



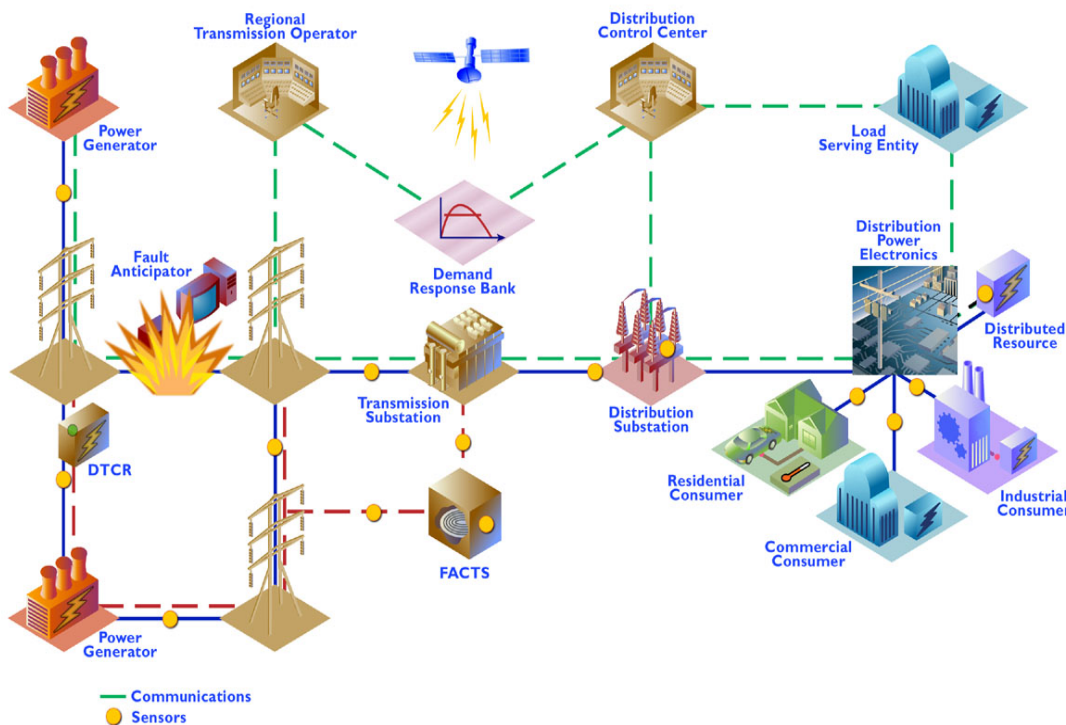
Mapping of Smart Grid Programs

ADA 3rd international conference
Raleigh, October 22-24, 2007

Xavier Mamo,
EDF loan-in at EPRI



Program Integration Context



OBJECTIVES:

Self-Healing and *Adaptive*
Interactive with consumers
and markets

Optimized to make best use of
resources and equipment

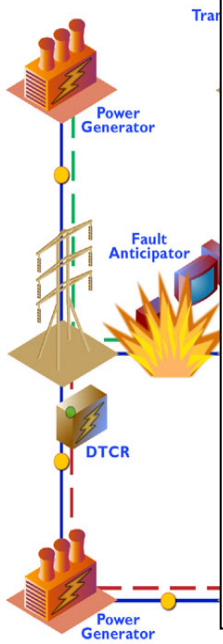
Predictive rather than just
reacting to emergencies

Distributed across
geographical and
organizational boundaries

Integrated, merging
monitoring, control, protection,
maintenance, EMS, DMS,
marketing, and IT

More Secure from attack

Program Integration Context



IntelliGrid Consortium have identified 3 interrelated dimensions that have to be addressed:

1. Master a gigantic assembly of highly coupled devices, which will be distributed, and operated in real time
2. Make it happen using the huge patchwork of existing assets as a foundation – gradually adding new parts
3. Optimize a design to synergize all the players and their processes

Adaptive

consumers

the best use of equipment

than just agencies

boundaries

ing

l, protection,

maintenance, EMS, DMS,

IntelliGrid provides key parts of the solution ... **but it's not enough** ...

More will be provided with a **close coordination & integration** with other programs

Program Integration

Goals and objectives

- Objectives of Program Integration
 - **Maximize IntelliGrid research value** with accomplishments that are the best fit to others programs' work
 - Provide tools to **facilitate the management of the coordination** of IntelliGrid Program with other programs
 - Continuously improve IntelliGrid ability to cross the traditional barriers and to **manage the repartition of resources**
- Mapping/Profiling
 - **Assess R&D results** that transform the Electric Delivery
 - **Share** these results broadly
 - **Identify actions** for IntelliGrid Program
 - **Propose and discuss actions** with other players

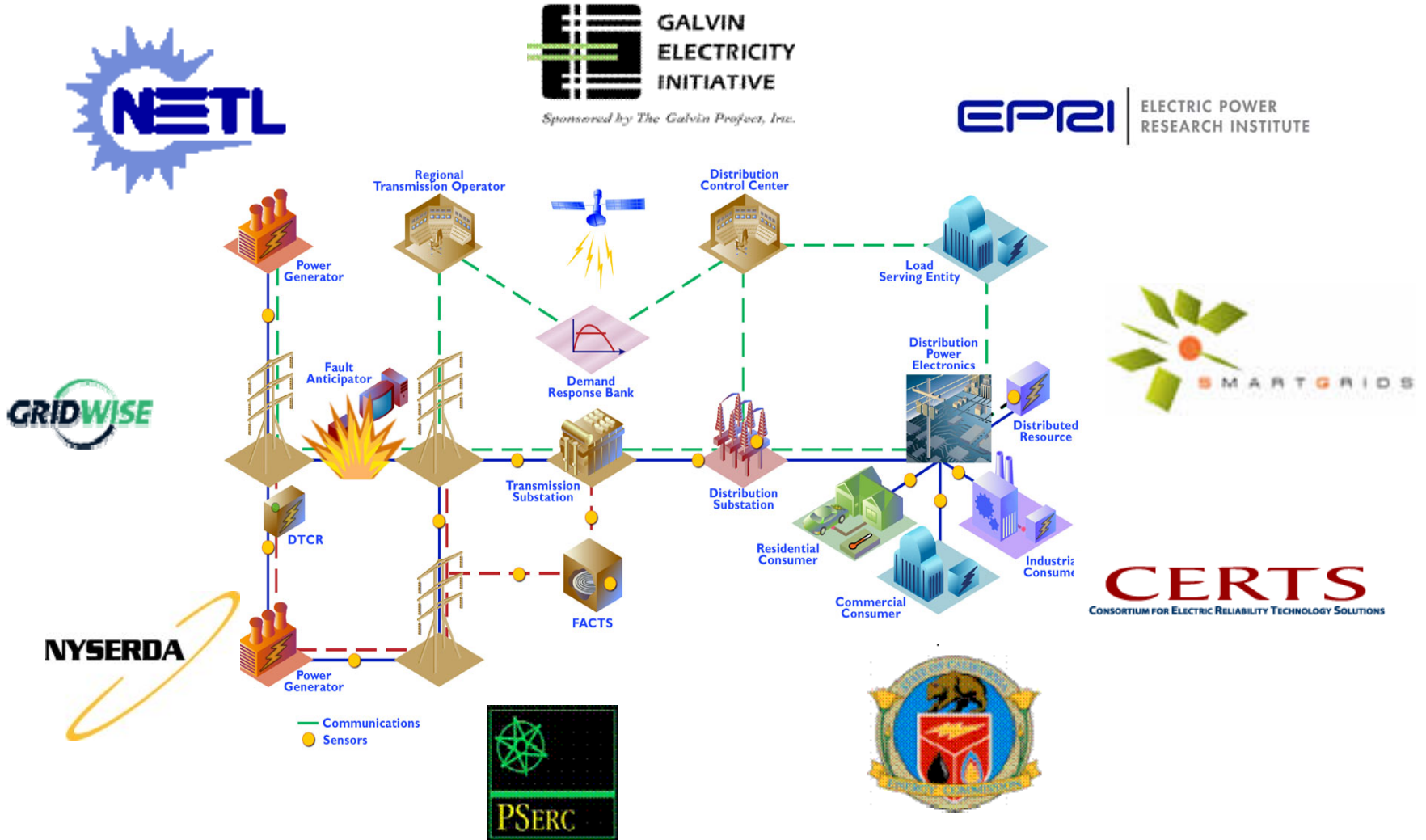
Program Integration Benefits and Uses

- Benefits
 - Increased value of IntelliGrid results to IntelliGrid members
 - Increased value to others programs with a crisp picture of positioning
 - Increased complementarities of programs

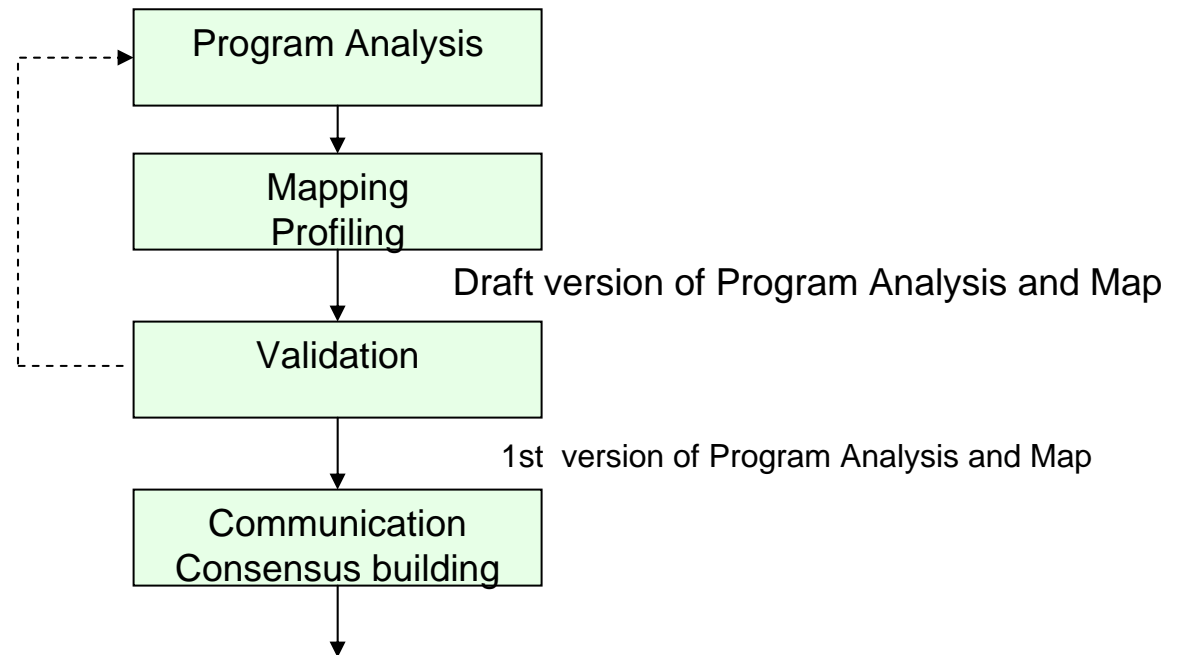
- Application of the mapping/profiles
 - Communication with key programs
 - *Operational tool to inform the steering committee for decision making*
 - Operational tool for program/project management

Transforming the Electric Delivery

Key research programs



Program Integration - Approach Tasks



Building a **shared and formalized** definition of the contributions of key research programs

Program Integration - Approach Profiles

- Main characteristics
 - Sponsor, budget
 - Governance / members
 - Technical domain covered (T&D&M)
 - National/International: focus only on 1 continent or local issues that will not be transposable ...?
- Research projects description
 - Technical objectives
 - On-going projects and results published
 - Accomplishments to date
- Analysis of each program contribution to the creation of the intelligent grid (system engineering)
- Mapping on an intelligent grid map

Program Integration – Approach Mapping

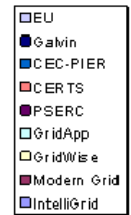
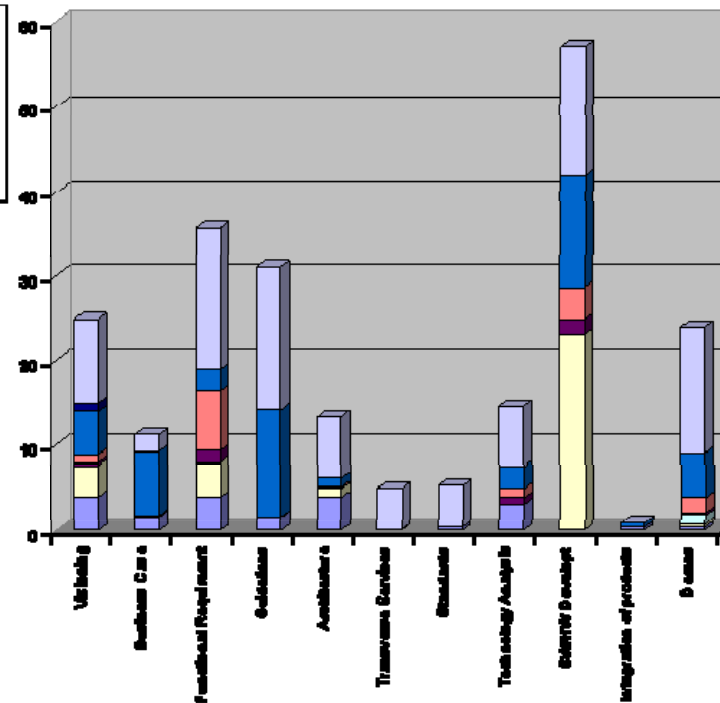
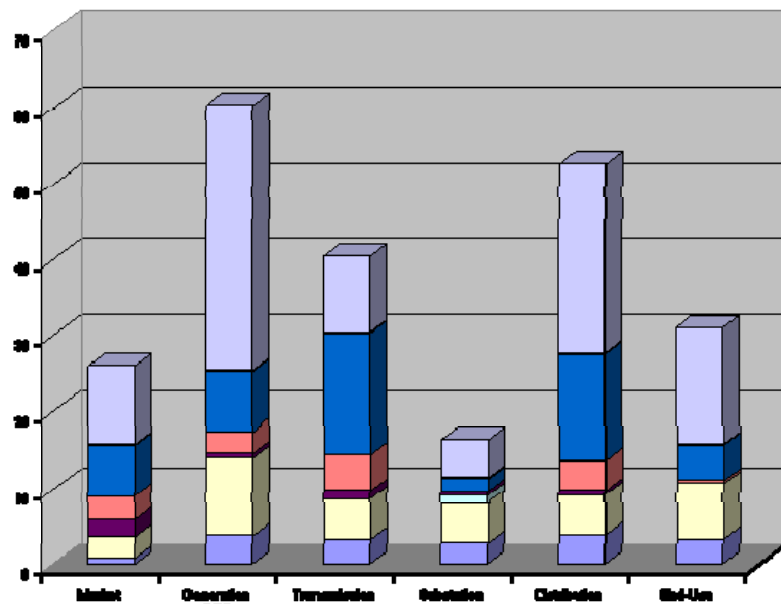
- A common reference has to be used to compare and position each of these projects
- This reference is not unique but one has to be chosen
- 1st metrics: Applications domains covered
- 2nd metrics: Contribution to basic steps of design
 - **Applications and needs:** Ideas, uses and applications (What are we doing)
 - **Architecture/Services** (What shared resources are needed)
 - **Infrastructures and product development** (What technology shall we use)

Program Integration Mapping

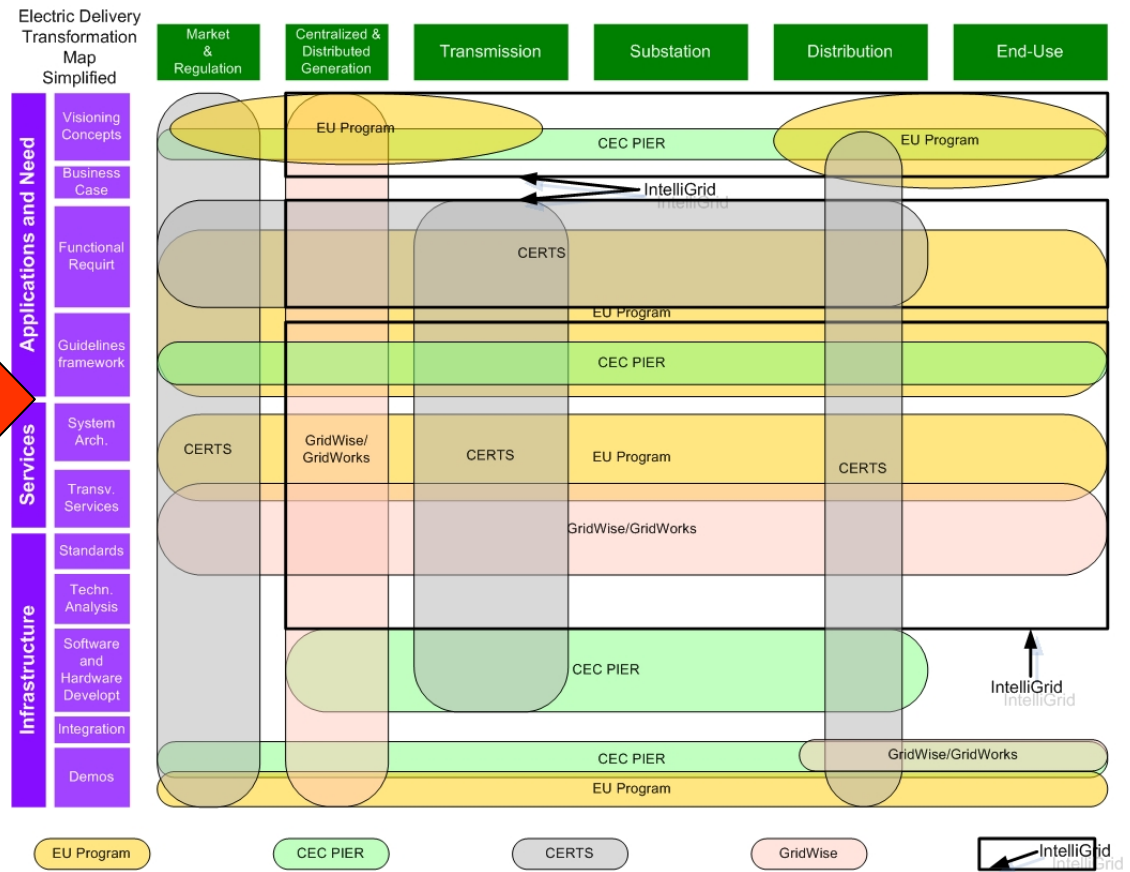
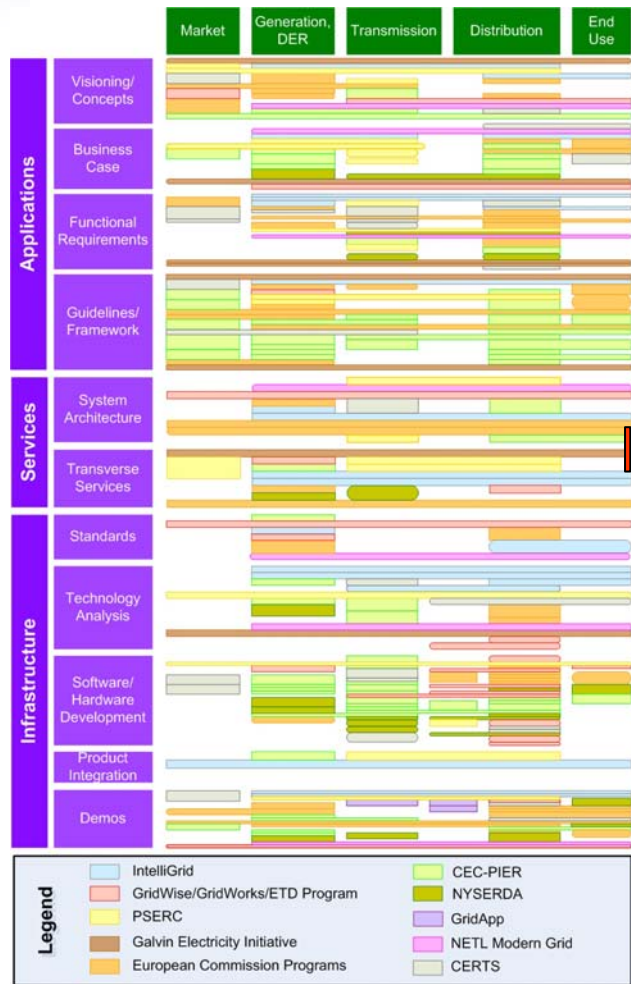


Program Integration Results

- Budget versus technical domains and area of interest



Program Integration Results



Detailed results of the mapping

Simplified results of the mapping

Program Integration

Results – Zoom on the distribution area

- Identification of **gaps** ...
 - System architecture
 - Standards, user groups
 - Integration of products
- ... and **possible overlaps** ...
 - Visioning and concepts
 - Functional requirements
 - Demonstrations
- ... to focus on and reinforce coordination to
 - share results
 - expand the global value of each program

Program integration

Next steps

- Review of the last profiles
- Improve profiles with:
 - Update mapping based on reviews
 - Clarification of uses
 - Identification of drivers and their links to the projects
- Integrate new programs profile to continue build the global vision
- Share the mapping/profiles widely

Program integration

Mapping of Smart Grid Programs

Questions?

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Applications Needs	Visioning Concepts	Self-Healing Grid (FSM) Key concepts of Consumer Portal	AMI, PCT, DR Concepts for California	LV Microgrids (reconfiguration)	Load control concept (DISPOWER) Modular FACTS (DGFACTS)	GridWise Architecture Council Constitution (vision for interoperability) DER agregation mechanisms
	Business Case	Consumer Portal for Energy Services	Cost effectiveness of DG interconnection		Microgrids (MICROGRIDS) Potential peak demand reduction and energy efficiency (EFFLOCOM)	
	Functional Requirement	Draft use cases of IntelliGrid functions Voltage and Reactive Power Management advanced functions (FSM) Consumer Portal use cases	Technical assessment on distribution impacts of electric vehicle charging	PV Controller, EMS, Protection for Microgrids	Generation control strategy with high penetration of DER (DISPOWER) Design of architecture of LSVPP (FENIX) Operation, control, protection of microgrids (MICROGRIDS) Load profiles in deregulated business (EFFLOCOM) Decentralized control strategy for fault detection and location (CRISP)	
	Guidelines FrameWork	iA recommendations to define an information architecture for an intelligent grid	Guide book to DG interconnection PQ guidelines for EE device DR programs Guide book for PQ Analysis on wind generation impacts to grid system operations		Tools and studies for the distribution of intelligence in sustainable power (CRISP)	GridWise Architecture Council Constitution; key concepts for interoperability
Services	System Architecture	IntelliGrid Architecture recommendations and principles to define a system architecture	Demand Response Reference Design		Security and dependability of communication infrastructure (CRISP) Coordination of electric delivery reliability and information technologies innovation (GRID)	
	Transverse Services	iA principles to specify support services Workshops and training to define use cases of an intelligent grid			Communication and control simulation environment (CRISP)	Power Electronics test facility Public library of fault disturbances
Infrastructure	Standards Users Group	Contribution to Intenational Standards for the Consumer Portal (ANSI C12, IEC TC57)			Interconnection requirements for DER (DGNet)	GridWise Standards Mapping Overview
	Technology Analysis	Recommendations of technologies for an intelligent grid (iA) Communications in utilities systems Sensors for an intelligent grid Consumer portal		I-Grid technology assessed (PQ)	Review of technos for grid control with DER (DISPOWER) State-of-the-art of DER (DGNet) State-of-the art of storage with RES (Investire)	Cable system diagnostic initiative Protection scheme assessment for SCE cicruit of the future
	Software and Hardware Development		Loop flow management Composite reinforced aluminium conductor Satellite communications system Light activated surge protector thyristor	Simulation platform to test technically Microgrids Microgrids prototype	Planning, design tool (DISPOWER) PQ management with DER (Dispower) Scada system with DER (Dispower) Modular FACTS (DGFACTS) Adaptation of DMS-EMS for LSVPP (FENIX)	New supervisory controls Protection scheme development GridAgent platform Integrated control with multi-agents Real-time load control and stability Monitoring fault location and prediction Integrated DMS Interfaces
	Integration of products	Technologies to facilitate field device integration and enterprise management (iA)				
	Demos	iA use cases applications iA system architecture principles, FSM and Portal functional requierements, Tech transfer for definition of transver services IntelliGrid	Evaluation of Auto DR in large facilities	Several type of load control demand-side management demonstrations Microgrids demonstration	Local management of DER (DISPOWER) 6 Pilots of controllable load & energy efficient measures (EFFLOCOM) 20 demos of RES and energy efficient measures in local communities (CONCERTO) New supply-demand matching with DER, storage, consumers (CRISP) Connect-disconnect of microgrids to transmission grid demonstrated (CRISP) Demo of Virtual Power Plant (FENIX)	GFA demonstration Olympic Peninsula Demand Response Demonstration (DR, backup generators, virtual market)

