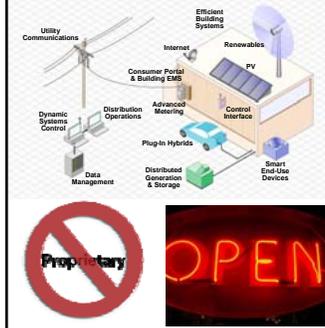




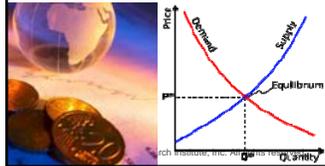
EPRI Smart Grid Demonstration Overview

Smart Grid Advisory Meeting

6/23/2009



Matt Wakefield
Smart Grid Program Manager
mwakefield@epri.com
865-218-8087



Welcome to the third (but first “real”) Smart Grid Advisory meeting

- Welcome
 - Logistics
 - Purpose & “Style” of meeting
 - Attendees (Collaborators, Peer Review, Stakeholders)
 - Feedback (Survey) & Next Meeting(s)
- 1 ½ Day Agenda
- Smart Grid Demo Overview & Update
 - Brief Overview of Smart Grid Demonstration Initiative
 - Membership Update
 - Project Plan Update (Status of Tasks)
 - Host-Sites

The 3rd Smart Grid Advisory Meeting Agenda

Tuesday
6/23

2:00 pm - 2:10 pm	Welcome & Introductions
2:10 pm - 3:00 pm	Smart Grid Demo Project Status & Update (Matt Wakefield, EPRI)
3:00 pm - 4:45 pm	First Energy Demo of IDER system (Eva Gardow, EPRI)
5:00 pm - 8:30 pm	Bus Returns to Molly Pitcher Inn & Dinner (Molly Pitcher Inn)

Wednesday
6/24

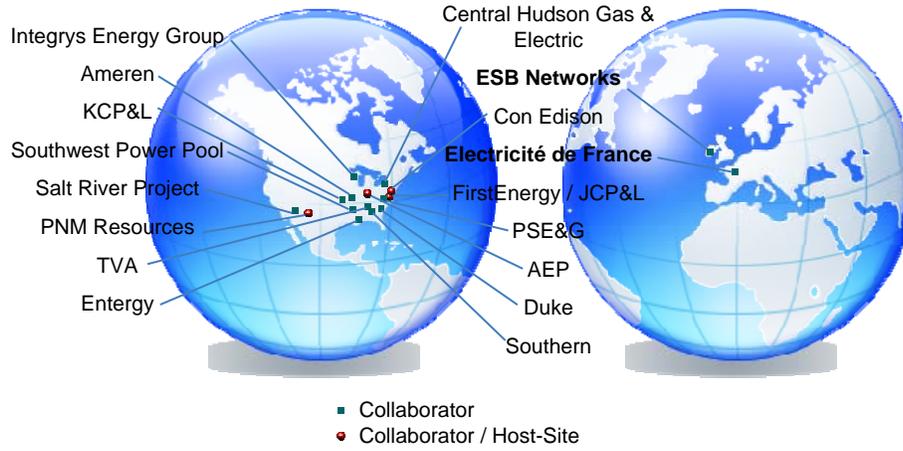
7:40 am	Bus Pickup from Molly Pitcher Inn to JCP&L Facility (Meet in Hotel Lobby at 7:30)
8:00 am - 8:30 am	Registration / Continental Breakfast. Location: JCP&L Office
8:30 am - 8:45 am	Welcome & Introductions
8:45 am - 9:30 am	Benefits of Smart Grid Interoperability & Collaboration with Smart Grid Partners (Stephanie Hamilton, EPRI)
9:30 am - 10:00 am	PSERC Update on DER Integration White Paper (Mladen Kezunovic, Texas A&M)
10:00 pm - 10:15 am	Morning Break
10:15 am - 10:40 am	FE Project Update (Eva Gardow, FE)
10:40 am - 11:05 am	PNM Project Update (Carla Barlow, PNM)
11:05 am - 11:30 am	Con Edison Project Update (Frank Doherty, Con Edison)
11:30 - 12:00 pm	AEP Project Overview (Tom Walker, AEP)
12:00 pm - 12:10 pm	Don Lynch, President JCP&L. Welcome & Lunch
12:30 pm - 1:00 pm	Working Lunch Topic: NIST Roadmap Update (Mark McGranaghan, EPRI)
1:00 pm - 1:30 pm	Task 2.6 TVA/Bristol Water Heater Analytics Update (Anna Morgan, TVA)
1:30 pm - 2:30 pm	Task 1.1 & 2.4 Regional Profiles & Aggregation Methods & Tools (Angela Chuang, EPRI)
2:30 pm - 2:45 pm	Afternoon Break
2:45 pm - 3:15 pm	Task 1.5 Economic Framework Assessment Update (Steve Bossart, NETL & Bernie Neenan, EPRI)
3:15 pm - 3:45 pm	Task 2.5 DER Controller Update (Gale Horst, EPRI)
3:45 pm - 4:15 pm	Task 1.3 Identify & Evaluate Analytical Tools for Planning & Operations (Heidi Mitchell, Dynamic Energy Group) Task 1.6 Deliverable: Scoping & Mapping of Smart Grid Projects (Matt Wakefield, EPRI)
4:15 pm - 5:20	Round Table: Member Smart Grid Activities & Member collaboration opportunities
5:15 pm - 5:30 pm	Wrap-up / Adjourn, Bus Returns to Molly Pitcher by 6pm

EPRI's Smart Grid Demonstration Team



Smart Grid Demonstration Participants

(Utilities that have given us permission to use their name. 6/06/2009)

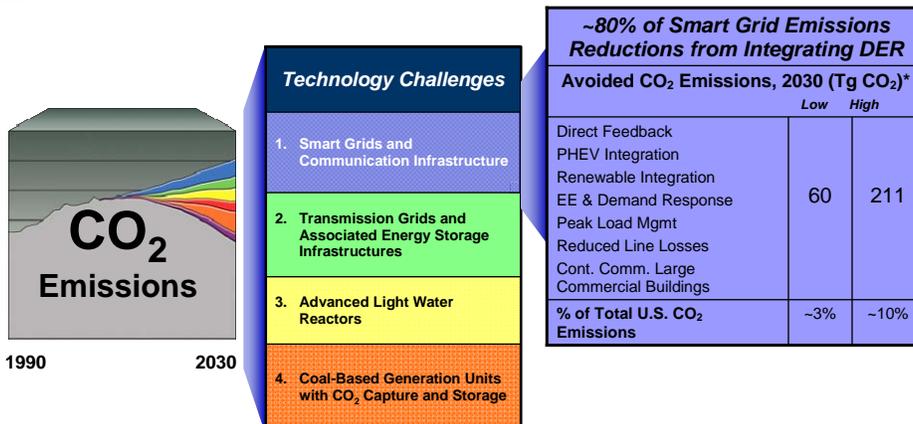


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5

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Smart Grid – One of the Four Technology Challenges



* Source: EPRI Publication 1016905, The Green Grid Savings and GHG reduction Enabled by a Smart Grid

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6

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EPRI Smart Grid Demonstrations

- Deploying the Virtual Power Plant
- Demonstrate Integration and Interoperability
- Several regional demonstrations
 - Multiple Levels of Integration
 - Multiple Types of Distributed Energy Resources & Storage
- Leverage information & Communication Technologies



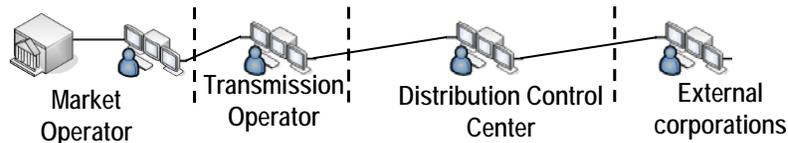
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7

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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

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8

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Collaboration with DOE Distribution Integration Awards



- Allegheny Power, WVU, NC State, Research & Development Solutions, Augusta Systems, Tollgrade – **West Virginia Super Circuit**
- ATK Launch Systems, Rocky Mountain Power, P&E Automation – **integration of renewables, DG, and storage (compressed air).**
- Chevron Energy Solutions, Alameda County, PG&E, VRN Power Systems, SatCon, Univ of Wisc., NREL, LBNL, E3 – **Solar, fuel cell and storage microgrid.**
- City of Fort Collins, Colorado State Univ, InteGrid Lab, Comm Found of Northern Col, Governor's Energy Office, Advanced Energy, Woodward Spira, Eaton – **3.5 MW mixed distributed resources for peak load reduction.**
- IIT, Exelon/ComEd, Galvin Electricity, S&C – **"perfect Power" demonstration**
- Con Edison, Verizon, Innovative power, Infotility, Enernex – **Interoperability between utility and end use customers for DG aggregation.**
- SDG&E, Horizon Energy Group, Advanced Control Systems, PNNL, Univ of San Diego, Motorola, Lockheed Martin – **Integrating multiple distributed resources with advanced controls.**
- Univ of Hawaii, GE, HECO, MECO, Columbus Electric Coop, NM Inst of Mining and Tech, Sentech, UPC Wind – **Mgt of distributed resources for improved quality and reliability, grid support, and transmission relief.**
- Univ of Nevada, Pulte Homes, Nevada Power, GE Ecomagination – **Integrated PV, battery storage, and consumer products with advanced metering.**

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9

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Project Plan. Task 1 & Task 2

✓ = Presentation during meeting ✓ = Update Now

ID	Task 1: Analytics on integrations approaches and impact of Distributed Resources	2008	2009				2010				2011				2012				2013		
		Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	
1	1.1 Develop Regional Profiles																				
2	1.2 Develop Integration Framework																				
3	1.3 Identify & Evaluate Analytical Tools																				
4	1.4 Develop and Evaluate Approaches for CO2 impact																				
5	1.5 Develop Framework for Economic Assessments																				
6	1.6 Develop Scope and Mapping of SG Projects																				

ID	Task 2: Critical Integration Technologies & Systems	2008	2009				2010				2011				2012				2013		
		Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	
1	2.1 Architecture Reference Design for distributed Resource Integration																				
2	2.2 Develop Information Exchange Model to support System Operations																				
3	2.3 Develop Comm Interfaces & Control Algorithms for DER																				
4	2.4 Develop Aggregation Methods & Tools																				
5	2.5 Develop DER Controller Requirements																				
6	2.6 Lab Trials of Critical Integration Technologies																				

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10

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Project Plan. Task 3 & Task 4

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ID	Task 3: Demonstrate Technologies & Systems in Actual Applications	2008				2009				2010				2011				2012				2013		
		Q4	Q1	Q2	Q3	Q4	Q1	Q2																
1	3.1 Project Definitions and Objectives																							
2	3.2 Application of IntelliGrid Methodology – Use case dev																							
3	3.3 Economic Analysis																							
4	3.4 Candidate Technology Selection																							
5	3.5 Laboratory Assessment of Technologies																							
6	3.6 Detailed Application Plan for Field Demonstrations																							
7	3.7 Field Data Collection & Assessment																							

ID	Task 4: Technology Transfer	2008				2009				2010				2011				2012				2013		
		Q4	Q1	Q2	Q3	Q4	Q1	Q2																
1	4.1 Quarterly Workshops																							
2	4.2 Coordination w/DOE, EPA, etc																							
3	4.3 Industry Standards Development Participation																							
4	4.4 Use Case and Requirements Repository																							
5	4.5 Technology Library																							
6	4.6 Publications																							

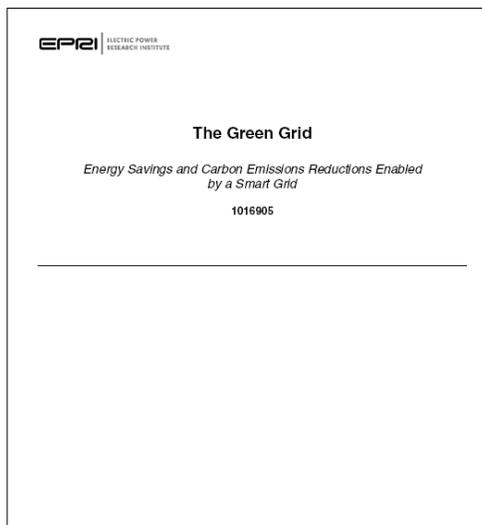
Task 1.4 Develop and Evaluate Approaches for CO₂ Impact

Leveraging Existing Work

- The Green Grid
- Prism Analysis (Update)

Smart Grid is Primarily an enabler for reduce CO₂

Next Phase will be Applying these learnings in the Demonstrations



2.1 Architecture Reference Design for DER

- Partnering with IBM on this Deliverable
- Case Studies where requirements exceed capabilities of deployed infrastructure
- Use Cases of DER
- Emerging Requirements of DER Communication & Controls – minimize risk of technology obsolescence
- Architectural considerations in the face of changing market requirements and opportunities
- Common Information Model (CIM) of Architecture
- Expect to complete Draft in Nov. Have Final in Dec.

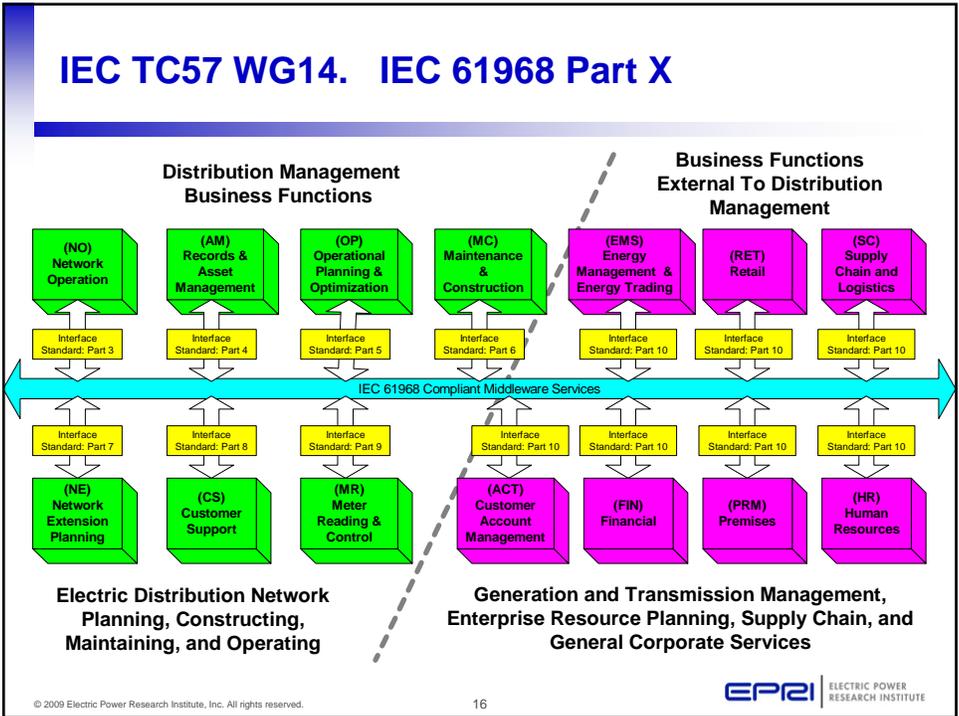
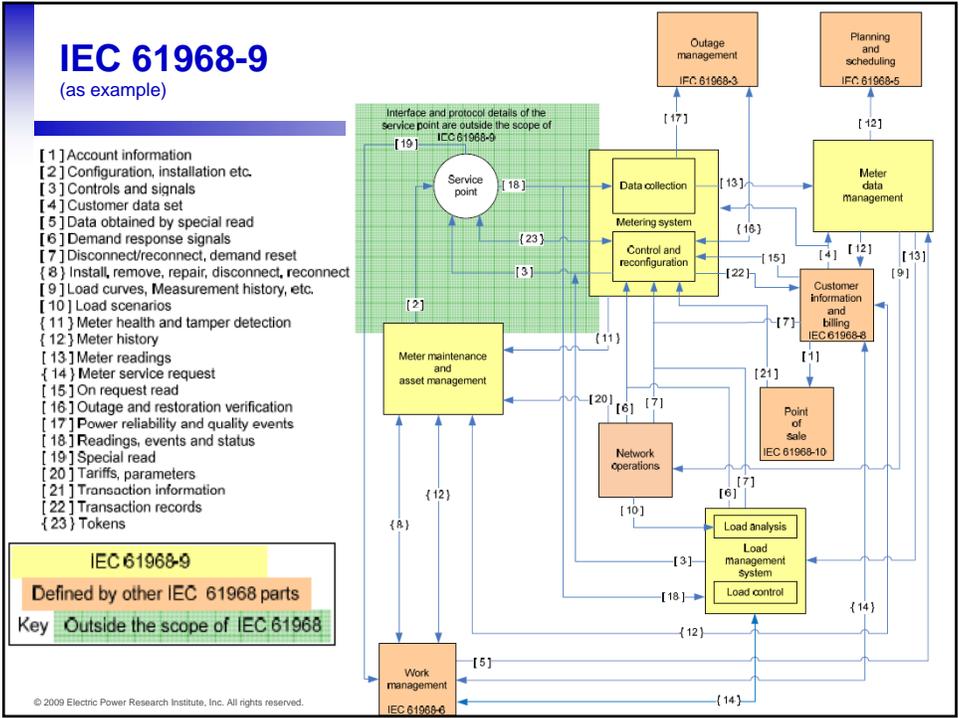
2.2 Information Exchange Model to Support System Operations

- State of Industry
- Best Practices (Are ISO / RTO Models adequate for Utility Applications?)
- Security
- Leveraging Existing Efforts
- International Electrotechnical Commission (IEC) Technical Committee 57, Working Group 14 ([IEC TC57 WG14](#))
- Expect 1st Deliverable in Jan. 2010

Recent Release:

- Part 9 of IEC 61968 specifies information content of a set of message types to support business functions of meter reading and control.
- Purpose –Information exchange between metering systems and utility enterprise.
- [Link to Final Draft](#)

		57/1009/FDIS	
		FINAL DRAFT INTERNATIONAL STANDARD PROJET FINAL DE NORME INTERNATIONALE	
Project number Nombre de projet		IEC 61968-9 Ed.1	
IEC/TC or SC / CECE ou SC		Secretariat / Secrétariat	
57		Germany	
Submitted for parallel voting in CENELEC Soumis au vote parallèle au CENELEC		Distributed on / Diffusé le	Voting terminates on / Vote clos le
<input checked="" type="checkbox"/>		2009-06-12	2009-08-14



NIST Smart Grid Roadmap Coordination

Standard	Application
AMI-SEC System Security Requirements	Advanced metering infrastructure (AMI) and Smart Grid end-to-end security
ANSI C12.19/MC1219	Revenue metering information model
BACnet ANSI ASHRAE 135-2008/ISO 16484-5	Building automation
DNP3	Substation and feeder device automation
IEC 60870-6 / TASE.2	Inter-control center communications
IEC 61850	Substation automation and protection
IEC 61968/61970	Application level energy management system interfaces
IEC 62351 Parts 1-8	Information security for power system control operations
IEEE C37.118	Phasor measurement unit (PMU) communications
IEEE 1547	Physical and electrical interconnections between utility and distributed generation (DG)
IEEE 1686-2007	Security for intelligent electronic devices (IEDs)
NERC CIP 002-009	Cyber security standards for the bulk power system
NIST Special Publication (SP) 800-53, NIST SP 800-82	Cyber security standards and guidelines for federal information systems, including those for the bulk power system
Open Automated Demand Response-OpenADR	Price responsive and direct load control
OpenHAN	Home Area Network device communication, measurement, and control
ZigBee/HomePlug Smart Energy Profile	Home Area Network (HAN) Device Communications and Information Model

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17

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2.3 Develop Comm Interfaces & Control Algorithms for DER

- Task 2.1 & Task 2.2 are Prerequisites
- State of the art in Communication Interfaces for DER
- Gaps in Communication Interfaces
- Align Research Activities with Gaps in Demonstrations to “Fill-the-Gap”
- Expect 1st Deliverable in early to mid 2010

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18

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2.6 Lab/Field Trials of Critical Technologies

Active “Mini Projects”

- PV Integration
- Two-Way Control of Electric Water Heaters

Under Consideration or Development

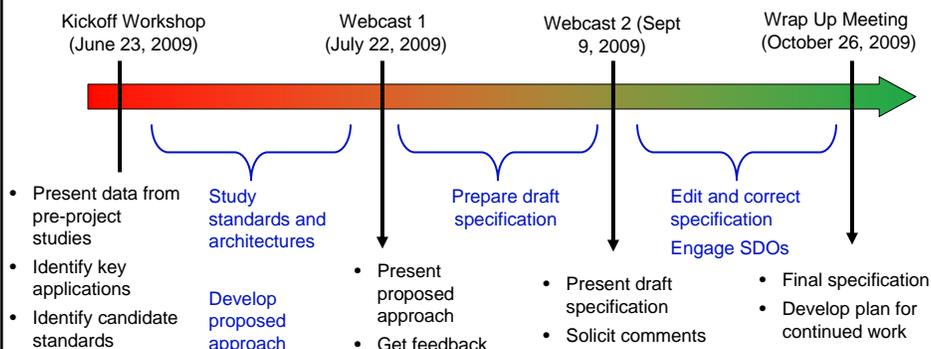
- Community Energy Storage
- Underground Network Monitoring
- “Smart Home” Evaluation
- Customer Behavior with AMI Enabled Technologies

Task 2.6 - Opportunity for All Collaborators, especially non host-sites.

–I want to ensure every member has the opportunity to participate in an active project that can benefit the member and the collaborative.

2.6 PV Integration

- To produce a communication **specification** for integrating PV inverters in utility programs
- Residential focused, larger systems noted
- Gaps identified, coordinated with SDOs
- Limited to a core set of functions... TBD
- Allowing flexibility for the phy/mac



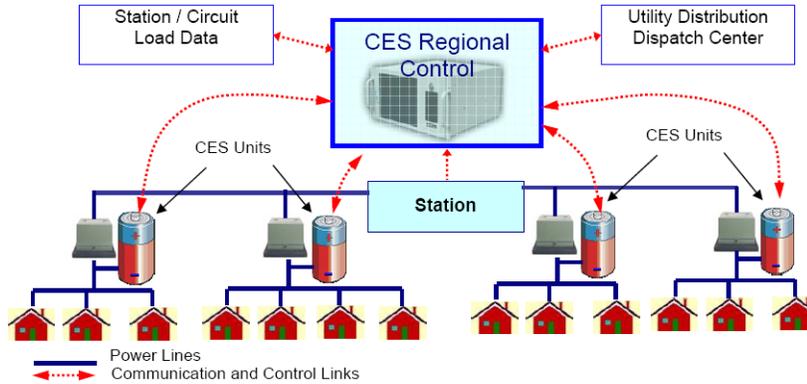
2.6 Community/Neighborhood Energy Storage

Grid Functions

- Load Leveling / Peak Shaving
- Power Factor Correction (VAR Support)
- Ancillary Services

Load Functions

- Backup power for locally connected houses
- Local Voltage Control



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21

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4.4 Use Case and Requirements Repository

Use Case Repository

The EPRi Use Case Repository is a collection of use cases and requirements developed within the industry as well as through EPRi's smart grid demonstration initiative. All use cases are delivered as PDF's. You may use the [MST Use Case Template](#) (0=084/0) to create your own use cases and submit them to ewainfe@epr.com.

Use Case Categories

- Customer Services (79)
- Distributed Energy Resources (178)
- Distribution Operations (119)
- Federated System Management Functions (7)
- Market Operations (32)
- Transmission Operations (34)

Name	Size	Published
Customer Services		
Consumer Portal P1 Customer Needs Meter Device	80k	1/6/09
Consumer Portal Scenario P4 Customer Account Move	75k	1/6/09
Consumer Portal Scenario P5 Customer Sign-Up for Demand Reduction Program	78k	1/6/09
Consumer Portal Scenario P7	113k	1/6/09
Consumer Portal Scenario P8	103k	1/6/09
Consumer Portal Scenario P9	69k	1/6/09
Create ORR Contingency Files V04	37k	1/23/09

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22

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4.5 Smart Grid Web-Site & Technology Library

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4.6 Publications

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Smart Grid Host Sites Overview

	Consolidated Edison	FirstEnergy	PNM Resources	AEP
Resources	-Distributed Generation -Demand Response -Wind Plant	-HVAC (Res., C&I) DR -Electric Storage -Permanent Peak Shifting (electro-thermal storage)	-Solar PV (residential & System) -Storage & DR	-Battery Storage -Panel & Conc. Solar -Small Wind Systems -Nat Gas fired DG -T-Stat Control -PHEV Charging -Ice Bear (Thermal) -Volt/Var Mgmnt
Integration	End-to-end (Customer owned DG, DR provider, Con Edison, NYISO)	Real Time T&D Ops & Planning PJM	HAN, SCADA, System Ops & Planning	System Ops & Planning Simulation Software Power Flow Communications
Diversity	Dense Urban Environment Customer Owned Resources	Smart Grid w/Out use of AMI system Master Controller Concept	Large deployment of Residential PV. Optimization Incl. Volt & Freq control	Modeling of large scale DER. "Deployed" in Real System (South Bend) via Simulator
Business Case	Increase Reliability Reduce Peak Demand	Grid efficiency and reliability at local level	15% peak load reduction at feeder	Reduce Risk of Smart Grid Deployment with Simulation Tools
Further Industry	Interoperability of Distributed Energy Resources (DER)	Local delivery system Integration of DER	Technologies & Standards for Renewable Integration	Risk Evaluation of DER Implementation Advances Simulation Tools

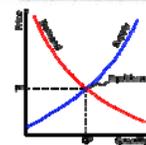
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25

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Smart Grid Demonstration Critical Elements

1. Integration of Multiple Distributed Resource Types
2. Connect retail customers to wholesale conditions
3. Integration with System Planning & Operations
4. Critical Integration Technologies and Standards
5. Compatibility with EPRI's Initiative and Approach
6. Funding requirements and leverage of other funding resources



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26

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Host Site Selections (1-2 Selections Per Cycle) (Expect 8-12 in total. 4 Selected, 1 Under Review)

Start Proposal Review Process No Later Than	Host Site Selection Timeline					Present Qualified Proposal at EPRI BOD Meeting
	2009		2010			
	Q3	Q4	Q1	Q2	Q3	
End of May						August 4, 2009
August 21, 2009						November 18, 2009
January 8, 2010						April 6, 2010
April 29, 2010						August 3, 2010

Host-Site Selection Cycle. Requires <u>AT LEAST</u> 3 months			
	Month 1 (1+ month strongly preferred)	Month 2	Month 3
Utility Draft Proposal			
EPRI Technical Review			
Peer Review			
Present to BOD			

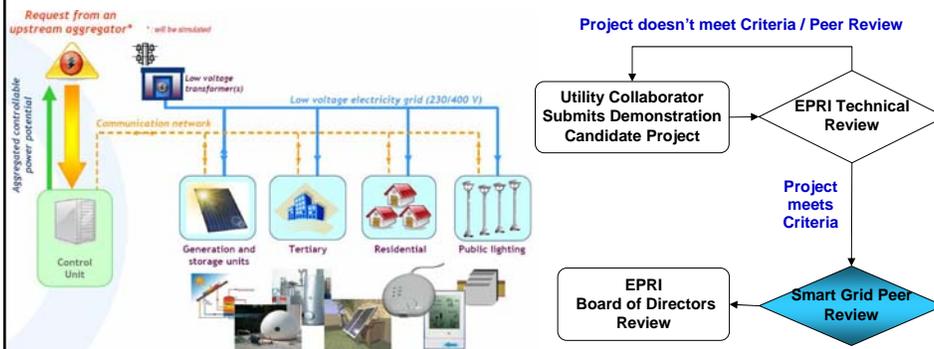
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27

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EDF Host-Site Peer Review Webcast

- Monday, July 6th 10-11am EDT (4-5pm Paris)
- EDF PREMIO Smart Grid Project



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28

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Summary

- Maximize the benefits of existing and planned investments
 - Communications and advanced metering infrastructures
 - Identify and further the foundation for demand side resource integration.
- Integration of distributed resources with utility system operations and planning
- Integration of distributed power generation, storage, demand response technology, and renewables into a virtual power plant.
- Demonstrations should further the industry in regards to integration of DER
- Expect 8-12 EPRI Demonstrations

Questions?

