MADRI Meetings: July 1 & 2, 2009 (Philadelphia PA)

IEEE SCC21 P2030^{TM} Standards Development: Smart Grid Interoperability

presented by Tom Basso, Senior Engineer, NREL
IEEE SCC21 Representative, P1547.X and P2030 Secretary

IEEE P2030 *Draft Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System (EPS) and End-Use Applications and Loads*

Chair: Dick DeBlasio;   Vice Chair: Tom Prevost;   Secretary Tom Basso;
Co-Chairs: Bob Grow,   Sam Sciacca,   Stefano Galli,   Bob Heile

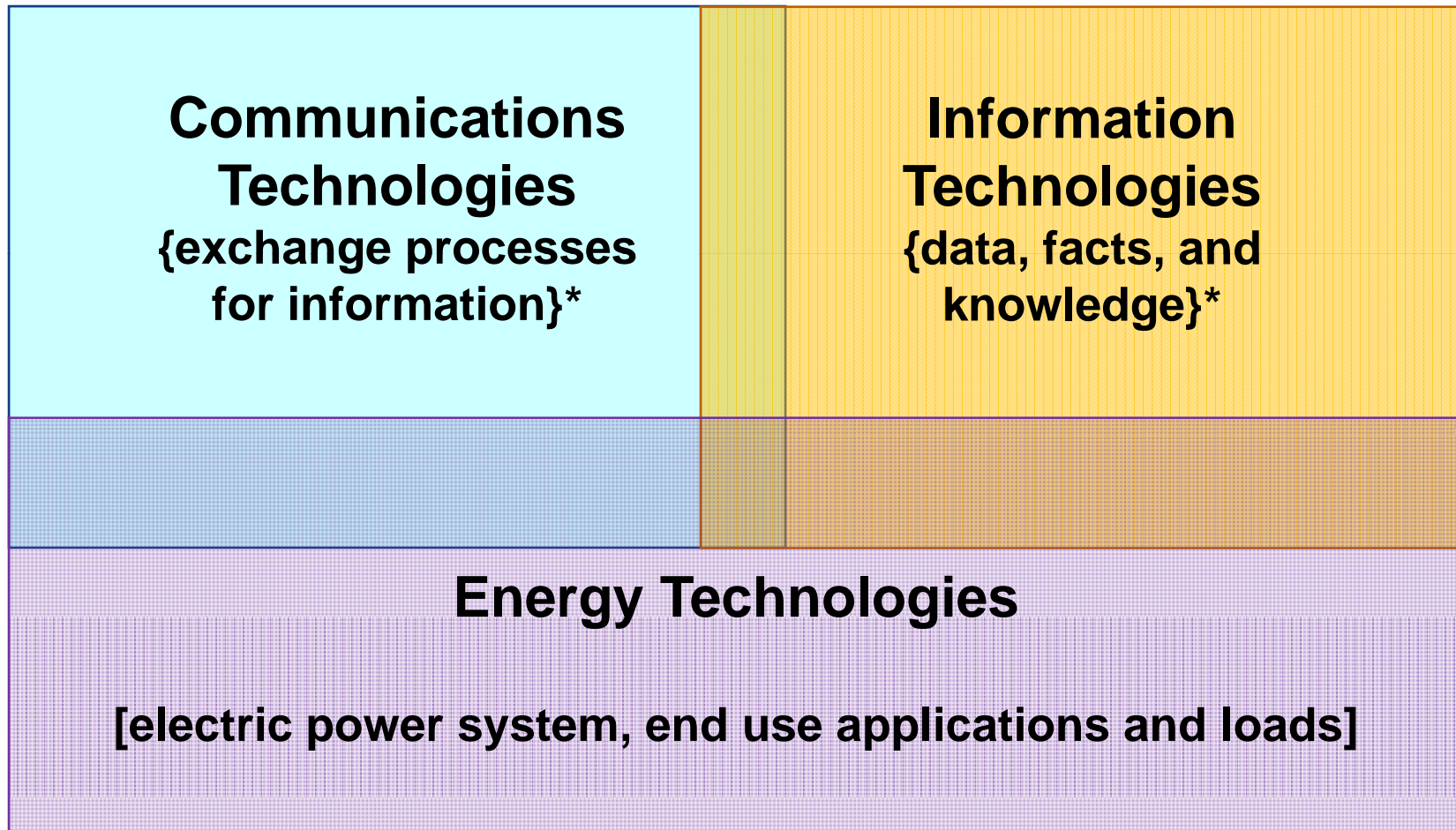**◆IEEE**

Interoperability Smart Grid Concepts
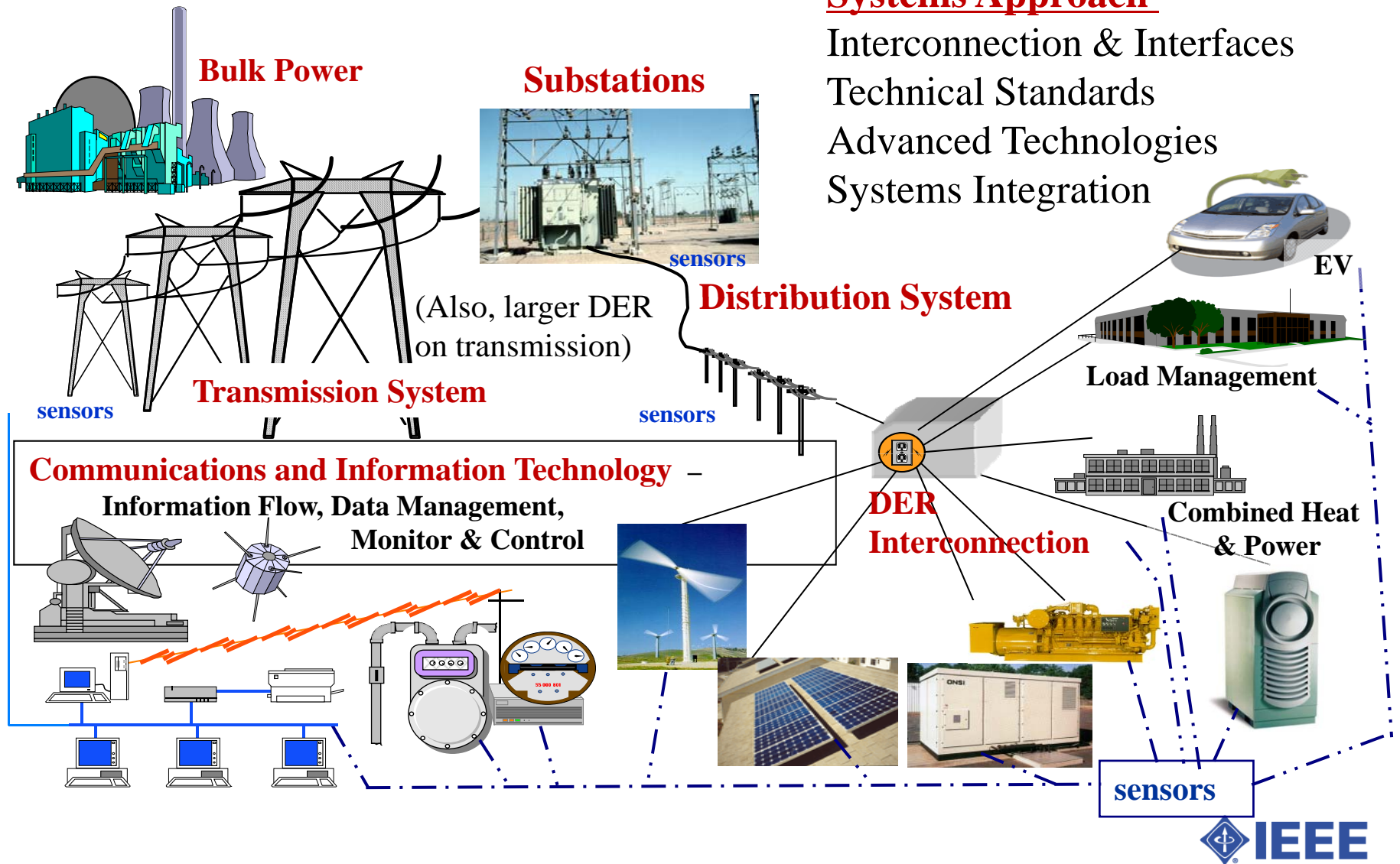
Systems Approach
Interconnection & Interfaces
Technical Standards
Advanced Technologies
Systems Integration

Bulk Power

Substations

EV

Load Management

(Also, larger DER on transmission)

Distribution System

sensors

Transmission System

sensors

sensors

Communications and Information Technology –
Information Flow, Data Management,
Monitor & Control

DER Interconnection

Combined Heat & Power

sensors

OBSERVATIONS

- Smart grid standards will extend across the entire grid (i.e., need interoperability standards (top down) and building block standards (bottom up).

- Smart grid equipment standards will be needed to handle information data management, communications and control.

- Flexible smart grid system interoperability design and operational standards will allow near term and long term smart grid evolution.

- Development of a body of interoperability smart grid standards need to be initiated now.

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IEEE Unifies Power, Communications and IT: Smart Grid Interoperability Standards Project P2030

Communications Technologies
{exchange processes for information}*

Information Technologies
{data, facts, and knowledge}*

Energy Technologies

[electric power system, end use applications and loads]

P2030   http://grouper.ieee.org/groups/scc21/index.html

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* {Webster's New Collegiate Dictionary}

- **P2030 Draft *Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation With the Electric Power System (EPS), and End-Use Applications and Loads*.** (PAR approved March 19, 2009)

- <u>**Scope.**</u> This document provides guidelines for smart grid interoperability. This guide provides a knowledge base addressing terminology, characteristics, functional performance and evaluation criteria, and the application of engineering principles for smart grid interoperability of the electric power system with end use applications and loads. The guide discusses alternate approaches to good practices for the smart grid.

- <u>**Purpose.**</u> This standard provides guidelines in understanding and defining smart grid interoperability of the electric power system with end-use applications and loads. Integration of energy technology and information and communications technology is necessary to achieve seamless operation for electric generation, delivery, and end-use benefits to permit two way power flow with communication and control. Interconnection and intra-facing frameworks and strategies with design definitions are addressed in this standard, providing guidance in expanding the current knowledge base. This expanded knowledge base is needed as a key element in grid architectural designs and operation to promote a more reliable and flexible electric power system.

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IEEE P2030 Overall Goals

1. Provide guidelines in understanding and defining smart grid interoperability of the electric power system with end-use applications and loads

2. Focus on integration of energy technology and information and communications technology

3. Achieve seamless operation for electric generation, delivery, and end-use benefits to permit two way power flow with communication and control

4. Address interconnection and intra-facing frameworks and strategies with design definitions

5. Expand knowledge in grid architectural designs and operation to promote a more reliable and flexible electric power system

6. Stimulate the development of a Body of IEEE 2030 smart grid standards and or revise current standards applicable to smart grid body of standards.

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IEEE P2030 Inaugural Meeting: June 3-5, 2009
Included Three Task Force Breakout Sessions

TF1: Power Engineering Technology	TF2: Information Technology	TF3: Communications Technology
Co-Leaders: Sam Sciacca and Tom Prevost Recorder: Tom Basso	Leader: Bob Grow Recorder: Mike Coddington	Co-Leaders: Stefano Galli and Bob Heile Recorder: Ben Kroposki

- Addressed: Smart Grid Definitions, Topologies, Interoperability, end-uses, interfaces, integration, etc.

- Systems Approach: focused on Functional and Performance Attributes including Test and Verification methods.

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Next Actions

- **Hold TF 1-2-3 meetings and teleconferences before next P2030 meeting**

- **Next meetings:**
  - **- TF1 (power engineering):** July at IEEE PES meeting
  - **- TF2 (IT): tentative** – July teleconference to decide
  - **- TF3 (communications):** September (tentative)

  P2030: October, east coast (tentative)

- **Other actions:** complete the IEEE SCC21 web pages, membership, listservs (email reflectors), etc.

Additional background slides follow
(Thomas.Basso@NREL.gov)

For more information visit:

IEEE SCC21 P2030 Series Public Web site:

http://grouper.ieee.org/groups/scc21/dr_shared/2030

E.g., Archives
- Meeting information
  - ➢ Registration
  - ➢ Agenda
  - ➢ Minutes

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TF1: Power (June summary notes)
Attendees Consensus of Direction

- TF-1 will focus on functional requirements of interoperability
- Draw as much as possible from existing/concurrent efforts of others (PES, ISA)
- Proactively Outreach for input/participation (e.g. EEI, NARUC, NEMA)
- Real time Collaboration with TF-2 and TF-3 essential to every aspect of our effort
- Break from traditional thinking to "future-proof" the efforts

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TF1 Work Groups (June summary notes)

- 6 Work Groups Identified and Populated
  - Energy Sources
  - Transmission
  - Transmission Substation
  - Distribution
  - Load Side (Working Title)
  - Cybersecurity

- Additional Work Group for Market Operation needs thought

- Some amalgamation/segmentation may occur as determined by Working Group activity

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TF2: IT (June summary notes) Rough Agreements – Architecture

❑ Privacy – support different ownership of data (aggregation enhances, high granularity compromises)

❑ Security – intrusion prevention and detection, focused on demarcs

❑ Data Integrity – undetected error requirements, communications and storage

❑ Safety – human (support for overides), device and grid

❑ Customer requires multi-manager (utility and customer) for both status and control

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TF2: IT (June summary notes)
Rough Agreements (cont.)

❑ Begin with NIST DEWG interfaces to define interoperability demarcation points
- o Each interface will have unique requirements
- o Volunteer group for generation, transmission and distribution
- o Volunteer group for consumer

❑ Also will consider "intrafaces" (within a cloud)

❑ Focus on object oriented device/function definitions
- o Accommodate "dumb" devices (aggregated)
- o Data structures, definitions and formats

TF2: IT (June summary notes)
TF2 Plans

- All participants challenged to become familiar with NIST document list and focus on those in their area of expertise and interest – applicability and gaps
- Will schedule July teleconference (week of 7/6)
  - Begin reflector discussion, papers of interest welcome
  - Will entertain proposals/presentations at next meeting
- Sara Biyabani, volunteered to be part of editorial team

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TF3: Communications (June summary notes)

- TF3 is defining communication requirements between devices in the Smart Grid

- Establish boundaries
  - Generation
  - Transmission
  - Distribution
  - Customer

TF3 – Communications (June summary notes)

- Action items
    - Read NIST Report (and digest it) - ALL
    - Identify security threat models – AMI-SEC has a document [Ruben Salazar will read and summarize], Kapil Sood (Intel) will contribute threat models
    - Gather inputs from TF1 and TF2 on what information needs to be transmitted and what requirements and what end points - Chair
    - Identify and establish Liaisons with outside groups – Chair
    - Determine frequency of TF3 meetings and conference calls
        - Would like to meet in person at least once before October
        - Have conference call in July, Meeting in Sept??
        - Need to avoid July NIST/EPRI meeting (July 23-24) Maybe have a meeting on July 25?

- Some people would like the following:
    - Identify existing communication standards and definitions for use in the Smart Grid - [Ben Rolfe, Brad Singletary - will provide wireless, Sterling Vaden – wired] Rish Ghatikar will also provide a list of existing communication standards and definitions used in Smart Grid – this info will get posted on the P2030 web

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TF3: Communications (June summary notes)

1. **Develop a Preliminary Guide Outline for Task Force**
   a) **Started by looking and understanding the PAR**
   b) **Discussed what OSI layers are within TF3 scope, layers 3-5**
   c) **Consensus on maintaining neutrality with respect to PHY/MAC**
   d) **Identified major advantages for IP as interoperability enabler**

2. **Develop Work Plan for Task Force**
   a) **Familiarize with the latest NIST report**
   b) **Work with TF1/TF2 on what information needs to be transmitted, from where to where, and with what requirements**
   c) **Start identifying threat models**

3. **Time line (schedule) for Task Force**
   a) **Timeline maybe premature to assess, but consensus on intent of meeting before October (July or September).**

4. **Make Task Force Assignments**
   a) **Establish liaison with other groups**
   b) **Start submitting documents**

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IEEE's role in smart grid standards

- *Numerous IEEE standards relate to the smart grid including diverse fields of digital information and controls technology, networking, security, reliability assessment, interconnection of distributed resources including renewable energy sources to the grid, sensors, electric metering, broadband over power line, and systems engineering. The standards are developed by a variety of expert groups within IEEE.*

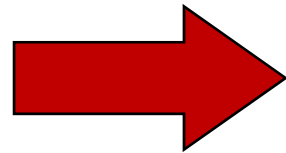# Standards Development Basic Functions

- Establish/maintain a consensus process to assure:
  - Openness,
  - Fairness,
  - Balance of interests among materially affected parties,
  - Right to appeal
  - Timely dissemination of standards and technical information

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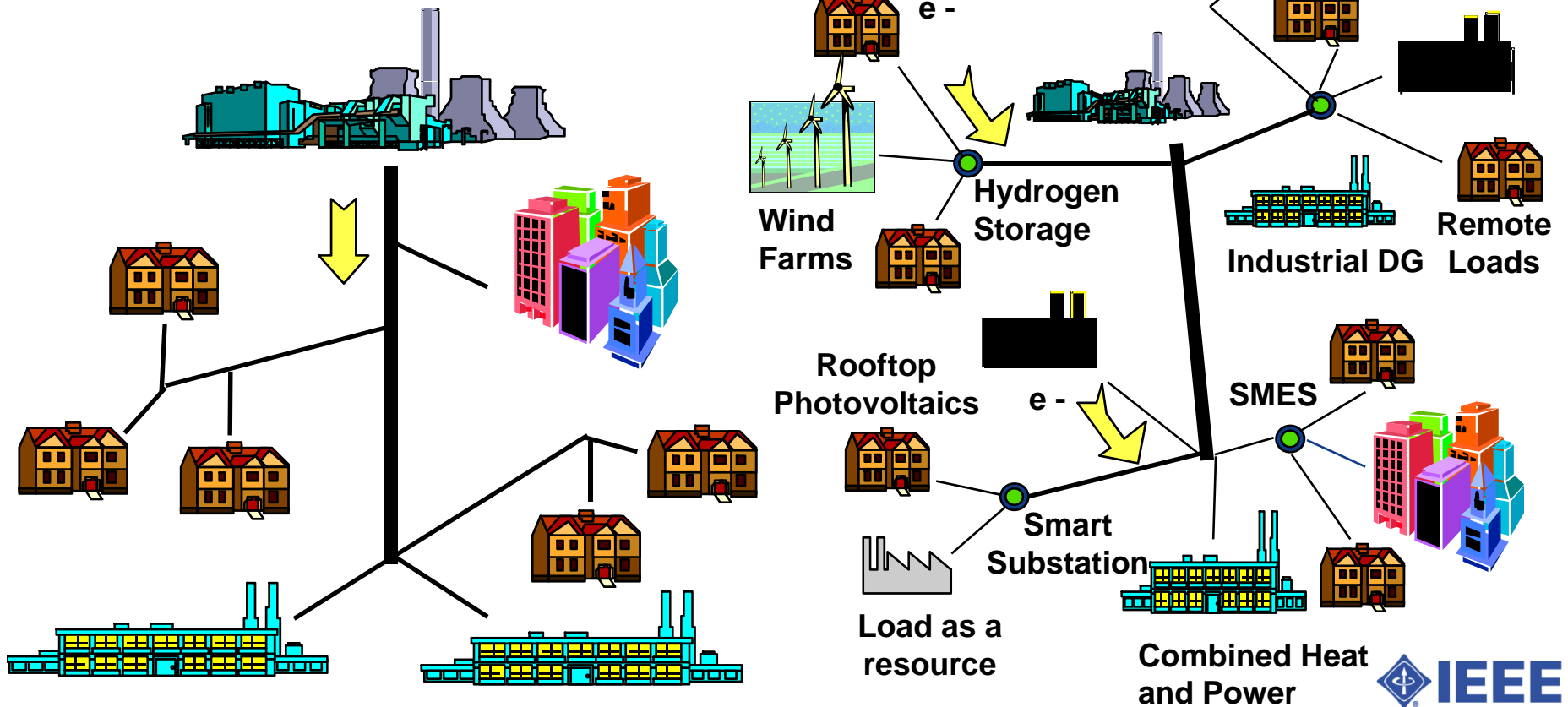# IEEE Task Force supporting NIST Smart Grid Interoperability Framework

- **IEEE Point of Contact (POC) and *IEEE* Smart Grid Ad-Hoc Review Group (established 2007) - Dick DeBlasio, Standards Board Member Liaison to NIST**

- **Power Engineering Society POC - Steve Pullins, Secretary, Intelligent Grid Coordinating Committee**

- **Computer Society POC – John Waltz, IEEE CS/VP**

- **Members at large to Date: Sam Sciacca (CEO/Microsol), James Pace /George Flammer /Jay Ramasastry (Silver Spring Networks), Chris Knudsen)PG&E), Phil Slack/George Casio (FPL), Bob Heile (chair IEEE 802.15), Geoff Mulligan (chair – 6LoWPAN), Alex Gelman (CTO/ NETovations), Chuck Adams (Program Director Standards – IBM), Larry Kotewa (SCC31/Community Energy), Joe Koepfinger (Standards Board Emeritus), Bob Grow (IEEE Standards Board Chair/Intel, Corp.), Steve Mills (Hewlett-Packard Company), Jean-Philippe Faure (P1901 chair), Tom Basso (SCC21 Representative/NREL), Cherry Tom (IEEE Standards Office), Tom Field, Bartosc Wojszczk, Joe Waligorski, and Pat Duggan.**

Grid Modernization

Today's Electricity … → *Tomorrow's Choices …*

Power park

e -

Wind Farms

Hydrogen Storage

Industrial DG

Remote Loads

Rooftop Photovoltaics

e -

SMES

Smart Substation

Load as a resource

Combined Heat and Power

Some Smart Grid Definitions

- "an automated, widely distributed energy delivery network characterized by a two-way flow of electricity and information, capable of monitoring and responding to changes in everything from power plants to customer preferences to individual appliances."

- "a smart grid is the electricity delivery system (from point of generation to point of consumption) integrated with communications and information technology"

- (Note: Other definitions may also be in the eyes of the beholder and multiple definitions may be a result of layers or sub-tiers of interoperability and end use applications but will have commonality once understood.)

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IEEE P2030 Guide to Interoperability Body of Smart Grid Standards
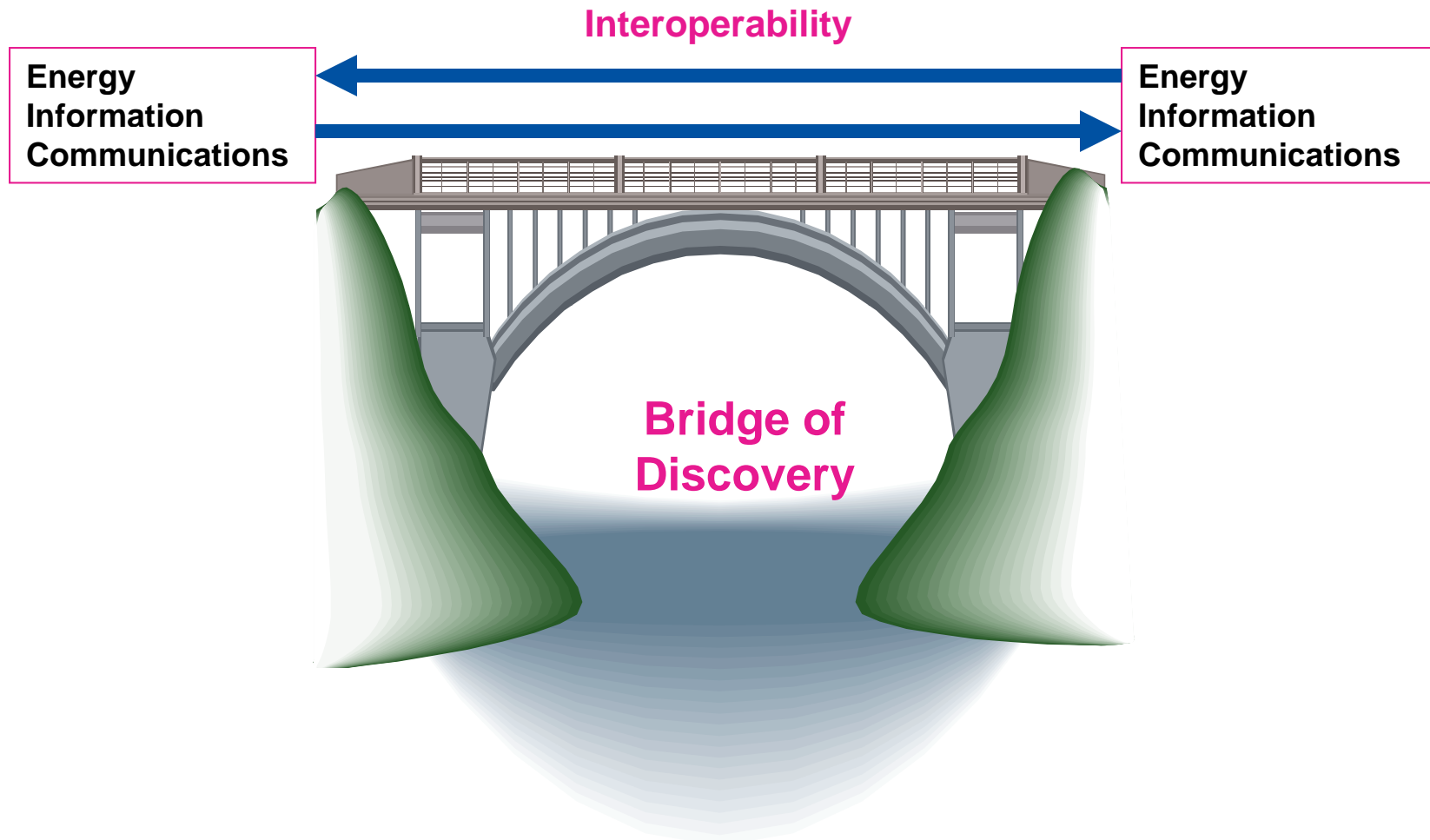
Interoperability Definitions/Concepts

E.g., Interoperability (NATO member nations document)*

" the ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services exchanged to enable them to operate effectively together."

- Other {DOD} definitions of interoperability exist.

And systems have become more complex – systems need to work together as a "system of systems"

- Thus, "Interoperability involves interoperation of equipment, interoperability of military forces, interoperation among systems, and the interchangeable use of hardware and software across different systems."

* DoD Reliability Analysis Center publication: Selected Topics in Assurance Related Technologies - START Vol.10 No. 1

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