

September 24, 2014



Office of Electricity
Delivery & Energy
Reliability

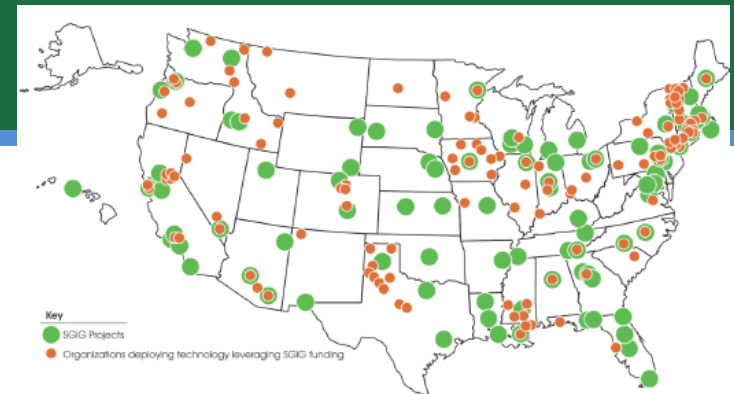


Progress and Results from ARRA
Smart Grid Programs

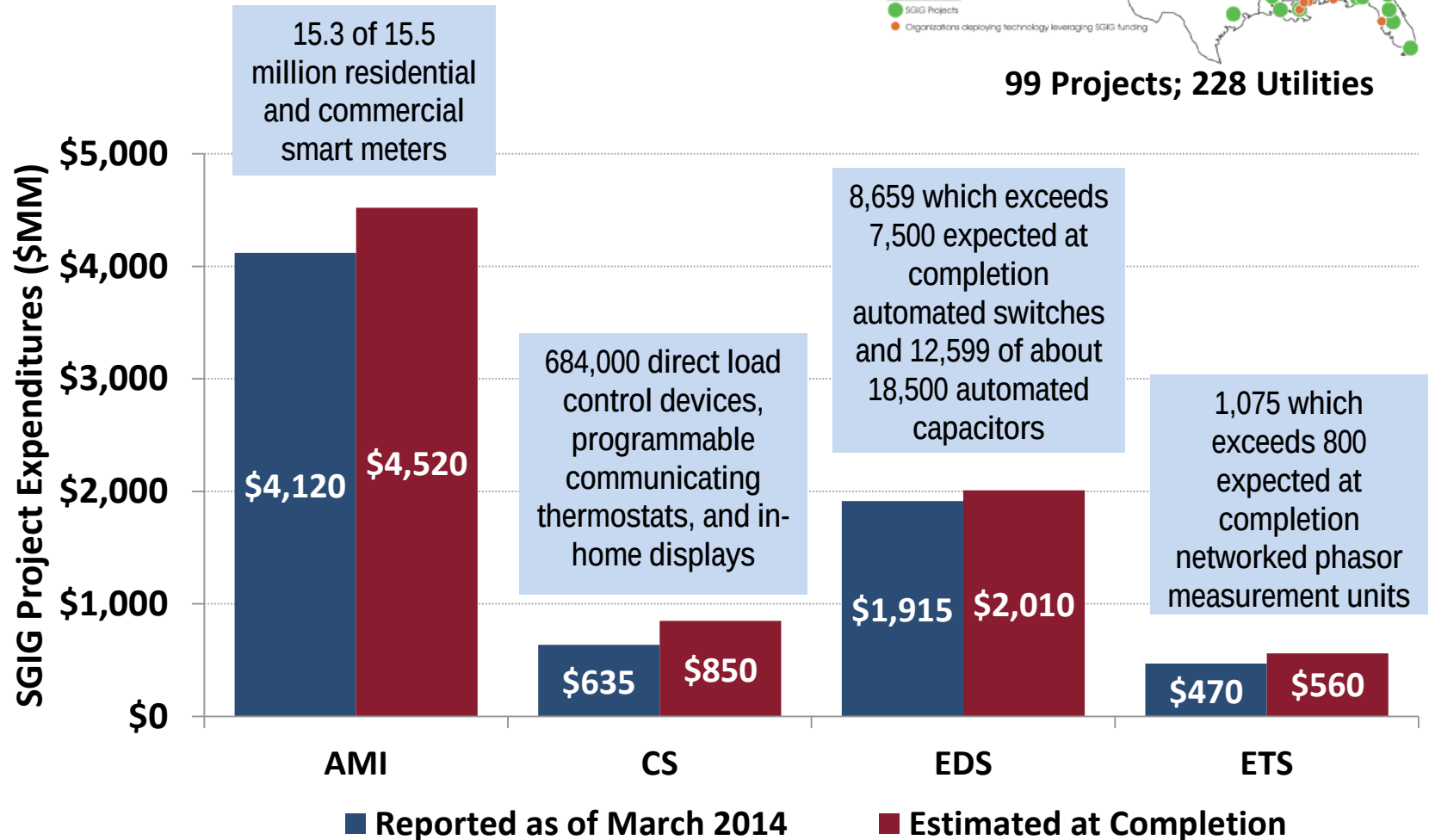
Joe Paladino
U.S. Department of Energy
Office of Electricity Delivery and Energy Reliability
Presented to the Electricity Advisory Committee



SGIG Deployment Status



99 Projects; 228 Utilities





Smart Grid Demonstration Program Status



Demonstrates how a suite of existing and emerging smart grid concepts can be innovatively applied and integrated to prove technical, operational, and business-model feasibility



Period-of-Performance Expended: 82.9%
Funds Expended: 82.0%



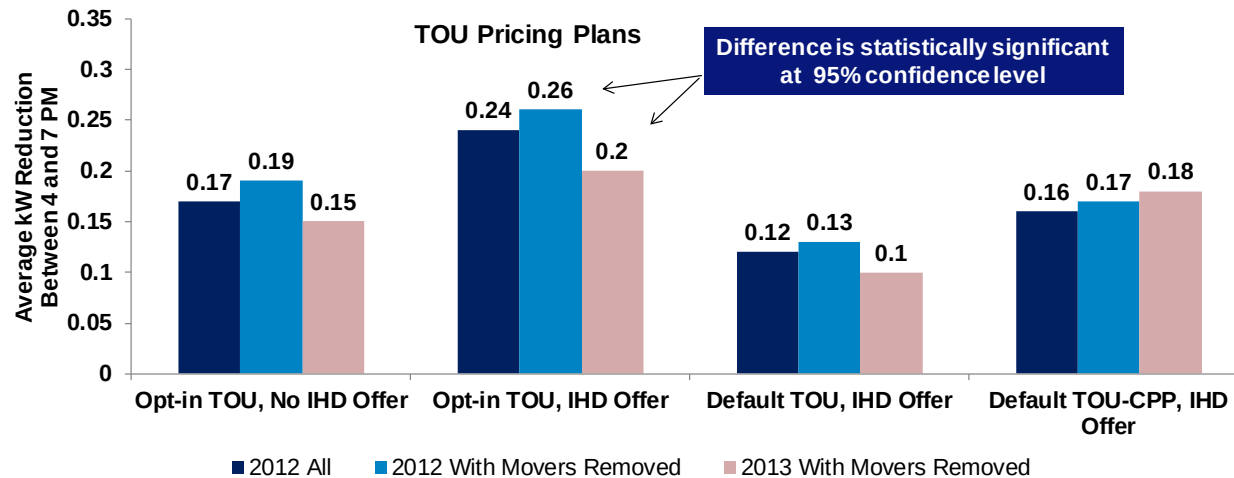
Applications and Benefits Matrix

Benefits	Smart Grid Technology Applications					
	Consumer-Based Demand Management Programs (AMI-Enabled)	Advanced Metering Infrastructure (AMI) Applied to Operations	Fault Location, Isolation and Service Restoration	Equipment Health Monitoring	Improved Volt/VAR Management	Synchrophasor Technology Applications
	- Time-based pricing - Customer devices (information and control systems) - Direct load control (does not require AMI)	- Meter services - Outage management - Volt-VAR management - Tamper detection - Back-Office systems support (e.g., billing and customer service)	- Automated feeder switching - Fault location - AMI and outage management	- Condition-based maintenance - Stress reduction on equipment	- Peak demand reduction - Conservation Voltage Reduction - Reactive power compensation	Real-time and off-line applications
Capital expenditure reduction – enhanced utilization of G,T & D assets	✓			✓	✓	✓
Energy use reduction	✓	✓	✓		✓	✓
Reliability improvements		✓	✓	✓		✓
O&M cost savings		✓	✓	✓		
Reduced electricity costs to consumers	✓				✓	
Lower pollutant emissions	✓	✓	✓		✓	✓
Enhanced system flexibility – to meet resiliency needs and accommodate all generation and demand resources	✓	✓	✓	✓	✓	✓



SMUD Consumer Behavior Study Summary

SMUD deployed opt-in and opt-out Flat w/ CPP, TOU and TOU w/CPP in Summers 2012-2013



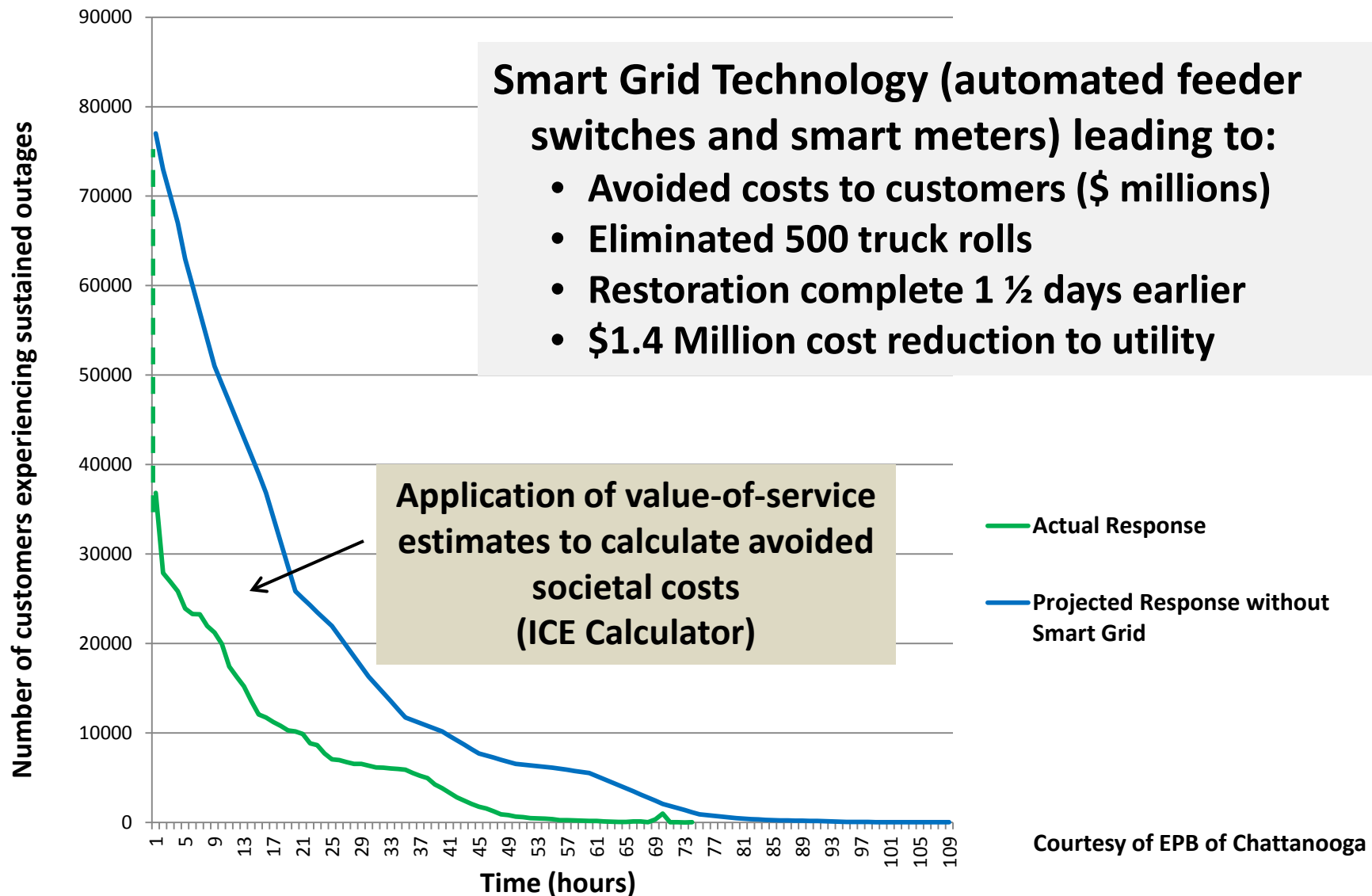
Rate Period	Price Level (¢ / kWh)		
	Flat w / CPP	TOU	TOU w / CPP
Base/Off-Peak <700 kWh	8.5	8.5	7.2
Base/Off-Peak >700 kWh	16.7	16.6	14.1
Peak	n/a	27.0	27.0
Critical Event	75.0	n/a	75.0

- Opt-out customers produced lower average peak period load impacts in response to TOU than Opt-in customers but...
- Acceptance rates were much higher for Opt-out (>93%) than Opt-in (16-18%); drop-out rates were low in ALL cases (5-9% for Opt-In and 4-8% for Opt-Out)
- Survey results indicate 59% of customers preferred some type of time-based pricing design (TOU or CPP) over the existing tiered rate structure and preferred TOU over CPP pricing by roughly 2 to 1
- Due to the study's results, SMUD has decided to alter the standard residential rate design from a tiered rate to a TOU in 2018

Scenario	Benefit/Cost Ratio	10 Year NPV (\$ millions)		
		Benefits	Costs	Net Benefits
Default TOU, no IHD	4.48	\$66.9	\$15.0	\$52.0



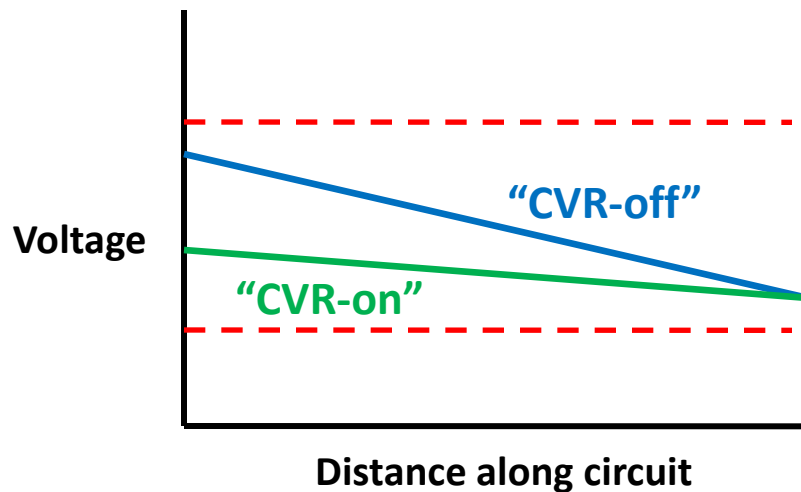
July 5, 2012 Storm Response in Chattanooga





Applying Volt/VAR Optimization to Improve Energy Efficiency

Conservation voltage reduction (CVR) reduces customer voltages along a distribution feeder for lowering peak demands and overall energy consumption



OG&E:

- Control algorithm 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)

PNNL 2010 GRID-LAB-D Analysis:

National deployment of CVR can provide a 3.0% reduction in annual energy consumption for the electricity sector. 80% of this benefit can be achieved from 40% of feeders.

CVR Study (due October 2014):

Report on technology applications, impacts and institutional hurdles. Seeing energy reductions ranging from 0.75 – 3.0% and peak reductions from 0.84 – 7.0%.

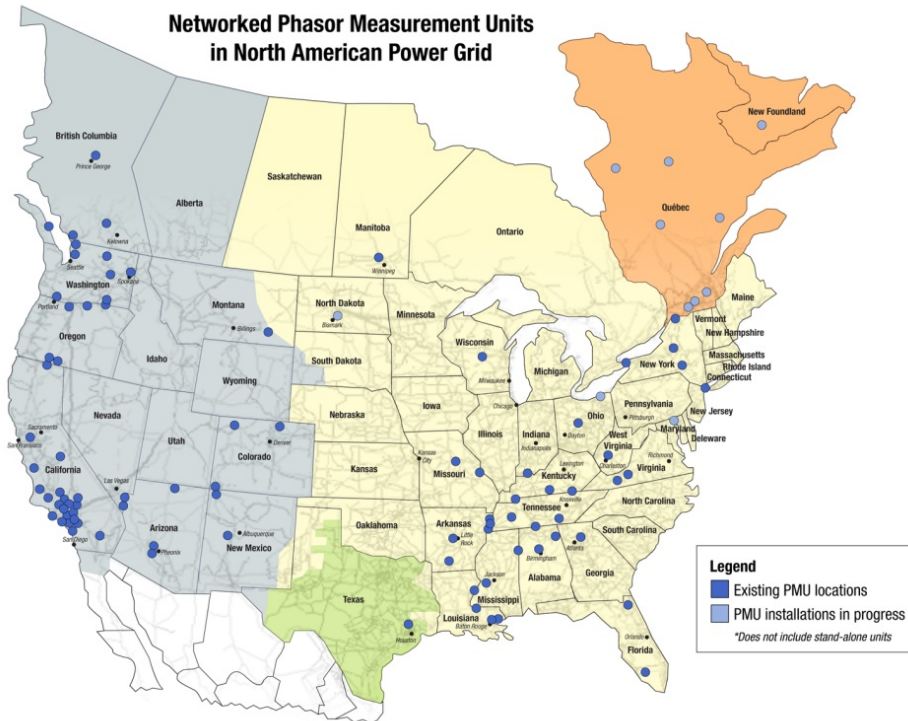


Synchrophasor Technology for Transmission System Operations

Improved reliability, capacity and operational efficiency – Energy flows on the California-Oregon Intertie can be increased by 100 MW or more reducing energy costs by an estimated \$35 - \$75 million over 40 years without new capital investments

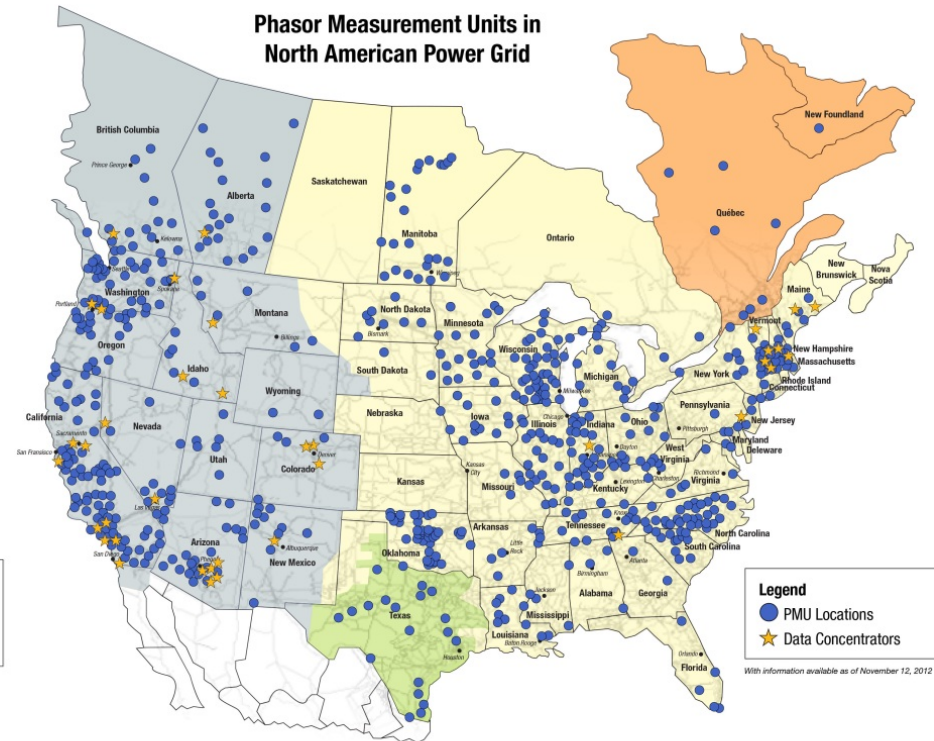
April 2007

Networked Phasor Measurement Units
in North American Power Grid



November 2012

Phasor Measurement Units in
North American Power Grid





Sharing Results

SGIG/SGDP Output

(DOE and Awardee Generated)

SGIG Progress Reports

Metrics and Benefits
Reports

Case Studies

Presentations/Briefings &
Articles

Best Practices/Lessons-
Learned

Consumer Behavior Reports

Technology Performance
Reports

Communication Mechanisms

www.smartgrid.gov

Conferences

User/focus groups

Partner/stakeholder
outreach

To Advance

The business case for
smartgrid technology

Knowhow in systems
integration and
communications

Cybersecurity practices

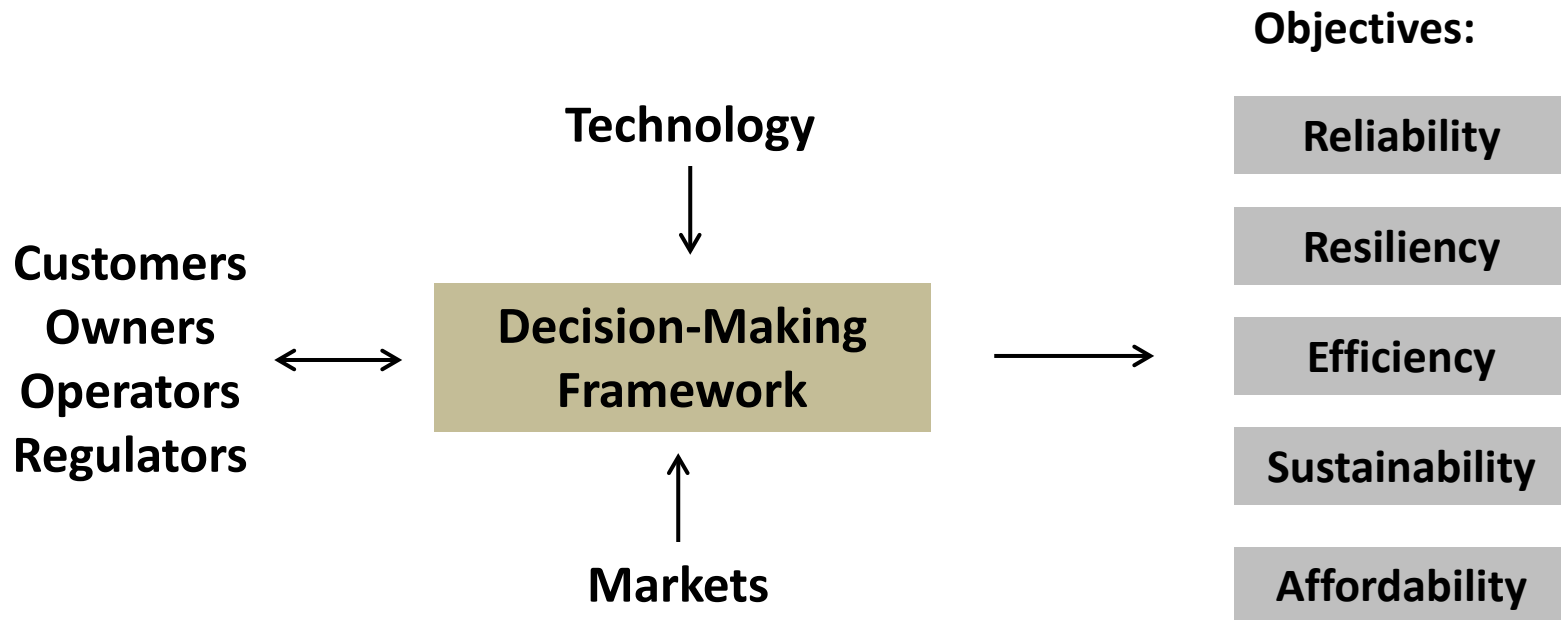
Architecture and
interoperability standards

Grid integration with
renewable and distributed
energy resources

Effective customer
interactions



Long-Term Investment Strategy





Questions / Comments

Joe Paladino

202-586-6916

joseph.paladino@hq.doe.gov

www.smartgrid.gov

