Program Report       | Smart Grid Modernization Initiative: Ohio PUC, Case No. 09-1820-EL-ATA, <a href="http://dis.puc.state.oh.us/TiffToPdf/A1001001A09K18B31543G06404.pdf">http://dis.puc.state.oh.us/TiffToPdf/A1001001A09K18B31543G06404.pdf</a> , accessed September 21, 2011  |
| Presentations             | Nortech, Advanced Energy Speaker Series – Smart Grid Technology, March 10, 2010, <a href="http://www.nortechenergy.org/resources/Smart_Grid_Technology_-_FirstEnergy.pdf">http://www.nortechenergy.org/resources/Smart_Grid_Technology_-_FirstEnergy.pdf</a> , accessed September 21, 2011   |
| News Articles             | <ul style="list-style-type: none"> <li>• Funk, John, FirstEnergy Pulls Plug – For Now – on ‘Smart Grid’ Pilot Project, The Plain Dealer, 07-01-2010, <a href="http://www.cleveland.com/business/index.ssf/2010/06/firstenergy_pulls_plug_on_smart_grid_pilot_project.html">http://www.cleveland.com/business/index.ssf/2010/06/firstenergy_pulls_plug_on_smart_grid_pilot_project.html</a>, September 21, 2011</li> <li>• Beyerlein, Tom, Smart grid technology promises more efficient electricity usage, <a href="http://www.daytondailynews.com/news/dayton-news/smart-grid-technology-promises-more-efficient-electricity-usage-1073996.html">http://www.daytondailynews.com/news/dayton-news/smart-grid-technology-promises-more-efficient-electricity-usage-1073996.html</a>, accessed September 21, 2011</li> </ul> |

|                 |   |
|-----------------|---|
| Other Resources | <ul style="list-style-type: none"> <li>• PUC approval of plan: <a href="http://dis.puc.state.oh.us/TiffToPdf/A1001001A10F30B35930J74282.pdf">http://dis.puc.state.oh.us/TiffToPdf/A1001001A10F30B35930J74282.pdf</a>, September 21, 2011</li> <li>• Ohio PUC, PUCO approves FirstEnergy’s Smart Grid Program, <a href="http://www.puco.ohio.gov/puco/index.cfm/media-room/media-releases/puco-approves-firstenergys28099s-smart-grid-program/">http://www.puco.ohio.gov/puco/index.cfm/media-room/media-releases/puco-approves-firstenergys28099s-smart-grid-program/</a>, accessed September 21, 2011</li> </ul> |
|-----------------|---|

## PROGRAM DESCRIPTION

In October 2009, DOE awarded FirstEnergy \$57.4 million in ARRA funding for smart grid improvements. FirstEnergy Corporation plans to use \$36.1 million of the award amount towards a grid modernization project in Cleveland, Ohio. The company plans to recover the other \$36.1 million through a PUC approved AMI rider. In November 2009, FirstEnergy Corporation subsidiaries Ohio Edison Company, Cleveland Electric Illuminating Company, and Toledo Edison Company submitted an application to the Ohio PUC for the Cleveland project. In June 2010, the PUC approved FirstEnergy’s Smart Grid Modernization Initiative in case number 09-1820-EL-ATA. However, the approval was subject to the condition that the utility take the following measures:

- Create a database of customer-specific momentary interruption data.
- Keep all accounting records for the pilot program separate.
- Set target values for service reliability performance indices in the project area and report those to the PUC at the completion of the pilot project.
- Set the cost recovery rider as a fixed monthly charge rather than a usage sensitive charge.
- Share pilot project metrics with the PUC.
- Report to the PUC assessment results of the information and lessons learned from the initial 5,000 meter deployment.

In the ruling, the PUC further ordered that FirstEnergy request PUC permission before initiating any additional smart grid projects outside of the Cleveland pilot.

The ruling did not specify how the company could recover the \$36.1 million cost not funded by the ARRA. The PUC stated that it would defer ruling on the cost recovery issue until FirstEnergy’s second Electricity Security Plan was approved.<sup>26</sup> Fearing this could put the DOE funded grant money in jeopardy, FirstEnergy filed a re-hearing on the case in July 2010, but was denied.<sup>27</sup> FirstEnergy’s Electricity Security Plan was later approved in August 2010, allowing the company to proceed in filing any associated tariffs related to the AMI project.<sup>28</sup> Since August 2010, FirstEnergy has been pursuing PUC approval of its AMI/Modern Grid Rider under case number 09-1820-EL-ATA.

Of the \$72.2 million cost for the total project, \$21 million will support AMI, \$5 million will be spent on distribution automation technology, \$2 million for advanced voltage controls, \$6 million for the communications network, and \$2 million for cyber security and project management.

<sup>26</sup> Ohio PUC, Case No. 09-1820-EL-ATA, Entry on Rehearing, <http://dis.puc.state.oh.us/TiffToPdf/A1001001A10H25B42331B53184.pdf>, accessed September 21, 2011

<sup>27</sup> Ohio PUC, Case No. 09-1820-EL-ATA, RHF Application for Rehearing, <http://dis.puc.state.oh.us/DocumentRecord.aspx?DocID=b3de1156-7c1d-43fa-9b8d-92a6c6b68021>, accessed September 21, 2011

<sup>28</sup> Ohio PUC, Case No. 09-1820-EL-ATA, OO-Opinion & Order, <http://dis.puc.state.oh.us/DocumentRecord.aspx?DocID=06922852-fbd0-478a-b18b-af058aea4691>, accessed September 21, 2011

The Cleveland area was chosen for the pilot program due to the limited amount of new infrastructure investment needed. The city's long circuit lengths (creating uneven voltage profiles across the lines) and concentrated population make it an ideal test-bed location for distribution automation. FirstEnergy plans to first deploy 5,000 meters for a random sample of customers and enter a program evaluation period before the other 39,000 meters are deployed.

Customers will be provided with programmable thermostats, electronic switches, and other in-home display devices to participate in CPP and load control portions of the pilot program. Customers will have access to "edge of the network" devices with dynamic pricing data, allowing them to participate in curtailment programs and maximize savings. In a study to evaluate customer responsiveness to the PTR pricing program, some customers will be credited 40¢ for every kWh they do not use compared with their home's average demand, while others will be credited 80¢ per kWh. The Zigbee Smart Energy Profile is one such product being considered as part of the AMI installations.

In another portion of the project, substation relay-based protection strategies will be implemented at nine substations. The distribution automation algorithm will have the capability to react to various loss-of-voltage scenarios.

For its communications network and interface architectures, FirstEnergy requires an open design and open protocols to ensure interoperability standards can be met in the future.

#### **UPDATES AS OF SEPTEMBER 2011**

There are no significant updates to this case study as of September 2011.

| <b>Georgia Power PowerRewards</b> |               |                      |           |
|-----------------------------------|---------------|----------------------|-----------|
| <b>Location:</b>                  | Georgia       | <b>Dates:</b>        | 2008-2009 |
| <b>Primary Utility/Entity:</b>    | Georgia Power | <b>ARRA Funding:</b> | No        |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• Critical Peak Pricing (CPP) Pilot for residential customers already with AMI</li> <li>• Customers receive credits for peak demand reduction</li> </ul>  |
| Status                         | Completed, successful  |
| Number of Participants         | 1,000 residential customers  |
| Participating Entities         | Georgia Power  |
| Program Budget                 | N/A  |
| Consumer Sector                | Residential  |
| Hardware/Software Technologies | Pilot available to residents who already have AMI installed  |
| Consumer Education Measures    | Information on pilot program availability, applicability, and description was provided on Georgia Power's website  |
| <b>PROGRAM RESULTS</b>         |  |
| Key Findings                   | <ul style="list-style-type: none"> <li>• Energy reductions achieved from participants with notification of CPP events were greater than energy reduction of the control group during CPP events</li> <li>• Effective payout was 88¢/kWh, compared to the highest 2008 RTP price of 29¢/kWh</li> <li>• Program required approximately 30 hours of administrative time per event</li> <li>• Biggest issue was the "Normal Electric Demand" algorithm, it was difficult to predict erratic residential customer behavior</li> </ul> |
| Other Outcomes                 | Residential AMI metering required additional time and research to support the interval data requirements of CPP  |
| Customer Feedback              | N/A  |
| Current Deployment Status      | N/A  |
| Future Implications            | N/A  |
| <b>IMPACTS/BENEFITS</b>        |  |
| Consumers                      | Energy reductions achieved from participants with notification of CPP events were greater than energy reductions from the control group during CPP events. Program has the potential to reduce peak energy consumption from customers and save customers money   |
| Utilities                      | <ul style="list-style-type: none"> <li>• Peak Load Reductions: Program reduced peak energy demand, easing the demand on the utility</li> <li>• Higher than expected costs: Effective payout was 88¢ per kWh, compared to the highest 2008 RTP price of 29¢ per kWh</li> </ul>  |



|                     |  |
|---------------------|--|
| Metrics Used        | <ul style="list-style-type: none"> <li>• Peak energy demand reduction: 0.9 kW/CPP participant and 0.5 kW/Control Group customer</li> <li>• Customer Dollar Savings: 35¢/kWh of energy reduced with a maximum CPP period of 50 hours each year</li> <li>• Average Payout: Average total payout was about \$6 per customer</li> </ul>  |
| <b>RESOURCES</b>    |  |
| Program Website     | <a href="http://www.georgiapower.com/pricing/gpc_resrates.asp">http://www.georgiapower.com/pricing/gpc_resrates.asp</a>  |
| Full Program Report | N/A  |
| Presentations       | Southern Company presentation to DOE/EIA Staff, Southern Company Update: Demand Response and Energy Efficiency, February 8, 2011   |
| News Articles       | N/A  |
| Other Resources     | <ul style="list-style-type: none"> <li>• CPP-R-1 Electric Service Tariff - Rider Schedule, <a href="http://www.georgiapower.com/pricing/files/rates-and-schedules/ CPP-R-1.pdf">http://www.georgiapower.com/pricing/files/rates-and-schedules/ CPP-R-1.pdf</a>, accessed September 21, 2011</li> <li>• General study, where Georgia Power was mentioned, <a href="http://www.naruc.org/Publications/SERCAT_Washington_2010.pdf">http://www.naruc.org/Publications/SERCAT_Washington_2010.pdf</a>, accessed September 21, 2011</li> <li>• Georgia Power, Your Meter is About to Get Smarter, <a href="http://www.georgiapower.com/residential/smartmeter.asp">http://www.georgiapower.com/residential/smartmeter.asp</a>, accessed September 21, 2011</li> <li>• Southern Company Services, Constructing Baseline of Customer's Hourly Electric Usage in SAS, <a href="http://analytics.ncsu.edu/sesug/2009/PO015.Xiao.pdf">http://analytics.ncsu.edu/sesug/2009/PO015.Xiao.pdf</a>, accessed September 21, 2011</li> </ul> |

## PROGRAM DESCRIPTION

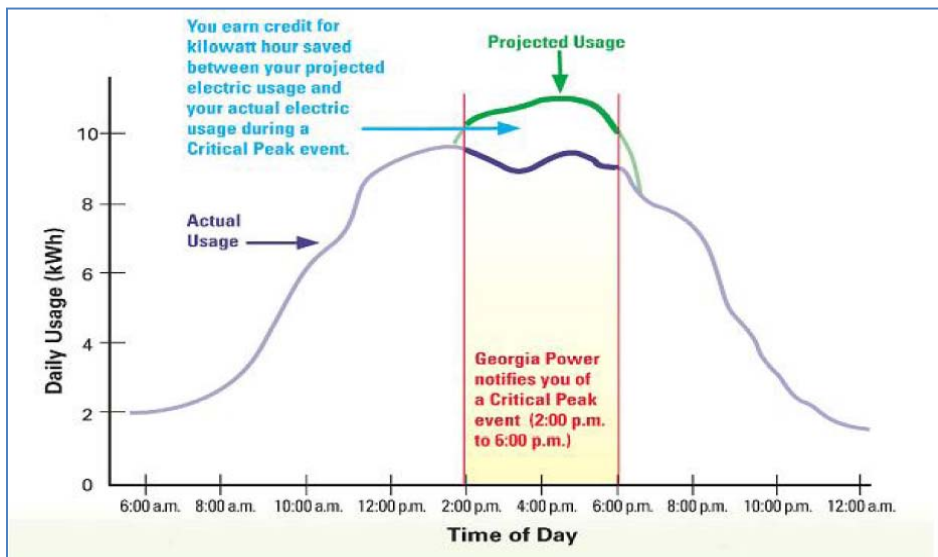
Georgia Power has one of the longest running and largest dynamic pricing programs in the nation. They began pilot-testing commercial and industrial RTP programs in 1992, and in 1994 offered the program to customers with power loads greater than 250 kW. Starting in 2008, Georgia Power began a critical peak pricing (CPP) pilot for its residential customers who already have AMI. The pilot, known as PowerRewards, allowed participating customers to receive credit when they reduce their electric usages during critical peak events called by the company (35¢/kWh of energy saved, with a maximum CPP period of 50 hours each year). In order to determine the rewards, baselines of each customer's hourly electric usage were constructed and rewards were calculated based on the differences between the customer's actual usage and the projected usage, called the baseline, as shown in Figure 2. Customers were notified at least one day before a CPP period was called, either by telephone or e-mail.

Results of the study showed that energy reductions achieved from participants with notification of CPP events (0.9 kW/customer on average) were greater than energy reduction of the control group (0.5 kW/customer on average). However, there were a number of concerns that arose following the end of the pilot. Financial concerns were noted since the effective payout to participating customers was 88¢/kWh, compared to the highest 2008 RTP price of 29¢/kWh.<sup>29</sup> Georgia Power also found issue with the amount of time required for each event; the CPP pilot required approximately 30 hours of administrative time per event. The biggest issue involved determining the baseline or Normal Electric Demand algorithm as it was difficult to predict the sometimes irregular power consumption behavior of residential customers.

<sup>29</sup> Southern Company presentation to DOE/EIA Staff, Southern Company Update: Demand Response and Energy Efficiency, February 8, 2011

Georgia Power’s parent company, Southern Company, recently reviewed several CPP programs that were piloted by its retail operating company and noted the overall experience resulting from these programs. In particular, Southern Company found that reliable, measurable residential demand-side resources require enabling technology, such as advanced energy management systems and customer gateways. Enabling technology can also further improve customer acceptance and satisfaction with CPP programs and increase the reliability of customer reductions. Southern Company also found that CPP/TOU programs need thorough customer education and energy management advice to be successful.

**Figure 2. Georgia PowerReward Concept**



Source: Southern Company Services, <http://analytics.ncsu.edu/sesug/2009/PO015.Xiao.pdf>, accessed September 21, 2011

**UPDATES AS OF SEPTEMBER 2011**

Georgia Power is in the process of installing smart meters for all of its customers. The company has installed about one million smart meters since 2008, and plans to complete installations by the end of 2012. Georgia Power plans to offer new rate options as a future smart grid benefit.<sup>30</sup>

<sup>30</sup> Georgia Power, Your Meter is About to Get Smarter, <http://www.georgiapower.com/residential/smartmeter.asp>, accessed September 21, 2011

| <b>ISO-NE Demand Response Reserve Pilot</b> |                          |                      |                         |
|---|--------------------------|----------------------|-------------------------|
| <b>Location:</b>                            | New England              | <b>Dates:</b>        | October 2006 – May 2010 |
| <b>Primary Utility/Entity</b>               | ISO-New England (ISO-NE) | <b>ARRA Funding:</b> | No                      |

| <b>PROGRAM INFORMATION</b>     |   |
|--------------------------------|---|
| Key Objectives                 | <ul style="list-style-type: none"> <li>To test the ability of smaller DR resources to respond to ISO dispatch instructions in a manner similar to resources providing Operating Reserve.</li> <li>To enable system operators to more accurately predict the likely performance of DR resources in varying system conditions, which would contribute to the analysis of contingencies and produce more confidence in the use of DR resources for enhancing system reliability at lower cost.</li> </ul>  |
| Status                         | Completed; successful   |
| Number of Participants         | <ul style="list-style-type: none"> <li>109 assets participated in at least one of the sessions of the Demand Response Reserve Program (DRRP)</li> <li>Of the 109 participants, 35 assets enrolled in all sessions of the program.</li> </ul>  |
| Participating Entities         | ISO New England   |
| Program Budget                 | N/A   |
| Consumer Sector                | Commercial  |
| Hardware/Software Technologies | N/A   |
| Consumer Education Measures    | N/A   |
| <b>PROGRAM RESULTS</b>         |   |
| Key Findings                   | <ul style="list-style-type: none"> <li>During all sessions, the performance of load reduction assets was always less than the demand response reserve contract amount.</li> <li>Generation asset performance usually exceeded the demand response reserve contract amount, except for one season (summer of 2009).</li> <li>Direct load control, which is combined with generators, had an average performance that was less than the demand response reserve contract amount.</li> <li>While certain sessions had higher performance than the preceding session, total performance decreased over the six sessions of the DRRP.</li> </ul> |
| Other Outcomes                 | <ul style="list-style-type: none"> <li>Generation resources, which provide reserve services in wholesale electricity markets, showed a moderate increase in reliability since the DRRP started.</li> <li>DRRP assets showed a decrease in reliability during the same time frame.</li> </ul>  |
| Customer Feedback              | N/A   |
| Current Deployment Status      | N/A   |

|                         |   |
|-------------------------|---|
| Future Implications     | <p>Recommendations to:</p> <ul style="list-style-type: none"> <li>• Conduct research regarding performance erosion over time</li> <li>• Conduct research regarding audit day behavior</li> <li>• Implement weather-based performance metrics and incentives for weather-sensitive assets</li> <li>• Introduce penalties for over-performance of assets</li> <li>• Continue the utilization of the symmetric baseline adjustment methodology</li> <li>• Provide tools that assist in setting realistic performance goals</li> <li>• Require justification for data changes over a given threshold</li> <li>• Investigate the need for special metering requirements for generation assets</li> </ul> |
| <b>IMPACTS/BENEFITS</b> |   |
| Consumers               | N/A   |
| Utilities               | ISO-NE could expect decreases in assets' loads; however, reliability of load reductions decreased throughout the pilot project.   |
| Metrics Used            | <ul style="list-style-type: none"> <li>• Average Enrolled Amount: 30.9 MW per session</li> <li>• Average Contract Amount: 15.8 MW</li> <li>• Average Performance: The average performance (total load relief) over all sessions was 42 percent (12.3 MW)</li> </ul>   |
| <b>RESOURCES</b>        |   |
| Program Website         | N/A   |
| Full Program Report     | <a href="http://www.iso-ne.com/committees/comm_wkgrps/mrks_comm/dr_wkgrp/mtrls/2010/dec12_010/a16_dr_reserve_pilot_final_report_11_30_10.pdf">http://www.iso-ne.com/committees/comm_wkgrps/mrks_comm/dr_wkgrp/mtrls/2010/dec12_010/a16_dr_reserve_pilot_final_report_11_30_10.pdf</a>   |
| Presentations           | N/A   |
| News Articles           | Rowland, Kate, ISOs and RTOs: The Demand Response Equation, Intelligent Utility, <a href="http://www.intelligentutility.com/article/10/12/isos-and-rtos-demand-response-equation">http://www.intelligentutility.com/article/10/12/isos-and-rtos-demand-response-equation</a> , accessed September 21, 2011  |
| Other Resources         | N/A   |

### PROGRAM DESCRIPTION

The DRRP was developed to acquire performance data for the types of DR resources that exist in New England in response to more frequent, short-duration activations like that of operating reserve resources. The DRRP also was intended to enable system operators to more accurately predict the likely performance of DR resources in varying system conditions, which would contribute to the analysis of contingencies and engender more confidence in the use of DR resources for enhancing system reliability at lower cost. The ISO-NE conducted six sessions of the DRRP between October of 2006 and May of 2010. There are three types of assets that participated in the DRRP:

- Load reduction assets, which reduced the amount of energy their facilities used during the event time. The most common strategies were reductions in lighting and HVAC usage. Asset performance was assessed by comparing their actual metered load during the event to a calculated baseline.
- Generation assets, which started after the meter generator. Their load impact is based solely on the metered generation at the time of the event.
- Direct load control assets, which applied control to a large number of small customers and consisted of residential air conditioner curtailment.

A total of 107 events were conducted over the pilot period, and at least 109 assets participated in at least one session of the DRRP. Thirty-five of the 109 total assets enrolled in all sessions. The average enrolled amount was 30.9 MW per session, and generally reflected each asset’s maximum interruptible capacity (see Table 67). On average, the total load relief for each session was 12.3 MW. However, while certain sessions had higher performance than the preceding sessions, total performance decreased over the six DRRP sessions. The performance of the load reduction assets remained fairly constant through each session, achieving an average of 35 percent of DRRP contract amount. Generation and direct load control assets experienced a visible downward trend over the sessions, in which they participated and experienced substantial fluctuation. Compared to generation resources, which provide reserve services in wholesale electricity markets, DRRP assets exhibited less reliability.

**Table 6. ISO-NE DRRP Performance Summary: Enrolled Amount vs. Average Performance**

| DRRP Session   | Load Reduction |            |                  | Generation and Direct Load Control |            |                  | Total Amount |             |                  |
|----------------|----------------|------------|------------------|------------------------------------|------------|------------------|--------------|-------------|------------------|
|                | Enrolled MW    | Actual MW  | Achieved Percent | Enrolled MW                        | Actual MW  | Achieved Percent | Enrolled MW  | Actual MW   | Achieved Percent |
| Winter 06/07   | 14.9           | 4.9        | 33%              | 5.0                                | 4.6        | 92%              | 19.9         | 9.5         | 48%              |
| Summer 07      | 20.2           | 8.4        | 42%              | 19.0                               | 10.7       | 56%              | 39.2         | 19.2        | 49%              |
| Winter 07/08   | 13.7           | 3.9        | 29%              | 5.0                                | 4          | 80%              | 18.7         | 7.9         | 43%              |
| Summer 08      | 18.6           | 6.8        | 37%              | 15.0                               | 7.6        | 51%              | 33.6         | 14.4        | 43%              |
| Winter 08/09   | 0              | 0          | N/A              | 0                                  | 0          | N/A              | 0            | 0           | N/A              |
| Summer 09      | 37.3           | 13.5       | 36%              | 10.0                               | 2.3        | 23%              | 47.3         | 13.5        | 33%              |
| Winter 09/10   | 26.5           | 9          | 34%              | N/A                                | N/A        | N/A              | 26.5         | 9.0         | 34%              |
| <b>Average</b> | <b>21.9</b>    | <b>7.8</b> | <b>35%</b>       | <b>10.8</b>                        | <b>5.8</b> | <b>60%</b>       | <b>30.9</b>  | <b>12.3</b> | <b>42%</b>       |

Note: Due to a lack of enrollment in Winter 08/09, the average calculations are derived over six sessions only.

Source: KEMA, Demand Response Reserve Pilot Evaluation, Final Report, Prepared for ISO New England, November 30, 2010, [http://www.iso-ne.com/committees/comm\\_wkgrps/mrks\\_comm/dr\\_wkgrp/mtrls/2010/dec12010/a16\\_dr\\_reserve\\_pilot\\_final\\_report\\_11\\_30\\_10.pdf](http://www.iso-ne.com/committees/comm_wkgrps/mrks_comm/dr_wkgrp/mtrls/2010/dec12010/a16_dr_reserve_pilot_final_report_11_30_10.pdf), accessed September 21, 2011

Through completing this pilot, several recommendations can be made in an attempt to improve asset performance moving forward, including: conduct research regarding performance erosion over time; conduct research regarding audit day behavior; implement weather-based performance metrics and incentives for weather-sensitive assets; introduce penalties for over-performance of assets; continue the utilization of the symmetric baseline adjustment methodology; provide tools that assist in setting realistic performance goals; require justification for data changes over a given threshold; investigate the need for special metering requirements for generation assets.

#### **UPDATES AS OF SEPTEMBER 2011**

There are no significant updates to this case study as of September 2011.

| <b>Oncor Smart Texas Program</b> |       |                      |                             |
|----------------------------------|-------|----------------------|-----------------------------|
| <b>Location:</b>                 | Texas | <b>Dates:</b>        | 2009-2012                   |
| <b>Primary Utility/Entity:</b>   | Oncor | <b>ARRA Funding:</b> | \$3.5 million for DLR pilot |

| <b>PROGRAM INFORMATION</b>     |   |
|--------------------------------|---|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• Smart meter installation designed to upgrade the utility's infrastructure to allow for better electricity reliability, peak-load reduction, and other benefits.</li> <li>• Installation throughout Oncor's customer service area in the Dallas/Fort Worth metropolitan area and nearby communities</li> <li>• Related dynamic line rating (DLR) project to mitigate varying conditions along transmission lines and improve reliability</li> </ul> |
| Status                         | In progress; some customer opposition   |
| Number of Participants         | <ul style="list-style-type: none"> <li>• 3.4 million customers to receive smart meters</li> <li>• 2,086,150 smart meters installed as of September 21, 2011</li> </ul>  |
| Participating Entities         | <ul style="list-style-type: none"> <li>• Oncor</li> <li>• Gateway</li> <li>• CenterPoint (pilots in concert with Oncor)</li> <li>• Landis+Gyr (smart meter manufacturer)</li> <li>• IBM (systems integrator)</li> <li>• The Valley Group (DLR equipment provider)</li> <li>• Siemens Energy (DLR systems integrator)</li> </ul>   |
| Program Budget                 | <ul style="list-style-type: none"> <li>• \$686 million (Total capital costs for installation, or about \$200 per meter)</li> <li>• \$7.3 million (DLR pilot)</li> </ul>   |
| Consumer Sector                | All   |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Smart meters</li> <li>• In-home display monitors</li> <li>• Integrated dynamic line rating systems (DLR pilot)</li> </ul>  |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• Website devoted to informing consumers about saving energy. Includes links to compliance reports and side-by-side demonstration tests</li> <li>• Smart Texas education campaign hosted eight Mobile Experience Center events</li> <li>• Door hangers</li> <li>• Advertisements</li> <li>• Local and national media coverage</li> </ul>   |
| <b>PROGRAM RESULTS</b>         |   |
| Key Findings                   | <ul style="list-style-type: none"> <li>• Oncor's smart meter rollout has been on time and the technology has worked effectively</li> <li>• Customer complaints about electricity bills have dominated news coverage</li> <li>• The Texas PUC commissioned a report that found that Oncor's smart meters were working, with few exceptions, as expected</li> </ul>   |
| Other Outcomes                 | No significant delays in rollout as of September 2010. Number of smart meters installed is less than initially projected because population growth in service area did not meet estimates   |

|                           |  |
|---------------------------|--|
| Customer Feedback         | <ul style="list-style-type: none"> <li>• Most customer inquiries are of a general nature</li> <li>• Opposition has come from some customers; a lawsuit was filed</li> <li>• Anti-smart meter groups, including Smart UR Citizen, have been formed</li> </ul>   |
| Current Deployment Status | <ul style="list-style-type: none"> <li>• More than 1.3 million smart meters were installed as of September 2010; expected completion in 2012.</li> <li>• DLR pilot expected to be completed 2<sup>nd</sup> Quarter 2013</li> </ul>   |
| Future Implications       | <ul style="list-style-type: none"> <li>• Electricity producers will be able to implement TOU pricing on a wider scale once installation is completed; for now, these programs are in pilot stages</li> <li>• DLR pilot will measure congestion relief and extrapolate potential economic effects in the overall Oncor service area</li> </ul>  |
| <b>IMPACTS/BENEFITS</b>   |  |
| Consumers                 | <ul style="list-style-type: none"> <li>• Monthly surcharge for smart meter installation (\$2.19/month)</li> <li>• Realization of fuller benefits will come when TOU pricing is more widespread.</li> </ul>   |
| Utilities                 | <ul style="list-style-type: none"> <li>• Oncor's reputation has been mildly damaged by negative AMS feedback from customers</li> <li>• More comprehensive infrastructure improvements, including DLR</li> </ul>  |
| Metrics Used              | <ul style="list-style-type: none"> <li>• 2,086,150 smart meters installed as of September 21, 2011</li> <li>• 770 meters required replacement as of September 2010</li> </ul>  |
| <b>RESOURCES</b>          |  |
| Program Website           | <a href="http://www.oncor.com/tech_reliable/smarttexas/">http://www.oncor.com/tech_reliable/smarttexas/</a>  |
| Full Program Report       | <ul style="list-style-type: none"> <li>• Compliance Report of Oncor Electric Delivery Company LLC Pursuant to the Commission's Order Issued Docket No. 35718, September 2010, <a href="http://www.oncor.com/tech_reliable/smarttexas/AMS_PUC_Report_September2010.pdf">http://www.oncor.com/tech_reliable/smarttexas/AMS_PUC_Report_September2010.pdf</a>, accessed September 21, 2011</li> <li>• Oncor Press Release, April 2010, <a href="http://www.oncor.com/news/newsrel/detail.aspx?prid=1254">http://www.oncor.com/news/newsrel/detail.aspx?prid=1254</a>, accessed September 21, 2011</li> <li>• Navigant Consulting, Evaluation of Advanced Metering System (AMS) Deployment in Texas, Report of Investigation, July 30, 2010, <a href="http://www.sdge.com/documents/smartmeter/PUCTFinalReport7-30.pdf">http://www.sdge.com/documents/smartmeter/PUCTFinalReport7-30.pdf</a>, accessed September 21, 2011</li> </ul>  |
| Presentations             | Smart Grid Demonstration Project – Dynamic Line Rating (DLR), June 25, 2010, PowerPoint Presentation, <a href="http://www.ercot.com/content/meetings/ros/keydocs/2010/0625/05_OncorDynamicLineRatingProject06252010.ppt">http://www.ercot.com/content/meetings/ros/keydocs/2010/0625/05_OncorDynamicLineRatingProject06252010.ppt</a> , accessed September 21, 2011  |
| News Articles             | <ul style="list-style-type: none"> <li>• PR Newswire, Oncor, Landis+Gyr Reach National Leadership Milestone in Advanced Meters, 2009, <a href="http://www.prnewswire.com/news-releases/oncor-landisgyr-reach-national-leadership-milestone-in-advanced-meters-63680562.html">http://www.prnewswire.com/news-releases/oncor-landisgyr-reach-national-leadership-milestone-in-advanced-meters-63680562.html</a>, accessed September 21, 2011</li> <li>• SustainableBusiness.com, Gateway Launches Smart Grid Pilot in Oncor Service Area, July 2010, <a href="http://www.sustainablebusiness.com/index.cfm/go/news.display/id/20678">http://www.sustainablebusiness.com/index.cfm/go/news.display/id/20678</a>, accessed September 21, 2011</li> <li>• DallasNews.com, Oncor wins federal funding for smart grid project, November 2009, <a href="http://energyandenvironmentblog.dallasnews.com/archives/2009/11/oncor-wins-federal-funding-for.html">http://energyandenvironmentblog.dallasnews.com/archives/2009/11/oncor-wins-federal-funding-for.html</a>, accessed September 21, 2011</li> </ul> |

|                 |   |
|-----------------|---|
|                 | <ul style="list-style-type: none"> <li>• GigaOM, Finally Some Good News for Smart Meters: Texas Lawsuit Tossed, August 2010, <a href="http://gigaom.com/cleantech/finally-some-good-news-for-smart-meters-texas-lawsuit-tossed/">http://gigaom.com/cleantech/finally-some-good-news-for-smart-meters-texas-lawsuit-tossed/</a>, accessed September 21, 2011</li> <li>• Greentech Grid, Oncor Reacts to Smart Meter Anger, March 2010, <a href="http://www.greentechmedia.com/articles/read/oncor-reacts-to-smart-meter-anger/">http://www.greentechmedia.com/articles/read/oncor-reacts-to-smart-meter-anger/</a>, accessed September 21, 2011</li> <li>• Greentech Grid, Oncor Sued for Fraud Over Smart Meters, March 2010, <a href="http://www.greentechmedia.com/articles/read/oncor-sued-for-fraud-over-smart-meters/">http://www.greentechmedia.com/articles/read/oncor-sued-for-fraud-over-smart-meters/</a>, accessed September 21, 2011</li> </ul> |
| Other Resources | <ul style="list-style-type: none"> <li>• SmartGrid.gov, Oncor Electric Delivery Company, Dynamic Line Rating, <a href="http://www.smartgrid.gov/project/oncor_electric_delivery_company_dynamic_line_rating">http://www.smartgrid.gov/project/oncor_electric_delivery_company_dynamic_line_rating</a>, accessed September 21, 2011</li> <li>• Components of AMS Surcharge, <a href="http://www.oncor.com/tech_reliable/pdf/Oncor-AMS-Surcharge-Analysis.pdf">http://www.oncor.com/tech_reliable/pdf/Oncor-AMS-Surcharge-Analysis.pdf</a>, accessed September 21, 2011</li> </ul>  |

### PROGRAM DESCRIPTION

Oncor’s Smart Texas program arose out of the State’s legislative efforts in 2007 to encourage smart meter deployment. The distribution utility’s Automated Metering System (AMS, akin to AMI) includes the installation of Landis+Gyr smart meters to all 3.4 million customers in Oncor’s service area in Dallas/Fort Worth and nearby communities. In July 2009, Oncor filed an application for a Smart Grid Investment Grant to cover a portion of the costs of the meter rollout. In October 2009, Oncor was informed by the DOE that it had not been selected to receive an award. Oncor is recovering the costs of deployment through a monthly service charge of \$2.19 per account, assessed on residential customers by their REP.

From a public-relations standpoint, Oncor’s smart grid rollout has not been a total success. Complaints about the accuracy of the meters, though low in overall number, have been widely publicized. In addition, a lawsuit was filed in 2010 alleging that smart meters incorrectly inflate measured electricity use, although the lawsuit was dismissed on technical grounds, as the Texas PUC was deemed to have jurisdiction. The Texas PUC commissioned a study in July 2010 that found that smart meters have been mostly accurate. The study, carried out by Navigant Consulting, conducted independent accuracy tests on 5,627 advanced meters in use by Oncor, CenterPoint, and AEP Texas. The study found that 5,625 of the 5,627 meters (99.96 percent) were determined to be accurate. According to filings with the Texas PUC, as of September 2010, over 1.3 million meters had been installed with a documented failure rate of 0.06 percent, as shown in Table 7. However, the utility still faces a challenge to convince customers that the meters will benefit them.

**Table 7. Oncor Replacement Rate of Smart Meters (through September 30, 2010)**

| Number of Meters Installed | Number of Meters Requiring Replacement | Meter Failure Rate |
|----------------------------|--|--------------------|
| 1,343,358                  | 770                                    | 0.06%              |

Source: Compliance Report of Oncor Electric Delivery Company LLC Pursuant to the Commission’s Order Issued Docket No. 35718, September 2010, [http://www.oncor.com/tech\\_reliable/smarttexas/AMS\\_PUC\\_Report\\_September2010.pdf](http://www.oncor.com/tech_reliable/smarttexas/AMS_PUC_Report_September2010.pdf), accessed September 21, 2011

A related DLR pilot, partially funded by an ARRA grant, is currently being implemented. The project will demonstrate the use of DLR monitoring technology to reduce transmission-line congestion and increase



the carrying capacity of the transmission lines. The pilot will help Oncor quantify the economic value of released transmission capacity to the market, determine how to use smart grid technologies to manage the amount of electricity moving on its lines, and quantify the total costs of implementing this type of DLR program on a wider scale. The pilot uses integrated dynamic line rating systems for overhead transmission lines along with a communications system that reads conductor tension, net radiation temperature, and ambient temperature and communicates this information to the substation through a spread spectrum radio.

**UPDATES AS OF SEPTEMBER 2011**

Oncor has installed about 2.1 million smart meters as of September 21, 2011, up from 1,343,356 on September 30, 2010. The company is approximately two-thirds complete with its planned smart meter installation program.<sup>31</sup>

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<sup>31</sup> Oncor, Smart Texas – Rethinking Energy, [http://www.oncor.com/tech\\_reliable/smarttexas/](http://www.oncor.com/tech_reliable/smarttexas/), accessed September 21, 2011

| <b>PEPCO PowerCentsDC</b>      |  |                      |   |
|--------------------------------|--|----------------------|---|
| <b>Location:</b>               | Washington, DC                         | <b>Dates:</b>        | 2008-2009; 2010-2011                            |
| <b>Primary Utility/Entity:</b> | Potomac Electric Power Company (PEPCO) | <b>ARRA Funding:</b> | None for 2008-09;<br>\$44.6 million for 2010-13 |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>To test the impacts of smart grid infrastructure on consumer behavior, specifically in response to three different dynamic electricity pricing plans (or groups): CPP, Critical Peak Rebate (CPR), and Hourly Pricing (HP).</li> <li>To measure five primary impacts: peak demand reduction, overall consumption changes, customer satisfaction, usefulness of technologies used, and value of pricing information to customers.</li> <li>To provide statistically valid results that could be extrapolated to the entirety of PEPCO's residential market in the District of Columbia.</li> </ul> |
| Status                         | Complete, successful   |
| Number of Participants         | <ul style="list-style-type: none"> <li>About 900 (plus a 400-person control group)</li> <li>PEPCO has approximately 778,000 customers in Washington, DC and its Maryland suburbs.</li> </ul>   |
| Participating Entities         | <ul style="list-style-type: none"> <li>Smart Meter Pilot Program, Inc. (ran pilot program)</li> <li>eMeter Strategic Consulting (wrote final report)</li> <li>Pepco (utility)</li> <li>DC Public Service Commission (PSC)</li> <li>Smart Meter Pilot Program, Inc. (SMPPPI), a nonprofit company comprised of Pepco, the D.C. Office of the People's Counsel, the D.C. Consumer Utility Board, the International Brotherhood of Electrical Workers Local 1900 and the PSC</li> </ul>   |
| Program Budget                 | N/A  |
| Consumer Sector                | Residential  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>Smart Meters installed for all households</li> <li>Smart Thermostats used for households with electric heating (about a third of total participants)</li> </ul>   |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>Time-based pricing explained in program brochure</li> <li>Consumer bills included a chart of consumer time use</li> </ul>   |
| <b>PROGRAM RESULTS</b>         |  |
| Key Findings                   | <ul style="list-style-type: none"> <li>All groups had electricity and dollar savings.</li> <li>CPP had highest average electricity savings.</li> <li>HP had highest average dollar savings, but exogenous factors likely contributed to this.</li> </ul>   |
| Other Outcomes                 | Feedback survey given to participants and control group showed general satisfaction with program.  |
| Customer Feedback              | <ul style="list-style-type: none"> <li>General satisfaction with program</li> <li>Primary motivation for participation was to save money</li> <li>Reducing use of air-conditioning and avoided use of appliances were common</li> </ul>  |

|                           |  |
|---------------------------|--|
| Current Deployment Status | Pepco has begun installing smart meters in all DC households; expects to complete the process by the end of 2011.  |
| Future Implications       | Further research needed to determine whether all three TOU pricing programs will be offered to all of Pepco's customers.   |
| <b>IMPACTS/BENEFITS</b>   |  |
| Consumers                 | <ul style="list-style-type: none"> <li>Increased access to information and smart meter/thermostat technology helped consumers make better decisions about their electricity use.</li> <li>Most participants saved money from load shifting.</li> <li>Additional savings, from overall demand reduction, may be realized.</li> </ul>  |
| Utilities                 | <ul style="list-style-type: none"> <li>Pepco could expect significant peak demand reduction, particularly in summer, from city-wide AMI implementation.</li> </ul>   |
| Metrics Used              | <ul style="list-style-type: none"> <li>Peak Demand Savings: Electricity savings reported as percentage; ranged from 2 to 34 percent, depending on pricing plan and season (winter/summer)</li> <li>Customer Dollar Savings: Average monthly savings of between \$1.56 and \$43.02 (2 to 39 percent), depending on price plan.</li> </ul>   |
| <b>RESOURCES</b>          |  |
| Program Website           | <ul style="list-style-type: none"> <li><a href="http://www.powercentsdc.org">http://www.powercentsdc.org</a></li> <li><a href="http://www.pepco.com/energy/blueprint/">http://www.pepco.com/energy/blueprint/</a></li> </ul>   |
| Full Program Report       | PEPCO, PowerCents DC Program Final Report, September, 2010, <a href="http://www.powercentsdc.org/ESC%2010-09-08%20PCDC%20Final%20Report%20-%20FINAL.pdf">http://www.powercentsdc.org/ESC%2010-09-08%20PCDC%20Final%20Report%20-%20FINAL.pdf</a> , accessed September 21, 2011  |
| Presentations             | Morgan, Rick, PowerCents DC: Smart Pricing for the Smart Grid, Pepco, <a href="http://www.powercentsdc.org/SMPPI%2010-01-07%20Federal%20Briefing%20Slides%20FINAL-rev.pdf">http://www.powercentsdc.org/SMPPI%2010-01-07%20Federal%20Briefing%20Slides%20FINAL-rev.pdf</a> , accessed September 21, 2011  |
| News Articles             | <ul style="list-style-type: none"> <li>eMeter, PowerCentsDC™ Selects eMeter's Energy Engage for Online Consumer Engagement, <a href="http://www.emeter.com/customers/powercentsdc/">http://www.emeter.com/customers/powercentsdc/</a>, accessed September 21, 2011</li> <li>Tweed, Katherine, PowerCentsDC Could Provide Best Practices for Other Utilities, Greentech Media, September 10, 2010 <a href="http://www.greentechmedia.com/articles/read/powercentsdc-could-provide-best-practices-for-other-utilities/">http://www.greentechmedia.com/articles/read/powercentsdc-could-provide-best-practices-for-other-utilities/</a>, accessed September 21, 2011</li> </ul> |
| Other Resources           | N/A  |

### PROGRAM DESCRIPTION

PowerCentsDC, an SMPPI DSM pilot program, was approved by the PSC in 2007 and launched the next year. The intent of PowerCentsDC was to measure and analyze residential customers' responses to the following three different dynamic electricity pricing plans (or groups): CPP, CPR, and HP. As the group names suggest, in CPP the electricity prices are about seven times the normal (slightly discounted) price for about 60 peak-consumption hours of the year; for CPR, rebates are earned for lower consumption in the peak pricing hours; and in HP, electricity prices change on an hourly basis based on wholesale prices.

Participants were given smart meters and, in some cases, smart thermostats for their air-conditioning units, and prices were designed to be revenue-neutral, so a participant would expect to pay the same as a non-participant with Standard Offer Service pricing. Additionally, participants received information about the pricing programs in the form of brochures. At the end of the pilot, in October 2009, a

customer survey was sent both to the 900 participants in PowerCentsDC as well as a control group of 400 non-participants. Low-income customers were included as a subset in CPR.

Questions the program tried to answer ranged from the very basic (would people even be willing to participate in the program?) to the very specific (how much money would consumers with central air-conditioning save, and how would this compare to consumers without central air-conditioning?). Thus, the pilot program generally tried to measure the relative effectiveness of the three pricing programs, as well as their absolute effectiveness when compared to business as usual. PowerCentsDC used a nonparametric conditional mean estimation framework for its analytical model.

Three major items were affirmed by PowerCentsDC in its full program report, released in September 2010 (summarized in Table 8):

- Peak demand was reduced in absolute terms (and, as a result, program participants saved money).
- Peak demand was reduced much more in summer than in winter.
- CPP resulted in the most peak energy savings, but had the smallest price savings.

**Table 8. PEPCO PowerCentsDC Demand and Price Reductions**

| Price Group | Summer Peak Reduction | Winter Peak Reduction | Dollar Savings | Percent Savings |
|-------------|-----------------------|-----------------------|----------------|-----------------|
| CPP         | 34%                   | 13%                   | \$1.56         | 2%              |
| CPR         | 13%                   | 5%                    | \$4.59         | 5%              |
| HP          | 4%                    | 2%                    | \$43.02        | 39%             |

Source: PEPCO, PowerCents DC Program Final Report, September, 2010, <http://www.powercentsdc.org/ESC%2010-09-08%20PCDC%20Final%20Report%20-%20FINAL.pdf>, accessed September 21, 2011

How was there an inverse relationship between peak demand reduction and price savings? It was probably just luck. Hourly Pricing program participants benefited from having prices tied to wholesale electricity prices, and it just so happened that over the course of PowerCentsDC, wholesale prices had a dramatic decrease, likely a result of economic downturn.

Other interesting conclusions include the following: use of smart thermostats increased demand reduction; low-income participants' demand reduction was smaller than others' in percentage terms; and the program was very popular with participants.

PEPCO was awarded a \$44.6 million ARRA grant to install to install about 280,000 smart meters equipped with the network interface, institute dynamic pricing programs, and deploy distribution automation and communication infrastructure technology to reduce peak load demand and improve grid efficiency.

#### **UPDATES AS OF SEPTEMBER 2011**

The installation of smart meters is continuing across the District of Columbia until December 2011, at which point all District customers will have a smart meter.<sup>32</sup> Pepco conducts a sample test on each

<sup>32</sup> Pepco, Smart Meters in D.C., <http://www.pepco.com/energy/blueprint/smetersdc/>, accessed September 21, 2011

production run of smart meters before installation to ensure accuracy; to-date, no sample tests have failed.<sup>33</sup>

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<sup>33</sup> Pepco, Pepco Tests Smart Meters for Accuracy, <http://www.pepco.com/energy/blueprint/smetersdc/meteraccuracy.aspx>, accessed September 21, 2011

| <b>PGE Critical Peak Pricing Pilot</b> |                                 |                      |                                   |
|--|---------------------------------|----------------------|-----------------------------------|
| <b>Location:</b>                       | Portland, Oregon                | <b>Dates:</b>        | 4 <sup>th</sup> quarter 2011-2013 |
| <b>Primary Utility/Entity:</b>         | Portland General Electric (PGE) | <b>ARRA Funding:</b> | No                                |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | To test a variable pricing program through which baseline data would be collected for one year, followed by the launching of a pilot program with 1,000 customers. A subset of those households eventually would get programmable thermostats that allow them to set default preferences for economy or comfort.                                     |
| Status                         | Pending; scaled back   |
| Number of Participants         | 1,000 residents (scaled back from 2,000 residents)   |
| Participating Entities         | <ul style="list-style-type: none"> <li>• PGE</li> <li>• Third-party contractor for billing services</li> </ul>   |
| Program Budget                 | \$1.6-2.0 million for third-party contractor   |
| Consumer Sector                | Residential  |
| Hardware/Software Technologies | Smart meters   |
| Consumer Education Measures    | N/A  |
| <b>PROGRAM RESULTS</b>         |  |
| Key Findings                   | Pilot study could commence during the 4 <sup>th</sup> quarter of 2011  |
| Other Outcomes                 | N/A  |
| Customer Feedback              | To be solicited throughout pilot   |
| Current Deployment Status      | N/A  |
| Future Implications            | N/A  |
| <b>IMPACTS/BENEFITS</b>        |  |
| Consumers                      | N/A  |
| Utilities                      | N/A  |
| Metrics Used                   | N/A  |
| <b>RESOURCES</b>               |  |
| Program Website                | <a href="http://www.portlandgeneral.com/default.aspx">http://www.portlandgeneral.com/default.aspx</a>  |
| Full Program Report            | N/A  |
| Presentations                  | N/A  |
| News Articles                  | Sickinger, Ted, PGE to test peak-pricing for electricity, The Oregonian, September 2, 2009, (initial pilot program)<br><a href="http://www.oregonlive.com/business/index.ssf/2009/09/pge_to_test_peak-pricing_for_e.html">http://www.oregonlive.com/business/index.ssf/2009/09/pge_to_test_peak-pricing_for_e.html</a> , accessed September 21, 2011 |

|                 |   |
|-----------------|---|
| Other Resources | <ul style="list-style-type: none"> <li>• PUC- Alternative Pilot submission: <a href="http://www.puc.state.or.us/PUC/meetings/pmemos/2010/092110/reg2.pdf?ga=t">http://www.puc.state.or.us/PUC/meetings/pmemos/2010/092110/reg2.pdf?ga=t</a>, accessed September 21, 2011</li> <li>• PGE, Schedule 12, Residential Critical Peak Pricing Pilot, <a href="http://www.portlandgeneral.com/our_company/corporate_info/regulatory_documents/pdfs/schedules/Sched_012.pdf">http://www.portlandgeneral.com/our_company/corporate_info/regulatory_documents/pdfs/schedules/Sched_012.pdf</a>, accessed September 21, 2011</li> <li>• PGE, Tariff update Announcement, June 8, 2011, <a href="http://www.portlandgeneral.com/our_company/corporate_info/regulatory_documents/pdfs/tariff_updates/Update_06_08_11.pdf">http://www.portlandgeneral.com/our_company/corporate_info/regulatory_documents/pdfs/tariff_updates/Update_06_08_11.pdf</a>, accessed September 21, 2011</li> </ul> |
|-----------------|---|

**PROGRAM DESCRIPTION**

In order for PGE to be able to initiate their CPP Pilot, the PUC of Oregon required PGE to provide a formal voluntary enrollment period by September 1, 2010. However, PGE acknowledged it would be unable to meet the PUC’s deadlines and requested to withdraw the initial pilot program in June 2010. In September 2010, PGE offered a substitute course of action, which would have an alternative CPP pilot running by sometime during the fourth quarter of 2011.

According to the PUC’s Staff Report from a public meeting held on September 21, 2010, PGE’s alternative CPP Pilot will include:

- A two-year CPP pilot investigation will be conducted as previously contemplated, except that the maximum number of residential customer participants will be scaled down to 1,000 from 2,000.
- Rather than PGE performing the CPP-participant billing services (including answering customers’ CPP billing questions) “in-house,” a third-party contractor will be retained to perform these functions. The contractor will utilize individual customer load data obtained by PGE from its smart meters. Third-party billing removes PGE’s dependency upon its own IT staff for this aspect of the pilot study.
- The range of estimated costs—largely for funding the third-party contract—were forecast in Advice No. 09-05 to be \$1.6 to \$2 million.
- The CPP pilot will be up and running, i.e., with customers being enrolled and incurring bills based upon tariff CPP prices, by sometime during the fourth quarter of 2011.

After hearing about PGE’s alternative plan, PUC staff had several comments and concerns. PGE’s incremental costs for the CPP pilot should be tracked and charged to ratepayers, as with any realized benefits so that ratepayers will be able to recognize the full CPP-related net benefits as described by PGE. Another big concern with PGE’s new CPP pilot plan relates to the costs and received value by relying upon a third-party contractor for customer/billing services. Staff mentioned that issues could arise when PGE would transition from the pilot program to a full roll-out of CPP to customers if the contractor used proprietary software or software that is incompatible with PGE’s current system. Given these concerns, PUC staff would like PGE to work with other parties to gain a more thorough understanding of all the feasible alternatives that may exist.

### **UPDATES AS OF SEPTEMBER 2011**

According to a tariff update announcement on June 8, 2011, PGE elevated the Critical Peak price and increased the On-Peak/Off-Peak price spread from 1.5 cents to 2.5 cents.<sup>34</sup> The CPP pilot is expected to be conducted from November 1, 2011 through October 31, 2013.

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<sup>34</sup> PGE, Tariff update Announcement, June 8, 2011, [http://www.portlandgeneral.com/our\\_company/corporate\\_info/regulatory\\_documents/pdfs/tariff\\_updates/Update\\_06\\_08\\_11.pdf](http://www.portlandgeneral.com/our_company/corporate_info/regulatory_documents/pdfs/tariff_updates/Update_06_08_11.pdf), accessed September 21, 2011



| SDG&E Smart Meter Program      |                                     |                      |               |
|--------------------------------|-------------------------------------|----------------------|---------------|
| <b>Location:</b>               | SDG&E Service Territory, California | <b>Dates:</b>        | 2009-2011     |
| <b>Primary Utility/Entity:</b> | San Diego Gas & Electric (SDG&E)    | <b>ARRA Funding:</b> | ~\$28 million |

| PROGRAM INFORMATION            |   |
|--------------------------------|---|
| Key Objectives                 | <ul style="list-style-type: none"> <li>Establishing the security of its smart grid network in preparation for advanced smart grid technologies.</li> <li>Smart meter installation is first step, with other infrastructure technologies still in pilot stages.</li> </ul>   |
| Status                         | In progress   |
| Number of Participants         | <ul style="list-style-type: none"> <li>1.4 million customers</li> <li>1,093,312 electric meters installed through 12/2010</li> <li>725,353 gas meters installed through 12/2010</li> </ul>  |
| Participating Entities         | SDG&E   |
| Program Budget                 | <ul style="list-style-type: none"> <li>\$572 million, as approved by the California PUC (CPUC) in 2007</li> <li>\$60 million (\$28 million ARRA grant and \$31 million cost-share) for wireless communications system</li> </ul>  |
| Consumer Sector                | All   |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>Two-way-communication smart meters (electricity and gas)</li> <li>Smart thermostats</li> <li>Integration with renewable generation (solar/wind)</li> <li>Sensors, communications and control equipment for Micro Grid Demonstration Project</li> </ul>   |
| Consumer Education Measures    | Website devoted to informing consumers about saving energy  |
| PROGRAM RESULTS                |   |
| Key Findings                   | <ul style="list-style-type: none"> <li>Deployment has been on time and on budget, with little of the organized opposition experienced by fellow California utility PG&amp;E.</li> <li>Held up as example of good management.</li> <li>Utility's focus has been on security/integrity first, with the belief that innovations in technology can be implemented later.</li> </ul> |
| Other Outcomes                 | SDG&E named "smartest utility" two years in a row by <i>UtiliQ</i> magazine.  |
| Customer Feedback              | <ul style="list-style-type: none"> <li>Number of unique visits declined substantially in Q4 2010 even as number of installations was relatively stable.</li> <li>Negative publicity has been limited.</li> </ul>  |
| Current Deployment Status      | <ul style="list-style-type: none"> <li>Smart meter installation scheduled to be completed in June 2011</li> <li>Micro Grid Demonstration Project scheduled to run through 2011, after which implementation of successful technologies may take place over the entire SDG&amp;E coverage area.</li> </ul>  |
| Future Implications            | Findings of Micro Grid Demonstration Project and other initiatives will help SDG&E improve other aspects of smart grid infrastructure relating to sensors, communications, control equipment, and intermittent/distributed generation.  |

| IMPACTS/BENEFITS    |   |
|---------------------|---|
| Consumers           | <ul style="list-style-type: none"> <li>• Ability to monitor energy use</li> <li>• Businesses have ability to join commercial CPP program</li> <li>• Forthcoming integration with renewable energy to allow customers to sell energy back to grid</li> </ul>   |
| Utilities           | <ul style="list-style-type: none"> <li>• Effectiveness of smart meters has been increasing, relative to old meters</li> <li>• Utility able to remotely read nearly all meters</li> <li>• Publicity helped by perceived success of rollout</li> </ul>  |
| Metrics Used        | <ul style="list-style-type: none"> <li>• Percentage of Smart Meters Requiring Estimated Reading: 0.11 percent (gas), 0.11 percent (electric) versus 2.49 percent for manually read meters (4Q 2010)</li> <li>• Smart Meter website visits: 10,449 unique visits (4Q 2010)</li> <li>• Smart Grid Deployment Plan Metrics: <ul style="list-style-type: none"> <li>○ Nine customer/smart meter metrics</li> <li>○ One plug-in electric vehicle metric</li> <li>○ One energy storage metric</li> <li>○ Eight grid operations metrics</li> </ul> </li> </ul>   |
| RESOURCES           |   |
| Program Website     | <ul style="list-style-type: none"> <li>• <a href="http://www.sdge.com/smartmeter">http://www.sdge.com/smartmeter</a></li> <li>• <a href="http://www.sdge.com/smartgrid/smartGriddemo.shtml">http://www.sdge.com/smartgrid/smartGriddemo.shtml</a></li> </ul>  |
| Full Program Report | <ul style="list-style-type: none"> <li>• <a href="http://www.sdge.com/smartgrid/deployment/index.shtml">http://www.sdge.com/smartgrid/deployment/index.shtml</a></li> </ul>   |
| Presentations       | N/A   |
| News Articles       | <ul style="list-style-type: none"> <li>• Rowland, Kate, UtilitiQ's most intelligent utility forges ahead, Intelligent Utility, <a href="http://www.intelligentutility.com/magazine/article/203205/san-diego-gas-electric">http://www.intelligentutility.com/magazine/article/203205/san-diego-gas-electric</a>, accessed September 21, 2011</li> <li>• Bigelow, Bruce, SDG&amp;E Gets \$28.1M Federal Grant for Smart Grid Innovations, Xconomy San Diego, <a href="http://www.xconomy.com/san-diego/2009/10/27/sdge-gets-28-1m-federal-grant-for-smart-grid-innovations/">http://www.xconomy.com/san-diego/2009/10/27/sdge-gets-28-1m-federal-grant-for-smart-grid-innovations/</a>, accessed September 21, 2011</li> <li>• KFMB-TV CBS 8, SDG&amp;E smart meters could help you cut power usage, <a href="http://www.cbs8.com/Global/story.asp?S=11772875">http://www.cbs8.com/Global/story.asp?S=11772875</a>, accessed September 21, 2011</li> <li>• Perdue, Christopher, San Diego Gas &amp; Electric weighs in on the costs of smart grid investments, Intelligent Utility, <a href="http://www.intelligentutility.com/article/11/06/san-diego-gas-electric-weighs-costs-smart-grid-investments">http://www.intelligentutility.com/article/11/06/san-diego-gas-electric-weighs-costs-smart-grid-investments</a>, accessed September 21, 2011</li> <li>• Renew Grid, SDG&amp;E Outlines Smart Grid Plan, <a href="http://www.renewgridmag.com/e107_plugins/content/content.php?content_6864">http://www.renewgridmag.com/e107_plugins/content/content.php?content_6864</a>, accessed September 21, 2011</li> </ul> |

|                 |   |
|-----------------|---|
| Other Resources | <ul style="list-style-type: none"> <li>• <a href="http://www.sdge.com/smartgrid/smartGriddemo.shtml">http://www.sdge.com/smartgrid/smartGriddemo.shtml</a></li> <li>• <a href="http://www.sdge.com/smartgrid/index.shtml">http://www.sdge.com/smartgrid/index.shtml</a></li> <li>• <a href="http://www.sdge.com/smartmeter/faq.shtml">http://www.sdge.com/smartmeter/faq.shtml</a></li> <li>• <a href="http://www.sdge.com/smartgrid/deployment/metrics.shtml">http://www.sdge.com/smartgrid/deployment/metrics.shtml</a></li> <li>• Smartgrid.gov, San Diego Gas and Electric Company: SDG&amp;E Grid Communication System, <a href="http://www.smartgrid.gov/project/san_diego_gas_and_electric_company_sdge_grid_communication_system">http://www.smartgrid.gov/project/san_diego_gas_and_electric_company_sdge_grid_communication_system</a>, accessed September 21, 2011</li> <li>• CPUC, Decision 10-06-047 June 25, 2010, <a href="http://docs.cpuc.ca.gov/WORD_PDF/FINAL_DECISION/119902.PDF">http://docs.cpuc.ca.gov/WORD_PDF/FINAL_DECISION/119902.PDF</a>, accessed September 21, 2011</li> <li>• Memorandum of Understanding on the Smart Grid Partnership Program, <a href="http://www.state.gov/documents/organization/164558.pdf">http://www.state.gov/documents/organization/164558.pdf</a>, accessed September 21, 2011</li> </ul> |
|-----------------|---|

### PROGRAM DESCRIPTION

SDG&E first began planning its smart meter rollout in 2005. The first installations began in 2009 and were nearly complete by year-end 2010, with about 1,820,000 electric and gas smart meters deployed; full deployment was expected to be complete in June 2011. A budget of \$572 million was approved by the CPUC in 2007. Since that time, SDG&E has won additional funding, including \$28.1 million in ARRA funds for a \$60-million communication improvement initiative, the centerpiece of which is a 700-mHz takeout point for data transmission. Additionally, \$7.5 million in Federal funding and \$3 million in State funding are going towards the utility’s Micro Grid Demonstration Project, which is incubating sensors, communications and control equipment technologies for a potential future utility-wide rollout. The Micro Grid Demonstration Project also includes a focus on linking intermittent generation to a smart grid infrastructure; SDG&E hopes to allow residents with rooftop solar panels, for example, to sell generation to the grid at peak hours. The Micro Grid Demonstration Project is scheduled to run through 2011.

The smart meter rollout has been regarded as successful, with SDG&E’s reputation further enhanced by being named the smartest utility for the second straight year by *UtiliQ* magazine in 2010. The prioritization of one aspect of smart grid, smart meter installation, has been mentioned as a possible factor in the success. This approach has allowed for a small pilot such as the Micro Grid Demonstration Project to study the effectiveness of other infrastructure technologies that could be installed at a later date, rather than rushing to implement unproven (and potentially soon-to-be-obsolete) technologies. Additionally, SDG&E’s customer outreach has been deemed effective, as evidenced by the lack of organized opposition to smart meters that other rollouts have experienced. Variable-pricing programs employing smart meters have not been utilized, except for business customers, but this may change in the future.

### UPDATES AS OF SEPTEMBER 2011

SDG&E has met with more than 25 stakeholder groups in academia, business, customer advocacy, and government since late 2010 in order to understand their smart grid preferences.<sup>35</sup> On June 6, 2011, SDG&E filed its “Smart Grid Deployment Plan 2011-2020” with CPUC. This plan serves as an overview of the company’s current smart grid status and as a policy guide for future deployment of smart grid

<sup>35</sup> Renew Grid, SDG&E Outlines Smart Grid Plan, [http://www.renewgridmag.com/e107\\_plugins/content/content.php?content.6864](http://www.renewgridmag.com/e107_plugins/content/content.php?content.6864), accessed September 21, 2011

technology. The deployment plan was filed in response to CPUC decision D.10-06-047, which adopted requirements for smart grid deployment plans pursuant to Senate Bill (SB) 17.<sup>36</sup> SDG&E estimates that the cost of smart grid deployments from 2006 to 2020 will total approximately \$3.5 to \$3.6 billion, including previously authorized programs (equivalent to about \$2,500 per customer).<sup>37</sup> SDG&E estimates that total benefits associated with smart grid deployments will total between \$3.8 billion and \$7.1 billion, including estimated societal and environmental benefits of between \$760 million to \$1.9 billion.

SDG&E currently quantifies the success of its current smart grid deployment through a variety of metrics posted on its smart grid homepage, including nine customer/smart meter metrics, one plug-in electric vehicle metric, one energy storage metric, and eight grid operations metrics. As of December 31, 2010, SDG&E has received 2,123 escalated customer complaints related to the accuracy, functioning, or installation of advanced meters, though there were only 37 instances when an advanced meter malfunction caused service to be disrupted. SDG&E reports that it replaced 27,472 advanced meters annually before the end of their expected useful life. As of the same date, 26,088 commercial and residential customers were enrolled in a time-variant or dynamic pricing tariff.<sup>38</sup>

SDG&E has also reached out to international partners. On May 24, 2011, SDG&E entered into an MOU with Russia's Interregional Distribution Grid Company of Centre to cooperate on the development of smart grid. Areas of cooperation will include AMI smart meters and distribution automation, among others.<sup>39</sup>

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<sup>36</sup> CPUC, Decision 10-06-047 June 25, 2010, [http://docs.cpuc.ca.gov/WORD\\_PDF/FINAL\\_DECISION/119902.PDF](http://docs.cpuc.ca.gov/WORD_PDF/FINAL_DECISION/119902.PDF), accessed September 21, 2011

<sup>37</sup> Perdue, Christopher, San Diego Gas & Electric weighs in on the costs of smart grid investments, Intelligent Utility, <http://www.intelligentutility.com/article/11/06/san-diego-gas-electric-weighs-costs-smart-grid-investments>, accessed September 21, 2011

<sup>38</sup> SDG&E, Smart Grid Deployment Plan Metrics, <http://www.sdge.com/smartgrid/deployment/metrics.shtml>, accessed September 21, 2011

<sup>39</sup> Memorandum of Understanding on the Smart Grid Partnership Program, <http://www.state.gov/documents/organization/164558.pdf>, accessed September 21, 2011

| SRP Smart Grid Project         |                          |                      |                |
|--------------------------------|--------------------------|----------------------|----------------|
| <b>Location:</b>               | Central Arizona          | <b>Dates:</b>        | 2003 - 2013    |
| <b>Primary Utility/Entity:</b> | Salt River Project (SRP) | <b>ARRA Funding:</b> | \$56.9 million |

| PROGRAM INFORMATION            |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>To enable SRP to remotely address customer orders.</li> <li>To provide more timely and detailed information to customers and help them to better monitor and manage their energy consumption.</li> <li>To reduce labor costs and conserve fuel.</li> </ul>  |
| Status                         | Successful to-date   |
| Number of Participants         | 935,000 customers  |
| Participating Entities         | <ul style="list-style-type: none"> <li>SRP (utility)</li> <li>Elster Group (Energy Axis AMI data management, REX meters)</li> <li>ALPHA</li> <li>Landis+Gyr (AMI meters)</li> </ul>  |
| Program Budget                 | <ul style="list-style-type: none"> <li>Total project cost is \$114 million.</li> <li>\$56.9 million in ARRA funding received.</li> </ul>   |
| Consumer Sector                | <ul style="list-style-type: none"> <li>Residential</li> <li>Commercial</li> <li>Industrial</li> </ul>  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>Wireless smart meters with two-way radio communications. Elster REX residential smart meters, ALPHA commercial and industrial smart meters. The meters communicate to the utility via radio signals. 300,000 of the meters are AMPY Pay-Smart Meters with in-home displays, wireless prepayment, or CPP-DR technologies.</li> <li>Voluntary dynamic pricing options offered.</li> <li>Elster's EnergyICT meter data management system is used to process meter data.</li> <li>SRP is the first utility in the U.S. to roll-out remotely controlled 200A service switches to customers.</li> </ul> |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>Website includes meter reading tutorial, FAQ, and a guide for what to expect during installation.</li> <li>Customer access to TOU data through a web portal and/or email notifications.</li> <li>During the smart meter installation process customers receive: <ul style="list-style-type: none"> <li>Postcard (one week prior to installation)</li> <li>Door hanger (after installation)</li> <li>Additional page with first bill explaining smart meter the benefits</li> </ul> </li> </ul>  |
| PROGRAM RESULTS                |  |
| Key Findings                   | <ul style="list-style-type: none"> <li>SRP planning to provide customers with a meter that gives hourly and/or real-time energy usage.</li> <li>M-Power prepaid plan remains a popular option for a variety of residents.</li> </ul>   |
| Other Outcomes                 | N/A  |

|                           |  |
|---------------------------|--|
| Customer Feedback         | <ul style="list-style-type: none"> <li>• Few complaints about smart meter installations (mainly health concerns).</li> <li>• Customers have high satisfaction rate for pre-paid M-Power plan.</li> </ul>   |
| Current Deployment Status | <ul style="list-style-type: none"> <li>• Smart meter deployment continues through 2012 or 2013</li> <li>• Up to 709,932 smart meters deployed as of August 31, 2011</li> </ul>   |
| Future Implications       | <ul style="list-style-type: none"> <li>• Prepaid metering options may become more prevalent due to the success of the SRP plan. SRP is looking into merging smart meter technology with the M-Power plan.</li> <li>• All customers will have the smart meter option by 2013.</li> </ul>  |
| <b>IMPACTS/BENEFITS</b>   |  |
| Consumers                 | <ul style="list-style-type: none"> <li>• 20 percent increase in voluntary TOU rate program participation with new smart meters.</li> <li>• SRP data shows 88 percent of M-Power customers prefer the prepaid plan to monthly bills; 93 percent say they use energy more wisely.</li> <li>• According to SRP, the average M-Power customer reduces energy usage by 12 percent annually.</li> <li>• M-Power customers could pay at most \$74.50 more per year than customers on basic plan (roughly 5 percent rate hike), as a trade-off for more control over bills.</li> </ul>   |
| Utilities                 | <ul style="list-style-type: none"> <li>• New meters contributed to SRP receiving several J.D. Power and Associates honors; highest in customer satisfaction for business and residential electric service among large electricity providers in the western U.S.</li> <li>• Voluntary pre-paid service is saving SRP money: <ul style="list-style-type: none"> <li>○ Less debt carried from customers who cannot pay bills.</li> <li>○ Reduced labor costs due to call center staff relieved from handling reconnect and billing inquiries from accounts that have been shut off or are delinquent.</li> </ul> </li> <li>• The utility now avoids tens of thousands of service calls a month.</li> <li>• On the company website, SRP claims the new smart meters are consistently proven to be highly accurate and reliable.</li> </ul> |
| Metrics Used              | <ul style="list-style-type: none"> <li>• Reduced number of customer calls to the utility.</li> <li>• Smart meters currently installed: ~ 14,000 smart meters each month.</li> <li>• By the end of 2010, more than 280,000 customers enrolled in My Account online portal.</li> </ul>   |
| <b>RESOURCES</b>          |  |
| Program Website           | <a href="http://www.srpnet.com/electric/home/smartmeter.aspx">http://www.srpnet.com/electric/home/smartmeter.aspx</a>  |
| Full Program Report       | SRP, SRP 2010 Annual Report, <a href="http://www.srpnet.com/about/financial/2010AnnualReport/siteassets/pdfx/2010_AR_PDF.pdf">http://www.srpnet.com/about/financial/2010AnnualReport/siteassets/pdfx/2010_AR_PDF.pdf</a> , accessed September 22, 2011   |
| Presentations             | <a href="http://www.srpnet.com/about/financial/2010annualreport/default.aspx">http://www.srpnet.com/about/financial/2010annualreport/default.aspx</a>  |
| News Articles             | <ul style="list-style-type: none"> <li>• Randazzo, Ryan, SRP gets boost from feds for customer 'smart meters,' The Arizona Republic, <a href="http://www.azcentral.com/business/news/articles/1969/12/31/19691231biz-srp1028.html">http://www.azcentral.com/business/news/articles/1969/12/31/19691231biz-srp1028.html</a>, accessed September 21, 2011</li> <li>• MeterPedia, Implementation in Arizona by Salt River Project, <a href="http://meterpedia.com/mwp/category/topics/prepayment/">http://meterpedia.com/mwp/category/topics/prepayment/</a>, accessed September 22, 2011</li> </ul>  |

|                 |  |
|-----------------|--|
|                 | <ul style="list-style-type: none"> <li>• Elster, SRP To Double Elster EnergyAxis AMI Smart Grid Solution Deployment, <a href="http://investors.elster.com/phoenix.zhtml?c=227678&amp;p=irol-newsArticle&amp;ID=1444588&amp;highlight=">http://investors.elster.com/phoenix.zhtml?c=227678&amp;p=irol-newsArticle&amp;ID=1444588&amp;highlight=</a>, accessed September 22, 2011</li> <li>• EP Overviews Publishing Inc., SRP seeks \$80,000,000 US for Smart Grid, Energy Efficiency projects (Funding, Leg. &amp; Reg.), <a href="http://epoverviews.com/articles/visitor.php?keyword=Smart%20Meter%20Rollout">http://epoverviews.com/articles/visitor.php?keyword=Smart%20Meter%20Rollout</a>, accessed September 22, 2011</li> <li>• <a href="http://www.greentechmedia.com/articles/read/shocker-a-utility-that-ranks-high-in-customer-satisfaction/">http://www.greentechmedia.com/articles/read/shocker-a-utility-that-ranks-high-in-customer-satisfaction/</a></li> <li>• Randazzo, Ryan, SRP's prepaid electricity plan found to have higher rates, The Arizona Republic, July 11, 2010, <a href="http://www.azcentral.com/business/articles/2010/07/11/20100711biz-prepaid-power-srp-rates0711.html">http://www.azcentral.com/business/articles/2010/07/11/20100711biz-prepaid-power-srp-rates0711.html</a>, accessed September 21, 2011</li> <li>• Randazzo, Ryan, Arizona utilities try to ease 'smart meter' fears, The Arizona Republic, September 8, 2011, <a href="http://www.azcentral.com/business/articles/2011/09/08/20110908arizona-utilities-try-ease-smart-meter-fears.html">http://www.azcentral.com/business/articles/2011/09/08/20110908arizona-utilities-try-ease-smart-meter-fears.html</a>, accessed September 21, 2011</li> </ul> |
| Other Resources | <ul style="list-style-type: none"> <li>• The Edison Foundation, Utility-Scale Smart Meter Deployments, Plans &amp; Proposals - September 2009, <a href="http://www.electric-efficiency.com/issueBriefs/Smart%20Meter%20Rollouts_0909_web.pdf">http://www.electric-efficiency.com/issueBriefs/Smart%20Meter%20Rollouts_0909_web.pdf</a>, accessed September 22, 2011</li> <li>• Smartgrid.gov, Salt River Project Agricultural Improvement and Power District, Advanced Data Acquisition and Management Program, <a href="http://www.smartgrid.gov/project/salt_river_project_agricultural_improvement_and_power_district_advanced_data_acquisition_and">http://www.smartgrid.gov/project/salt_river_project_agricultural_improvement_and_power_district_advanced_data_acquisition_and</a>, accessed September 21, 2011</li> </ul>  |

### PROGRAM DESCRIPTION

In October 2009, SRP was awarded a matching grant of \$56.9 million under ARRA Smart Grid Investment Grant initiative. SRP plans to install up to 1 million smart meters, along with the current implementation of the following four pricing plans:<sup>40</sup>

- TOU Plan: Higher prices during on-peak hours; all other off-peak hours are lower-priced.
- EZ3 Plan: Charges premium energy prices during the on-peak hours of 3-6 pm Monday to Friday. All other off-peak hours are lower-priced.
- Basic Plan: Energy prices are the same regardless of TOU. Prices go up slightly when energy usage in a month exceeds certain levels, which vary in winter and summer.
- M-Power Plan: Using an SRP M-Power smart card, customers can buy power when needed, in the quantity desired, at roughly 100 SRP PayCenter machines (similar to ATMs) in grocery stores, convenience stores, and SRP offices throughout Phoenix. An in-home display unit can be used to monitor energy costs. No monthly bills or late charges are assessed; the customer pays only an \$87.50 equipment deposit and \$11.50 plus tax refurbishment fee.

The Customer Metering Services department at SRP supports the metering operations for residential and commercial customers. The five department subdivisions (the Field Metering Operations, Metering

<sup>40</sup> SRP, Choose the right price plan, <http://www.srpnet.com/prices/home/ChooseYourPricePlan.aspx>, accessed September 22, 2011

Back-office Operations, Meter Shop Operations, Meter Reading, and Technical Support Services) achieve the following basic functions:<sup>41</sup>

- Install, test, maintain, and repair generation, substation, commercial/industrial, and residential metering
- Upgrade, program, and exchange meters
- Administer maintenance programs to ensure acceptable accuracy performance of population
- Test and evaluate new metering equipment and technologies
- Investigate customer complaints for billing and high/low usage

The wireless, RF smart meter deployments for residential, commercial, and industrial customers began in August 2003. Elster REX meters have an internal service control switch, enabling SRP to remotely connect and disconnect meters without sending personnel to the meter location.<sup>42</sup>

SRP is taking steps to ensure that customer education measures are in place and security risks are mitigated. Two weeks prior to installation, customers are sent smart meter information along with the contact information for staff that can respond to any follow-up questions. SRP chose to specifically design the customer education program to minimize the amount of effort needed for customers to obtain accurate information and resolve any issues or questions. Not only can customers check their energy use online, but SRP also offers estimated monthly or weekly bills via email or text messages based on current power usage. These capabilities were established and tested far ahead of the smart meter rollout, in anticipation of a sharp increase in customer questions. SRP plans to provide more detailed information, such as hourly and real-time data, in the coming years. Over a quarter of SRP customers have accessed the “My Account” online feature associated with their energy pricing plan.<sup>43</sup>

To address data security risks, SRP has implemented proprietary meter protocols to defend against unauthorized access to customer data. Encryption is used at each step of the data transmission process between the customer and SRP. The meters are password protected, meet the ANSI 12.21 and 12.22 security standards, and the network is equipped with a firewall to ensure complete isolation from the broad internet.<sup>44</sup>

SRP has received a great deal of attention for its successful M-Power plan, a prepaid metering program introduced to customers in 2000. By mid 2010, around 100,000 customers had enrolled in the plan, which was originally designed to assist low income residents with payment management.<sup>45</sup> The program has one of the highest customer satisfaction ratings of any customer program offered by SRP. Landis+Gyr will be working together with SRP to merge the latest smart meter technology into the plan to enable both credit and prepay modes. Currently, customers can only load their smart cards at SRP’s PayCenter locations, but this will soon change once the customer can wirelessly load a credit amount onto their smart meter.

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<sup>41</sup> Metering.com, Sustaining growth at Salt River Project, <http://www.metering.com/node/15542>, accessed September 21, 2011

<sup>42</sup> Ibid.

<sup>43</sup> Tweed, Katherine, Shocker! A Utility That Ranks High in Customer Satisfaction, Greentech Media, Inc., <http://www.greentechmedia.com/articles/read/shocker-a-utility-that-ranks-high-in-customer-satisfaction/>, accessed September 21, 2011

<sup>44</sup> SRP, FAQ about smart meters, <http://www.srpnet.com/electric/home/smartmeterfaqs.aspx#1>, accessed September 21, 2011

<sup>45</sup> Randazzo, Ryan, SRP’s prepaid electricity plan found to have higher rates, The Arizona Republic, <http://www.azcentral.com/business/articles/2010/07/11/20100711biz-prepaid-power-srp-rates0711.html>, accessed September 21, 2011



According to local news reports, some public outcry against the wireless smart meters has occurred in the Phoenix area, mainly for health reasons. However, SRP offers the M-Power plan which does not require a wireless, RF smart meter.

There have also been reports of radio interference caused by the new smart meters. Reports have surfaced of shorted out appliances catching fire, and interference with garage door openers or security systems. Currently the meter roll-out continues with no major problems reported. On the company website, SRP claims “the new meters will not interfere with any of your home electronics.”

Consumer advocacy groups have raised concerns about some facets of the M-Power program. If M-Power customers don't reduce their electricity consumption, they could pay up to \$74.50 more a year on the M-Power plan than on the basic rate plan, according to an Arizona Republic analysis of the rate structure. This is equivalent to a five percent rate increase. Though most customers express satisfaction with the program, advocacy groups object to the fact that low income residents, particularly those with smaller homes, are being charged more than customers on the basic plan. M-Power customers currently cannot take advantage of dynamic rates like TOU, CPP, or RTP pricing unless additional steps are taken to configure these rate plans on the meter.<sup>46</sup> The ease with which the electricity can be shut off is also a concern, particularly in the Arizona desert. SRP responds that it is expected that customers will reduce energy usage on these plans, and will receive savings as a result. In at least one "friendly credit" feature of the plan, if a customer runs out of purchased power after 6 p.m. on weekdays, weekends, or on a holiday, the power will not be shut off.<sup>47</sup> Prepaid metering does require significant capital investment for utilities due to extra equipment, which may explain why it remains a rare program in the United States.

#### **UPDATES AS OF SEPTEMBER 2011**

SRP's smart grid homepage gives differing numbers regarding the progress of its smart meter deployment program. According to one set of figures, 709,932 smart meters have been installed as of August 31, 2011, about 14,000 new smart meters are being installed each month, and virtually all customers will have advanced meters by April 2013. However, SRP also indicates on its program's frequently asked questions (FAQ) page that 560,000 smart meters have been installed, over 10,000 new smart meters are being installed each month, and deployment is set to be complete as soon as summer 2012. Recent news reports indicate that the larger number of installed meters is likely more accurate.<sup>48</sup>

SRP indicates on its program homepage that smart meter deployment is allowing it to save 249,000 labor hours, avoid 1.3 million driving miles, and conserve 135,000 gallons of fuel.

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<sup>46</sup> Kumar P. B, Satheesh, Are We Ready for Era of Smart Prepaid Services?, Wipro Council for Industry Research, <http://www.wipro.com/datadocs/EnergyUtilities/UtilitiesWP/smart-prepaid-services.pdf>, accessed September 21, 2011

<sup>47</sup> Consumer Reports, Prepaid and "smart" meters let you see how much electricity you use—and how much you might save, <http://news.consumerreports.org/home/2007/11/smart-meters-prepaid-meters-electricity-use-save-energy-salt-river-project-mpower-plan.html>, accessed September 21, 2011

<sup>48</sup> Randazzo, Ryan, Arizona utilities try to ease 'smart meter' fears, The Arizona Republic, September 8, 2011, <http://www.azcentral.com/business/articles/2011/09/08/20110908arizona-utilities-try-ease-smart-meter-fears.html>, accessed September 21, 2011

| <b>Xcel Saver's Switch</b>     |             |                      |              |
|--------------------------------|-------------|----------------------|--------------|
| <b>Location:</b>               | Minnesota   | <b>Dates:</b>        | 1990-Present |
| <b>Primary Utility/Entity:</b> | Xcel Energy | <b>ARRA Funding:</b> | No           |

| <b>PROGRAM INFORMATION</b>     |   |
|--------------------------------|---|
| Key Objectives                 | To reduce peak demand through direct load control, and in turn, allow Xcel Energy to manage its energy resources and avoid paying higher fuel prices during peak periods.   |
| Status                         | In progress, successful   |
| Number of Participants         | <ul style="list-style-type: none"> <li>• 314,000 residential customers (this equates to about half of Minnesota's eligible residential population) as of June 1, 2009</li> <li>• 13,000 business customers as of the end of 2008</li> </ul>   |
| Participating Entities         | <ul style="list-style-type: none"> <li>• Xcel Energy (utility, runs program)</li> <li>• Hunt Electric (provides majority of switch technology installation)</li> <li>• The Cadmus Group (wrote 2010 status report)</li> </ul>   |
| Program Budget                 | \$8.5 million (from 2010 cost benefit study)  |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> </ul>   |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Standard 900 MHz paging switch (initially)</li> <li>• Automated meter reading system to send a remote signal to meters (2001)</li> <li>• Smart switches, a 900 MHz adaptive algorithm switch (2003)</li> </ul>   |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• Marketing channels, including bill inserts, direct mail, their standard utility website</li> <li>• Dedicated website just for DSM and DR programs</li> <li>• Telemarketing</li> </ul>  |
| <b>PROGRAM RESULTS</b>         |   |
| Key Findings                   | <ul style="list-style-type: none"> <li>• Both residential and business program participants reported high satisfaction with their program experiences.</li> <li>• Program marketing analysis concludes that traditional marketing approaches, augmented by a segmentation and target marketing approach, effectively promote the program.</li> <li>• To resolve issues surrounding participants' understanding of how the program works, Xcel Energy should communicate more frequently with participants.</li> </ul> |
| Other Outcomes                 | In a 2010 net present cost-benefit analysis, customer cost-savings were greater than the utility's costs, with high societal net benefits.  |
| Customer Feedback              | Saver's Switch participants report high levels of satisfaction with their participation experience.   |
| Current Deployment Status      | Xcel (and its predecessors) have been offering Saver's Switch in Minnesota since 1990. Xcel now offers Saver's Switch as an across its service territory, including in Colorado, New Mexico, Texas, North Dakota, South Dakota, and Wisconsin.  |
| Future Implications            | N/A   |

| IMPACTS/BENEFITS    |  |
|---------------------|--|
| Consumers           | <ul style="list-style-type: none"> <li>• Participants receive 15 percent off their electric energy charges from June through September.</li> <li>• If a water heater is also enrolled in the program an additional 2 percent discount on monthly bills is given throughout the year.</li> <li>• Businesses receive a discount of \$5 per air conditioning ton on their June, July, August, and September electric bills.</li> <li>• 2010 bill reduction savings for business customers in this program was estimated to be \$3.9 million, while bill reduction savings for residential participants was estimated to be \$11.7 million.</li> </ul>   |
| Utilities           | <ul style="list-style-type: none"> <li>• Switch hardware and installation work are the significant costs.</li> <li>• Xcel Energy incurs labor costs for managing the program and promotional expenses for program expansion.</li> <li>• 2010 utility project costs for business customers were estimated to be \$1.98 million.</li> <li>• Costs for residential customers were estimated to be \$6.5 million.</li> </ul>   |
| Metrics Used        | <ul style="list-style-type: none"> <li>• Peak Demand Savings: Total residential peak load reduction at end of 2005 was 445 MW.</li> <li>• Energy Savings: 49,598 kWh is proposed to be saved (generator) from business participants between 2010 and 2012. 171,406 kWh is proposed to be saved annually from 2010-2012 from residential participants.</li> <li>• Customer Dollar Savings: calculated from 15 percent discount on residential electric bills June-September; additional 2 percent discount every month from adding on electric water heaters, and \$5 credit per air conditioning ton for business participants June-September.</li> </ul>  |
| RESOURCES           |  |
| Program Website     | <ul style="list-style-type: none"> <li>• Residential Site:<br/><a href="http://www.xcelenergy.com/Save_Money_&amp;_Energy/For_Your_Home/Heating_&amp;Cooling/Saver%27s_Switch_-_MN">http://www.xcelenergy.com/Save_Money_&amp;_Energy/For_Your_Home/Heating_&amp;Cooling/Saver%27s_Switch_-_MN</a>, accessed September 21, 2011</li> <li>• Commercial Site:<br/><a href="http://www.xcelenergy.com/Save_Money_&amp;_Energy/Find_a_Rebate/Saver%27s_Switch_-_MN">http://www.xcelenergy.com/Save_Money_&amp;_Energy/Find_a_Rebate/Saver%27s_Switch_-_MN</a>, accessed September 21, 2011</li> </ul>  |
| Full Program Report | Xcel Energy, 2010/2011/2012 Triennial Plan, Minnesota Electric and Natural Gas Conservation Improvement Program,<br><a href="http://www.xcelenergy.com/staticfiles/xcel/Regulatory/Regulatory%20PDFs/2010-11-12Triennial_FINAL_FILED.pdf">http://www.xcelenergy.com/staticfiles/xcel/Regulatory/Regulatory%20PDFs/2010-11-12Triennial_FINAL_FILED.pdf</a> , accessed September 21, 2011  |
| Presentations       | N/A  |
| News Articles       | <ul style="list-style-type: none"> <li>• <a href="http://www.xcelenergy.com/About_Us/Energy_News/News_Archive/Xcel_Energy_offers_Saver%27s_Switch_discounts_to_four_New_Mexico_communities">http://www.xcelenergy.com/About_Us/Energy_News/News_Archive/Xcel_Energy_offers_Saver%27s_Switch_discounts_to_four_New_Mexico_communities</a>, accessed September 21, 2011</li> <li>• <a href="http://www.xcelenergy.com/About_Us/Energy_News/News_Archive/Xcel_Energy_customers_help_reduce_peak_electricity_demand">http://www.xcelenergy.com/About_Us/Energy_News/News_Archive/Xcel_Energy_customers_help_reduce_peak_electricity_demand</a>, accessed September 21, 2011</li> <li>• <a href="http://www.xcelenergy.com/About_Us/Energy_News/News_Archive/Xcel_Energy_encourages_customers_to_help_reduce_peak_electricity_demand_by_using_Saver%27s_Switch">http://www.xcelenergy.com/About_Us/Energy_News/News_Archive/Xcel_Energy_encourages_customers_to_help_reduce_peak_electricity_demand_by_using_Saver%27s_Switch</a>, accessed September 21, 2011</li> </ul> |

|                 |  |
|-----------------|--|
| Other Resources | Public Service Company of Colorado, 2012/2013 Demand-Side Management Plan, Electric and Natural Gas, <a href="http://www.xcelenergy.com/staticfiles/xcel/Regulatory/2012-2013%20Biennial%20DSM%20Plan.pdf">http://www.xcelenergy.com/staticfiles/xcel/Regulatory/2012-2013%20Biennial%20DSM%20Plan.pdf</a> , accessed September 21, 2011 |
|-----------------|--|

### PROGRAM DESCRIPTION

The Saver’s Switch Program is a direct load control program that offers residential and business customers credit on their electric bills by allowing Xcel Energy to cycle their air conditioners during peak demand periods. Xcel Energy has offered the Saver’s Switch Program in Minnesota since 1990; in 2008, Xcel Energy offered residential participants in Minnesota the option of adding their water heater into the program for an additional incentive. Minnesota residents participating in the program receive 15 percent off their electric energy charges from June through September; if a water heater is also enrolled in the program an additional 2 percent discount on monthly bills is given throughout the year. Businesses in Minnesota receive a discount of \$5 per air conditioning ton on their June, July, August, and September electric bills.

Xcel Energy now offers Saver’s Switch across much of its service territory, including in Colorado, New Mexico, North Dakota, Texas, South Dakota, and Wisconsin. The program has proven popular in service territories outside of Minnesota. Saver’s Switch was launched in Colorado in 2000, and as of December 31, 2010 Xcel Energy reports that there are 137,000 switches in the field. Compensation for participation in the program varies by state; for example, Colorado residents receive a \$40 annual bill credit, rather than a fixed percentage off their summer bills as in Minnesota.<sup>49</sup>

A 2010 net present cost-benefit analysis shows that for business customers in this program, bill reduction savings was estimated to be \$3.9 million, while bill reduction savings for residential participants was estimated to be \$11.7 million. This analysis also showed that utility costs for business customers were estimated to be \$1.98 million, whereas utility costs for residential customers were estimated to be \$6.5 million. Societal net benefits from the business sector in 2010 were calculated to be \$9.1 million, whereas societal net benefits from the residential sector in 2010 were calculated to be \$20.45 million

A recent study shows that Saver’s Switch participants report high levels of satisfaction with their participation experience. HVAC contractors do not present a significant barrier to program implementation and focus group discussions with HVAC contractors indicated those that understood how the switch worked and had more accurate information about the program were less likely to negatively influence customers. Additionally, traditional marketing approaches, augmented by a segmentation and target marketing approach, are effective methods for promoting the program. The marketing methods implemented in 2009, including bill inserts, direct mail, telemarketing, target marketing, and advertising, were successful for meeting increased participation goals in Minnesota and doubling the number of new program participants in Colorado from those in 2008. Recommendations going forward include the increased use of promotions that drive more sign-ups to the web; this is a cost-efficient but underutilized channel for enrollment.

However, marketing materials, such as program brochures and direct mail pieces, have some missing information and ambiguous messaging. Marketing materials minimize the effect of cycling on

<sup>49</sup> Public Service Company of Colorado, 2012/2013 Demand-Side Management Plan, Electric and Natural Gas, <http://www.xcelenergy.com/staticfiles/xcel/Regulatory/2012-2013%20Biennial%20DSM%20Plan.pdf>, accessed September 21, 2011

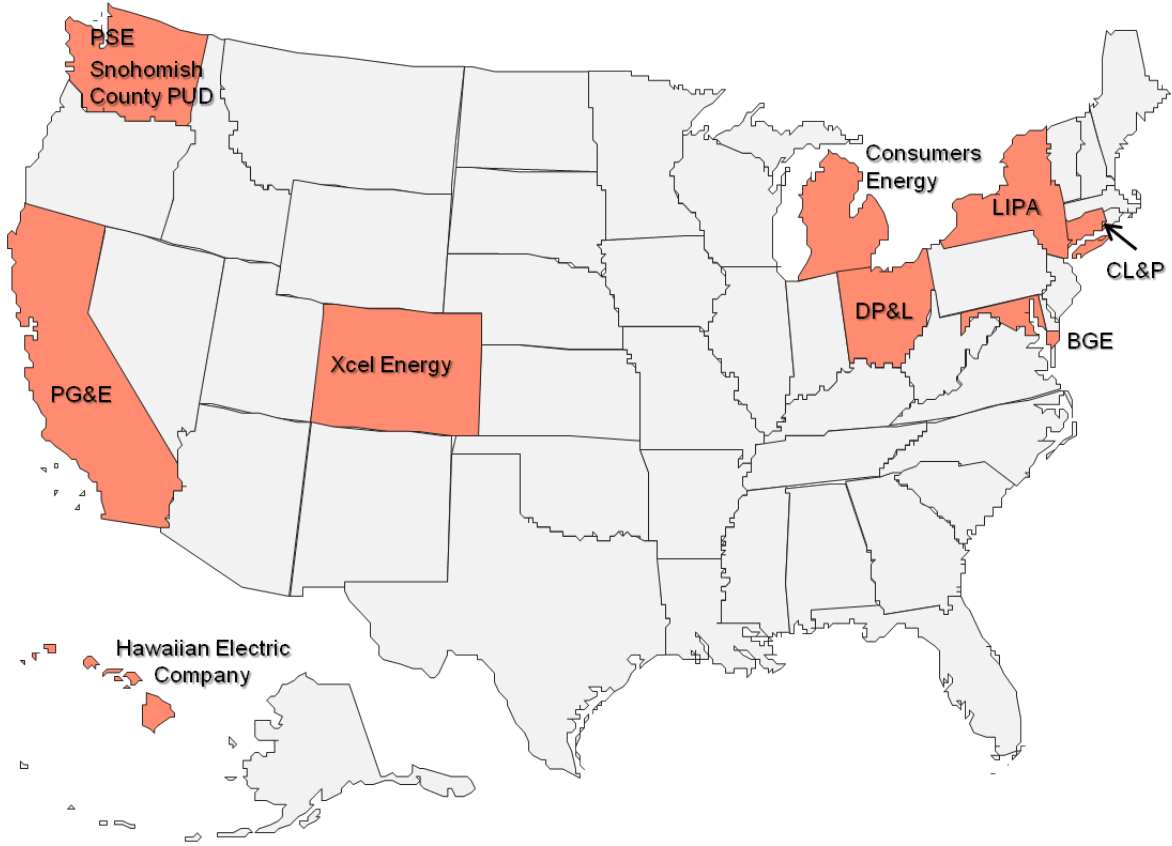
participants and information specific to renters. Additionally, participants could benefit from more frequent communication from the program. With most if not all the marketing efforts focused on recruitment, participants are only reminded about their involvement in the program when cycling is in effect and by a single line in their October electric bills. Although the program is designed to be low-engagement, participants recognize a need for more information about the program.

**UPDATES AS OF SEPTEMBER 2011**

There are no significant updates to this case study as of September 2011.

# Case Studies of Cancelled or Postponed Smart Grid Projects

Figure 3. Locations of Cancelled/Postponed Smart Grid Project Case Studies



Source: SAIC

| <b>BGE Smart Grid Initiative</b> |                                |                      |                |
|----------------------------------|--------------------------------|----------------------|----------------|
| <b>Location:</b>                 | Central Maryland               | <b>Dates:</b>        | 2009 - Present |
| <b>Primary Utility/Entity</b>    | Baltimore Gas & Electric (BGE) | <b>ARRA Funding:</b> | \$200 million  |

| <b>PROGRAM INFORMATION</b>     |   |
|--------------------------------|---|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To achieve \$2.5 billion worth of savings for BGE customers.</li> <li>• To enhance customer service and electric reliability.</li> <li>• To encourage customers to better manage, conserve and save money on energy.</li> </ul>  |
| Status                         | Initially stalled by a Maryland PSC decision; later approved by PSC after BGE re-filed a new plan.  |
| Number of Participants         | <ul style="list-style-type: none"> <li>• 1.2 million digital electric meters covering all residential and small business customers</li> </ul>   |
| Participating Entities         | <ul style="list-style-type: none"> <li>• BGE</li> <li>• ZigBee</li> <li>• Elster American (for gas diaphragm meters)</li> </ul>   |
| Program Budget                 | <ul style="list-style-type: none"> <li>• BGE estimates that the cost of the proposed program would total \$835 million.</li> <li>• BGE received \$200 million in support from DOE.</li> </ul>   |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> </ul>   |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Smart meters with two-way communication through a wide area network and a local area network, equipped with a ZigBee chip, with the following: <ul style="list-style-type: none"> <li>○ Hourly meter readings (at minimum)</li> <li>○ Voltage monitoring</li> <li>○ Ability to accept remote programming instructions</li> <li>○ Remote disconnect/reconnect capabilities</li> <li>○ Ability to communicate outage restoration events</li> <li>○ Net metering support</li> </ul> </li> <li>• Peak Rewards Program: Initially included as a mandatory TOU rate schedule in the first application to the PSC.</li> <li>• Meter Data Management system</li> <li>• Transmission/Distribution Upgrades: <ul style="list-style-type: none"> <li>○ Embedded sensors</li> <li>○ Automated substations</li> <li>○ “Smart” transformers</li> <li>○ Analytical computer modeling tools</li> <li>○ High-speed integrated communications</li> <li>○ Reconfigured distribution circuits</li> </ul> </li> </ul> |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• New filing includes a comprehensive customer-focused education and outreach plan.</li> <li>• Customer web portal for viewing hourly electricity usage, including previous day comparisons.</li> <li>• BGE indicates the company “will begin communication with customers prior to technology installation” and will foster customer understanding of the</li> </ul>  |

|   |   |
|---|---|
|   | <p>rebate program and the tangible benefits of the Smart Energy Pricing program.</p> <ul style="list-style-type: none"> <li>• BGE is researching education methods including benchmarking, focus group testing, online/phone/contact center and awareness surveys, and social landscape monitors.</li> <li>• Education outlets will include traditional mass media such as TV, radio, and print , along with social media – all directing customers and stakeholders to the new smart grid micro site for more information.</li> <li>• Opt-in email campaign, online newsroom, webinars, customer tool kit, and FAQs on BGE’s Smart Grid website serve as education outlets.</li> </ul> |
| <b>PROGRAM RESULTS</b>                      |   |
| Key Findings                                | <ul style="list-style-type: none"> <li>• Regulators objected to BGE's mandatory TOU rates and the proposal to recover funds from customers via a surcharge, before the cost benefits of smart grid improvements could be seen.</li> <li>• In order to proceed, BGE was ordered to recoup its costs through base-rate increases (not through surcharges) once installations are completed.</li> </ul>  |
| Other Outcomes                              | N/A   |
| Customer Feedback                           | <ul style="list-style-type: none"> <li>• BGE reports that over 90 percent of customers expressed satisfaction during the two years of the pilot program; the average savings was more than \$100 a year.</li> <li>• In mid-March 2011, BGE reports that “customers continue to strongly support BGE’s Smart Energy Savers program” with more than 300,000 customers enrolled in BGE’s PeakRewards.</li> </ul>   |
| Current Deployment Status                   | BGE is reported to be starting a full scale roll-out of smart meter technology, though no specifics were found in the identified sources.   |
| Future Implications                         | <ul style="list-style-type: none"> <li>• BGE must install smart meter systems before recovering any portion of the costs from customers.</li> <li>• Mandatory TOU programs remain a sticking point for State regulators.</li> </ul>   |
| <b>IMPACTS/BENEFITS</b>                     |   |
| Consumers                                   | N/A   |
| Utilities                                   | N/A   |
| Metrics Used                                | N/A   |
| <b>CAUSES FOR CANCELLATION/POSTPONEMENT</b> |   |
| Primary                                     | <ul style="list-style-type: none"> <li>• Lack of funding or cost issues</li> <li>• Inadequate customer education for effective system use</li> </ul>  |
| Secondary                                   | <ul style="list-style-type: none"> <li>• Negative response to rate increases</li> <li>• Waiting for technological advancements</li> <li>• State/local regulatory orders causing delays</li> </ul>   |
| <b>RESOURCES</b>                            |   |
| Program Website                             | <a href="http://www.bge.com/learnshare/smartgrid/smartmeters/Pages/default.aspx">http://www.bge.com/learnshare/smartgrid/smartmeters/Pages/default.aspx</a> , accessed September 21, 2011   |
| Full Program Report                         | N/A   |
| Presentations                               | Carmody, Paula, Dumb Policies and Smart Grids: A Consumer Perspective, University of Florida – Public Utility Research Center, February 3, 2011, <a href="http://warrington.ufl.edu/purc/docs/AnnualConference/38_Carmody.pdf">http://warrington.ufl.edu/purc/docs/AnnualConference/38_Carmody.pdf</a> , accessed September 21, 2011  |



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|------------------------|--|
| <p>News Articles</p>   | <ul style="list-style-type: none"> <li>• Sustainable Business.com, Maryland Regulators Approve BGE's Revised Smart Grid Proposal, <a href="http://www.sustainablebusiness.com/index.cfm/go/news.display/id/20873">http://www.sustainablebusiness.com/index.cfm/go/news.display/id/20873</a> , accessed September 22, 2011</li> <li>• SustainableBusiness.com, Baltimore Gas and Electric Revises Rejected Smart Grid Proposal, <a href="http://www.sustainablebusiness.com/index.cfm/go/news.display/id/20675">http://www.sustainablebusiness.com/index.cfm/go/news.display/id/20675</a> , accessed September 22, 2011</li> <li>• BGE, News Release, BGE Customers Continue to Strongly Support BGE's Smart Energy Savers Program, <a href="http://files.shareholder.com/downloads/CEG/1198083822x0x449890/fc67fb45-bfe2-4759-a858-a41e69353f69/BGE_Milestone_Release_Final_3.14.11.pdf">http://files.shareholder.com/downloads/CEG/1198083822x0x449890/fc67fb45-bfe2-4759-a858-a41e69353f69/BGE_Milestone_Release_Final_3.14.11.pdf</a>, accessed September 22, 2011</li> <li>• BGE, News Release, BGE to Proceed with Smart Grid Implementation, <a href="http://files.shareholder.com/downloads/CEG/1198083822x0x395710/cf4f0b8f-a675-44ea-991a-cf2328d9575b/Implementation_Final_Release_v2_8-16-10.pdf">http://files.shareholder.com/downloads/CEG/1198083822x0x395710/cf4f0b8f-a675-44ea-991a-cf2328d9575b/Implementation_Final_Release_v2_8-16-10.pdf</a>, accessed September 22, 2011</li> <li>• Sustainablebusiness.com News, Maryland Regulators Approve BGE's Revised Smart Grid Proposal, <a href="http://www.sustainablebusiness.com/index.cfm/go/news.display/id/20873">http://www.sustainablebusiness.com/index.cfm/go/news.display/id/20873</a>, accessed September 21, 2011</li> <li>• Behr, Peter, MD.'s Veto of Advanced Meter Deployment Stuns Smart Grid Advocates, <a href="http://www.nytimes.com/cwire/2010/06/23/23climatewire-mds-veto-of-advanced-meter-deployment-stuns-95998.html">http://www.nytimes.com/cwire/2010/06/23/23climatewire-mds-veto-of-advanced-meter-deployment-stuns-95998.html</a>, accessed September 21, 2011</li> <li>• Greater Baltimore Committee News, BGE updates GBC committee on next-generation 'Smart Grid' technology, <a href="http://www.gbc.org/news/2045/">http://www.gbc.org/news/2045/</a>, accessed September 21, 2011</li> </ul> |
| <p>Other Resources</p> | <ul style="list-style-type: none"> <li>• Public Service Commission of Maryland, Order No. 83410, Case No. 9208, <a href="http://webapp.psc.state.md.us/Intranet/Casenum/NewIndex3_VOpenFile.cfm?filepath=C:\Casenum\9200-9299\9208\Item_59\59.pdf">http://webapp.psc.state.md.us/Intranet/Casenum/NewIndex3_VOpenFile.cfm?filepath=C:\Casenum\9200-9299\9208\Item_59\59.pdf</a>, accessed September 21, 2011</li> <li>• Public Service Commission of Maryland Case No. 9208, <a href="http://webapp.psc.state.md.us/intranet/maillog/content.cfm?filepath=C:%5CCasenum%5CAdmin%20Filings%5C110000-159999%5C121153%5COPCINITIALBRIEFFINAL.pdf">http://webapp.psc.state.md.us/intranet/maillog/content.cfm?filepath=C:%5CCasenum%5CAdmin%20Filings%5C110000-159999%5C121153%5COPCINITIALBRIEFFINAL.pdf</a>, accessed September 21, 2011</li> <li>• Public Service Commission of Maryland, Order No. 83531, Case No. 9208, <a href="http://webapp.psc.state.md.us/Intranet/Casenum/NewIndex3_VOpenFile.cfm?ServerFilePath=C:\Casenum\9200-9299\9208\82.pdf">http://webapp.psc.state.md.us/Intranet/Casenum/NewIndex3_VOpenFile.cfm?ServerFilePath=C:\Casenum\9200-9299\9208\82.pdf</a>, accessed September 21, 2011</li> <li>• SGIC, Baltimore Gas and Electric Smart Grid Project, <a href="http://www.sgiclearinghouse.org/ProjectList?q=node/168&amp;lb=1">http://www.sgiclearinghouse.org/ProjectList?q=node/168&amp;lb=1</a>, accessed September 21, 2011</li> <li>• Smartgrid.gov, Baltimore Gas and Electric Company, Smart Grid Project, <a href="http://www.smartgrid.gov/project/baltimore_gas_and_electric_company_smart_grid_project">http://www.smartgrid.gov/project/baltimore_gas_and_electric_company_smart_grid_project</a>, accessed September 21, 2011</li> </ul>  |

## **PROGRAM DESCRIPTION**

In July 2009, BGE announced its Smart Grid Initiative, to allow deployment of smart meters throughout the entire service territory of BGE. Smart meters would allow for two-way communication and the implementation of a mandatory TOU rate schedule for all residential customers. BGE estimated that the cost of the proposed program would total \$835 million with \$482 million expended during the initial deployment phase and the additional \$353 million required over the expected life of the program. The \$200 million in DOE stimulus funds would help to offset a substantial portion of the proposed customer surcharges. BGE urged the PSC to quickly review their initial filing, requesting a final decision by the end of September 2010.

## **CAUSES FOR CANCELLATION OR POSTPONEMENT**

On July 22, 2010, the PSC denied the Smart Grid Initiative filing. The PSC found the proposal untenable, citing financial risks for the ratepayers, concerns about the proposed tariff structure, technological uncertainties, and underlying assumptions and cost-effectiveness of the business plan.

The PSC questioned the underlying assumptions regarding cost recovery. BGE made the point in its testimony to the PSC that “traditional rate recovery would place an undue strain on the company’s balance sheet.” The PSC admitted that surcharges were frequently approved to support energy efficiency and DR programs, but smart grid projects could not be grouped in the same category due to the infrastructure involved, specifically the cost of meters, which were never previously funded through surcharges. The PSC also noted that customers who contribute to the funding of the program that later relocate outside BGE’s territory might never receive a return on the investment if meters are not installed in their area by that time. Additionally, the plan did not address the \$100 million in functional traditional meters that would have to be retired.

In citing concerns about the proposed tariff structure, some groups pointed out during the proceedings that certain groups would be at a great disadvantage in the mandatory TOU program. The Office of the People's Counsel viewed the mandatory TOU program as detrimental to older adults, children and others that are at home during the afternoon peak demand period.<sup>50</sup> It was also argued that up to 40 percent of low-income customers would see a rise in summer energy bills and up to 15 percent would see a rise in annual energy bills overall. The lack of in-home displays to alert customers of rising prices was also criticized. The PSC commented that the surcharge would raise the average electricity customer's monthly rate by 38¢ beginning in 2010, rising to \$3.78 in 2013.<sup>51</sup> Some see the decision to reject mandatory RTP as a general trend in State commissions throughout the United States.

The PSC argues that technological innovations and standards for interoperability in the coming years would result in current ratepayers funding outdated technology and could result in additional costs. The PSC stated in its decision, “If it turns out that appliance manufacturers decide to adopt some alternative to ZigBee technology, the expectation that the proposed ‘smart meters’ will one day be capable of communicating with a customer’s ‘smart’ appliances evaporates.” Others also argued that since standards are actively being developed, there is a high level of risk if BGE’s proposed technology is deployed and later found to be incompatible with the new standards.

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<sup>50</sup> SmartGridNews.com, BG&E Takes Its Smart Grid Case to Regulators, [http://www.smartgridnews.com/artman/publish/Business\\_Policy\\_Regulation\\_News/BG-E-Takes-Its-Smart-Grid-Case-to-Regulators-1418.html](http://www.smartgridnews.com/artman/publish/Business_Policy_Regulation_News/BG-E-Takes-Its-Smart-Grid-Case-to-Regulators-1418.html), accessed September 21, 2011

<sup>51</sup> Behr, Peter, Md.'s Veto of Advanced Meter Deployment Stuns Smart Grid Advocates, The New York Times, <http://www.nytimes.com/cwire/2010/06/23/23climatewire-mds-veto-of-advanced-meter-deployment-stuns-95998.html>, accessed September 21, 2011

The PSC cited a lack of a strong customer education program as another reason for denying the proposal. The PSC did not feel that customers were provided with the amount of information needed to trigger the desired behavior to shift their energy usage. The PSC brought forth suggestions such as print, radio and television media, live in-person question and answer sessions, town hall meetings and hands-on demonstrations for customers as possible education measures. The PSC further requested that a timeline for education measures be provided as well.

The PSC clearly stated its support for the smart grid concept and urged the company to submit a revised plan. In the order, the PSC stressed that a revised plan should address 1) a cost recovery mechanism that spreads some of the risk to BGE shareholders; 2) elimination of the mandatory TOU rates and 3) the development of a concrete, detailed customer education plan.

### **FUTURE CHANGES**

BGE re-submitted its smart grid metering proposal on July 12, 2010, addressing the three principal concerns of the PSC. BGE dropped the mandatory TOU rates, and developed a more detailed customer education program. Although BGE did not drop its request for an upfront cost recovery surcharge, it did reduce the amount requested to 25 percent of its costs.

On August 12, 2010 the PSC conditionally approved the revised plan, approving the revised customer education plan and the elimination of the mandatory TOU provision, but rejected the up-front surcharge assigned to ratepayers for the roll-out. On August 14, 2010, BGE accepted the conditions and announced the program would be implemented. As a result, the program did qualify for the \$200 million in stimulus money from the DOE grant program.

According to the 2010 Securities and Exchange Commission 10-K filing, dated Dec. 31, 2010, BGE was authorized to establish a separate regulatory asset for incremental costs the company will incur to implement the Smart Grid Initiative, net depreciation, and amortization associated with the meters. The PSC order requires that BGE prove the cost effectiveness of the entire smart grid initiative prior to seeking recovery associated with these regulatory assets. BGE indicates in the filing “the commencement and timing of the amortization of these deferred costs is currently unknown.”<sup>52</sup> BGE is proceeding with its plan to deploy smart meter technology, but the company cannot recover its costs until after the system is in place.

### **ALTERNATIVE PROGRAMS**

Though it is unclear what program BGE may put in place if the Smart Grid Initiative fails, BGE currently offers energy efficiency programs and a voluntary DR program for customers. In the BGE Smart Energy Savers Program, businesses have access to financial incentives and engineering services for projects such as:<sup>53</sup>

- Retrofits of inefficient equipment
- New construction
- Major renovation and remodeling
- New equipment purchases
- End-of-life equipment replacements

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<sup>52</sup> BGE, Securities and Exchange Commission Form 10-K, [http://files.shareholder.com/downloads/CEG/1198083822x0x451977/923C10D6-7064-4CD2-A2D2-4AEF9A3F9FDB/10-K\\_2010.pdf](http://files.shareholder.com/downloads/CEG/1198083822x0x451977/923C10D6-7064-4CD2-A2D2-4AEF9A3F9FDB/10-K_2010.pdf), accessed September 21, 2011

<sup>53</sup> BGE, Smart Energy Savers Program, <http://www.bgesmartenergy.com/business>, accessed September 21, 2011

For residential customers, the BGE Smart Energy Savers Program provides a variety of discounts and rebates to help customers cut energy costs, save money, and improve home quality. The PeakRewards program is designed to help residential electric customers reduce "peak" demand for electricity, regardless of their electricity supplier. Customers' homes are equipped with smart thermostats or water heater switches controlled by a radio signal, and BGE is permitted to "cycle" the participant's air conditioning (or water heater) on and off, typically during the summer months at peak electricity demand. Participants can also log onto an online portal to access thermostat or equipment settings.

BGE also offers the Energy Choice program, which allows customers to choose their energy supplier. Some suppliers specialize in green options of wind and solar generated electricity.

#### **UPDATES AS OF SEPTEMBER 2011**

BGE is planning to begin deployment of 1.2 million digital electric meters and 1,200 radios between 2012 and 2014, thereby covering every home and small business in its service territory.<sup>54</sup> Benefits will not begin immediately after installation, though some smart meter features will be available by 2012. BGE plans to roll out peak event reports and savings summaries, peak event web notifications, and smart energy pricing programs in 2013. BGE plans to notify customers well in advance of their meter installation.

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<sup>54</sup> Greater Baltimore Committee News, BGE updates GBC committee on next-generation 'Smart Grid' technology, <http://www.gbc.org/news/2045/>, accessed September 21, 2011

| <b>CL&amp;P Plan-it Wise Energy Program</b> |                                  |                      |                |
|---|----------------------------------|----------------------|----------------|
| <b>Location:</b>                            | Connecticut                      | <b>Dates:</b>        | 2009 - Present |
| <b>Primary Utility/Entity:</b>              | Connecticut Light & Power (CL&P) | <b>ARRA Funding:</b> | No             |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To provide CL&amp;P customers the tools to better control their energy usage.</li> <li>• To improve outage detection and restoration accuracy.</li> <li>• To improve electricity theft detection.</li> <li>• To reduce meter reading costs.</li> </ul>  |
| Status                         | <ul style="list-style-type: none"> <li>• Delayed due to suspension of PUC review; State Attorney General requesting PUC reject CL&amp;P request due to costs.</li> <li>• Could begin an AMI deployment by December 31, 2012.</li> <li>• Cyber security and interoperability standards in progress and should be complete in mid-2011.</li> </ul>   |
| Number of Participants         | 1.2 million customers, representing all CL&P customers   |
| Participating Entities         | <ul style="list-style-type: none"> <li>• CL&amp;P</li> <li>• Bridge Strategy Group (assisted with cost effectiveness analysis)</li> </ul>  |
| Program Budget                 | <ul style="list-style-type: none"> <li>• \$863 million over 20 years (\$493 million on a present value basis)</li> </ul>   |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> <li>• Industrial</li> </ul>  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Smart meters (two-way wireless network)</li> <li>• Three new pricing options, including one with rebates for limited-income customers. Includes peak time pricing, a PTR, and an eight-hour TOU year-round rate.</li> <li>• Meter Data Management system, to be implemented in 2011, will: <ul style="list-style-type: none"> <li>○ Enable the ability to read, store and process hourly energy data</li> <li>○ Aggregate hourly energy usage into pre-defined peak times to enable dynamic pricing</li> </ul> </li> <li>• Smart thermostat</li> <li>• A/C switch</li> <li>• Energy orb</li> <li>• In-home display</li> </ul>                 |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• Budgeted \$44 million in “customer engagement costs” for marketing, education and peak day notification. This includes: <ul style="list-style-type: none"> <li>○ \$26 million for general marketing of voluntary dynamic pricing</li> <li>○ \$15 million to provide an additional page on every customer’s monthly bill regarding the program</li> <li>○ \$3 million to enable peak day notifications to customers via radio and television</li> </ul> </li> <li>• Direct mail, bill inserts and outbound calling for disseminating program information</li> <li>• Enhanced energy analytics provided through the company web site</li> </ul> |

| <b>PROGRAM RESULTS</b>    |   |
|---------------------------|---|
| Key Findings              | <ul style="list-style-type: none"> <li>Concerns about upfront costs of full scale deployment</li> <li>Data privacy concerns</li> <li>Proposed ten-to-one pricing differential at peak times expected, translating to high rates at peak times.</li> </ul>   |
| Other Outcomes            | N/A   |
| Customer Feedback         | CL&P expects that customers will further embrace emerging energy products and services, including distributed generation, electric vehicle smart charging, and smart appliances through the program.  |
| Current Deployment Status | Public Utilities Regulatory Authority review temporarily suspended due to passage of Public Act Number 11-80  |
| Future Implications       | <ul style="list-style-type: none"> <li>CL&amp;P expects that by 2017, 25 percent of residential customers and 50 percent of commercial and industrial customers will be enrolled in program.</li> <li>CL&amp;P will build additional IT capabilities to provide dynamic pricing, on-bill hourly energy usage analytics, outage detection during AMI deployment.</li> <li>Dynamic pricing will be available to all customers by 2016.</li> </ul>   |
| <b>IMPACTS/BENEFITS</b>   |   |
| Consumers                 | <p>CL&amp;P estimates:</p> <ul style="list-style-type: none"> <li>The average residential customer will save \$11 over the twenty-year life of the program.</li> <li>The average commercial and industrial customer will save \$96 over the twenty-year life of the program.</li> <li>The base case indicates that the average customer bill will increase until 2019 and then decrease.</li> </ul>   |
| Utilities                 | <p>CL&amp;P estimates:</p> <ul style="list-style-type: none"> <li>Peak load reduction of 125 MW annually.</li> <li>Total energy reduction of 190 million kWh per year; enough energy to power 20 homes.</li> <li>Carbon emission reduction of 100,000 tons per year; equivalent to 13,000 fewer cars on the road.</li> <li>Two percent reduction in storm outage duration.</li> </ul>   |
| Metrics Used              | <ul style="list-style-type: none"> <li>Operation and maintenance metrics include improved theft detection, reduced meter reading costs, elimination of off-cycle meter reads, reduction in manual connect and disconnects.</li> <li>Amount of avoided or delayed capital investments by: 1) reducing peak-load needs and allowing for reduction in system growth capital and 2) reduced capital costs associated with the replacement of the current AMR meters and other manual meter-reading equipment.</li> <li>Shifting of megawatts from peak to off-peak hours.</li> <li>Reduction of peak load through various tested pilot rates.</li> <li>Reduction in overall energy consumption through AMI.</li> <li>Will reduce CL&amp;P's storm "System Average Interruption Duration Index" by six minutes.</li> <li>Net reduction, on the scale tons, in carbon emissions.</li> </ul> |

| <b>CAUSES FOR CANCELLATION/POSTPONEMENT</b> |   |
|---|---|
| Primary                                     | Lack of funding or cost issues  |
| Secondary                                   | <ul style="list-style-type: none"> <li>• Privacy concerns</li> <li>• Negative response to rate increases</li> <li>• State/local regulatory orders causing delays</li> </ul>   |
| <b>RESOURCES</b>                            |   |
| Program Website                             | <a href="http://www.cl-p.com/home/saveenergy/goinggreen/planitwise.aspx">http://www.cl-p.com/home/saveenergy/goinggreen/planitwise.aspx</a>   |
| Full Program Report                         | <ul style="list-style-type: none"> <li>• <a href="http://nuwnotes1.nu.com/apps/clp/clpwebcontent.nsf/AR/recommendations/\$File/recommendations.pdf">http://nuwnotes1.nu.com/apps/clp/clpwebcontent.nsf/AR/recommendations/\$File/recommendations.pdf</a>, accessed September 21, 2011</li> <li>• CL&amp;P, Results of CL&amp;P Plan-it Wise Energy Pilot, Docket No. 05-10-03RE01 Compliance Order No. 4, <a href="http://www.cl-p.com/Home/SaveEnergy/Plan-it_Wise_Pilot_Results/">http://www.cl-p.com/Home/SaveEnergy/Plan-it_Wise_Pilot_Results/</a>, accessed September 21, 2011</li> </ul>   |
| Presentations                               | <ul style="list-style-type: none"> <li>• Faruqui, Ahmad, and Sanem Sergici, Appendix A: Impact Evaluation of CL&amp;P's Plan-it Wise Energy Program, The Brattle Group, <a href="http://www.cl-p.com/Home/SaveEnergy/Plan-it_Wise_Pilot_Results_Appendix/">http://www.cl-p.com/Home/SaveEnergy/Plan-it_Wise_Pilot_Results_Appendix/</a>, accessed September 21, 2011</li> </ul>   |
| News Articles                               | <ul style="list-style-type: none"> <li>• Kane, Brad, Smart grid's fate hinges on DPUC, consumer embrace, Hartford Business Journal Online, <a href="http://www.hartfordbusiness.com/news17308.html">http://www.hartfordbusiness.com/news17308.html</a>, accessed September 21, 2011</li> <li>• Tweed, Katherine, Connecticut Light &amp; Power Proposes 10:1 Ratio for Peak Power, greentechmedia, <a href="http://www.greentechmedia.com/articles/read/connecticut-power-light-proposes-10-1-ratio-for-peak-power/">http://www.greentechmedia.com/articles/read/connecticut-power-light-proposes-10-1-ratio-for-peak-power/</a>, accessed September 21, 2011</li> </ul>  |
| Other Resources                             | <ul style="list-style-type: none"> <li>• CL&amp;P, AMI and Dynamic Pricing Deployment Cost Benefit Analysis, <a href="http://nuwnotes1.nu.com/apps/clp/clpwebcontent.nsf/AR/recommendations/\$File/recommendations.pdf">http://nuwnotes1.nu.com/apps/clp/clpwebcontent.nsf/AR/recommendations/\$File/recommendations.pdf</a>, accessed September 21, 2011</li> <li>• Connecticut Public Utilities Regulatory Authority, Docket 05-10-03RE04, <a href="http://www.dpuc.state.ct.us/SearchDB.nsf/MenuForm?Openform">http://www.dpuc.state.ct.us/SearchDB.nsf/MenuForm?Openform</a>, accessed September 21, 2011</li> <li>• Summary of Public Act Number 11-80: An Act Concerning the Establishment of the Department of Energy and Environmental Planning for Connecticut's Energy Future, Murtha Cullina, <a href="http://www.murthalaw.com/publications/918-summary-public-act-number-11-80-act-concerning-establishment-of">http://www.murthalaw.com/publications/918-summary-public-act-number-11-80-act-concerning-establishment-of</a>, accessed September 21, 2011</li> <li>• SGIC, Smart Grid Projects, <a href="http://www.sgicclearinghouse.org/ProjectList?voc_18=776&amp;voc_36=1151&amp;submit=Apply">http://www.sgicclearinghouse.org/ProjectList?voc_18=776&amp;voc_36=1151&amp;submit=Apply</a>, accessed September 21, 2011</li> </ul> |

## PROGRAM DESCRIPTION

CL&P first began designing a meter data management system in late 2008. In summer 2009, approximately 3,000 customers (1,500 commercial and industrial customers and 1,500 residential customers) from Hartford and Stamford participated in a pilot program known as the as the Plan-it Wise Energy Program, which included smart meters and dynamic pricing options.<sup>55</sup> The pilot program achieved its objective, which was to gain insight into customer interest and response patterns for

<sup>55</sup> CL&P, Plan-it Wise Energy Program, <http://www.cl-p.com/home/saveenergy/goinggreen/planitwise.aspx>, accessed September 21, 2011

dynamic pricing rates and four enabling technologies, including smart thermostats, smart switches, Energy Orb, and a Power Cost Monitor. CL&P also gathered additional insight into the maturity of certain AMI technologies.

Peak time pricing, PTRs, and TOU pricing were the three rate designs used, each tested with a high and low price differential of off-peak to on-peak. The CPP and PTR rates were in effect for a total of 40 hours on 10 days from 2 p.m. to 6 p.m. The CPP program increased prices up to \$1.60 per kWh during peak hours, while providing a discount of up to \$0.05 per kWh during off-peak hours. The PTR program retained normal tariff pricing during all hours of the pilot, but provided rebates of up to \$1.60 per kWh during the peak hours if customers reduced their energy usage during that time. The TOU pilot rate tested response from noon to 8 p.m. weekdays as the on-peak period, and all other hours as the off-peak period. The pilot price differential for on-peak versus off-peak was substantially wider than the TOU pricing CL&P currently implements in its TOU rates. The pilot program proved that customer adoption of dynamic pricing achieves significant peak load reduction. Some of the findings indicated that:

- Peak time pricing is the most cost effective dynamic pricing rate (most cost effective/most satisfying to customers).
- PTRs are also cost effective and the utility recommended that all low income customers should be placed on the PTR rate to encourage participation.
- The four-hour TOU rate for residential and business customers is not cost effective unless coupled with other rates.
- The eight-hour TOU rate for residential and business customers is not cost effective unless coupled with other rates. For both TOU options, the utility recommended using an on and off-peak period price differential similar to the high TOU differential tested, to encourage greater customer response).

CL&P used these results to analyze and determine the cost effectiveness of different AMI and dynamic pricing deployment scenarios.

As of March 2011, cyber security and interoperability standards were still being developed for the program, and were anticipated to be completed by mid-2011. At that time, CL&P was to move forward with an RFP for AMI technology selection. Assuming all other approvals are received, CL&P could begin deploying AMI by December 31, 2012 with a four-year AMI implementation. The project would progress through IT development for dynamic pricing and on-bill hourly energy usage analytics, with dynamic pricing available to all customers by 2016. Underlying technology for outage detection, theft detection, and remote service activation operational efficiencies would be developed through 2017. After a public comment period, the PUC was expected to issue its final ruling approving or rejecting the plans by April 6, 2011.<sup>56</sup>

#### **CAUSES FOR CANCELLATION OR POSTPONEMENT**

Businesses and State officials have expressed concerns about the upfront costs of CL&P's smart meters. In addition, the industry continues to resolve issues such as security and privacy while ratepayers remain less than enthusiastic about new meter technology. Connecticut Attorney General George Jepsen has indicated that the \$492 million cost of the project is too high considering the project benefits are still

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<sup>56</sup> Connecticut Public Utilities Regulatory Authority, Application of CL&P to Implement TOU, Interruptible Load Response, and Seasonal Rates, Docket 05-10-03, [http://www.dpuc.state.ct.us/dockhist.nsf/\(Web%20Main%20View%5CAll%20Dockets\)?OpenView&Start=13441.1](http://www.dpuc.state.ct.us/dockhist.nsf/(Web%20Main%20View%5CAll%20Dockets)?OpenView&Start=13441.1), accessed September 21, 2011



unknown. The \$600 million in savings proposed by CL&P depends heavily on customer response to the programs. Further, Jepsen asked the PUC to deny the full scale smart meter proposal, arguing that the upgrade should be postponed until the existing mechanical meters require replacement.<sup>57</sup>

Privacy issues surrounding customer electricity consumption data are also emerging as a concern. Some critics argue that a utility should make it clear in the project plans that the data will only be used for better cost controls and efficiencies in the system. Security measures should also be integrated into the design to protect meter data from unauthorized access.

In analyzing the rate structure for the dynamic pricing programs, some reports indicate the differential between on-peak and off-peak prices will be too wide. CL&P plans to implement a ten-to-one ratio in critical to off-peak pricing, resulting in electricity prices as high as \$1.60 per kWh in the summer months. CL&P argues that steep price signals will further encourage conservation among customers, and allow the company to expand DR services. Connecticut has had successful DR activities, with around 12 percent of peak MW under DR management.<sup>58</sup> With the average U.S. residential electricity price in the second quarter of 2010 of 11.90¢ per kWh according to the EIA, a price increase to \$1.60 per kWh could be difficult for customers to accept.<sup>59</sup>

## **FUTURE IMPLICATIONS**

In order for the project to be cost effective, CL&P must have a significant, positive, long-term response to the AMI programs. In the company's program analysis, it is mentioned that "uncertainty in assumptions extending twenty years out" has required the company develop a best, worst and reasonable base case scenario with benefits that are highly dependent on external variables. If CL&P can present a major return on the \$492 million AMI investment, the PUC will be more likely to approve the proposal. If the project is given permission to proceed, CL&P will have the opportunity to provide the PUC with additional details regarding its proposal prior to full scale deployment. As of March 2011, CL&P was due to provide an informational update on key AMI standards, technology, deployments and Smart Controlling Technologies in the industry around the end of October 2011.

## **ALTERNATIVE PROGRAMS**

Though it is not yet known what other smart grid projects the utility might pursue if the Plan-it Wise program is not approved, CL&P offers green pricing through a CT Clean Energy Option. This program supports clean, renewable energy produced from wind, water and other renewable sources.

CL&P also has a pilot program, known as "Home Energy Reports," where customers receive detailed bills with the following features:

- Comparison reports: Customers can view how their electricity consumption compares to similar homes in their neighborhood. Only the customer can see their personal information.
- Progress tracker: Customers can view their energy use over time, so they can set targets to save money and electricity.
- Energy efficiency tips: CL&P provides tips designed for the customer based on their energy use patterns and home characteristics.

<sup>57</sup> Kane, Brad, Smart grid's fate hinges on DPUC, consumer embrace, Hartford Business Journal Online, <http://www.hartfordbusiness.com/news17308.html>, accessed September 21, 2011

<sup>58</sup> Tweed, Katherine, CL&P Proposes 10:1 Ratio For Peak Power, Greentech Media, Inc., <http://www.greentechmedia.com/articles/read/connecticut-power-light-proposes-10-1-ratio-for-peak-power/>, accessed September 21, 2011

<sup>59</sup> Energy Information Administration, Table 2. U.S. Energy Prices Short-Term Energy Outlook - March 2011, [http://www.eia.doe.gov/steo/steo\\_full.pdf](http://www.eia.doe.gov/steo/steo_full.pdf), accessed September 21, 2011

## UPDATES AS OF SEPTEMBER 2011

Connecticut's PUC has been considering CL&P's smart meter deployment proposal under Docket No. 05-10-03RE04, "Application of The Connecticut Light and Power Company to Implement Time-of-use, Interruptible Load Response, and Seasonal Rates – Review of Meter Study, Deployment Plan and Rate Pilot." Though no final decision has been made whether to approve the project or not, a draft decision issued on August 29, 2011 would deny CL&P permission to deploy smart meters across the state. The draft decision cites a number of reasons for denying the project, including the following: uncertainties regarding AMI technology and standards, minor savings for customers, a lack of confidence in the cost/benefit analysis provided by CL&P and a concern that customers do not desire to participate in dynamic rate plans. Though a full deployment would not be permitted, the draft decision does call for CL&P to provide the PUC with four reports throughout 2012 and 2013 describing the latest advancements in AMI technology. Should the AMI industry develop to the point where CL&P believes that a smart meter deployment would be cost effective, the utility may request a meeting with the PUC to develop a plan of action to evaluate an updated deployment plan.<sup>60</sup>

Public Act No. 11-80, an act concerning the establishment of the Department of Energy and Environmental Protection and planning for Connecticut's energy future, came into effect July 1, 2011. This new law consolidates development of Connecticut's energy policy within the new Department of Energy and Environmental Protection, and requires the department to implement a variety of new clean energy and energy efficiency programs. The commissioner of the Public Utilities Regulatory Authority decided to suspend all further action on Docket No. 05-10-03RE04 while the new department establishes Connecticut's smart meter policy. By delaying review of CL&P's smart meter deployment plan, the Public Utilities Regulatory Authority will ensure that CP&L's proposals align with the Connecticut legislature's directives.<sup>61</sup>

Despite the draft decision and the suspension of review, CL&P's Plan-it Wise homepage still states that the company recommends smart meter installations begin in the latter part of 2012, once a series of industry standards are in place.

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<sup>60</sup> Connecticut Public Utilities Regulatory Authority, Draft Decision for Docket No. 05-10-03RE04, <http://www.dpuc.state.ct.us/dockcurr.nsf/8e6fc37a54110e3e852576190052b64d/225548e74546efe585257905005603e3?OpenDocument>, accessed September 21, 2011

<sup>61</sup> Connecticut Public Utilities Regulatory Authority, Motion Ruling for Docket No. 05-10-03RE04, <http://www.dpuc.state.ct.us/dockcurr.nsf/8e6fc37a54110e3e852576190052b64d/225548e74546efe585257905005603e3?OpenDocument>, accessed September 21, 2011

## Consumers Energy SmartStreet Pilot and Full Scale Smart Meter Project

|                               |                            |                      |                |
|-------------------------------|----------------------------|----------------------|----------------|
| <b>Location:</b>              | Michigan's Lower Peninsula | <b>Dates:</b>        | 2008 - Present |
| <b>Primary Utility/Entity</b> | Consumers Energy           | <b>ARRA Funding:</b> | No             |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To quickly respond to outages and decrease repair time</li> <li>• To provide real-time information to customers allowing them to better manage energy consumption</li> <li>• To increase operation efficiency and implement DR programs</li> </ul>  |
| Status                         | Full scale deployment postponed until Michigan PSC approval is received.   |
| Number of Participants         | <ul style="list-style-type: none"> <li>• Anticipated conversion of 3.5 million electric and gas meters (1.8 million electricity meters) to smart technology</li> <li>• An initial 7,000 smart meters were installed in Jackson County in 2010</li> <li>• About 60 homes and businesses in Grand Rapids received smart meters as part of the SmartStreet program in 2011</li> </ul> |
| Participating Entities         | <ul style="list-style-type: none"> <li>• Consumers Energy</li> <li>• IBM</li> <li>• SAP</li> <li>• OSIsoft</li> <li>• General Electric</li> <li>• Elster</li> </ul>  |
| Program Budget                 | <ul style="list-style-type: none"> <li>• \$2.57 billion (nominal dollars, over lifecycle) for full scale deployment</li> <li>• \$200 million for the Smart Grid/AMI pilot</li> </ul>   |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> </ul>  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Elster's EnergyAxis system used in pilot program</li> <li>• General Electric's high-speed wireless system with WiMAX (the first of its kind in a U.S. deployment)</li> <li>• Planned smart meters, wireless mesh networks, backhaul networks</li> </ul>   |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• Company website has smart meter information.</li> <li>• Consumers Energy's Smart Services Learning Center analyzes smart grid technology effects on service quality and monitors customer satisfaction.</li> </ul>  |
| <b>PROGRAM RESULTS</b>         |  |
| Key Findings                   | Pilot costs, and proposed full scale costs not deemed reasonable by the PSC at this time.  |
| Other Outcomes                 | N/A  |
| Customer Feedback              | No feedback found in identified sources.   |
| Current Deployment Status      | <ul style="list-style-type: none"> <li>• In 2010, Consumers Energy installed smart meters at about 6,000 customer homes in Jackson County.</li> <li>• Full scale deployment is currently pending PSC approval.</li> </ul>  |
| Future Implications            | Consumers Energy will have to significantly lower costs before receiving approval from the PSC for full scale deployment.  |
| <b>IMPACTS/BENEFITS</b>        |  |
| Consumers                      | N/A  |

|   |  |
|---|--|
| Utilities                                   | N/A  |
| Metrics Used                                | N/A  |
| <b>CAUSES FOR CANCELLATION/POSTPONEMENT</b> |  |
| Primary                                     | Lack of funding or cost issues   |
| Secondary                                   | <ul style="list-style-type: none"> <li>• Waiting for technological advancements</li> <li>• State/local regulatory orders causing delays</li> <li>• Observing other pilot projects before proceeding</li> </ul>   |
| <b>RESOURCES</b>                            |  |
| Program Website                             | <ul style="list-style-type: none"> <li>• <a href="http://www.consumersenergy.com/content.aspx?ID=3776">http://www.consumersenergy.com/content.aspx?ID=3776</a></li> <li>• <a href="http://www.consumersenergy.com/content.aspx?id=1503">http://www.consumersenergy.com/content.aspx?id=1503</a></li> </ul>   |
| Full Program Report                         | <a href="http://efile.mpsc.state.mi.us/efile/docs/16191/0293.pdf">http://efile.mpsc.state.mi.us/efile/docs/16191/0293.pdf</a>  |
| Presentations                               | N/A  |
| News Articles                               | <ul style="list-style-type: none"> <li>• SmartGridNews Online, Consumers Energy Profile, <a href="http://www.smartgridnews.com/artman/publish/Key_Players_Utilities_Profiles/Consumers_Energy_Profile-1083.html">http://www.smartgridnews.com/artman/publish/Key_Players_Utilities_Profiles/Consumers_Energy_Profile-1083.html</a>, accessed September 22, 2011</li> <li>• SGIC, Consumer Energy Smart Meter Pilot Project, <a href="http://www.sgicclearinghouse.org/node/1565">http://www.sgicclearinghouse.org/node/1565</a>, accessed September 21, 2011</li> <li>• Dickinson, Boonsri, In Michigan, a Smart Meter Plan Gets Scaled Back, Greentech Media, Inc., <a href="http://www.greentechmedia.com/articles/read/in-michigan-a-smart-meter-plan-gets-whacked-back/">http://www.greentechmedia.com/articles/read/in-michigan-a-smart-meter-plan-gets-whacked-back/</a>, accessed September 21, 2011</li> <li>• Puchala, Jessica, Consumers Energy's SmartStreet program underway, WZZM 13 ABC, <a href="http://www.wzzm13.com/news/article/172746/48/Keeping-track-of-energy-usage?odyssey=mod newswell text FRONTPAGE t">http://www.wzzm13.com/news/article/172746/48/Keeping-track-of-energy-usage?odyssey=mod newswell text FRONTPAGE t</a>, accessed September 21, 2011</li> </ul> |
| Other Resources                             | <ul style="list-style-type: none"> <li>• Carson, Phil, Consumers Energy's measured steps, Intelligent Utility, <a href="http://www.intelligentutility.com/magazine/article/203203/consumers-energys-measured-steps">http://www.intelligentutility.com/magazine/article/203203/consumers-energys-measured-steps</a>, September 22, 2011</li> <li>• Consumers Energy, SmartStreet Frequently Asked Questions, <a href="http://www.consumersenergy.com/content.aspx?id=3807">http://www.consumersenergy.com/content.aspx?id=3807</a>, accessed September 21, 2011</li> <li>• Michigan PSC, Order, March 17, 2011, Case No. U-16191, <a href="http://efile.mpsc.state.mi.us/efile/docs/16191/0315.pdf">http://efile.mpsc.state.mi.us/efile/docs/16191/0315.pdf</a>, accessed September 21, 2011</li> </ul>   |

### PROGRAM DESCRIPTION

In 2010, Consumers Energy installed smart meters at about 7,000 customer homes in Jackson County. Due to the success of the pilot program, Consumers Energy has progressed with the new demonstration project "SmartStreet," deployed in 2011 in the Grand Rapids neighborhood of East Hills. Full scale deployment of smart meter devices in the rest of Consumers Energy's service area would then follow upon PSC approval.

### CAUSES FOR CANCELLATION OR POSTPONEMENT

The full scale budget of the project has been problematic for Consumers Energy. It was reported that a full scale deployment of AMI for the service area could cost as much as \$2.57 billion over the project lifecycle. In August of 2010 it was determined that the budget and scope of the project had to be cut.

The company decided to cut out smart gas meters entirely, and reduce its smart meter budget from \$900 million to about \$500 million over the next five years.

In a November 2010 order, case U-16191, the PSC authorized Consumers Energy to increase its electric rates by \$145.7 million, but it refused to transform the pilot into a permanent program, finding that cost-benefit data from the initial pilot did not support permanent deployment.<sup>62</sup>

While the PSC expressed general support for AMI, it feared that AMI vendors would benefit more from the programs than customers. The PSC indicated that Consumers Energy ignored collaboration opportunities with other companies in customizing AMI software, which would have reduced costs.

The PSC pointed to “the level of expenditures for intangible IT labor and expenses” and other expenditures “being vetted by Consumers” as additional areas of concern.

The Attorney General pointed out that the current spending has been heavily weighted toward the beginning of the project. Consumers Energy proposes to spend 80 percent of the total IT costs in the pilot phase, putting ratepayers at great financial risk if full deployment is cancelled. According to the Attorney General, the company’s benefit-cost analysis shows that the program is only “a financial break-even for customers.”

The PSC recommended a 20 percent adjustment to the AMI software configuration costs, though Consumers Energy argues that this level of cost-cutting may not be possible. The PSC also encouraged Consumer’s Energy to observe the outcome of smart grid deployment plans funded through the Federal stimulus dollars, anticipating that more viable systems would become commercially available at reduced cost at that time, to further aid in vendor selection. Consumers Energy was ordered to provide documentation of the reasonableness of its pilot program costs.

#### **FUTURE CHANGES**

According to the PSC, Consumers Energy must prove that its costs will directly fulfill the goal of the pilot, before further progress can be made on a full scale deployment. Since the programs would be funded by ratepayer dollars, the PSC requires the project pilot costs be kept as low as possible. The PSC has also reiterated that if full deployment is not approved, “any full deployment costs incurred during the pilot phase of the project are not recoverable from ratepayers.”

The approval of full deployment cost recovery hinges on the company achieving all major pilot milestones and demonstrating that a detailed cost-benefit analysis of the entire project supports full deployment. The company must also file a comprehensive plan with program details that prove customer savings will offset any smart grid infrastructure cost recovery request presented to the PSC.

Sue Swan, vice president for smart grid development at Consumers Energy indicated that many consumers have very little knowledge of how the smart grid would function.<sup>63</sup> Increased customer education could potentially increase support for a full scale deployment in Michigan.

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<sup>62</sup> Public Utilities Blog, Michigan Extends Consumers Energy AMI Pilot, <http://blog.fortnightly.com/category/smart-grid/>, accessed September 21, 2011

<sup>63</sup> Carson, Phil, Consumers Energy’s measured steps, Intelligent Utility, <http://www.intelligentutility.com/magazine/article/203203/consumers-energys-measured-steps>, accessed September 21, 2011

## **ALTERNATIVE PROGRAMS**

Though it is unclear what new programs Consumers Energy might implement if the full scale program is not approved, the company has several energy efficiency programs in place that help residential, commercial, and industrial customers reduce their energy use. The company offers rebates for residential customers who buy products such as CFL bulbs, energy efficient furnaces, air conditioners and appliances. Customers who weatherize their homes by installing additional insulation or those who participate in appliance recycling are also offered rebates. Qualified low-income customers are offered weatherization options as well. Business customers who make energy efficient upgrades to their heating and cooling systems, water heaters, lighting, and food service equipment can also receive rebates. Rebates are also offered to some industrial customers to help pay for energy efficiency improvements in their facilities.<sup>64</sup>

## **UPDATES AS OF SEPTEMBER 2011**

In a March 17, 2011 order, the Michigan PSC denied Consumers Energy's request to deploy 400,000 smart meters as part of a proposed \$217 million expanded pilot program. The PSC left open the possibility that Consumers Energy could file an application in a new docket requesting approval of the 400,000 meter pilot.<sup>65</sup> No other relevant orders have been made by the PSC in the same docket since March 17.

Consumers Energy currently plans to continue its SmartStreet demonstration program in Grand Rapids through December 2011. In 2012, the company will begin deployment of smart electric meters in the greater Grand Rapids area, with Muskegon slated to be the first community to receive wide use. Smart meter deployment across the state is expected to continue over several years.

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<sup>64</sup> Consumers Energy, Energy Efficiency, <http://www.consumersenergy.com/content.aspx?id=1499>, accessed September 21, 2011

<sup>65</sup> Michigan PSC, Order, March 17, 2011, Case No. U-16191, <http://efile.mpsc.state.mi.us/efile/docs/16191/0315.pdf>, accessed September 21, 2011

## DP&L Customer Conservation and Energy Management Plan

|                               |                               |                      |           |
|-------------------------------|-------------------------------|----------------------|-----------|
| <b>Location:</b>              | Western and Central Ohio      | <b>Dates:</b>        | 2009-2011 |
| <b>Primary Utility/Entity</b> | Dayton Power and Light (DP&L) | <b>ARRA Funding:</b> | No        |

| PROGRAM INFORMATION            |   |
|--------------------------------|---|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To develop an advanced, modern distribution system to integrate renewable energy into the grid.</li> <li>• To implement AMI, enabling customers to manage their electricity consumption through direct load control, TOU and PTR pricing.</li> </ul>   |
| Status                         | Postponed   |
| Number of Participants         | All 500,000 customers in service area   |
| Participating Entities         | <ul style="list-style-type: none"> <li>• DP&amp;L</li> <li>• Energy efficiency vendors and channel partners</li> <li>• Bridge Strategy Group and Accenture involved in planning phase</li> </ul>  |
| Program Budget                 | <ul style="list-style-type: none"> <li>• Would require investment of \$297.1 million in capital and \$185.8 million in operation and maintenance (O&amp;M) costs over seven years.                             <ul style="list-style-type: none"> <li>○ \$255 million to support AMI, \$41.6 million for smart grid development, and \$0.5 million for energy efficiency programs</li> <li>○ O&amp;M includes \$118.4 million for energy efficiency programs, \$63.1 million for AMI, and \$4.3 million for smart grid development</li> </ul> </li> </ul> |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> <li>• Industrial</li> </ul>   |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• AMI and home energy management systems communicating through broadband, two-way voice/data and microwave IP networks</li> <li>• New electricity pricing models</li> <li>• Home area network gateway to communicate with smart appliances</li> <li>• Distribution system upgrades to include automation controls such as SCADA voltage telemetry</li> </ul>   |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• Educational information on DP&amp;L website</li> <li>• Energy efficiency showcase</li> <li>• Educational facility for customer outreach activities</li> </ul>  |
| PROGRAM RESULTS                |   |
| Key Findings                   | N/A (Plan postponed)  |
| Other Outcomes                 | N/A   |
| Customer Feedback              | Some customers have expressed concerns regarding privacy and costs.   |
| Current Deployment Status      | Plans withdrawn by DP&L due to lack of stimulus funding; no solidified plans for smart meter installation at this time.   |
| Future Implications            | DP&L looking into new technology with microwave communications and two-way radio systems and evaluating the deployments currently underway by other utilities.  |

| IMPACTS/BENEFITS                     |  |
|--------------------------------------|--|
| Consumers                            | N/A  |
| Utilities                            | N/A  |
| Metrics Used                         | N/A  |
| CAUSES FOR CANCELLATION/POSTPONEMENT |  |
| Primary                              | Waiting for technological advancements   |
| Secondary                            | <ul style="list-style-type: none"> <li>• Lack of funding or cost issues</li> <li>• Privacy concerns</li> <li>• Negative response to rate increases</li> <li>• Observing other pilot projects before proceeding</li> </ul>  |
| RESOURCES                            |  |
| Program Website                      | <ul style="list-style-type: none"> <li>• <a href="http://www.dpandl.com/education/electricity-information/smart-grid-the-facts/">http://www.dpandl.com/education/electricity-information/smart-grid-the-facts/</a></li> <li>• DP&amp;L, Customer Conservation and Energy Management Programs, Direct Testimony of Kevin L. Hall, <a href="http://www.dpandl.com/documents/Testimony2.pdf">http://www.dpandl.com/documents/Testimony2.pdf</a>, accessed September 21, 2011</li> </ul>   |
| Full Program Report                  | <ul style="list-style-type: none"> <li>• <a href="http://www.dpandl.com/documents/CustomerConservationandEnergyManagementPrograms.pdf">http://www.dpandl.com/documents/CustomerConservationandEnergyManagementPrograms.pdf</a></li> <li>• DP&amp;L, Energy Efficiency and Demand Response Plan 2009-2015, <a href="http://www.dpandl.com/documents/EnergyEfficiencyandDemandResponsePlan.pdf">http://www.dpandl.com/documents/EnergyEfficiencyandDemandResponsePlan.pdf</a>, accessed September 21, 2011</li> </ul>  |
| Presentations                        | N/A  |
| News Articles                        | Beyerlein, Tom, DP&L only Ohio power company to delay 'smart meter' upgrades, <a href="http://www.daytondailynews.com/news/dayton-news/dpl-only-ohio-power-company-to-delay-smart-meter-upgrades-1073958.html">http://www.daytondailynews.com/news/dayton-news/dpl-only-ohio-power-company-to-delay-smart-meter-upgrades-1073958.html</a> , accessed September 21, 2011  |
| Other Resources                      | <ul style="list-style-type: none"> <li>• Metering.com, DP&amp;L files smart metering and smart grid plan, <a href="http://www.metering.com/node/13727">http://www.metering.com/node/13727</a>, accessed September 21, 2011</li> <li>• DP&amp;L, AMI Plan, <a href="http://intelligrid.epri.com/AMI_Business_Cases/DPL_09_02_25_AMI_Business_Case_for_PUCO.pdf">http://intelligrid.epri.com/AMI_Business_Cases/DPL_09_02_25_AMI_Business_Case_for_PUCO.pdf</a>, accessed September 21, 2011</li> <li>• <a href="http://dis.puc.state.oh.us/TiffToPDF/A1001001A11A05B35417E65734.pdf">http://dis.puc.state.oh.us/TiffToPDF/A1001001A11A05B35417E65734.pdf</a></li> </ul> |

### PROGRAM DESCRIPTION

In 2008 DP&L filed its proposal for AMI and smart grid developments with the PUC of Ohio. The plan, titled Customer Conservation and Energy Management (CCEM), was approved by the PUC in June 2009. The plan included the development of an upgraded distribution system with real-time, automated controls. AMI installations for all customers, substation automation, energy efficiency programs, and DR programs were also included. Under the plan, TOU and PTR pricing would become available once the underlying AMI was installed. The plan was designed to allow easier integration of intermittent, renewable energy sources into the grid.



## CAUSES FOR CANCELLATION OR POSTPONEMENT

DOE rejected DP&L's application for a \$145 million stimulus grant to fund the program; a reason for the rejection was not disclosed in the identified sources.<sup>66</sup> Initially, DP&L requested permission from the PUC to recover the program costs through ratepayers, but the company later retracted the request. In January 2011 the PUC approved DP&L's withdrawal of the \$370 million, 10-year CCEM plan for smart grid developments. Given current economic conditions, the plan no longer seemed to be in the company's best interest. DP&L reported that some customers objected to the meters due to cost and privacy concerns. From the outset, customers made it clear that they didn't want to pay for the plan's implementation through rate increases.<sup>67</sup> Additionally, DP&L indicated in the withdrawal request to the PUC, that the company preferred to observe how AMI and smart grid programs being implemented by other Ohio utilities fare before making significant investments in their own plan.

## FUTURE CHANGES

As economic conditions change, DP&L could revisit AMI and smart grid deployment in the future. DP&L will be evaluating the deployments currently underway by American Electric Power, Duke Energy, and FirstEnergy, and will develop their own plans from the lessons learned.

The DP&L website states that the company continues to work on a smart grid plan, along with investments in upgrades of their systems and distribution technology. Old technologies will be retired and new technology installed in the system will be designed with smart meter and smart grid compatibility in mind. The company is looking into microwave communications and two-way radio system technology and specifically observing how other companies' test pilots progress with these and other technologies.

## ALTERNATIVE PROGRAMS

Though it is unclear what new programs DP&L might implement in place of CCEM, the company currently has programs that encourage reductions in electricity consumption and promote overall energy efficiency. For residential customers, DP&L has proceeded in offering: 1) appliance recycling and cooling system tune-ups; 2) rebates on qualified, new energy-efficient air conditioning and heat pump systems; 3) discounts on CFL bulbs; and 4) the Smart Energy Community Program where customers qualifying for bill assistance receive a free audit of their home energy usage along with energy improvements. Business customers can receive rebates on new equipment that reduces energy consumption and demand as well as rebates for new construction surpassing standard building codes. DP&L government customers can receive a comprehensive energy analysis of their facility from a qualified auditor who evaluates energy usage and can recommend cost-effective, improvement projects.<sup>68</sup>

DP&L also offers an energy efficiency education program in the Miami Valley. The program is offered to teachers, students, and families, and includes 9,000 take-home energy efficiency kits with accompanying classroom curriculum.<sup>69</sup>

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<sup>66</sup> Dayton Daily News, DP&L only Ohio power company to delay "smart meter" upgrades, <http://www.daytondailynews.com/news/dayton-news/dpl-only-ohio-power-company-to-delay-smart-meter-upgrades-1073958.html>, accessed September 21, 2011

<sup>67</sup> Dayton Daily News, DP&L only Ohio power company to delay "smart meter" upgrades, <http://www.daytondailynews.com/news/dayton-news/dpl-only-ohio-power-company-to-delay-smart-meter-upgrades-1073958.html>, accessed September 21, 2011

<sup>68</sup> DP&L, Business & Government Rebates, <http://www.dpandl.com/save-money/>, accessed September 21, 2011

<sup>69</sup> DP&L, Energy Efficiency Program (E-3), <http://www.dpandl.com/education/educational-programs/energy-efficiency-program-e-3/>, accessed September 21, 2011

All DP&L customers can take advantage of net metering for renewable energy systems and customers can apply to sell their RECs to DP&L. Green pricing is also provided through the “Green Connect program.”<sup>70</sup>

In Dayton, DP&L currently utilizes AMR technology, in a drive-by mode, through an RF network.<sup>71</sup>

#### **UPDATES AS OF SEPTEMBER 2011**

There are no significant updates to this case study as of September 2011. DP&L reports on its smart grid homepage that it continues to work on its smart grid plan, but no details are provided.<sup>72</sup> When old technologies are retired, new digital options are incorporated into the system, thereby supporting the foundation for the implementation of smart meters and a smart grid in the future.

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<sup>70</sup> DP&L, Renewable Energy, <http://www.dpandl.com/environment/renewable-energy/>, September 21, 2011

<sup>71</sup> DP&L, AMI Plan, [http://intelligrid.epri.com/AMI\\_Business\\_Cases/DPL\\_09\\_02\\_25\\_AMI\\_Business\\_Case\\_for\\_PUCO.pdf](http://intelligrid.epri.com/AMI_Business_Cases/DPL_09_02_25_AMI_Business_Case_for_PUCO.pdf), accessed September 21, 2011

<sup>72</sup> <http://www.dpandl.com/education/electricity-information/smart-grid-the-facts/>, accessed September 21, 2011

| <b>HECO Smart Meter Pilot Program</b> |                                  |                      |           |
|---------------------------------------|----------------------------------|----------------------|-----------|
| <b>Location:</b>                      | Hawaii                           | <b>Dates:</b>        | 2006-2010 |
| <b>Primary Utility/Entity</b>         | Hawaiian Electric Company (HECO) | <b>ARRA Funding:</b> | No        |

| <b>PROGRAM INFORMATION</b>     |   |
|--------------------------------|---|
| Key Objectives                 | <ul style="list-style-type: none"> <li>To test the ability to provide RF coverage in urban and rural applications.</li> <li>To evaluate third party contractor installation of the meters.</li> <li>To demonstrate the capability to reliably and accurately deliver timely monthly billing readings and interval data via two-way commands.</li> </ul>   |
| Status                         | Cancelled   |
| Number of Participants         | <ul style="list-style-type: none"> <li>430,000 residential and commercial electric customers.</li> <li>Approximately 9,400 meters installed by mid-2010.</li> </ul>   |
| Participating Entities         | <ul style="list-style-type: none"> <li>HECO</li> <li>Sensus</li> </ul>  |
| Program Budget                 | \$115 million for full scale smart meter deployment. Ratepayers would have to absorb \$1.35 million.  |
| Consumer Sector                | <ul style="list-style-type: none"> <li>Residential</li> <li>Commercial</li> </ul>   |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>Sensus FlexNet AMI system</li> <li>Sensus iCon smart meters</li> </ul>   |
| Consumer Education Measures    | N/A   |
| <b>PROGRAM RESULTS</b>         |   |
| Key Findings                   | <ul style="list-style-type: none"> <li>Technical problems associated with the performance of the AMI system were identified, including apparent data anomalies.</li> <li>Other issues identified were associated with business processes.</li> <li>AMI software was criticized for being proprietary, rather than open-source.</li> </ul>   |
| Other Outcomes                 | N/A   |
| Customer Feedback              | N/A   |
| Current Deployment Status      | July 2010 extension request for pilot project denied by the Hawaii PUC, but in October 2010, the PUC approved the company's new smart grid roadmap.   |
| Future Implications            | <ul style="list-style-type: none"> <li>East Oahu Transmission Project will include smart grid elements.</li> <li>The current smart grid roadmap focuses on transmission upgrade projects rather than customer smart meter installations.</li> <li>PUC has noted that any new AMI or preferably AMI/smart grid application for any utility should include or be preceded by an overall smart grid plan or proposal filed with the commission.</li> </ul> |
| <b>IMPACTS/BENEFITS</b>        |   |
| Consumers                      | N/A   |
| Utilities                      | N/A   |
| Metrics Used                   | N/A   |

| CAUSES FOR CANCELLATION/POSTPONEMENT |  |
|--------------------------------------|--|
| Primary                              | Equipment or construction related problems   |
| Secondary                            | <ul style="list-style-type: none"> <li>Lack of funding or cost issues</li> <li>State/local regulatory orders causing delays</li> </ul>   |
| RESOURCES                            |  |
| Program Website                      | <a href="http://www.hawaiisenergyfuture.com/articles/Smart_Grid.html">http://www.hawaiisenergyfuture.com/articles/Smart_Grid.html</a>  |
| Full Program Report                  | N/A  |
| Presentations                        | N/A  |
| News Articles                        | <ul style="list-style-type: none"> <li>Tweed, Katherine, HECO Requests Second Pilot of Sensus Meters, Greentech Media, Inc., <a href="http://www.greentechmedia.com/articles/read/heco-requests-second-pilot-of-sensus-meters/">http://www.greentechmedia.com/articles/read/heco-requests-second-pilot-of-sensus-meters/</a>, accessed September 21, 2011</li> <li>Smartmeters.com, Hawaiian utility to install AMI, <a href="http://www.smartmeters.com/the-news/403-hawaiian-utility-to-install-ami.pdf">http://www.smartmeters.com/the-news/403-hawaiian-utility-to-install-ami.pdf</a>, accessed September 21, 2011</li> <li>Cocke, Sophie, Grid stability critical to state's energy future, Pacific Business News, <a href="http://www.bizjournals.com/pacific/stories/2010/08/09/story11.html">http://www.bizjournals.com/pacific/stories/2010/08/09/story11.html</a>, accessed September 21, 2011</li> <li>SmartGridNews.com, Smart Meter Setback: Hawaii PUC Kicks Back Project, Tells Utility to Try It Again, <a href="http://www.smartgridnews.com/artman/publish/Business_Policy_Regulation_News/Hawaii-PUC-Kicks-Back-Smart-Meter-Project-Tells-Utility-to-Try-It-Again-2795.html">http://www.smartgridnews.com/artman/publish/Business_Policy_Regulation_News/Hawaii-PUC-Kicks-Back-Smart-Meter-Project-Tells-Utility-to-Try-It-Again-2795.html</a>, accessed September 21, 2011</li> </ul>   |
| Other Resources                      | <ul style="list-style-type: none"> <li>PUC Letter of Denial, <a href="http://www.mmidl.com/sgt/2010-Jul-29/20100726%20Order%20Closing%20Docket.pdf">http://www.mmidl.com/sgt/2010-Jul-29/20100726%20Order%20Closing%20Docket.pdf</a>, accessed September 21, 2011</li> <li>PUC documentation for East Oahu Transmission Project, <a href="http://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A10F14B10939I51169">http://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A10F14B10939I51169</a> and <a href="http://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A10H30B03334C50131">http://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A10H30B03334C50131</a>, accessed September 21, 2011</li> <li>Metering.com, Hawaiian Electric selects AMI solution, <a href="http://www.metering.com/Hawaiian/Electric/selects/AMI/solution">http://www.metering.com/Hawaiian/Electric/selects/AMI/solution</a>, accessed September 21, 2011</li> <li>HECO, Japan-U.S. Smart Grid project on Maui to demonstrate new technologies, <a href="http://www.heco.com/portal/site/heco/menuitem.508576f78baa14340b4c0610c510b1ca/?vgnextoid=6d9a7368ae500310VgnVCM1000005c011bacRCD&amp;vgnnextfmt=default&amp;cpsextcurrchannel=1">http://www.heco.com/portal/site/heco/menuitem.508576f78baa14340b4c0610c510b1ca/?vgnextoid=6d9a7368ae500310VgnVCM1000005c011bacRCD&amp;vgnnextfmt=default&amp;cpsextcurrchannel=1</a>, accessed September 21, 2011</li> <li>Smartgrid.gov, Hawaiian Electric Company, East Oahu Switching Project, <a href="http://www.smartgrid.gov/project/hawaiian_electric_company_east_oahu_switching_project">http://www.smartgrid.gov/project/hawaiian_electric_company_east_oahu_switching_project</a>, accessed September 21, 2011</li> <li>Maui Electric Company, Maui Smart Grid Project Now Recruiting Volunteers, <a href="http://www.hawaiisenergyfuture.com/articles/MauiSmartGridProject.pdf">http://www.hawaiisenergyfuture.com/articles/MauiSmartGridProject.pdf</a>, accessed September 21, 2011</li> </ul> |

## **PROGRAM DESCRIPTION**

HECO initiated three AMI pilot projects prior to 2008, which comprised an investigation into the functionality and reliability of Sensus AMI technology for RF coverage, ease of installation by contractors, and monthly meter reading/billing needs. This included 500 AMI meters on Oahu and two tower gateway base radio base station sites; 3,000 residential and commercial meters in the Ocean Pointe area, along with a third tower gateway base tower; and 400 residential meters at two more TGB sites in Koko Head and Pu'u Papa'a to support a Dynamic Pricing Pilot program.<sup>73</sup>

In December 2008, HECO sought approval from the Hawaii PUC to install smart meters at approximately 451,000 locations. The cost for the project was estimated at approximately \$115 million.

By July 2010, HECO had installed approximately 9,400 meters under three pilot programs. During performance testing, a number of issues were identified, and in order to address these issues, HECO applied for an extension of the pilot program. HECO submitted a request to the PUC for an additional \$1.35 million to expand the pilot by installing 5,000 additional meters on Oahu to test the equipment with a new customer information system (CIS), to address issues that were uncovered during the pilot programs, and to gather information on cyber security matters.

## **CAUSES FOR CANCELLATION OR POSTPONEMENT**

Technical issues associated with the performance of the AMI system included:

- Apparent data anomalies
- AMR and bill processing problems
- Interval data collection problems
- Two-way communication performance (including demand reset and firmware upgrade functionality) issues
- TOU data delivery problems
- Availability and maturity of key network equipment and installation tools

HECO identified issues associated with business processes and other areas critical to ensuring that a full scale deployment could proceed securely, efficiently and economically. These issues included new developments regarding cyber security measures, hardware/software quality processes, mitigation of RF interference, efficient and automated management of the AMI network, supply chains and the robustness of the backhaul communications links.

In July, 2010, the Hawaii PUC denied the pilot extension request and dismissed the pilot program, though it reiterated its support for an AMI and the smart grid concept to reduce the State's dependence on fossil fuels. The PUC pointed to timing and cost concerns and indicated extended pilot testing was needed before any additional deployments could take place. The PUC noted concerns about allowing "a pilot program to occur during what is ostensibly a capital improvement project. Generally, any pilot programs should occur prior to the application, rather than during the application." The PUC also noted concerns about the cost effectiveness of the project and "significant unanswered questions" that the extended pilot testing may not answer, such as the communication issues between AMI and the CIS. The PUC dismissed the application and closed the docket, requiring that HECO re-file a new application if desired, rather than a project extension request. HECO was advised to develop a comprehensive

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<sup>73</sup> Kema Consulting, New trends emerging for AMI cost recovery, <http://www.kema.com/services/consulting/utility-future/smart-grid/ami-cost-recovery.aspx>, accessed September 21, 2011

approach, detailing the costs and benefits associated with the project before requesting use of additional ratepayer funds.<sup>74</sup>

Critics argued for more public discussion to evaluate costs of alternative systems. Some groups recommended more decentralized power, such as rooftop solar panels. Some also questioned the high cost of installing AMI, since it is exacerbated by Hawaii's isolation from other utilities, requiring much higher levels of in-system backups. Unlike the mainland, utilities in Hawaii cannot rely on adjacent utilities to supply vital, ancillary services as operational reserves or spinning reserves for backup. Instead, backups must be built into the grid of each island, which contributes to the high cost of electricity in the State.

### **FUTURE CHANGES**

Since cost was a driving factor in the PUC decision, technological breakthroughs that reduce smart grid equipment costs could help AMI projects significantly.

The significant increase in fuel costs (oil over \$100 per barrel) could push smart grid development forward as well. Other than solar and wind, fuel oil is the primary source for the generation of electricity, making the cost of electricity in Hawaii the highest in the nation. Hawaii accounted for more than 30 percent of the fuel oil used in the generation of electricity in the United States in 2010.<sup>75</sup>

### **ALTERNATIVE PROGRAMS**

In observing the HECO pilot example, it becomes clear that focused, detailed plans with cost/benefit analysis are more likely to win approval from the Hawaii PUC. In October 2010, the Hawaii PUC approved a request from HECO for \$10.1 million for the installation of computer controlled sensors and switches to automatically isolate outages and re-route power to affected customers. This project, known as the East Oahu Transmission Project, would improve the reliability of the transmission system through smart grid upgrades and by adding additional transmission routes. The project could save customers as much as \$18 million, and will avoid the underground construction that could severely impact traffic. The project will also improve outage troubleshooting and reduce outage duration.

Originally, HECO planned to spend \$28 million on the project, but was able to scale back the cost in the approved plan as well as avoid the traffic congestion that would have resulted had the original plan been implemented.<sup>76</sup> HECO was awarded \$5.3 million in stimulus money for the project. The project is planned to be completed by 2012. Other smart grid pilot projects and testing can continue as funding allows, including a joint project with Sacramento Municipal Utility District using California PUC funds.<sup>77</sup>

In a GE Smart Grid pilot on Maui, GE and HECO are testing wall-mounted meters that will monitor power consumption of household appliances and alert customers when peak demand periods occur. This

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<sup>74</sup> Hawaii PUC, Docket No. 2008-0303, <http://www.mmidl.com/sgt/2010-Jul-29/20100726%20Order%20Closing%20Docket.pdf>, accessed September 21, 2011

<sup>75</sup> Energy Information Administration, Electric Power Monthly September 2011, Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State, June 2011 and 2010, Table 5.6.A; Receipts of Petroleum Liquids Delivered for Electricity Generation by State, Year-to-Date through June 2011 and 2010, Table 4.7.B, [http://www.eia.doe.gov/cneaf/electricity/epm/epm\\_sum.html](http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html), accessed September 21, 2011.

<sup>76</sup> HECO, Hawaii PUC approves Hawaiian Electric smart grid project using \$5.3 million federal stimulus grant, <http://www.heco.com/portal/site/heco/menuitem.508576f78baa14340b4c0610c510b1ca/?vgnnextoid=c14d1c9e623fb210VgnVCM1000005c011bacRCD&vgnnextfmt=default&cpsexcurrchannel=1>, accessed September 21, 2011

<sup>77</sup> HECO, Hawaii Clean Energy Initiative - Hawaiian Electric Companies' Energy Agreement Update - Year Two, [http://www.heco.com/vcmcontent/StaticFiles/pdf/HCEI\\_2YearUpdate.pdf](http://www.heco.com/vcmcontent/StaticFiles/pdf/HCEI_2YearUpdate.pdf), accessed September 21, 2011

project is funded by a \$14 million Smart Grid Investment Grant from DOE, with the goal of reducing peak electricity consumption by 15 percent by 2012.<sup>78</sup>

HECO is deploying utility applications from SAP to manage customer service, billing, metering data, and energy information with the goal of allowing customers to better understand their electricity use. It is also hoped that the project will allow for flexible rate options in the future. The system will establish a centralized source of customer information for advancing customer service and infrastructure management capabilities of the utility.<sup>79</sup>

HECO also has net metering programs available for customers. All residential and commercial utility customers enrolled in net metering, who own and operate an eligible renewable energy generation system up to 100 kW and intend to connect to the grid, must register their systems with the utility. The net metering law specifies that solar, wind, biomass, hydroelectric generation facilities, or a hybrid system of two or more of these technologies are eligible.<sup>80</sup>

### **UPDATES AS OF SEPTEMBER 2011**

Though HECO's large-scale AMI pilot program remains permanently canceled, two of the utility's alternative smart grid programs, the East Oahu Transmission Project and the Maui Smart Grid Project, are both proceeding. Various partners in the U.S. and Japan agreed on May 18, 2011 to collaborate on the smart grid demonstration in Maui. The organizations partnering on the project include DOE; HECO; Maui Electric Company; the Hawaii Department of Business, Economic Development and Tourism; the Hawaii Natural Energy Institute at the University of Hawaii; and Japan-based New Energy and Industrial Technology Development Organization, an entity under the government of Japan's Ministry of Economy, Trade and Industry. The New Energy and Industrial Technology Development Organization agreed to provide about \$37 million in funding for the project, and selected six Japanese companies to work with their U.S. project partners to develop and install smart grid technologies on Maui. The U.S.-Japanese partnership will focus on demonstrating new technologies focused on the integration of clean energy and electric vehicles.<sup>81</sup>

On September 21, 2011, the Maui Smart Grid Project began actively recruiting volunteers from the Maui Meadows neighborhood in South Kihei to participate in a smart grid pilot program. Organizers are seeking 200 volunteers to have a smart meter installed in their home and receive access to a personalized website displaying energy usage information. Volunteers will also have the opportunity to use other smart grid technologies, such as in-home energy displays and smart thermostats.<sup>82</sup>

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<sup>78</sup> SmartGridNews.com, Beyond Metering: 10 Pretty Darn Interesting Stimulus-Funded Smart Grid Projects, [http://www.smartgridnews.com/artman/publish/Stimulus\\_Awards\\_Projects\\_News/Beyond-Metering-10-Pretty-Darn-Interesting-Stimulus-Funded-Smart-Grid-Projects-2254.html](http://www.smartgridnews.com/artman/publish/Stimulus_Awards_Projects_News/Beyond-Metering-10-Pretty-Darn-Interesting-Stimulus-Funded-Smart-Grid-Projects-2254.html), accessed September 21, 2011

<sup>79</sup> Renew Grid, Hawaiian Electric Using SAP Technology To Streamline Operations, [http://www.renewgridmag.com/e107\\_plugins/content/content.php?content.5770](http://www.renewgridmag.com/e107_plugins/content/content.php?content.5770), accessed September 21, 2011

<sup>80</sup> HECO, Net Energy Metering in Hawaii, <http://www.heco.com/portal/site/heco/menuitem.508576f78baa14340b4c0610c510b1ca/?vgnnextoid=12a290a2decab110VgnVCM1000005c011bacRCD&vgnnextchannel=a48df2b154da9010VgnVCM10000053011bacRCD&vgnnextfmt=default&vgnnextrefresh=1&level=0&ct=article>, accessed September 21, 2011

<sup>81</sup> HECO, Japan-U.S. Smart Grid project on Maui to demonstrate new technologies, <http://www.heco.com/portal/site/heco/menuitem.508576f78baa14340b4c0610c510b1ca/?vgnnextoid=6d9a7368ae500310VgnVCM1000005c011bacRCD&vgnnextfmt=default&cpsectcurrchannel=1>, accessed September 21, 2011

<sup>82</sup> Maui Electric Company, Maui Smart Grid Project Now Recruiting Volunteers, <http://www.hawaiisenergyfuture.com/articles/MauiSmartGridProject.pdf>, accessed September 21, 2011

| <b>LIPA BPL and Wireless Communications Demonstration</b> |                                    |                      |           |
|---|------------------------------------|----------------------|-----------|
| <b>Location:</b>  | Hauppauge and Commack, New York    | <b>Dates:</b>        | 2006-2007 |
| <b>Primary Utility/Entity</b>                             | Long Island Power Authority (LIPA) | <b>ARRA Funding:</b> | No        |

| <b>PROGRAM INFORMATION</b>                  |   |
|---|---|
| Key Objectives                              | <ul style="list-style-type: none"> <li>To assess the potential for large-scale application of Broadband over Power Lines (BPL) technology on the grid.</li> <li>To enhance service reliability for LIPA customers and enable quick fault detection in the T&amp;D system.</li> <li>To facilitate AMR and reduce costs.</li> </ul> |
| Status                                      | Cancelled   |
| Number of Participants                      | 100 residential customers; five commercial customers.   |
| Participating Entities                      | <ul style="list-style-type: none"> <li>LIPA</li> <li>Main.net Power Line Communications</li> <li>Partnership with Stony Brook University, Brookhaven National Laboratory, and Maritime</li> </ul>   |
| Program Budget                              | <ul style="list-style-type: none"> <li>LIPA would pay Main.net \$887,762, plus an estimated \$90,000 in third-party internet carrier costs.</li> <li>LIPA's customers were not charged for their participation.</li> </ul>  |
| Consumer Sector                             | <ul style="list-style-type: none"> <li>Residential</li> <li>Commercial</li> </ul>   |
| Hardware/Software Technologies              | <ul style="list-style-type: none"> <li>Real-time AMR technology</li> <li>Consumer internet, VoIP, IM and other broadband services over power lines</li> </ul>   |
| Consumer Education Measures                 | N/A (project cancelled)   |
| <b>PROGRAM RESULTS</b>                      |   |
| Key Findings                                | N/A (Cancelled sometime around first test period in mid-2007.)  |
| Other Outcomes                              | N/A   |
| Customer Feedback                           | Project met with some resistance due to RF interference issues.   |
| Current Deployment Status                   | Cancelled; abandoned due to cost issues.  |
| Future Implications                         | FCC regulations and concerns over interference continue to overshadow BPL technology benefits. If implemented, the utility would compete directly with broadband service providers for customers.   |
| <b>IMPACTS/BENEFITS</b>                     |   |
| Consumers                                   | N/A   |
| Utilities                                   | N/A   |
| Metrics Used                                | N/A   |
| <b>CAUSES FOR CANCELLATION/POSTPONEMENT</b> |   |
| Primary                                     | <ul style="list-style-type: none"> <li>Lack of funding or cost issues</li> <li>Equipment or construction related problems</li> </ul>  |
| Secondary                                   | Health concerns   |



| RESOURCES           |  |
|---------------------|--|
| Program Website     | N/A  |
| Full Program Report | LIPA, "Minutes of the 177th Meeting Held on June 22, 2006," <a href="http://www.lipower.org/pdfs/company/papers/minutes/062206.pdf">http://www.lipower.org/pdfs/company/papers/minutes/062206.pdf</a> , accessed September 23, 2011  |
| Presentations       | N/A  |
| News Articles       | <ul style="list-style-type: none"> <li>• Belson, Ken, Plug-In Internet Connection to Get Test on Long Island, New York Times, February 17, 2006, <a href="http://www.nytimes.com/2006/02/17/nyregion/17lipa.html?_r=2&amp;oref=slogin">http://www.nytimes.com/2006/02/17/nyregion/17lipa.html?_r=2&amp;oref=slogin</a>, accessed September 21, 2011</li> <li>• Long Island Press, LIPA Applies For \$119 Million In Smart Grid Funding, August 10, 2009, <a href="http://www.longislandpress.com/2009/08/10/lipa-applies-for-119-million-in-stimulus-funding-for-smart-grid-projects/">http://www.longislandpress.com/2009/08/10/lipa-applies-for-119-million-in-stimulus-funding-for-smart-grid-projects/</a>, accessed September 21, 2011</li> </ul>   |
| Other Resources     | <ul style="list-style-type: none"> <li>• National Association for Amateur Radio, Electric Utility Communications, Applications and Smart Grid Technologies, <a href="http://www.arrl.org/electric-utility-communications-applications-and-smart-grid-technologies">http://www.arrl.org/electric-utility-communications-applications-and-smart-grid-technologies</a>, accessed September 21, 2011</li> <li>• Smartgrid.gov, Long Island Power Authority: Long Island Smart Energy Corridor, <a href="http://www.smartgrid.gov/project/long_island_power_authority_long_island_smart_energy_corridor">http://www.smartgrid.gov/project/long_island_power_authority_long_island_smart_energy_corridor</a>, accessed September 21, 2011</li> <li>• Efacec ACS, Efacec ACS to Deliver Advanced Distribution Management System to Long Island Power Authority, <a href="http://www.efacec-acs.com/index.php?option=com_content&amp;view=article&amp;Itemid=134&amp;id=173%3A2011-efacec-acs-to-deliver-advanced-distribution-management-system-to-long-island-power-authority">http://www.efacec-acs.com/index.php?option=com_content&amp;view=article&amp;Itemid=134&amp;id=173%3A2011-efacec-acs-to-deliver-advanced-distribution-management-system-to-long-island-power-authority</a>, accessed September 21, 2011</li> </ul> |

### PROGRAM DESCRIPTION

LIPA issued an RFP on February 21, 2006 seeking firms experienced in BPL and wireless communication technologies for a pilot project.<sup>83</sup> Around Sept. 2006 Main.net was chosen for the project and LIPA's "BPL and Wireless Communications Demonstration Project" began. The project area covered approximately 2.8 square miles, with 1,500 households and 50 industrial properties on the affected circuits.<sup>84</sup> LIPA was interested in a large-scale application of the BPL technology, which would enable AMR in the area.

### CAUSES FOR CANCELLATION OR POSTPONEMENT

The demonstration projects had several barriers to overcome from the start. In general, BPL equipment is very expensive, and tends to interfere with other radio communications, such as ham radio service. Some local community groups assembled teams to test the interference and noise level measurements in the area, just prior to the project testing period.

LIPA also had the additional challenge of ensuring the deployment of a BPL system would not affect its tax-exempt status. LIPA's chairman confirmed that the project could not progress on a commercial basis without firm assurance LIPA's non-profit, tax exempt status would remain intact. LIPA's tax exempt

<sup>83</sup> LIPA, Minutes of the 177th Meeting Held on June 22, 2006, <http://www.lipower.org/pdfs/company/papers/minutes/062206.pdf>, accessed September 21, 2011

<sup>84</sup> LIPA, BPL Fact Sheet - LIPA Test Areas, Schedule for Testing, <http://rr13.net/Ham/BPL/LIPA%20Fact%20Sheet.pdf>, accessed September 21, 2011

bonds could have been affected by the use of LIPA's lines financed with tax exempt debt. Private use of the lines and facilities owned by LIPA could have resulted in the bonds being recalled and reissued as taxable debt, an additional cost LIPA was not willing to bear.<sup>85</sup>

By April 2007, the State had not yet approved the project and with a new governor taking office, some doubted the project would move forward. In July 2007, LIPA made special design changes to ensure that the amateur radio bands in the area would not be affected by interference. However, a few months later the project appeared to be abandoned due to cost.<sup>86</sup>

Due to the high cost of BPL technology, most U.S. utilities have not been able to affordably use the technology for advanced metering alone, without the assistance of government subsidies or private sector partners.<sup>87</sup> Additionally, BPL signals are limited by distance in the overhead U.S. electrical distribution topology without additional equipment such as couplers and repeaters to boost the signal. This additional equipment tends to eliminate cost savings associated with using the existing wires. Not only do BPL signals traveling on overhead lines have the potential to interfere with shortwave radio signals, but local RF on an unlicensed spectrum also can interfere with the BPL network signal itself, requiring costly mitigation. Additional drawbacks include noisy lines and poor interoperability due to the lack of IEEE-P1901 Standard.<sup>88</sup> All of these factors contribute to the challenges BPL projects face in the U.S.

#### **FUTURE CHANGES**

Technological improvements to reduce noise and improve interoperability may help. Tailored design considerations to minimize local radio interference, such as the steps LIPA took to exclude frequencies used by local operators, could help as well.

Cost issues may have resolution at some point, but utilities would have to be adequately prepared to address the new broadband services market they are entering. This becomes a problem for BPL integration in lines owned by non-profit entities like LIPA.

#### **ALTERNATIVE PROGRAMS**

While the BPL demonstration project has been cancelled, LIPA continues to invest in other smart grid technologies through the assistance of ARRA funding. In 2009, LIPA applied for \$119 million in stimulus funding to add an advanced computer system and digital technology to its existing grid system. Under the plan, the funding would support the Dynamic Reactive Support System Project (\$49.6 million), consisting of a voltage management system to reduce blackouts and integrate renewable energy sources. Another \$69.5 million of the funding would support the Smart Grid Communications Backbone Project, a fiber optic and radio network that would improve communications between all LIPA substations.

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<sup>85</sup> National Association for Amateur Radio, Electric Utility Communications, Applications and Smart Grid Technologies, <http://www.arrrl.org/electric-utility-communications-applications-and-smart-grid-technologies>, accessed September 21, 2011

Belson, Ken, Plug-In Internet Connection to Get Test on Long Island, New York Times, February 17, 2006, <http://www.nytimes.com/2006/02/17/nyregion/17lipa.html>, accessed September 21, 2011

<sup>86</sup> National Association for Amateur Radio, April 2007 Hudson Division Beacon - # 73, <http://www.hudson.arrrl.org/beacon/2007/200704hudsonbeacon.htm>, accessed September 21, 2011

National Association for Amateur Radio, Electric Utility Communications, Applications and Smart Grid Technologies, <http://www.arrrl.org/electric-utility-communications-applications-and-smart-grid-technologies>, accessed September 21, 2011

<sup>87</sup> Global Smart Energy, Advanced Metering Opportunities, [http://store.globalsmartenergy.com/media/summarypdf/AMO\\_Summary\\_Report.pdf](http://store.globalsmartenergy.com/media/summarypdf/AMO_Summary_Report.pdf), accessed September 21, 2011

<sup>88</sup> National Association for Amateur Radio, Electric Utility Communications, Applications and Smart Grid Technologies, <http://www.arrrl.org/electric-utility-communications-applications-and-smart-grid-technologies>, accessed September 21, 2011

In a third project, totaling \$25.3 million (of which \$12.5 million comes from ARRA funding), LIPA is partnering with Stony Brook University and Farmingdale State College for the Smart Grid Corridor Project along Route 110, where 500 residential, commercial and industrial customers could test smart technologies for reducing electricity usage. The technologies include smart meters, distribution automation, distributed energy resources, electric vehicle charging stations, and the testing of cyber security systems. New York State's first Smart Campus would be developed to tie smart grid systems with energy conservation and renewable technologies.<sup>89</sup>

In 2009, LIPA deployed its pilot Smart Metering Program in the cities of Hauppauge and Bethpage. In the pilot, LIPA is testing the new meters, dynamic pricing signals, remote control capabilities and load measurement capabilities of new distribution system equipment. LIPA allocated \$3 million for smart meters in the 2009 capital budget and \$5 million in 2010.<sup>90</sup> Another \$1.7 million will be spent in 2011 with a congressional grant of \$158,000.<sup>91</sup>

LIPA also has a program known as LIPAEedge in which residential and small commercial customers allow LIPA to control their central air conditioning unit, between the hours of 2 pm and 6 pm in the summer months, through the use of a smart thermostat. The project helps customers save on energy bills, and helps LIPA avoid new construction of transmission and generation facilities.<sup>92</sup>

LIPA has recently contracted with Efacec ACS to implement an integrated real-time distribution and outage management system, which will include smart grid applications for power optimization and self-healing feeders. The system will support the goals of LIPA's Smart Grid Corridor Project, though it will be internally funded and deployed independently. The project will be deployed in five phases over the next year.<sup>93</sup>

#### **UPDATES AS OF SEPTEMBER 2011**

There are no significant updates to this case study as of September 2011. All developments have occurred in alternative programs.

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<sup>89</sup> Long Island Press, LIPA Applies For \$119 Million In Smart Grid Funding, <http://www.longislandpress.com/2009/08/10/lipa-applies-for-119-million-in-stimulus-funding-for-smart-grid-projects/>, accessed September 21, 2011

SmartGrid.gov, Regional Demonstration Projects, <http://www.smartgrid.gov/taxonomy/term/2?page=13>, accessed September 21, 2011

<sup>90</sup> SGIC, LIPA Smart Metering Program, <http://www.sgicclearinghouse.org/node/1777>, accessed September 21, 2011

<sup>91</sup> LIPA, Approved Operating Budget – 2011, <http://www.lipower.org/pdfs/company/investor/2011budget.pdf>, accessed September 21, 2011.

<sup>92</sup> LIPA, LIPAEedge FAQs, <http://www.lipaedge.com/faq.asp>, accessed September 21, 2011

<sup>93</sup> Efacec ACS, Efacec ACS to Deliver Advanced Distribution Management System to Long Island Power Authority, [http://www.efacec-acs.com/index.php?option=com\\_content&view=article&Itemid=134&id=173%3A2011-efacec-acs-to-deliver-advanced-distribution-management-system-to-long-island-power-authority](http://www.efacec-acs.com/index.php?option=com_content&view=article&Itemid=134&id=173%3A2011-efacec-acs-to-deliver-advanced-distribution-management-system-to-long-island-power-authority), accessed September 21, 2011

| <b>PG&amp;E SmartMeter Program</b> |                                 |                      |                |
|------------------------------------|---------------------------------|----------------------|----------------|
| <b>Location:</b>                   | Northern and Central California | <b>Dates:</b>        | 2006 - Present |
| <b>Primary Utility/Entity</b>      | Pacific Gas and Electric (PG&E) | <b>ARRA Funding:</b> | No             |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To enable new programs that help customers track energy usage and control costs.</li> <li>• To enable PG&amp;E to quickly pinpoint power outages and restore power.</li> <li>• To upgrade California’s electrical grid infrastructure.</li> <li>• To reduce costs of manual inspections, approximated readings, and meter failures.</li> </ul>  |
| Status                         | Installations delayed due to customer complaints/refusals.   |
| Number of Participants         | <ul style="list-style-type: none"> <li>• 4,418,901 smart electric meters installed as of July 29, 2011</li> <li>• 5.3 million electric customer accounts in service area</li> </ul>  |
| Participating Entities         | <ul style="list-style-type: none"> <li>• PG&amp;E</li> <li>• Wellington Energy (smart meter installation)</li> <li>• General Electric and Landys+Gyr (meter manufacturers)</li> </ul>  |
| Program Budget                 | \$1,956,438,000 spent through December 2010  |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Agricultural</li> <li>• Commercial</li> <li>• Industrial</li> </ul>  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Approved for 5.1 million electric meters.</li> <li>• RF wireless smart meter consisting of a small one watt radio that allows two-way communication between the customer and PG&amp;E, enabling the customer to review their daily energy use. The SmartMeter transmits information via radio signals.</li> <li>• A CPP option is offered along with the meter that records usage every hour, in 15 minute increments.</li> <li>• Customers can also enroll in a separate program for TOU rates.</li> </ul> |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• PG&amp;E website provides: <ul style="list-style-type: none"> <li>○ FAQ page</li> <li>○ Energy usage tools</li> <li>○ Tutorials for reading smart meters</li> <li>○ Information for a side by side comparison with traditional meters</li> <li>○ Guide of “what to expect” during the installation process</li> </ul> </li> </ul>   |
| <b>PROGRAM RESULTS</b>         |  |
| Key Findings                   | <ul style="list-style-type: none"> <li>• Meters record data accurately in most cases. PG&amp;E is working to resolve any concerns regarding meter calibration problems.</li> <li>• Customer concerns regarding privacy and health remain large factors, even prompting some jurisdictions to ban meter installations.</li> <li>• PG&amp;E has submitted a plan (pending PUC approval) to allow customers to decline wireless meter installations.</li> </ul>   |

|   |  |
|---|--|
| Other Outcomes                              | N/A  |
| Customer Feedback                           | <ul style="list-style-type: none"> <li>• In May 2010 PG&amp;E issued a public apology to customers for poor customer service.</li> <li>• Angry customers in Bakersfield sued the utility over what they perceived were billing inaccuracies.</li> <li>• Cities and counties in California continue to impose their own moratoriums on the meter installations.</li> </ul>  |
| Current Deployment Status                   | <ul style="list-style-type: none"> <li>• 4,418,901 smart electric meters installed as of 7/29/11.</li> <li>• PG&amp;E reports that an increasing number of installations are delayed due to refusals.</li> <li>• Portions of the projects are behind schedule due to testing and delays during the design phase, causing additional costs</li> <li>• The company is working on deploying in-home devices to residential customers connected through the AMI network.</li> </ul>  |
| Future Implications                         | <ul style="list-style-type: none"> <li>• PG&amp;E is working on a plan to address refusals with an alternative metering device, as directed by the CPUC.</li> <li>• Passage of Assembly Bill 37 could require all other utilities provide an alternative metering option for those rejecting installation.</li> </ul>  |
| <b>IMPACTS/BENEFITS</b>                     |  |
| Consumers                                   | <ul style="list-style-type: none"> <li>• Ability for consumers to track hourly usage online, providing some PG&amp;E customers with a tool to minimize energy usage.</li> <li>• Bill savings unlikely to be realized from smart meter use alone, but from participation in the SmartRate and Energy Alert programs, which had approximately 25,000 participants each as of 12/2010.</li> </ul>   |
| Utilities                                   | <ul style="list-style-type: none"> <li>• Failure rate of smart meters lower than previous generation of meters.</li> <li>• Dollar savings occur from not needing a manual reading.</li> </ul>  |
| Metrics Used                                | <ul style="list-style-type: none"> <li>• Percentage of smart meters requiring estimated reading: electric meters: 0.09 percent (versus 1.83 percent for non-smart meters); gas meters: 0.05 percent (versus 0.96 percent for non-smart meters), as of June 30, 2011</li> <li>• Percentage of total intervals received from smart meters: 99.85 percent from electric meters, 99.66 percent from gas meters</li> <li>• 1,586,979 pge.com My Account customers (as of 12/2010); 293,285 online usage inquiries (as of 12/2010); failure rate of meter tests by meter type (as of 12/2010)</li> </ul> |
| <b>CAUSES FOR CANCELLATION/POSTPONEMENT</b> |  |
| Primary                                     | <ul style="list-style-type: none"> <li>• Health concerns</li> <li>• Equipment or construction related problems</li> </ul>  |
| Secondary                                   | <ul style="list-style-type: none"> <li>• Privacy concerns</li> <li>• Inadequate customer education for effective system use</li> <li>• Customer service issues</li> <li>• State/local regulatory orders causing delays</li> </ul>  |
| <b>RESOURCES</b>                            |  |
| Program Website                             | <ul style="list-style-type: none"> <li>• PG&amp;E, SmartMeter – See Your Power, <a href="http://www.pge.com/myhome/customerservice/smartmeter/">http://www.pge.com/myhome/customerservice/smartmeter/</a>, accessed September 21, 2011</li> </ul>  |

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|---------------------|--|
| Full Program Report | <ul style="list-style-type: none"> <li>PG&amp;E, SmartMeter Program Data, <a href="http://www.pge.com/myhome/customerservice/smartmeter/programdata/">http://www.pge.com/myhome/customerservice/smartmeter/programdata/</a>, accessed September 21, 2011</li> <li>Structure Consulting Group, LLC, PG&amp;E Advanced Metering Assessment Report Commissioned by the California Public Utilities Commission, September 2, 2010, <a href="http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/StructureExecutiveSummary.pdf">http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/StructureExecutiveSummary.pdf</a>, accessed September 21, 2011</li> <li>PG&amp;E, Smart Grid Deployment Plan 2011-2020, <a href="http://www.pge.com/includes/docs/pdfs/shared/edusafety/electric/SmartGridDeploymentPlan2011_06-30-11.pdf">http://www.pge.com/includes/docs/pdfs/shared/edusafety/electric/SmartGridDeploymentPlan2011_06-30-11.pdf</a>, accessed September 21, 2011</li> </ul>   |
| Presentations       | N/A  |
| News Articles       | <p>SmartGridNews, Smart Meters: An Apology from PG&amp;E – and a New Paper on Meter Accuracy and Customer Perceptions from EPRI, May 11, 2010, <a href="http://www.smartgridnews.com/artman/publish/Technologies_Metering_News/Smart-Meters-An-Apology-from-PG-E-and-a-New-Paper-on-Meter-Accuracy-and-Customer-Perceptions-from-EPRI-2322.html">http://www.smartgridnews.com/artman/publish/Technologies_Metering_News/Smart-Meters-An-Apology-from-PG-E-and-a-New-Paper-on-Meter-Accuracy-and-Customer-Perceptions-from-EPRI-2322.html</a>, accessed September 21, 2011</p>  |
| Other Resources     | <ul style="list-style-type: none"> <li>PG&amp;E, Company Profile, <a href="http://www.pge.com/about/company/profile/">http://www.pge.com/about/company/profile/</a>, accessed September 21, 2011</li> <li>PG&amp;E, SmartMeter Steering Committee Update, December 2010, <a href="http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/smartmeter_steeringcomm_1210.pdf">http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/smartmeter_steeringcomm_1210.pdf</a>, accessed September 21, 2011</li> <li>PG&amp;E, SmartMeter Steering Committee Update, July 2011, <a href="http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/smartmeter_steeringcomm_0711.pdf">http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/smartmeter_steeringcomm_0711.pdf</a>, accessed September 21, 2011</li> <li>PG&amp;E, Understanding RF, <a href="http://www.pge.com/myhome/edusafety/systemworks/rf/">http://www.pge.com/myhome/edusafety/systemworks/rf/</a>, accessed September 21, 2011</li> <li>CPUC, Ruling, September 21, 2011, <a href="http://docs.cpuc.ca.gov/efile/RULINGS/143742.pdf">http://docs.cpuc.ca.gov/efile/RULINGS/143742.pdf</a>, accessed September 21, 2011</li> <li>CPUC, Proceeding A1103014, <a href="http://docs.cpuc.ca.gov/published/proceedings/A1103014.htm">http://docs.cpuc.ca.gov/published/proceedings/A1103014.htm</a>, accessed September 21, 2011</li> <li>CPUC, CPUC Adopts Rules to Protect the Privacy and Security of Customer Electricity Usage Data, <a href="http://docs.cpuc.ca.gov/PUBLISHED/NEWS_RELEASE/140316.htm">http://docs.cpuc.ca.gov/PUBLISHED/NEWS_RELEASE/140316.htm</a>, accessed September 21, 2011</li> </ul> |

### PROGRAM DESCRIPTION

In July 2006, PG&E was given approval to begin full deployment of an AMI project pursuant to PUC decisions D.06-07-027 and D.09-03-026. That year, PG&E began installing gas and electric meters with SmartMeter technology, manufactured by General Electric and Landys+Gyr. The program includes the upgrade of metering and communications networks as well as related systems and software for 5.1 million electric meters and 4.2 million gas meters within the PG&E service territory. As of January 2011, 3,878,492 smart meters have been installed in northern and central California. The program is not currently funded by stimulus dollars.

## CAUSES FOR CANCELLATION OR POSTPONEMENT

Throughout 2009 and into early 2010, PG&E received approximately 1,378 customer complaints regarding electrical bills and meter accuracy.<sup>94</sup> As a result, the PUC ordered a third party, the Structure Group of Houston, to investigate the root cause of the complaints and evaluate the accuracy of the meters.

Some of the first issues arising from the SmartMeter installations were related to the functionality of the meters themselves. These included installation and calibration problems, network connection problems, and meter data storage issues. One-tenth of one percent (0.1 percent) of the 5.5 million electric and gas meters installed had trouble connecting with the network. Bills were issued using an estimate based on the customer's routine energy usage, until the actual usage could be retrieved. Two-tenths of one percent (0.2 percent) of the meters accurately captured data, but did not retain the data correctly, thus software upgrades or meter replacements were required. In this case, PG&E billed the customer for less energy than was used and no retroactive corrections were made. In the case of installation complications, less than 0.5 percent of the 5.5 million meters consisted of perfectly functioning meters that hadn't been connected properly and calibrated as they should. In these cases PG&E issued an apology to the customer and corrected the billing information. PG&E has indicated that the company is working to improve training for installation technicians.<sup>95</sup>

It was discovered that interference can occur between the meter and nearby devices, such as security lights and hot tub pumps. As with any RF device, the SmartMeters can cause electrical surges or interruptions in timed electrical services. Motion sensors, garage door openers, baby monitors, wireless telephones, and wireless speakers may also be affected. In addition, PG&E has determined that certain models of Ground Fault Interrupter (GFI) breakers (such as those used on hot tubs) may be impacted if they are in close proximity to the meter. PG&E is working with meter manufacturers to address the GFI interference issue, and has trained the installation contractors to listen for GFI tripping at the point of installation.<sup>96</sup>

Health concerns regarding the RF emissions from the meters are also a major issue for some customers. The meters send information over a wireless network which is required to meet FCC guidelines, specifically the guidelines regarding levels at which body tissues heat up from RF waves. This is known as the "thermal effect." There have been claims of sensitivity to electromagnetic frequencies with symptoms including headaches and restlessness. Neither the FCC nor the World Health Organization has been convinced that the current health standards surrounding RF devices need to be revised, though some customers remain concerned.<sup>97</sup>

Customer communication issues have also been a recurring source of frustration regarding the SmartMeter program. Some expressed concern that the SmartMeter installations were treated as the replacement of another piece of infrastructure by PG&E, without the customer being presented the full amount of information about the new installed device. PG&E indicates that they now provide as much

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<sup>94</sup> Structure Consulting Group, LLC, PG&E Advanced Metering Assessment Report Commissioned by the California Public Utilities Commission, September 2, 2010, <http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/StructureExecutiveSummary.pdf>, accessed September 21, 2011

<sup>95</sup> Metering.com, PG&E reports on smart meter technology to California Senate panel, May 3, 2010, <http://www.metering.com/node/17517>, accessed September 21, 2011

<sup>96</sup> Structure Consulting Group, LLC, PG&E Advanced Metering Assessment Report Commissioned by the California Public Utilities Commission, September 2, 2010, <http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/StructureExecutiveSummary.pdf>, accessed September 21, 2011

<sup>97</sup> Hoppin, Jason, Santa Cruz County ground zero for SmartMeter opposition, San Jose Mercury News, February 28, 2011, [http://www.mercurynews.com/breaking-news/ci\\_17505532?nclink\\_check=1](http://www.mercurynews.com/breaking-news/ci_17505532?nclink_check=1), accessed September 21, 2011

information as possible to customers at the installation point, and when customers refuse the meters, PG&E makes every effort to help the customer understand the program.

The PUC does not have plans to impose a moratorium on SmartMeter installations and has confirmed it wouldn't honor a local moratorium. This has not stopped the individual cities and counties from imposing their own moratoriums on the meter installations. The Lake County Board of Supervisors may be headed for legal action to stop SmartMeter installations in the county until legislation addressing smart meters is passed. The city and county of San Francisco also has petitioned for expedited treatment of a petition against the meters, which was denied last September by an administrative law judge who said, "the information available at this time indicates that the costs associated with a suspension of PG&E's Smart Meter installation program, in both monetary and human terms, appear to be substantial and exceed the doubtful benefits of an immediate suspension." The Big Valley Tribal Business Committee has also banned SmartMeters within tribal boundaries.<sup>98</sup> The Monterey City Council recently passed a resolution demanding that PG&E halt the installation and activation of the controversial meters for customers who don't want the devices. Health hazards and privacy concerns are driving the resolution. Passing an ordinance against smart meters was out of the question due to legal expenses. The city resolution urges PG&E to respect the wishes of people who want to "opt out" of the program.<sup>99</sup> A resolution from a city, town or county banning the meters, however, is not legally binding.

In mid-March 2011, the PUC further ruled that PG&E had two weeks to develop a plan to allow customers to decline the wireless smart meters. The ruling was directed to PG&E specifically and does not include other California utilities installing smart meters.<sup>100</sup> On March 24, 2011, PG&E submitted its plan to the PUC to charge customers upfront fees, monthly charges, or an increase in electric rates to cover the utility's costs to disable the wireless meters and reinstitute traditional meter reading. The plan is pending approval.<sup>101</sup> In total, approximately ten counties and 36 cities are protesting against the smart meter installations. Many of these cities and counties are located in coastal areas.<sup>102</sup>

## **FUTURE CHANGES**

PG&E may find that customers would be more inclined to accept the new meters if: 1) better education exists for consumers; 2) better training exists for smart meter installation technicians; 3) an improved PG&E customer service and complaint resolution process exists; 4) a choice to "opt out" or use wired/power-line based meters is presented; and 5) PG&E addresses the technical problems, like the Ground Fault Interrupter interference issue, to improve the reliability of the meters.

The PG&E website offers a "frequently asked questions" page, energy usage tools, tutorials for reading smart meters, side by side comparison with traditional meters, and a guide for what to expect during the installation process. To further educate customers, pending legislation in Assembly Bill 37 would

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<sup>98</sup> Larson, Elizabeth, SmartMeter fight grows locally; supervisors prepare to look at legal options, Lake County News, March 7, 2011, <http://lakeconews.com/content/view/18576/919/>, accessed September 21, 2011

<sup>99</sup> Monterey County Herald, Monterey says PG&E smart meters should be optional, <http://www.allvoices.com/news/8357921-monterey-says-pgame-smart-meters-should-be-optional>, accessed September 21, 2011

<sup>100</sup> Larson, Elizabeth, CPUC chair directs PG&E to create SmartMeter opt-out proposal for customers, Lake County News, March 10, 2011, <http://lakeconews.com/content/view/18630/919/>, accessed September 21, 2011

<sup>101</sup> Norberg, Bob, PG&E proposes SmartMeter opt-out plan, but it will cost you more money, The Press Democrat, March 24, 2011, <http://www.pressdemocrat.com/article/20110324/ARTICLES/110329726/1350?Title=SmartMeter-opt-out-will-cost-you->, accessed September 21, 2011

<sup>102</sup> Stop Smart Meters!, CA Local Governments On Board, <http://stopsmartmeters.org/how-you-can-stop-smart-meters/sample-letter-to-local-government/ca-local-governments-on-board/>, accessed September 21, 2011



allow customers to have access to more detailed information regarding the RF emissions of the meters, which would assist them in making more informed decisions regarding meter installation.<sup>103</sup>

PG&E is working on improved training for smart meter installation technicians. A sizeable portion of the bill complaints filed by PG&E customers in 2010 were due to calibration errors that occurred when the meter was installed. The meter functioned properly at the incorrectly calibrated level, but these errors have contributed to the general assumption that the meters record electricity consumption incorrectly.<sup>104</sup>

Through an independent evaluation of the SmartMeter program in September 2010, the Structure Group indicated that the PG&E customer service and complaint resolution process needed significant improvements. While customer service representatives made corrections to correct billing inaccuracies, customers were not always given the background information surrounding the mistake, thereby reducing customer confidence in the program. In addition, some customer service representatives were categorized as “unprofessional” in dealing with customer complaints.<sup>105</sup> Improvements within PG&E’s customer service area to address these issues could improve public opinion of the program.

To address customers’ refusal to allow meter installations on their property, PG&E is waiting for its latest plans to be approved by the PUC. The company hopes to “engage customers across multiple communication channels to enhance customer understanding.”<sup>106</sup>

To address health concerns surrounding wireless meters, allowing customers to “opt out,” or use a wired meter may also improve public opinion of the program in some cities. PG&E was authorized by the PUC to implement power line communications for its metering technology, but PG&E opted for a wireless transmission system instead.<sup>107</sup> The passage of Assembly Bill 37 may also force PG&E, as well as the other California utilities, to provide an alternative to the current technology by Jan. 1, 2012. The bill also requires PG&E disclose additional information about the meters, including timing, magnitude, frequency and duration of RF emissions. On January 24, 2011, this bill was referred to the Assembly Committee on Utilities and Commerce.<sup>108</sup> In addition, PG&E claims that in light of consumer concerns the company is looking at other options including a wired device.<sup>109</sup>

## ALTERNATIVE PROGRAMS

Though it is unclear what new programs PG&E might implement in place of the SmartMeter program, PG&E currently provides other DR programs for all business sizes. However, DR programs require an electric interval meter that can be read remotely by PG&E. These programs include the Peak Day Pricing Plan for large businesses where consumers receive credits for accepting additional charges during peak

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<sup>103</sup> California Legislature—2011–12 Regular Session, Assembly Bill No. 37, [http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab\\_0001-0050/ab\\_37\\_bill\\_20101206\\_introduced.pdf](http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_0001-0050/ab_37_bill_20101206_introduced.pdf), accessed September 21, 2011

<sup>104</sup> Metering.com, PG&E reports on smart meter technology to California Senate panel, May 3, 2010, <http://www.metering.com/node/17517>, accessed September 21, 2011

<sup>105</sup> Structure Consulting Group, LLC, PG&E Advanced Metering Assessment Report Commissioned by the California Public Utilities Commission, September 2, 2010, <http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/StructureExecutiveSummary.pdf>, accessed September 21, 2011

<sup>106</sup> PG&E, SmartMeter Steering Committee Update, December 2010, [http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/smartmeter\\_steeringcomm\\_1210.pdf](http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/smartmeter_steeringcomm_1210.pdf), accessed September 21, 2011

<sup>107</sup> Public Utilities Commission of the State of California, Final Opinion Authorizing PG&E To Deploy AMI, [http://docs.cpuc.ca.gov/PUBLISHED/FINAL\\_DECISION/58362.htm](http://docs.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/58362.htm), accessed September 21, 2011

<sup>108</sup> California Legislature—2011–12 Regular Session, Assembly Bill No. 37, [http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab\\_0001-0050/ab\\_37\\_bill\\_20101206\\_introduced.pdf](http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_0001-0050/ab_37_bill_20101206_introduced.pdf), accessed September 21, 2011

<sup>109</sup> Larson, Elizabeth, SmartMeter fight grows locally; supervisors prepare to look at legal options, Lake County News, March 7, 2011, <http://lakeconews.com/content/view/18576/919/>, accessed September 21, 2011

hours on certain “event” days. The credits then can be used during the summer months. In the PeakChoice program large business consumers receive an incentive to reduce their facility's load to or below a level that is pre-selected by the consumer. In the Optional Binding Mandatory Curtailment Plan, customers can avoid rotating outages in tight demand periods by reducing the entire electric circuit load of their facility on any given day or time that PG&E specifies via email or text message. In some cases, standard interval metering could be sufficient for this plan.<sup>110</sup>

PG&E has been awarded \$25 million in ARRA funding for a smart grid demonstration project. The company plans to build and test an advanced, underground 300 MW compressed air energy storage plant using a saline porous rock formation near Bakersfield, California as the storage reservoir.<sup>111</sup>

In September 2010, PG&E joined with the WECC to work on the Western Interconnection Synchrophasor stimulus grant project. PG&E is creating a prototype facility in the first phase of the project. Synchrophasors and phasor measurement unit technology is quickly advancing with the devices now taking in data measurements 20 to 40 times per second. The telecommunications system design, data storage, and user interfaces will be developed during the project, and could be implemented in the existing system by early 2013.

PG&E has also requested approval from the CPUC to develop a large pumped hydro storage project in the Sierras using new technology. The company is also exploring battery storage on its distribution system, including a 2 MW battery at one of its substations and a 4 MW battery on the distribution system to provide ancillary services. PG&E anticipates that the technology will result in a reduction of sustained outages.<sup>112</sup>

#### **UDPATES AS OF SEPTEMBER 2011**

PG&E has taken a number of steps to continue its deployment of smart grid technology. In response to a 2010 CPUC order, PG&E issued a smart grid deployment plan in June 2011. The plan identifies 21 potential smart grid projects and initiatives which would achieve approximately \$900 million to \$2 billion in benefits, plus a 10 to 20 percent improvement in system reliability over 20 years.<sup>113</sup> PG&E has also opened a Smart Grid Test Center in San Ramon to analyze new technology to reduce the number of customers affected by outages.<sup>114</sup> The company continues to deploy smart meters across its service territory: as of the week ending July 29, 2011, PG&E had installed 4,418,901 smart meters out of 5,271,508 total electric customers. PG&E plans to roll out its smart meter system to all customers by mid-2012.

Public opposition to PG&E's smart meter program remains significant. One anti-smart meter organization reports that ten counties and 36 cities or towns are opposed to mandatory wireless smart meters. Four counties and seven cities or towns have gone as far as passing ordinances making smart meter installations illegal within their jurisdictions. In response, PG&E proposed a plan to CPUC on March 24, 2011 to give residential customers the option to have the radios in their smart meters turned

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<sup>110</sup> PG&E, Demand Response Incentives, <http://www.pge.com/mybusiness/energysavingsrebates/demandresponse/>, accessed September 21, 2011

<sup>111</sup> Smartgrid.gov, Pacific Gas & Electric Company Advanced Underground Compressed Air Energy Storage, [http://www.smartgrid.gov/project/pacific\\_gas\\_electric\\_company\\_advanced\\_underground\\_compressed\\_air\\_energy\\_storage](http://www.smartgrid.gov/project/pacific_gas_electric_company_advanced_underground_compressed_air_energy_storage), accessed September 21, 2011

<sup>112</sup> Rowland, Kate, PG&E Testing technologies off-the-grid proves valuable, Intelligent Utility Magazine, January/February 2011, <http://www.intelligentutility.com/magazine/article/203211/pge-corp>, accessed September 21, 2011

<sup>113</sup> PG&E, Smart Grid Deployment Plan 2011-2020, [http://www.pge.com/includes/docs/pdfs/shared/edusafety/electric/SmartGridDeploymentPlan2011\\_06-30-11.pdf](http://www.pge.com/includes/docs/pdfs/shared/edusafety/electric/SmartGridDeploymentPlan2011_06-30-11.pdf), accessed September 21, 2011

<sup>114</sup> Marshall, Jonathan, PG&E Tests the Future of Smart Grid, Next 100, April 18, 2011, <http://www.next100.com/2011/04/pge-tests-the-future-of-smart.php>, accessed September 21, 2011

off in exchange for both an up-front and a monthly fee. CPUC is still considering the request.<sup>115</sup> Separately, on July 28, 2011, CPUC approved a series of rules designed to protect the privacy and security of customer electricity usage data gathered by smart meters.<sup>116</sup>

A July 2011 report from PG&E provides analysis of numerous smart meter program metrics. The report identifies two issues in particular that have impacted smart meter deployment. One issue, which is classified as ongoing, is the increasing number of customers refusing to grant PG&E access to install smart meters. In response, PG&E is planning to use multiple communication channels to educate customers about the benefits of smart meters. PG&E is also offering customers the option to temporarily delay their smart meter upgrades. CPUC ordered a set of protocols on September 21, 2011 for how PG&E (and other IOUs in California) should honor the requests of customers who wish to delay the installation of smart meters on their property.<sup>117</sup>

The second issue identified in the report is that approximately 1,600 residential customers were impacted by a meter defect which occasionally ran fast in a narrow band of high temperatures. PG&E attempted to contact all impacted customers by telephone and replaced affected meters for free. Impacted customers received full refunds of over-billed amounts, plus interest and a \$25 inconvenience payment; they were also given the offer of a free in-home energy audit. PG&E now classifies this issue as resolved.<sup>118</sup>

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<sup>115</sup> CPUC, Proceeding A1103014, <http://docs.cpuc.ca.gov/published/proceedings/A1103014.htm>, accessed September 21, 2011

<sup>116</sup> CPUC, CPUC Adopts Rules to Protect the Privacy and Security of Customer Electricity Usage Data, [http://docs.cpuc.ca.gov/PUBLISHED/NEWS\\_RELEASE/140316.htm](http://docs.cpuc.ca.gov/PUBLISHED/NEWS_RELEASE/140316.htm), accessed September 21, 2011

<sup>117</sup> CPUC, Ruling, September 21, 2011, <http://docs.cpuc.ca.gov/efile/RULINGS/143742.pdf>, accessed September 21, 2011

<sup>118</sup> PG&E, SmartMeter Steering Committee Update, July 2011, [http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/smartmeter\\_steeringcomm\\_0711.pdf](http://www.pge.com/includes/docs/pdfs/myhome/customerservice/meter/smartmeter/smartmeter_steeringcomm_0711.pdf), accessed September 21, 2011

| <b>PSE Personal Energy Management Program</b> |                          |                      |             |
|---|--------------------------|----------------------|-------------|
| <b>Location:</b>                              | Washington State         | <b>Dates:</b>        | 2000 - 2003 |
| <b>Primary Utility/Entity</b>                 | Puget Sound Energy (PSE) | <b>ARRA Funding:</b> | No          |

| <b>PROGRAM INFORMATION</b>     |   |
|--------------------------------|---|
| Key Objectives                 | <ul style="list-style-type: none"> <li>To implement a network metering system with TOU information and customer communications to enable customers to manage their own energy use (i.e., Personal Energy Management, PEM)</li> <li>To shift usage to off-peak hours in a period of volatile energy prices due to the 2000 energy crisis that affected the western United States</li> </ul>  |
| Status                         | Cancelled   |
| Number of Participants         | 300,000 residential customers   |
| Participating Entities         | <ul style="list-style-type: none"> <li>PSE</li> <li>Landis+Gyr</li> <li>Alliance Data Systems</li> <li>SchlumbergerSema</li> </ul>  |
| Program Budget                 | Incremental cost to provide customized energy usage information was approximately \$1.26 per customer per month; translating to \$378,000 per month for the pilot participants.   |
| Consumer Sector                | Residential   |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>Ittron smart meters enabling AMR were installed on 900,000 homes and businesses six months before program began (300,000 of these customers later involved in pilot).</li> <li>Wireless, near real-time data transfer via network meter reading system supported AMR and the customer web portal with price/consumption data.</li> <li>ConneXt's ConsumerLinX™ consumer care and billing system.</li> <li>Landis+Gyr advanced information services and website applications.</li> <li>PSE call center applications.</li> </ul> |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>PEM clients could log on to the company's website and learn: <ul style="list-style-type: none"> <li>What their energy consumption was the previous day</li> <li>How much they paid for energy at different times during the day</li> <li>How to modify their consumption habits and take advantage of lower electricity costs</li> </ul> </li> </ul>   |
| <b>PROGRAM RESULTS</b>         |   |
| Key Findings                   | Customers shifted their demand to off-peak periods, and reduced overall demand, but did not see savings reflected on bills during 2002.   |
| Other Outcomes                 | N/A   |
| Customer Feedback              | Initial satisfaction, then sharp decline in support in 2002.  |
| Current Deployment Status      | Cancelled   |
| Future Implications            | The widespread adoption of metering technology that allows customers to respond to TOU pricing could make the pricing strategy more common, but the savings must outweigh the costs of deploying meters.  |

| IMPACTS/BENEFITS                     |  |
|--------------------------------------|--|
| Consumers                            | N/A  |
| Utilities                            | N/A  |
| Metrics Used                         | N/A  |
| CAUSES FOR CANCELLATION/POSTPONEMENT |  |
| Primary                              | Negative response to rate increases  |
| Secondary                            | <ul style="list-style-type: none"> <li>• Lack of funding or cost issues</li> <li>• Health concerns</li> <li>• Inadequate customer education for effective system use</li> <li>• Equipment or construction related problems</li> <li>• State/local regulatory orders causing delays</li> </ul>  |
| RESOURCES                            |  |
| Program Website                      | N/A  |
| Full Program Report                  | <a href="http://www.wutc.wa.gov/rms2.nsf/6d24f40d9ee81e4a882570900002a478/dd401dcacf211ca908256b7300044682!OpenDocument">http://www.wutc.wa.gov/rms2.nsf/6d24f40d9ee81e4a882570900002a478/dd401dcacf211ca908256b7300044682!OpenDocument</a>  |
| Presentations                        | N/A  |
| News Articles                        | Richter, Roxane, Time-of-Use Plan Benefiting PSE and its Customers, Electric Light & Power, <a href="http://www.elp.com/index/display/article-display/145966/articles/utility-automation-engineering-td/volume-7/issue-3/features/time-of-use-plan-benefiting-pse-and-its-customers.html">http://www.elp.com/index/display/article-display/145966/articles/utility-automation-engineering-td/volume-7/issue-3/features/time-of-use-plan-benefiting-pse-and-its-customers.html</a> , accessed September 21, 2011  |
| Other Resources                      | <ul style="list-style-type: none"> <li>• California Public Utilities Commission, Summary Report on the Experiential Workshops, Day-1: September 9, 2002, <a href="http://sites.energetics.com/MADRI/toolbox/pdfs/pricing/workshop_summary.pdf">http://sites.energetics.com/MADRI/toolbox/pdfs/pricing/workshop_summary.pdf</a>, accessed September 21, 2011</li> <li>• Energy Priorities, TOU Electricity Billing: How PSE Reduced Peak Power Demands (Case Study), <a href="http://energypriorities.com/entries/2006/02/pse_tou_amr_case.php">http://energypriorities.com/entries/2006/02/pse_tou_amr_case.php</a>, accessed September 21, 2011</li> <li>• Brockway, Nancy, AMI: What Regulators Need to Know About Its Value to Residential Customers, National Regulatory Research Institute, <a href="http://nrri.org/pubs/multiutility/advanced_metering_08-03.pdf">http://nrri.org/pubs/multiutility/advanced_metering_08-03.pdf</a>, accessed September 21, 2011</li> </ul> |

## PROGRAM DESCRIPTION

PSE introduced a mandatory TOU pricing plan, called Personal Energy Management (PEM), in 2000. The Washington Utility and Transportation Commission (WUTC) approved a limited trial of the TOU tariff starting May 1, 2001.<sup>119</sup> Three hundred thousand residential customers were placed on the plan on an “opt-out” basis. Customers were charged an on-peak summer rate of 6.25¢ per kWh and an off-peak rate of 4.7¢ per kWh, plus a \$1 incremental monthly charge to be a participant in the program. The program was put in place in response to the crisis in the Western markets that was occurring at the time, including droughts resulting in low hydropower water problems.<sup>120</sup>

<sup>119</sup> Northwest Energy Efficiency Taskforce, Workgroup #6: Rethinking Governance and Energy Efficiency Policies,

<http://www.nwcouncil.org/energy/neet/workgroups/6/Load%20Management%20and%20B3F47.doc>, accessed September 21, 2011

<sup>120</sup> Brockway, Nancy, AMI: What Regulators Need to Know About Its Value to Residential Customers, National Regulatory Research Institute, [http://nrri.org/pubs/multiutility/advanced\\_metering\\_08-03.pdf](http://nrri.org/pubs/multiutility/advanced_metering_08-03.pdf), accessed September 21, 2011

## CAUSES FOR CANCELLATION OR POSTPONEMENT

Customers began receiving comparison bills in late 2002, and found that their electricity bills either remained the same, or rose from their previous amount on the flat rate, even though customers had shifted their electricity use to off-peak hours. As a result, customers began to opt-out of the program in large numbers; there simply wasn't an incentive to stay in the program if their bills were not reduced.

Though peak demand was reduced by 5 to 6 percent, it was also discovered that the reduction was due to a small number of customers with large loads. Many customers made no actual reduction to their peak use. This further indicated that peak load reductions may not be repeatable each year, depending on the needs of the few customers with large loads. PSE claimed that a lack of financial rewards on the lower cost for peak power at the time, contributed to the poor results in bill savings.<sup>121</sup>

Since most PSE customers' bills had actually increased by an average of \$0.80 per month on the program, the current energy crisis in the West had subsided, and power prices migrated down to normal levels, PSE could not find justification to continue the program. The WUTC was also concerned that in the current rate structure, customer bills might increase even more. In August 2003, PSE and the WUTC ended the PEM program officially.<sup>122</sup> The company indicated it planned to restructure the rates for the program, and would refund the \$1 per month fee to the participants.

It was further discussed that the program results showed much lower elasticity of demand for low income groups, in that groups such as the elderly and disabled could not shift their usage to off-peak times. Multi-family homes and mobile homes were among the groups with the largest bill impacts.

## FUTURE CHANGES

Some have suggested that the TOU rates employed by the PEM program would be appropriate in a future energy crisis situation, as long as the technology exists to support it. If customers have the technology needed to respond to the price changes, such a program could be implemented in the future.

Some also argue that the regulatory environment surrounding the PEM program may not be sufficient in responding to quick price fluctuations in the wholesale market. If the regulatory and technological barriers were removed, a program like PEM might be effective in the long term.<sup>123</sup>

## ALTERNATIVE PROGRAMS

In 2009, PSE deployed its Bainbridge Island residential DR pilot program. By the end of the pilot project in 2011, PSE will evaluate how electric space, water heating and central air conditioning customers can voluntarily manage their electric demand during peak use periods. Load control devices, including ZigBee-enabled programmable two-way communicating thermostats, Comverge ZigBee-enabled digital control units and internet-enabled Comverge ZigBee gateways have been installed on several hundred participating PSE residential electric customers' electric space and water heating systems, and central air-conditioners. Participants will have access to their energy data via a web interface.<sup>124</sup>

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<sup>121</sup> U.S. Dept. of Energy, Office of Energy Efficiency and Renewable Energy, PSE to Restructure TOU Pilot, [http://apps1.eere.energy.gov/news/news\\_detail.cfm/news\\_id=6156](http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=6156), accessed September 21, 2011

<sup>122</sup> Energy Priorities, TOU Electricity Billing: How PSE Reduced Peak Power Demands (Case Study), [http://energypriorities.com/entries/2006/02/pse\\_tou\\_amr\\_case.php](http://energypriorities.com/entries/2006/02/pse_tou_amr_case.php), accessed September 21, 2011

<sup>123</sup> International Energy Agency, The Power to Choose: Demand Response in Liberalised Electricity Markets, [http://www.schneider-electric.us/documents/solutions1/demand-response-solutions/powerchoose\\_2003.pdf](http://www.schneider-electric.us/documents/solutions1/demand-response-solutions/powerchoose_2003.pdf), accessed September 21, 2011

<sup>124</sup> Metering.com, PSE to undertake smart grid-enabled demand response pilot program, <http://www.metering.com/node/16458>, accessed September 21, 2011

Today, PSE uses an automatic meter reading system to gather data from 900,000 smart meters within the company's service area, as a method of controlling costs and improving customer service.<sup>125</sup>

Through PSE's green pricing program, titled "Green Power Program," customers can support renewable energy in the Northwest. For residential customers and businesses, PSE offers a collection of efficiency programs, tips and rebates.<sup>126</sup>

#### **UPDATES AS OF SEPTEMBER 2011**

There are no significant updates to this case study as of September 2011.

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<sup>125</sup> Energy Priorities, TOU Electricity Billing: How PSE Reduced Peak Power Demands (Case Study), [http://energypriorities.com/entries/2006/02/pse\\_tou\\_amr\\_case.php](http://energypriorities.com/entries/2006/02/pse_tou_amr_case.php), accessed September 21, 2011

<sup>126</sup> PSE, Green Power Program, <http://www.pse.com/energyEnvironment/renewableenergy4/Pages/GreenPowerProgram.aspx>, accessed September 21, 2011

PSE, Home & Business Solutions, <http://www.pse.com/solutions/Pages/Default.aspx>, accessed September 21, 2011

| <b>Snohomish Smart Grid Project</b> |                              |                      |                |
|-------------------------------------|------------------------------|----------------------|----------------|
| <b>Location:</b>                    | Snohomish County, Washington | <b>Dates:</b>        | 2010 - 2013    |
| <b>Primary Utility/Entity</b>       | Snohomish County PUD         | <b>ARRA Funding:</b> | \$15.8 million |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To isolate and minimize power disruptions and reduce restoration time.</li> <li>• To enable efficient management of a growing number of distributed energy sources.</li> <li>• To achieve a reduction in line losses.</li> <li>• To achieve reduced greenhouse gas emissions.</li> <li>• To enable better integration of electric vehicles in the PUD service area.</li> <li>• To lower operating and maintenance costs and improve grid security.</li> </ul> |
| Status                         | Partially postponed (smart meter installations, smart devices, and dynamic pricing options only)   |
| Number of Participants         | 320,000 residential customers  |
| Participating Entities         | <ul style="list-style-type: none"> <li>• Snohomish County PUD</li> <li>• RFP issued for software providers, three finalists identified: <ul style="list-style-type: none"> <li>○ Areva T&amp;D, Inc.</li> <li>○ Telvent</li> <li>○ Ventyx, an ABB Company</li> </ul> </li> </ul>   |
| Program Budget                 | \$31.6 million for entire project (47 percent funded by ARRA).   |
| Consumer Sector                | Residential  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Fiber optic installations to enable power control and monitoring via two-way power communications</li> <li>• Substation automation, communications equipment/SCADA, using wireless telecommunications</li> <li>• Distribution management system development</li> <li>• Cyber security development</li> <li>• Feeder monitors/indicators</li> <li>• Automated reclosers, capacitor banks, and line switches</li> </ul>   |
| Consumer Education Measures    | N/A (utility side upgrades only)   |
| <b>PROGRAM RESULTS</b>         |  |
| Key Findings                   | The PUD has moved forward with substation automation and fiber optic cable installation and is on target to achieve the major milestones for the project.  |
| Other Outcomes                 | N/A  |
| Customer Feedback              | N/A (utility side upgrades only)   |
| Current Deployment Status      | <ul style="list-style-type: none"> <li>• 18 substations automated (out of 84) at this time</li> <li>• 163 miles of fiber optic cable installed; connects a set of 62 substations, two radio sites, and utility buildings (completed on time and under budget)</li> <li>• Currently installing wireless field area network and automation hardware on poles/substations in a demonstration area in Tulalip, Warm Beach and Lake Goodwin.</li> </ul>   |



|   |  |
|---|--|
| Future Implications                         | With extensive utility side grid management technology in place, the utility may have a smooth integration of new smart meters, in home devices, and DG in the future.   |
| <b>IMPACTS/BENEFITS</b>                     |  |
| Consumers                                   | N/A  |
| Utilities                                   | N/A  |
| Metrics Used                                | N/A  |
| <b>CAUSES FOR CANCELLATION/POSTPONEMENT</b> |  |
| Primary                                     | Waiting for technological advancements   |
| Secondary                                   | Negative response to rate increases  |
| <b>RESOURCES</b>                            |  |
| Program Website                             | <a href="http://www.snopud.com/PowerSupply/smartgrid.ashx?p=1869">http://www.snopud.com/PowerSupply/smartgrid.ashx?p=1869</a>  |
| Full Program Report                         | <a href="http://www.snopud.com/Site/Content/Documents/custpubs/sgridprojdes.pdf">http://www.snopud.com/Site/Content/Documents/custpubs/sgridprojdes.pdf</a>  |
| Presentations                               | <a href="http://www.electricleague.net/files/luncheons/2010_jan_luncheon_snopud_presentation.pdf">http://www.electricleague.net/files/luncheons/2010_jan_luncheon_snopud_presentation.pdf</a> , accessed September 21, 2011  |
| News Articles                               | <ul style="list-style-type: none"> <li>• Beniwal, Angela, Kicking Off Upgrades With Back-End Automation, Renew Grid, <a href="http://issuu.com/zackinpublications/docs/reg1103_online?mode=embed&amp;layout=http%3A%2F%2Fskin.issuu.com%2Fv%2Fflight%2Flayout.xml&amp;showFlipBtn=true&amp;pageNumber=1">http://issuu.com/zackinpublications/docs/reg1103_online?mode=embed&amp;layout=http%3A%2F%2Fskin.issuu.com%2Fv%2Fflight%2Flayout.xml&amp;showFlipBtn=true&amp;pageNumber=1</a>, accessed September 21, 2011</li> <li>• Snohomish County PUD No. 1, Power News, September 15, 2011, <a href="http://snopud.com/Site/Content/Documents/ci/pn911_web.pdf">http://snopud.com/Site/Content/Documents/ci/pn911_web.pdf</a>, accessed September 21, 2011</li> </ul> |
| Other Resources                             | SmartGrid.gov, Snohomish County PUD Smart Grid Project, <a href="http://www.smartgrid.gov/project/public_utility_district_no_1_snohomish_county_smart_grid_infrastructure_modernization_electr">http://www.smartgrid.gov/project/public_utility_district_no_1_snohomish_county_smart_grid_infrastructure_modernization_electr</a> , accessed September 21, 2011  |

### PROGRAM DESCRIPTION

The PUD received \$15.8 million in ARRA funding for a distribution automation project, which has a total cost of \$31.7 million. The project includes fiber optic installations, substation automation, distribution management system development, and cyber security development. The PUD recently installed 163 miles of fiber optic cable as part of an overall project to automate their distribution system. Once the automated distribution system is in place for a select region of the system by early 2012, the full-scale roll-out of the technology will begin across the entire system. The project must be completed by 2013. The PUD decided against smart meter deployment, smart appliances, smart water heaters, and dynamic pricing options for customers until a dependable, optimized distribution system is in place.

The PUD anticipates that savings achieved through the fiber optic system installation will help pay for other smart grid components in the future.<sup>127</sup>

### CAUSES FOR CANCELLATION OR POSTPONEMENT

The Snohomish County PUD has indicated that back-end optimization will be necessary to ensure proper price signals are sent to customers in the future when smart meters are in place. The PUD insists that they be prepared with the software and infrastructure in place on their end in order to manage the enormous amount of data received from customer meters, other various smart devices, and DG

<sup>127</sup> Snohomish County PUD No. 1, What is Smart Grid? <http://www.snopud.com/PowerSupply/smartgrid.ashx?p=1869>, accessed September 21, 2011

systems. The PUD is hesitant to impact ratepayers by spending large sums of money on smart meters at this early stage of the grid modernization process.

Additionally, the PUD sees an attempt to change a customer's energy consumption behavior through smart meters as more challenging than the projects they can complete to optimize their transmission system. It is planned that the back-end automation will provide better information and benefits to the customer in the long run, and will allow for an easier transition away from traditional meters. The PUD indicates that it wants to avoid a time gap between the point the new piece of equipment is installed at the customer's residence, and the point at which the associated pricing program can begin. The PUD also hopes that smart meter technology will have advanced by the time installations are needed.

Integrating renewable energy sources into the grid is a high priority for the PUD, and focusing efforts to upgrade and automate their distribution system is the district's preferred method to achieve this goal.

### **FUTURE CHANGES**

Once the automated distribution system is thoroughly tested and programs are developed to encourage energy conservation through metering methods, the PUD will consider installing smart meters. The PUD prefers to first automate its way out to the customer to ensure it can monitor and store the information that will be retrieved through smart devices.

The PUD is not certain that TOU rates will be offered in the future. The PUD Board of Commissioners will be evaluating the need for a policy adoption, in light of current system improvements, maintenance costs, and other factors, in order to implement TOU rates.

### **ALTERNATIVE PROGRAMS**

If the PUD decides not to deploy smart meters and smart devices, or to offer dynamic pricing options, other programs are currently in place to encourage DG and energy efficiency. The PUD offers the Solar Express program which provides incentives for distributed solar electric systems for customers.<sup>128</sup>

The PUD is also implementing its Community Energy Efficiency Pilot for residential and small business customers in select neighborhoods. An estimated 3,000 homes and 100 small businesses will be included in the pilot, with a projected annual savings of approximately 10 million kWh. The project is supported by a \$2.17 million ARRA grant, and will include new installations of CFL bulbs, showerheads, smart power strips, programmable thermostats and ENERGY STAR CFL light fixtures as well as incentives to upgrade common area lighting, install attic insulation, retrofit windows and install energy efficient appliances.<sup>129</sup>

### **UPDATES AS OF SEPTEMBER 2011**

The PUD continues to concentrate its efforts on internal operations to lay the groundwork for a modernized grid, rather than rushing to deploy residential smart meters. In 2012, the PUD plans to complete installation of a distribution automation demonstration project in the Tulalip/Warm Beach community. The PUD also recently began operations at a smart grid test lab at its Operations Center.

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<sup>128</sup> Snohomish County PUD No. 1, For Your Home - Solar Express, <http://www.snopud.com/?p=1207>, accessed September 21, 2011

<sup>129</sup> The Electric League, Snohomish County PUD & ARRA Grants, [http://www.electricleague.net/files/luncheons/2010\\_jan\\_luncheon\\_snopud\\_presentation.pdf](http://www.electricleague.net/files/luncheons/2010_jan_luncheon_snopud_presentation.pdf), accessed September 21, 2011

According to the PUD, future upgrades will allow the utility to plan for features including advanced metering, smart appliances, and dynamic pricing.<sup>130</sup>

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<sup>130</sup> Snohomish County PUD No. 1, Power News, September 15, 2011, [http://snopud.com/Site/Content/Documents/cj/pn911\\_web.pdf](http://snopud.com/Site/Content/Documents/cj/pn911_web.pdf), accessed September 21, 2011

| <b>Xcel Energy SmartGridCity</b> |                   |                      |                |
|----------------------------------|-------------------|----------------------|----------------|
| <b>Location:</b>                 | Boulder, Colorado | <b>Dates:</b>        | 2008 - Present |
| <b>Primary Utility/Entity</b>    | Xcel Energy       | <b>ARRA Funding:</b> | No             |

| <b>PROGRAM INFORMATION</b>     |  |
|--------------------------------|--|
| Key Objectives                 | <ul style="list-style-type: none"> <li>• To utilize emerging smart grid technologies to improve reliability and reduce the number (and impact) of power outages.</li> <li>• To evaluate which energy-management and conservation tools customers prefer.</li> <li>• To reduce carbon emissions.</li> </ul>   |
| Status                         | Full-scale deployment beyond the pilot program is on hold due to funding issues.   |
| Number of Participants         | <ul style="list-style-type: none"> <li>• Approximately 23,000 smart meters installed</li> <li>• 4,685 customers initially enrolled in SmartGridCity Pricing Pilot</li> </ul>   |
| Participating Entities         | <ul style="list-style-type: none"> <li>• Xcel Energy</li> <li>• Accenture</li> <li>• Current Group</li> <li>• Schweitzer Engineering Laboratories</li> <li>• Ventyx, GridPoint Inc.</li> <li>• OSIsoft</li> <li>• Landis+Gyr</li> <li>• SmartSynch, Inc.</li> </ul>  |
| Program Budget                 | As of February 2011, the pilot program cost is \$44.5 to \$44.8 million.   |
| Consumer Sector                | <ul style="list-style-type: none"> <li>• Residential</li> <li>• Commercial</li> <li>• Industrial</li> </ul>  |
| Hardware/Software Technologies | <ul style="list-style-type: none"> <li>• Automated, two-way high-speed broadband, smart electric meters with measurements in 15-minute increments.</li> <li>• Three pricing plans: <ul style="list-style-type: none"> <li>○ Shift &amp; Save Plan: Encourages customers to shift usage to hours with lower cost electricity.</li> <li>○ Peak Plus Plan: Customers are notified in advance to shift usage on Peak Energy Events (days with higher electricity pricing).</li> <li>○ Reduce-Your-Use Rebate: Encourages customers to cut back usage on Peak Energy Event days to earn rebates.</li> </ul> </li> <li>• Smart plugs that enable hybrid/electric vehicles to supply energy.</li> <li>• Fiber optic cable, transformers, and network elements along with power-line sensors.</li> <li>• Wireless in-home devices (e.g. smart thermostats).</li> </ul> |
| Consumer Education Measures    | <ul style="list-style-type: none"> <li>• Xcel Energy website allows participants to view and control energy consumption.</li> <li>• Promotional materials and workshops encourage enrollment in pricing plans.</li> </ul>  |

| <b>PROGRAM RESULTS</b>                      |  |
|---|--|
| Key Findings                                | Xcel Energy underestimated construction costs, as well as costs associated with software and permitting.   |
| Other Outcomes                              | City of Boulder replaced 20-year franchising of Xcel Energy with voter-approved occupational tax that began 1/2011; some residents see option for replacing Xcel's services with a municipal utility.  |
| Customer Feedback                           | Little feedback found from identified sources. Some of the 5,000 randomly selected customers were angered by letters sent from Xcel Energy requiring them to respond to new pricing plans; customers claim mailing verbiage is in conflict with Colorado PUC agreement.  |
| Current Deployment Status                   | <ul style="list-style-type: none"> <li>• Infrastructure for pilot program completed in 2009.</li> <li>• Pilot meter installation complete and rate programs initiated in 2010; planned to progress through 2013.</li> <li>• Full scale deployment beyond the pilot program appears to be on hold due to funding issues.</li> </ul> |
| Future Implications                         | The future full scale deployment hinges on Xcel Energy proving to the PUC that the pilot is cost-effective.  |
| <b>IMPACTS/BENEFITS</b>                     |  |
| Consumers                                   | <ul style="list-style-type: none"> <li>• Potential exists for customers save on energy bills through the choice to join a TOU pricing plan.</li> <li>• Because a portion of the program is being paid by customers, most residents have paid more as a result of SmartGridCity.</li> </ul>   |
| Utilities                                   | <ul style="list-style-type: none"> <li>• Savings for Xcel from reduced need for meter readers and from strengthened system integrity</li> <li>• Dissatisfied shareholders may put Xcel's future in Boulder in jeopardy.</li> </ul>   |
| Metrics Used                                | <ul style="list-style-type: none"> <li>• Focus on grid intelligence and utility management (rather than demonstrated peak-load reduction)</li> <li>• Outage Reduction: Xcel Energy indicated that power-line sensors prevented 63 outages in 2009.</li> </ul>  |
| <b>CAUSES FOR CANCELLATION/POSTPONEMENT</b> |  |
| Primary                                     | Lack of funding or cost issues   |
| Secondary                                   | <ul style="list-style-type: none"> <li>• Privacy concerns</li> <li>• Inadequate customer education for effective system use</li> <li>• Equipment or construction related problems</li> <li>• State/local regulatory orders causing delays</li> </ul>   |
| <b>RESOURCES</b>                            |  |
| Program Website                             | <a href="http://smartgridcity.xcelenergy.com/">http://smartgridcity.xcelenergy.com/</a> , accessed September 21, 2011  |
| Full Program Report                         | Xcel Energy, SmartGridCity Information Sheet, <a href="http://smartgridcity.xcelenergy.com/media/pdf/Information-Sheet.pdf">http://smartgridcity.xcelenergy.com/media/pdf/Information-Sheet.pdf</a> , accessed September 21, 2011  |
| Presentations                               | N/A  |

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|------------------------|---|
| <p>News Articles</p>   | <ul style="list-style-type: none"> <li>• National Conference of Black Mayors, Are Consumers Ready to Use and Pay For A Smart Grid?, August 2009, <a href="http://ncbm.org/2009/08/are-consumers-ready-to-use-and-pay-for-a-smart-grid/">http://ncbm.org/2009/08/are-consumers-ready-to-use-and-pay-for-a-smart-grid/</a>, accessed September 21, 2011</li> <li>• Kanellos, Michael, Boulder Prepares to Wash Its Hands of SmartGridCity, Greentech Media, August 25, 2010, <a href="http://www.greentechmedia.com/articles/read/boulder-prepares-to-wash-its-hands-of-smartgridcity/">http://www.greentechmedia.com/articles/read/boulder-prepares-to-wash-its-hands-of-smartgridcity/</a>, accessed September 21, 2011</li> <li>• Jaffe, Mark, PUC must walk the line between Xcel, customers, The Denver Post, February 13, 2011, <a href="http://www.denverpost.com/business/ci_17367998">http://www.denverpost.com/business/ci_17367998</a>, accessed September 21, 2011</li> <li>• Snider, Laura, Boulder residents outraged by Xcel's mandatory pricing pilot, Boulder Daily Camera, February 17, 2011, <a href="http://www.dailycamera.com/boulder-county-news/ci_17418583">http://www.dailycamera.com/boulder-county-news/ci_17418583</a>, accessed September 21, 2011</li> <li>• Davidson, Michael, Lines Drawn in Boulder utility debate, Boulder County Business Report, September 2, 2011, <a href="http://www.bcbcr.com/article.asp?id=59526">http://www.bcbcr.com/article.asp?id=59526</a>, accessed September 21, 2011</li> <li>• Enbysk, Liz, Power struggle erupts in SmartGridCity, smartgridnews.com, September 6, 2011, <a href="http://www.smartgridnews.com/artman/publish/Projects_Updates/Power-struggle-erupts-in-SmartGridCity-3975.html">http://www.smartgridnews.com/artman/publish/Projects_Updates/Power-struggle-erupts-in-SmartGridCity-3975.html</a>, accessed September 21, 2011</li> </ul>   |
| <p>Other Resources</p> | <ul style="list-style-type: none"> <li>• Xcel Energy, SmartGridCity Frequently Asked Questions, <a href="http://smartgridcity.xcelenergy.com/learn/frequently-asked-questions.asp">http://smartgridcity.xcelenergy.com/learn/frequently-asked-questions.asp</a>, accessed September 21, 2011</li> <li>• Colorado PUC, Decision No. C09-1446, <a href="http://www.dora.state.co.us/puc/docketsdecisions/decisions/2009/C09-1446_09AL-299E.doc">http://www.dora.state.co.us/puc/docketsdecisions/decisions/2009/C09-1446_09AL-299E.doc</a>, accessed September 21, 2011</li> <li>• Colorado PUC, Decision No. C11-0139, <a href="http://www.smartgridlegalnews.com/CPUC%20decision.pdf">http://www.smartgridlegalnews.com/CPUC%20decision.pdf</a>, accessed September 21, 2011</li> <li>• Colorado PUC, Decision No. C11-0869, <a href="https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=125674">https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=125674</a>, accessed September 21, 2011</li> <li>• Xcel Energy, SmartGridCity Pricing Pilot Informational Report, Docket No. 09A-796E, July 20, 2011, <a href="https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=120732">https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=120732</a>, accessed September 21, 2011</li> <li>• City of Boulder, Memorandum to IBM Smarter Cities Challenge Team, May 11, 2011, <a href="http://www.bouldercolorado.gov/files/Energy/SGC_IBM/SGC_memo_may11.pdf">http://www.bouldercolorado.gov/files/Energy/SGC_IBM/SGC_memo_may11.pdf</a>, accessed September 21, 2011</li> <li>• IBM, IBM's Smarter Cities Challenge, Boulder: Report, <a href="http://www.bouldercolorado.gov/files/Energy/SGC_IBM/IBM_SmrtCity_SGC_Report.pdf">http://www.bouldercolorado.gov/files/Energy/SGC_IBM/IBM_SmrtCity_SGC_Report.pdf</a>, accessed September 21, 2011</li> </ul> |

## PROGRAM DESCRIPTION

The SmartGridCity network began operation in the summer of 2009 in Boulder, Colorado. The smart grid infrastructure allows Xcel Energy to communicate and connect with nearly 47,000 premises throughout Boulder. Participants with smart meters can view their electricity consumption through the company's online portal. Starting in 2010, Xcel Energy began to focus on the deployment of in-home energy management options, pricing pilot programs, and additional plug-in hybrid electric vehicle testing.<sup>131</sup>

## CAUSES FOR CANCELLATION OR POSTPONEMENT

In 2008, Xcel Energy chose not to file a Certificate of Public Convenience and Necessity (CPCN) with the PUC prior to the start of the project with the reasoning that the pilot program was a research project. Xcel Energy also decided to forgo an initial cost-benefit analysis for the project. Without a CPCN, the PUC (or other interested parties) could not cap costs to protect ratepayers. The original \$15.3 million project cost estimate soared to \$27.9 million, and at last report to roughly \$44.5 to \$44.8 million due to permitting, tree trimming, software, and construction difficulties.<sup>132</sup> Construction crews were required to drill through a larger amount of rock than anticipated to install the fiber optic lines. Additionally, construction crews did not anticipate the cost of drilling through granite with diamond-tipped drill bits and utilizing cranes and dump trucks to move large boulders.

The fiber optic network accounts for a large portion of the ballooning project cost. While many utilities limited fiber optic installations to major transmission lines, ending at substations, Xcel Energy has chosen to install the cables in neighborhood distribution grids. While fiber optic cable is the fastest and most reliable communications network material available to utilities, its high cost has prompted other utilities to use utility-owned wireless or power line-carrier networks, and public cellular networks such as Sprint, AT&T and Verizon to reduce costs. Xcel Energy decided against using wireless mesh technologies, provided by vendors such as Silver Spring Networks and Trilliant, which have usually been the first choice of U.S. utilities deploying smart meters. Though the SmartGridCity network includes some BPL technology, Xcel Energy indicates wireless technology is only used in isolated instances.<sup>133</sup>

The lack of a clear division of shared project costs among Xcel Energy's partners has also contributed to the project's delays. Xcel Energy planned to bring on industry partners that would share the cost of the project. Once operation and maintenance is included, the cost calculations reach above \$100 million. Though the seven "consortium" members/partners are in place, the PUC could not determine what their financial contribution would be from Xcel Energy's plans. As a result, the PUC finds the plans difficult to approve when they don't know where (or how much) funding is in place on Xcel Energy's part.<sup>134</sup>

As a result of these challenges, the PUC decided Xcel Energy needed an approved CPCN to prove the project is practical and in the public interest. In its December 2009 order, the PUC confirmed the funds obtained through rate hikes would be refunded to ratepayers if Xcel Energy failed to obtain a CPCN authorizing the project.<sup>135</sup>

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<sup>131</sup> Xcel Energy, SmartGridCity Information Sheet, <http://smartgridcity.xcelenergy.com/media/pdf/Information-Sheet.pdf>, accessed September 21, 2011

<sup>132</sup> Berst, Jesse, SmartGridCity Meltdown: How Bad Is It?, SmartGridNews Online, August 3, 2010, [http://www.smartgridnews.com/artman/publish/Business\\_Policy\\_Regulation\\_News/SmartGridCity-Meltdown-How-Bad-Is-It-2822.html](http://www.smartgridnews.com/artman/publish/Business_Policy_Regulation_News/SmartGridCity-Meltdown-How-Bad-Is-It-2822.html), accessed September 21, 2011

<sup>133</sup> Xcel Energy, SmartGridCity Frequently Asked Questions, <http://smartgridcity.xcelenergy.com/learn/frequently-asked-questions.asp>, accessed September 21, 2011

<sup>134</sup> Snider, Laura, Xcel smart grid costs blow up, PUC orders more transparency, Boulder Daily Camera, February 6, 2010, [http://www.dailycamera.com/news/ci\\_14346139](http://www.dailycamera.com/news/ci_14346139), accessed September 21, 2011

<sup>135</sup> Colorado PUC, Decision No. C09-1446, [http://www.dora.state.co.us/puc/docketsdecisions/decisions/2009/C09-1446\\_09AL-299E.doc](http://www.dora.state.co.us/puc/docketsdecisions/decisions/2009/C09-1446_09AL-299E.doc), accessed September 21, 2011

On Oct. 27, 2010, the CPCN was approved by the PUC subject to conditions involving customer usage information, confidentiality, intellectual property rights and patent rights. The PUC further stated, "This Commission believes that the Company needs to 're-boot' the [SmartGridCity] project and restore some of the promise this concept originally held. If the Company demonstrates in a future application that the [SmartGridCity] project has a coherent and valuable future, we may allow the Company to recover the balance of the investment disallowed in this case."<sup>136</sup>

As the project nears completion, only about 23,000 meters in the city are smart meters. Some feel the metering system is not providing as many in-home benefits as anticipated in a smart grid program. Due to the funding issues, some also argue that the SmartGridCity technology will not be fully deployed in Boulder for the foreseeable future.

To further complicate matters, the City of Boulder has petitioned the Colorado PUC to effectively remove itself from the hearings over SmartGridCity. The petition requests to eliminate the city's testimony within the hearings. City representatives pointed to the lack of a clear consensus among the members of the Boulder City Council regarding the value of SmartGridCity. Some city leaders maintain that the project in its present state has stopped short of what Xcel Energy promised. The City of Boulder expected that the project would be entirely paid for by the PUC, and it is dissatisfied that Xcel Energy has sought to recover some of the costs through rate increases. In late 2010, the City of Boulder further decided not to renew Boulder's franchise agreement with Xcel Energy, allowing for the possibility of Boulder forming its own municipal utility. As a result of the decision, Xcel Energy began operating the project under a revocable permit.<sup>137</sup>

In January 2011, the PUC awarded \$27.9 million in rate recovery for the project, with the possibility of Xcel Energy receiving the other \$16.6 million if it can show a significant benefit to Colorado ratepayers.<sup>138</sup>

Some of those Colorado ratepayers were recently angered by an Xcel Energy mail-out to gather participants for a new pilot pricing program. In February 2011, a flier was sent to 5,000 randomly selected Boulder residents prompting recipients to sign up for one of three pricing plans. The goal of the pricing pilot is to evaluate the ability of Boulder's smart grid to help residents reduce peak demand. Thousands of Xcel customers received the fliers which state, "You have been selected as one of the participants for this mandatory program. Your response is required to select your top two choices by March 1<sup>st</sup>." A statement that a response is required was also printed on the flier envelope. Although it is not explained on the flier, customers who do not respond to the mailing continue to be charged the standard rate, according to paperwork filed with the Public Utilities Commission in December 2010. The PUC approved the pricing pilot with the requirement that Xcel Energy allow those selected to decline participation, if desired, though the flier verbiage seemed to suggest otherwise.<sup>139</sup>

## FUTURE CHANGES

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<sup>136</sup> Colorado PUC, Decision No. C11-0139, <http://www.smartgridlegalnews.com/CPUC%20decision.pdf>, accessed September 21, 2011

<sup>137</sup> Kanellos, Michael, Boulder Prepares to Wash Its Hands of SmartGridCity, Greentech Media, Inc., August 25, 2010, <http://www.greentechmedia.com/articles/read/boulder-prepares-to-wash-its-hands-of-smartgridcity/>, accessed September 21, 2011  
Heath, Urie, Boulder's energy goals summed up in mission statement, Boulder Daily Camera, February 16, 2011, <http://www.istockanalyst.com/article/viewiStockNews/articleid/4896086>, accessed September 21, 2011

<sup>138</sup> Colorado PUC, Decision No. C11-0139, <http://www.smartgridlegalnews.com/CPUC%20decision.pdf>, accessed September 21, 2011

<sup>139</sup> Snider, Laura, Boulder residents outraged by Xcel's mandatory pricing pilot, Boulder Daily Camera, February 17, 2011, [http://www.dailycamera.com/boulder-county-news/ci\\_17418583](http://www.dailycamera.com/boulder-county-news/ci_17418583), accessed September 21, 2011



A reduction in costs could change the future of the SmartGridCity project. If Xcel Energy can prove its technology is cost-effective for ratepayers, the company could recover the funds it needs to continue the pilot program. If Xcel Energy “re-boots” SmartGridCity with new plans regarding smart meter communications platforms (e.g. cheaper wireless mesh networks), the result might be reduced costs. Additionally, the PUC might be more inclined to approve Xcel Energy’s plans if the company can provide clear financial contributions from the seven "consortium" members.

The arrangements between the City of Boulder and Xcel Energy could also change the path of the project. If Boulder's franchise agreement with Xcel Energy is renewed, this would resolve the issue of the pilot program being operated under revocable conditions. The Boulder City Council would first need to come to a consensus with regard to the value of SmartGridCity, as dissenting opinions among council members exist at this time.

The feedback Xcel Energy receives as a result of its 2011 pricing pilot will also help the company gauge the effectiveness of its SmartGridCity programs. If there is considerable response to the new pricing options, the long term outlook of the project may improve.

Though it has been reported that Xcel Energy will neither expand nor replicate its Boulder project, cost reduction measures and revised technology requirements could increase PUC and customer confidence in a large scale project. In Xcel Energy’s 2011 DSM Plan, the company states that SmartGridCity is now in Phase IV, where the focus has shifted to wider technology deployment, systems operation, and evaluation of the systems requirements driving the project.<sup>140</sup>

#### **ALTERNATIVE PROGRAMS**

Xcel Energy’s companywide Smart Grid implementation involves three phases: 1) Quick-hit projects; 2) SmartGridCity and 3) Xcel-wide deployment of proven technologies. Prior to the initiation of SmartGridCity, Phase 1 (Quick-hit projects) included the following projects focused on vertical aspects of the utility:

- Wind energy storage
- Neural networks to reduce coal slagging and fouling
- Smart substation development of cutting-edge technology for remote monitoring of critical and non-critical operating data to reduce transmission losses
- Smart distribution asset development to detect isolated outages
- Smart outage management diagnostic software that uses statistics on eight factors (including maintenance, weather, and historical data) to predict problems in the power distribution system
- Plug-in hybrid electric vehicle technology, which will allow vehicles to charge from and discharge energy to the grid, among other DG developments
- Consumer web portal development to give customers an opportunity to automatically control their energy<sup>141</sup>

Xcel Energy supported the legislative requirements in both Colorado and Minnesota for increasing the renewable portfolio standard benchmarks to 20 percent of annual retail electricity sales by 2020 in Colorado and 30 percent of annual retail electricity sales (25 percent from wind energy) by 2025 in

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<sup>140</sup> Xcel Energy, 2011 Demand-Side Management Plan, July 2010.

<http://www.swenergy.org/news/news/documents/file/Xcel%202011%20DSM%20Plan.pdf>, accessed September 21, 2011

<sup>141</sup> Xcel Energy, Xcel Energy Smart Grid, A White Paper, February 2008, <http://smartgridcity.xcelenergy.com/media/pdf/SmartGridWhitePaper.pdf>, accessed September 21, 2011

Minnesota.<sup>142</sup> By investing in battery technology, and wind energy storage, Xcel Energy hopes to become a player in the energy storage market.<sup>143</sup>

Other Xcel Energy DSM pilots continuing into 2011 in Colorado include:

- Energy Feedback Pilot: Investigates how various feedback methods affect residential customer energy consumption.
- Central Air- Conditioning Tune-Up Pilot: This pilot seeks to provide customers with an affordable option for improving existing residential air conditioning efficiency and reducing costs. Includes 1,000 “tune up” units where Public Service Company of Colorado can monitor results and determine true cost-benefit savings.
- ENERGY STAR Retailer Incentive Pilot: Designed to increase the sales of energy efficient technologies by providing upstream rebates to retailers that sell ENERGY STAR equipment, particularly large appliances and electronics.
- In-Home Smart Device Pilot: Designed to test how residential customers respond to control strategies and energy consumption information received through tools, such as utility-controllable programmable thermostats or plug-load or hard wired appliance controls, monitoring and tracking their energy usage.<sup>144</sup>

Xcel Energy announced a new energy efficiency program in 2011 in which the company will discount more than 1.3 million ENERGY STAR qualified CFL bulbs for Colorado residential electric customers. Xcel Energy will offer special prices at participating retailers throughout 2011.<sup>145</sup>

#### **UPDATES AS OF SEPTEMBER 2011**

The number of smart meters deployed throughout Boulder has not changed substantially since 2010. Using data from 2010, the City of Boulder reported on May 11, 2011 that the SmartGridCity smart meter system includes about 23,000 smart meters out of 44,000 total residential meters, plus 100 smart meters out of 7,600 commercial, institutional, and governmental meters in the SmartGridCity area. Xcel Energy continues to report in various sources that approximately 23,000 smart meters are currently deployed in the city. City officials say that questions remain about the exact numbers of smart meters and home automation systems that have been deployed, as well as how far various Xcel Energy smart grid projects have progressed.<sup>146</sup>

In mid-2011 Xcel Energy has moved forward with its SmartGridCity Pricing Pilot to test customer responses to three different types of rates: TOU, CPP, and PTR. This pilot program has suffered a number of significant setbacks. Initially, the Colorado PUC declined to allow Xcel Energy to classify the Pricing Pilot as a DSM plan, though the company is still moving forward with the pilot, regulated by the PUC under Docket No. 09A-796E. In addition to a “voluntary” first phase, Xcel Energy planned to enroll 5,000 customers in a “random selection” second phase of the pilot. During enrollment for Phase 2, more customers than anticipated opted for PTR rates, leading to over-subscription of this tariff. In addition,

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<sup>142</sup> Ibid.

<sup>143</sup> Johnson, Rachel, Energy Storage: enabling a shift away from baseload generation, Industrial Fuels and Power, March 1, 2011, <http://www.ifandp.com/article/009866.html>, accessed September 21, 2011

<sup>144</sup> Xcel Energy, 2011 Demand-Side Management Plan, July 2010, <http://www.swenergy.org/news/news/documents/file/Xcel%202011%20DSM%20Plan.pdf>, accessed September 21, 2011

<sup>145</sup> Xcel Energy, Xcel Energy to discount more than 1.3 million CFLs in 2011, March 8, 2011, <http://www.xcelenergy.com/Colorado/Company/Newsroom/Pages/2011-03-0813millionCFLsin2011.aspx>, accessed September 21, 2011

<sup>146</sup> City of Boulder, Memorandum to IBM Smarter Cities Challenge Team, May 11, 2011, [http://www.bouldercolorado.gov/files/Energy/SGC\\_IBM/SGC\\_memo\\_may11.pdf](http://www.bouldercolorado.gov/files/Energy/SGC_IBM/SGC_memo_may11.pdf), accessed September 21, 2011

fewer than 5,000 customers enrolled in the pilot program overall, meaning that the company was unable to establish a true random sample. Xcel Energy opted to close enrollment even without a random sample, stating that the company had already contacted selected customers multiple times and feared that they had become fatigued and possibly upset with Xcel Energy's repeated attempts to market the pilot tariffs. Xcel Energy has already reported an attrition of 669 participants due to a variety of factors, negatively impacting statistical precision factors used to test pricing structures. A final setback for the project relates to the state of the In-Home Smart Devices that were planned to be used in conjunction with the pricing pilot. Xcel Energy has had difficulties procuring devices that meet the company's functionality and security requirements. As a result, the company did not install any In-Home Smart Devices for pricing pilot customers during summer 2011.<sup>147</sup> In response, the PUC ordered in August that Xcel Energy finish installation of all In-Home Smart Devices for the pilot by December 31, 2011.<sup>148</sup> The SmartGridCity Pricing Pilot is due to continue through September 30, 2013.

It is unclear what the future holds for Xcel Energy's SmartGridCity project. Negotiations over whether to grant Xcel Energy a new 20-year franchise agreement to supply power to Boulder broke down in July 2011, largely due to the perception that Xcel Energy is not working hard enough to reduce the city's greenhouse gas emissions by providing sources of renewable energy. On November 1, 2011, city residents will vote on two ballot measures which, if passed, could lead to the creation of a municipal utility in Boulder.<sup>149</sup>

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<sup>147</sup> Xcel Energy, SmartGridCity Pricing Pilot Informational Report, Docket No. 09A-796E, July 20, 2011,

[https://www.dora.state.co.us/pls/efi/efi\\_p2\\_v2\\_demo.show\\_document?p\\_dms\\_document\\_id=120732](https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=120732), accessed September 21, 2011

<sup>148</sup> Colorado PUC, Decision No. C11-0869, [https://www.dora.state.co.us/pls/efi/efi\\_p2\\_v2\\_demo.show\\_document?p\\_dms\\_document\\_id=125674](https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=125674), accessed September 21, 2011

<sup>149</sup> Davidson, Michael, Lines Drawn in Boulder utility debate, Boulder County Business Report, September 2, 2011, <http://www.bctr.com/article.asp?id=59526>, accessed September 21, 2011

Enbysk, Liz, Power struggle erupts in SmartGridCity, smartgridnews.com, September 6, 2011, [http://www.smartgridnews.com/artman/publish/Projects\\_Updates/Power-struggle-erupts-in-SmartGridCity-3975.html](http://www.smartgridnews.com/artman/publish/Projects_Updates/Power-struggle-erupts-in-SmartGridCity-3975.html), accessed September 21, 2011

