

June 26, 2012



## Office of Electricity Delivery & Energy Reliability

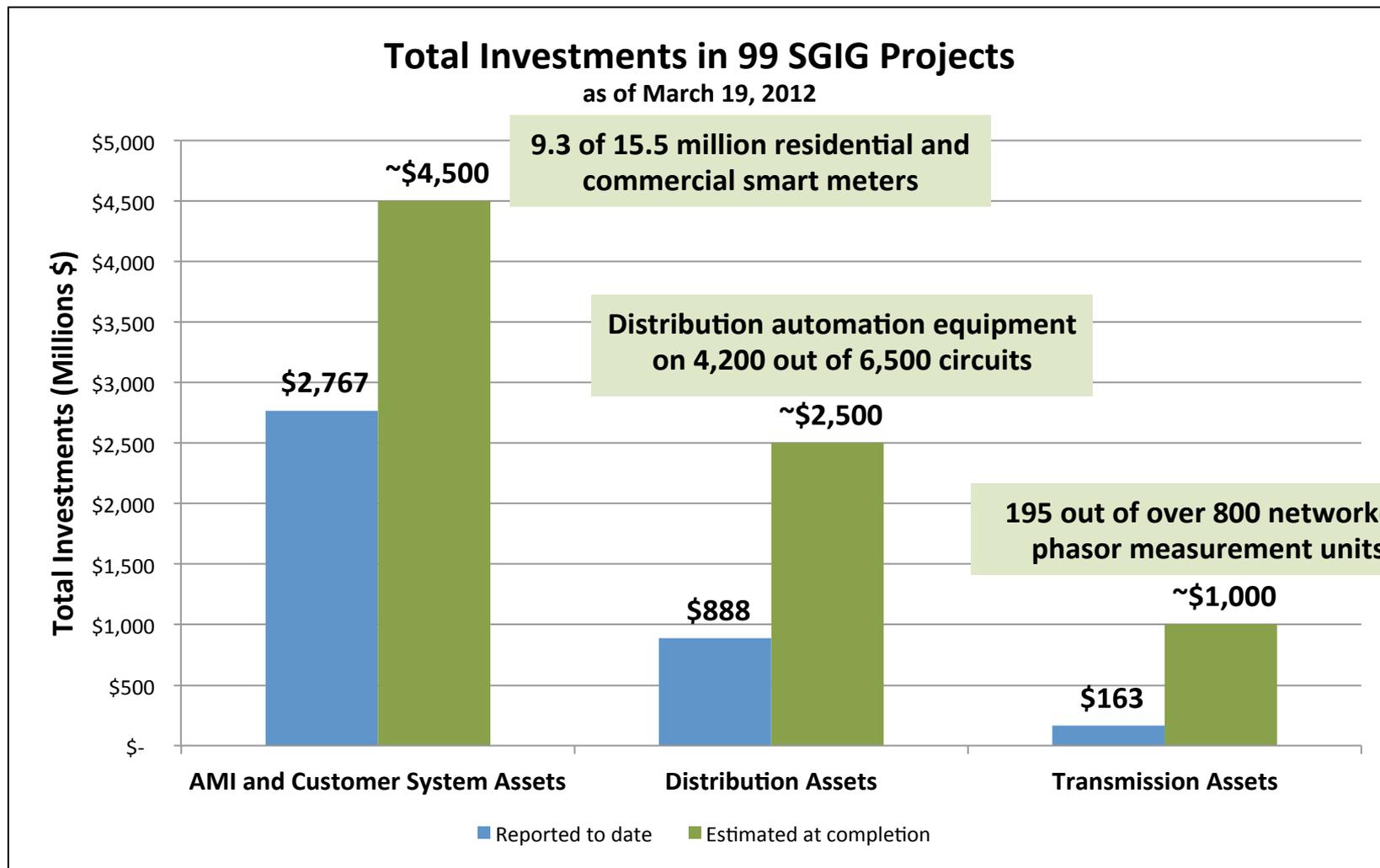


# The Impact of Smart Grid Projects Funded by the Recovery Act of 2009

Joe Paladino  
US Department of Energy  
Smart Grid Task Force Meeting



# SGIG Deployment Status

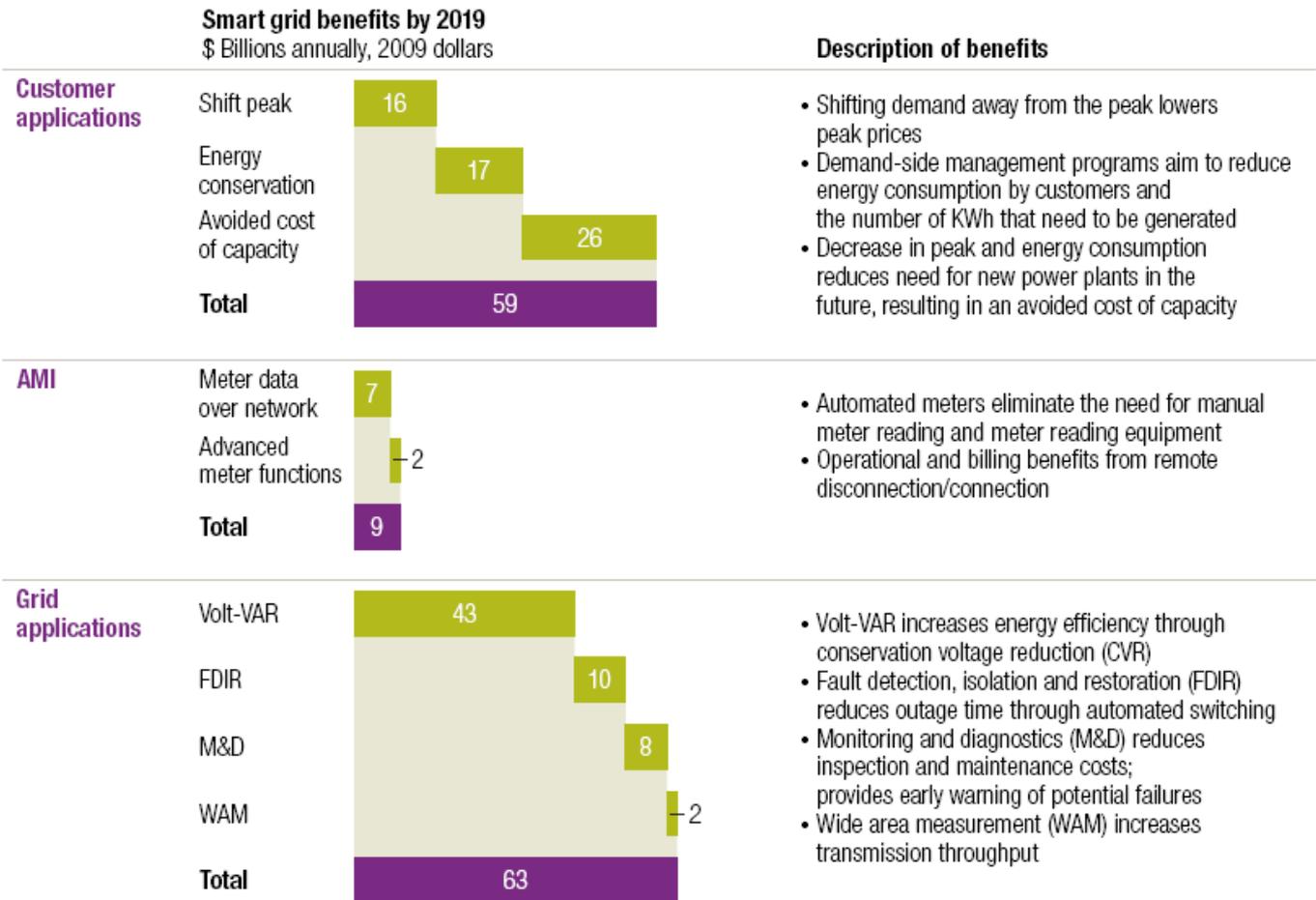




# Value of the Smart Grid

## Exhibit 1 The \$130 billion question

The U.S. smart grid value at stake is over \$130 billion annually.



\* 2019 value including societal and GHG benefits

Source: "McKinsey on Smart Grid", McKinsey & Company, Summer 2010



# Analytical Focus

## Advanced Metering Infrastructure

**Peak and Overall Demand Reduction (62 projects)**

**Operational Efficiency Improvements (60 projects)**

## Distribution Automation

**Reliability Improvements (48 projects)**

**Efficiency Improvements (47 projects)**

## Transmission System Applications

**Reliability and Efficiency Improvements (10 projects)**



# Consumer Behavior Studies

	Sierra Pacific	Nevada Power	OG&E	MMLD	CVPS	VEC	MN Power*	CEIC	SMUD	DECo	Lake land	Total
<b>Rate Treatments</b>												
TOU	●	●							●		●	3
CPP	●	●	●	●	●		●		●	●		8
CPR					●			●				2
VPP			●			●						2
<b>Non-Rate Treatments</b>												
Education	●	●								●		3
Cust. Service						●						1
IHD	●	●	●		●	●	●	●	●	●		9
PCT	●	●	●					●		●		5
DLC								●				1
<b>Features</b>												
Bill Protection	●	●	●	●							●	4
<b>Experimental Design</b>												
Opt In	●	●	●	●	●	●	●		●	●	●	9
Opt Out								●	●	●	●	3
Within									●			1
<b>Number of Participants</b>												
	9,509	6,853	3,196	500	3,735	6,440	4,025	5,000	97,480	5,400	3,000	145,138

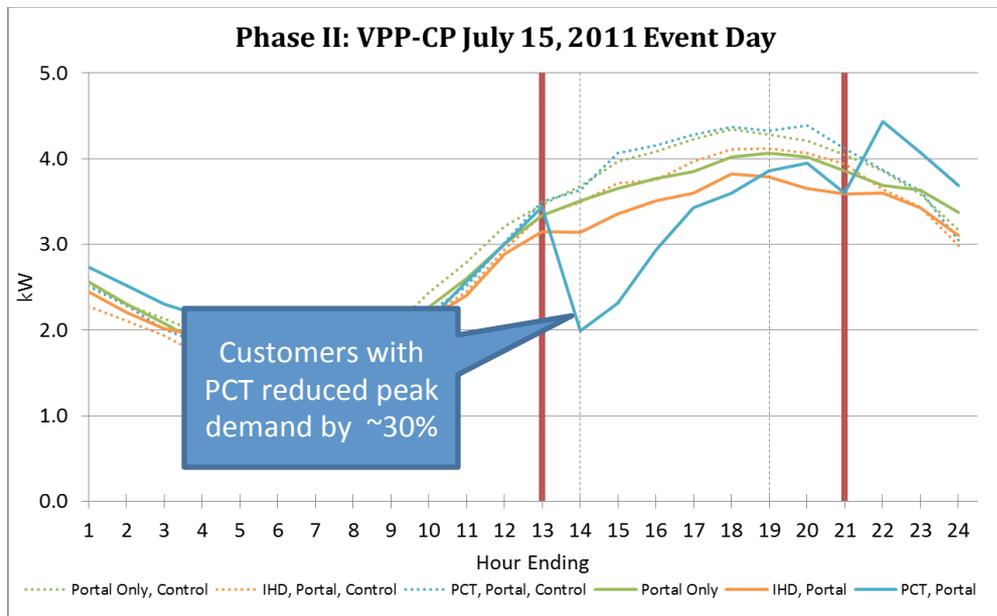
●—● Sierra Pacific and Nevada Power are testing the effect of a technology package, including an IHD and a PCT

\* MN Power is also testing the difference between hourly energy feedback and daily energy feedback



# Pricing Pilot: OG&E

OG&E deployed a CPP overlay on TOU and VPP in Summer 2011; VPP-CP rate highlighted here.



Price Level	Residential VPP-CP Price	Number of days in summer 2011 at each price level
Low and off-peak	4.5¢ per kWh	63
Standard	11.3¢ per kWh	25
High	23.0¢ per kWh	28
Critical	46.0¢ per kWh	6
Critical Event	46.0¢ per kWh	7 (included in the above)

## Potentially Avoid Future Generation:

- Study results show a 1.3 kW avg. peak load reduction per customer during events is possible
- Goal of 20% participation by Dec 2014 in VPP-CP rate offering supported by high satisfaction rates
- Achieving 20% participation goal (~150K residential customers) will allow OG&E to offset the need for a new natural gas-fired peaking plant (~210 MW)



# Operational Efficiency Improvements at Talquin Electric Cooperative

## Background:

- For over 70 years, members submitted their own meter readings (highly inaccurate)
- Rolling trucks 6,000 times/year for routine service connection/reconnection and 9,000 times/year for non-payment problems (\$40-\$50/truck roll)
- Outage locations based on pattern of customer phone calls

## TEC's SmartGrid Program:

- Deployed AMI to about 56,000 customers and upgraded 46 of 86 circuits with advanced capacitors for voltage control and outage management.
- With AMI, TEC avoided 8,800 truck rolls in 2011 for non-payment problems saving more than \$350,000
- Expecting to avoid additional 5,500 truck rolls for routine service connections (savings of \$200,000/year)
- Expecting to reduce outage durations from more precise pinpointing of faults and dispatching of repair crews to exact locations without guesswork.



Technician changes out analog meter with a smart meter

## Facts & Figures

### Total Project Budget:

\$16,200,000

### Federal Share:

\$ 8,100,000

### Customers Served:

57,000

**Service Area:** 2,600 square miles spanning 4 counties in northern Florida



# Reliability Improvements

**One utility has installed 230 automated feeder switches on 75 circuits in an urban area. From Apr 1 – Sep 30 2011:**

**SAIDI improved 24%; average outage duration decreased from 72.3 minutes to 54.6 minutes (or by 17.7 minutes).**

**Estimated Avg. Customer Interruption Costs US 2008\$ by Customer Type and Duration**

Customer Type	Interruption Cost Summer Weekday	Interruption Duration				
		Momentary	30 mins	1 hr	4 hr	8 hr
Large C&I	Cost Per Average kWh	\$173	\$38	\$25	\$18	\$14
Small C&I	Cost Per Average kWh	\$2,401	\$556	\$373	\$307	\$272
Residential	Cost Per Average kWh	\$21.6	\$4.4	\$2.6	\$1.3	\$0.9

Sullivan J, Michael, 2009 *Estimated Value of Service Reliability for Electric Utility Customers in the US*, LBNL 2132E, June 2009

**VOS Improvement  $\Delta = \Delta$  SAIDI x Customers Served x Avg Load x VOS Coefficient**

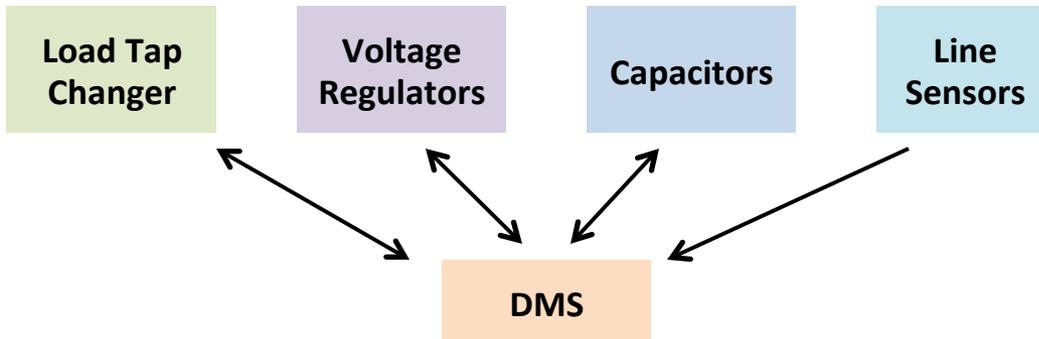
**VOS Estimate for SAIDI Improvement on 75 feeders from Apr 1 to Sep 30 2011**

Customer Class	$\Delta$ SAIDI	Customers Served within a Class	Average Load (kW) Not Served	VOS Coefficient (\$/kWh)	$\Delta$ VOS
Residential	17.7 mins (0.295 hrs)	107,390	2	\$ 2.60	\$ 164,736
Commercial		8,261	20	\$ 373.00	\$ 18,179,477
Industrial		2,360	200	\$ 25.00	\$ 3,481,325
<b>Total</b>		<b>118,011</b>			



# Conservation Voltage Reduction

**Objective:** Reduce energy consumption and peak load via operating at the low end of the ANSI C84.1 Range A Band (114V – 126V)



Near-real-time feedback loop enables optimized operation of these components. However, deployment strategies differ with respect to objectives and levels of sophistication.

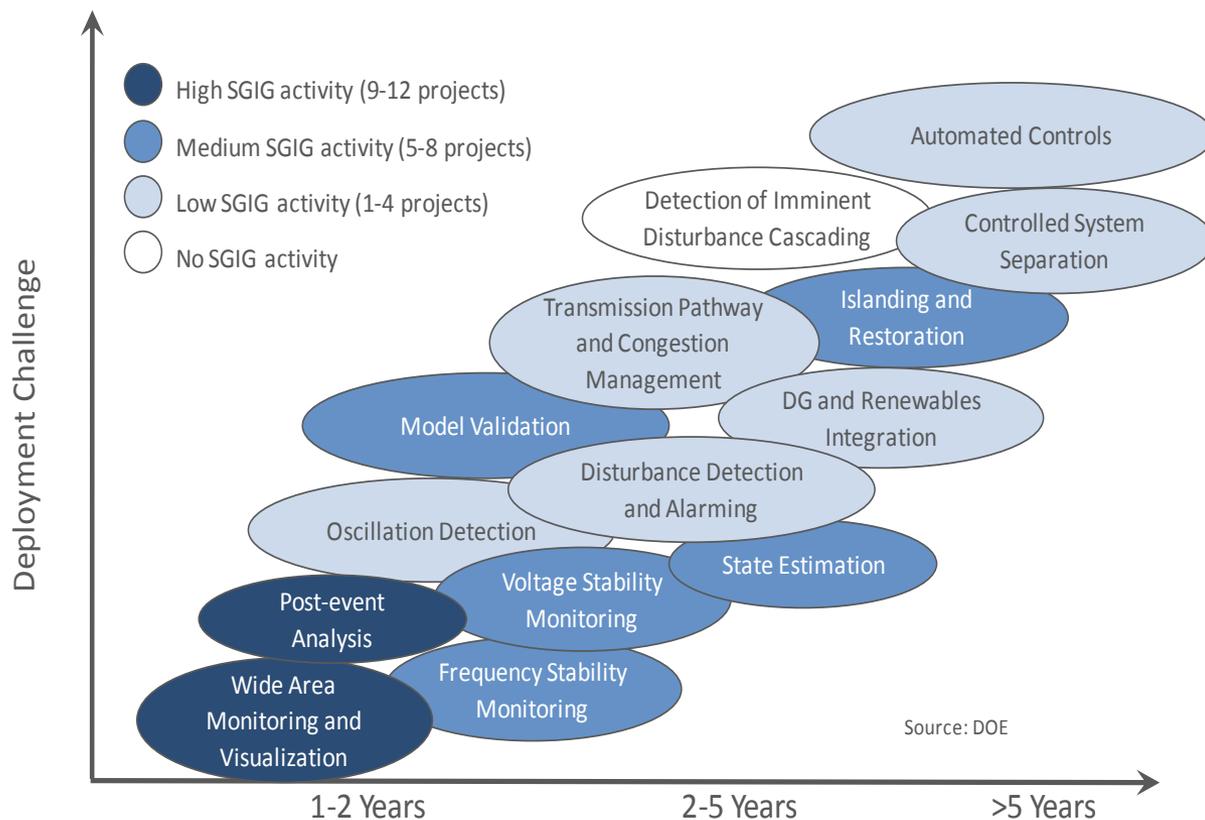
Results Averaged across 11 Circuits	Initial Results	Potential Customer Savings (estimated for a 7 MW peak circuit with 53% load factor)	
Customer Energy Reduction	2.9%	943 MWh/year	\$75,440 (at \$.08/kWh)
Peak Demand Reduction	3%	210 kW	Defer construction of peaking plants

**NOTE: Utilities and regulatory commissions will need to work together to establish appropriate recovery of fixed costs as consumption is reduced**



# Application of Synchrophasor Technology

Investments in synchrophasor technology are being made by 10 SGIG projects



## Benefits:

- Improved reliability and resiliency
- Improved asset utilization
- Reduced transmission congestion
- Integration of distributed generation and renewables

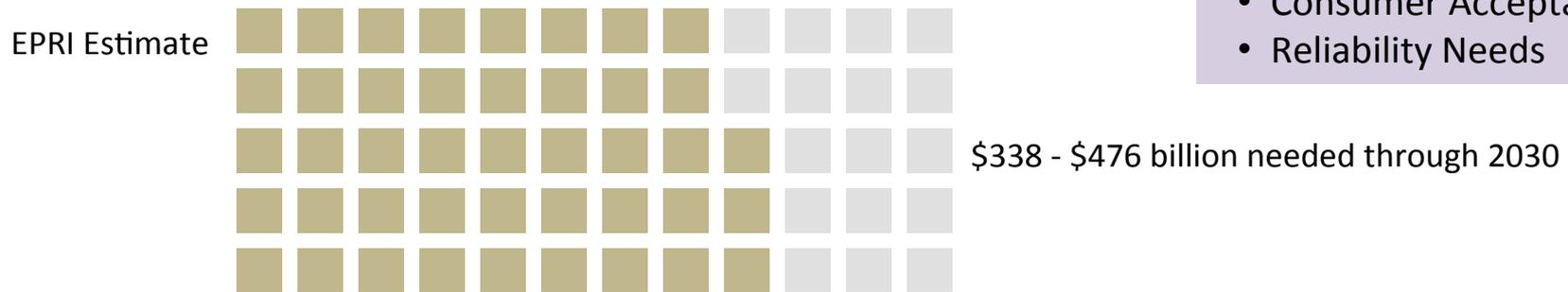


# Scope and Challenges

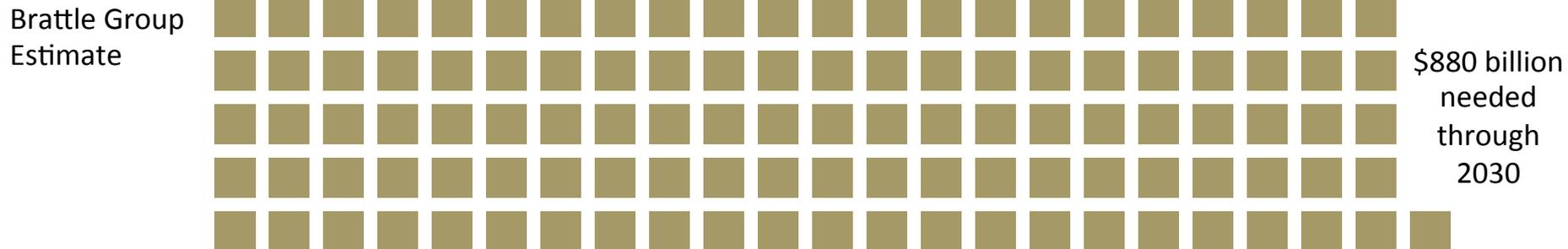
## Adoption Rate Factors:

- Economy
- Policy
- Technology
- Consumer Acceptance
- Reliability Needs

SGIG Spending  \$7.9 billion with cost share to be spent through 2015



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. EPRI, Palo Alto, CA; 2011.



Chupka, M.W. Earle, R., Fox-Penner, P., Hledik, R. Transforming America's power industry: The investment challenge 2010 - 2030. Edison Electric Institute, Washington D.C.; 2008.