Industry Smart Grid Interoperability – From Roadmap to Action

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Interoperability: Foundation for a Smarter Grid

- Media Agnostic
- Intelligent Communicating Appliances

Utility Smart Grid

- Wireless
- Fiber Optic
- Copper Wire
- Powerline Carrier

Ability To Seamlessly Communicate, Exchange Information and Act Upon it
### Standards Lead to Interoperability

#### Systems Integration & Operation

<table>
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<th>Lack of Standards</th>
<th>Custom Integration</th>
<th>Interfaces can be Mapped</th>
<th>Interfaces with Common Models</th>
<th>Optimal ‘Plug n Play’ Standards</th>
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#### Design & Install Costs vs. Operation & Maintenance Costs

- **Available Workforce**: Decrease
- **Competitive Innovation**: Increase
Foundation for Interoperability

PUBLICLY AVAILABLE SPECIFICATION
PRE-STANDARD

IntelliGrid Methodology for Developing Requirements for Energy Systems

Key Contribution from EPRI’s IntelliGrid R&D Program

http://www.nist.gov/smartgrid/

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0

Office of the National Coordinator for Smart Grid Interoperability
NIST Report: Interoperability Framework and Roadmap 1.0

- Published January 2010
  - Extensive public input and review
  - Completed in less than 1 year
  - Work completed by an EPRI led team
- Smart Grid Vision and Reference Model
- Identified 75 existing standards
- 16 Priority Action Plan Projects are filling key gaps
- Companion Cyber Security Strategy

http://www.nist.gov/smartgrid/

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0

Office of the National Coordinator for Smart Grid Interoperability

NIST Special Publication 1108

Smart Grid Domains

National Institute of Standards and Technology • U.S. Department of Commerce
# Priority Action Plans

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Created to Address Gaps in Smart Grid Standards
Example Standard Gap: Grid to Photovoltaic (PV) Communication

- All Offer Communication Options
- Working with Utilities on Integration Projects
- None Involved in a Common Approach to the Utility Interface
Result of Utility/Inverter Industry Collaboration in 2009

1. Connect / Disconnect from Grid
2. Output Power Management
3. Power Factor and Volt/Var Management
4. Storage Management – PV to grid/storage, grid to/from storage
5. Event/History Logging (basic set)
6. Status Reporting /Reading
7. Time-sync

Core Set of Functions Supported by Inverter
Result of Utility/Inverter Industry Collaboration in 2009

Define Standardized Functions for Inverters

1. Connect / Disconnect from Grid
2. Output Power Management
3. Power Factor and Volt/Var Management
4. Storage Management – PV to grid/storage, grid to/from storage
5. Event/History Logging (basic set)
6. Status Reporting /Reading
7. Time-sync

More in Phase 2

Represent Information in Standard Information Model (IEC 61850)

Map to Protocols

DNP3, Smart Energy Profile, MMS, Web Services, Other
Smart Grid Demonstration: Moving from Interoperability Standards to Implementation

Critical Integration Technologies and Standards
- Intelligrid-Based Use-Case Analysis
- Zigbee/Homeplug, BACNET – Customer Side
- IEC Standards – Utility Side
- CIM – Operations Integration

High Penetration PV in Residential Circuit

PNM Resources/EPRI Smart Grid Demo
Shared Learning Opportunity:
Industry Smart Grid Demonstration Collaboration

• Demonstrate Integration and Interoperability
• Leverage information and Communication Technologies
• Integration of Multiple Types of Distributed Energy Resources (DER)

11 Host-Sites, 18 Collaborators
New International Collaborators Invited to Join
Example of International Collaboration: EDF/EPRI Smart Grid Demonstration
Example Standard Gap: Vehicle to Grid Communication

Key is a Standard Language that operates with optional Bridge Communication Transports

* EMS = Energy Management System
** A system upstream of the premise meter, e.g., Distribution Automation or other equivalent system
Result of Utility/Auto Industry Collaboration

- EPRI leading standards definition, technology and supplier evaluation through implementation
- EPRI Infrastructure Working Council central to setting technical direction
- SAE participation from Utility, automotive and electrical equipment manufacturing industries
Ford – EPRI PHEV Program
1st OEM—Utility Demo of PHEV Passenger Vehicles

- First opportunity to demo OEM-built, FMVSS-certified vehicles
- Demonstrate leveraging smart grid infrastructure to increase the value of PHEVs
- Pre-production PHEV Ford Escape vehicles as a test bed
- Application and integration of advanced batteries and their secondary use for stationary, utility applications
GM – EPRI PHEV Program
1st OEM—Utility Production Rollout of PEV Technology

- Production smart-grid interface in mainstream OEM product
- Development, test and validation of real-world PEV/Smart Grid integration with AMI and telematics
- Broad effort spans on-vehicle and smart grid technology development
- Open, interoperable interface compliant with SAE and IEEE standards and protocols
- Development of secondary use applications for PEV batteries
Demonstrations and Shared Learning Leading to Reference Design

EPRI DER Integration Smart Grid Demonstrations
~ 12 Host Sites

Knowledge Base from EPRI Demonstrations

Interoperability Should be the Key Foundation for all Smart Grid Demonstrations

1. Regional Impacts of DER
2. Cost Benefit Analysis
3. System Architecture
4. Lab & Field Trials
5. Industry Tracking
Key Takeaways
Interoperability: From Roadmap to Actions

• Standard Based Interoperability will Lead to Scalability of Smart Grid Deployment Beyond Demonstrations

• Get Engaged on Priority Action Plans to Fill the Standards Gaps – Join the NIST Smart Grid Interoperability Panel (SGIP)

• Smart Grid Demonstrations: Foundation for testing Interoperability Standards and Developing Implementation Guidelines

Collaborate...Shared Learning...Maximize Value of Individual Smart Grid Demonstrations