U.S. DEPARTMENT OF
ENERGY

Electricity Delivery
& Energy Reliability

American Recovery and
Reinvestment Act of 2009

Smart Grid Investment Grant Program

Progress Report
July 2012

SMARTGRID.GOV
RECOVERY ACT SMART GRID PROGRAMS

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Executive Summary

The Smart Grid Investment Grant (SGIG) program is a $3.4 billion initiative that seeks to accelerate the transformation of the nation's electric grid by deploying smart grid technologies and systems. The program is authorized in Title XIII of the Energy Independence and Security Act of 2007 and is funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act). The SGIG program and related Recovery Act activities are managed by the U.S. Department of Energy (DOE), Office of Electricity Delivery and Energy Reliability (OE), which leads national efforts to modernize the nation's electric grid.

It is the policy of the United States to support grid modernization to maintain a reliable and secure electricity infrastructure.[1] The SGIG program implements this policy by making substantial investments in smart technologies and systems that increase the flexibility, reliability, efficiency, and resilience of the nation's electric grid. Expected benefits include:

- Reductions in peak and overall electricity demand
- Reductions in operation costs
- Improvements in asset management
- Improvements in outage management and reliability
- Improvements in system efficiency
- Reductions in environmental emissions

This report provides a summary of the SGIG program's progress, initial accomplishments, and next steps.

The Smart Grid Investment Grant Program

The SGIG program is structured as a public–private partnership to accelerate investments in grid modernization. The $3.4 billion in federal Recovery Act funds are matched on a one-to-one basis (at a minimum) with private sector resources—bringing the total investment in SGIG projects to $7.8 billion. DOE used a merit-based, competitive process to select and fund 99 projects that are now deploying smart grid technologies and systems across the power grid, from transmission system to end-use customer, in almost every U.S. state.

The SGIG program provides a unique opportunity to spur innovation and investment in building a smarter electric grid. While the SGIG funds are substantial, recent studies show that hundreds of billions of dollars in smart grid investments will be needed over the next two decades to *fully*

[1] The Energy Independence and Security Act of 2007, Title XIII Smart Grid, Section 1301.

modernize the national electric grid. It will take a sustained commitment by industry, government, states, and other stakeholders to realize this vision.

DOE-OE designed the SGIG program to achieve wide-reaching, sustainable benefits by supporting early adopters of smart grid technologies and systems, and collecting performance data to evaluate and document realized benefits. This approach seeks to reduce uncertainty and encourage future investors and policy makers to maintain momentum toward a modernized electric grid. The program is designed to:

- Accelerate electric industry plans to deploy smart grid technologies by several years
- Develop and transfer know-how on designing and integrating complex systems
- Measure realized benefits in areas such as asset utilization, system efficiency, reliability, and operations management
- Advance development and deployment of effective cybersecurity protections for smart grid technologies and systems

Implementation Progress

The SGIG projects were launched in early 2010, and all projects are expected to complete equipment installation in the 2013–2014 time frame. Data analysis and reporting is expected to be completed by 2015.

As shown in Figure ES-1, actual spending is on track with planned spending based on estimates of cumulative project costs submitted by the project recipients. As of March 31, 2012, roughly two-thirds of the total $3.4 billion in federal funds have been expended. Including the investments made by the recipients, the combined level of federal and recipient investment totals about $4.6 billion, through March 31, 2012.

SGIG projects are organized in four areas: Electric Transmission Systems (ETS), Electric Distribution Systems (EDS), Advanced Metering Infrastructure (AMI), and Customer Systems (CS). Figure ES-2 shows progress on expenditures in each of these areas. The technologies, systems, and programs in these areas include:

- ETS – phasor measurement units (PMU), line monitors, and communications networks
- EDS – automated sensors and controls for switches, capacitors, and transformers
- AMI – smart meters, communications systems, and meter data management systems
- CS – in-home displays, programmable communicating thermostats, web portals, and time-based rate programs

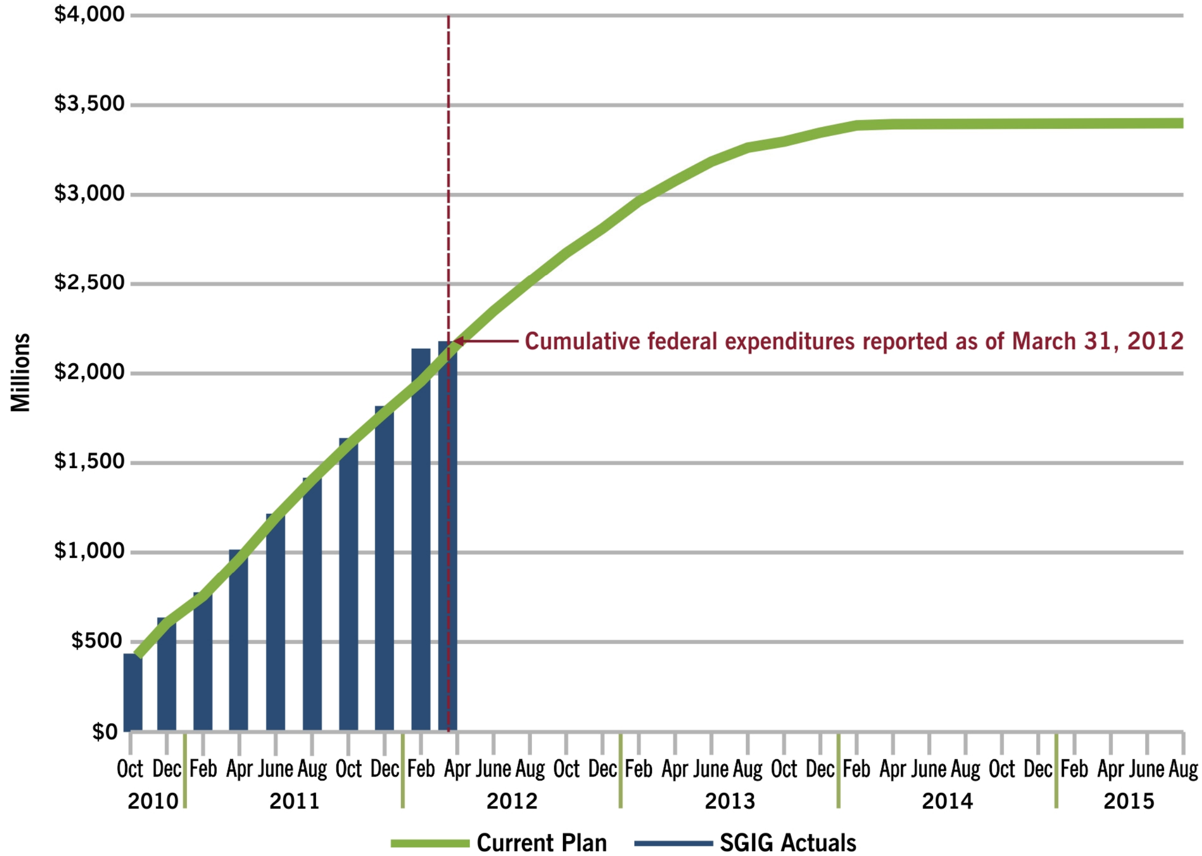

Figure ES-1. Federal SGIG Expenditures versus Plan through March 31, 2012

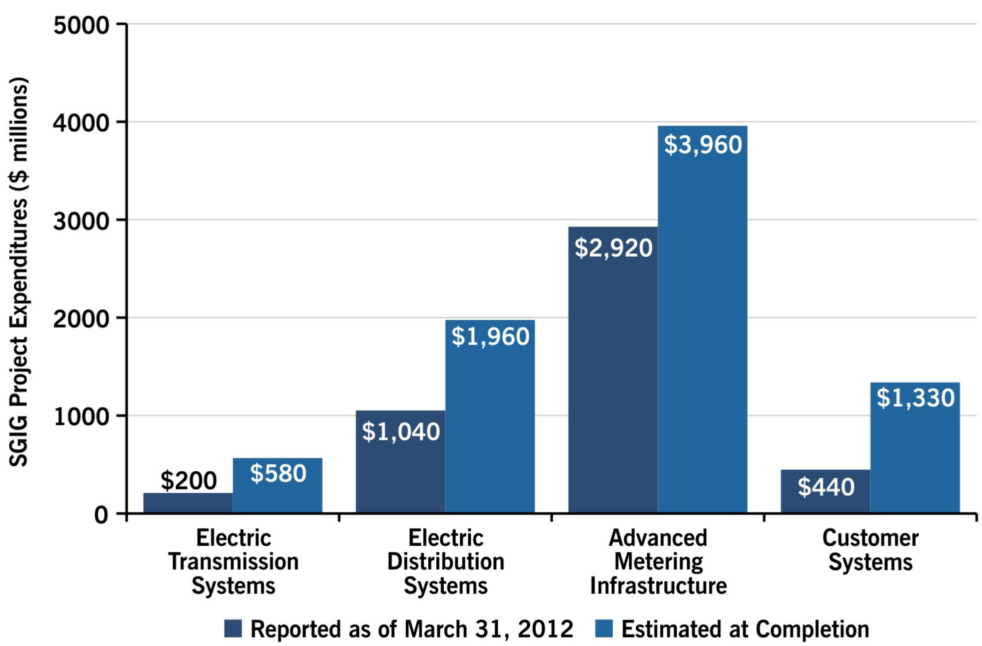

Figure ES-2. Total SGIG Expenditures by Type of Project through March 31, 2012 (combined federal and recipient expenditures)

To measure progress of SGIG deployments, DOE-OE tracks the type and number of technologies and systems deployed within each project area. For example, the ETS projects track the installation of PMUs. These projects have installed more than 287 networked PMUs and a total of at least 800 networked PMUs will be installed at completion—more than quadruple the number of networked PMUs that were installed in the United States before the program. These PMUs and associated software applications will help grid operators visualize and respond to voltage and frequency fluctuations in real time, and improve outage management and system efficiencies.

The AMI projects track the installation of smart meters. These projects have installed more than 10.8 million smart meters, which is almost 8 percent of the 144 million meters currently serving electric customers in the United States.[2] At completion, the AMI projects are expected to install a total of at least 15.5 million smart meters, which more than doubles the number of smart meters that were installed in the United States before the program. In addition, SGIG smart meter deployments represent a significant contribution toward the 65 million smart meters that industry estimates will be installed by 2015.[3]

Cybersecurity is a critical element of all SGIG projects. DOE-OE is working with the SGIG project recipients to ensure the SGIG smart grid systems are adequately protected against cyber events. To date, all recipients have developed cybersecurity plans that are tailored to meet the unique requirements of their project. DOE has reviewed the plans, conducted site visits, and approved all 99 plans. As the projects are deployed, the plans will be revised to reflect changes in system design and/or the "as built" condition.

Selected Highlights

Although SGIG projects have focused mainly on deployment, many are already seeing results and identifying lessons learned. The examples below illustrate the potential benefits from selected projects.

- The Electric Power Board of Chattanooga (EPB) is installing 1,500 automated circuit switches and sensors on 164 circuits. When nine tornados ripped through communities in April of 2011, early in the project's installation schedule, EPB used 123 of the smart switches that were in service to re-route power, avoiding 250 truck rolls and saving customers thousands of hours of outage time.

[2] Energy Information Administration, "Electric Power Annual 2010," November 2011.
[3] Edison Foundation, Institute for Electricity Efficiency, "Utility-Scale Smart Meter Deployments, Plans, & Proposals," May 2012.

- Talquin Electric Cooperative (TEC) in northern Florida has deployed smart meters that have already produced annual savings of more than $500,000 by avoiding more than 13,000 truck rolls for service connections and disconnections and non-payment problems. The system also improves outage management and enables TEC to send repair crews to the precise locations where faults have occurred.
- Oklahoma Gas and Electric (OGE) is implementing time-based rates and customer systems such as in-home displays, web portals, and programmable communicating thermostats to reduce peak demand, defer construction of new power plants, and save money on capital expenditures. Based on studies of about 6,000 customers, OGE is rolling out time-based rates to approximately 150,000 customers over the next several years to defer up to 210 megawatts of new power plant capacity.
- The Western Electricity Coordinating Council (WECC) synchrophasor project involves 18 transmission owners in 14 states and is installing 341 PMUs and 62 phasor data concentrators (PDC). WECC estimates that the application of these devices will enable approximately 100 megawatts of additional capacity on the California-Oregon intertie. Approximately 14 percent of this equipment has been installed to date, and WECC is moving forward with development of applications, models, and tools for enabling grid operators to improve power flow management.

Next Steps

During the next 18 months, the SGIG projects will continue deploying technologies and systems, and will provide quarterly reports on installations and costs.

As the projects gather more information on their experiences in operating the technologies and systems, emphasis will shift to the analysis of results, lessons learned, impacts, and benefits. Specifically, DOE-OE plans to issue a series of five analysis reports in the following areas:

- Peak demand and electricity consumption reductions from advanced metering infrastructure, customer systems, and time-based rate programs
- Operational improvements from advanced metering infrastructure
- Reliability improvements from automating distribution systems
- Energy efficiency improvements from advanced Volt/VAR controls in distribution systems
- Efficiency and reliability improvements from applications of synchrophasor technologies in electric transmission systems

Additional information, including progress updates and case studies, will continue to be posted on the website www.smartgrid.gov.

1. Introduction

This report summarizes the progress made in the Smart Grid Investment Grant (SGIG) program through March 31, 2012, including initial program accomplishments and next steps. Most of the accomplishments focus on the funds expended and assets installed, supported by summaries of the initial lessons learned that have been reported.

1.1 The American Reinvestment and Recovery Act of 2009

Congress enacted the American Recovery and Reinvestment Act of 2009 (Recovery Act) to create new jobs and save existing ones, stimulate economic activity, and invest in long-term growth. Part of the Recovery Act appropriated $4.5 billion to the U.S. Department of Energy (DOE), Office of Electricity Delivery and Energy Reliability (OE), to jump-start grid modernization through the deployment of several smart grid programs and related efforts. This funding is one of the largest federal investments in advanced technologies and systems for the nation's electric grid. It provides a unique opportunity to spur innovation and investment to enhance the delivery of electric power through the application of smart grid technologies, tools, and techniques. Even though the Recovery Act funding for grid modernization is a significant investment of taxpayer dollars, experts estimate that hundreds of billions of private capital will be needed in the years ahead to *fully* modernize the nation's entire electric transmission and distribution grid.[4]

The SGIG program represents the technology deployment portion of the Recovery Act funds appropriated to DOE-OE for grid modernization activities. However, s*ustainable* grid modernization will require more than just the replacement of aging grid assets and the deployment of advanced technologies. Initiatives are needed to tackle the policy, market, and institutional barriers that currently inhibit investments by the private sector.

To address these needs, DOE initiated a portfolio of programs (see Table 1) that complement SGIG and will help ensure success by getting markets ready for grid modernization. One program is developing and training the workers who will be needed to design, build, install, and maintain smart technologies; another program is developing the interoperability framework—the complex standards that will enable digital components and devices to interoperate securely and efficiently throughout the electric grid.

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[4] Total cost of grid modernization has been estimated at $340–$480 billion, based on the following studies:

- EPRI, "Estimating the Costs and Benefits of the Smart Grid: A Preliminary Estimate of the Investment Requirements and the Resultant Benefits of a Fully Functioning Smart Grid," Palo Alto, CA, 2011.
- M.W. Chupka, R. Earle, P. Fox-Penner, and R. Hledik, "Transforming America's power industry: The investment challenge 2010—2030." Edison Electric Institute, Washington, D.C., 2008.

Major Smart Grid Program Activities	Total Obligations ($Million)
Smart Grid Investment Grant	$3,425
Smart Grid Regional and Energy Storage Demonstration Projects	$685
Workforce Training and Development Program	$100
Interconnection Transmission Planning	$80
State Assistance for Recovery Act Related Electricity Policies	$49
Enhancing State Energy Assurance	$44
Interoperability Standards and Framework	$12
Enhancing Local Government Energy Assurance	$8

Table 1. Federal Recovery Act Funding for Major Smart Grid Program Activities

1.2 SGIG and Grid Modernization

Reliable, affordable, secure, and clean electric power is essential for national security, energy security, economic competitiveness, and environmental protection. Yet our nation's electric infrastructure is aging, siting of new transmission assets is constrained, and there is a growing need to integrate more renewable and variable generation resources. As a result, grid modernization has become a national imperative for meeting the demands of a 21st century economy.

DOE-OE is responsible for leading national efforts to modernize the electric grid, enhance the security and reliability of the nation's energy infrastructure, and facilitate recovery from disruptions to energy supply. To fulfill these responsibilities, DOE-OE leads programs in permitting and siting for grid infrastructure, infrastructure security, and development of advanced grid technologies, including smart grid technologies, tools, and techniques. The SGIG program is designed to deploy technologies that accelerate the transition to a modern power grid that integrates the two-way flow of electricity and information, enables customers to better manage their electricity use, and provides more reliable electricity delivery. The impact of SGIG investments will be realized primarily in three ways:

- Direct investment in smart grid technologies and systems by SGIG projects (e.g., devices installed)
- Direct benefits realized by SGIG projects through operation of these assets (e.g., cost savings)
- Reduced uncertainty for decision makers and investors resulting from analysis of the costs and benefits based on data obtained from SGIG projects

1.3 Organization of this Report

Section 2 of this report provides a program overview; Section 3 presents implementation progress within the four project areas: Electric Transmission Systems (ETS), Electric Distribution Systems (EDS), Advanced Metering Infrastructure (AMI), and Customer Systems (CS); and Section 4 outlines next steps. Also included are selected project highlights to illustrate examples of initial results and lessons learned. Because many of the projects involve more than one of the four project areas, the data aggregations in the tables and figures may sum to more than 99 projects.

Two appendices provide supplemental information about the SGIG program. Appendix A is a table of the 99 SGIG projects and indicates which of the four areas they address. Appendix B provides 99 project abstracts and includes information on activities and funding levels.

2. The SGIG Program

The SGIG program is authorized by the Energy Independence and Security Act of 2007, Section 1306, as amended by the Recovery Act, which makes grid modernization a national policy. The program's overall purpose is to accelerate the modernization of the nation's electric transmission and distribution systems and promote investments in smart grid technologies, tools, and techniques which increase flexibility, reliability, efficiency, and resilience.

2.1 Program Objectives

The SGIG program is designed to provide a foundation to encourage sustainable investments in smart grid technologies and systems. The program has three main objectives:

- Accelerate deployment of smart grid technologies across the transmission and distribution system and empower customers with information so they can better manage their electricity consumption and costs
- Measure the impacts and benefits of smart grid technologies to reduce uncertainty for decision makers and attract additional capital and further advance grid modernization
- Accelerate the development and deployment of effective cybersecurity protections for smart grid technologies and systems

Through these objectives, the SGIG program seeks to achieve the following measurable improvements in electricity delivery:

- Fewer and shorter power outages and grid disturbances
- Lower system peak demands, leading to improved asset utilization
- Informed consumers who can better manage electricity consumption and costs
- Operational efficiencies, leading to reduced costs
- Positive environmental impacts such as reduced greenhouse gas emissions
- Economic opportunities for businesses and new jobs for workers

To maximize the value of the SGIG program, DOE-OE is pursuing a program strategy that emphasizes *partnership*, *information sharing*, and *outreach*. The task of grid modernization is enormous and, to be successful, close coordination and collaboration is needed among federal agencies, private industry, and other stakeholders.

Partnership: As stewards of the public trust, DOE-OE has the responsibility to make sure the funds provided to the SGIG projects are invested in ways that maximize public benefits. These projects are conducted as public–private partnerships, and through them DOE-OE leverages federal and private-sector resources to advance technology deployments and provide results that help industry tackle potential policy, regulatory, workforce, and market barriers that could impede success.

Information Sharing: DOE-OE is also engaging stakeholders in sharing information on the benefits and costs of smart grid technologies and systems and helping determine potential business cases. Information sharing is accomplished through meetings, webinars, and websites that circulate information to a broad audience of interested parties. DOE-OE encourages major stakeholder groups and individuals to become involved in the program by providing opportunities to learn about DOE-OE analysis and contribute suggestions for making information sharing more useful. The www.smartgrid.gov website is DOE-OE's focal point for sharing project results.

Outreach: DOE-OE is strongly encouraging the SGIG projects and other interested stakeholders to identify and share information on lessons learned and best practices. This includes experiences about installing equipment, engaging customers, integrating new with legacy systems, collecting and processing data, analyzing grid and other impacts, and evaluating costs and benefits. Peer-to-peer workshops and information exchanges are central parts of DOE-OE's outreach efforts and they have proven to be effective mechanisms for addressing many of the challenges and opportunities presented by smart grid technologies, tools, and techniques.

Table 2 lists major stakeholder organizations that have been involved in SGIG information exchange activities.

- The American Public Power Association (APPA) and its members
- The Edison Electric Institute (EEI) and its members
- The Electric Power Research Institute (EPRI)
- The National Association of Regulatory Utility Commissioners (NARUC) and state commissioners and their staffs
- The National Association of State Utility Consumer Advocates (NASUCA), its members, and other consumer advocate organizations
- The National Rural Electric Cooperative Association (NRECA), the Cooperative Research Network, and its members
- The North American Synchrophasor Initiative (NASPI) and its members

Table 2. Stakeholders Involved in SGIG Outreach and Information Exchange Activities

2.2 Program Profile

The SGIG program includes 99 projects (see Appendices A and B) that were competitively selected from more than 400 proposals submitted by utilities and other eligible organizations. The size and scope of a project depends on many factors which can vary by location and circumstances, including regulatory policies, market conditions, customer mixes, levels of experience with advanced technologies, levels of maturity of existing systems, and forecasts of electricity supply and demand.

By design, the SGIG program consists of a project portfolio that encompasses these factors and varies in scope, technologies and systems, applications, and expected benefits, incorporating-an-appropriate mix of methods, approaches, concepts, and strategies. The SGIG portfolio includes projects that reflect different:

- Geographic areas to assess smart grid functions and benefits across a range of weather conditions, customer and business demographics, electricity prices, supply and demand conditions, and market structures
- Types and sizes of organizations to assess smart grid functions and benefits across a range of utility types, institutional structures, business models, and operational requirements
- Topic areas to assess a range of potential smart grid technologies, tools, techniques, concepts, and technical approaches
- Technology deployments and time-based rate programs to evaluate effects on consumer behaviors

Each project is managed by a lead recipient and may include other teaming partners such as other power companies, vendors, and equipment suppliers. Figure 1 shows the location of the headquarters offices of the 99 lead recipients; these include 47 states, the territory of Guam, and the District of Columbia. The projects actually cover larger areas than indicated by the map. This is because many projects include multiple partners that have offices in several locations, and utility service territories may cover broad areas that extend over state lines.

Figure 2 shows the breakdown of the SGIG projects by type of recipient (lead recipient) and by number of projects and level of funding (including both the federal and recipient shares). The largest number of projects and percentage of funding involve investor-owned utilities. Electric cooperatives and publicly owned utilities also lead many projects and a few are led by non-utility organizations, including regional entities and equipment manufacturers.

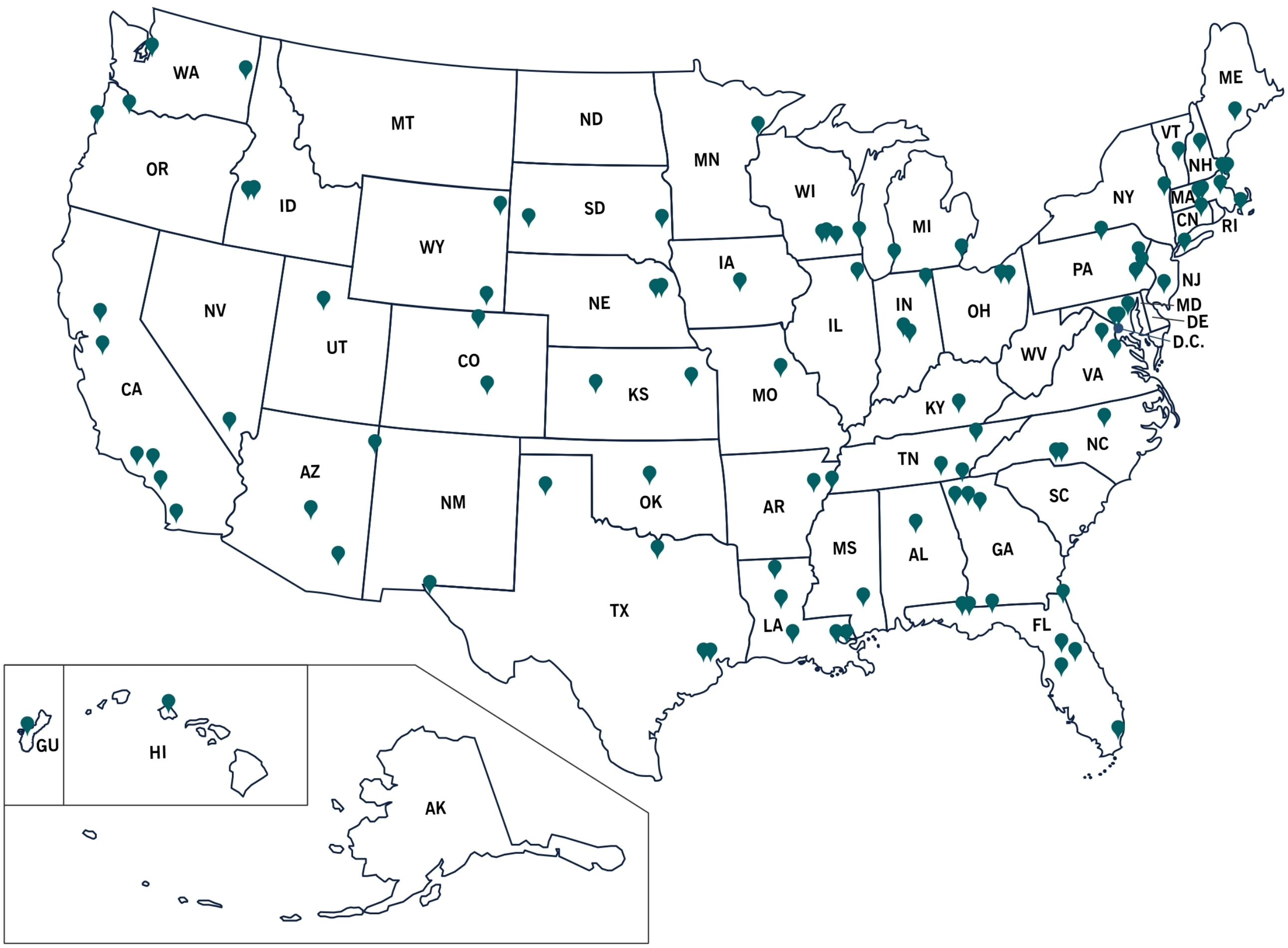
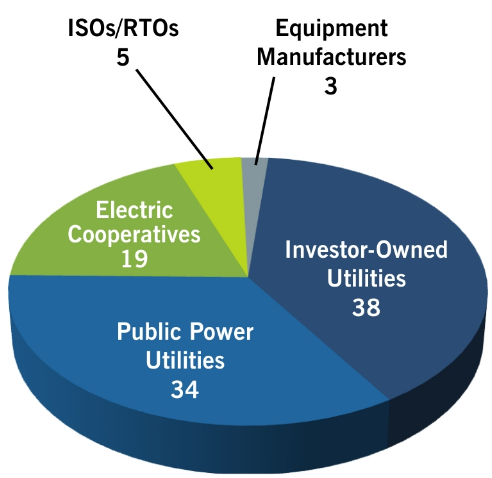
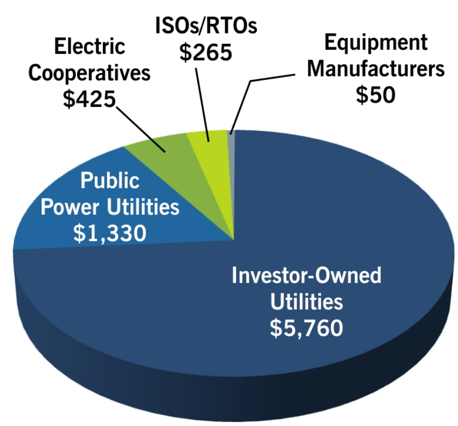


Figure 1. Headquarters Locations of the SGIG Project Lead Organizations



2a. SGIG Projects by Type of Recipient (Total =99)



2b. SGIG Funds by Type of Recipient ($millions, total = $7.8 billion)

ISOs/RTOs – Independent System Operators and Regional Transmission Operators

Figure 2. SGIG Projects and Total Funds by Type of Recipient

To achieve coverage across the entire sector, the SGIG program organizes the projects in four topic areas:

- **Electric Transmission Systems** – These projects are aimed at adding smart grid functions to the electric transmission systems in bulk power markets that typically involve power delivery over long distances, including multistate regions.
- **Electric Distribution Systems** – These projects are aimed at adding smart grid functions to local electric distribution systems for better management of outages, voltage levels, and reactive power.
- **Advanced Metering Infrastructure** – These projects are aimed at the installation of smart meters, communications systems, and back-office systems for meter data management for application of time-based rates, remote connect/disconnect, outage detection and management, and tamper detection.
- **Customer Systems** – These projects are aimed at the installation of in-home displays, programmable communicating thermostats, smart appliances, energy management systems, and web portals for greater customer participation in electricity markets and involvement in demand-side programs, including time-based rates and load management.

Figure 3 shows SGIG funding by project area.

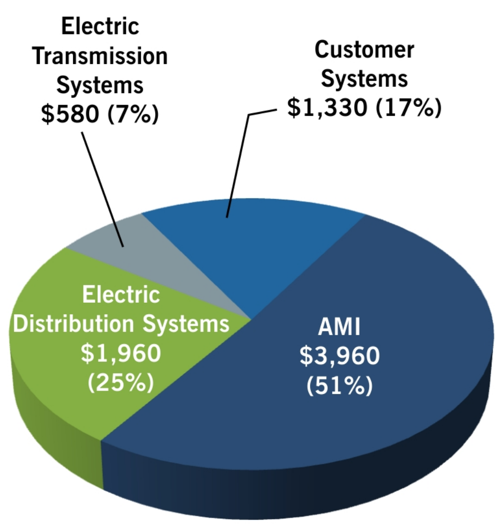


Figure 3. SGIG Total Project Funding by Project Area (total = $7.8 billion)

2.3 Analysis and Reporting

The overall success of the SGIG program is strongly tied to the ability to measure project impacts, estimate costs and benefits, and determine progress toward achievement of the SGIG objectives. Designing and implementing a process for evaluating project impacts, costs, and benefits is an essential aspect of DOE-OE's management responsibilities for the SGIG program, a responsibility that is shared with each of the project recipients. DOE-OE is working in cooperation with project recipients to collect and analyze consistent and comparable data from across the projects with regard to the impacts and benefits they are observing.

By undertaking this type of analysis, DOE-OE plans to address the following questions:

- To what extent can AMI, coupled with time-based rate programs and enabling technologies such as in-home displays or programmable communicating thermostats, reduce peak and overall demand for electricity?
- To what extent can AMI improve operational efficiencies and reduce operations and maintenance costs?
- To what extent can technologies used to automate the switching and reconfiguration of distribution circuits improve reliability and enhance operational efficiencies?
- To what extent can technologies used to actively manage voltage and reactive power levels in distribution circuits improve both energy and operational efficiencies?
- What applications can be developed through the deployment of synchrophasor technology, and what is their impact on transmission system reliability and operational improvements?

The analysis of the results of the SGIG projects provides important information for the electric power industry that can be used to help guide grid investment decision-making in the years ahead. This information is also important for DOE-OE, as it will be used to help identify technology development and other needs, guide research and development planning, and shape decision making for DOE-OE's grid modernization programs.

2.4 Project Implementation

DOE-OE established the SGIG Program Office, which consists of: (1) technical project officers to oversee project performance, (2) a Metrics and Benefits Team to lead data collection and analysis, and (3) a Cybersecurity Team to guide cybersecurity activities. The Program Office is designed to ensure the effective management of the projects, and analysis and reporting of the results.

Each SGIG project has followed a similar process in carrying out activities. This process involves planning for and purchasing, testing, installing, operating, and evaluating the impact of the smart grid technology deployments.

From 2009 to 2011, DOE-OE worked with each recipient to develop detailed work plans for managing and monitoring each SGIG project, and by 2011 all 99 projects were installing, testing, and operating equipment and reporting initial results.

- **Project execution plans (PEPs)** – The primary management tools for DOE-OE and the projects to monitor progress and evaluate spending rates, deliverables, schedules, and risks. The projects provide DOE-OE with monthly updates to track progress and evaluate performance according to the PEP. DOE-OE conducts annual site visits with each of the projects to further evaluate progress, accomplishments, and risks.
- **Cybersecurity plans (CSPs)** – The primary management tools for DOE-OE and the projects for describing and monitoring the project approach to ensuring all smart grid systems are adequately protected against cyber events. The CSPs provide assessments of the relevant cybersecurity risks and a plan for mitigating those risks at each phase of the project.
- **Metrics and benefits reporting plans (MBRPs)** – The primary management tools for DOE-OE and the projects for monitoring data collection and reporting on the assets, functions, impacts, and benefits that are associated with each of the projects. In conjunction with the Electric Power Research Institute (EPRI), DOE-OE developed a smart grid project analysis framework[5] aimed at encouraging the collection and reporting of impacts and benefits in a consistent manner across states and regions so that results can be more easily compared and shared (Figure 4 provides an overview of the smart grid analysis framework that is being applied to the SGIG projects); the MBRPs were developed according to this analysis framework. The MBRPs also contain descriptions of the data to be collected on the smart grid assets being installed and their costs. These data are called "build metrics," and the projects report the status of these installations to DOE-OE quarterly. Information on the impacts and benefits the projects are to be analyzing, called "impact metrics," are reported to DOE-OE semi-annually. Each project reports on its own set of build and impact metrics.

[5] EPRI, "Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects," January 2010.

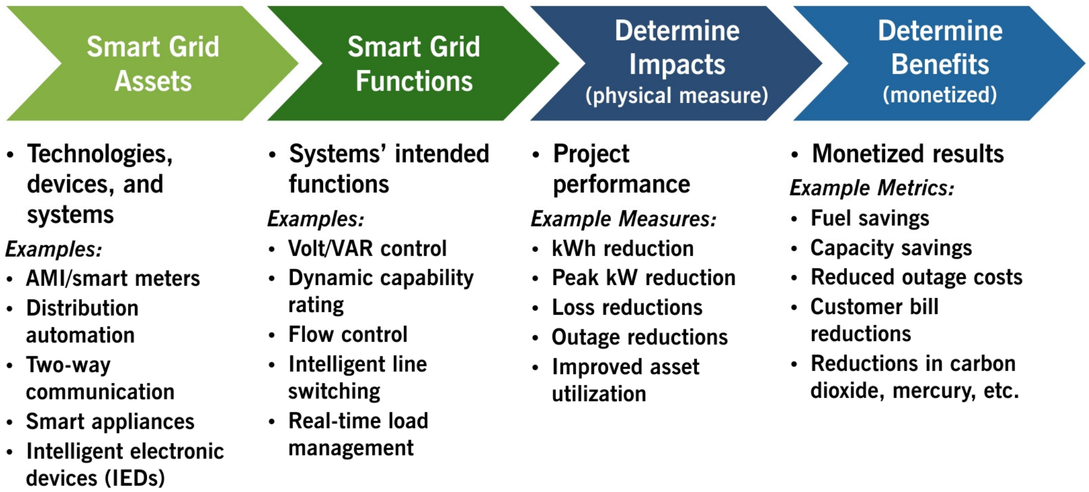


Figure 4. Smart Grid Project Analysis Framework

- **Consumer behavior study plans (CBSPs)** – The primary tools for DOE-OE and the subset of the nine projects that are conducting studies for tracking progress, the CBSPs aim to improve understanding of the magnitude and persistence of demand response by customers who participate in time-based rate programs and have smart meters and/or customer systems. The CBSPs contain information on experimental designs, treatment and control groups, strategies for randomized assignments, customer recruitment strategies, statistical analysis techniques, and other key study parameters.

3. SGIG Implementation Progress

DOE-OE is monitoring implementation progress to ensure on-schedule and on-budget performance of the SGIG program. Progress includes (1) the overall schedule of activities and level of expenditures, (2) the deployment of technologies and systems, and (3) initial results and lessons learned, including selected project examples.

3.1 Schedule of Activities and Expenditures

All of the key SGIG program activities are generally on schedule as of March 31, 2012. Figure 5 shows the overall schedule of key SGIG activities and progress so far. Project selection and planning have been completed and procurement and installation of equipment is well under way. Project analysis and reporting is just now beginning as project results are collected and reported. Though the program is generally on schedule, several projects may experience delays because of severe weather and supply chain difficulties.

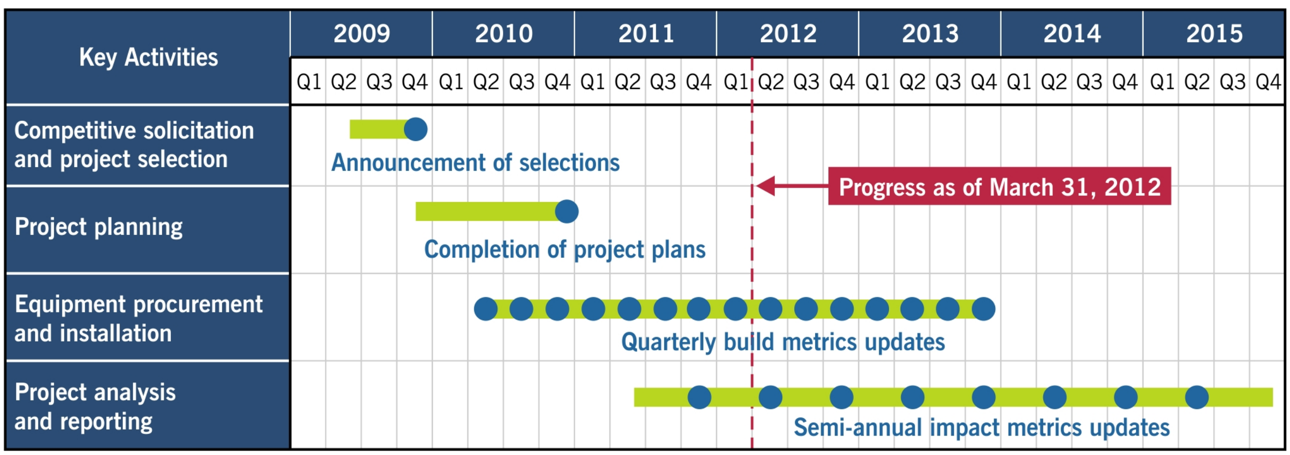


Figure 5. Progress in the Overall SGIG Schedule as of March 31, 2012

Figure 6 shows the overall expenditures by the 99 SGIG projects for the purchase and installation of equipment. DOE-OE is monitoring the total amount of project expenditures, including both DOE (about $3.4 billion) and recipient (about $4.4 billion) spending, to assess the overall financial performance of the projects. Based on information reported by the projects as of March 31, 2012, Figure 6 shows that the projects are well past the halfway mark on total expenditures (about 59 percent) and are on budget overall.

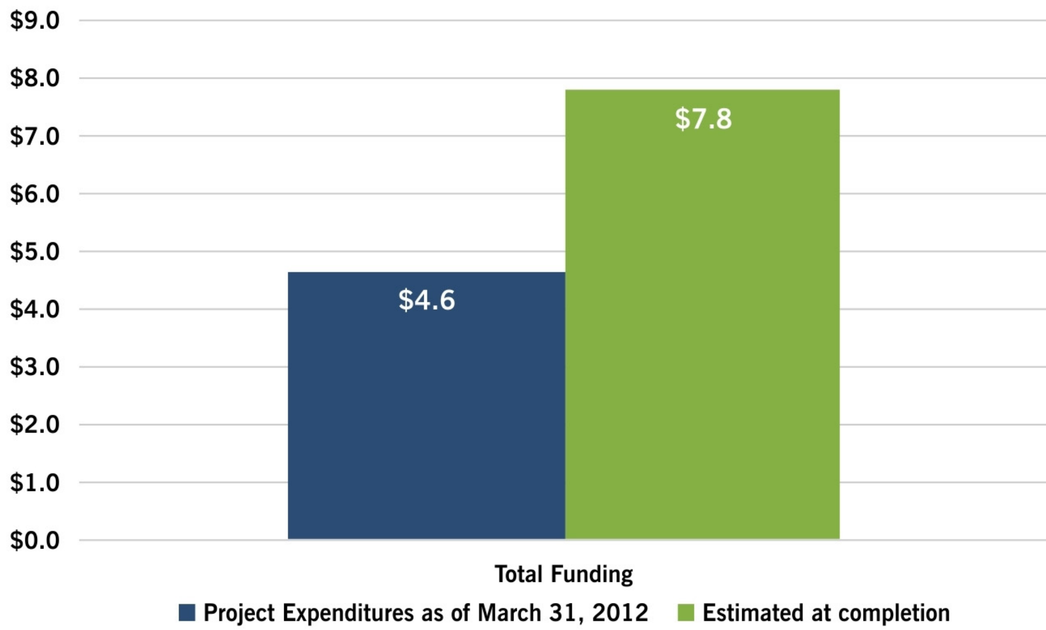


Figure 6. Progress in Overall SGIG Expenditures as of March 31, 2012 ($ billions)

DOE separately monitors expenditures of the DOE portion of the funds. Based on information reported by the projects as of March 31, 2012, Figure 7 shows that the planned versus actual level of expenditures of DOE funds is on target.

3.2 Overview of Deployment Progress

Figure 8 provides examples within each of the four project categories (ETS, EDS, AMI, and CS), and Figure 9 shows the level of SGIG project expenditures, including both DOE and recipient funds, as of March 31, 2012. Figure 9 shows the relatively quicker pace of installations of technologies and systems for AMI and CS than those for EDS and ETS.

Deploying smart grid technologies and systems with "built-in" cybersecurity protections is a key objective that cuts across each of the four SGIG project areas. DOE-OE is working closely with the projects to implement sound cybersecurity practices and policies.

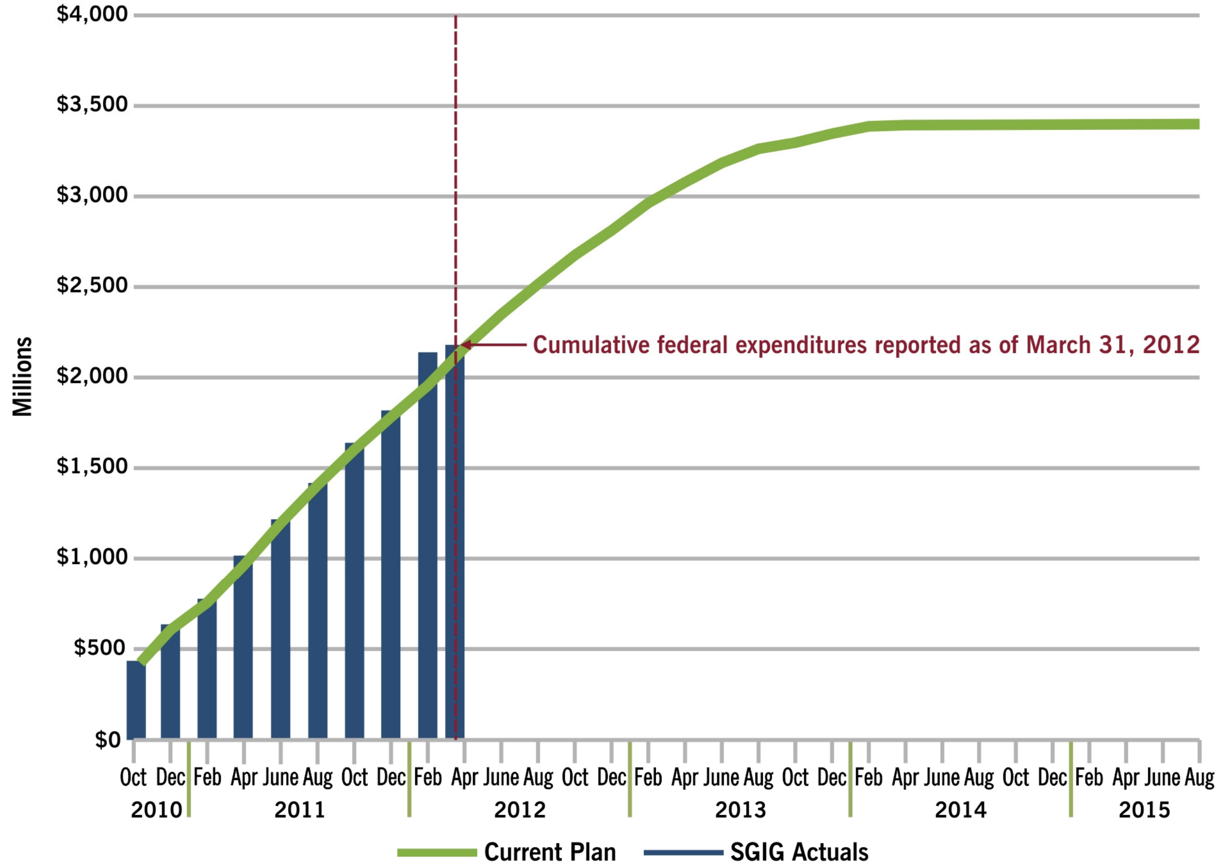


Figure 7. Progress in Planned versus Actual SGIG Expenditures of DOE SGIG Funds as of March 31, 2012

Electric Transmission Systems	Electric Distribution Systems	Advanced Metering Infrastructure	Customer Systems
			
• Synchrophaser technologies • Communications infrastructure • Wide area monitoring and visualization • Line monitors	• Automated switches • Equipment monitoring • Automated capacitors • Communications infrastructure • Distribution management systems	• Smart meters • Communications infrastructure • Data management systems • Back-office integration	• In-home displays • Programmable communicating thermostats • Home area networks • Web portals • Direct load controls • Smart appliances

Figure 8. Examples of SGIG Technologies and Systems

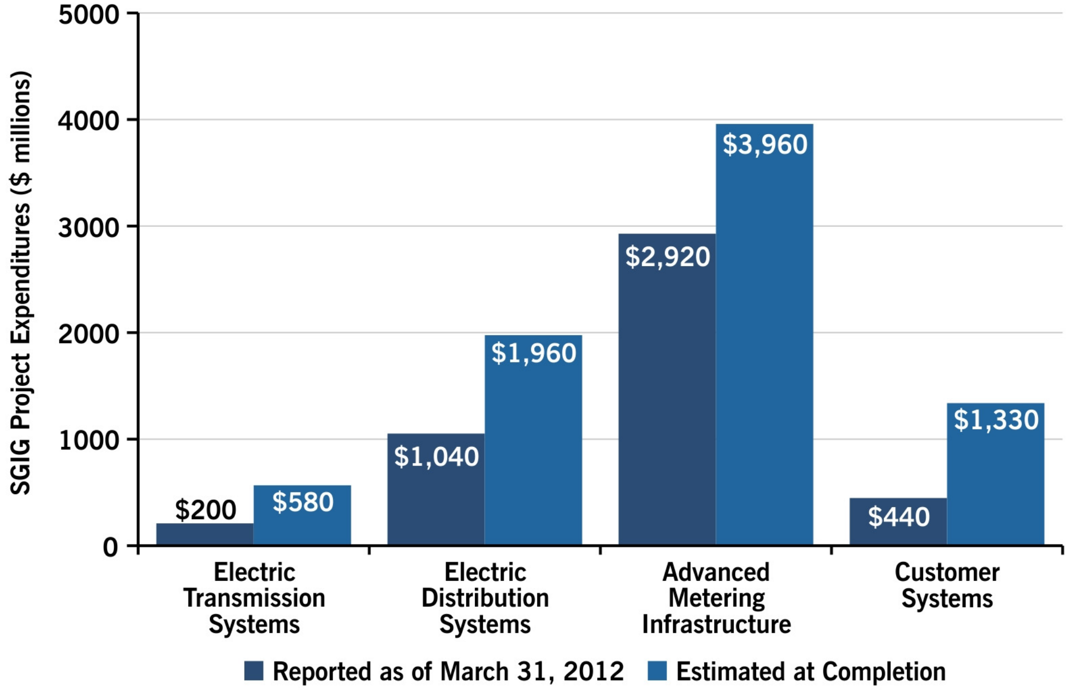


Figure 9. SGIG Expenditures by Categories of Technologies and Systems (total = $7.8 billion)

Ensuring Smart Grid Cybersecurity

DOE-OE is advancing the development of effective cybersecurity protections for smart grid technologies and ensuring SGIG systems are adequately protected against cyber events through several activities, including:

- Every SGIG project was required to develop, implement, refine, and manage a comprehensive cybersecurity plan (CSP; see Section 2.4). DOE-OE has approved the CSPs for all projects, and utilities update them when significant project changes occur.
- As part of its project management responsibilities, DOE conducts regular site visits to ensure SGIG projects are on track and that each project is implementing cybersecurity consistent with their CSP. Reviewers also provide additional assistance to help projects improve and maintain the security postures of their smart grid deployments.
- DOE-OE created a dedicated website to help SGIG recipients develop, implement and manage their CSPs and promote sound cybersecurity policies and practices: ARRA Smart Grid Cyber Security (https://www.arrasmartgridcyber.net/). The site provides information, tools, and resources from government and industry sources.
- DOE-OE hosted two cybersecurity webinars for the SGIG projects. The first, conducted in January 2010, explained the SGIG cybersecurity mission and reviewed requirements for

the CSPs. The second, conducted in February 2011, helped the projects to develop an effective response to smart grid cybersecurity requirements.

- In August 2011, DOE-OE hosted a two-day Smart Grid Cybersecurity Information Exchange, which brought together SGIG recipients to foster peer-to-peer sharing of lessons learned from implementing their cybersecurity plans and to identify the persistent security needs and information gaps that electric utilities face.
- As a follow up to the Information Exchange, DOE-OE prepared the Smart Grid Cybersecurity Resource Tool for utilities, which identifies available cybersecurity tools and program resources that match the security needs and information gaps identified by the grant recipients.
- SGIG recipients are now using many of the cybersecurity tools developed with support from DOE-OE and industry, including cybersecurity profiles that support secure smart grid technology integration, and the National Institute of Standards and Technology (NIST) "Guidelines for Smart Grid Cybersecurity."
    - Multiple electric utilities came together with matched support from DOE-OE in the Advanced Security Acceleration Project for the Smart Grid (ASAP-SG), which has developed four security profiles of trusted guidance for the secure implementation of advanced metering infrastructure (AMI), third party data access, distribution automation, and wide-area monitoring systems.
    - More than 475 participants from the private sector contributed to three-volume "Guidelines for Smart Grid Cybersecurity," developed by NIST with funding under the Recovery Act. The document provides a framework utilities can use to examine their cybersecurity posture and build effective cybersecurity strategies tailored to their organization.

3.3 Electric Transmission System Projects

ETS projects for SGIG involve deployment of synchrophasor technologies, communications infrastructure, field measurement devices (such as line monitors), and equipment upgrades to enable better wide-area monitoring and improved reliability of the bulk transmission system. ETS technologies and systems are often accompanied by information management and visualization tools so that data collected by field measurement devices can be sent over communications networks to transmission system operators and processed there for use in models and other analytical tools. Data transmitted from field measurement devices to back-office systems typically use communication systems that can involve both public and private wireless and fiber optic networks.

Synchrophasor Technologies and Applications

One of the aims of the SGIG ETS projects is to enable wide-area monitoring across each of the major transmission system interconnections so that grid operators can observe system conditions in service territories other than their own. This capability provides operators with the ability to assess disturbances in their own or neighboring systems and take steps to prevent them from cascading from local disturbances into regional outages. The U.S.–Canada Power System Outage Task Force found inadequate situational awareness and the lack of wide-area visibility to be among the root causes of the August 2003 regional blackout.[6] That blackout caused an estimated $6 to $10 billion in damages. Lack of situational awareness was also identified as a contributing cause to the regional outage that affected Arizona and Southern California on September 8, 2011.[7]

Following the 2003 blackout, the North American Electric Reliability Corporation and DOE-OE established the North American Synchrophasor Initiative (NASPI) to provide a focused national organization to address wide-area visibility and other applications of synchrophasor technologies to support grid operations on the bulk transmission system. Today, hundreds of system operators, analysts, and engineers from across North America participate in NASPI activities, including work group meetings and technical task teams. Since 2009, NASPI meetings have become important venues for the SGIG ETS projects to convene and exchange information regarding synchrophasor technologies, technical challenges, and report on results.

In general, there are two types of synchrophasor applications: real-time applications and off-line applications. Real-time applications include wide-area monitoring and visualization, state estimation, voltage stability monitoring, frequency stability monitoring, oscillation detection, disturbance detection and alarming, congestion management, islanding and restoration, and renewable energy integration. Off-line applications include post-event analysis and model validation.[8]

Deployment of synchrophasor technologies is essential for accomplishing wide-area visibility and improving other aspects of transmission grid operations for several reasons. First, PMUs record data at 30 to 120 times per second, which is more than 100 times faster than current systems, such as those for supervisory control and data acquisition (SCADA) systems. Second,

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[6] U.S. Department of Energy, "Final Report on the August 14, 2003, Blackout in the United States and Canada: Causes and Recommendations," April 2004.
[7] Federal Energy Regulatory Commission and the North American Electric Reliability Corporation, "Arizona-Southern California Outages on September 8, 2011 – Causes and Recommendations," April 2012.
[8] For further information on synchrophasor applications, see NERC, "Real-Time Application of Synchrophasors for Improving Reliability," by M. Patel, S. Aivaliotis, E. Ellen, et al., October 2010.

each PMU time-stamps every measurement it takes, enabling all data to be synchronized across large regions of the country through access to the global positioning system (GPS). Finally, phasor data concentrators (PDCs) and high-bandwidth communications networks process and transmit these data to control centers for uploading to models and visualization tools.

With these systems in place, grid operators can use synchrophasor data to create in-depth "pictures" of operating conditions on the grid, which enables them to detect disturbances that would have been impossible to see otherwise. The data are also valuable for forensic analysis of grid disturbances because the detailed, GPS-synchronized data allow investigators to immediately understand grid conditions before, during, and after an event and diagnose its root causes.

ETS Deployment Progress

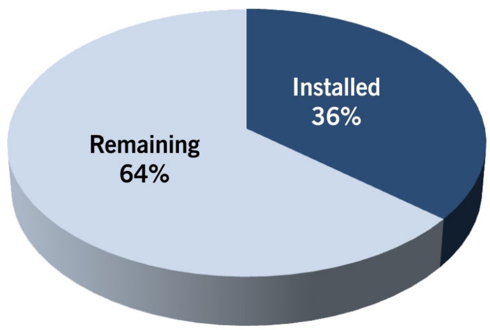
There are 19 SGIG ETS projects, which have total funding of approximately $580 million (including DOE and recipient funds). As of March 31, 2012, ETS expenditures totaled approximately $200 million, which is approximately 35 percent of the total funds. ETS deployments are on schedule and budget.

The 19 ETS projects involve 5 of the nation's regional transmission organizations and independent system operators, and more than 60 transmission system owners participating as either leads or sub-recipients. Eleven projects are installing synchrophasor technologies, and eight are installing line monitors and other equipment to provide smart grid capabilities that upgrade their transmission and/or communications systems. Advancing the development of synchrophasor technologies is one of the major goals of the SGIG program; progress with their deployment is highlighted in the sections below.

Before the SGIG program, there were about 166 networked PMUs installed in locations across the United States. The SGIG objective for ETS projects is to install an additional 800 networked PMUs and achieve near-nationwide coverage. As a result, after SGIG there will be a total of at least 966 networked PMUs installed and operational across the country. In addition, substantial progress will have been made in developing applications to improve the performance of transmission system operations. However, synchrophasor applications are in their early phases of development and will not be fully operational until the systems that transmit, store, process, and manage synchrophasor data are fully analyzed and tested.

Figure 10 provides a summary of the PMU deployments and expenditures for the 11 SGIG synchrophasor projects. A total of 287 PMUs (about 36 percent) are installed and operational.

Figure 11 shows the progress with PMU installations for each of the 11 SGIG synchrophasor projects. The projects are installing PMUs according to their project timelines and are generally on schedule.



Phasor Measurement Units (PMUs)	
Number of Projects	11
Number of PMUs Expected at Completion	at least 800
Number of PMUs Installed (as of March 31, 2012)	287
Expenditures (as of March 31, 2012)	$22.69 million

Figure 10. SGIG PMU Deployments as of March 31, 2012

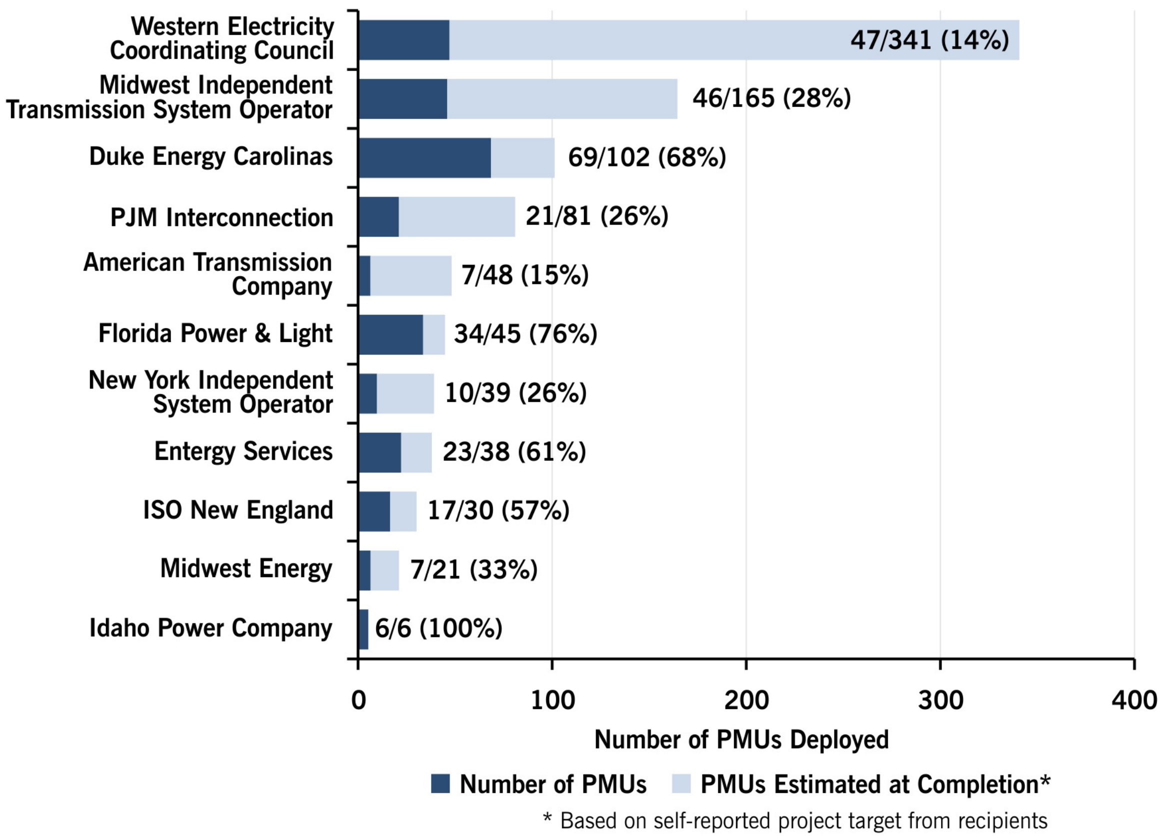


Figure 11. Percentage of SGIG PMU Deployments by the Synchrophasor Projects as of March 31, 2012

ETS Initial Results

Some of the ETS synchrophasor projects are beginning to document lessons learned and report results. For example, interoperability is paramount for synchrophasor technologies to succeed, as data must flow across multiple transmission owners, systems, and communications networks. With participation of the SGIG synchrophasor project teams, NASPI has been able to expand their efforts with DOE and the National Institute of Standards and Technology (NIST) to accelerate development of new technical standards for synchrophasor data, equipment, and communications systems.

According to NASPI, the SGIG synchrophasor projects have been a "forcing function" for helping to reduce by half the planned five-year standards development schedule. NASPI also credits the SGIG synchrophasor projects with helping to accelerate manufacturer timetables for making more accurate and reliable "production-grade" PMUs. The PMUs being installed by the SGIG projects meet new industry specifications for data quality, performance, and cybersecurity.

The project example that is shown below from the Western Electricity Coordinating Council highlights initial accomplishments in the exchange of synchrophasor data among power companies and on a regional basis. Sharing synchrophasor data faces a number of technical and institutional hurdles. With NASPI and the SGIG synchrophasor projects, many of those hurdles are being addressed. The goal of data sharing is now more widely accepted, and the synchrophasor data exchanges themselves are beginning to occur more routinely.

Western Electricity Coordinating Council (WECC)

The WECC) and its members manage the operation of the vast interconnected transmission system connecting generators and loads across the Western Interconnection—a territory of approximately 1.8 million square miles across 14 states. The Western Interconnection Synchrophasor Program (WISP), led by WECC and involving 18 transmission owners, is an initiative to modernize the transmission system in the Western Interconnection, with the ultimate aim of increasing reliability and system performance and enabling greater use of renewable resources such as solar, hydropower, and wind.

WISP partners are installing an extensive network of synchrophasor technology, including 341 PMUs, 62 PDCs, and a communications infrastructure to tie all of these devices together and connect them to WECC's two reliability coordination centers. Once these devices are installed and operational, and grid operators are applying the data to improve operations, WECC estimates about 100 megawatts of additional operating capacity on the California-Oregon intertie will be enabled. About nine percent of this equipment has been installed so far.

3.4 Electric Distribution System Projects

SGIG EDS projects involve the deployment of technologies and systems for improving distribution system operations, including: (1) outage management with field devices such as automated circuit switches and reclosers, and (2) voltage/volt-ampere reactive (VAR) control with field devices such as automated capacitors, voltage regulators, and voltage sensors. These field devices can work autonomously or be monitored and controlled via communications networks linked to back-office systems for distribution and/or outage management. Grid operators use these systems for applications such as fault detection, power flow control, islanding, voltage/VAR control, and preventative maintenance for transformers, capacitors, switches, and other equipment.

Outage Management and Voltage/VAR Control

Electric distribution systems are expected to advance significantly over the next several decades to accommodate many new requirements, including greater numbers of distributed and renewable resources and demand-side programs and equipment. These include rooftop photovoltaic arrays, wind energy systems, customer responses to time-based rate and energy efficiency programs, and deployment of charging stations for electric vehicles. To meet these and other requirements, electric distribution systems will need greater flexibility to instantaneously balance supply and demand while maintaining the delivery of reliable, affordable, and clean electricity services.

Outage management and voltage/VAR control are among the key objectives for the SGIG EDS projects. With respect to outage management, many of the EDS projects are seeking to shorten restoration times and reduce the number of customers affected by downed lines or equipment failures. Several projects are installing automated circuit switches, reclosers, advanced sensors, and equipment monitors to reroute power flows around faults, island line segments to reduce the spread of cascading service interruptions, and detect faulty equipment in advance so that it can be maintained or replaced before failure. These enhanced capabilities can be used to reduce the frequency and duration of power outages. Potential benefits include better service reliability, improved capital asset management, enhanced operational flexibility, and reduced operations and maintenance costs.

With respect to voltage/VAR control, many EDS projects are seeking to improve the management of voltage and reactive power levels and use automated capacitors to adjust voltages and accomplish reactive power compensation. Several projects are installing automated capacitors and voltage regulators to improve phase balancing and reactive power compensation, and optimize voltage levels on distribution circuits. These enhanced capabilities can be used to minimize voltage levels and reactive power levels, so that electricity requirements for real and reactive power can be reduced during peak periods or for longer periods of time. Potential benefits include improved capital asset management and utilization, energy savings and reduced environmental emissions, and lower customer bills.

EDS Deployment Progress

There are 57 SGIG EDS projects. While the majority of the projects involve small-scale deployments on a limited number of circuits and substations, several are involved in more extensive deployments that cover major portions of their service territories.

EDS expenditures are on schedule and budget. The total funding for the EDS projects is approximately $1.96 billion (including both DOE and recipient funds). As of March 31, 2012, 2011, EDS expenditures totaled approximately $1.04 billion (53 percent). These expenditures include the costs of field devices, communications infrastructure, and information management systems.

There are an estimated 160,000 distribution circuits in the United States,[9] and the SGIG objective for the EDS projects is to install electric distribution technologies and systems on 6,500 of them (about 4 percent). Figures 12 and 13 provide the status of equipment installations as of March 31, 2012, for two of the key electric distribution technologies and systems. As shown, approximately 75 percent of the automated switches and 47 percent of the automated capacitors have been installed.

Figure 14 shows expenditures (including both DOE and recipient funds) for several EDS technologies and systems. As shown, expenditures on field devices comprise approximately 71 percent of the total. The field devices include automated capacitors, automated switches, relays, regulators, and equipment monitors.

EDS Initial Results

Some of the EDS projects are beginning to document lessons learned from their deployments, including the value of effective planning and testing for the integration of new technologies with legacy systems before widespread deployment. Following this approach, several EDS projects were able to avoid problems by ensuring that the new technologies were properly integrated with legacy equipment and back-office systems, and that they were ready to receive and process data before field devices were installed.

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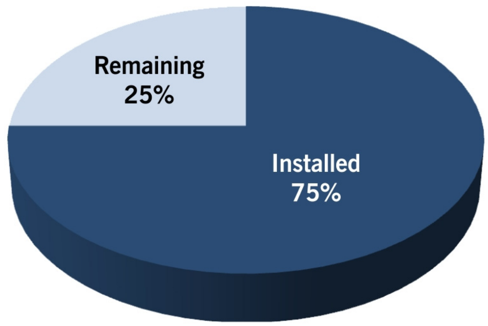
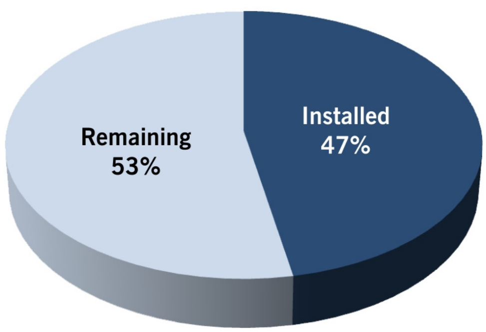
[9] Navigant Consulting Inc., "Assessment of the Total Number of Distribution Circuits in the United States," Analysis Memorandum to the U.S. Department of Energy, June, 2012.



Automated Switches	
Number of Projects	46
Number of Automated Switches Expected at Completion	about 7,500
Number of Automated Switches Installed (as of March 31, 2012)	5,628
Expenditures (as of March 31, 2012)	$307.4 million

Figure 12. Installed SGIG Automated Switches as of March 31, 2012



Automated Capacitors	
Number of Projects	43
Number of Automated Capacitors Expected at Completion	about 18,500
Number of Automated Capacitors Installed (as of March 31, 2012)	8,768
Expenditures (as of March 31, 2012)	$79.72 million

Figure 13. Installed SGIG Automated Capacitors as of March 31, 2012

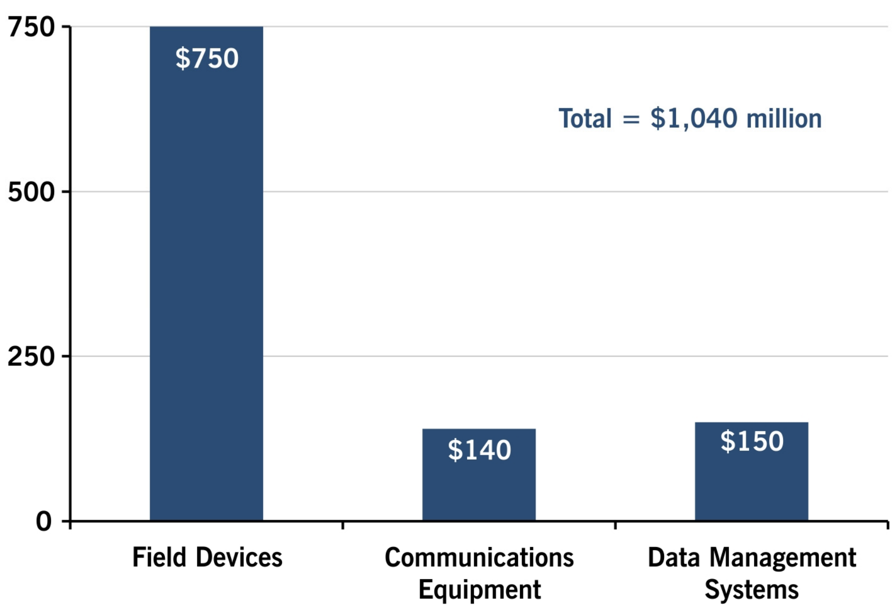


Figure 14. SGIG Expenditures on Selected EDS Technologies and Systems as of March 31, 2012

For example, in planning for the build out of its communications infrastructure, one of the EDS projects was able to choose low-frequency and narrow-bandwidth radio channels that required construction of only one additional radio tower. This system also enabled the project to use a dedicated communications pathway for all control signals and equipment status updates. Enabled by up-front planning and testing, this approach allowed the project to harden its dedicated communications pathway in a cost-effective manner and ensure appropriate cybersecurity protections.

The project example that is shown below from the Electric Power Board of Chattanooga highlights how smart technologies and systems can also help reduce service restoration times after severe weather events that knock down power lines and cause extended outages.

Electric Power Board of Chattanooga (EPB)

EPB serves about 170,000 customers in Tennessee and Georgia—areas that frequently experience severe weather events. Under SGIG, EPB is upgrading its distribution system by installing approximately 1,500 advanced automated circuit smart switches and sensor equipment for 164 distribution circuits. The smart switches detect customer outages, isolate damaged sections of their power lines, and automatically restore power to customers more quickly and for lower costs.

On April 27, 2011—early in the project's installation phase—EPB's service territory was hit by the most damaging storm in the utility's history. Nine tornados ripped through neighborhoods and business districts, impacting the entire EPB system. Three quarters of the utility's customers—129,000 residences and businesses—were out of power. When the storm hit, EPB had 123 smart switches in service. Only one of those switches went off line during the storm. With the outage data from the initial switches and other sensing devices, EPB was able to avoid 250 truck rolls and thousands of hours of outage time.

The experience with the new devices and automation indicates that EPB is on track to realize significant improvement once all the automation is complete. Utility officials expect the number of customer minutes lost to power outages to be down by 40 percent or more—increased reliability worth at least $35 million a year to area businesses and homeowners.

3.5 Advanced Metering Infrastructure Projects

The SGIG AMI projects involve deployment of smart meters; communications networks to transmit data from the meters at 15-, 30-, or 60-minute intervals; and the back-office systems (such as meter data management systems) to receive, store, and process the data from the meters. All of these projects use smart meters for collecting interval load data, while a few of the projects also use smart meters for collecting data on voltage levels and power quality. This information can be used in electric distribution systems for voltage management. In addition, the smart meters can be used by electric distribution systems for outage management because they automatically send signals to grid operators when the power is off. Power-off signals can be used with geographic information systems (GIS) to pinpoint outage locations.

Many of the AMI projects are using the outage detection capabilities of the smart meters to pinpoint outage locations and dispatch repair crews to exactly where they are needed. AMI is integrated with the company's outage management and GIS systems to accelerate response and restoration efforts and reduce the number of truck rolls.

AMI Applications and Services

While AMI systems offer many services, one of the primary applications involves processing meter readings for billing. This eliminates the need for manual meter readings and reduces operating costs. Other operational benefits include tamper detection, outage detection, and remote service connection and disconnection. Automation of these functions reduces the number of truck rolls by repair and service crews, leading to reductions in gasoline consumption and air pollution.

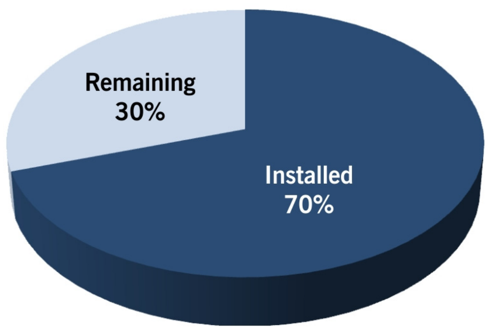
A large number of the AMI projects also involve deployment of CS to provide information to customers (such as critical peak prices or notification of critical peak events) so that they can take actions to reduce or shift their consumption of electricity from on-peak to off-peak periods. These practices lower peak demand and enable power companies to defer power plant and power line construction projects and help customers to better manage electricity consumption and costs.

A small number of the AMI projects are collecting data on voltage and power quality levels, which can then be coupled with EDS for voltage control and reactive power management. The projects that are pursuing this approach are doing so in small, pilot-scale projects and on a limited basis.

AMI Deployment Progress

There are 65 SGIG AMI projects, and more smart meters are being installed by the SGIG program than any of the other devices. The objective for the SGIG AMI projects is to install a total of at least 15.5 million smart meters, which will more than double the number of smart meters that were installed nationwide before the SGIG program. Figure 15 shows that about 10.8 million smart meters have been installed as of March 31, 2012, which is about 70% of the 15.5 million that are expected at completion. The SGIG AMI projects are generally on schedule and budget.

The 15.5 million smart meters to be installed by the SGIG AMI projects represent almost 24 percent of the 65 million smart meters that industry is estimating will be installed nationwide by 2015[10], which will be a major fraction of the 144 million meters currently serving electric customers in the U.S. today.[11]



AMI Smart Meters	
Number of Projects	65
Number of Smart Meters Expected at Completion	at least 15.5 million
Number of Smart Meters Installed (as of March 31, 2012)	10.8 million
Expenditures (as of March 31, 2012)	$1,970 million

Figure 15. SGIG Smart Meter Deployment as of March 31, 2012

Figure 16 shows SGIG AMI project expenditures as of March 31, 2012. The largest cost is smart meters, which represents about 68 percent of the AMI project expenditures. Communications equipment and data management systems comprise the other 32 percent.

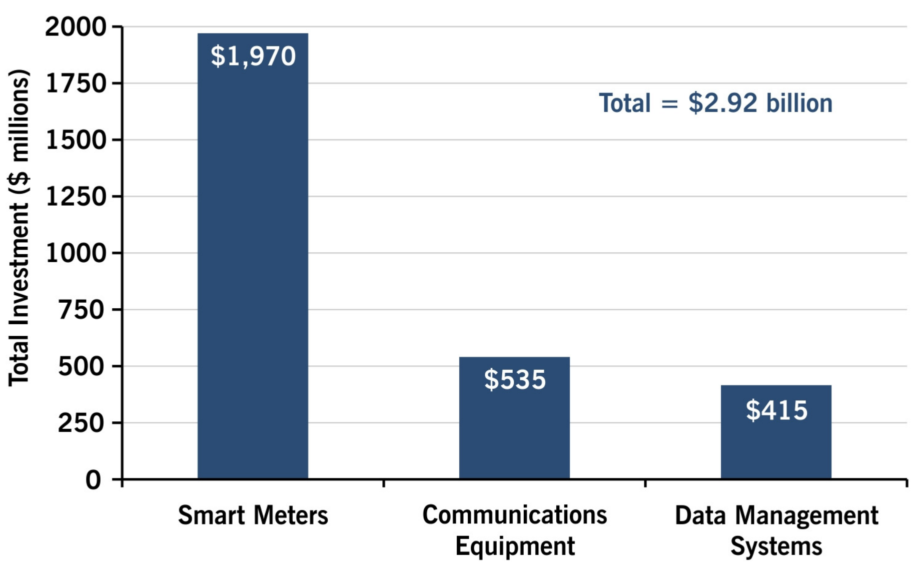


Figure 16. SGIG AMI Project Expenditures on Technologies and Systems as of March 31, 2012

[10] Edison Foundation, Institute for Electricity Efficiency, "Utility-Scale Smart Meter Deployments, Plans & Proposals," May 2012.
[11] Energy Information Administration, "Electric Power Annual 2010," November 2011.

AMI Initial Results

The SGIG AMI projects are beginning to document lessons learned and report results. Many of the projects are now processing quantities of interval load data that are several orders of magnitude larger than before. Meter data management systems are processing and storing these data, which are being used primarily for billing systems and web portals. Several of the projects report challenges with integrating meter data management systems with legacy billing systems and with supporting new communications and educational tools, such as the web portals. Integration challenges include error checking, ensuring accurate billing, and producing meaningful and visually appealing consumption and cost reports for customers.

Several projects have highlighted the importance of thoroughly testing the meter data management system and solving any problems with it before installing meters and receiving data. This approach helps minimize post-deployment problems including complaints about inaccurate bills.

The project example that is shown below from Talquin Electric Cooperative highlights several of the operational savings a utility can achieve from AMI systems, including cost savings from reductions in truck rolls for service connections and disconnections and from more accurate meter readings.

Talquin Electric Cooperative (TEC)

Located in northern Florida and bordering on the Gulf of Mexico, TEC's service territory spans four counties and covers about 2,600 square miles. From their inception in 1940 until recently, TEC's customers read their own meters and reported their monthly usage by mail or phone. As a result, each year TEC wrote off hundreds of thousands of dollars in revenue shortfalls from misreporting, levels far in excess of industry averages. With AMI and more accurate billing, TEC is now able to turn losses into revenues and pass the savings to customers.

In addition, in the past TEC routinely sent personnel to customer homes about 5,500 times a year for service connections and disconnections and almost 9,000 times a year for non-payment problems. At about $40 to $50 per truck roll, this adds up to a significant annual expense. In 2011, with the new metering system in place, TEC avoided 8,800 truck rolls for non-payment problems, saving TEC and its customers more than $350,000, not to mention reductions in pollution from fewer miles driven by TEC crews. TEC expects to avoid an additional 5,500 truck rolls per year for routine service connections with annual savings of more than $200,000.

3.6 Customer Systems Projects

The SGIG CS projects involve deployment of technologies and systems for customers to better understand, and/or control their electricity consumption and costs. Specifically, the CS projects involve deployment of direct load control (DLC) devices, web portals (which access AMI information via the internet), in-home displays (IHDs), and programmable communicating thermostats (PCTs). The SGIG CS projects also involve communications systems for transmitting information from in-home devices to and from AMI systems and back-office systems of the power companies.

In addition, many CS projects are deploying time-based rate programs, either in addition to, or as replacements for, traditional rates. Time-based rate programs include time-of-use (TOU) rates, critical peak pricing (CPP), critical peak rebates (CPR), and variable peak pricing (VPP). More information on these types of time-based rate programs can be found at http://www.smartgrid.gov/recovery_act/deployment_status/time_based_rate_programs.

SGIG Consumer Behavior Studies

Many of the CS projects are coupling AMI and time-based rate programs to provide financial incentives to customers for reducing peak demand through demand response, load management, energy efficiency, and other types of demand-side programs. One of the aims is to expand the level of customer engagement by providing information and tools. Many projects are providing educational materials to acquaint customers with time-based rates and new technologies, and evaluating how well the materials work in terms of customer acceptance, satisfaction, and retention in programs.

As discussed in Section 2.4, a subset of nine CS projects are conducting rigorous studies of consumer behavior to estimate reductions in peak demand, shifts in demand from on-peak to off-peak periods, and reductions in overall electricity consumption. The studies also assess customer acceptance and retention. The nine projects are implementing experimental designs involving randomized assignment of participants to treatment and control groups to minimize bias and maximize the internal and external validity of the results. The projects are taking these steps because they are interested in determining the levels of impact with a high degree of statistical precision and accuracy.

Figure 17 provides a summary of the scope and objectives of the projects that are conducting these consumer behavior studies, including the types of time-based rates, customer systems, and study design features. The nine projects are conducting a total of eleven consumer behavior studies.

	Nevada Energy (Northern)	Nevada Energy (Southern)	Oklahoma Gas & Electric	Marblehead Municipal Light District	Central Vermont Public Service	Vermont Electric Power	Minnesota Power	FirstEnergy Service	Sacramento Municipal Utilty District	Detroit Edison Company	Lakeland Electric	Total
Rate Treatments												
TOU	■	■							■		■	4
CPP	■	■	■	■	■		■		■	■		8
CPR					■			■				2
VPP			■			■						2
Non-rate Treatments												
Education	■	■										2
Customer Service						■						1
IHD	■	■	■		■	■	■	■	■	■		9
PCT	■	■	■					■		■		5
DLC								■				1
Features												
Bill Protector	■	■	■	■							■	5
Experimental Design												
Opt In	■	■	■	■	■	■	■		■	■	■	10
Opt Out								■	■		■	3
Number of Participants	9,509	6,853	3,196	500	3,735	6,440	4,025	5,000	97,480	3,075	3,000	142,813

Legend

TOU	Time of Use
CPP	Critical Peak Pricing
CPR	Critical Peak Rebates
VPP	Variable Peak Pricing
IHD	In-Home Display
PCT	Programmable Communicating Thermostats
DLC	Direct Load Control

Figure 17. SGIG Consumer Behavior Studies

CS Deployment Progress

There are 66 SGIG projects deploying various types of CS. Figure 18 shows the number of CS devices installed as of March 31, 2012. The number of CS devices installed is relatively small compared to the number of smart meters installed (10.8 million), which shows that there are very few CS projects involved in large-scale roll-outs as the vast majority are involved in small-scale deployments and testing. The SGIG CS projects are generally on schedule and budget.

In addition, a small but growing number of customers are signing up to participate in time-based rate programs. As of March 31, 2012, approximately 265,000 customers were enrolled in time-based rate programs out of a total customer population of approximately 38 million. This illustrates that the vast majority of the CS projects are implementing time-based rate programs on a pilot basis and that relatively small numbers of participants are involved.

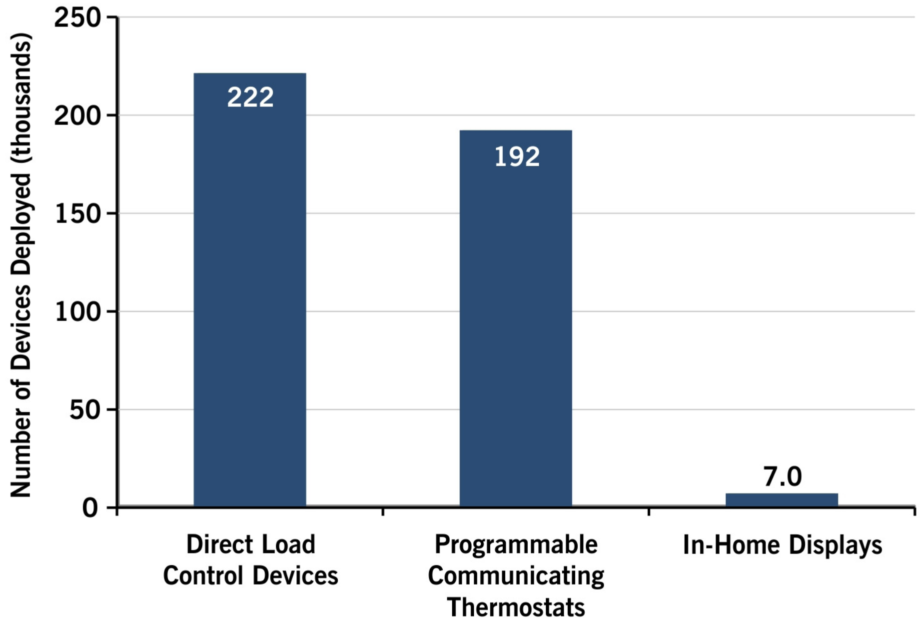


Figure 18. SGIG CS Deployment as of March 31, 2012

CS Initial Results

CS projects are beginning to document lessons learned and report results. One of the challenges reported by several of the CS projects involves the development of effective customer education strategies for building awareness and acceptance of some of the new customer systems, including how to use them to realize benefits. For example, many of the CS projects are offering web portals that provide access to "dashboards" on company websites where customers can get information on their consumption and costs, sometimes as soon as the day after it has been recorded on their smart meters.

Several of the projects are exploring ways to encourage customers to use the web portals and get them excited about monitoring their consumption and taking steps to modify their consumption patterns to save money. One of the lessons learned is that it often takes extra effort to acquaint customers with, and to entice them to use, these tools. Some projects report success in attracting customers to web portals with targeted email campaigns and special education programs, including offering classes at local community colleges.

The project example that is shown below from Oklahoma Gas and Electric (OGE) discusses how time-based rate programs coupled with AMI and CS can help reduce peak demand and save customers money.

Oklahoma Gas and Electric (OGE)

OGE analyzed two summers of data and found statistically significant demand reductions. OGE conducted a consumer behavior study to explore peak demand reductions from time-based rate programs, AMI, and CS to defer new power plants and help customers save money on their bills. During the two-year study, OGE offered a sample of customers several rates, including time-of-use with critical peak pricing and variable peak with critical peak pricing. About 6,000 volunteers were randomly assigned to treatment and control groups that included tests of various combinations of customer systems, including in-home displays, programmable communicating thermostats, and web portals.

The study found that there were measurable demand reductions for all of the combinations of rates and customer systems. The customers with programmable communicating thermostats (PCT) consistently provided the largest on-peak demand reductions. OGE determined that they could achieve their objective of a 1.3 kW reduction in peak demand per customer; although a maximum peak load reduction of 1.8 kW was observed for the PCT group.

The vast majority of the participating residential customers said they were satisfied with their experiences, and the vast majority experienced reductions in their summer electric bills—some by as much as $150. Because of the relatively high satisfaction rate, OGE plans to enroll an additional 150,000 customers by 2014. If they reach this goal, they anticipate deferring up to 210 megawatts of additional generation capacity.

OGE's evaluation report is posted on www.smartgrid.gov.

4. Next Steps

The SGIG projects will continue deploying technologies and systems over the next 18 months and provide quarterly updates on installations and costs. As more data becomes available on lessons learned and impacts, DOE-OE is planning to provide five analysis reports in the following areas:

- Peak demand and electricity consumption reductions from advanced metering infrastructure, customer systems, and time-based rate programs
- Operational improvements from advanced metering infrastructure
- Reliability improvements from automating distribution systems
- Energy efficiency improvements from advanced Volt/VAR control in distribution systems
- Efficiency and reliability improvements from applications of synchrophasor technologies in electric transmission systems

Additional information, including progress updates and case studies, will continue to be posted on several websites. These are listed in Table 3.

Website Address	Website Content
SMARTGRID.GOV http://www.smartgrid.gov	• General information on smart grid technologies, tools, and techniques for the general public • Background information on Recovery Act smart grid programs, including SGIG, Smart Grid Demonstration Program (SGDP), and the Workforce Training for the Electric Power Sector Program (WFT) • Equipment installations and spending by SGIG and SGDP projects • Two-page project descriptions of the SGIG, SGDP, and WFT projects • Background information and reports for the SGIG consumer behavior studies • Impact reports for the SGIG projects • Technology performance reports for the SGDP projects
http://www.energy.gov/oe	• Information about OE's smart grid-related research and development (R&D) and permitting, siting and analysis (PSA) programs and projects • Blog entries highlighting important Recovery Act smart grid project developments

Website Address	Website Content
http://www.recovery.gov	• Information about all federal government Recovery Act projects, including SGIG
https://www.arrasmartgridcyber.net	• Information on the cybersecurity aspects of the Recovery Act smart grid projects, including webinars and other resources outlining requirements and accomplishments
http://www.nist.gov/smartgrid	• Information on smart grid interoperability standards, interoperability framework, and the Smart Grid Interoperability Panel

Table 3. Websites Providing Information about DOE-OE Smart Grid Program Activities

Appendix A. List of SGIG Projects

Legend

AMI – Advanced Metering Infrastructure
CS – Customer Systems
EDS – Electric Distribution Systems
ETS – Electric Transmission Systems

Note: The asterisks indicate projects conducting consumer behavior studies.

SGIG Project Recipient	Project Types			
	AMI	CS	EDS	ETS
American Transmission Company LLC (I)				X
American Transmission Company LLC (II)				X
Atlantic City Electric Company		X	X	
Avista Utilities			X	
Baltimore Gas and Electric Company	X	X		
Black Hills Corporation/Colorado Electric	X	X		
Black Hills Power	X			
Burbank Water and Power	X	X	X	
CenterPoint Energy Houston Electric, LLC	X	X	X	
Central Lincoln People's Utility District	X	X	X	
Central Maine Power Company	X	X		
Cheyenne Light, Fuel and Power Company	X			
City of Anaheim Public Utilities Department	X		X	
City of Auburn, Indiana	X	X	X	
City of Fort Collins Utilities	X	X	X	
City of Fulton, Missouri	X	X		
City of Glendale Water & Power	X	X	X	
City of Leesburg, Florida	X	X	X	
City of Naperville, Illinois	X	X	X	
City of Quincy, Florida	X	X		
City of Ruston, Louisiana	X	X	X	
City of Tallahassee, Florida		X	X	
City of Wadsworth, Ohio	X	X	X	
Cleco Power LLC	X			
Cobb Electric Membership Corporation	X	X		
Connecticut Municipal Electric Energy Cooperative	X	X	X	
Consolidated Edison Company of New York, Inc.			X	

SGIG Project Recipient	Project Types			
	AMI	CS	EDS	ETS
Cuming County Public Power District		X	X	
Denton County Electric Cooperative	X	X	X	
Detroit Edison Company*	X	X	X	
Duke Energy Business Services LLC	X	X	X	
Duke Energy Carolinas, LLC				X
El Paso Electric			X	
Entergy New Orleans, Inc.	X	X		
Entergy Services, Inc.				X
EPB	X	X	X	
FirstEnergy Services Corporation*	X	X	X	
Florida Power & Light Company	X	X	X	X
Georgia System Operations Corporation Inc.				X
Golden Spread Electric Cooperative, Inc.	X	X	X	
Guam Power Authority	X	X	X	
Hawaiian Electric Company Inc.			X	
Honeywell International, Inc.		X		
Idaho Power Company	X	X	X	X
Indianapolis Power and Light Company	X	X	X	
Iowa Association of Municipal Utilities	X	X		
ISO New England, Inc.				X
JEA	X	X		
Knoxville Utilities Board	X	X	X	
Lafayette Consolidated Government	X	X	X	X
Lakeland Electric*	X	X		
M2M Communications		X		
Madison Gas and Electric Company	X		X	
Marblehead Municipal Light Department*	X	X		
Memphis Light, Gas and Water Division			X	
Midwest Energy Inc.				X
Midwest Independent Transmission System Operator				X
Minnesota Power*	X	X	X	
Modesto Irrigation District	X	X	X	
Municipal Electric Authority of Georgia			X	X
Navajo Tribal Utility Authority	X			
New Hampshire Electric Cooperative	X	X		
New York Independent System Operator, Inc.				X

SGIG Project Recipient	Project Types			
	AMI	CS	EDS	ETS
Northern Virginia Electric Cooperative			X	
NSTAR Electric Company			X	
NV Energy*	X	X		
Oklahoma Gas and Electric Company*	X	X	X	
Pacific Northwest Generating Cooperative	X	X		
PECO Energy Company	X	X	X	
PJM Interconnection, LLC				X
Potomac Electric Power Company (DC)	X	X	X	
Potomac Electric Power Company (MD)	X	X	X	
Powder River Energy Corporation			X	
PPL Electric Utilities			X	
Progress Energy Service Company	X	X	X	X
Qualcomm Atheros, Inc.		X		
Rappahannock Electric Cooperative	X	X	X	
Reliant Energy Retail Services, LLC		X		
Sacramento Municipal Utility District*	X	X	X	
Salt River Project	X	X		
San Diego Gas and Electric Company			X	X
Sioux Valley Energy	X	X		
Snohomish County PUD			X	
South Kentucky Rural Electric Cooperative Corp.	X	X		
South Mississippi Electric Power Association	X	X	X	
Southern Company Services, Inc.			X	X
Southwest Transmission Cooperative, Inc.	X	X	X	X
Stanton County Public Power District	X			
Talquin Electric Cooperative, Inc.	X	X	X	
Town of Danvers, Massachusetts	X	X	X	
Tri State Electric Membership Corporation	X	X		
Vermont Transco, LLC*	X	X	X	
Vineyard Energy Project		X		
Wellsboro Electric Company	X	X		
Westar Energy, Inc.	X	X	X	
Western Electricity Coordinating Council				X
Whirlpool Corporation		X		
Wisconsin Power and Light Company			X	
Woodruff Electric	X			

Appendix B. SGIG Project Abstracts

Contents

Legend

AMI – Advanced Metering Infrastructure
CBS – Consumer Behavior Studies
CS – Customer Systems
EDS – Electric Distribution Systems
ETS – Electric Transmission Systems

Note: Funding amounts noted in this appendix represent planned numbers.

American Transmission Company LLC: Smart Grid Project I

States: Wisconsin

Category: ETS

Total Project Cost: $22,888,360

Federal Funding: $11,444,180

American Transmission Company's (ATC) enhanced supervisory control and data acquisition (SCADA) and phasor measurement unit communications backbone project is deploying new fiber optic transmission communications infrastructure across the company's Wisconsin footprint. The interconnection of the new fiber segments expands ATC's data communications and integrates a total of 149 substations within ATC's data communication and collection networks. Targeted benefits include improved communications reliability and reduced operations and maintenance costs.

American Transmission Company LLC: Smart Grid Project II

States: Wisconsin

Category: ETS

Total Project Cost: $2,661,650

Federal Funding: $1,330,825

American Transmission Company's (ATC) phasor measurement unit (PMU) project is deploying synchrophasor technologies across the company's Wisconsin service area. The project expands the collection of synchrophasor data throughout ATC's transmission system from 25 substations to 73 substations by project completion. ATC is using synchrophasor monitoring to improve electric system reliability and restoration procedures and to help prevent the spread of local outages to neighboring regions. The project deploys PMUs, digital fault recorders (DFRs), a new synchrophasor data concentrator, and improved data collection software. These devices increase the ability of grid operators to monitor the condition of bulk power systems in near-real time, enable earlier detection of conditions that could result in grid instability or outages, and facilitate the sharing of information with neighboring regional control areas.

Avista Utilities: Spokane Smart Circuit

States: Idaho, Washington

Category: EDS

Total Project Cost: $40,000,000

Federal Funding: $20,000,000

Avista Utilities' (Avista) project, Spokane Smart Circuit, aims to reduce energy losses and improve reliability and efficiency in the electricity distribution system while reducing the need for new generation facilities. The project includes upgrading the distribution system by automating the management of the distribution grid and installing a rapid communications and monitoring infrastructure. New switches, capacitors, and sensors are being installed in substations and distribution circuits across the project area. This equipment provides automated regulation of power quality, rapid response to grid disturbances, and improvements to distribution reliability. A radio and fiber optic communications system integrates real-time data from grid sensors with the grid operator's distribution management software platform. The upgrades reduce the need for truck visits for system maintenance and operations and reduce costs and emissions.

Baltimore Gas and Electric Company: Smart Grid Project

States: Maryland

Category: AMI, CS

Total Project Cost: $451,814,234

Federal Funding: $200,000,000

Baltimore Gas and Electric's (BGE) Smart Grid Initiative consists of a territory-wide deployment of advanced metering infrastructure (AMI), implementation of a customer web portal and home energy management reports, deployment of a direct load control program, and installation of a new customer care and billing system. BGE will replace or upgrade more than 1.25 million electric meters to improve customer service, reduce BGE operation and maintenance costs, and offer customers a critical peak rebate program to help reduce peak demand and lower customer bills. Through a web portal, energy management reports, emails, texts, and phone messaging, BGE delivers usage information to help customers better manage their energy usage. A direct load control program offers customers a rebate to enable cycling of central air conditioners and electric hot water heaters. In addition, a new billing system enables optimal utilization of the new technologies offered by these programs.

Black Hills/Colorado Electric Utility Company: Advanced Metering Infrastructure/Meter Data Management System

States: Colorado

Total Project Cost: $12,285,708

Category: AMI, CS

Federal Funding: $6,142,854

Black Hills/Colorado Electric Utility Company (BHCOE) is one of three Black Hills Corporation subsidiaries deploying advanced metering infrastructure (AMI)—the other two are Black Hills Power (South Dakota/Wyoming) and Cheyenne Light, Fuel and Power (Wyoming). BHCOE's project includes the deployment of smart meters, communications infrastructure, and a meter data management system (MDMS). The project provides improved outage restoration from the integration of an outage management system with the AMI. Two-way communication allows for off-cycle reads, remote connect/disconnect of customer loads, tamper detection, and potential future implementation of time-based rate programs. BHCOE is also deploying approximately 200 direct load control devices as part of a pilot program to understand customer acceptance and load impacts.

Black Hills Power: Advanced Metering Infrastructure/Meter Data Management System

States: South Dakota, Wyoming

Total Project Cost: $19,153,256

Category: AMI

Federal Funding: $9,576,628

Black Hills Power (BHP) is one of three Black Hills Corporation subsidiaries deploying advanced metering infrastructure (AMI)—the other two are Black Hills/Colorado Electric (BHCOE) and Cheyenne Light, Fuel and Power (Wyoming). BHP's project includes the deployment of smart meters, communications infrastructure, and a meter data management system (MDMS). The project provides improved outage restoration from the integration of an outage management system with the AMI. Two-way communication allows for off-cycle reads, remote connect/disconnect of customer meters, tamper detection, and potential future implementation of time-based rate programs.

Burbank Water and Power:
Smart Grid Program

States: California | Total Project Cost: $62,650,755

Category: AMI, CS, EDS | Federal Funding: $20,000,000

Burbank Water and Power's (BWP) Smart Grid Program includes smart meters, a communications infrastructure, an outage management system, distribution automation, time-based rate programs, advanced customer service options, demand response, and electric vehicle charging stations. The project implements two-way communications and metering to enable customers to view their energy consumption at their convenience through systems such as web portals. The project also includes distribution automation to enhance the reliability and quality of electric delivery and reduce operations and maintenance costs. In addition, the project includes controls for distributed energy resources to manage peak electric demand and integrate renewable resources into grid operations.

CenterPoint Energy:
Smart Grid Project

States: Texas | Total Project Cost: $639,187,435

Category: AMI, CS, EDS | Federal Funding: $200,000,000

CenterPoint Energy Houston Electric's (CPE) smart grid project involves deployment of a fully integrated advanced metering system and web portal access to over 2.2 million customers, along with installation of advanced monitoring and distribution automation equipment. The project aims to reduce peak loads, overall electricity use, and operations and maintenance costs while increasing distribution system reliability. The project implements secure communications to: (1) allow smart meter customers to view their electricity consumption data whenever they want through the Smart Meter Texas (SMT) data exchange, and (2) allow CPE to effectively visualize and operate the distribution system. As a transmission and distribution service provider, CPE provides metering data to retail energy providers (REPs) through the SMT data exchange. The billing data and customer systems enable REPs to offer information feedback, new pricing programs, and other electric service options to customers. The project also deploys a more advanced distribution management system and automated circuit switching that reduces operational costs and improves service reliability.

Central Lincoln People's Utility District: Smart Grid Project

States: Oregon

Total Project Cost: $19,873,900

Category: AMI, CS, EDS

Federal Funding: $9,936,950

Central Lincoln People's Utility District (Central Lincoln PUD) is deploying advanced metering infrastructure (AMI) and distribution automation assets as part of their Smart Grid Team 2020. The AMI project consists of a system-wide deployment of smart meters to both commercial and residential customers as well as a communications infrastructure to gather the smart meter data. The two-way communication provided by the AMI allows Central Lincoln PUD to deploy direct load control devices and pricing programs, helping to lower peak demand through increased customer awareness. In addition to the AMI, Central Lincoln PUD is also upgrading its electric infrastructure with an improved supervisory control and data acquisition (SCADA) system, installation of an outage management system, automated distribution circuit controls, and regulators. The enhancements improve power quality, system reliability, and system efficiency.

Central Maine Power Company: CMP Advanced Metering Infrastructure Project

States: Maine

Total Project Cost: $191,716,614

Category: AMI, CS

Federal Funding: $95,858,307

Central Maine Power Company's (CMP) advanced metering infrastructure (AMI) project consists of territory-wide deployments of more than 600,000 smart meters to all of its residential, commercial, and industrial customers. This project is designed to create a technology platform for providing customers with electricity usage information and alternative electricity rates from third-party energy providers. Customers view their energy consumption through a web portal and can use that information to help manage electricity bills. CMP can monitor real-time electricity demand and use that information to better manage peak loads. This project aims to reduce operations and maintenance costs and service restoration times for customers through quicker and more accurate location of faults and power outages. CMP plans to assess the load-shape and consumption impacts of providing customers with different types of information using web portals and home area networks.

Cheyenne Light, Fuel and Power Company: Advanced Metering Infrastructure/Meter Data Management System

States: Wyoming

Total Project Cost: $10,066,882

Category: AMI

Federal Funding: $5,033,441

Cheyenne Light, Fuel and Power Company (CLFP) is one of three Black Hills Corporation subsidiaries deploying advanced metering infrastructure (AMI)—the other two are Black Hills/Colorado Electric (BHCOE) and Black Hills Power, Inc. (South Dakota/Wyoming). CLFP's project includes the deployment of smart meters, communications infrastructure, and a meter data management system (MDMS). The project provides improved outage restoration from the integration of an outage management system with the AMI. Two-way communication allows for off-cycle reads, tamper detection, potential remote connect/disconnect of customer loads and potential future implementation of time-based rate programs.

City of Anaheim, California: Smart Grid Project

States: California

Total Project Cost: $12,167,050

Category: AMI, EDS

Federal Funding: $5,896,025

The City of Anaheim's smart grid project involves a city-wide deployment of advanced metering infrastructure (AMI) and an expansion of distribution automation capabilities, which include circuit switches, remote fault indicators, and smart relays. Commercial customers can enroll in a program to receive programmable communicating thermostats that assist in managing electricity use and costs. These activities allow the City of Anaheim to manage, measure, and verify targeted demand reductions during peak periods. The new AMI and distribution automation technologies help improve service quality and reliability by enabling improved outage management, distribution circuit monitoring, and automated circuit switching.

City of Auburn, Indiana: Smart Grid Project

States: Indiana

Category: AMI, CS, EDS

Total Project Cost: $4,150,160

Federal Funding: $2,075,080

City of Auburn's (Auburn's) project, SmartGRID, involves a city-wide deployment of advanced metering infrastructure (AMI) and implementation of distribution automation equipment, which includes circuit switches, capacitors, voltage regulators, fault indicators, smart relays, and equipment sensors. Auburn expects the smart meters to reduce meter-reading costs, lower vehicle emissions, and enable advanced electric services for its customers. These services include an enhanced web portal and the introduction of time-based rate programs. Overall, the project aims to reduce operations and maintenance costs, improve reliability, reduce outage duration, reduce peak loads, and reduce overall energy usage across Auburn's service territory.

City of Fort Collins Utilities: Smart Grid Project

States: Colorado

Category: AMI, CS, EDS

Total Project Cost: $36,202,526

Federal Funding: $18,101,263

The City of Fort Collins' Front Range Smart Grid Development project involves the municipal utilities for the cities of Fort Collins and Fountain, Colorado. The project includes citywide deployment of advanced metering infrastructure (AMI), expansion of distribution automation capabilities including supervisory control and data acquisition (SCADA) system-connected fault indicators, SCADA-connected remote operated circuit switches, integration with the outage management system, demand response products, evaluation and potential implementation of time-based rate programs, customer education, and web portal access. Information from this project facilitates (1) customer participants' ability to view their energy consumption through in-home displays, a web portal, or both; and (2) the ability of the City of Fort Collins and the City of Fountain to manage, measure, and verify targeted demand reductions during peak periods. The new AMI and distribution automation technologies help improve service quality and reliability by enabling more efficient outage management, distribution circuit monitoring, and remote circuit switching.

City of Fulton, Missouri: Smart Grid Project

States: Missouri

Total Project Cost: $3,055,282

Category: AMI, CS

Federal Funding: $1,527,641

The City of Fulton, Missouri, smart grid project involves installing new smart meters for all residential, commercial, and electric meters inside city limits; supporting communication infrastructure; and offering advanced electricity service options for customers across its entire customer base. The project includes (1) implementing two-way communication and utility applications to enable customers to view their electricity consumption at their convenience through the customer web portal, and (2) implementing time-based rate programs that allow customers to better manage their electricity usage and costs.

City of Glendale, California: AMI Smart Grid Initiative

States: California

Total Project Cost: $51,302,105

Category: AMI, CS, EDS

Federal Funding: $20,000,000

The City of Glendale's Advanced Metering Infrastructure (AMI) Smart Grid Initiative involves system-wide deployment of advanced meters, use of customer systems and in-home displays, installation of distribution automation equipment systems, and management of distributed energy storage. The project aims to reduce peak loads, overall electricity use, and operations and maintenance costs while increasing distribution system efficiency and reliability. The project implements secure wireless communications to (1) allow customers to view their electricity consumption through web portals and displays at any time and (2) allow Glendale to manage, measure, and verify targeted demand reduction during peak periods. In addition to the AMI deployment, Glendale is upgrading selected circuits with distribution automation equipment to improve operational efficiency as well as system reliability.

City of Leesburg, Florida:
Leesburg Smart Grid Investment Grant Project

States: Florida

Total Project Cost: $19,497,625

Category: AMI, CS, EDS

Federal Funding: $9,748,812

The City of Leesburg's (Leesburg) SGIG project involves a city-wide deployment of advanced metering infrastructure (AMI), new customer systems, and expansion of distribution automation capabilities. Leesburg is providing consumer education to help customers use the new devices and usage information to their full potential. The project also automates and increases the efficiency of portions of the electric distribution system through the deployment of automated voltage capacitors and regulators, fault indicators, and automated reclosers. These devices improve power quality, reduce line losses, and reduce the duration and number of customers affected by power outages.

City of Naperville, Illinois:
City of Naperville Smart Grid Initiative

States: Illinois

Total Project Cost: $21,988,220

Category: AMI, CS, EDS

Federal Funding: $10,994,110

The City of Naperville (Naperville) Smart Grid Initiative involves a city-wide deployment of an advanced metering infrastructure (AMI) and an expansion of distribution automation capabilities, which includes circuit switches, remote fault indicators, and smart relays. Customers are allowed to purchase devices that assist in managing electricity use and costs, including in-home displays, programmable communicating thermostats, and direct load control devices for participation in load management programs. This project allows (1) participants to view their energy use through in-home displays, a web portal, or both; and (2) Naperville to manage, measure, and verify targeted demand reductions during peak periods. The new AMI and distribution automation technologies are intended to help improve service quality and reliability by enabling outage management, distribution circuit monitoring, and automated circuit switching.

City of Quincy, Florida: Smart Grid Project

States: Florida

Total Project Cost: $4,942,082

Category: AMI, CS

Federal Funding: $2,471,041

The City of Quincy, Florida, (Quincy) smart grid project involves the installation of new smart meters, supporting communication infrastructure, and advanced service programs for customers across its entire customer base. The project includes 1) implementing two-way communication and utility applications to enable customers to view their energy consumption at their convenience through the customer's web portal, 2) deploying monitoring devices, supervisory control and data acquisition (SCADA) and load control systems to Quincy's distribution system, and 3) adding demand response programs to all customer classes, including programmable communicating thermostats capable of cycling air conditioning units with no manual intervention.

City of Ruston, Louisiana: Advanced Metering Infrastructure and Smart Grid Development Program

States: Louisiana

Total Project Cost: $9,168,000

Category: AMI, CS, EDS

Federal Funding: $4,331,650

The City of Ruston's Advanced Metering Infrastructure and Smart Grid Development Program includes smart meters, distribution automation equipment, building energy management pilot programs, and an electric vehicle charging station demonstration pilot. The project is installing smart meters for all 10,125 customers served by the City of Ruston. The smart meter program enhances customer control of electricity costs, reduces customer costs, and improves peak-load conditions on the distribution system. New automation equipment is being installed for all circuits of the City of Ruston's distribution grid. The equipment automatically adjusts voltage levels and averts power disturbances. The City of Ruston expects to reduce electricity line losses, improve system reliability, reduce operations and maintenance costs, and lower vehicle emissions.

City of Tallahassee, Florida: Full-Scale Implementation of Automated Demand Response

States: Florida

Total Project Cost: $19,869,787

Category: CS, EDS

Federal Funding: $8,890,554

The City of Tallahassee's automated demand response project involves the deployment of customer systems, load control programs, and distribution automation equipment. The City of Tallahassee is installing customer systems and programs to provide consumers with information, choices, and technologies to better manage their electricity costs while reducing distribution system peak demand and correlated pollution and cost impacts. Distribution projects include deployment of a communications network and automated devices, and upgrade of the distribution management system (DMS), which enables interoperability with existing and new devices. The City of Tallahassee expects distribution automation to improve the reliability of electric service and to enhance monitoring and optimizing distribution system conditions when demand response events are initiated.

City of Wadsworth, Ohio: Connected Grid Project

States: Ohio

Total Project Cost: $10,823,539

Category: AMI, CS, EDS

Federal Funding: $5,411,769

The City of Wadsworth's (Wadsworth) Connected Grid project involves system-wide deployment of advanced metering infrastructure (AMI) and targeted installation of in-home displays, home area networks, programmable communicating thermostats, load control devices, and distribution automation equipment. The smart meters provide two-way communication, allowing customers to view their energy use and Wadsworth to better monitor customer demand. Load control devices and programmable communicating thermostats help Wadsworth manage its peak load and reduce electricity costs for customers. Wadsworth is also upgrading and expanding its distribution automation equipment, including installation of automated reclosers (circuit switches) and capacitor bank controls. This is expected to improve reliability, reduce operations and maintenance costs, and decrease distribution energy losses.

Cleco Power LLC: Advanced Metering Infrastructure Project

States: Louisiana

Total Project Cost: $69,026,089

Category: AMI

Federal Funding: $20,000,000

Cleco Power's (Cleco) advanced metering infrastructure project involves the deployment of smart meters, new metering communications infrastructure, and a meter data management system. All of Cleco's residential, commercial, and small industrial customers are receiving new meters. The project implements two-way communication and utility applications to (1) automate meter reading and service activities, (2) identify and respond to customer outages more efficiently, and (3) develop a backbone for future customer systems, advanced electricity service options, and possible time-based rate programs.

Cobb Electric Membership Corporation: Cobb EMC Smart Grid Program

States: Georgia

Total Project Cost: $33,787,672

Category: AMI, CS

Federal Funding: $16,893,836

The Cobb Electric Membership Corporation (Cobb EMC) project includes the installation of a fully integrated advanced metering system across the service territory. The installation includes smart meters, enhanced communications infrastructure and availability of in-home displays and direct load control devices. The project aims to reduce peak electricity demand, overall energy usage, outage durations, and operations and maintenance costs. The project implements two-way communication and utility applications to (1) allow customers to view their energy consumption at their convenience through the customer web portal and in-home displays, (2) allow Cobb EMC to manage, measure, and verify targeted demand reduction, and (3) provide the utility with automated notifications indicating the scope and location of customer outages.

Connecticut Municipal Electric Energy Cooperative: Connecticut Municipal Electric Energy Cooperative Smart Grid Project

States: Connecticut

Total Project Cost: $18,376,100

Category: AMI, CS

Federal Funding: $9,188,050

The Connecticut Municipal Electric Energy Cooperative project (ConnSMART Program) involves the deployment of advanced metering and multiple pilot programs to introduce dynamic pricing to the customers of the four participating municipal utilities (Groton Utilities, Jewett City Department of Public Utilities, Norwich Public Utilities, and South Norwalk Electric and Water). The program aims to reduce customer electricity costs, peak demand, and utility operating costs. The program deploys about 22,000 smart meters and advanced metering infrastructure (AMI) communication networks to (1) allow customers to view their energy consumption at their convenience through an energy web portal and/or an in-home display, and (2) allow the participating utilities to manage, measure, and verify targeted demand reductions during peak periods. The communication and data management systems are aimed to provide enhanced wholesale power purchasing and forecasting capabilities and, ultimately, a reduction in the cost of service for customers.

Consolidated Edison Company of New York, Inc.: Smart Grid Deployment Project

States: New Jersey, New York

Total Project Cost: $272,341,798

Category: EDS

Federal Funding: $136,170,899

The Consolidated Edison Company of New York, Inc. (Con Edison) Smart Grid Deployment project involves the deployment of smart grid systems and components to enhance electric distribution planning and operations. It is aimed at reducing operations and maintenance costs and deferring distribution capacity investments while increasing distribution system efficiency, reliability, and power quality. The project is deploying various types of distribution automation equipment such as substation and circuit monitors, automated switches, and capacitor automation devices on 850 circuit lines to improve operational efficiency and control. When combined with the integration of distribution management systems and supervisory control and data acquisition (SCADA) systems, the automated devices allow Con Edison to better control its distribution system and improve the reliability of its electricity service.

Cuming County Public Power District: Smart Grid Project

States: Nebraska

Total Project Cost: $3,749,988

Category: EDS

Federal Funding: $1,874,994

The Eastern Nebraska Public Power District Consortium's (Consortium) Smart Grid Initiative includes wireless communications, supervisory control and data acquisition (SCADA) software, distribution automation software, intelligent reclosers and controls, automated regulator controls, and irrigation load control devices. The project implements two-way communications, SCADA, and distribution automation applications to allow the Consortium to (1) automate substations, (2) integrate new distribution automation equipment, (3) provide increased system visibility for customer outages, and (4) reduce operations and maintenance costs. Existing irrigation load control devices for the Cuming County Public Power District are being upgraded, enhancing demand response and peak load reduction capabilities.

Denton County Electric Cooperative d/b/a CoServ Electric: Smart Grid Project

States: Texas

Total Project Cost: $40,966,296

Category: AMI, CS, EDS

Federal Funding: $17,205,844

The Denton Country Electric Cooperative (CoServ Electric) advanced metering project involves the installation of advanced metering infrastructure (AMI) throughout CoServ Electric's service territory and explores the application of distribution automation and customer systems. The project is aimed at improving customers' understanding of their electricity usage, reducing operations and maintenance costs, and improving awareness of and response to distribution system outages. The project implements two-way communications to (1) provide customers with more timely electricity usage information, (2) identify when and where outages are occurring, and (3) demonstrate the performance of select distribution automation, load management, and customer systems equipment.

Detroit Edison Company: SmartCurrents

States: Michigan

Category: AMI, CBS, CS, EDS

Total Project Cost: $169,133,271

Federal Funding: $83,828,878

Detroit Edison's (DTE) SmartCurrents project includes deployment of distribution automation assets, advanced metering infrastructure (AMI), and various customer systems. Distribution automation includes 55 circuits and 11 substations upgraded with automated switches and monitors a volt ampere-reactive (VAR) control. AMI includes 600,000 smart meters with customer systems including in-home displays, smart appliances, and programmable communicating thermostats. A time-based rate program pilot will assess demand response and customer acceptance. Overall, the project improves distribution system reliability, operational efficiency, and power quality, and assists customers to make more informed decisions about electricity usage to control costs and bills.

Duke Energy Business Services LLC: Duke Energy Smart Grid Deployment

States: Indiana, Kentucky, Ohio, North Carolina, South Carolina

Category: AMI, CS, EDS

Total Project Cost: $688,480,400

Federal Funding: $200,000,000

Duke Energy's (Duke) overall Smart Grid Program began in 2008 and includes the development and implementation of a comprehensive end-to-end solution that transforms its five-state electric system (Indiana, Kentucky, North Carolina, Ohio, and South Carolina) and leads to "beyond the meter" products and services that increase the consumer's role in reducing energy use and carbon emissions. Duke's Smart Grid Deployment project, a part of the Smart Grid Program, includes advanced metering infrastructure (AMI) and distribution automation systems in five states. The project involves large-scale deployments of AMI and distribution automation in Ohio and Indiana, a pilot deployment of AMI and distribution automation in Kentucky, and deployment of distribution automation in North and South Carolina. The project includes pilot programs for electricity pricing including time-of-use rates, peak-time rebates, and critical-peak pricing. Customers in these pilot programs use home area networks, web portals, and direct load control devices to reduce their electricity consumption and peak demand. In December 2008, Duke received a state regulatory order to proceed with this effort in Ohio and continues to work with the other states for similar approval.

Duke Energy Carolinas, LLC:
PMU Deployment in the Carolinas with Communication System Modernization

States: North Carolina, South Carolina

Total Project Cost: $7,855,797

Category: ETS

Federal Funding: $3,927,899

Duke Energy's (Duke) Phasor Measurement Unit (PMU) Deployment in the Carolinas with Communication System Modernization project upgrades the existing serial-based communications infrastructure across the Carolinas. This project includes the installation of PMUs and phasor data concentrators. An update to the existing energy management systems will be performed, along with visualization software to provide enhanced situational awareness for grid operators. Fifty-one substations across the Carolinas, at the 230 kV and 500 kV levels, are targeted to have the communications upgrade, and approximately two PMUs are planned per substation. PMUs provide high-resolution monitoring that improves grid operators' ability to visualize and manage the transmission system, improving reliability and grid operations.

EPB:
Smart Grid Project

States: Georgia, Tennessee

Total Project Cost: $226,707,000

Category: AMI, CS, EDS

Federal Funding: $111,567,606

EPB's smart grid project involves the installation of advanced metering systems and communications infrastructure. The project installs automated distribution grid equipment expected to enhance the reliability and quality of electric service delivery. The project implements two-way communications and metering expected to 1) enable customers to view their energy consumption at their convenience through systems such as web portals, 2) provide time-based rate programs to customers, 3) provide information and tools to improve outage management, and 4) reduce operations and maintenance costs.

El Paso Electric: Smart Grid Project

States: New Mexico, Texas

Category: EDS

Total Project Cost: $2,196,187

Federal Funding: $1,014,414

El Paso Electric Company's (El Paso) distribution automation project involves installation of new switches, relays, reclosers, fault locators, and sensors to address two needs: 1) the Van Horne phase involves faster restoration for customers served by a radial transmission line that is subject to outages during bad weather, and 2) the Santa Teresa phase involves improving distribution service to a relatively isolated group of industrial and residential customers. The equipment installed as part of this project provides automated reaction to system outages, allowing for more rapid response to grid disturbances. A communications system integrates real-time data from grid monitors with the grid operator's distribution management software platform. El Paso expects these upgrades to improve reliability and power quality and reduce truck rolls for grid maintenance, operating costs, and emissions.

Entergy New Orleans, Inc.: Smart Grid Project

States: Louisiana

Category: AMI, CS

Total Project Cost: $10,306,668

Federal Funding: $4,996,968

Entergy New Orleans' (ENO) advanced metering infrastructure (AMI) pilot program includes smart meters, in-home displays, programmable communicating thermostats, and web portals for low-income customers. The pilot project evaluates customer acceptance and the impacts of peak-time rebates, air conditioning load controls, and enabling technologies on customer electricity usage and peak demands. ENO is working with local community outreach organizations to help solicit and enroll low-income customers in the pilot programs.

Entergy Services, Inc.: Deployment and Integration of Synchrophasor Technology

States: Louisiana

Total Project Cost: $9,222,402

Category: ETS

Federal Funding: $4,611,201

Entergy's Deployment and Integration of Synchrophasor Technology project is deploying phasor measurement units (PMUs), phasor data concentrators (PDCs), and state-of-the-art decision support tools across Louisiana, Mississippi, Arkansas, and non-ERCOT (Electric Reliability Council of Texas) portions of east Texas. These capabilities will enhance grid visibility of the bulk power system in near-real time, enable detection of disturbances that may produce instabilities or outages, and facilitate sharing of information with neighboring regional control areas. Additionally, the project will focus on training and education throughout the operations and engineering groups at Entergy to provide the foundational learning required to implement these advanced tools.

FirstEnergy Service Corporation: Smart Grid Modernization Initiative

States: Ohio, Pennsylvania

Total Project Cost: $114,940,274

Category: AMI, CBS, CS, EDS

Federal Funding: $57,470,137

FirstEnergy's Smart Grid Modernization Initiative includes deployment of advanced metering infrastructure (AMI), distribution automation assets, time-based rate programs, load control, and customer systems in New Jersey, Ohio, and Pennsylvania. AMI for residential and commercial customers enables two-way communication and helps customers manage energy use and bills. Distribution automation includes capacitor and regulator controls and circuit switches. Direct load control devices are being deployed to reduce peak demand. The project also includes a statistically rigorous consumer behavior study to assess load impacts and customer acceptance of time-based rate programs.

Florida Power & Light Company: Energy Smart Florida

States: Florida

Total Project Cost: $578,963,314

Category: AMI, CS, ETS

Federal Funding: $200,000,000

The Florida Power and Light (FPL) project is deploying advanced metering infrastructure (AMI), distribution automation, new electricity pricing programs, and advanced monitoring equipment for the transmission system. AMI supports two-way communication between FPL and its three million consumers receiving smart meters associated with the DOE grant, providing detailed information about electricity usage and the ability to implement new electricity pricing programs. New distribution automation devices expand the functionality of FPL's distribution system to increase reliability, reduce energy losses, and reduce operations and maintenance costs. Synchrophasor and line monitoring devices help increase the reliability and security of the transmission system.

Georgia System Operations Corporation: Energy Management Infrastructure Project

States: Georgia

Total Project Cost: $12,913,003

Category: ETS

Federal Funding: $6,456,501

The Georgia System Operations Corporation's (GSOC) Energy Management Infrastructure project involves upgrades to the transmission operations communications and control system, along with new analysis tools for grid operators. GSOC is upgrading the software and hardware platform for their energy control system, which is used to manage the operation of their transmission system and the dispatch of generation resources. Advanced analysis software is also being implemented for improved monitoring, planning, and electricity cost analysis. GSOC expects enhanced transmission planning to reduce the need for ancillary services. GSOC also expects greater accuracy in allocating costs for transmission services. Reductions in generation costs are expected as a result of more efficient dispatch of resources.

Golden Spread Electric Cooperative, Inc.: Smart Grid Project

States: Texas

Category: AMI, CS, EDS

Total Project Cost: $43,157,788

Federal Funding: $17,263,115

The Golden Spread Electric Cooperative, Inc. (GSEC) smart grid project deploys advance metering and distribution automation to 10 of its 16 member distribution cooperatives (co-ops). Each member co-op designed and planned its project to address specific challenges and achieve benefits. In general, the co-op projects aim to reduce customer electricity costs, peak demand, and operations costs while improving distribution reliability. The GSEC project deploys about 81,785 smart meters in total and advanced communication networks to (1) allow select customers to view their electricity usage through a web portal and/or in home display, (2) allow participating co-ops to manage, measure, and verify targeted reductions during peak periods, and (3) reduce operations and maintenance costs by automating meter reading and service tasks.

Guam Power Authority: Smart Grid Project

States: Guam

Category: AMI, CS, EDS

Total Project Cost: $33,207,014

Federal Funding: $16,603,507

The Guam Power Authority's (GPA) smart grid project involves a territory-wide deployment of advanced metering infrastructure (AMI) and implementation of distribution and substation automation equipment, which includes circuit switches, capacitors, voltage regulators, fault indicators, smart relays, and equipment sensors. Customers can install devices that assist in managing electricity use and costs, including in-home displays and home area networks. The new AMI and distribution automation technologies are intended to improve reliability and stability of GPA's electric system, reduce operating costs, and accommodate future deployment of distributed generation.

Hawaiian Electric Company: East Oahu Switching Project

States: Hawaii

Category: EDS

Total Project Cost: $13,387,881

Federal Funding: $5,347,598

Hawaiian Electric Company's East Oahu switching project involves the installation of automation equipment for a key part of the utility's distribution grid, coupled with upgrades to the control and communications platform for grid operators. The distribution automation involves upgrades in eastern Oahu near Honolulu, with 8 of the company's 146 overall substations receiving new supervisory control and data acquisition (SCADA) equipment and software. A new automated switch for a 46-kV sub-transmission line, along with a communication and monitoring system, integrates the new automated distribution equipment with the existing grid. Projected benefits include more precise and timely responses to outages, enhanced distribution system reliability, and the reduction of operations and maintenance costs.

Honeywell International, Inc.: Full-Scale Implementation of Automated Demand Response

States: Massachusetts

Category: CS

Total Project Cost: $22,768,726

Federal Funding: $11,384,363

Honeywell is demonstrating, on a utility program scale, commercial acceptance of automated demand response (autoDR) working with Southern California Edison (SCE) and Pacific Gas and Electric Company (PG&E). Honeywell is providing a turnkey utility-style program effort to sign up and implement technology for commercial and industrial customers whose average electric load exceeds 200 kW. Large-scale customer adoption of autoDR enables SCE and PG&E to initiate and automatically execute customized load shedding and other strategies in response to peak load event notifications or price signals. Honeywell provides all aspects of customer delivery for the autoDR program, including customer audits, installation of customer-sited automated load control devices, and recommendations for optimal demand response strategies. This project coincides with the California utilities' adoption of critical peak pricing (CPP). CPP is a mandatory tariff for new large commercial customers that will push electricity rates approximately 10 times higher during high electric demand days, but offers customers a lower daily rate for non-critical peak days.

Idaho Power Company: IPC Smart Grid Program

States: Idaho, Oregon

Category: AMI, CS, ETS

Total Project Cost: $94,000,000

Federal Funding: $47,000,000

Idaho Power Company's (IPC) Smart Grid Program includes customer systems, advanced metering infrastructure (AMI), distribution automation, and advanced monitoring equipment for the transmission system. The AMI and customer systems portions provide 475,000 smart meters to nearly all of IPC's residential and commercial customers. Enhanced billing and on-line energy monitoring systems provide detailed energy use information to help customers better manage their consumption and bills. Smart meters enable IPC to increase its offering of existing time-of-use rates aimed at lowering customer electricity costs in addition to lowering peak load. Peak load is also managed through direct load control devices on participating customers' irrigation systems. IPC is implementing automated circuit switches in Pocatello, Idaho, to improve the reliability of its distribution system. To improve transmission system visibility, IPC is installing phasor measurement units, which increase monitoring capabilities and improve reliability. Advanced applications include enhanced forecasting of renewable generation and short-term demand enabling improved load and generation balancing as renewable power supplies are added to the system.

Indianapolis Power and Light Company: Smart Energy Program

States: Indiana

Category: AMI, CS, EDS

Total Project Cost: $48,900,000

Federal Funding: $20,000,000

Indianapolis Power and Light Company's (IPL) Smart Energy Program is deploying distribution automation, advanced metering infrastructure (AMI), and customer systems assets to improve the operational efficiency of its distribution systems. Distribution automation assets include automated controls, relays, and reclosers, which are used to reduce operations and maintenance costs and restoration times. AMI assets include 10,400 smart meters, and customer systems include programmable communicating thermostats. Through pilot programs, IPL is determining best practices for peak demand management through pricing and the impacts of new technologies including electric vehicles and charging stations.

Iowa Association of Municipal Utilities: Smart Grid Thermostat Project

States: Iowa

Category: AMI, CS

Total Project Cost: $12,531,203

Federal Funding: $5,000,000

The Iowa Association of Municipal Utilities (IAMU) Smart Grid Thermostat Project involves the deployment of advanced metering and customer systems for five participating municipal utilities. The project aims to reduce customer electricity costs, peak demands, and utility operating costs. The project deploys about 5,450 smart meters, 13,800 programmable communicating thermostats, and direct load control devices to (1) allow customers to view and control their energy consumption at their convenience through a web portal, and (2) allow the participating utilities to manage, measure, and verify targeted demand reductions during peak periods.

ISO–New England: Synchrophasor Infrastructure and Data Utilization in the ISO New England Transmission Region

States: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

Category: ETS

Total Project Cost: $18,087,427

Federal Funding: $7,993,714

ISO–New England (ISO-NE) and seven of its transmission owners are installing synchrophasor and phasor data concentrator (PDC) devices across the six states in the New England control area. These devices, in conjunction with a set of new applications, enable further improvements to the transmission grid's reliability and prevent the spread of local disturbances to neighboring regions through enhanced monitoring capabilities and increased situational awareness. This project deploys phasor measurement units (PMUs), PDCs, and communication infrastructure in New England. Advanced transmission software determines real-time grid stability margins. This technology increases grid operators' visibility of bulk power market conditions in near-real time, enables earlier detection of disturbances that could result in instabilities or outages, and facilitates sharing of information with neighboring regional control areas. Access to better system operating information allows ISO-NE engineers to improve power system models and analytical techniques, enhancing the overall reliability of the ISO-NE system.

Jacksonville Electric Authority: Smart Energy Project

States: Florida | Total Project Cost: $26,204,891

Category: AMI, CS | Federal Funding: $13,031,547

Jacksonville Electric Authority's (JEA) Smart Energy project involves the installation of smart meters, supporting communication infrastructure, and advanced electric service programs for customers. A limited number of customers are receiving new smart meters that can more precisely monitor real-time electricity usage. A new communications system transfers customer data to the utility, where upgraded software platforms analyze and present the data to grid operators. The meters eliminate the need for truck visits for meter reading, reduce costs and emissions, and enable the development of new electric service program offerings for customers. This project, which includes a web portal and voluntary time-of-use rate programs, increases customers' control of their electricity use and costs.

Knoxville Utilities Board: Knoxville Smart Grid Community Project

States: Tennessee | Total Project Cost: $9,356,989

Category: AMI, CS, EDS | Federal Funding: $3,585,022

The Knoxville Smart Grid Community project includes the deployment of advanced metering infrastructure (AMI) infrastructure and distribution automation assets. The project aims to reduce costs for operations, maintenance, and electricity through reduced meter reading expenses, faster outage detection, and improved peak load management. It is also aimed at increasing distribution system efficiency, reliability, and power quality. Better power quality and reactive power management are being addressed with fault current indicators and volt ampere-reactive (VAR) control at substations. Furthermore, the Knoxville Utilities Board is collaborating with the University of Tennessee to analyze the metering and distribution data.

Lafayette Consolidated Government, Louisiana: Smart Grid Project

States: Louisiana

Total Project Cost: $23,260,000

Category: AMI, CS, EDS, ETS

Federal Funding: $11,630,000

The Lafayette Consolidated Government's Lafayette Utilities System (LUS) smart grid project involves the deployment of advanced metering infrastructure (AMI), distribution automation equipment, and advanced monitoring equipment for the transmission system. LUS expects the smart meters to reduce meter reading costs, lower vehicle emissions through fewer truck rolls, and enable advanced electric services for its customers. These services include an enhanced web portal and introduction of time-based rate programs. A network of new transmission and distribution assets provides improved reliability, reduced grid operations and maintenance costs, reduced outage duration, reduced peak loads, and reduced overall energy usage across LUS's service territory.

Lakeland Electric: Smart Grid Project

States: Florida

Total Project Cost: $35,078,152

Category: AMI, CBS, CS

Federal Funding: $14,850,000

Lakeland Electric's (Lakeland) Smart Grid Initiative includes smart meters, time-based rate programs, advanced customer service options, and communications infrastructure. The project implements two-way communications and metering expected to (1) enable customers to view their energy consumption at their convenience through in-home displays and a web portal, (2) provide time-based rate programs to customers, (3) provide information and tools to improve outage management, and (4) reduce distribution operations and maintenance costs.

M2M Communications: Smart Grid Project

States: California, Idaho

Total Project Cost: $4,343,421

Category: CS

Federal Funding: $2,171,710

The M2M Agricultural Load Control Program in California's Central Valley project includes the deployment of a voluntary demand response program and customer devices for agricultural customers. The program operates in the service territories of Pacific Gas & Electric and Southern California Edison. M2M is installing direct load control devices for irrigation and food processing facilities, along with enhanced communications infrastructure and energy web portals. M2M also provides analytics and software for bidding into the California Independent System Operator (CAISO) demand response market. The project aims to reduce peak electricity demand and overall energy usage during the growing season. The project implements two-way communications and automated demand response applications to (1) allow customers to view and manage their energy consumption at their convenience through the customer web portal, and (2) allow M2M to manage, measure, aggregate, and verify targeted demand reduction.

Madison Gas and Electric Company: Smart Grid Project

States: Wisconsin

Total Project Cost: $11,101,882

Category: AMI, EDS

Federal Funding: $5,550,941

The Madison Gas and Electric Company's (MGE) project, Customer-Driven Design of Smart Grid Capabilities, involves installation of advanced metering infrastructure (AMI), deployment of a new distribution management system, and installation of electric vehicle charging stations. These activities help improve efficiency, reliability, and service for MGE customers. Within MGE's service territory, the following are receiving advanced meters: all medium- to large-size commercial and industrial customers, randomly selected residential customers, and randomly selected small business customers. A cellular communications system remotely relays customer energy use data to MGE, where upgraded software uses this data for billing and other operational needs. MGE is installing a new distribution management software platform that improves analysis capabilities and overall system reliability. Under a pilot project, MGE is also installing electric vehicle charging stations and 25 home charging tracking points to study the impact of electric vehicle use on the grid and home-based energy demand.

Marblehead Municipal Light Department: Integrated AMI System with Real-Time Pricing Pilot Program

States: Massachusetts

Total Project Cost: $2,692,350

Category: AMI, CBS, CS

Federal Funding: $1,346,175

The Marblehead Municipal Light Department (MMLD) project involves town-wide installation of a fully integrated advanced metering system and a pilot program to assess effectiveness of time-based rate programs and automated load management. The project is aimed at reducing peak electricity demand, overall energy use, and operations and maintenance costs while increasing distribution system efficiency, reliability, and power quality. The project implements two-way communication to (1) allow customers to view their energy consumption at their convenience through an energy web portal, and (2) allow MMLD to manage, measure, and verify targeted demand reductions during peak periods. The project also includes a study of consumer behavior in response to a critical peak pricing service option.

Memphis Light, Gas and Water Division: Implementation of Smart Grid Technology in a Network Electric Distribution System

States: Tennessee

Total Project Cost: $13,112,363

Category: EDS

Federal Funding: $5,063,469

Memphis Light, Gas, and Water Division's (Memphis's) project implements smart grid technology in a network electric distribution system. The project includes new intelligent relays and sensor equipment to provide remote switching at the transformer level and information to aid in the design, operation, and preventive maintenance of this complex electric system. The project is deploying a fiber optic communications system that integrates real-time data from grid monitors with the grid operator's distribution management software platform. Memphis expects these upgrades to reduce restoration times and the need for truck rolls for grid maintenance, improving reliability and reducing operating costs and pollutant emissions.

Midwest Energy Inc.: Smart Grid Project

States: Kansas

Category: ETS

Total Project Cost: $1,424,514

Federal Funding: $712,257

Midwest Energy (Midwest) is deploying new smart relays at its Knoll transmission substation. These relays include synchrophasor measurement technologies that can increase grid operators' visibility of bulk power system conditions in near-real time, enable earlier detection of problems that threaten grid stability or cause outages, and facilitate sharing of information with neighboring control areas. Having access to better system operating information allows Midwest to improve power system models and analysis tools, increasing reliability of grid operations.

Midwest Independent System Transmission Operator: Midwest ISO Synchrophasor Deployment Project

States: Idaho, Illinois, Indiana, Michigan, Minnesota, Missouri, Montana, North Dakota, Ohio, Pennsylvania South Dakota, Wisconsin

Category: ETS

Total Project Cost: $34,543,476

Federal Funding: $17,271,738

The Midwest Independent Transmission System Operator (Midwest ISO) is deploying synchrophasor technology throughout its service footprint. Midwest ISO's primary objective is to use the technology to optimize the dispatch and operation of power plants while improving the reliability of the bulk transmission system. This project deploys phasor measurement units (PMUs), phasor data concentrators, and advanced transmission software applications. This technology increases the visibility of grid operators' bulk power system conditions in near-real time, enables earlier detection of conditions that could result in grid instability or outages, and facilitates information sharing with neighboring regional control areas. Access to better system operating information allows Midwest ISO engineers to improve power system models and analytical techniques, improving the overall reliability and operating efficiency of the Midwest ISO system.

Minnesota Power: Smart Grid Advanced Metering Infrastructure Project

States: Minnesota

Total Project Cost: $3,088,008

Category: AMI, CBS, EDS

Federal Funding: $1,544,004

Minnesota Power's Smart Grid Advanced Metering Infrastructure Project involves the installation of advanced metering infrastructure (AMI) and explores the application of distribution automation. The project is aimed at improving customer understanding of their electricity usage, reducing operations and maintenance costs, and improving awareness of and response to distribution system outages. The project implements two-way communication to (1) provide customers with more timely electricity usage information, (2) identify when and where outages are occurring, and (3) demonstrate the performance of select distribution automation equipment.

Modesto Irrigation District: Smart Grid Project

States: California

Total Project Cost: $2,986,298

Category: AMI, CS, EDS

Federal Funding: $1,493,149

The Modesto Irrigation District's (MID) Smart Deployment and Installation Project involves installation of smart meters, implementation of customer interface systems, and automation of distribution substations. The smart meter deployment covers the Mountain House Development, a single isolated area with 3,348 customer sites. The project includes a web portal to enable the customers to monitor their electricity consumption and costs. The project aims to reduce peak demand, system-wide losses, outage duration, and frequency, while improving voltage control. The smart meters and web portal allow MID to consider implementation of time-based rate programs in the future.

Municipal Electric Authority of Georgia: MEAG Smart Grid Distribution Automation Project

States: Georgia

Total Project Cost: $24,534,700

Category: EDS, ETS

Federal Funding: $12,267,350

The Municipal Electric Authority of Georgia (MEAG) project involves the implementation of information technology infrastructure to manage new automated or remotely controlled equipment deployed in the electric distribution system. This project aims to reduce operating and maintenance costs, while improving reliability of the transmission and distribution assets owned and operated by MEAG. The communication systems and automation equipment being deployed within MEAG's distribution substations reduce the frequency of system failures and associated maintenance activities. Furthermore, the new information technology infrastructure established as a result of this project supports future deployments of distribution automation and advanced metering infrastructure (AMI) by municipal utilities served by MEAG. This project also implements remotely controlled motor operators to operate transmission switches, which reduces operations cost and improves outage response time.

Navajo Tribal Utility Authority: Smart Grid Project

States: Arizona, New Mexico, Utah

Total Project Cost: $10,611,849

Category: AMI

Federal Funding: $4,991,750

The Navajo Tribal Utility Authority's (NTUA) advanced metering infrastructure (AMI) project deploys 28,000 residential smart meters and supporting communications and information technologies. The project provides automated meter reading, improved outage detection and response, power quality monitoring, and tamper detection capabilities. The communications system relays customer electricity data to NTUA, where the new meter data management system helps NTUA leverage the data to better manage peak demand, which results in reduced system-wide capacity needs, electrical losses, and operations and maintenance costs.

New Hampshire Electric Cooperative, Inc.: Communications Systems Infrastructure/Automated Metering Infrastructure

States: New Hampshire

Category: AMI, CS

Total Project Cost: $35,144,946

Federal Funding: $15,815,225

The New Hampshire Electric Cooperative, Inc. (NHEC) Communications Systems Infrastructure/ Automated Metering Infrastructure project involves the installation of two-way voice and data communications infrastructure to support smart metering systems for over 80,000 members located throughout New Hampshire. The project will assist NHEC's members by providing them usage information and the option to participate in time-based rate programs for managing electricity consumption and associated costs. In addition, NHEC expects to use the new systems to improve outage detection, response time, and tamper detection, as well as reducing operations and maintenance costs.

New York Independent System Operator, Inc.: New York Capacitor/Phasor Measurement Project

States: New York

Category: ETS

Total Project Cost: $75,710,733

Federal Funding: $37,828,825

New York Independent System Operator (NYISO) and eight transmission owners are deploying synchrophasor technologies and smart grid-enabled capacitors across the New York transmission system. The project aims to improve the reliability of the transmission grid and prevent the spread of local outages to neighboring regions through enhanced monitoring capabilities. The transmission owner partners in this project are deploying phasor measurement units (PMUs) and phasor data concentrators (PDCs). New transmission capacitor banks increase the ability of grid operators to regulate transmission voltage. Advanced transmission software determines real-time grid stability margins. These systems increase grid operator visibility of bulk power system conditions in near-real time, enable earlier detection of disturbances that could result in instabilities or outages, and facilitate sharing of information with neighboring regional control areas. Access to better system operating information helps NYISO engineers to improve power system models and analytical techniques, and improve the overall reliability of the NYISO system.

Northern Virginia Electric Cooperative: Electric Distribution System Automation Program

States: Virginia

Total Project Cost: $10,000,000

Category: EDS

Federal Funding: $5,000,000

Northern Virginia Electric Cooperative's (NOVEC) Electric Distribution System Automation Program is deploying digital devices to expand automation and control systems to cover a majority of NOVEC's substations and distribution circuits. The project is also deploying a new communications network to complement the distribution system upgrades, providing more precise monitoring of grid operations. The project aims to improve system efficiencies, reduce line losses, and enhance situational awareness of the system and critical components to improve reliability and lower operating costs.

NSTAR Electric Company: Grid Self-Healing and Efficiency Expansion

States: Massachusetts

Total Project Cost: $20,123,766

Category: EDS

Federal Funding: $10,061,883

The NSTAR Electric Company (NSTAR) Grid Self-Healing and Efficiency Expansion project involves the installation of significant new equipment for automation and management of the distribution grid. A network of new and existing switches, monitors, and reclosers are installed on selected circuits to provide the grid with the capability to automatically isolate grid power disturbances and to rapidly restore functional portions of circuits. New automated distribution equipment is also being deployed by the utility as a means to better manage power fluctuations on the grid, thus improving power factor and system energy efficiency.

NV Energy, Inc.:
NV Energize

States: Nevada

Total Project Cost: $275,755,812

Category: AMI, CBS, CS

Federal Funding: $137,877,906

NV Energy's NV Energize project includes deployment of smart meters and communications infrastructure for all residential and commercial customers and pilot programs for time-based rates, advanced customer service options, and electric vehicle monitoring. The project also includes a new meter data management system (MDMS) that integrates all the smart meter data for use in system management, operations, and billing activities. An advanced demand response management system (DRMS) integrates the utility's portfolio of demand response programs and provides a link to customer service, control operations, system operations, and other functions. An energy management system links the control of the electric transmission, distribution, and generation facilities with the two distinct northern and southern Nevada balancing areas, thereby consolidating transmission and balancing operations statewide across all of NV Energy's generation fleet and grid interface points. The associated operations improvements result in reduced operations costs, fewer truck rolls, and associated reductions in emissions.

Oklahoma Gas & Electric:
Positive Energy Smart Grid Integration Program

States: Arkansas, Oklahoma

Total Project Cost: $357,376,037

Category: AMI, CBS, CS, EDS

Federal Funding: $130,000,000

The Oklahoma Gas and Electric (OG&E) program involves system-wide deployment of a fully integrated advanced metering system, distribution of in-home devices to almost 6,000 customers, and installation of advanced distribution automation systems. The program is a partnership with customers aimed at reducing peak loads, overall electricity use, and operations and maintenance costs while increasing distribution system efficiency, reliability, and power quality. The program implements secure wireless communications to 1) allow smart meter customers to view their electricity consumption data at any time through a personalized website (study participants are testing other visual displays), and 2) allow OG&E to manage, measure, and verify targeted demand reductions during peak periods. New systems capture meter information for billing and implement new customer pricing programs and service offerings. The project deploys a more dynamic distribution management system, automated switching, and integrated voltage and reactive power control (IVVC) that reduces line losses, reduces operational costs, and improves service reliability. The program also includes a study of consumer behavior in response to different forms of dynamic pricing and home area network smart technology on an opt-in basis. Finally, the program includes collaboration with University of Oklahoma faculty and students to deploy technologies within 46 buildings on the Norman, Oklahoma, campus and to take advantage of opportunities for education and training.

Pacific Northwest Generating Cooperative: Advanced Meter Infrastructure Implementation Project

States: Idaho, Montana, Nevada, Oregon, Utah, Washington

Category: AMI, CS

Total Project Cost: $39,172,987

Federal Funding: $19,576,743

The Pacific Northwest Generating Cooperative (PNGC) is implementing a project that includes 10 distribution cooperatives. The cooperatives are deploying advanced metering infrastructure (AMI) assets including smart meters and two-way communications networks. AMI enables automated meter reading, which reduces meter operation costs, fuel usage for truck rolls, and air pollution. Several of the cooperatives are deploying direct load control devices. The direct load control programs offer customers a way to lower their electricity bills and provide the utility with a tool to manage peak load.

PECO: Smart Future Greater Philadelphia

States: Pennsylvania

Category: AMI, CS, EDS

Total Project Cost: $415,118,677

Federal Funding: $200,000,000

PECO's Smart Future Greater Philadelphia project includes deployment of advanced metering infrastructure (AMI) and distribution automation assets. AMI supports new electricity pricing programs for customers and pilot programs, such as in-home devices that provide energy information and energy usage control. Distribution automation helps PECO improve service to customers and reduce energy loss by managing circuit voltages. These systems help PECO improve operational efficiency and service quality for customers.

PJM Interconnection, LLC: PJM Synchrophasor Technology Deployment Project

States: Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Virginia, West Virginia

Category: ETS

Total Project Cost: $228,203,511

Federal Funding: $13,698,091

PJM Interconnection (PJM) and 12 of its member transmission owners are deploying synchrophasor measurement devices in 81 of its high-voltage substations and are implementing a robust data collection network. This project complements existing equipment to provide the necessary information technology infrastructure and wide-area monitoring and coverage of the PJM system to support further development of more advanced applications. The project is aimed at improving electric system reliability and restoration procedures, and preventing the spread of local outages to neighboring regions. The project deploys phasor measurement units, phasor data concentrators, communication systems, and advanced transmission software applications. These devices increase grid operators' visibility of bulk power system conditions in near-real time, enable earlier detection of problems that threaten grid stability or cause outages, and facilitate information sharing with neighboring control areas. Access to better system operating information allows PJM engineers to improve power system models and analysis tools for better reliability and operating efficiency.

Potomac Electric Power Company – Atlantic City Electric Company: SGIG Distribution Automation Project

States: New Jersey

Category: CS, EDS

Total Project Cost: $37,400,000

Federal Funding: $18,700,000

The Atlantic City Electric Company's (ACE) SGIG distribution automation project is deploying distribution automation assets, direct load control devices, and a wireless communications network. Direct load control devices are being offered that provide financial incentives for customers for allowing ACE to cycle air conditioners or control thermostats during peak periods. Distribution automation devices, which include circuit monitors, equipment condition monitors, and automated circuit switches, improve the reliability and power quality of the distribution system. These systems also reduce operation and maintenance costs as well as distribution line losses.

Potomac Electric Power Company – District of Columbia: Smart Grid Project

States: District of Columbia

Total Project Cost: $89,161,098

Category: AMI, CS, EDS

Federal Funding: $44,580,549

The Potomac Electric Power Company (Pepco) smart grid project in Washington, DC, includes distribution automation, advanced metering infrastructure (AMI), and demand response programs that involve load control devices and time-based rate programs. The AMI installation is designed to provide customers and Pepco with detailed electricity usage information which, when combined with the demand response programs, helps customers reduce electricity usage and peak demand. The distribution automation deployment includes automated distribution circuit switches and transformer monitors that can improve reliability of the distribution system while decreasing operations and maintenance costs.

Potomac Electric Power Company – Maryland: Maryland Smart Grid Program

States: Maryland

Total Project Cost: $209,561,098

Category: AMI, CS, EDS

Federal Funding: $104,780,549

The Potomac Electric Power Company (Pepco)–Maryland smart grid project includes distribution automation, advanced metering infrastructure (AMI), and a demand response program that involves direct load control and time-based rate programs. The AMI installation is designed to provide customers and Pepco with detailed electricity usage information which, when combined with demand response programs, can help customers reduce their electricity usage and manage their electricity costs. The distribution automation deployment includes automated distribution circuit switches and transformer monitors that can improve reliability of the distribution system while decreasing operations and maintenance costs.

Powder River Energy Corporation: Powder River Innovation in Energy Delivery

States: Wyoming

Total Project Cost: $5,109,614

Category: EDS

Federal Funding: $2,554,807

Powder River Energy Corporation's (PRECorp) Innovation in Energy Delivery project involves the installation of new communications infrastructure for the distribution grid throughout the entire service territory in northeastern Wyoming and southeastern Montana. Three sets of upgrades include 1) the addition of new microwave terminals and antennas to the backhaul network between operators and the distribution grid, 2) upgrades that allow key substations to establish radio monitoring linkages with grid operators, and 3) new equipment that allows the computer platform for grid control to help integrate the communications upgrades. By increasing the ability of operators to remotely monitor and respond to grid disturbances, PRECorp expects improvements in electric reliability, as well as reduced operating costs and emissions owing to fewer truck rolls for site visits.

PPL Electric Utilities Corporation: PPL Smart Grid Project

States: Pennsylvania

Total Project Cost: $38,109,316

Category: EDS

Federal Funding: $19,054,800

PPL Electric Utilities Corporation's smart grid project includes new equipment to automate distribution circuits integrated through installation of new grid communications and control systems. New automation equipment is being installed at 10 distribution substations and 50 distribution circuits in the coverage area. The project focuses on upgrades in south-central Pennsylvania, largely in the vicinity of the City of Harrisburg. The distribution automation equipment enhances system reliability through better protection and faster response and isolation of outages, while simultaneously lowering costs for operations and maintenance of the system. An additional objective is to improve the voltage for delivered electricity, reducing customer usage and deferring the need for additional power generation capacity in the region.

Progress Energy Service Company: Optimized Energy Value Chain

States: Florida, North Carolina, South Carolina

Category: AMI, CS, EDS, ETS

Total Project Cost: $520,000,000

Federal Funding: $200,000,000

Progress Energy Service Company's (Progress Energy) Optimized Energy Value Chain project involves the deployment of advanced metering and distribution automation systems. The project aims at reducing peak loads, overall energy use, and operations and maintenance costs while improving distribution system efficiency, reliability, and power quality. The project implements two-way communications to (1) allow customers to view their energy consumption through a web portal, and (2) allow Progress Energy to manage, measure, and verify targeted demand reductions during peak periods. New information and communications systems capture meter data for billing and future implementation of new pricing programs and service offerings. The project includes a distribution management system, automated switching, and integrated voltage and reactive power control to reduce line losses and improve service reliability. The project involves installation of advanced transmission systems including on-line monitoring equipment on key and "at-risk" transmission substations and transformer banks. The project includes installation of up to 600 electric vehicle charging stations in the Carolinas and Florida service territories to encourage use of electric vehicles.

Public Utility District No. 1 of Snohomish County: Smart Grid Infrastructure Modernization of Electrical Distribution System

States: Washington

Category: EDS

Total Project Cost: $31,651,634

Federal Funding: $15,825,817

The Public Utility District No. 1 of Snohomish County Washington (Snohomish PUD) project involves several types of smart grid systems to enhance distribution system performance and reliability. The project includes a digital communication network covering Snohomish PUD's entire distribution system to better respond to changes in electricity demand and grid conditions. The project upgrades 42 of 85 substations with automated control capabilities to prepare the substations for full-scale deployment of distribution automation and integration of distributed energy resources. The project is deploying advanced automation equipment to 10 circuits to reduce line losses and to improve service reliability. These assets are being managed through a distribution management system, which allows Snohomish PUD to better monitor and control grid operations and conditions. These upgrades allow Snohomish PUD to reduce operations and maintenance costs and improve distribution system efficiency, reliability, and power quality.

Qualcomm Atheros, Inc.: HomePlug Green PHY Integrated Circuit Development

States: Florida

Total Project Cost: $9,109,600

Category: CS

Federal Funding: $4,554,800

Through this HomePlug Green Physical Layer (PHY) Integrated Circuit Development project ("HomePlug"), Atheros is developing a compliant power line communications (PLC) solution to support smart grid functionality in a wide range of equipment, including advanced metering infrastructure (AMI), smart meters, smart appliances, electric transportation, and home area network peripheral devices. The objectives of the project involve developing a PLC integrated circuit for use in AMI smart meters and customer systems that is fully interoperable with Institute of Electrical and Electronics Engineers (IEEE) 1901 and HomePlug equipment, reducing the material and manufacturing costs of the circuit as well as the device power consumption. With the development of this new device, Atheros is offering efficient and cost-effective home area networking connectivity options for meters and customer system providers, which reduces implementation costs for both power companies and customers.

Rappahannock Electric Cooperative: Smart Grid Initiative

States: Virginia

Total Project Cost: $31,388,194

Category: AMI, CS, EDS

Federal Funding: $15,694,097

Rappahannock Electric Cooperative's (REC) Smart Grid Initiative involves deploying smart meters, distribution system infrastructure and a communications network to support the new smart grid assets. The project is focused on the portion of REC's service territory recently acquired from Allegheny Power. As part of this project, REC is deploying smart meters throughout its service territory. Full coverage allows REC to introduce and test advanced pricing programs and a pre-pay program. The project includes a meter data management system (MDMS) to assist in managing all the increased data available from the smart meters. The project also deploys distribution automation equipment including supervisory control and data acquisition (SCADA) and automated controls on distribution voltage regulators to improve power quality, reduce line losses, and reduce operations and maintenance costs through monitoring and control of distribution voltage.

Reliant Energy Retail Services, LLC: Smart Grid Enabled Consumer Participation

States: Texas

Category: CS

Total Project Cost: $63,696,548

Federal Funding: $19,839,689

Reliant Energy Retail Services' (Reliant) Smart Grid Enabled Consumer Participation project deploys new services and market offerings for retail customers in the Electric Reliability Council of Texas (ERCOT) region. Reliant is deploying in-home energy displays, smart appliances, and new time-based rate programs to customers within the ERCOT region. Furthermore, Reliant will inform the customers about their energy usage patterns through a web portal and individualized weekly usage emails. These services and products provide Reliant's potential and existing customers with timely information and feedback about their electricity use, enabling them to optimize their energy usage and make informed choices. The project aims to provide customers with new information and services, which can lower their electricity costs and ultimately enable transmission and distribution service providers (TDSPs) and independent power producers to optimize capital investment and their business operations. Due to Reliant's position as a licensed retail energy provider within ERCOT, it will utilize the Smart Meter Texas (SMT) data exchange to obtain meter data and communicate energy usage information with the customers. The meter data is provided to the SMT data exchange by TDSPs—Oncor, CenterPoint Energy, and AEP Texas—which are currently deploying advanced metering infrastructure (AMI) throughout the ERCOT region.

Sacramento Municipal Utility District: SmartSacramento® Project

States: California

Total Project Cost: $308,406,477

Category: AMI, CBS, CS, EDS

Federal Funding: $127,506,261

Sacramento Municipal Utility District's (SMUD) SmartSacramento Project involves system-wide deployment of an advanced metering system integrated with existing enterprise and information technology systems, as well as a partial deployment of advanced distribution grid assets that equip SMUD's distribution circuits with automated control and operation capabilities. The project also involves customer systems that provide usage and cost information to customers, educating them and enabling more control over their consumption. These systems enable more informed participation by customers and more effective management by SMUD to improve reliability and efficiency of grid operations and better optimize the use of assets. The project includes a field test of plug-in electric vehicle charging stations to assess their technical performance, vehicle charging patterns, and effects on electric distribution system operations.

Salt River Project Agricultural Improvement and Power District: Advanced Data Acquisition and Management Program

States: Arizona

Total Project Cost: $114,003,719

Category: AMI, CS

Federal Funding: $56,859,359

Salt River Project Agricultural Improvement and Power District's (SRP) Advanced Data Acquisition and Management Program involves the installation of smart meters and supporting communication infrastructure, and the expansion of advanced electric service options for customers. Virtually all SRP customers are receiving new smart meters, which monitor electric consumption and power quality. A two-way communication system relays customer electricity data to the utility, where upgraded software platforms analyze and present the data. SRP expects the smart meters to reduce meter-reading costs and field service visits, lower vehicle emissions, and enable development of advanced electric services for customers. These services include a web portal and expansion of existing time-of-use rates that empower the customer and enable a lower peak demand for SRP. Charging stations for plug-in electric vehicles and transformer metering are being monitored and evaluated.

San Diego Gas & Electric Company: SDG&E Grid Communication System

States: California

Category: EDS, ETS

Total Project Cost: $59,427,645

Federal Funding: $28,115,052

San Diego Gas & Electric's (SDG&E) Grid Communication System (SGCS) project includes the installation of a fully integrated wireless communication system covering up to 90 percent of the utility's customers. The project aims to enhance reliability and reduce outage durations and operations and maintenance costs. The project implements two-way communications and applications to (1) allow SDG&E to integrate new advanced metering infrastructure and distribution automation equipment, and (2) provide increased system visibility and identify the scope and location of outages.

Sioux Valley Southwestern Electric Cooperative Inc.: SVE Smart Grid Program

States: Minnesota, South Dakota

Category: AMI, CS

Total Project Cost: $8,032,736

Federal Funding: $4,016,368

The Sioux Valley Energy (SVE) Smart Grid Program involves installation of an advanced metering system and a pilot program across the service territory to assess the effectiveness of time-based rate programs and enabling technologies. The project is aimed at reducing peak electricity demand, overall energy use, and operations and maintenance costs, while increasing distribution system efficiency and reliability. The project implements two-way communications to (1) allow customers to view their energy consumption at their convenience through a web portal and other customer systems, (2) allow SVE to manage, measure, and verify targeted demand reductions during peak periods, (3) allow SVE to evaluate the breadth of outages and restore those outages more quickly, often without the necessity of the customer calling to inform SVE of the outage, (4) perform near-real-time engineering analysis of the electric distribution system to allow for the most prudent use of capital dollars for system improvements, and (5) facilitate the installation of customer-owned distributed generation, typically renewable energy, without any additional metering costs to the customer.

South Kentucky Rural Electric Cooperative Corporation: Advanced Metering Infrastructure Deployment

States: Kentucky

Category: AMI, CS

Total Project Cost: $19,636,295

Federal Funding: $9,538,234

The South Kentucky Rural Electric Cooperative Corporation's (SKRECC) project includes the installation of a fully integrated advanced metering system across the service territory. The installation includes smart meters, enhanced communications infrastructure, in-home displays, and direct load control devices. The project implements two-way communications and utility applications to 1) allow customers to view their energy consumption at their convenience through the customer web portal and in-home displays, 2) allow SKRECC to manage, measure, and verify targeted demand reduction, 3) provide the utility with automated notifications indicating the scope and location of customer outages, and 4) reduce operational costs.

South Mississippi Electric Power Association: Advanced Metering Infrastructure and Associated Smart Grid Investments for Rural Mississippi

States: Mississippi

Category: AMI, CS, EDS

Total Project Cost: $61,318,005

Federal Funding: $30,563,967

South Mississippi Electric Power Association's (SMEPA) smart grid project involves the deployment of advanced metering infrastructure (AMI) and covers the generation and transmission (G&T) cooperative and five of its member distribution cooperatives: Coast Electric Power Association, Magnolia Electric Power Association, Pearl River Valley Electric Power Association, Southern Pine Electric Power Association, and Southwest Mississippi Electric Power Association. AMI enables two-way communication between SMEPA and its member cooperatives' substation meters and between the member cooperatives and their customers' meters for more detailed electric usage information as well as improved outage detection. Automated meter reading enables the SMEPA collaborative to improve operational efficiencies and reduce costs. Additionally, three of the member cooperatives (Magnolia, Southwest, and Pearl River Valley) are implementing supervisory control and data acquisition (SCADA) systems to enable improved reliability through increased visibility of distribution substations and circuits.

Southern Company Services, Inc.: Smart Grid Project

States: Alabama, Florida, Georgia, Mississippi

Total Project Cost: $330,130,420

Category: EDS, ETS

Federal Funding: $164,527,160

The Southern Company Services' (Southern Company) smart grid project involves integrated upgrades of the distribution, transmission, and grid management systems throughout Southern Company's large service territory. Major efforts include automation of major parts of the distribution system, automation of selected transmission lines, and new equipment for many substations. This project centers on deployment of new distribution technologies intended to improve power factor at delivery, thereby increasing the effective usability of existing electricity generation. This reduction in line losses may lead to the deferral of new generation capacity investments and associated reductions in greenhouse gas emissions. The distribution automation equipment in this project should also enhance system reliability through better protections and faster response to outages while simultaneously lowering costs for operation and maintenance of the system by human operators.

Southwest Transmission Cooperative, Inc.: Arizona Cooperative Grid Modernization Project

States: Arizona

Total Project Cost: $64,488,970

Category: AMI, CS, EDS, ETS

Federal Funding: $32,244,485

The Arizona Cooperative Grid Modernization Project upgrades electric infrastructure for three electric cooperatives in Arizona. Southwest Transmission Cooperative (SWTC) is the primary recipient of the project. The project also includes two distribution system cooperatives, Mohave Electric Cooperative (MEC) and Sulphur Springs Valley Electric Cooperative (SSVEC), which receive transmission service from SWTC. SWTC is upgrading the communications infrastructure of their transmission network by installing optical ground wire cables between several substations. The project is also installing microprocessor-based protective relays and equipment monitors. MEC is replacing thousands of existing meters in its service territory with smart meters and is expanding the communications network and power-line-carrier-based meter communications system. SSVEC is implementing advanced metering infrastructure (AMI) and distribution automation. SSVEC is expanding its existing fiber optic communication infrastructure and upgrading its monitoring software as well.

Stanton County Public Power District: Advanced Metering Infrastructure Initiative

States: Nebraska

Total Project Cost: $794,000

Category: AMI

Federal Funding: $397,000

Stanton County Public Power District's (SCPPD) Advanced Metering Infrastructure Initiative is deploying 2,315 smart meters to cover all customers in the service territory. The project provides automatic meter reading and improved outage detection and response. The project extends smart meter coverage from 453 to 2,768 meters and uses existing radio frequency and power-line-carrier communications networks for data collection.

Talquin Electric Cooperative: Smart Grid Program

States: Florida

Total Project Cost: $16,200,000

Category: AMI, CS, EDS

Federal Funding: $8,100,000

The Talquin Electric Cooperative's (TEC) project involves the installation of advanced metering, communications infrastructure, distribution automation equipment, load control devices, and other customer systems. The project implements two-way communications to (1) enable customers to view their energy consumption at their convenience through customer systems and web portals, (2) provide time-based rate programs to customers, (3) provide information and tools to improve outage management, and (4) reduce operations and maintenance costs. The project also installs automated distribution grid equipment expected to (1) enhance the reliability and quality of electric delivery, and (2) reduce operations and maintenance costs.

Town of Danvers, Massachusetts: Smart Grid Implementation Program

States: Massachusetts

Category: AMI, CS, EDS

Total Project Cost: $16,953,600

Federal Funding: $8,476,800

The Town of Danvers' Smart Grid Implementation Program includes advanced metering infrastructure (AMI) and automated distribution equipment. Smart meters and AMI for Danvers' residential, commercial, and industrial customers support time-based rate programs and a home energy network pilot. AMI is aimed at helping customers manage their energy usage, and Danvers hopes to reduce meter reading costs and air pollution by reducing the number of truck rolls for meter reading. Benefits from distribution automation include better reliability and lower line losses.

Tri-State Electric Membership Corporation: Smart Grid Project

States: Georgia, North Carolina, Tennessee

Category: AMI, CS

Total Project Cost: $2,428,454

Federal Funding: $1,138,060

Tri-State Electric Membership Corporation's (TSEMC) smart grid project involves the installation of new smart meters, supporting communication infrastructure, and advanced service programs for customers. The project implements two-way communication and utility applications to 1) enable customers to view their energy consumption at their convenience through the customer web portal, 2) provide time-based rate programs to customers, 3) provide information and tools to improve outage management, and 4) reduce operations and maintenance costs.

Vermont Transco, LLC: eEnergy Vermont

States: Vermont

Category: AMI, CBS, CS, EDS

Total Project Cost: $137,857,302

Federal Funding: $68,928,650

The Vermont Transco project, eEnergy Vermont, involves a collaboration of 20 publicly owned and investor-owned utilities in Vermont as well as Efficiency Vermont, a statewide non-profit energy efficiency organization. The project deploys advanced metering infrastructure (AMI), including approximately 300,000 smart meters across the state over three years, and provides two-way communication between customers and utilities. The project includes assessment of time-of-use and peak-time rebate programs through statistically rigorous consumer behavior studies that involve consumer web portals and in-home displays. The project also involves installation of automated voltage regulators and supervisory control and data acquisition (SCADA) equipment at selected substations, enabling better management of the distribution system and reducing operations and maintenance costs.

Vineyard Energy Project: Smart Grid Project

States: Massachusetts

Category: CS

Total Project Cost: $1,574,500

Federal Funding: $787,250

The Vineyard Energy Project's smart grid project involves the deployment of customer systems to enable real-time load measurement and management while helping customers optimize their electricity usage. The main objective is to assess the effectiveness and customer acceptance of the technologies and determine the extent to which they can help accommodate greater penetration of wind energy. Home area networks, energy management systems, direct control devices (including water heaters, air conditioners, and water pumps), and various smart appliances are integrated into the Vineyard Power Management System (VPMS) (i.e., Vineyard Power's load balancing system). The project also allows participating customers access to a web portal that allows them to view their energy usage information and to participate in adjusting the load shape to better match wind generation patterns. A supermarket implementation widely monitors energy use and connects VPMS with a temperature sensor and a load control switch in a refrigeration demand response demonstration responding to the VPMS price signal.

Wellsboro Electric Company:
Smart Choices Project

States: Pennsylvania

Category: AMI, CS

Total Project Cost: $961,195

Federal Funding: $431,625

The Wellsboro Electric Company (WECo) project involves the installation of advanced metering systems and a pilot program for in-home displays. The project is aimed at reducing overall energy use and operations and maintenance costs while improving distribution system efficiency and reliability. The project implements two-way communication to (1) allow customers to view their energy consumption at their convenience through in-home displays and energy web portals, and (2) allow WECo to monitor outages and tamper detections. Serving one of the poorest communities in Pennsylvania, WECo is planning a large energy education campaign using radio spots and informational booths to help customers use the new technologies to reduce their electricity consumption and lower their bills.

Westar Energy, Inc.:
Smart Grid Project

States: Kansas

Category: AMI, CS, EDS

Total Project Cost: $39,290,749

Federal Funding: $19,041,565

Westar Energy's SmartStar Lawrence project deploys advanced metering infrastructure (AMI), a meter data management system (MDMS), and distribution automation equipment. AMI and MDMS systems are expected to reduce operating costs, improve reliability, and enhance customer services by improving enterprise systems, including billing, outage management, and load research. The AMI and MDMS also support a customer web portal that provides energy usage and billing information for customers. Distribution automation assets include automated reclosers, capacitor automation equipment, and fault indicators to speed up restoration of service following outages and reduce energy losses through improved management of circuit voltages.

Western Electricity Coordinating Council: Western Interconnection Syncrophasor Program

States: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, South Dakota, Texas, Utah, Washington, Wyoming

Category: ETS

Total Project Cost: $107,780,000

Federal Funding: $53,890,000

The Western Electricity Coordinating Council (WECC) and eight of its member transmission owners are deploying synchrophasor devices throughout the U.S. portion of the Western Interconnection. The project aims to improve electric system reliability and restoration procedures and prevent the spread of local outages to neighboring regions. The project could also improve the grid integration of renewable resources. Phasor measurement units, phasor data concentrators, communication systems, information technology infrastructure and advanced transmission software applications are being deployed. These systems increase grid operators' visibility of bulk power system conditions in near-real time, enable earlier detection of problems that threaten grid stability or cause outages, and facilitate sharing of information with neighboring control areas. Having access to better system operating information allows WECC staff to improve power system models and analysis tools, thus improving the reliability and operating efficiency of the bulk power system.

Whirlpool Corporation: Smart Appliance Project

States: Michigan

Category: CS

Total Project Cost: $38,681,000

Federal Funding: $19,330,000

In the Smart Appliance Project, Whirlpool seeks to develop and commercialize home appliances with wireless communications and advanced control software. The objectives are to (1) develop a wireless communications protocol for home appliances, (2) design appliance control and interface software optimized for demand response and time-based rate programs, and (3) produce cost-effective communications hardware for appliances. With the development of the new appliances and systems, Whirlpool aims to provide cost-effective options for residential customers that can enhance the effectiveness of time-based rate and load management programs to reduce peak demand.

Wisconsin Power and Light Company: Smart Grid Distribution Automation

States: Wisconsin

Category: EDS

Total Project Cost: $6,378,509

Federal Funding: $3,165,704

Wisconsin Power and Light Company's (WPL) smart grid distribution automation project is designed to improve distribution system efficiency and reliability while lowering operations and maintenance costs. WPL is deploying a new centralized energy management system and adding intelligent communication and control modules to approximately 40 percent of its distribution capacitor banks. The capacitor banks selected for upgrade were determined based on coverage area and load usage. Project benefits include reducing distribution energy losses by improving power factor and reducing distribution operations and maintenance costs. WPL also expects to reduce vehicle fuel consumption and associated greenhouse gas emissions by reducing truck rolls through automation.

Woodruff Electric Cooperative: Woodruff Electric Advanced Metering Infrastructure Project

States: Arkansas

Category: AMI

Total Project Cost: $5,016,000

Federal Funding: $2,357,520

Woodruff Electric Cooperative's (Woodruff) advanced metering infrastructure (AMI) project provides two-way communicating smart meters to all of its residential customers and selected commercial customers. The primary project objective is to gain efficiencies related to metering operations. The AMI system provides time-of-use data, outage information, and distribution load data, which is used to improve system reliability. In addition to the meters, Woodruff provides remote disconnect/reconnect switches that operate on the same existing power line carrier infrastructure as the smart meters and allow for bill prepay options for customers, remote firmware upgrades, and remote demand reset.