Project: IEEE Region 6 Keynote

Submission Title: SmartGrid Evolution and the Roll Standards will Play
Date Submitted: 28, March, 2009
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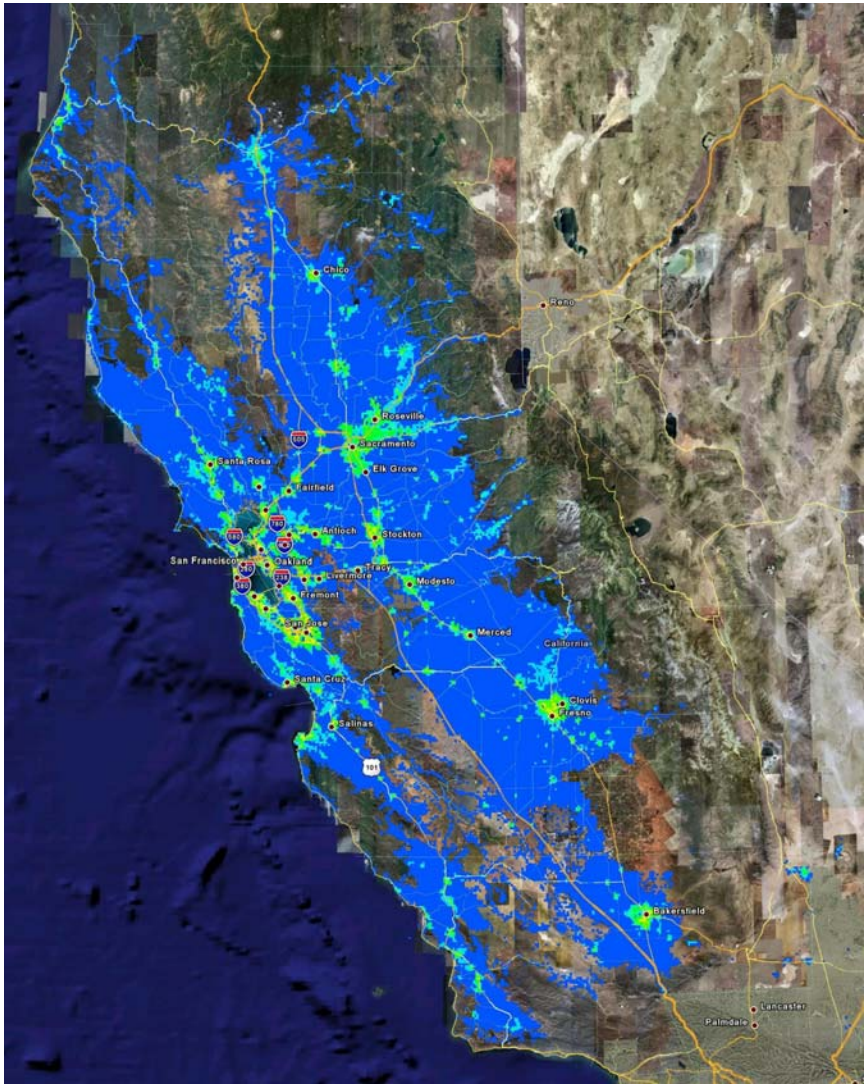
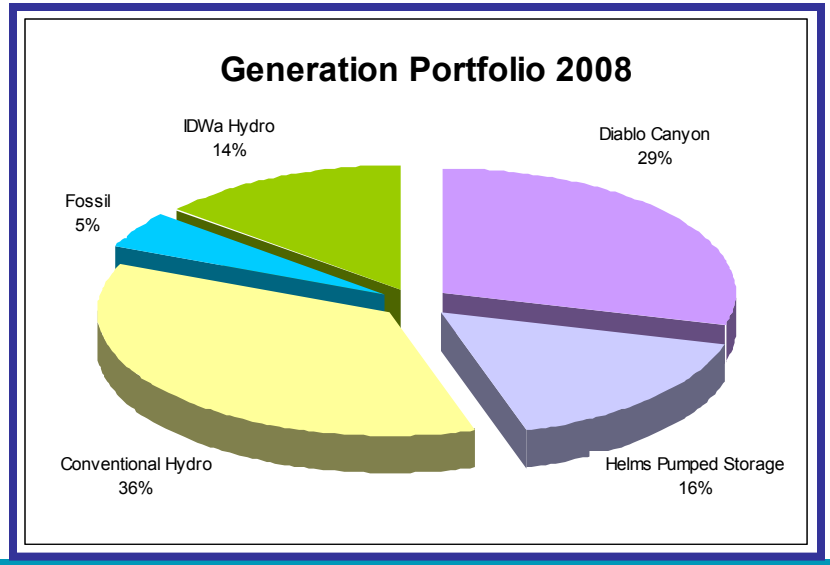
Abstract: The Obama administration is intending to invest close to 45 billion dollars to address renewal energy and a future "Smart Energy Grid" that will reduce our dependence on foreign oil. Chris will be discussing the "Smart Energy Grid" and what PG&E and the Technology Innovation Center are doing about it. He will provide insight as to how to think about the future of this project and what has been accomplished so far. He will also provide a road map related to the industry standards and technology that is required to address the challenges and gaps related to the future success of this project.
Purpose: Keynote

About PG&E



- Energy Services to about 15 M People:
  - 5.0 M Electric Customer Accounts
  - 4.1 M Natural Gas Customer Accts
- 70,000 square miles with diverse topography ~20,000 Employees
- Regulated by the California Public Utilities Commission (CPUC)
- 6,833 MW of Generation
- Electric transmission circuits 18,616 miles
- Electric distribution circuits 120,000 miles
- Gas transmission backbone 6,128 miles
- Gas distribution pipeline 40,123 miles
- Deploying >7000 IPv6 wireless meshed meters/day



The US Macro Energy problem

Figure 50: WECC-U.S. Capacity Margins — Summer

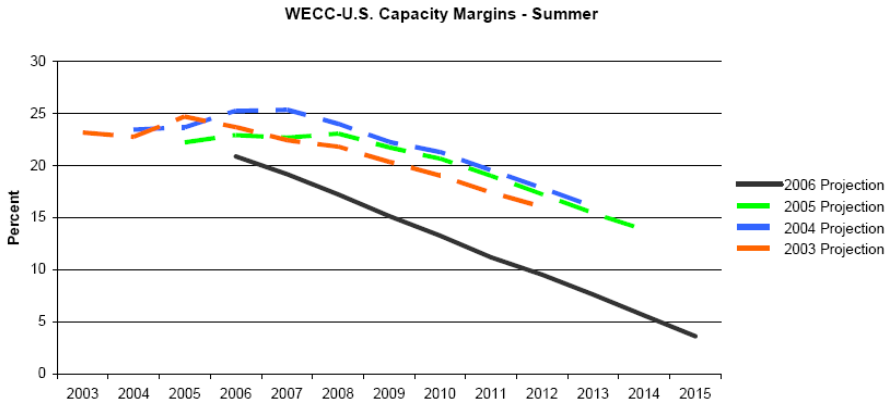
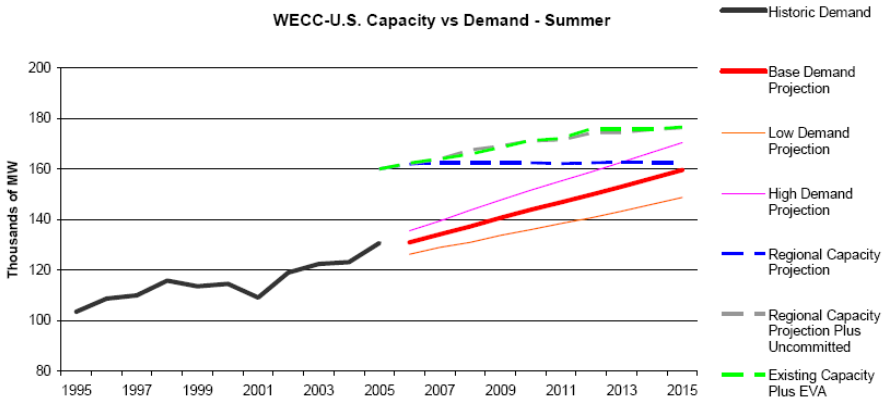
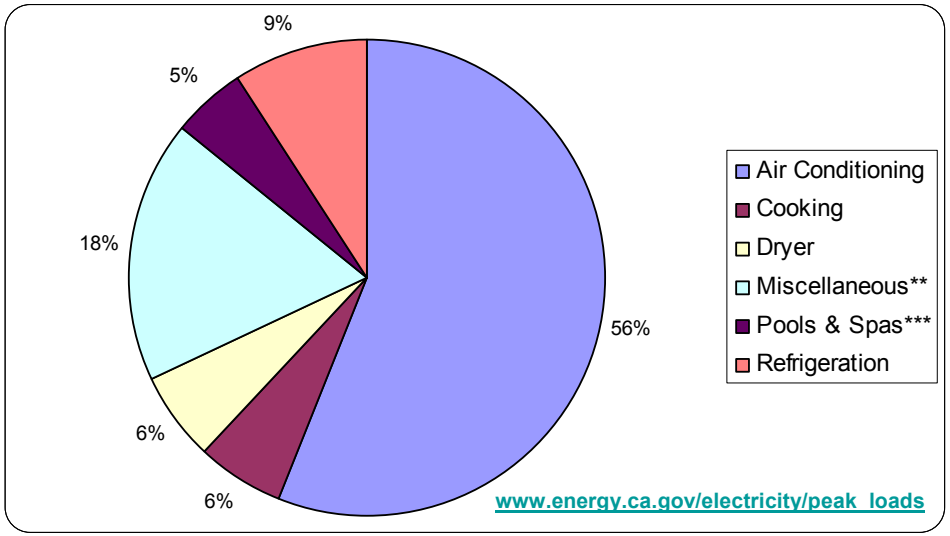


Figure 51: WECC-U.S. Capacity Versus Demand — Summer



Source: NERC 2006 Long-Term Reliability Assessment

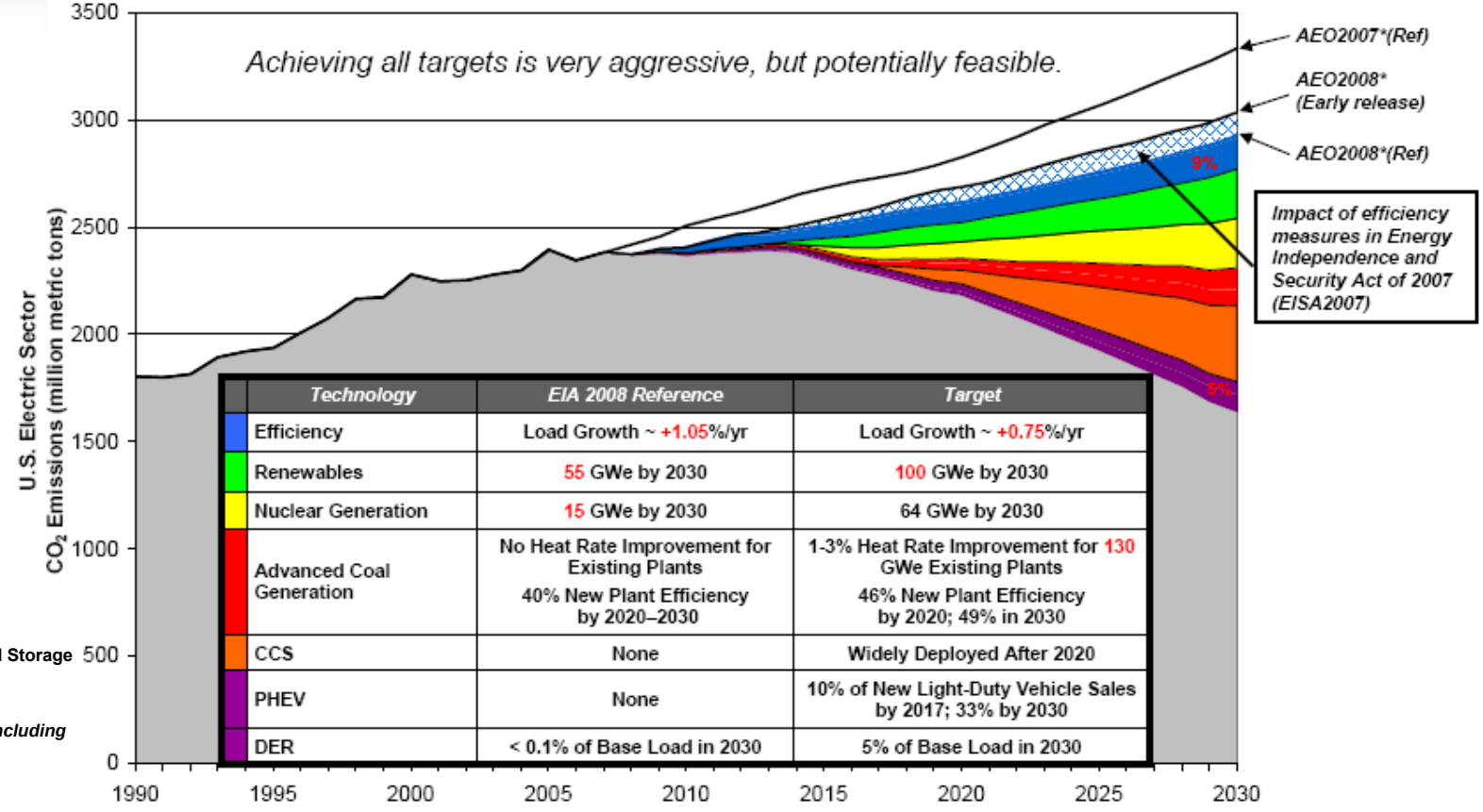
- The US is on a trajectory of declining bulk energy margin
- There is no good supply side solution
- The solution is a dynamic distributed demand side energy efficiency and load control system
- Reasonable reductions can dramatically improve our peak energy position



California Residential Peak Load

…and GHG/ Global Warming

2008 Prism...Technical Potential for CO_2 Reductions



Technology	EIA 2008 Reference	Target
Efficiency	Load Growth ~ +1.05%/yr	Load Growth ~ +0.75%/yr
Renewables	55 GWe by 2030	100 GWe by 2030
Nuclear Generation	15 GWe by 2030	64 GWe by 2030
Advanced Coal Generation	No Heat Rate Improvement for Existing Plants 40% New Plant Efficiency by 2020–2030	1-3% Heat Rate Improvement for 130 GWe Existing Plants 46% New Plant Efficiency by 2020; 49% in 2030
CCS	None	Widely Deployed After 2020
PHEV	None	10% of New Light-Duty Vehicle Sales by 2017; 33% by 2030
DER	< 0.1% of Base Load in 2030	5% of Base Load in 2030

Carbon Capture and Storage

Distributed Energy Resources (DER) ***(including distributed solar)***

**Energy Information Administration (EIA) Annual Energy Outlook (AEO)*

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EPRI ELECTRIC POWER RESEARCH INSTITUTE

Why Smart Grid Now?

- EISA 2007 Legislation has mandated the regulation of interoperable standards for Smart Grid
- The CPUC is also tasked to address Smart Grid in the EISA legislation and in presently considering its approach
- NIST is undertaking a mapping of relevant industry standards for Smart Grid implementation
- The recently signed Economic Stimulus Package provides funding for Smart Grid projects

California Public Utilities Commission

SmartGrid is a Journey, Not an End State

- **Following the principles of best practices to take emerging technologies to scale must be followed**
- **There are no shortcuts**

Testing facilities

- PG&E employs end to end laboratorys to enable rapid prototyping and testing of smart-grid technologies
- Accelerates technology development and ensures standards compliance early on

Pilots

- PG&E focuses on pilots to evaluate the viability of technology and resolve technical issues
- Partnerships spanning the smart-grid ecosystem ensure that insights are scalable

Standards definition

- PG&E plays a broad role in shaping and accelerating the standards that will underlie future smart-grid implementations

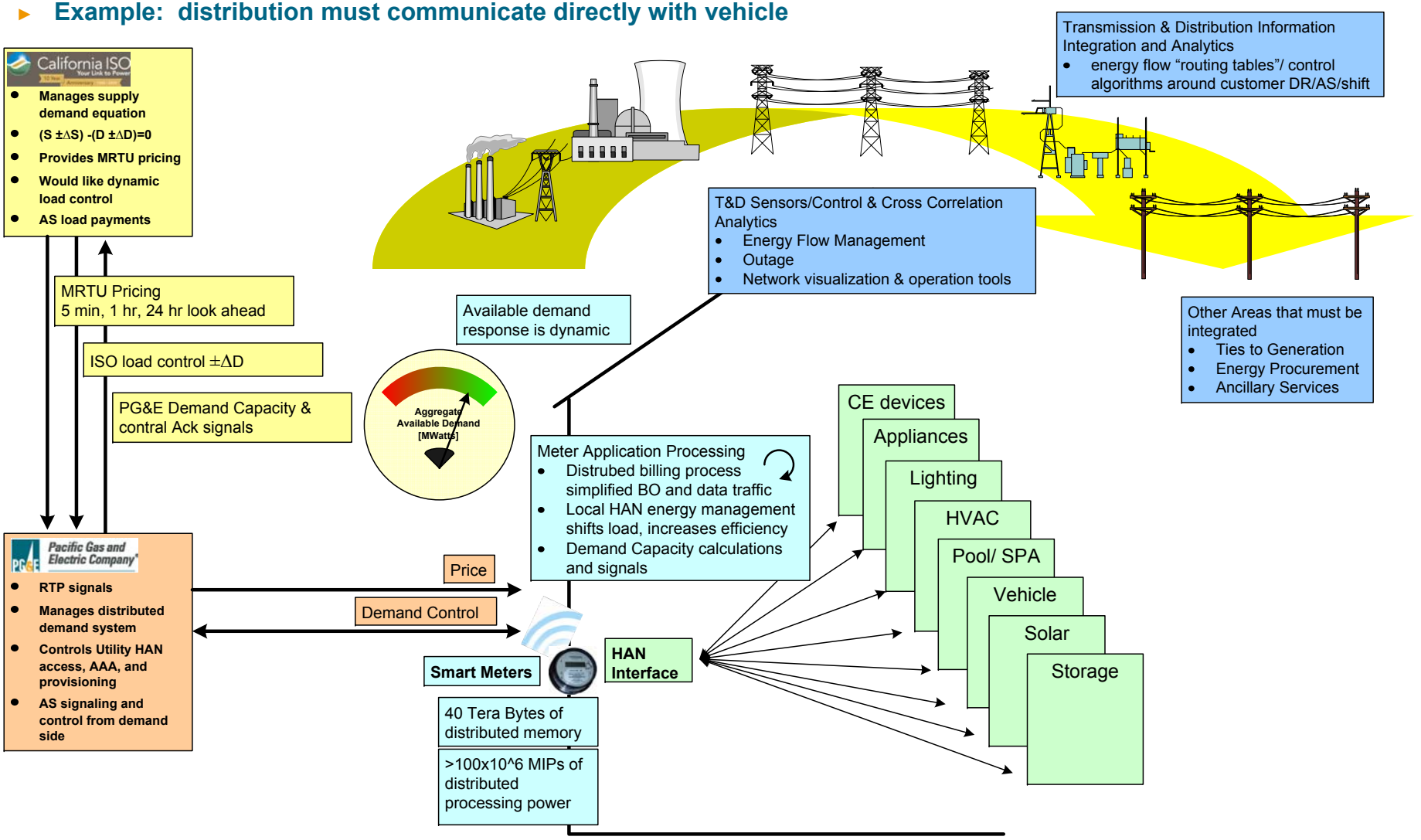
- PG&E's service area in California

Full customer deployment

- pilots extend to full-scale roll-out, assuming benefits are proven
- PG&E's industry-leading smart-meter deployment allows it to be at the leading-edge of other smart-grid technology deployments
- Insights are used to feed the next cycle of the technology deployment cycle

One vision of SmartGrid…

- **All systems are interdependent. New systems must consider how they need to communicate across systems in a distributed way**
- **Centralized systems will not scale**
- **Example: distribution must communicate directly with vehicle**



Open Standards are an Absolute Requirement

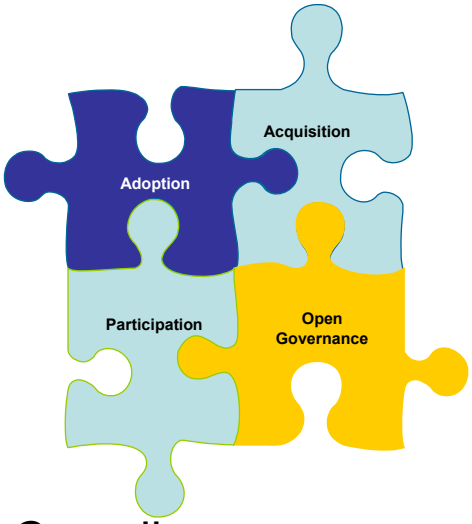
- Without open standards a SmartGrid will not be achieved
- Without industry compliance an interoperable SmartGrid will not be achieved
- The industry is highly engaged on creating open SmartGrid standards
  - The top world wide standards organizations and technologists are doing this work
  - IEEE, IEC, NIST, UCA OpenSG, others
- Standards are critical but certification is even more important
  - Vendors will call things standard or interpret standards differently
  - Certification levels the playing field
  - The utility model will move to complying with certified standards and demonstrating interoperability.
  - Vendors will need to differentiate on value above the standards
  - The message to vendors is no proprietary systems
- A set of interoperable standards will be regulated at the federal level (DOE)
  - FERC is mandated to regulate under EISA 2007

Benefits of Open and Interoperable Standards

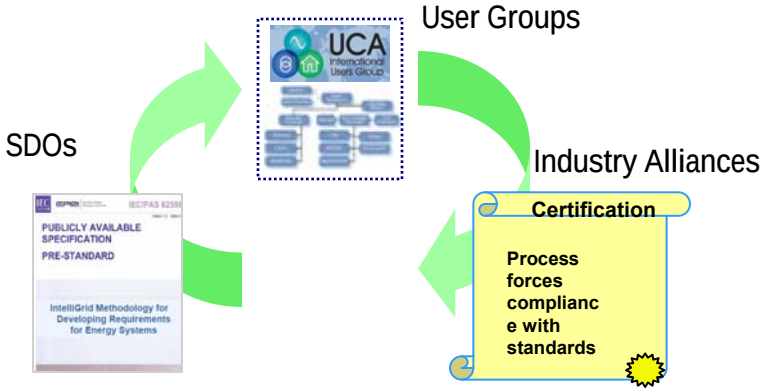
- 50% savings in integration costs
- Avoid re-inventing the wheel
- Learn from industry best practices
- Specify requirements more easily
- Prevent single vendor "lock-in"
- Vendors share a much larger market
- Reduced maintenance and training costs
- Reduced development costs
- Security and network management requirements better understood

Key Principles of Standards Strategy

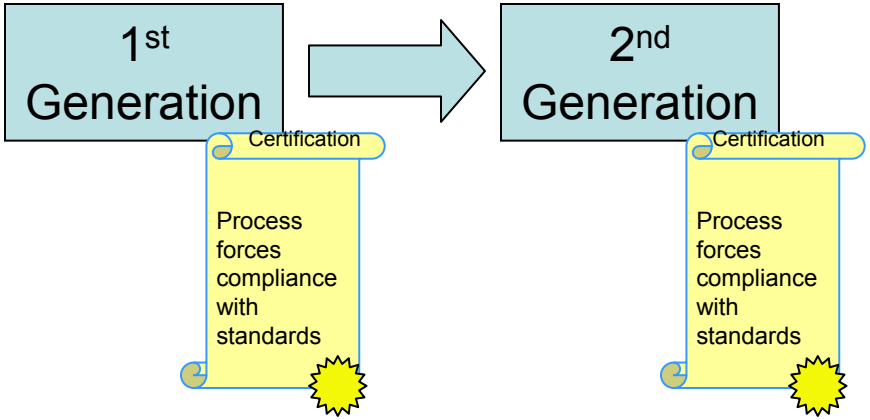
1. Openness



2. Separation of Duties



3. Generational Compliance



4. Loose Coupling

Smart Grid Standards Mapping

Type of Organization							Areas of Focus or Attention
National Organizations	NIST	NERC FERC	NEMA	ASHRAE	CEA EIA	SAE	NIST is a key Focus is NIST, SAE
User Groups	UCA OpenSG	EPRI/EEI USGE WG	IEC 61970/68 CIM Users	DNP Users Group	BACnet Users	AEIC Meter Group	Focus is UCA, EPRI/EEI & IEC
Industry Alliances & Consortia	GWA GWAC	ZigBee+HomePlug (ZBHP)	ZigBee Alliance	HomePlug Alliance	AHAM	Z-Wave Alliance IPSO	Focus is ZigBee & ZBHP
SDOs	IEC	IETF	IEEE	ISO	ANSI		Focus is IETF, IEC and IEEE
Standards Material Sources	CEC Projects	DOE Projects	EPRI projects yellow/blue	Utility Projects	DOD Projects yellow/gray	Other Projects (NIST, …)	Focus is CEC/DOE

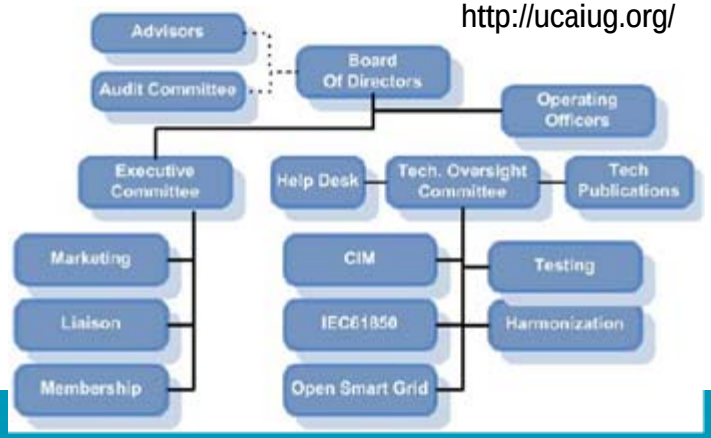
- We focus our energies on the green
- UCA is our lead Users Group
- Home Plug and Zigbee are key alliances now, more to come with Grid
- IEEE P2030, 802.15.4, P1901,

Utility Communication Architecture Iug

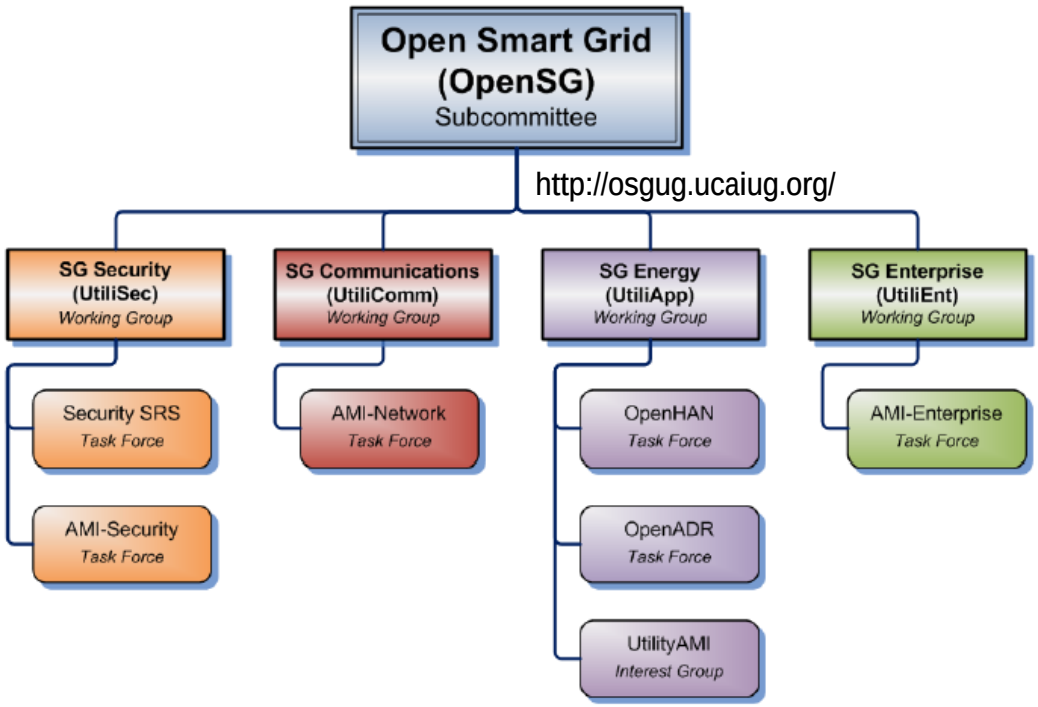
- The mission of the UCA International Users Group is to enable utility integration through the deployment of open standards by providing a forum in which the various stakeholders in the utility industry can work cooperatively together as members of a common organization to:
  - Influence, select, and/or endorse open and public standards appropriate to the utility market based upon the needs of the membership.
  - Specify, develop and/or accredit product/system-testing programs that facilitate the field interoperability of products and systems based upon these standards.
  - Implement educational and promotional activities that increase awareness and deployment of these standards in the utility industry.

UCA International Users Group

http://ucaiug.org/



Led by 10 Utilities representing 27% of all US electric meters



Key Takeaways to Today's Discussion

- Industry Standards are the primary, critical, component necessary to build an interoperable SmartGrid
- Standards must be developed in an open process. Failure to do so will impair the ability to deploy a SmartGrid
- Certification can not be achieved without standards but certification is even more critical than standards
- Understand the importance of separation of duties with regard to standards development

Questions?