# Smart Grid Information Update

## July 2010
## 802EC DCN 13

## IEEE 802 LMSC
## Tutorial
### San Diego, CA, USA

IEEE

# Introduction to the event

90 minutes  7:30 – 9:00 pm

Motivation -  Inform members of  the rapidly expanding set of activities around the world

Currently the "Pet Rock" of the Standards World

Brief overview of topics – not enough time for in depth exposes

This will be interactive, ask questions, but there is a lot to cover

# Speakers

- Bruce Kraemer – Chair 802.11, SGIP, PAP#2, Marvell Semiconductor

- Bob Grow – Chair Standards Board, Co-Chair P2030 TF2, Intel Corporation

- Larry Taylor – Rapporteur ETSI ERM/TG28, Discrete Time

- Mark Klerer – Chair 802.20, SGIP Vice Chair, Qualcomm

- Joseph Reddy – Systems Engineer Texas Instruments

- Bob Heile – Chair 802.15, Chair ZigBee, Co-Chair P2030 TF3

◈IEEE

# Part 1

**Agenda**

Introduction to Information Event
Introduction to Smart Grid - What is it?

Bruce Kraemer

Bob Grow

**Multi-national & International**

JTC1     Special Working Group

IEEE

IEEE project list

15.4g

P2030 series

P1901

1547 series

# Part 2

**Europe**

IEC

Global Standards for the Smart Grid

SG3 – Smart Grid Standardization Roadmap

ITU

Smart Grid Standards Initiative

G.hn

EC

Directive 2006/32/EC

Smart Grids Task Force

M/441 European Open Meter Mandate

CEN

Standardisation Mandate concerning the charging of electric vehicles

CENELEC

ETSI

Larry Taylor

# Part 3

## Primarily US Centric

NIST SGIP

PAPs

SGAC

SGTCC

Cyber Security


SAE

Open SG

Mark Klerer

# Part 4

Energy STAR

EPRI – Unified Metrics

GWAC – Grid Wise Architecture
   Council

Bruce Kraemer

Joseph Reddy

IETF

6LoWPAN (RFCs:  4944, 4919)

Roll  (RFCs:  5867, 5826, 5673, 5548)

IEEE

# Part 5

ZigBee SEP                          Bob Heile

AHAM – Association of Home Appliance
Manufacturers

The Future for Appliances in the Smart Grid

## Japan and Asia

Japan, Other

◆IEEE

# What is Smart Grid?

# Bob Grow

# SG Definition Depends on Perspective

- An upgrade to the electrical power transmission, generation and distribution grid.
- A business opportunity for "smart" utility meters.
- A business opportunity to networking the home for managing energy consumption.
- A vehicle to facilitate energy independence and curb greenhouse gas emissions.
- The latest thing my boss asked me to work on.

# Example definition –
# US Department of Energy

"an automated, widely distributed energy delivery network characterized by a two-way flow of electricity and information and will be capable of monitoring everything from power plants to customer preferences to individual appliances. It incorporates into the grid the benefits of distributed computing and communications to deliver real-time information and enable the near-instantaneous balance of supply and demand at the device level."

# An observation

Recognize that what is being worked on is a "smarter" grid. Smart grid isn't a destination as much as it will be a framework for continuing evolution.

# Multi-National Engagement

# Relevant standards

- Most SDOs have been evaluating their standards portfolios for relevant standards
- Most SDOs are also looking for new standardization opportunities
- List of IEEE Smart Grid standards http://smartgrid.ieee.org/standards
  - List developed by Power and Energy Society
  - More than 100 standards (including 802 standards)
  - More than 20 standards projects listed

◆IEEE

# IEEE Smart Grid projects

- A IEEE 2030 series was conceived years ago, it is now beginning to emerge
- Something new specific for Smart Grid should consider a P2030 identification
  - P2030 – Smart Grid interoperability
  - P2030.1 – Electrical transportation infrastructure
- Established technologies appropriately retain existing numbering
  - IEEE P802.15.4g – one of the first to address Smart Grid specifically
  - IEEE P1901 – Power line communications
  - IEEE 1547 series – established standards for distributed generation, additional work underway

# IEEE P2030

- As with many IEEE standards for the power industry, this is a guide (presents alternatives)

- P2030/D3.0 will be produced soon

- On track for March 2011 sponsor ballot

IEEE

# INCITS to JTC1

- ISO/IEC JTC1 has estabilished a Special Working Group on Smart Grid
- INCITS has estabilished a study group on Smart Grid
- The Terms of Reference for both groups is similar
- The INCITS SG is the US TAG to the JTC1 SWG

◆IEEE

# Europe

# Larry Taylor

# Smart Grid in Europe

- **Fairly complex landscape**
  - Many national authorities
    - Range of national economic and technological development
    - Range of market philosophies from open to closed
  - European Union
    - EC Directives
    - EC Mandates
    - Funded R&D programs
  - Many standards publishing organisations
    - IEC
    - ITU
    - CEN/CENELEC
    - ETSI

# European Context

- Markets
  - Fragmented electricity market vs US aging power grid
  - Deregulation of electricity in some EC states
  - Vision:
    - Start with a smart metering infrastructure then extend to a smart grid network
- Energy Efficiency Directive 2006/32/EC
  - Promotes competition in energy supply as well as improvements in efficiency and carbon footprint reduction
- Smart Grids Directive 2009/72/EC of 13 July 2009
  - "Member States should encourage the modernisation of distribution networks, such as through the introduction of smart grids, which should be built in a way that encourages decentralised generation and energy efficiency."
- Smart Energy Technology (SET) Plan sets out following objectives:
  - 35% of electricity from dispersed and renewable sources by 2020
  - integrating further national networks into a pan-European network
  - guaranteeing a high quality of electricity supply
  - EU has funded a large number of research projects under FP7

◆IEEE

# European Smart Grid Programs

- EU Smart Grids Task Force
  - A Steering Committee and 3 Expert Groups
  - EG 1. Functionalities of Smart Grids and Smart Meters
    - State of the art - standards field trials,, products on the market
    - Functionalities - services, SG components, functions, strategy for standards
  - EG 2. Regulatory recommendations for data safety, data handling & data protection.
    - Who owns the data? Who has access to the data? Need for one  (standardized) data model.
    - Cyber Security
  - EG 3. Roles and responsibilities of actors involved in the deployment of Smart Grids.
    - Role of standards

IEEE

# European Smart Grid Programs (2)

- CEN/CENELEC/ETSI Smart Grids Joint WG
  - A common initiative launched on March 8th
  - Agreement to form a coordination group and a "Focus Group"
  - Major stakeholders represented

- IEC Global Standards for the Smart Grid
  - Strategic Group 3 – working on Smart Grid since April '09
  - Cooperation with NIST
  - Identified relevant IEC standards for Smart Grid

# EU M/441 Smart Metering Mandate

- European Commission Mandate
  - Issued in March 2009 by DG TREN
  - Sent to, and accepted by, the 3 ESO's : CEN, CENELEC and ETSI
  - Managed by SM-CG populated by major stakeholders and user group
- Main objective
  - To build open interoperable standards for European smart meters, providing secure bi-directional communication and as well as enhanced functionality to promote consumer awareness of actual consumption
- Time schedule :
  - March 2009 + 9 months
    - state of the art of existing standards, gap analysis, and first Work Program
    - Currently preparing a Technical Report on architecture and standards
  - March 2009 + 30 months
    - Develop smart metering standards for additional functionality defined in the initial report

◈IEEE

# ITU

- International rather than European, but based in Geneva
  - T - Focus Group on Smart Grid (FG Smart)
    - The Focus Group (FG) aims to identify potential impacts on standards development
    - Investigate future ITU-T study items and standards development
    - Familiarize ITU-T and standardization communities with emerging attributes of smart grid
    - Encourage collaboration between ITU-T and smart grid communities
    - G.hn
      - Home networking standard – Fibre, Cable & PLC
  - R - Spectrum requirements for smart grid
    - ITU-R is developing a study question on suitable spectrum for Smart Grid
    - Fixed & Mobile and possibly other interested work groups

◆IEEE

# ETSI

- Machine-to-Machine
  - Internet of Things
  - Key strategic direction for ETSI
  - Leverage vast mobile network experience
  - Generic architecture for services
  - Smart Metering / Smart Grid use cases
  - TC M2M focus for ETSI responses to EC Mandates on Smart Metering and Smart Grid
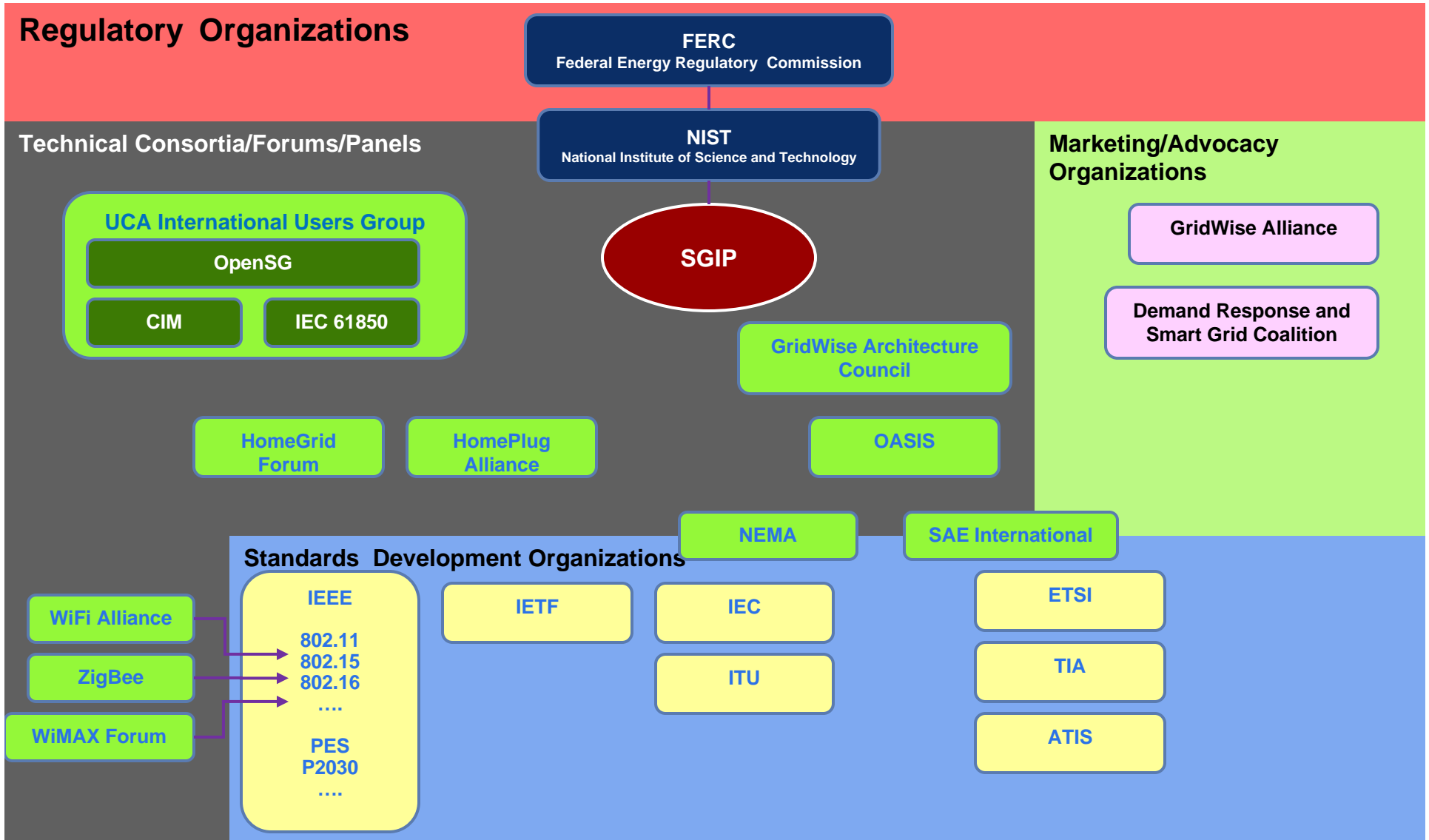
# ETSI (2)

- Many other TCs working on relevant technology
  - ERM (EMC & Radio Matters)
    - TG28 (SRDs) – Smart Metering Wireless Access
    - TG11 (2.4GHz wideband modulation), TGUWB and others
  - TISPAN
    - Security and End-to-End communications
  - PLT
    - ETSI Powerline communications standards
  - More…..
- Smart Grid Scoping Workshop – June '10
  - Led by ETSI Board "Champion"
  - Investigate what is happening
  - Brainstorm the issues and future direction

# Primarily US Centric

# Smart Grid Standards Environment

**Regulatory Organizations**

**FERC**
Federal Energy Regulatory Commission

**NIST**
National Institute of Science and Technology

**SGIP**

**Technical Consortia/Forums/Panels**

**UCA International Users Group**

**OpenSG**

**CIM** | **IEC 61850**

**HomeGrid Forum**

**HomePlug Alliance**

**GridWise Architecture Council**

**OASIS**

**Marketing/Advocacy Organizations**

**GridWise Alliance**

**Demand Response and Smart Grid Coalition**

**Standards Development Organizations**

**NEMA**

**SAE International**

**WiFi Alliance**

**ZigBee**

**WiMAX Forum**

**IEEE**

**802.11
802.15
802.16
….**

**PES
P2030
….**

**IETF**

**IEC**

**ITU**

**ETSI**

**TIA**

**ATIS**

7/12/2010

28

# SGIP (Smart Grid Interoperability Panel)
## Snapshot

| | |
|---|---|
| Overview | The SGIP is an advisory panel that supports NIST in fulfilling its responsibilities under the 2007 Energy Independence and Security Act. The SGIP will identify, prioritize and address new and emerging requirements for Smart Grid standards. It will further develop the initial NIST Framework and Roadmap for Smart Grid Interoperability Standards. That roadmap will contain a list of standards required for interoperability of the Smart Grid and connected devices. It will also identify standards gaps and additional standards required. The guidelines will likely become mandated by the FERC (Federal Regulatory Energy Commission). The various technical working groups from NIST and the GridWise Architecture council have been subsumed by this body. |
| Focus of Standards Activity | The SGIP will not develop standards but its work products will include standards by reference. The SGIP will:<br>•Maintaining and evolve the Smart Grid Conceptual Model<br>•Identify and coordinate of SDO led standards development effort to support the Smart Grid operational framework<br>•Maintain Priority Action Plans (PAP) for the development of Smart Grid related standards<br>•Provide guidance for Smart Grid Cyber Security<br>•Establish a Testing and Certification regime<br>•Maintain an Interoperability Knowledge Base (IKB) |
| Standing Committees and Work Groups | • Architecture Working Group<br>• Cyber Security Task Group<br>• Buildings to Grid (B2G) DEWG (Domain Experts Working Group)<br>• Industrial to Grid (I2G) DEWG<br>• Home to Grid (H2G) DEWG<br>• Transmission & Distribution (T&D) DEWG<br>• Business & Policy (BnP) DEWG<br>• Plug in Electric Vehicle Task Group (PEVTG) |

◆IEEE

# SGIP Internal Structure and Governance Overview

**NIST Oversight**

**Stakeholder Category Members (22)**

**SGIP Standing Committee Members (2)**

**At large Members (3)**
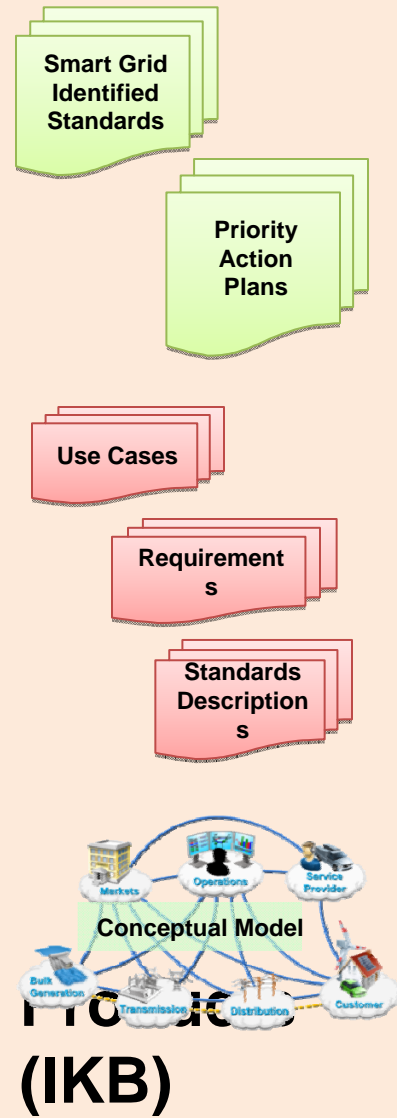
**Ex Officio (non-voting) Members**

**SGIPGB**

**One Organization, One Vote**

**Standing Committees**

**Working Groups**

**SGIP**

**Smart Grid Interoperability Panel and Governing Board**

**Smart Grid Identified Standards**

**Priority Action Plans**

**Use Cases**

**Requirements**

**Standards Descriptions**

**Conceptual Model**

**Products (IKB)**

◆IEEE

# NIST Defined Priority Action Plans

| # | Priority Action Plan [*] | # | Priority Action Plan [*] |
|---|---|---|---|
| 0 | Meter Upgradeability Standard | 1 | Role of IP in the Smart Grid |
| 2 | Wireless Communications for the Smart Grid | 3 | Common Price Communication Model |
| 4 | Common Scheduling Mechanism | 5 | Standard Meter Data Profiles |
| 6 | Common Semantic Model for Meter Data Tables | 7 | Electric Storage Interconnection Guidelines |
| 8 | CIM for Distribution Grid Management | 9 | Standard DR Signals |
| 10 | Standard Energy Usage Information | 11 | Common Object Models for Electric Transportation |
| 12 | IEC 61850 Objects/DNP3 Mapping | 13 | Time Synchronization, IEC 61850 Objects/IEEE C37.118 Harmonization |
| 14 | Transmission and Distribution Power Systems Model Mapping | 15 | Harmonize Power Line Carrier Standards for Appliance Communications in the Home |
| 16 | Wind Plant Communications | | |

[*] There is *no relative* priority implied within the 16 PAPs.
Source: http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/WebHome#Priority_Action_Plans_PAPs

◆IEEE

# Priority Action Plans

| PAP | SSO Lead(s) | Output |
|---|---|---|
| 1 | IETF | IETF Requests For Comment (RFC's) Approximately 80 are referenced in the "core " document for this PAP. Well defined networking "stacks" will use a subset of these core standards |
| 2 | IEEE, EIA, WIMAX Forum, TIA, 3GPP2, ATIS, 3GPP, ETSI | IEEE 802 series: IEEE 802.11, 802.15.4, 802.16, IPOS DVB S2, CDMA 2000 series, TIA HRPD and MPS series, 1X-EV-DO, EDGE, UMTS, HSPA+, LTE |
| 3 | OASIS, ZigBee, NAESB | OASIS Energy Market Information Exchange, SEP2 |
| 4 | CalConnect, IETF, OASIS, NAESB | OASIS WS-Calendar |
| 5 | AEIC, ANSI, IEEE, MC | AEIC v2.0 Guidelines for implementing ANSI/IEEE/MC metering protocol standards; Improved/clarified ANSI/IEEE/MC metering protocol standards; Tutorial/education materials on metering protocol standards |
| 6 | ANSI, IEC, IEEE, MC, MultiSpeak | Technical mappings between key standards (ANSI/IEC, ANSI/MultiSpeak), integration roadmap |
| 7 | IEEE SCC21, IEC TC57 WG17 | IEEE 1547.8, IEC 61850-7-420 |
| 8 | IEC TC 57 WGs 13, 14, 17 | IEC 61968, IEC 61970, IEC 61850 |
| 9 | OASIS, LBL OpenADR, ZigBee, NAESB, ASHRAE, LonMark | OASIS Energy Interoperation, SEP2 |
| 10 | UCAIug, EIS Alliance, ANSI, NAESB, OASIS, IEC, IEEE, Open ADR, IEC, ASHRAE, ISA, OVDA | IEC 61968, IEC 61850, SEP 2, ASHRAE 135/189, ANSI C12.19/22, EIA 721, EIA 709, OASIS Open ADR, Open ADE |
| 11 | IEC TC 57, IEC TC 69, UL, NEC, NEMA, IEEE 1547, SAE | IEC 61850-7-420, IEC 61968, IEC 61970, IEEE 1547, SEP 2, SAE, NEMA, UL, NEC Codes |
| 12 | IEC, DNP User's Group, IEEE, UCA-IUG | **New:** IEC 61850-80-5, DNP3 Application Note, **Potential (not confirmed) Changes to:** DNP3, IEEE P1815, IEC 61850 |
| 13 | IEEE, IEC, NASPI | **New:** IEEE C37.118 (updated version), IEC 61850-90-5, IEEE C37.238, **Potential (not confirmed) Changes to:** IEEE 1588, NASPI Guidelines and Specifications |
| 14 | IEC TC 57 Working Groups 10, 13,14,16, 17,19 IEEE PSRC H5, H16, Multispeak | IEC 61850, IEC 61970, IEC 61968, IEEE C37.239, IEEE C37.237 MultiSpeak v1-v4 |
| 15 | IEEE, ITU-T | IEEE 1901, IEEE 1901.2, ITU-T G.hn (G.9960, G.9961), G.cx (G.9972), ITU-T G.hnem, ISO/IEC 14908-3 (LonWorks ), ISO/IEC 14543 (ST/KNX), EN 50065-1 |
| 16 | IEC | 61400-25, Wind Plant Communications, based on 61850 |

# SGIP's Key Role in Smart Grid Evolution

▣ Though SGIP itself does not develop standards it is central to the adoption of Smart Grid Standards and the evolution of the Smart Grid:

   ➢ It derives its authority via the Energy Independence and Security Act (EISA) of 2007. Under that authority it will:

      ▪ Evolve the Smart Framework

      ▪ Specify Smart Grid standards requirements

      ▪ Specify Smart Grid Cyber-Security requirements

      ▪ Oversee the development of a testing and certification test-bed

      ▪ Oversee the evolution of a Smart Grid standards catalog

   ➢ Its recommendations to NIST are likely to become regulations promulgated by the Federal Energy Regulatory Committee (FERC)

◆IEEE

# UCA International Users Group

# Mark Klerer

# UCA International Users Group (UCAIug)
## Snapshot

| | |
|---|---|
| Overview | The UCA International Users Group is focused on assisting users and vendors in the deployment of standards for real-time applications for several industries with related requirements. The Users Group does not write standards, however works closely with those bodies that have primary responsibility for the completion of standards (notably IEC TC 57: Power Systems Management and Associated Information Exchange).<br><br>The UCAIug as well as its member groups (CIMug, Open Smart Grid, and IEC61850) draws its membership from utility user and supplier companies. |
| Focus of Activity | 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:<br>• Influence, select, and/or endorse open and public standards appropriate to the utility market based upon the needs of the membership.<br>• Specify, develop and/or accredit product/system-testing programs that facilitate the field interoperability of products and systems based upon these standards.<br>• Implement educational and promotional activities that increase awareness and deployment of these standards in the utility industry. |
| Work Groups | • OpenSG (Open Smart Grid)<br>   • OpenHAN<br>   • OpenAMI<br>   • AMI-Sec TF<br>   • OpenADR<br>   • UtiliComm<br>• CIM (Common Information Model) User Group<br>• IEC 61850 User Group (Substation Automation) |

# UCA International Users Group

- The UCA® International Users Group is a not-for-profit corporation consisting of utility user and supplier companies that is dedicated to promoting the integration and interoperability of electric/gas/water utility systems through the use of international standards-based technology. It is a User Group for IEC 61850, the Common Information Model – Generic Interface Definition (CIM/GID as per IEC 61970/61968), advanced metering and demand response via OpenDR.

- Mission: 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.

- The Users Group is a focus group to assist users and vendors in the deployment of standards for real-time applications for several industries with related requirements. The Users Group does not write standards and shall, where appropriate, work closely with those bodies that have primary responsibility for the completion of standards (notably IEC TC 57: Power Systems Management and Associated Information Exchange).

- Note that the Users Group is working on many areas of interest for different users where standards bodies may not yet be active or where the interests of users goes beyond the purview of the presently identified standards (such as the completion of users guides, industry education, transfer of technology, marketing support, identification of users needs and industry demonstrations to prove concepts).
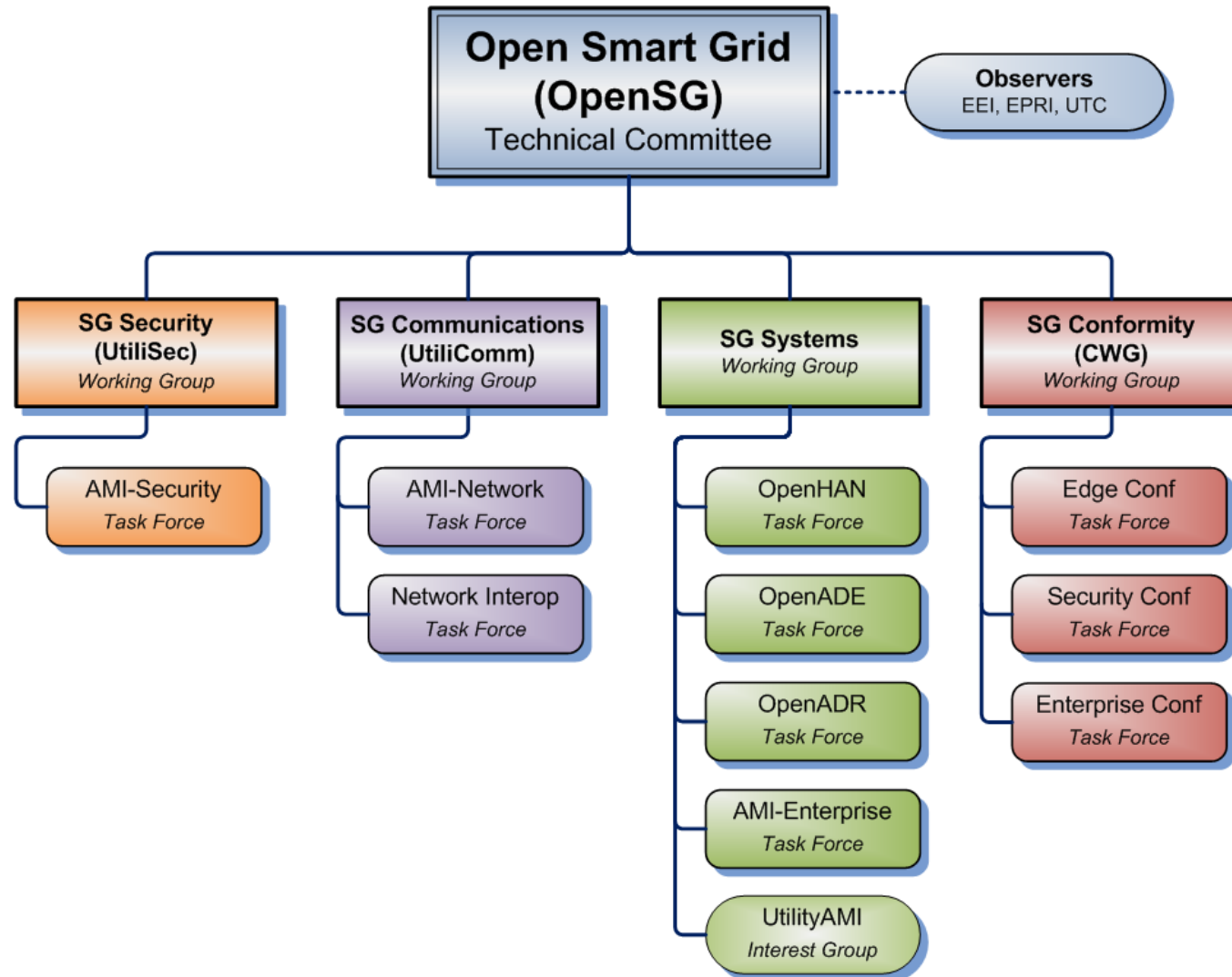
◈IEEE

# UCA International Users Group



UCA International Users Group Organization Chart
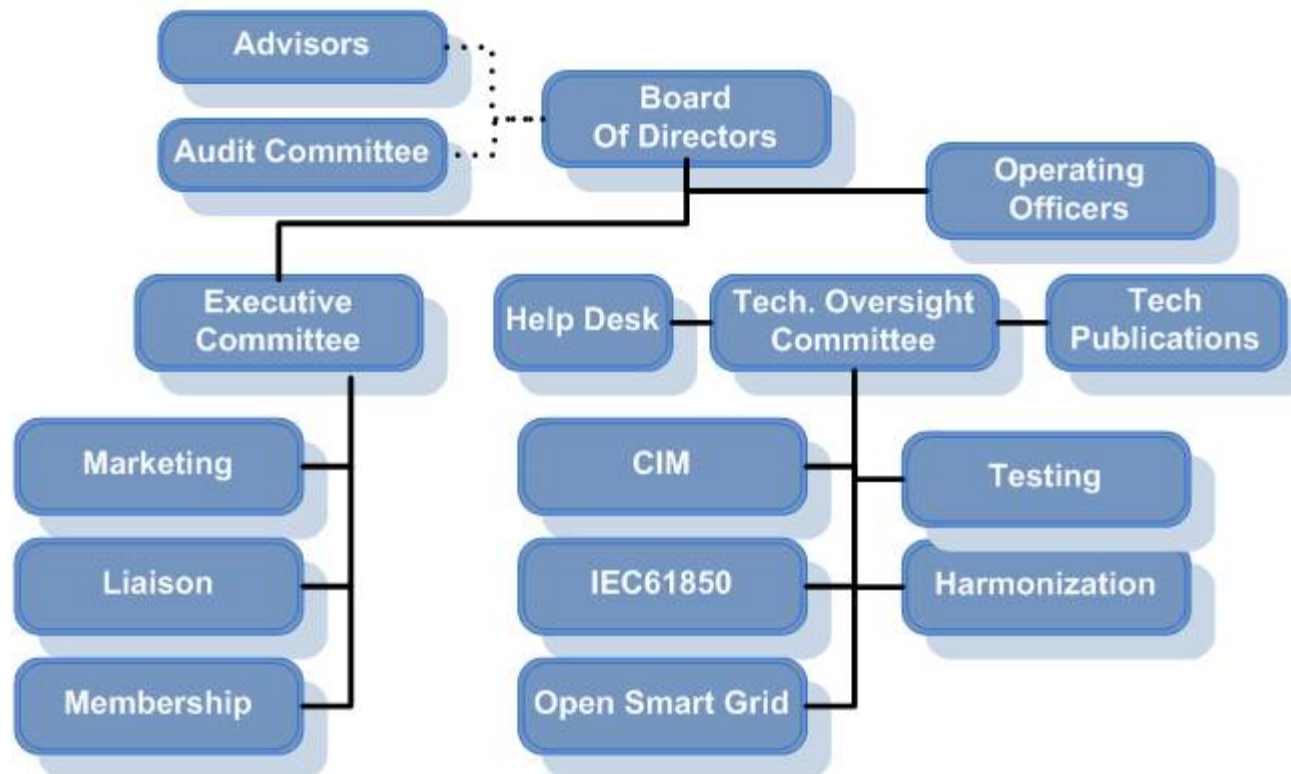
# OpenSG Users Group
## *UCA International Users Group*

# OSGug Mission

- The mission of the OSGug Technical Subcommittee is to foster enhanced functionality, lower costs and speed market adoption of Advanced Metering networks and Demand Response solutions through the development of an open standards-based information/data model, reference design & interoperability guidelines. The objectives are to:
  - Facilitate the broad adoption of advanced metering and demand response
  - Define what 'open standards' means for advanced metering infrastructures and demand response solutions
  - Diminish technical and functional risk concerns for utilities, regulators and ratepayers
  - Empower consumers with tools to better understand and manage their energy use
  - Foster industry innovation, efficiency and lower cost solutions

◆IEEE

# OpenSG Users Group
## *UCA International Users Group*

▪ SG Communications (UtiliComm)

– SG-Network

– Network Interop

▪ SG Systems

– OpenHAN

▪ Develops HAN requirements and Use cases (*Cited as a NIST key standard).*

– OpenADR (Automated Demand Response)

▪ Developed by Lawrence Berkley National Laboratory (US-DOE) (*Cited as a NIST key standard)*

– OpenADE (Open Automatic Data Exchange)

▪ Develops business requirements, use cases, and system requirements specifications that allow a consumer to grant a third party access to their electric data and in accordance with that authorization, the utility delivers the consumer data to the third party using a standard interoperable machine-to-machine (M2M) interface. These recommendations will be developed according to guidelines provided by standards development organizations (SDOs) such as IEC, referenced in OpenADE documents, with the goal of gaining consensus and adoption as international standards.  (Target completion date 12/2010)

http://osgug.ucaiug.org/

# OpenADE and OpenHAN Interfaces
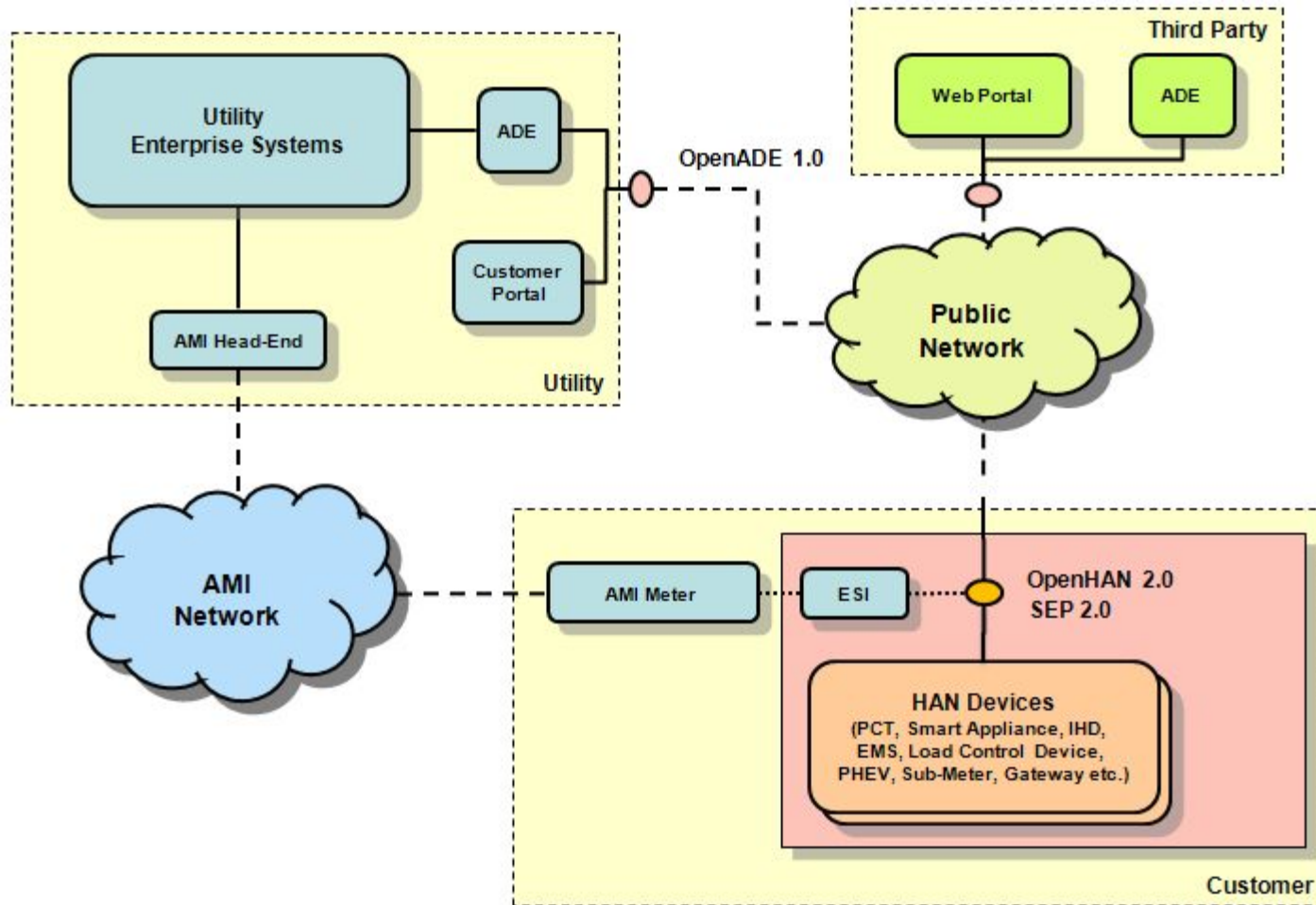
# SG Communications WG

- The charter for SG Communications can be summarized as follows:
  - Identify and articulate Smart Grid communications requirements and work with Standards Development Organizations (SDOs) and vendor consortiums to realize those requirements.
  - Engage with the NIST Smart Grid Roadmap activities and address communications related OpenSG tasks in the various NIST Priority Action Plans (PAPs).

- The SG Communications Working Group will work with the SG Systems, SG Security and the SG Conformity Working Group in support of their charters. The SG Communications Working Groups may also cover application and security support topics such as:
  - Efficient delivery of XML meta data between entities in the system
  - Deployment of security policies within various layers of the OSI stack
  - Other communications and support features as identified by the SG Systems and SG Security Working Groups.

- SG Communications is responsible for defining how components defined in AMI Network and Network Interop supply internetworking services to hybrid systems employing combinations of physical layers. Targeted standards will cover the complete set of use cases envisioned in the OpenSG Market Requirements Document (MRD) and in the OpenHAN specification. Deployments targeted by OpenSG will contain subsystems and components that communicate using the Internet Engineering Task Force (IETF) Internet Protocol (IP) family of standards. The Working Group is responsible for defining how these IP sub-systems and components are incorporated into the system as a whole such that all relevant use-cases and market requirements are satisfied.

◆IEEE

# CIM Users Group
## UCA International Users Group

- The **CIM Users Group** is dedicated to the promotion of the portability of existing applications and to the promotion of the ease of installation of new applications through the use of such standards as the common information model, message bus, and common data access specification.

- Unlike a protocol standard, the common information model (CIM) is an abstract model that may be used as a reference, a category scheme of labels (data names) and applied meanings of data definitions, database design, and a definition of the structure and vocabulary of message schemas. The CIM also includes a set of services for exchanging data called the Generic Interface Definition (GID). Due to its abstract nature, the CIM may be implemented in many ways. Some users may want to be more specific to support a particular product or project; others may want to limit its scope. The abstract nature of the CIM leads to flexibility and competing demands for its enhancement. It is important to remember that the CIM does not have to be implemented in its entirety in a given project.

- The **CIM Users Group** is under the administrative umbrella of the **UCA International Users Group**, a not-for-profit corporation. The UCAIug as well as its member groups (CIMug, OpenAMI, and IEC61850) draws its membership from utility user and supplier companies. The mission of the CIMug is to manage and to communicate issues concerning the CIM model and to serve as the primary means for developing the CIM model consensus and consistency across the industry.

# IEC 61850 User Group
## UCA International Users Group

- IEC 61850 Systems and Network Management Project sponsored by AEP and EPRI.

- The Electric Utility Substation is arguably the most critical link in the real time operations of the utility. Data from the field is brought back in real time to monitor the power system and commands are sent to reliably and cost-effectively control the transmission, generation and distribution subsystems. Modern substation automation systems utilizing LAN technology must be independent of any possible failures of the power systems, as they are essential in recovery operations. Therefore the system design for the backup of the substation LAN hardware, software, communications and management functions is essential. Further, Systems and Network Management tools are essential as they assist in monitoring and maintaining the substation LAN functions, the connected intelligent devices, and provide a means of rapid recovery.

# SAE

# SAE International (SAE Standards)
## Snapshot

| Overview | SAE International a professional organization for mobility engineering professionals in the aerospace, automotive, and commercial vehicle industries. The Society includes a standards development organization for the engineering of powered vehicles of all kinds, including cars, trucks, boats, aircraft, and others. The Hybrid Vehicle committee covers projects dealing with PEV communications. |
|---|---|
| Focus of Standards Activity | SAE covers the full gamut of standardization for aerospace automotive and commercial vehicles. Its work includes standards for data communications within the vehicle as well as standards for Plug In Electric Vehicles. |
| Relevant Standards and Work Groups | • Hybrid Committee |

# Plug-in Electric Vehicles and the Smart Grid

- **Smart Charging Strategies**
  Sophisticated software algorithms aggregate charging vehicles into a single power resource that can be managed as controllable load. Smart charging requests are transmitted over secure, two-way communication networks, in support of the following functions:
  - **Load Shifting –** Charging load can be moved out of peak periods by establishing time-based charging intervals.
  - **Load Shaping –** By integrating a variety of real-time signals, utilities are able to dynamically dispatch charging load to achieve specific objectives.
  - **Vehicle to Grid (V2G) –** The two-way flow of power between the grid and electric vehicles can be managed, returning energy to the grid when needed.

# SAE International

- Hybrid Vehicle Committee
  - Hybrid electric vehicle standards including communication aspects of PEVs

| Project | Title |
|---------|-------|
| J1715 | Hybrid Electric Vehicle (HEV) & Electric Vehicle (EV) Terminology |
| J1772 | Electrical Connector between PEV and EVSE |
| J2293 | Communications between PEVs and EVSE for DC Energy |
| J2836/1 | Use Cases for Communication between Plug-in Vehicles and the Utility Grid |
| J2836/2 | Use Cases for Communication between Plug-in Vehicles and the Supply Equipment (EVSE) |
| J2836/3 | Use Cases for Communication between Plug-in Vehicles and the Utility Grid for Reverse Power Flow |
| J2847/1 | Communication between Plug-in Vehicles and the Utility Grid |
| J2847/2 | Communication between Plug-in Vehicles and the Supply Equipment (EVSE) |
| J2847/3 | Communication between Plug-in Vehicles and the Utility Grid for Reverse Power Flow |

# Energy Star, EPRI, GWAC

# Bruce Kraemer

# Energy STAR

▪ http://www.energystar.gov/

International standards for energy efficient consumer products

Intended to encourage use of the most energy efficient equipment and thereby reduce energy consumption and greenhouse gas emission by power plants.

Activity within the US Environmental Protection Agency Started in partnership with the DOE in 1992, but Australia, Canada, Japan, New Zealand, Taiwan and the European Union have also adopted the program

◆IEEE

# Energy Rated Devices

- Refrigerators, freezers
- Air conditioners
- Light Bulbs
- Washing machines and Dryers
- Small Networking Equipment
- Servers, WLAN Network appliances
- http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/small_network_equip/SNE_Stakeholder_Meeting_Final.pdf

Switches    Wireless Networking    Power over Ethernet



◆IEEE

# EU Energy Label

According to several different EU Directives (92/75/CEE, 94/2/CE, 95/12/CE, 96/89/CE, 2003/66/CE, et alia) most white goods, light bulb packaging and cars must have an **EU Energy Label** clearly displayed

◆IEEE

# Energy Power Research Institute EPRI

- http://www.epri.com/

The Electric Power Research Institute (EPRI) is an independent, non-profit company performing research, development and demonstration in the electricity sector for the benefit of the public.

Members represent more than 90% of the electricity generated and delivered in the U.S. International participation extends to 40 countries.

# Smart Grid Demonstration Initiative

The EPRI Smart Grid Demonstration Initiative is a five-year collaborative research effort focused on design, implementation, and assessment of field demonstrations to address prevalent challenges with **integrating distributed energy resources** in grid and market operations to create a "Virtual Power Plant." This newsletter provides periodic updates on the project and relevant industry news and events.

http://www.smartgrid.epri.com/doc/EPRI%20Smart%20Grid%20Advisory%20Update%202010_05_24.pdf

◈IEEE

# Unified Metrics

Unified Metrics for Management of Smart Grid Home Area Networks (Dec 2009)  Tim Godfrey Craig Rodine
1$^{st}$ International Workshop on Smart Grid Communications

**Multiple IEEE network technologies, including 802.11, 802.15.4 and P1901 can all support Smart Grid applications in Home Area Networks (HANs).**

**Utilities need visibility into the HAN to ensure the network is operational and able to support critical applications such as Demand Response and Electric Vehicle Charging.**

**This paper describes a set of network performance metrics that are consistent among the most prevalent HAN network technologies.**

IEEE

# GWAC – GridWise Architecture Council

☐ http://www.gridwiseac.org/

**Mission**

The GridWise Architecture Council (GWAC) enlists industry involvement to:

• Articulate the goal of interoperability across the electric system

• Identify the concepts and architectures needed to make interoperability possible

• Develop actionable steps to facilitate the interoperation of the systems, devices, and institutions that encompass the nation's electric system.

◆IEEE

# Domain Expert Working Groups

- NIST has joined with the GridWise Architecture Council (GWAC) to form Domain Expert Working Groups (DEWGs) to explore smart grid interoperability issues.
- **Standards Landscape Map**
- **NIST Smart Grid Standards Workshop**
- **Smart Grid Interoperability Roadmap**
- **NIST Smart Grid Standards KnowledgeBase (Smart Grid KB)**

**◈IEEE**

# Internet Engineering Task Force

## Joseph Reddy

# IETF activities update

- 6lowpan WG – Adaption of IPv6 protocol to operate on constrained nodes and link layers
  - RFC 4944: adaption of IPv6 to 802.15.4 link layer
  - Improved header compression scheme ( draft-ietf-6lowpan-hc-07 ), currently in WG last call
  - Neighbor disocvery protocol modifications ( draft-ietf-6lowpan-nd-11 ), close to WG last call

- ROLL WG – Routing protocol for efficient operation in low-power, lossy networks
  - RPL protocol (draft-ietf-roll-rpl-10 ), currently in WG last call

◆IEEE

# IETF activities ( contd. )

- CoRe WG: An application framework ( based on Restful-HTTP ) for resource constrained environments
  - Constrained Application Protocol ( draft-ietf-core-coap-01 )

- Miscellaneous items under consideration
  - PANA protocol for use in multihop wireless
  - TLS ciphersuite extensions to use AES-CCM

◆IEEE

# ZigBee Alliance activities

- ZigBee IP work group
  - Create protocol stack based on IETF standards for 802.15.4 based networks
  - Draft 0.7 document in letter ballot

- Interop events
  - 5 events held so far with different IETF protocols tested at each event
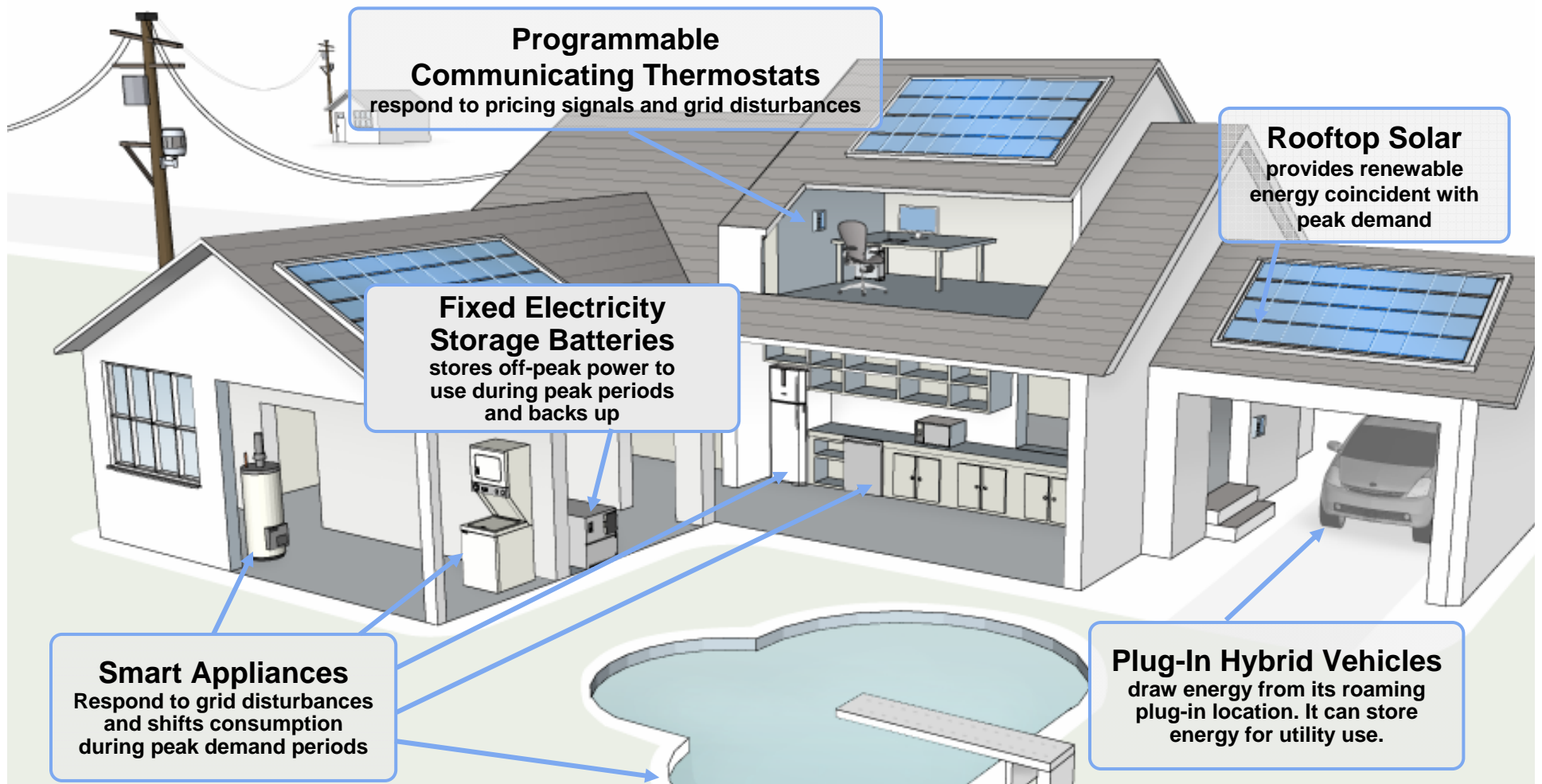  - Feedback from implementer's back into WG's

◆IEEE

# ZigBee SEP

# Bob Hiele

# Overall Smart Energy Status

▣ Important milestones in market adoption:
  – Ongoing NIST and US work
  – More than $400M in American Reinvestment & Recovery Act (ARRA) awards to ZigBee member companies for Smart Energy pilots, trials and implementations
  – 40+ million Smart Energy electric meters being deployed

    by over 11 utility companies
    ▪ Major deployments in California, Texas, Michigan and Virginia
    ▪ Total smart energy meter market in North America of

      80 million beyond 2011 (from utility RFPs)
    ▪ British Gas announced the deployment of more than 3M meters
    ▪ Asia – China poised to leapfrog other countries

▣ Profile development accelerating to take advantage of IP and multiple

media support, increases the usability and reach of smart energy and the

customer's ability to control

▣ Expanding cooperation in deployments, adoption and interaction with sister organizations around the world

◆IEEE

# Where does ZigBee Smart Energy fit?

**Programmable Communicating Thermostats** respond to pricing signals and grid disturbances

**Rooftop Solar** provides renewable energy coincident with peak demand

**Fixed Electricity Storage Batteries** stores off-peak power to use during peak periods and backs up

**Smart Appliances** Respond to grid disturbances and shifts consumption during peak demand periods

**Plug-In Hybrid Vehicles** draw energy from its roaming plug-in location. It can store energy for utility use.

Source: wsj.com

# Technical Work Progressing & Markets Expanding

*Accelerating market means expanding reach of technical work, relationships and processes*

- Some key formal liaisons:
  - ESMIG
  - HomePlug
  - NIST
  - DLMS Users Group
  - IETF
  - OpenSG
  - SunSpec Alliance
  - SAE
  - WiFi
- Joint Workgroup within the North American Energy Standards Board (*NAESB*) on aspects of the information model – leading NIST/SGIP efforts in consumer market
- Public comment being incorporated to further expand on open SE 2.0 development effort

# ZigBee Smart Energy 2.0

- Integration of Smart Energy with the IP stack
- ZigBee+IP Stack+MAC/PHY agnostic comms
- Best Practices, FAQ, Ongoing Documentation, marketing
- Forward-Thinking Developments
  (PHEVs, V2G, Distributed Generation, etc.)
- Other Improvements based on continuing feedback
  Market needs
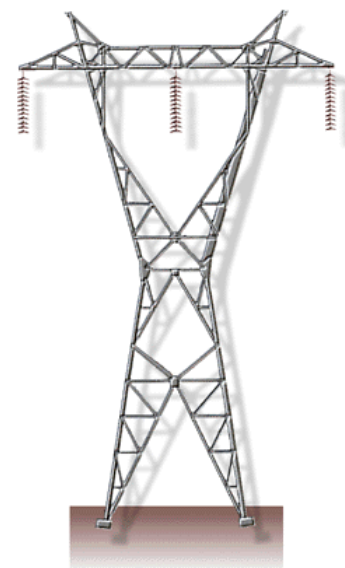
# AHAM

# Smart Appliances Taking Hold – Reaching the Consumer

- AHAM Guidance on architecture – Dec 2009 White Paper called for open, flexible and limited communications standards to enable the consumer market

  - Whirlpool stated all appliances will be Smart Grid compatible by 2015 & plans to put 1 M Smart Energy clothes dryers on shelves by end of 2011

  - GE announced to make available appliances with ZigBee Smart Energy nodes by end 2010

  - Indesit announces Smart Energy Appliances

# Japan, Australia, China

# Japan Smartgrid Update

- Japan Smart Community Alliance (JSCA) being set up
  - Managed by the New Energy and Industrial Technology Development Organization (*NEDO*)
  - Chaired by TOSHIBA
  - Directors: HITACHI, PANASONIC, MITSUBISHI, TEPCO, TOKYO GAS, ITOCHU, TOYOTA
  - Charter and Organization Structure of the Organization:
    - International Strategy WG (Working Group)
    - International Standardization WG (Industrial Technology and Guidelines for Conformance)
      - Smart House
      - Home Appliance Information
      - Energy Management
      - Smart Meter
      - Auto Mobile (EV,PHV etc..)
      - Communication Interface

**◆IEEE**

# Japan Smartgrid Update

- JSCA Communication Interface Participants are: NTT, NTT DoCoMo, KDDI, SoftBank, NEC, OKI, OMRON, Renesas, MITSUBISHI, SONY, NISSAN, PANASONIC, TOKYO GAS, TEPCO, TODEN (TOSHIBA). Other Members can be added
- The Communication Interface will have following objectives:
    - Network Architecture
    - Home Network
    - Mobile + Electric Vehicle Communication Link
    - Smart Meter and Compliance
        - Road Map WG
        - Smart House WG
    - Additional WG may be established based on the needs…

IEEE

# Australia Smartgrid Update

- Victoria mandating ZSE for Smart Metering
- Significant Water and Gas deplyments
- Western AU considering doing the same
- National Stakeholder Steering Committee (NSSC) developing a Federal Recommendation for Smart Metering and Smartgrid

# Chinese Smartgrid Update

- Related interests being grouped under the umbrella of the Sensing China Center
- Major facility being built in Wuxi which includes:
  - Demo center
  - Smart home trial
  - Multi-company research center

# Thank You