



Framework for the Evaluation of State Smart Grid Pilot Projects

**FERC /NARUC Smart Grid Collaborative
Workshop**
July 23, 2008

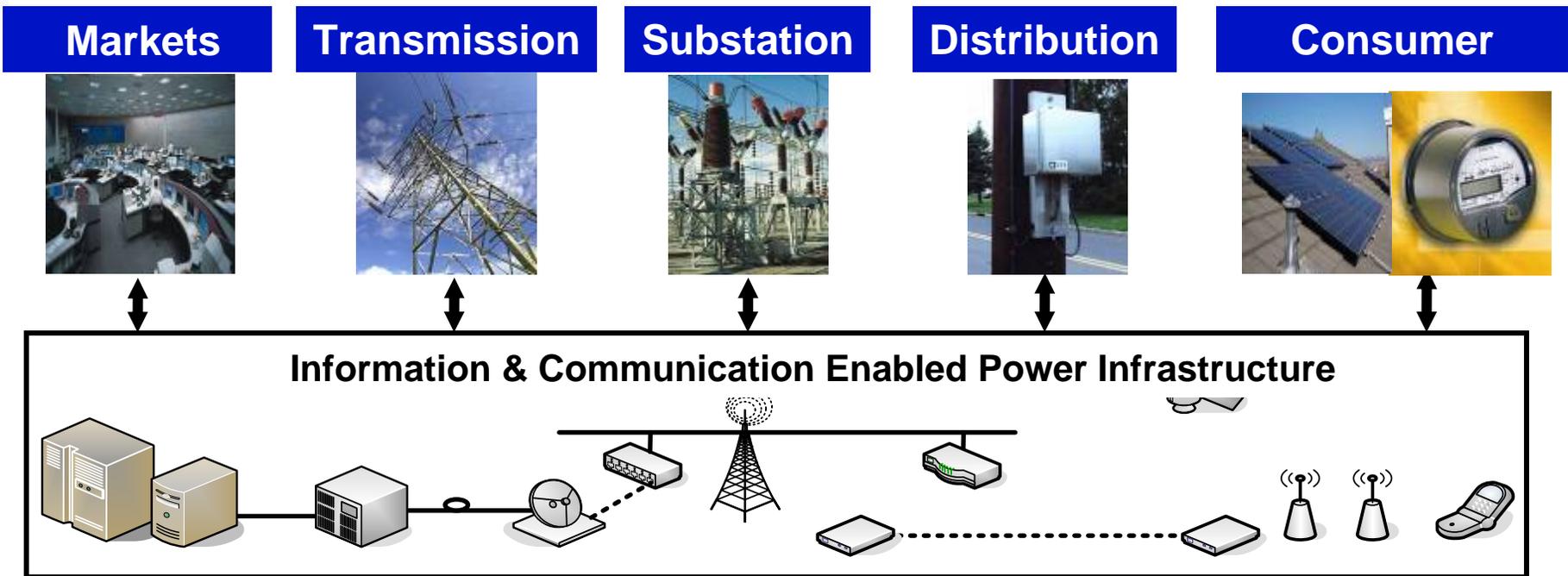
Dr. Arshad Mansoor
Vice President, Power Delivery & Utilization
Electric Power Research Institute (EPRI)

Discussion Topics

- **Smart Grid Technologies & Projects**
- **Framework for Evaluation of Smart Grid Projects**
- **Example of a Clearinghouse for Lessons Learned from Smart Grid Projects**
- **Next Steps**

Smart Grid

Two Way Communications.....Sensors.....Distributed Computing



Exchanging Information Across the Electricity Enterprise to Improve the Efficiency, Reliability and Safety of Power Delivery and Utilization

Examples of Smart Grid Technologies – Sensors/Controllers/Communication

Transmission



Phasor
Measurement



Backscatter
Sensors

Substation



Wireless Mesh
Sensors for
Substations

Distribution



Distribution
Automation
Devices



Smart Meters

Consumer



Smart Outlet



Smart
Thermostats

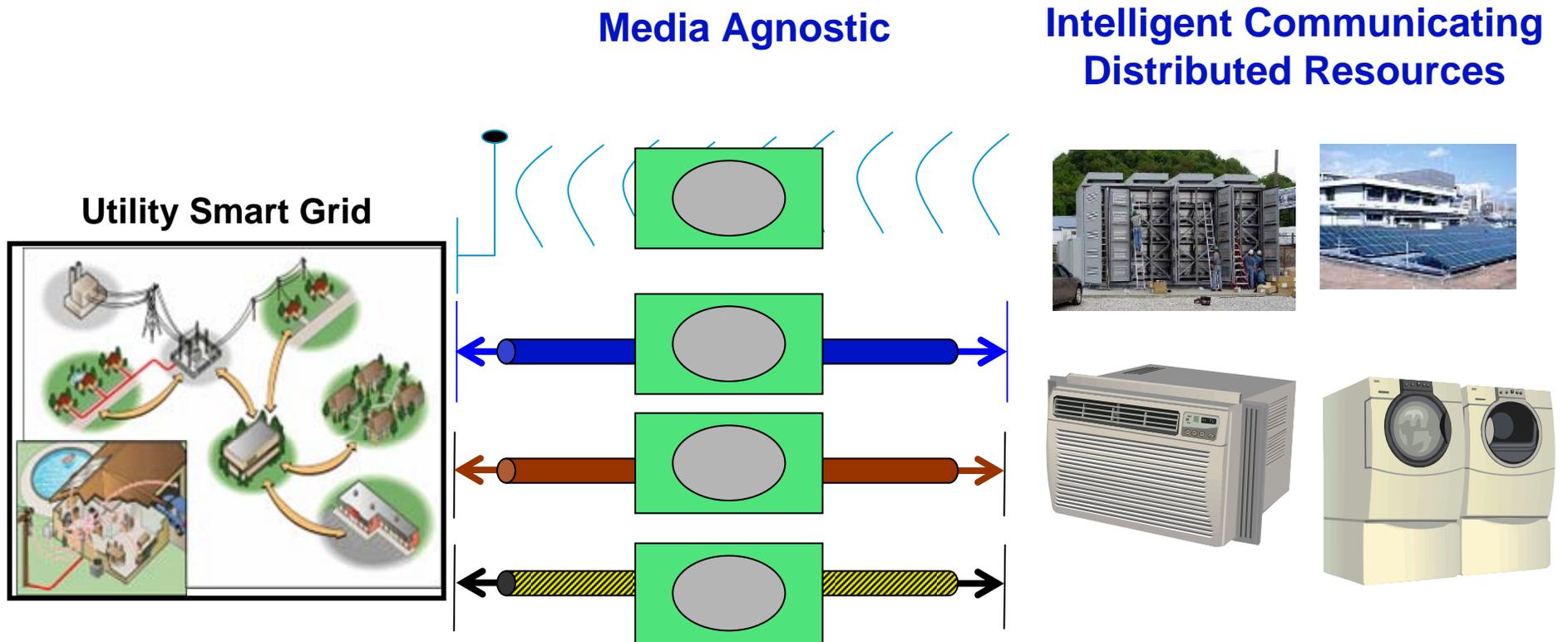


Smart Panel

Wireless (WiMax, Mesh Network, WiFi, Zigbee), Wired (Fiber, Power Line),
Software/Information Management Tools



Smart Grid Deployment Challenge: Lack of standard language for exchanging information



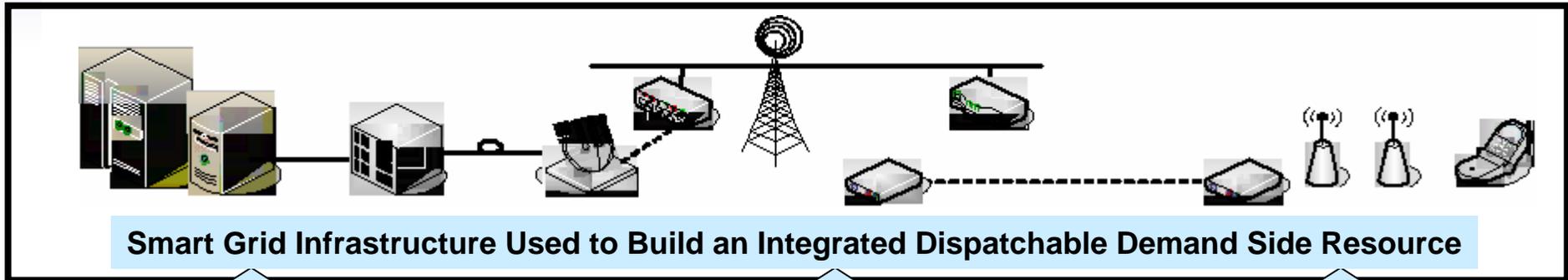
Smart Grid Projects: Early Stages of Planning & Deployment

- DOE Sponsored Smart Grid Projects
- **EPRI Board Approved Smart Grid Demonstration Projects**
- State Smart Grid Projects
- European Smart Grid Initiative

Demonstration Projects Designed Right Can Accelerate Standards and Help Develop a Comprehensive Smart Grid Reference Design for Utilities

EPRI Smart Grid Demonstration Projects

Integrating Distributed Energy Resources and Demand Response



Substation/Feeder Level Energy Storage

C&I Customer Demand Response & Distributed Generation

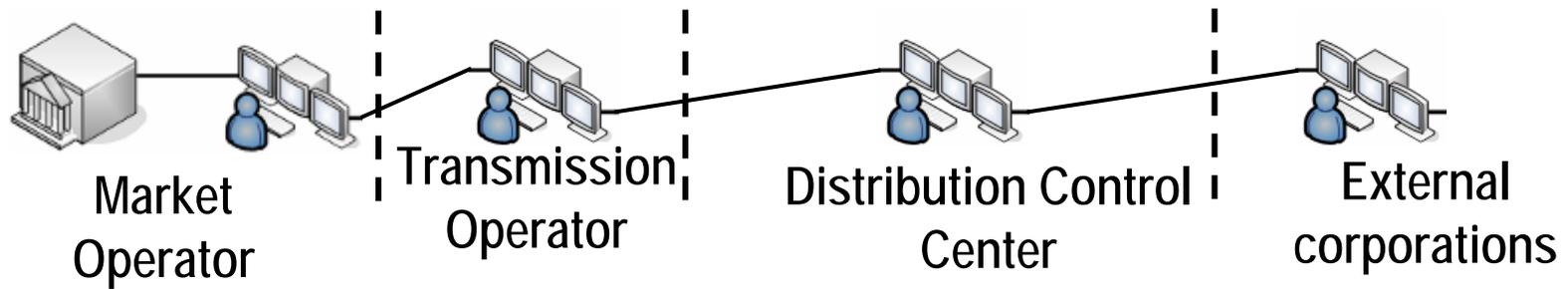
Price Sensor, Policy Client & # Meter Software, PEAK CPP Load Trigger, Internet & private WAN, Electric Loads, Test Sites

Residential Customer Demand Response & DER Integration

EPRI's IntelliGrid Architecture Will be the Foundation for The Smart Grid Demos

Smart Grid Demonstration Approach

• Integration of DER with Utility Operations



• Ensure Interoperability of DER

- Demonstrating use of common language to exchange information with distributed resources from various manufacturers
- Multiple use of communication and metering infrastructure for control, measurement & verification of the dispatchable resource

Shared Learning from Multiple Demonstrations and Use of EPRI's IntelliGrid Architecture will Lead to Expandability, Scalability, and Repeatability

Discussion Topics

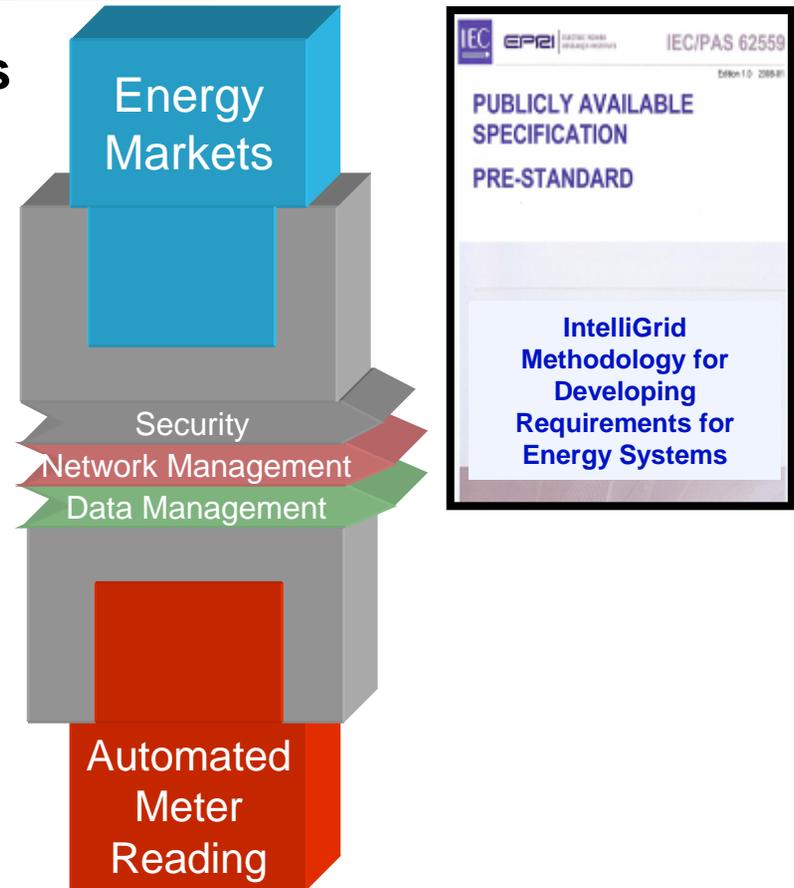
- **Smart Grid Technologies & Projects**
- **Framework for Evaluation of Smart Grid Projects**
- **Example of a Clearinghouse for Lessons Learned from Smart Grid Projects**
- **Next Steps**

EPRI Smart Grid Project Evaluation

- **Planning Phase (Before Implementation)**
 - Building the Architecture of Smart Grid
 - Designing of Experiments (e.g., Consumer Response to Feedback)
 - Plan for Smart Grid Performance Evaluation
- **Commissioning Phase (During Implementation)**
- **Performance Monitoring Phase (After Implementation)**

Using IntelliGrid Methodology to Develop the Smart Grid Architecture

- Business Case/Cost Benefit Analysis
- Define Requirements of Each Smart Grid Application using the **Use Case Process**
- Design an Architecture for Security, Data Management and Network Management
- Select Technologies, Finalize Cost Benefit Assessment



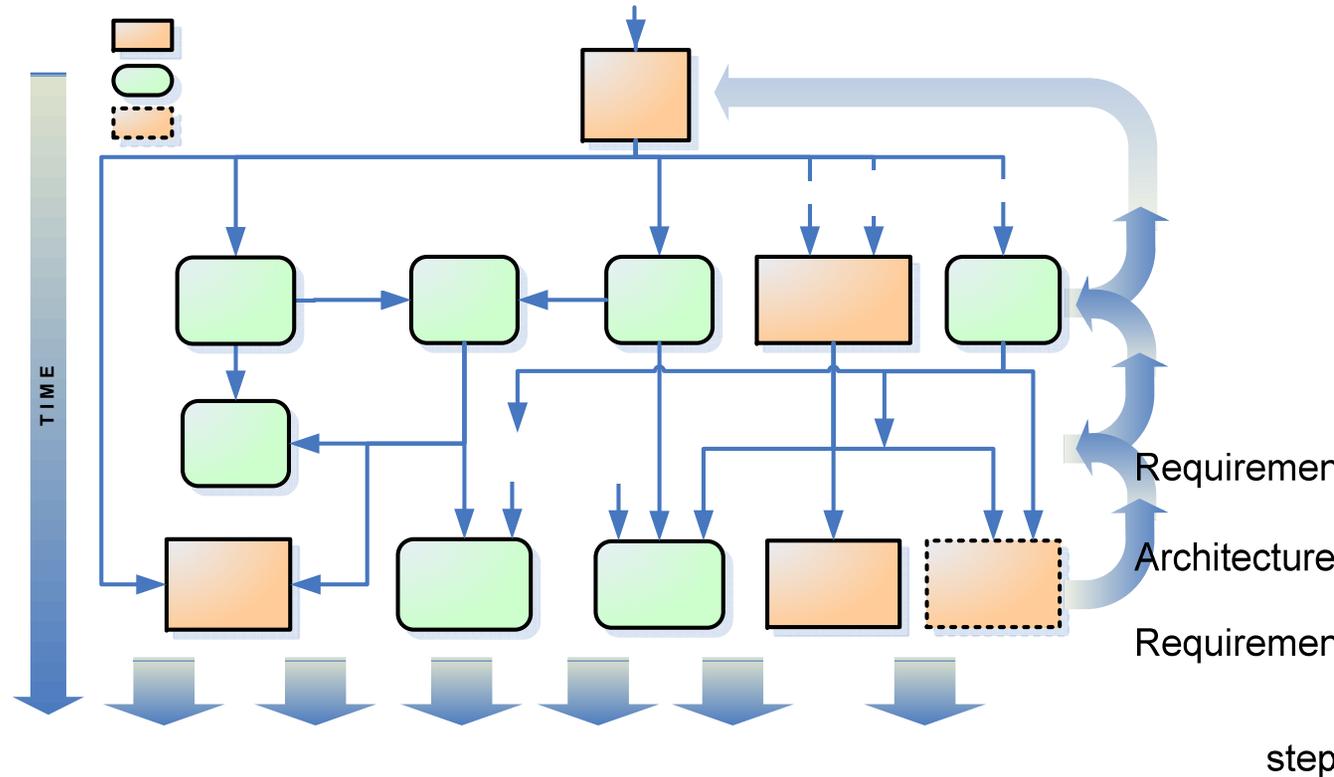
EPRI's IntelliGrid Methodology is Accepted as an International Recommended Specification and an Industry Best Practice to Architect a Smart Grid

Use Cases for Each Smart Grid Application: Key to Defining Requirements

Use cases are the descriptions of smart grid applications

They define the important actors, systems and technologies that are part of the smart grid applications

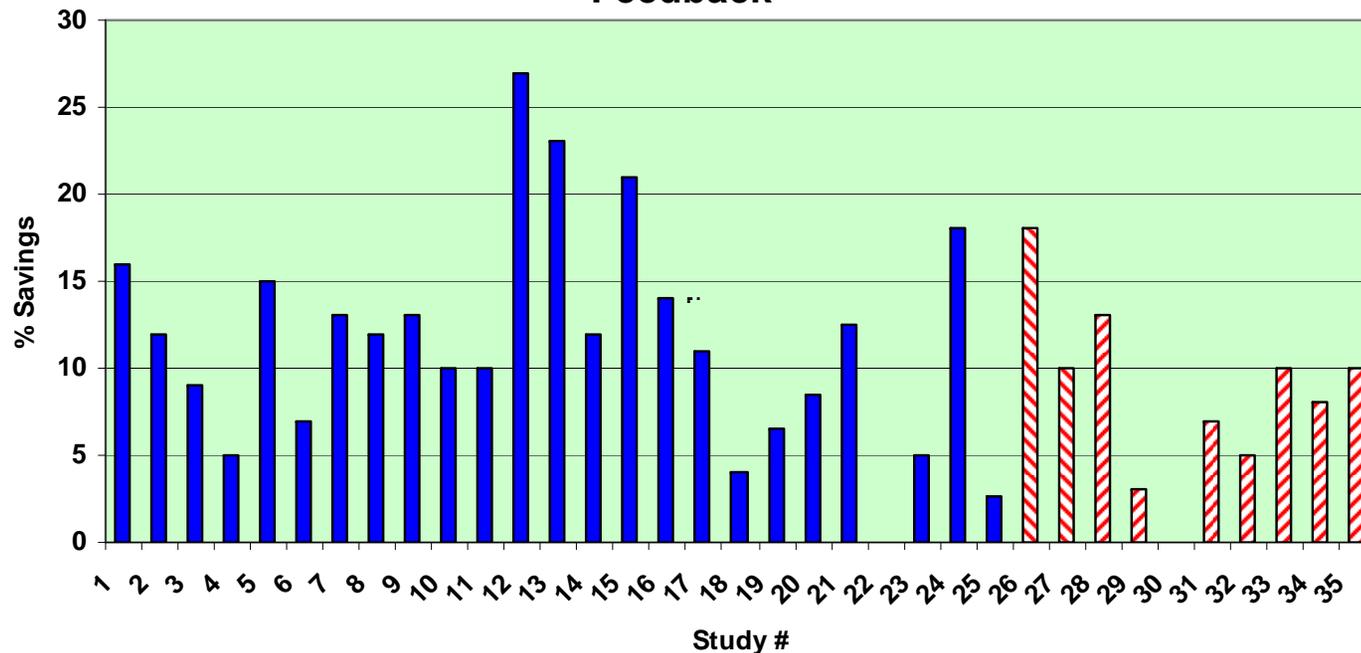
They define the requirements for these technologies and systems



Sharing Use Cases from All Smart Grid Projects Will be a Key to Developing an Industry Best Practice for Smart Grid Architecture

Consistent Framework for Designing of Experiments Supported by the Smart Grid Project

Feedback Studies - % Electricity Savings; Direct and Indirect Feedback



Consistency in Design of Experiments Key for Comparing Apples to Apples

Example of Multiple Studies Showing Effectiveness of Feedback to Consumers in Reducing Energy Consumption

Plan for Smart Grid Project Performance Assessment

<i>Value Attributes</i>	<i>Metrics Examples</i>
Distribution Reliability	Outage Duration (SAIDI), Outage Frequency (SAIFI)
Grid Reliability	Loss of Load Probability (LOLP), Number of Major Events as Defined in Section 311 of the Federal Power Act
Power Quality	Momentary Interruption (MAIFI), Voltage Sags (SARFI), Harmonics, Unbalance
Utilization	Load Factor (Average to Peak), Asset Utilization Factor, O&M Labor Utilization factor
Sustainability	Efficiency: Delivery System Losses, Information Enabled End-Use Energy Efficiency; Environmental: CO2 footprint of delivery system
Market Efficiency	Extent of participation of distributed resources in the energy market
Safety	Public and worker safety

How to Assess the Value Enabled by the Smart Grid Project?

Smart Grid Project Assessment List

-  Architecture for data management, network management, security upon which smart grid applications can be developed
-  Use cases to support the smart grid applications that are planned for the pilot
-  Comprehensive cost benefit analysis that includes an assessment of societal benefits
-  Clearly defined plan/metrics on how the performance of the pilot project will be assessed
-  Clearly defined plan on how pilots will evolve into full scale deployments?

Discussion Topics

- **Smart Grid Technologies & Projects**
- **Framework for Evaluation of Smart Grid Projects**
- **Example of a Clearinghouse for Lessons Learned from Smart Grid Projects**
- **Next Steps**

Smart Grid Information Clearinghouse

- **Background Documents** – white papers, executive summaries, important high level references
- **Standards Reference** – including current status of standards and links to the activities under way
- **Projects Database** – smart grid projects, objectives, contacts, status
- **Use Case Library** – defining requirements for smart grid applications
- **Technology Library** with smart grid requirements organized as a function of technology and application
- **Business cases** – costs and benefits of smart grid applications
- **Application experience and lessons learned** from actual demonstrations

Example of Information Clearing House: AMI Project Google Map

Google Maps - Microsoft Internet Explorer

File Edit View Favorites Tools Help

My Web Search [Search] Address <http://maps.google.com/maps/mc?e=UTF8&hl=en&ms=0&mid=115519311058367534378.000011362secsd7d21187&ll=...> Go Links

Web Images Maps News Shopping Gmail more

amazon15@gmail.com | My Profile | Help | My Account | Sign out

Google Maps Search Maps Search the map Find businesses Get directions

Search Results My Maps

View in Google Earth Print Send Link to this page

Traffic More... Map Satellite Terrain

Smart Metering Projects Map

Map showing smart metering initiatives around the world, including details of technology used, dates, volumes etc.

Initiatives could relate to electricity, gas or water metering.

Created and updated regularly under the auspices of the SRSM smart metering project being run by the Energy Retail Association in the UK.

If you have information about a project you would like to add to the map, please go to <http://tinyurl.com/5zwx2f> where you will find a form for submissions.

PLEASE NOTE: I am adding and updating the pushpins to make it easier to see what is happening - this might take some time - has call red=electricity, green=gas, blue=water and triangle=trial or pilot where circle=project

For more details, or if you would like to become a collaborator on this map, please contact:

simon.harrison@engage-consulting.co.uk
131,451 views - Public
Created on Jun 25 - Updated Jul 8
By Simon - 3 Collaborators
★★★★ 10 ratings - 4 comments

- UK Smart Metering**
SRSM Project: Initiative by Energy Retail Association to...
- Norway**
Announcement by regulator NVE of intention to follow E...
- Italy**
ENEL Volume: 20 million electricity meters Cost: 2.2 b...
- Northern Ireland**
NI: Prepayment Keypass Metering Two way communi...
- Sweden**
Various Companies Electricity Only. Dates: Looking fo...

© 2007 Google - Map data © 2007 Tele Atlas, A&E, NAVTEQ™, Europa Technologies - Terms of Use

Drill Down to Any AMI Project for Basic Information

Italy
Last Updated by [Simon](#) on May 16

ENEL

Volume: 30 million electricity meters
Cost: 2.2 billion euros
Technology: Ampy designed meter, built by third parties, using Echelon Power Line Communications and GSM.

Feb 08 Update: Time of Use 'Smart' Tariff now offered, although initial uptake has been low

Meters:



Get directions: [To here](#) - [From here](#)
[Search nearby](#)

More...

Discussion Topics

- **Smart Grid Technologies & Projects**
- **Framework for Evaluation of Smart Grid Projects**
- **Example of a Clearinghouse for Lessons Learned from Smart Grid Projects**
- **Next Steps**

Next Steps

- Finalize the Smart Grid Project Assessment Framework
- Work with DOE to Develop the Database for the Joint EPRI-DOE Smart Grid Information Clearinghouse
- Coordinate the Use Case Development Process across the Industry
- Continue to develop the content to accelerate the standards development in key areas in Smart Grid