October 16, 2012

Office of Electricity Delivery & Energy Reliability

The Impact of Smart Grid Projects Funded by the Recovery Act of 2009

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US Department of Energy
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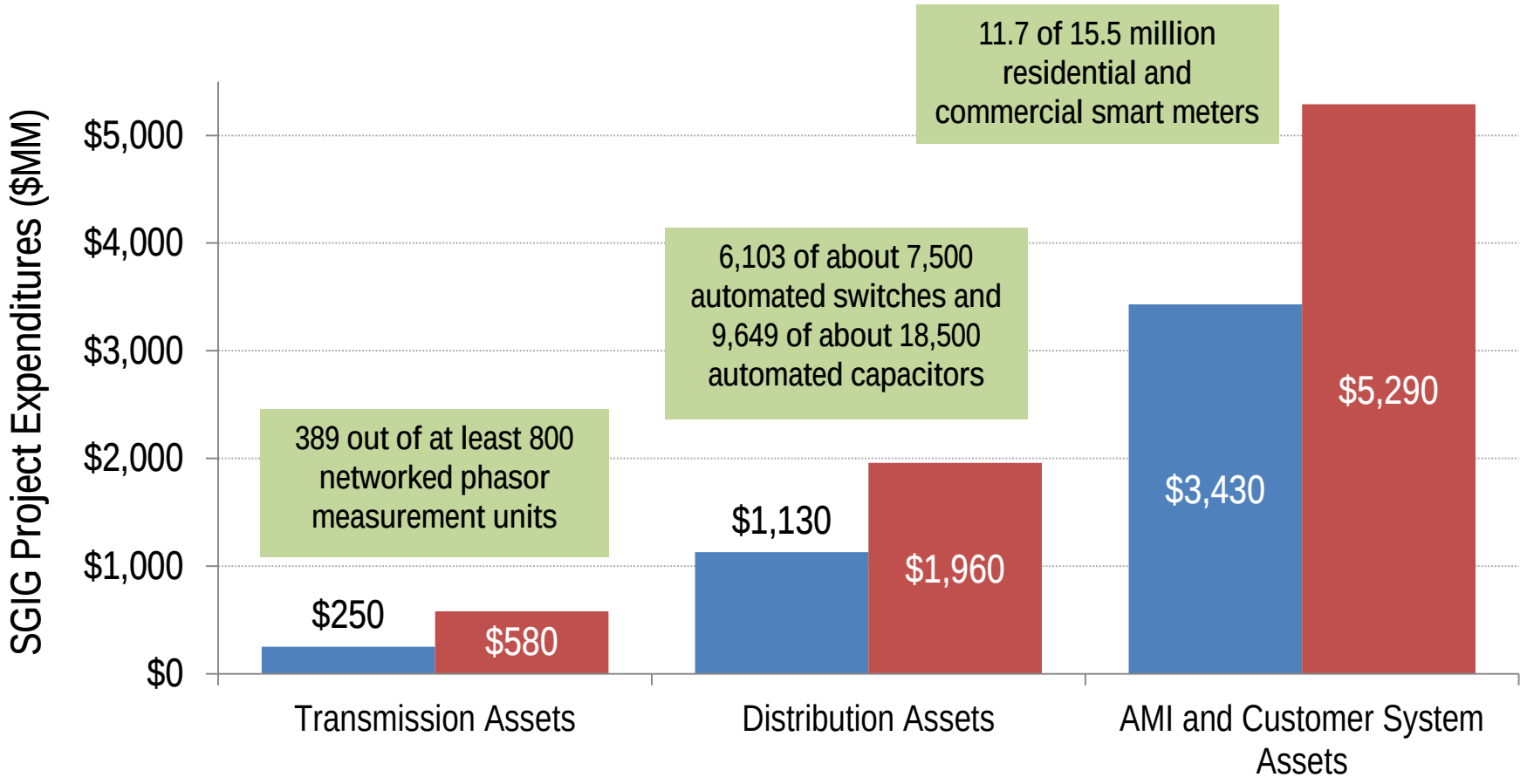
SGIG Deployment Status



* Based on self-reported project target from Recipients.

Peak and Overall Demand Reduction via AMI, Pricing and Customer Systems

62 SGIG projects (pricing and customer systems offered mostly at pilot scales):

- **56 offering web portals; 46 offering (DLC, PCTs, and/or IHDs)**
- **32 offering pricing (TOU, CPP, CPR, VPP)**

Project Elements	OG&E 770,000 customers	MMLD 11,000 customers	SVE 18,000 customers
Customers Tested	6,000 residential	500 residential	600 mostly residential
Time-Based Rate(s)	TOU and VPP, w/CPP	CPP	CPP
Customer Systems	IHDs, PCTs, and Web Portals	Web Portals	Web Portals
Peak Demand Reduction	Up to 30% 1.3 kW/customer (1.8 kW/customer w/CPP)	37% 0.74 kW/customer	Up to 25% 0.85 kW/customer
Outcome	Deferral of 210 MW of peak demand by 2014 with 20% participation	Lowers total purchase of peak electricity	Lowers total purchase of peak electricity
Customer Acceptance	Positive experience, many reduced electricity bills	Positive experience, but did not use the web portals often	Interested in continued participation, many reduced electricity bills

Advanced Volt/VAR Control to Improve Energy Efficency

25 SGIG projects are deploying advanced VVC:

- **11 are applying conservation voltage reduction (CVR) to reduce peak load –**
  - **Up to 200 MW reduction for one utility (over 100's of circuits)**
- **7 are using CVR to reduce energy consumption**
- **Multitude of equipment integration and control schemes –**
  - **Many are applying distributed management systems**
  - **Some are using smart meter data**

OG&E Example:

- **Implementing a control algorithm to set voltage levels at the substation**
  - **Applying smart meter data**
  - **Capability turned on when power price exceeds $0.22/kWh**
- **Achieved 8 MW reduction from application of VVC technology on 50 circuits during Summer 2011**
- **Goal – 74 MW reduction over 400 circuits by 2017 (SGIG contributes to 16 MW)**

Reliability Improvements

48 SGIG projects are applying distribution automation technologies to improve reliability:

- **42 deploying automated feeder switches (1 to > 1000's of switches)**
  - **Enables fault location, isolation and service restoration functions (FLISR)**
- **Multitude of system integration schemes (AMI/OMS/DMS/SCADA/GIS)**
  - **26 projects are applying distribution management systems**
  - **36 implementing AMI outage notification**
  - **22 deploying equipment health sensors**

Initial results from 4 Projects (1,250 feeders) – April 1, 2011 through March 31, 2012

Reliability Index	Description	Weighted Average (Range)
SAIFI	**System Average Interruption Frequency Index (outages)**	**-22 %** (-11% to -49%)
MAIFI	**Momentary Average Interruption Frequency Index (interruptions)**	**-22 %** (-13% to -35%)
SAIDI	**System Average Interruption Duration Index (minutes)**	**-18 %** (+4% to -56%)
CAIDI	**Customer Average Interruption Duration Index (minutes)**	**+8 %** (+29% to -15%)

Weighted average based on numbers of feeders

AMI: Operational Efficiency Improvements

63 SGIG projects deploying AMI are expecting to see operational efficiency improvements derived from smart meter features:

- Automated meter reading
- Remote service connections / disconnections
- Voltage and power quality monitoring
- Outage and restoration notification

Data from 15 AMI projects over one year shows a 36% reduction in operating costs and 39% reduction in vehicle miles –

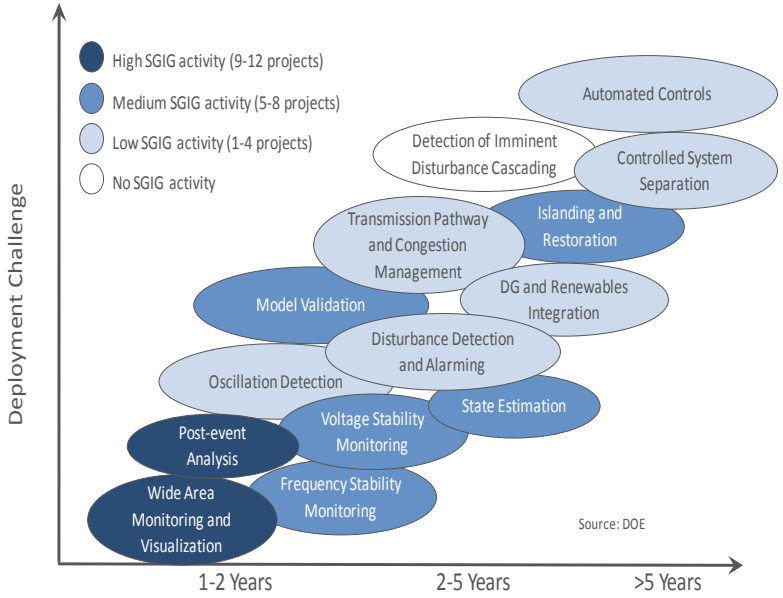
- Benefits are attributable to fewer labor resources, overtime hours and truck rolls
- Observations:
  - Projects with low customer density are reducing overtime labor and fuel usage, but staffing requirements are not expected to change significantly
  - Large projects with high customer density are reducing (or shifting) labor resources to 10% of the levels needed prior to SGIG

Application of Synchrophasor Technology

Investments in synchrophasor technology are being made by 10 SGIG projects

Midwest Independent System Operator (MISO):

- **161 synchrophasor measurement devices installed and now operating along the 50,000-mile interconnected system in the MISO 11-state region.**
- **MISO expects to make available synchrophasor data to its real-time system operators in April 2013**



MISO Applications:

- **System Modeling - Dynamic model enhancement process to more accurately determine transfer limits on the system**
- **After-the-fact event analysis - To determine an accurate sequence of events and accurate picture of how equipment responded, resulting in more timely and accurate evaluations of disturbances**

Questions