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JCP&L/FirstEnergy
EPRI Demonstration Host Site Project
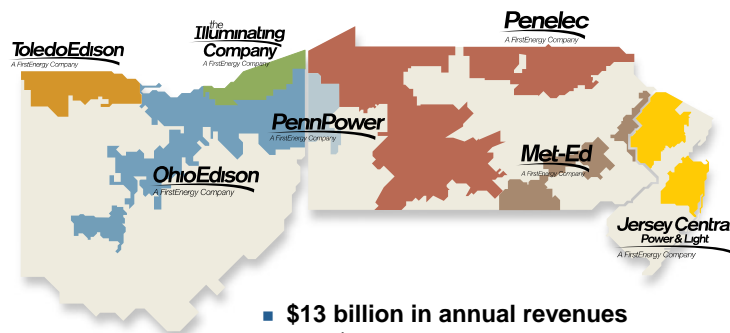
EasyGreen™

Joe Waligorski
Eva Gardow

Jersey Central Power & Light
A FirstEnergy Company

EPRI Smart Grid Advisory Meeting
June 23, 2009

FirstEnergy/JCP&L Profile

ToledoEdison *A FirstEnergy Company*

the Illuminating Company *A FirstEnergy Company*

Penelec *A FirstEnergy Company*

PennPower *A FirstEnergy Company*

OhioEdison *A FirstEnergy Company*

Met-Ed *A FirstEnergy Company*

Jersey Central Power & Light *A FirstEnergy Company*

- $13 billion in annual revenues and $32 billion in assets
- 4.5 million customers, 1.1 in New Jersey
- 18 generating plants; more than 14,272 MW
- Approx. 133,000 transmission and distribution circuit miles
- Approx. 14,500 employees

Rankings Among Electric Utilities (12 mos. ended 12/31/2007)	
Assets	11
Customers	5
Revenues	11
Market Cap (as of 2/29/08)	7

Source: EEI

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Demonstration Host Site Project Overview

- Integrated Distributed Energy Resources (DER) Management to enable Operational and PJM market benefits

- NJBPU approved deployment of the Integrated Distributed Energy Resources Management Pilot
  - 8MW Residential and Commercial & Industrial customers with control by the integrated control platform

- Integrated Smart Grid Control Platform

- Direct Load Control

- Permanent Peak Load Shift devices at commercial customers

- Electricity Storage in substations

- Electrical Distribution Sensors on distribution circuits

- Utility Solar installed on distribution poles

- Real-time system monitoring and status for utility operations

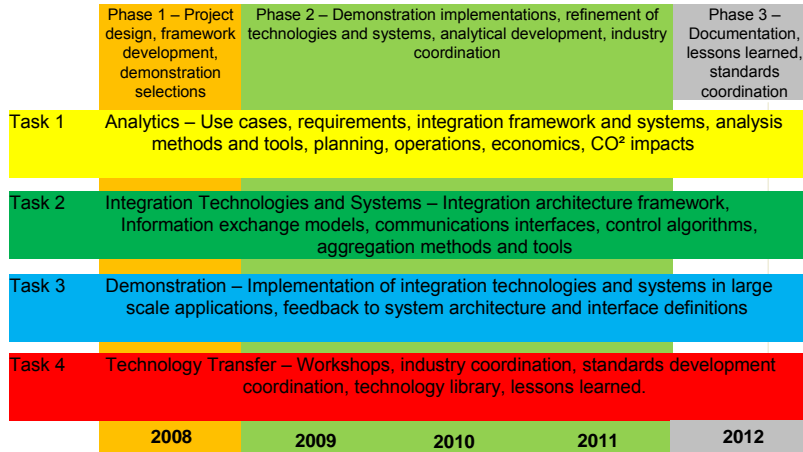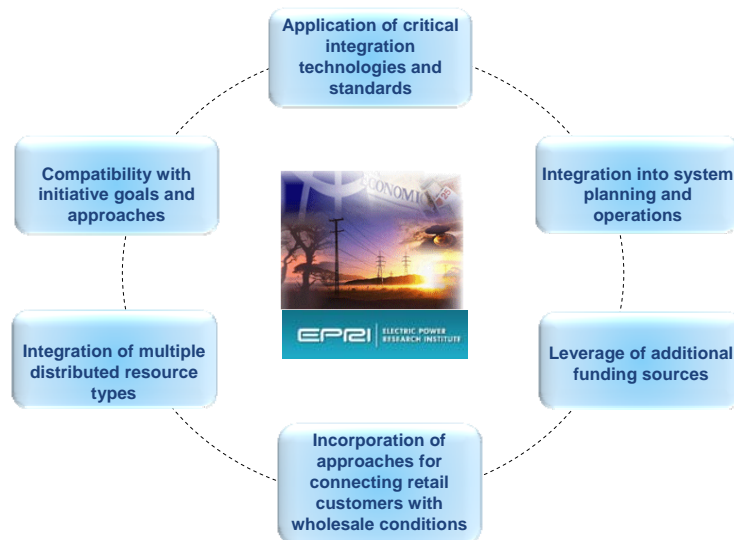- Use Cases and the associated Business Cases development

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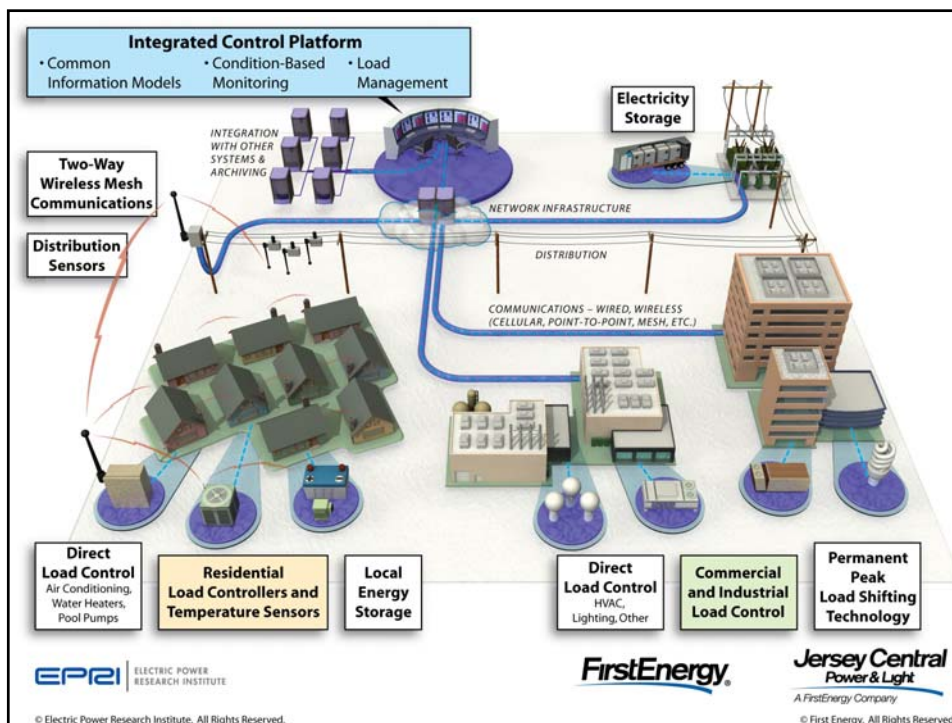
EPRI Smart Grid Demonstration Collaborative

- Industry research effort
- Addressing grid modernization and integration of distributed energy resources in grid operations and RTO markets

	Phase 1 – Project design, framework development, demonstration selections	Phase 2 – Demonstration implementations, refinement of technologies and systems, analytical development, industry coordination			Phase 3 – Documentation, lessons learned, standards coordination
Task 1	Analytics – Use cases, requirements, integration framework and systems, analysis methods and tools, planning, operations, economics, CO_2 impacts				
Task 2	Integration Technologies and Systems – Integration architecture framework, Information exchange models, communications interfaces, control algorithms, aggregation methods and tools				
Task 3	Demonstration – Implementation of integration technologies and systems in large scale applications, feedback to system architecture and interface definitions				
Task 4	Technology Transfer – Workshops, industry coordination, standards development coordination, technology library, lessons learned.				
	2008	2009	2010	2011	2012

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Project Alignment with EPRI Smart Grid Initiative

- Application of critical integration technologies and standards
- Compatibility with initiative goals and approaches
- Integration into system planning and operations
- Integration of multiple distributed resource types
- Leverage of additional funding sources
- Incorporation of approaches for connecting retail customers with wholesale conditions
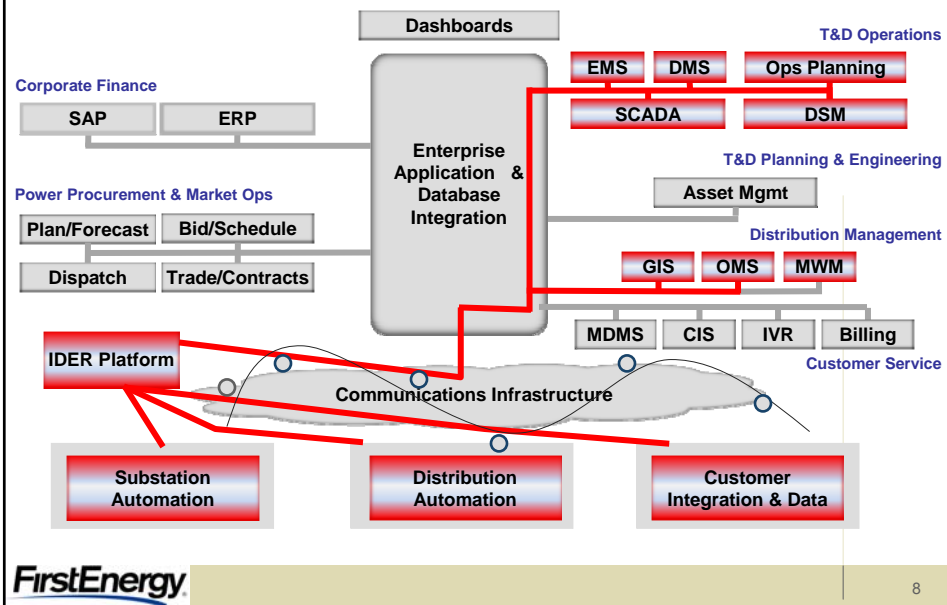
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Project Alignment with FirstEnergy IGCA

- Integrated Grid Communications and Automation (IGCA) is FirstEnergy's roadmap to modernize the infrastructure

- IGCA developed through collaboration with industry partners
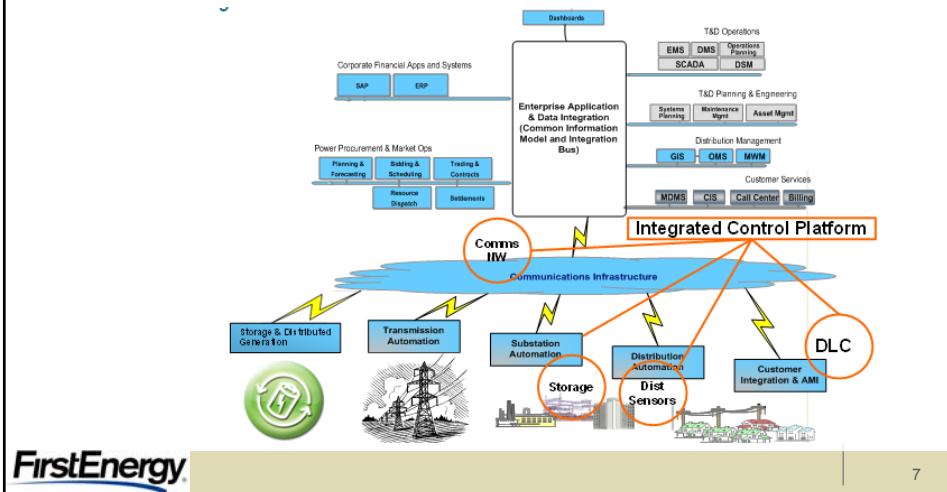
Integration into Energy Delivery

Objectives

- Deploy and integrate distributed energy resources (DER) for system interoperability
- Deploy advanced system equipment, such as two-way communications and decision processing technologies
- Test and document integrated DER functionality with Use Cases

Substation | Distributed Renewable Generation & Storage | Distribution Grid | Customer Premises

- Evaluate integrated DER to support operations of local distribution system
- Participate in RTO markets
- Develop and evaluate cost benefit valuation methodologies
- Contribute to development of Industry standards

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Benefits

Operational Benefits

- Visualize and evaluate state of distribution system
- Monitor and control integrated resources
- Evaluate operational efficiency for improvements

Market Benefits

- Dispatch aggregated capacity and energy resources
- Effective Demand Response realized through two-way communication

pjm

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Host Site Project Technologies

- Integrated Smart Grid Control Platform

- Direct Load Control
  - Residential and Commercial & Industrial customers

- Distribution Line Sensors

- Permanent Peak Load Shift devices at commercial customers

- Electricity Storage

- Utility Solar installed on distribution poles

Integrated Control Platform

- Central point of integration, system supervision and control

- Integration of devices and sensors provides operational measurements on voltage, current, active power, reactive power, and peak load

- Platform will evaluate:
  - State Configuration – how operators can designate different classes of grid performance
  - State Estimation – confirm coordination of data to evaluate actual operation versus configured states
  - Response Coordination – evaluate how operator responses can be developed and displayed; automation
  - Request Control – evaluate system interaction with operators to restore normal state.
  - Verification – confirm verification of all operations

Communications Network

- Agnostic
- 900MHz/2.4GHz Frequency-Hopping Spread Spectrum (FHSS) Radio mesh network
- Cellular Backhaul

JCP&L Regional Dispatch Operator

Client Network

Power SG (Client) Outage Monitoring

Power SG (Client) Demand Dispatch

Power SG Server

Wireless Mesh

Demand Controllers

Data Concentrator

Network Backbone

Wireless Mesh

Data Concentrator

Demand Controllers

Event Database

Database Network

Wireless Mesh

Data Concentrator

Demand Controllers

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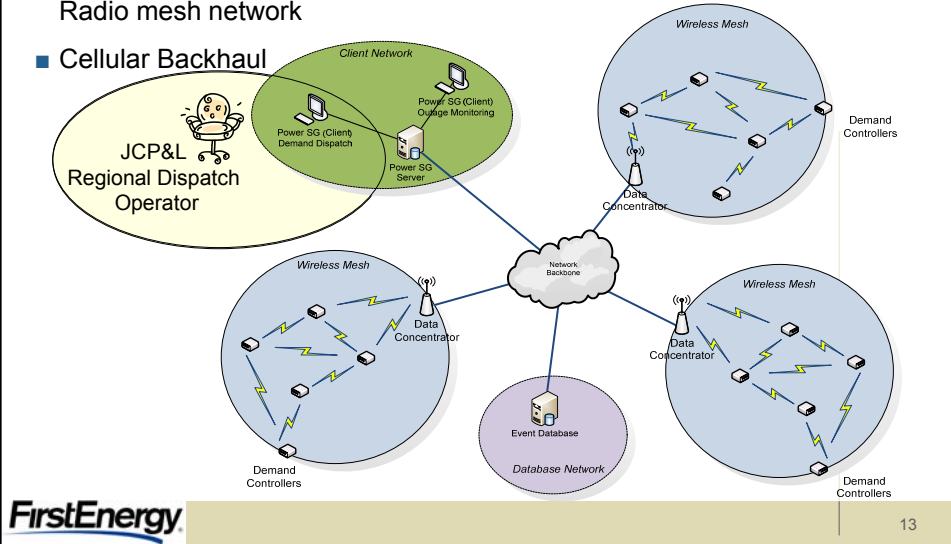
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Direct Load Control

- Manages Residential and Commercial non-critical HVAC load
- Load is reduce and verified through the platform
- Network monitoring and management views gives utility operators visibility to Customer devices, Location on the grid, Status and state change, Two-way communication mesh

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Distribution Sensors

- Monitored and controlled by platform
- Support functions:
  - Locational Load Profiling
  - Power Factor
  - Fault :Location
  - Voltage Profile
  - Device Control
  - Voltage Regulation Control
  - Capacitor Bank Control
  - Insight into Sensor and Device Placement
  - Advanced System Integration
  - Modeling and Planning Benefits

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Permanent Peak Load Shift Program

- Shifts air conditioning load to off-peak by 95%
- Improves load factor, permanent peak shift
- Installed at targeted commercial buildings
- Monitored and controlled by platform

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Electricity Storage

Premium Power

- **Substation Sited Electricity Storage**
  - Monitored and controlled by platform
  - Transflow & PowerBlock
  - Supports multiple customers
  - Transportable Load Management
- **Customer Electricity Storage**
  - Monitored and controlled by platform
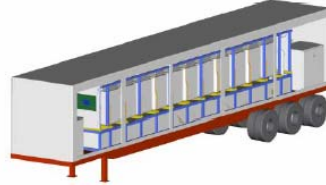
GRIDPOINT

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Utility Solar

PETRA SOLAR
Intelligent Energy By Design

- AC ~200W solar module
- Monitored and controlled by platform
- Var support
- New Jersey Company

Pole-Mounted SunWave™

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Project Management Approach

- **Formal project management tools and software used**
  - Attention to timelines, costs, deliverables and results

- **Weekly planning and review meetings held**
  - Vendor collaborators attend
  - Project Deployment Update
  - Integrated Control Platform Development Update
  - Project Coordination Update

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1	**1 Project Planning and Objectives Setting**	**492 days?**	**Fri 7/11/08**	**Fri 5/28/10**		
2	1.1 Create Project Definition & Objective Setting	37 days?	Fri 7/11/08	Mon 9/1/08		FE (DEG)
3	**1.2 Create Host Site Project Management Documents**	**163 days?**	**Mon 9/1/08**	**Wed 4/15/09**		
4	**1.2.1 Create Host Site Project Management SOW**	**90 days?**	**Mon 12/1/08**	**Fri 4/3/09**		
5	1.2.1.1 Create Host Site Project Management S	90 days?	Mon 12/1/08	Fri 4/3/09	2SS	FE (DEG)
6	1.2.1.2 Review and acceptance of Project Mana	0 days	Fri 4/3/09	Fri 4/3/09		FE (DEG)
7	**1.2.2 EPRI Microsoft Project Document**	**33 days?**	**Mon 3/2/09**	**Wed 4/15/09**		
8	1.2.2.1 Create EPRI Microsoft Project Documer	33 days?	Mon 3/2/09	Wed 4/15/09	5SS	EPRI (DEG)
9	1.2.2.2 Review and acceptance of EPRI MS Pro	3 days?	Mon 4/13/09	Wed 4/15/09	8SS	FE (DEG)
10	1.2.2.3 Delivery of MS Project SOW document t	0 days	Wed 4/15/09	Wed 4/15/09	9SS	DEG
11	1.2.3 Develop Equipment Status Report	23 days?	Mon 9/1/08	Wed 10/1/08		FE (BPLG)
12	1.2.4 Develop Integrated Control Platform Developm	11 days?	Mon 2/16/09	Mon 3/2/09		FE (BPLG)
13	1.2.5 Develop Project Coordination Report	23 days?	Mon 3/2/09	Wed 4/1/09	11SS,12SS	FE (DEG)
14	**1.3 Project Objectives Documentation**	**456 days?**	**Mon 9/1/08**	**Fri 5/28/10**		
15	**1.3.1 Project Objectives Abstract**	**456 days?**	**Mon 9/1/08**	**Fri 5/28/10**		
16	**1.3.1.1 for Direct Load Control**	**194 days?**	**Mon 9/1/08**	**Thu 5/28/09**		
17	1.3.1.1.1 Create Direct Load Control Abstra	163 days?	Mon 9/1/08	Wed 4/15/09	2SS	EPRI (DEG)
18	1.3.1.1.2 Deliver Direct Load Control Abstr	1 day?	Wed 4/15/09	Wed 4/15/09	17SS	DEG
19	1.3.1.1.3 Deliver Direct Load Control Abstr	1 day?	Thu 5/28/09	Thu 5/28/09		DEG

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Project Tasks

Task 1 – Project Planning & Objectives Setting

Task 2 – Equipment Deployment

Task 3 – System Integration Activities

Task 4 – Benchmarking Project to Existing Methodologies & Standards

Task 5 – Performance & Integration Requirements

Task 6 – Develop Use Case Scenarios

Task 7 – Develop Business Case Scenarios

Task 8 – Monitoring & Performance Assessment

Task 9 – Tasks to Support System Use

Task 10 – Project Analysis Activities

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Project Use and Market Cases

- **Operations Based Use Case Development**
  - Visualization and Operation of integrated DER via ICP
  - Operation of Load Management in Response to Condition Alarms
  - Condition Coordination and Response for Asset Protection
- **Market Based Use Case Development**
  - Capacity - Aggregated Load Reduction for Market Participation
  - Energy - Aggregated Load Reduction for Market Participation
- **Use Case Models**
  - EPRI IntelliGrid Methodology
  - Use Case template

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