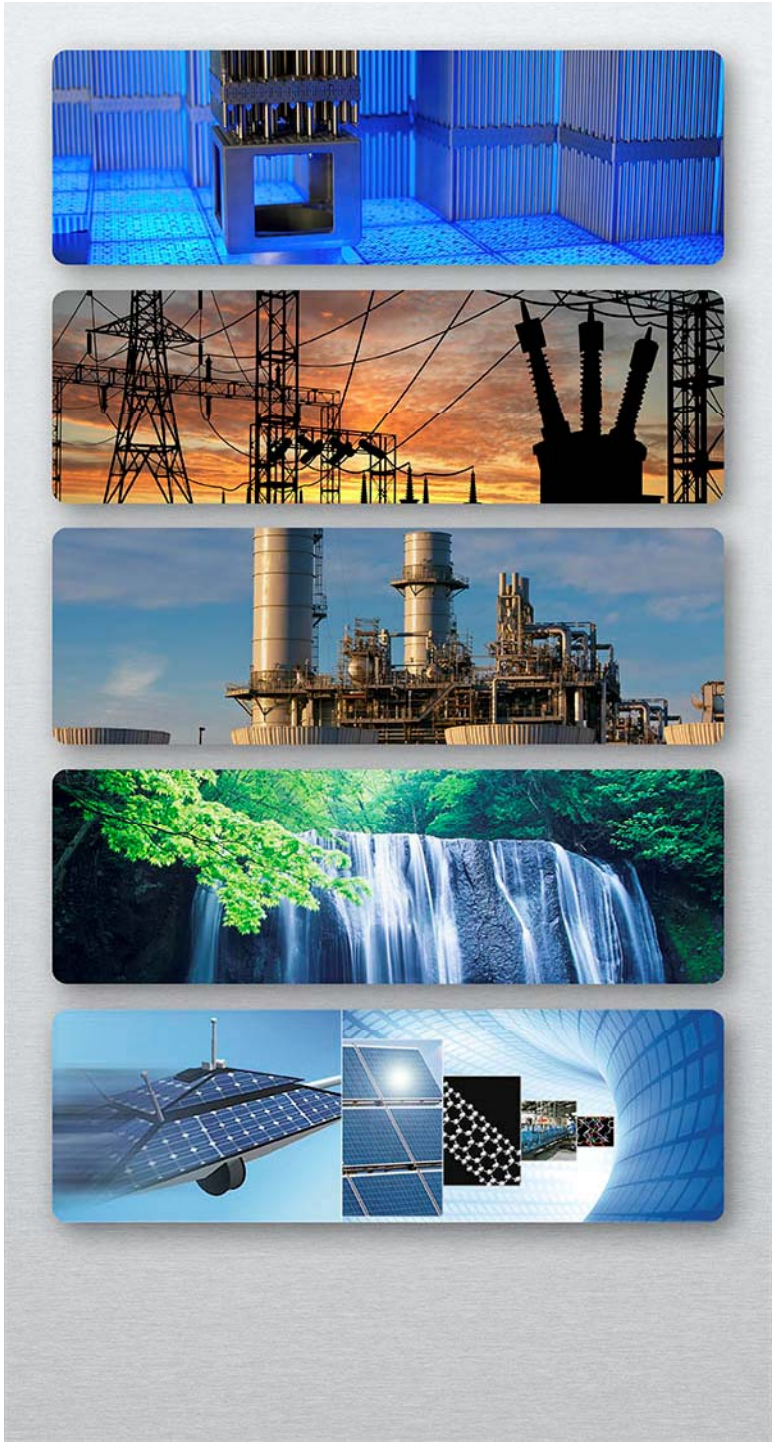

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Smart Grid Demonstration Initiative Overview & Project Examples

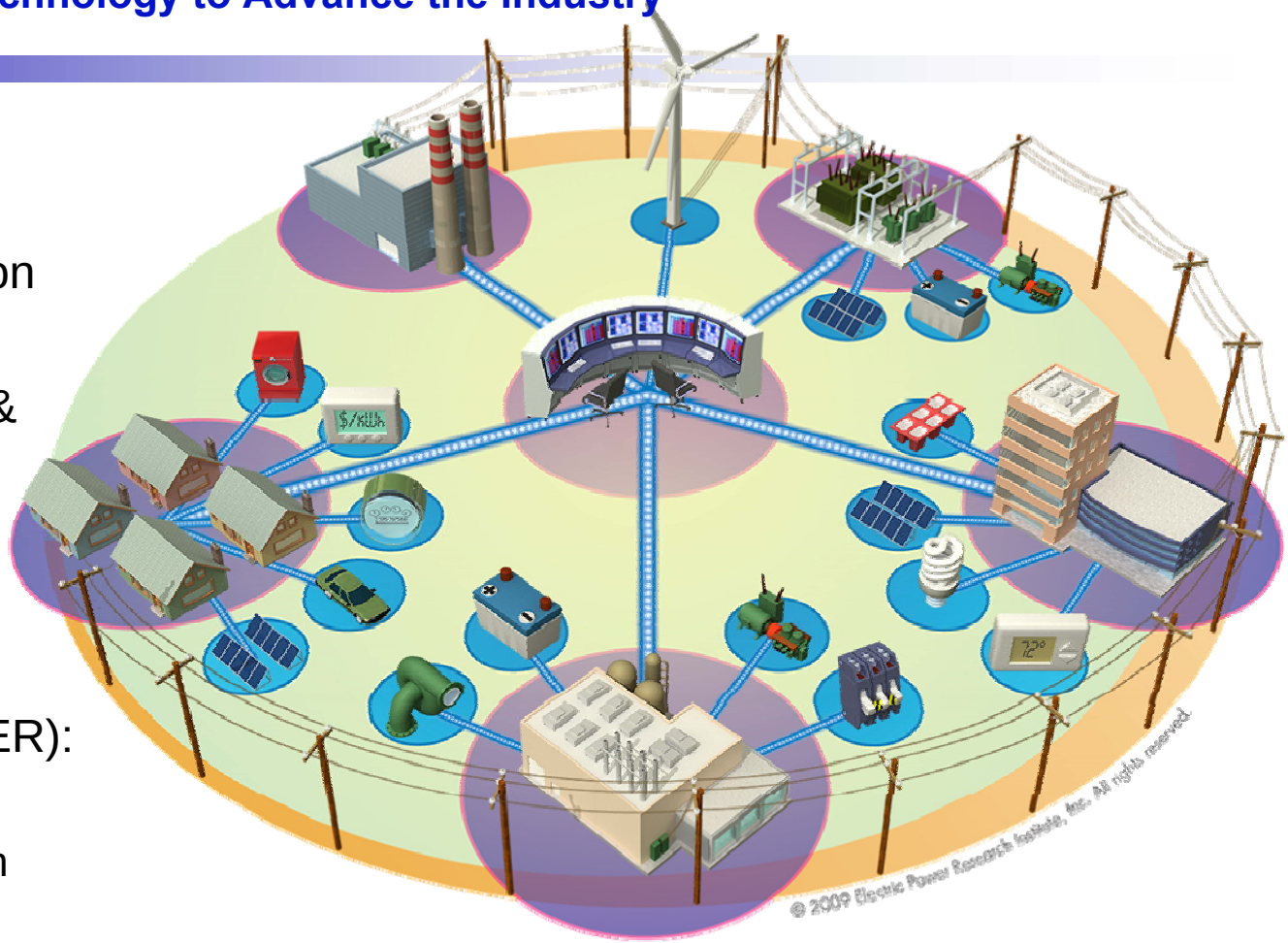
March 31, 2011

Matt Wakefield
Program Manager, Smart Grid Demonstrations

EPRI Smart Grid Demonstration Initiative

Leveraging Today's Technology to Advance the Industry

- Deploying the Virtual Power Plant
- Demonstrate Integration and Interoperability
- Leverage information & Communication Technologies
- Integration of Multiple Types of Distributed Energy Resources (DER):
  - Distributed Generation
  - Renewable Generation
  - Storage
  - Demand Response



- Multiple Levels of Integration - Interoperability

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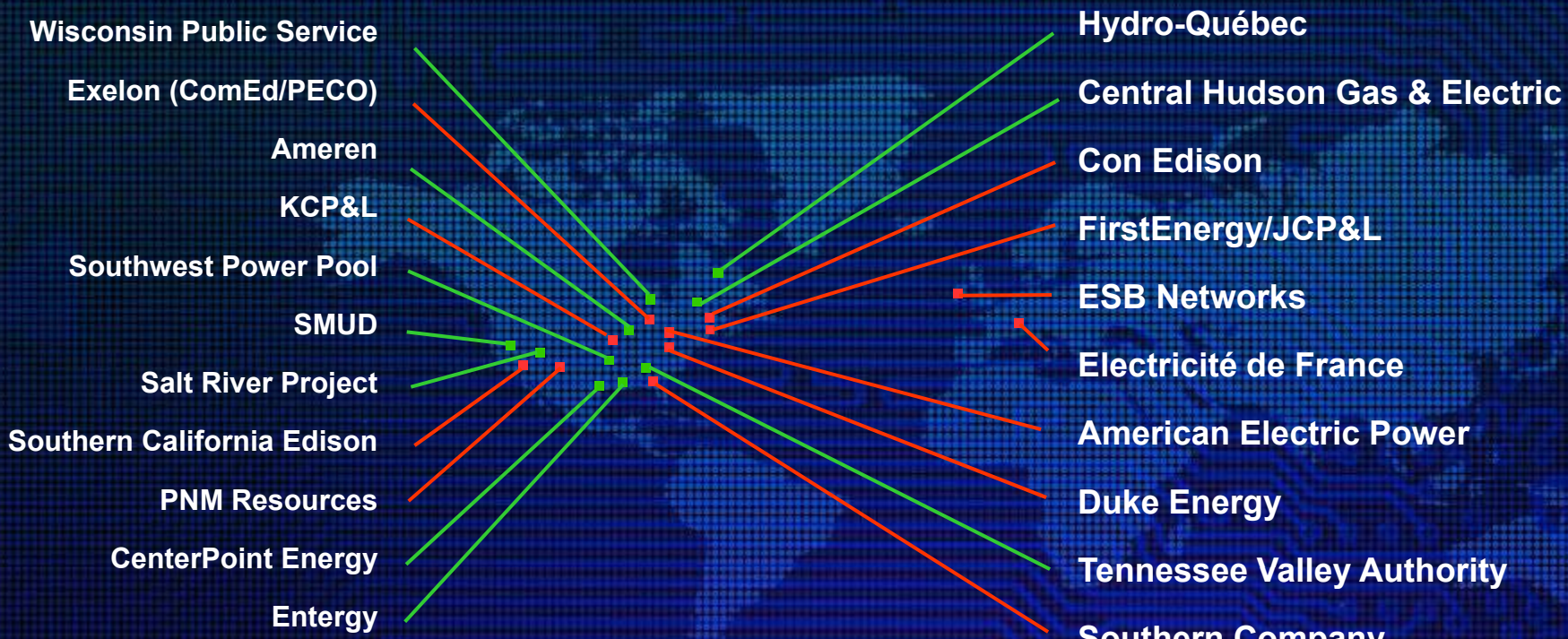
Smart Grid Demonstration - 21 Collaborators

Several Pending New International Members



- Collaborator
- Collaborator & Host Site

Several "Mini-Demo's" Underway

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Collaboration Results in Richer Research Results and Value to Industry

	Primary Integrated Technologies & Applications	Smart Grid Demonstration Members																	
		Host Site Colloborators											Collaborators						
		AEP	Con Ed	Duke	EDF	ESB	Exelon	FE	KCP&L	PNM	SCE	Southern	Ameren	CHG&E	Entergy	SPP	SRP	TVA	WPS
Distributed Energy Resources	Demand Response Technologies	■	■	■	■	■	■	■	■	■	■	■							
	Electric Vehicles	■		■		■			■		■	■							
	Thermal Energy Storage	■			■	■	■	■	■	■									
	Electric Storage <= 100 kWh (Utility Local Storage, Customer Storage,...)	■	■	■	■		■	■		■	■	■							
	Electric Storage > 100 kWh (Typically at substations or near renewables .)	■						■	■	■	■	■							
	Solar Photovoltaic	■		■	■		■		■	■	■	■							
	Wind Generation	■				■	■												
	Conservation Voltage Reduction (volt/var management and related)	■		■		■			■		■	■							
	Distributed Generation (Microturbin, Fuel Cell, Diesel Generator, Biogas,...)	■	■		■		■		■	■									
Communications and Standards	Customer Domain (SEP, BACnet, HomePlug, WiFi, etc.)	■	■	■		■	■		■	■	■	■							
	Transmission & Distribution (IEC 61850, 60870, DNP3, IEEE 1547)	■	■	■		■	■	■	■	■	■	■							
	Operations Domain (IEC 61968/61970, MultiSpeak, OpenADR,...)	■			■	■	■		■	■		■							
	Cyber Security (Authentication, Certificates, Encryption, Intrusion Detection,...)		■	■	■	■	■			■	■	■							
	AMI or AMR	■		■		■	■		■	■		■							
	RF Mesh or Tower	■				■	■	■	■		■	■							
	Public or Private Internet		■	■	■	■	■		■	■	■	■							
	Cellular Based (1xRTT, GPRS, EVDO, CDMA, 3G, LTE, 4G,...)	■		■		■			■	■	■	■							
	WiMAX (IEEE 802.16) Communications			■							■								
Programs	Price Based (RTP, DA, CPP, PTR, TOU, Block,...)	■		■		■	■	■	■	■	■	■							
	Incentive Based (DR, DLC, Ancillary Services, Interruptible, Bidding,...)	■	■		■	■	■	■	■	■	■	■							
Ops & Planning	Integration with System Operations (RT Visibility of DER, DMS Integration)	■	■	■		■	■	■	■	■	■	■							
	Integration with System Planning (Visibility of DER in planning,...)	■	■	■	■	■		■		■	■	■							
	Modeling and/or Simulation Tools	■	■	■	■	■		■		■	■	■							

Cross Collaboration Opportunities
- Areas of Interest
- Similar Project Learnings

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EPRI Smart Grid Resource Center

www.smartgrid.epri.com

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Smart Grid Resource Center

Home | Use Case Repository | EPRI Research | Smart Grid Demo | Presentations & Papers | Event Calendar | Related Links

Smart Grid Resource Center

This site serves as a home for information about EPRI's Smart Grid research, demonstration projects, and the Smart Grid Use Case Repository.

A Smart Grid is one that incorporates information and communications technology into every aspect of electricity generation, delivery and consumption in order to:

- Minimize environmental impact
- Enhance markets
- Improve reliability and service
- Reduce costs and improve efficiency

Smart Grid Use Case Repository

The Smart Grid Use Case Repository is a public resource for the electric power industry to house Smart Grid related use cases as well as provide a forum for the industry to contribute to this effort by submitting their own use cases.

- Use Case Repository

Smart Grid Demonstration

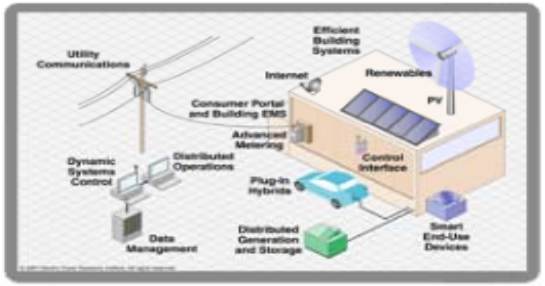
EPRI is conducting a series of industry demonstration projects to address the key issues facing the electric power industry over the next decade. Developing technology to address CO2 challenges, for example, can take a decade or longer and requires large-scale demonstrations to ensure that the technologies are ready for commercial operation. EPRI's role is to develop the collaborative environment for technology development, integration and application prior to commercialization.

- Smart Grid Demonstration

Smart Grid Advisory Update Newsletter

- August 2010 (PDF STORE)

Smart Grid Network



Click for larger image

Smart Grid in the News

Most Recent | Archive

- Consumers Energy's New Plug-In Electric Vehicle Website Helps Customers Get "PEV Ready" - October 05, 2010
- California Law Drives Definition of Grid Storage Value - October 04, 2010
- An Easy Smart-Grid Upgrade Saves Power - October 01, 2010
- NEC works with EPRI to test Lithium-ion storage systems - September 30, 2010
- Utility SDR Works across Frequencies - September 28, 2010
- DOE Selects EPRI Collaborative to Lead Cyber Security Project - September 27, 2010
- Report: Smart Grid Outspends Smart Meters - September 24, 2010
- Environmental Magazine: Are We Ready For Electric Cars? - September 21, 2010

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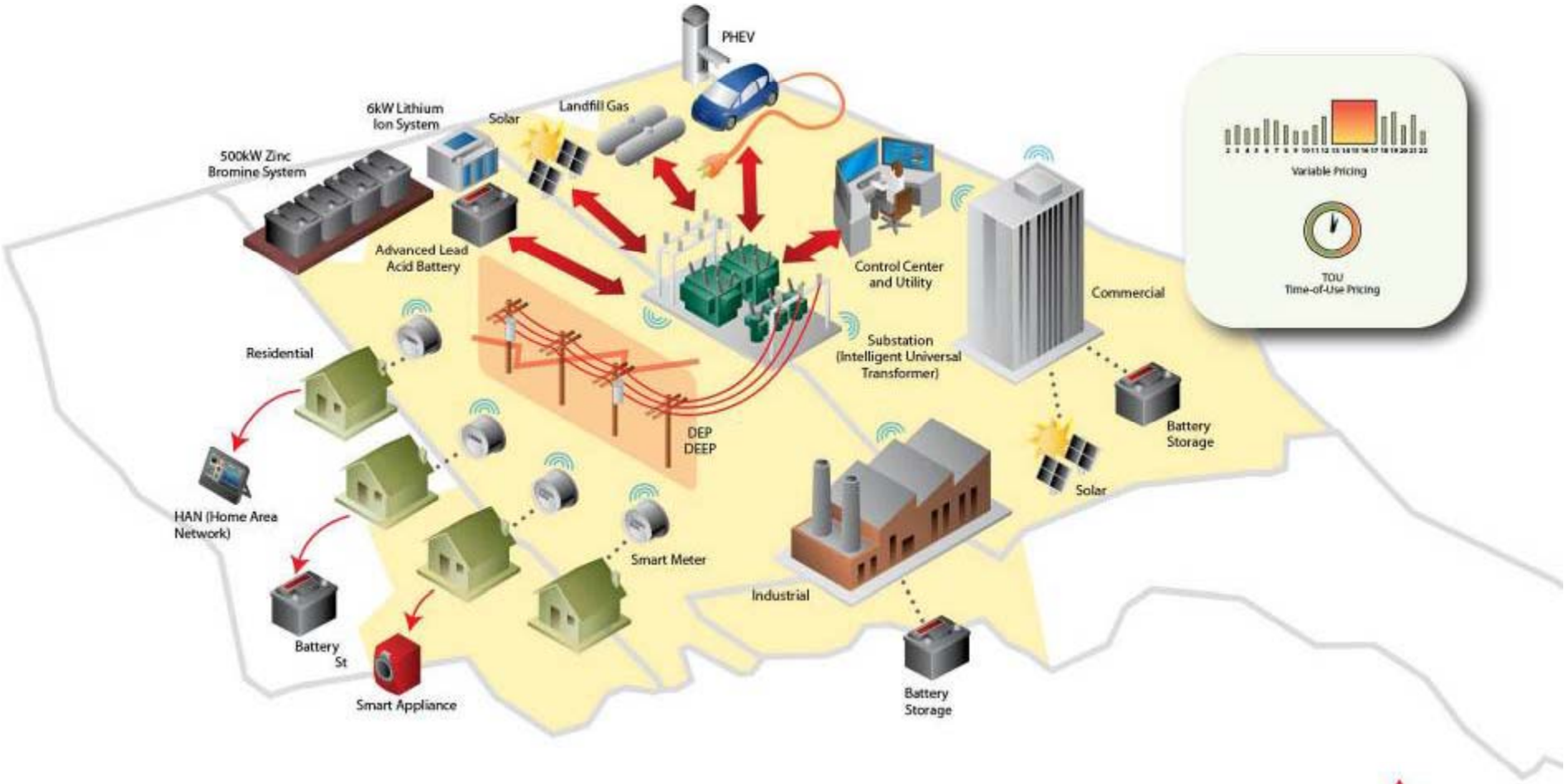
Southern Company Demonstration Project



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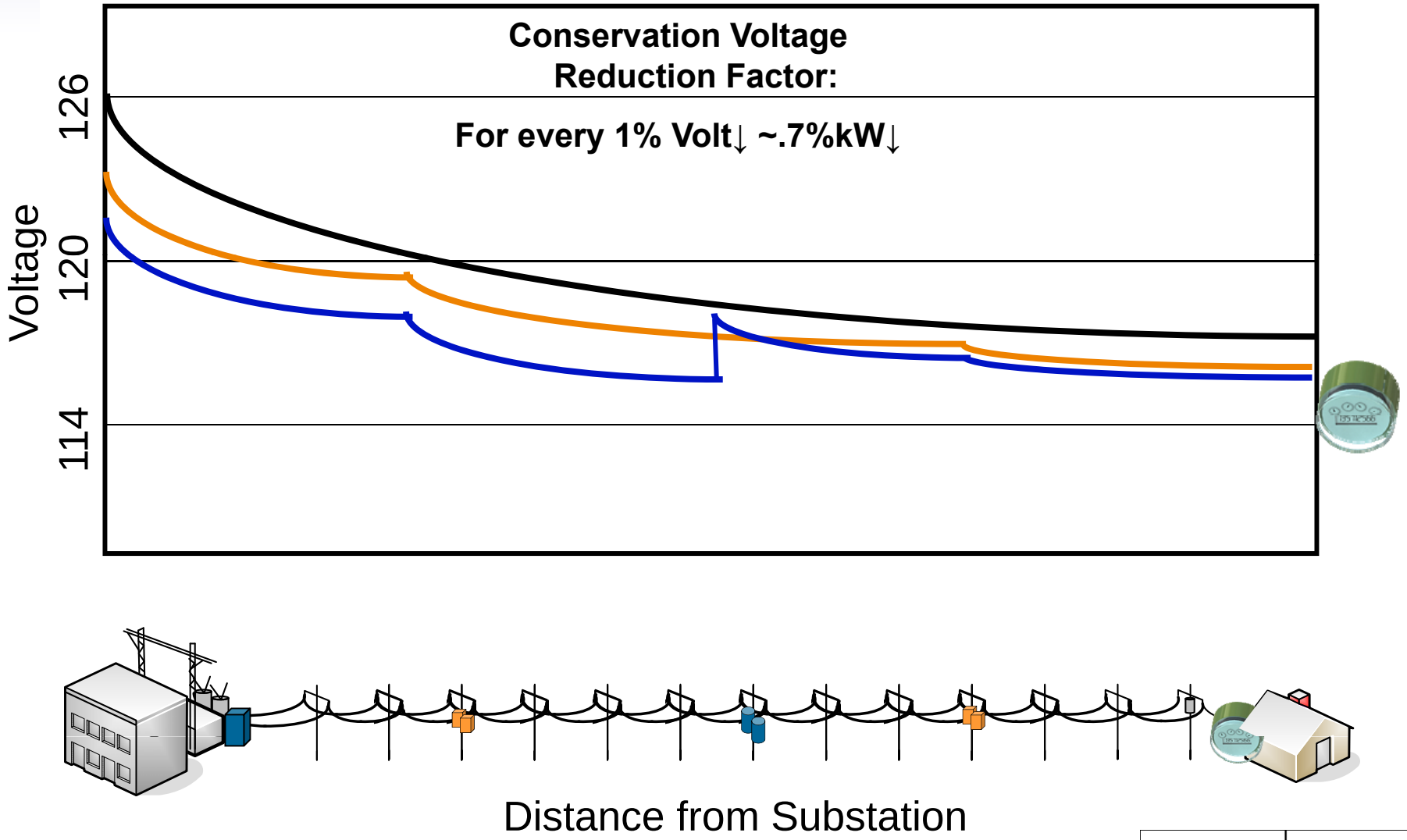
Conservation Voltage Reduction For Efficiency & Demand Response – Matt's "Cartoon"



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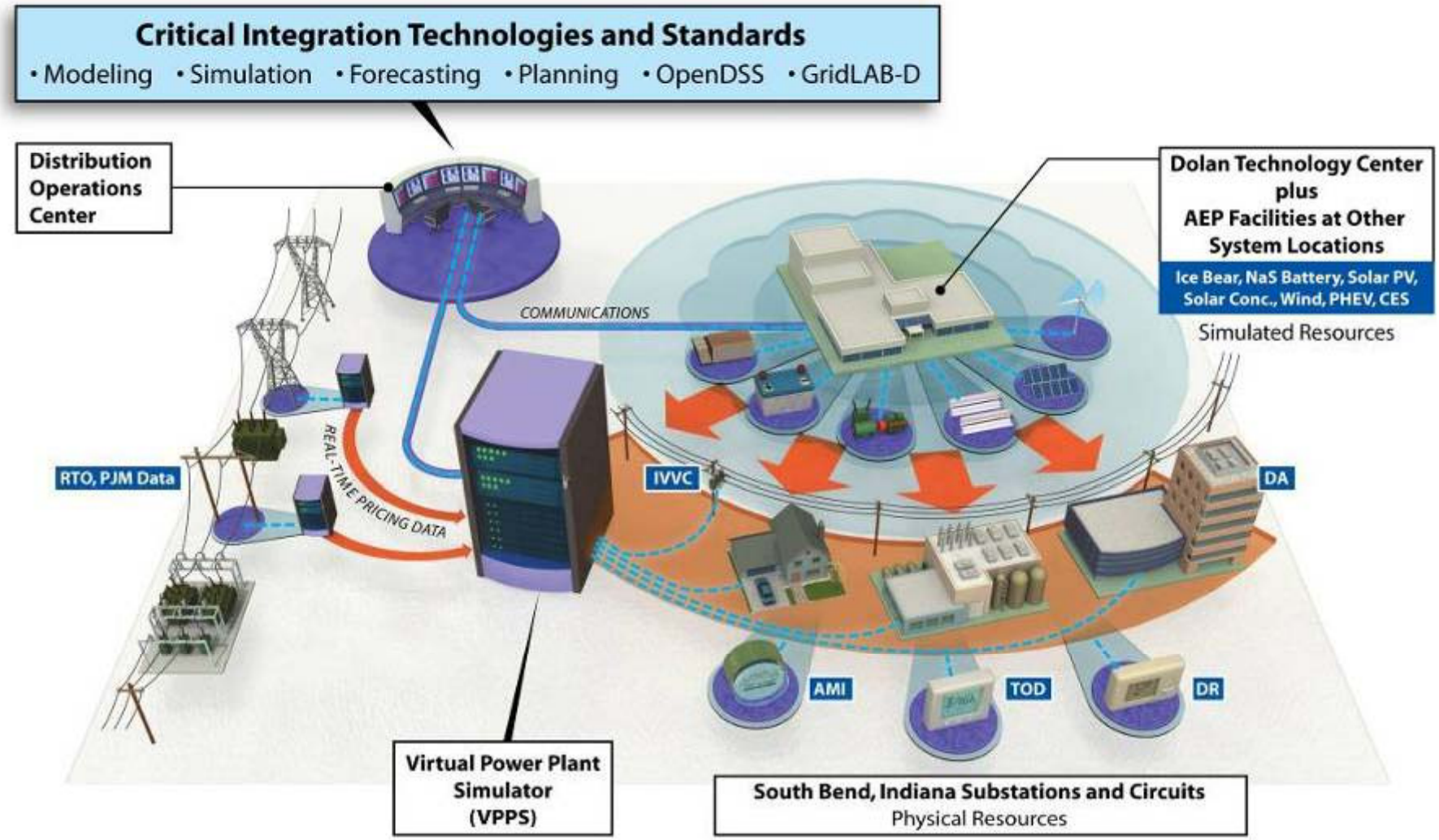
American Electric Power Demonstration Project



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AEP AMERICAN® ELECTRIC POWER

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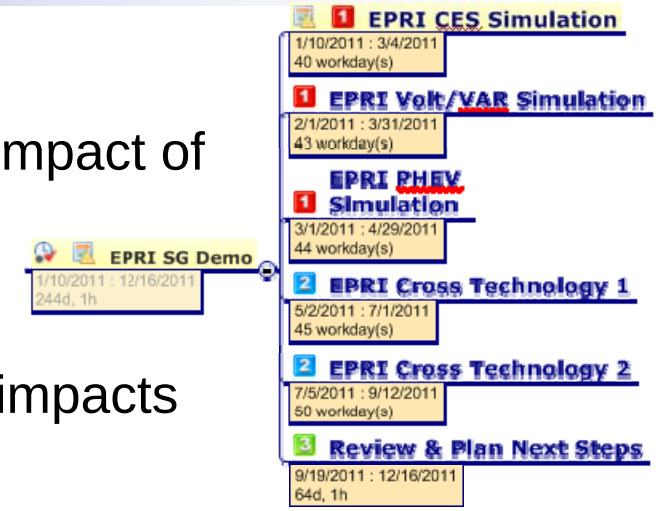
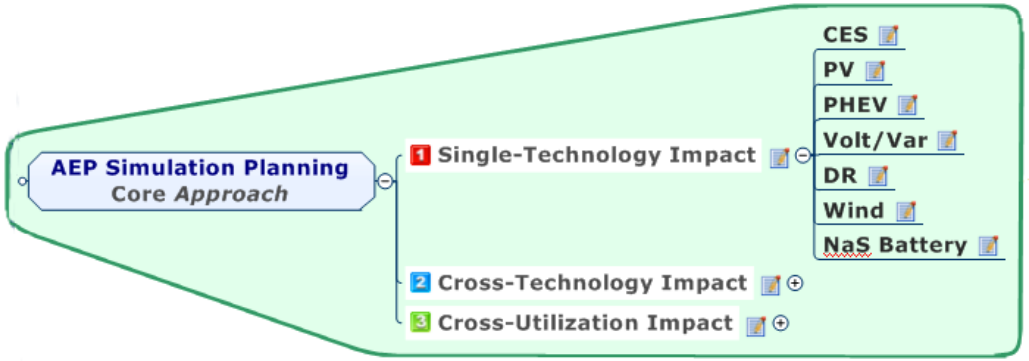
AEP Approach to Smart Grid Technology Simulations

1 Single-Technology Impact
The single-technology simulations isolate the impact of each particular technology.

2 Cross-Technology Impact
Cross-Technology simulations study potential impacts of the combination of smart grid technologies.

3 Cross-Functionality (Cross-Utilization) **Impact**
Understanding concurrent utilization opportunities for the same technology





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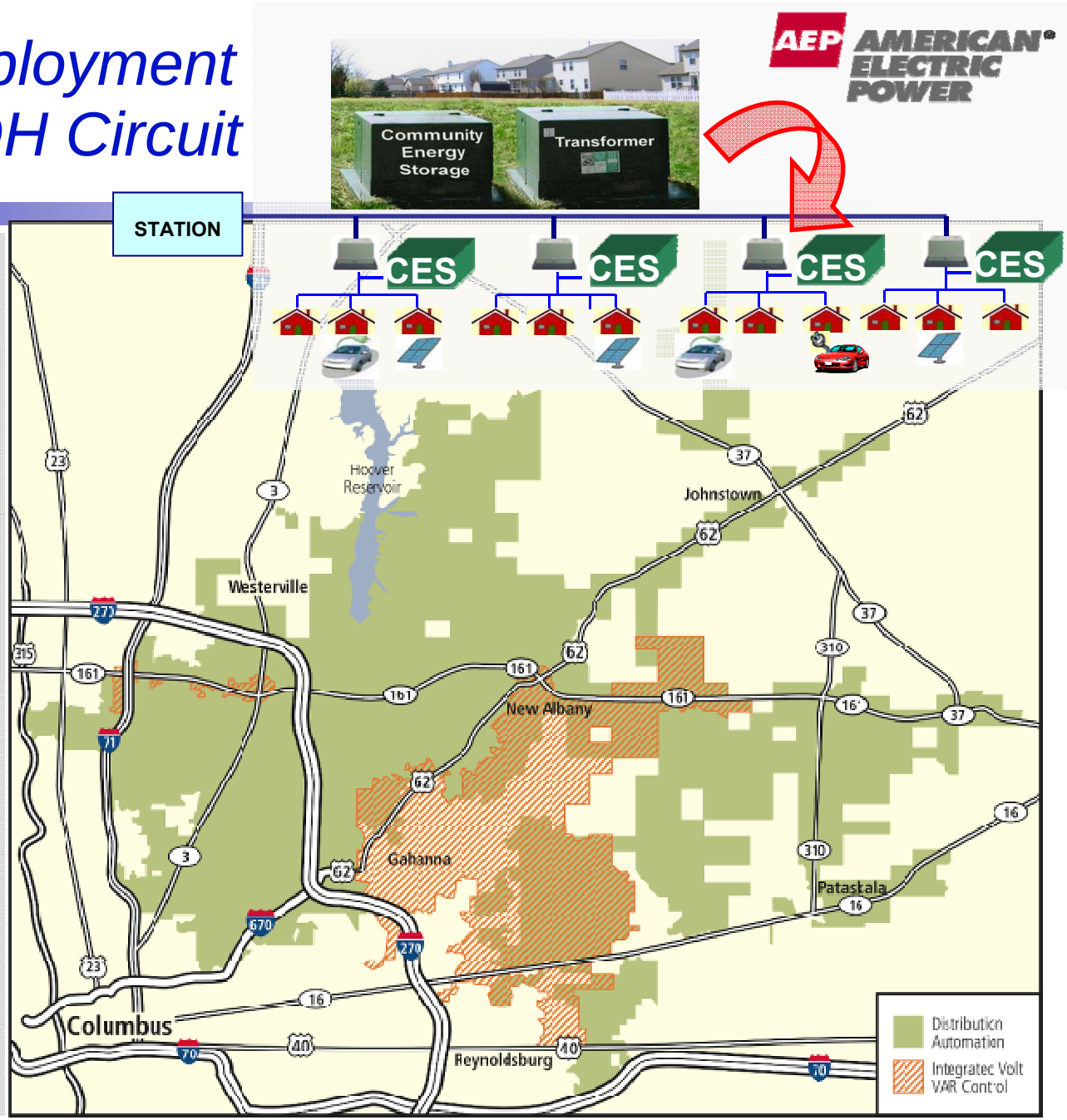
Simulation & Deployment NE Columbus, OH Circuit

- **OpenDSS Model For CES Unit**
- **Modes:**
  - **4 discharge**
  - **3 charge**
- **AMI Data Imported into OpenDSS for Circuit Modeling**



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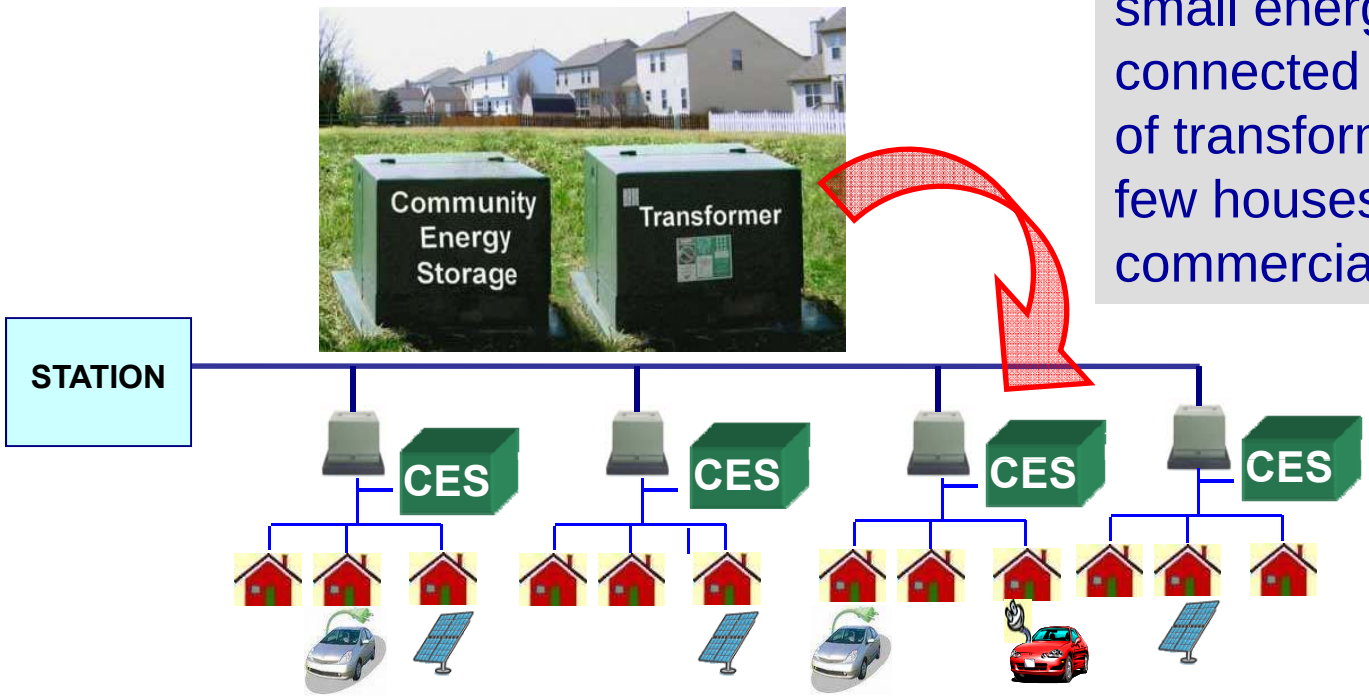
AEP SG DEMO Project – Primary Objective

Models for technologies that will be applied to Smart Grid circuits and develop simulations of how these technologies will interact.

CES is a distributed fleet of small energy storage units connected to the secondary of transformers serving a few houses or small commercial loads.



Community Energy Storage (CES)

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Exelon (ComEd / PECO) Host Site Update

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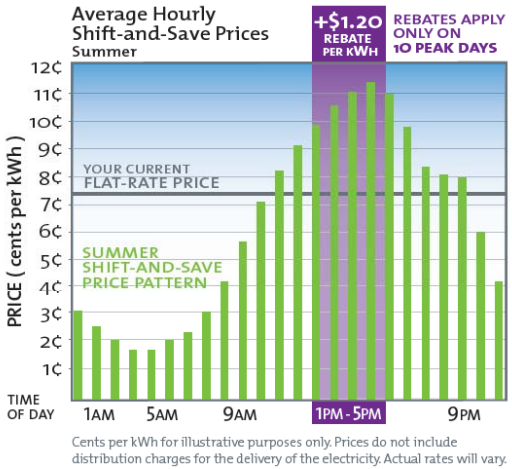
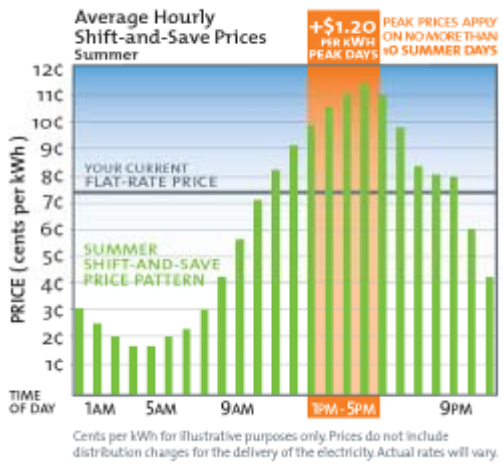
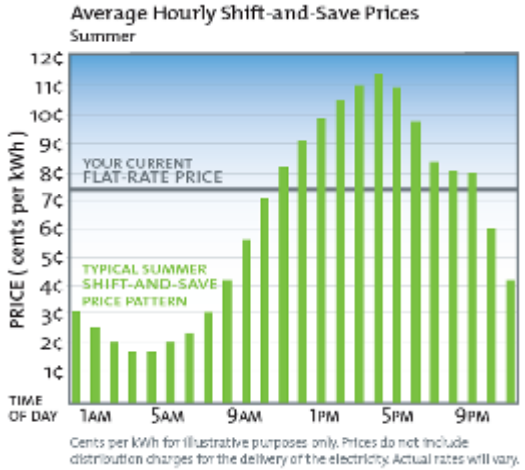
ComEd: Customer Applications Plan (CAP)



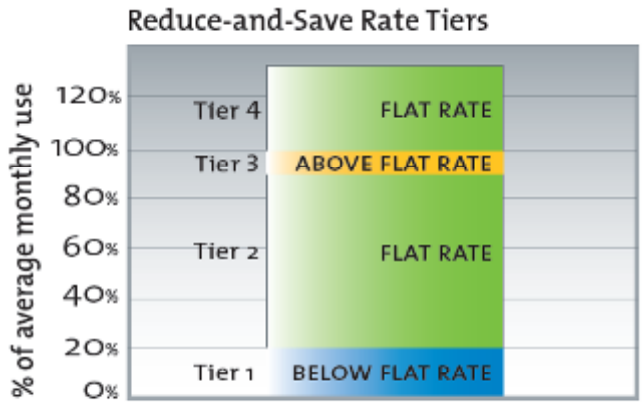
PTR



CPP



DA-RTP



IBR

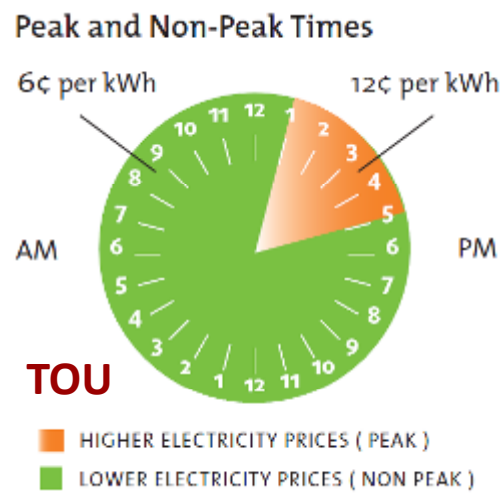
IBR: Increasing Block Rate

CPP: Critical Peak Pricing

PTR: Peak-Time Rebate

DA-RTP: Day-Ahead Real-Time Pricing

TOU: Time of Use



TOU

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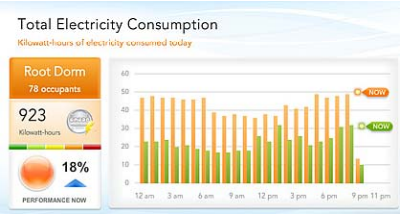
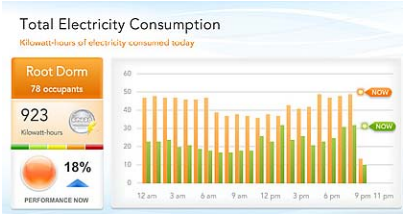
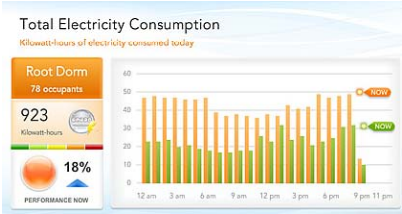
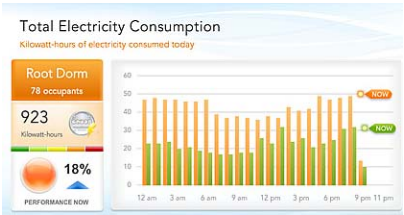
Enabling Technology Variables

Evaluations – Technologies Provided for Free and for Purchase

Web	Web + IHD Basic	Web + IHD Advanced	Web + IHD + PCT
			

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Balancing the social side with the technology

ComEd An Exelon Company

Testing combinations including time-based rates, enabling technologies, and consumer education with on "Opt-Out" Method of Residential Enrollment

RATE TYPES
- Flat
- Increasing Block
- Critical Peak
- Peak-Time Rebate
- Day Ahead RTP
- TOU

CONSUMER EDUCATION
- None
- Basic AMI
- Complete

Technology
- Web
- Basic IHD
- Advanced IHD
- Adv & PCT

		Enabling Technology Type					
		None	Removed	Enhanced Web (eWeb)	eWeb+ Basic IHD (BIHD)	eWeb+ Advanced IHD (AIHD)	eWeb+PCT /IHD (AIHD/PCT)
Flat Rate Type N = 1,650	Flat Rate Existing Meter No Education	Control F1 N=450					
	Flat Rate Existing Meter Education			Application F2 N=225			
	Flat Rate AMI Meter Basic AMI Education			Control F3 N=225			
	Flat Rate AMI Meter Education		~~Application F4 N=0~~	Application F5 N=225	**Application F6 N=300**	Application F7 N=225	
Energy Efficiency Rate Type N = 750	IBR Rate AMI Meter Education			Application E1 N=225	**Application E2 N=300**	Application E3 N=225	
Demand Response Rate Type N = 3,525	CPP/DA-RTP Rate AMI Meter Education			**Application D1 N(a)=525 N(b)=225**	**Application D2 N=525**	**Application D3 N=525**	**Application D4 N=525**
	PTR/DA-RTP Rate AMI Meter Education			Application D5 N=225	**Application D6 N=525**	Application D7 N=225	Application D8 N=225
Load Shifting Rate Type N = 2,625	DA-RTP Rate AMI Meter Education			Application L1 N(a)=225 N(b)=225	**Application L2 N=525**	Application L3 N=225	
	TOU Rate AMI Meter Education			Application L4 N=225	**Application L5 N(a)=525 N(b)=225**	Application L6 N(a)=225 N(b)=225	
N = 8,550		N = 450	N = 0	N = 2,550	N = 2,925	N = 1,875	N = 750

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Opt-Out Results after 9 Months

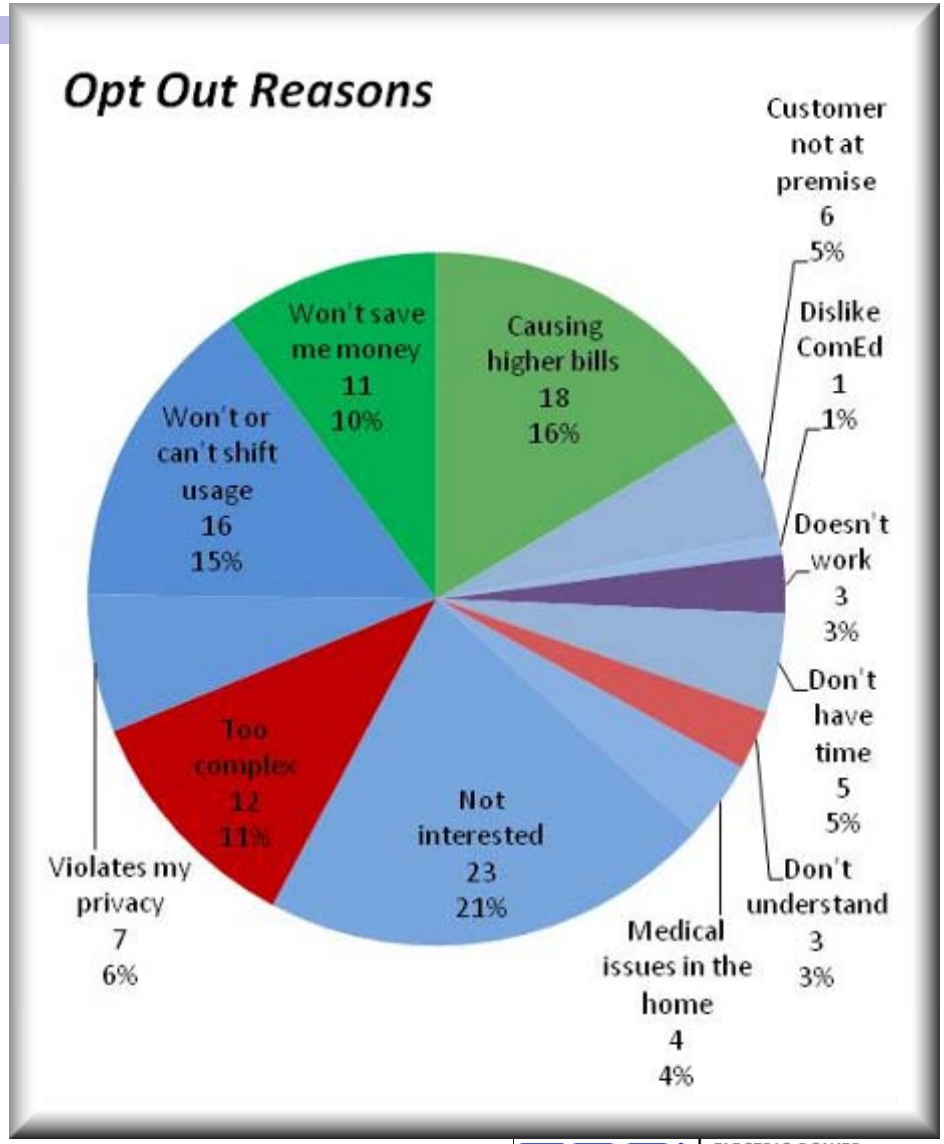
Note: These are preliminary results, further analysis is underway

About 8500 Customers

- Assigned a new electric rate
- Provided enabling technologies
- Given option to "Opt-Out"

Percentage of Customers Opting Out (so far)?

1. 2%
2. 17%
3. 41%



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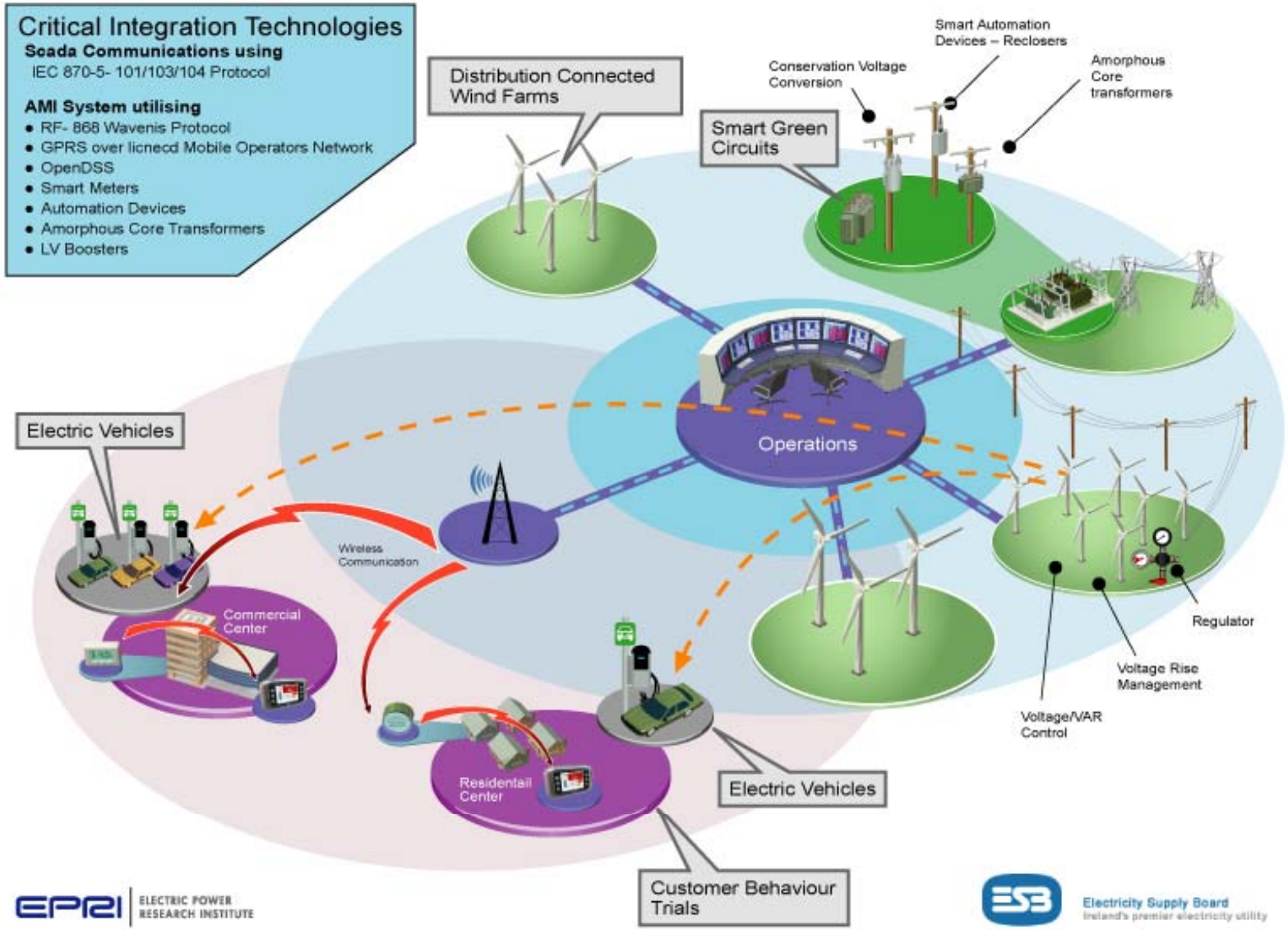
ESB Networks Demonstration Project



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ESB Electricity Supply Board
Ireland's premier electricity utility

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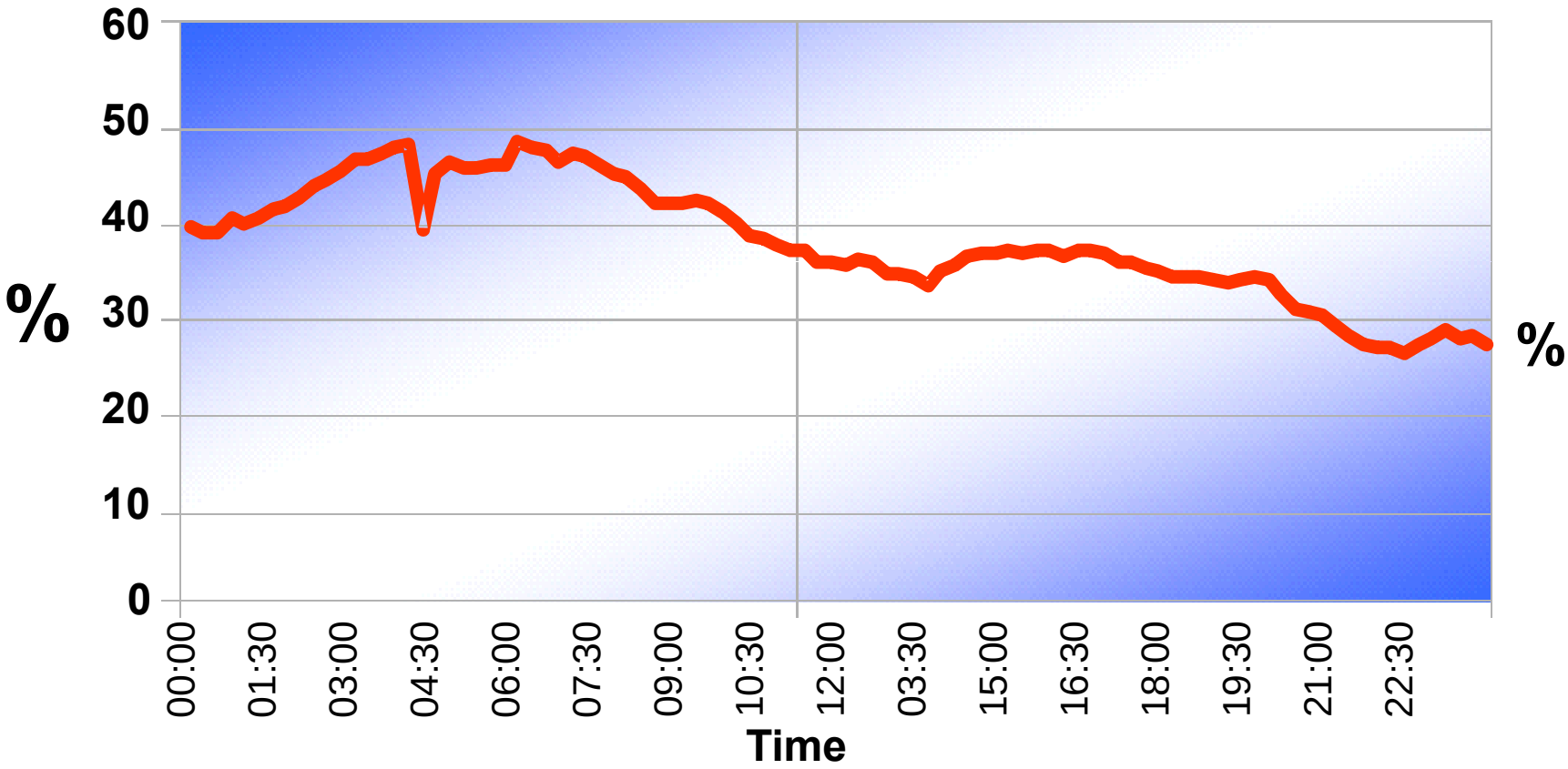
TUTE

Wind generation as % of system demand

Monday 5th April 2010



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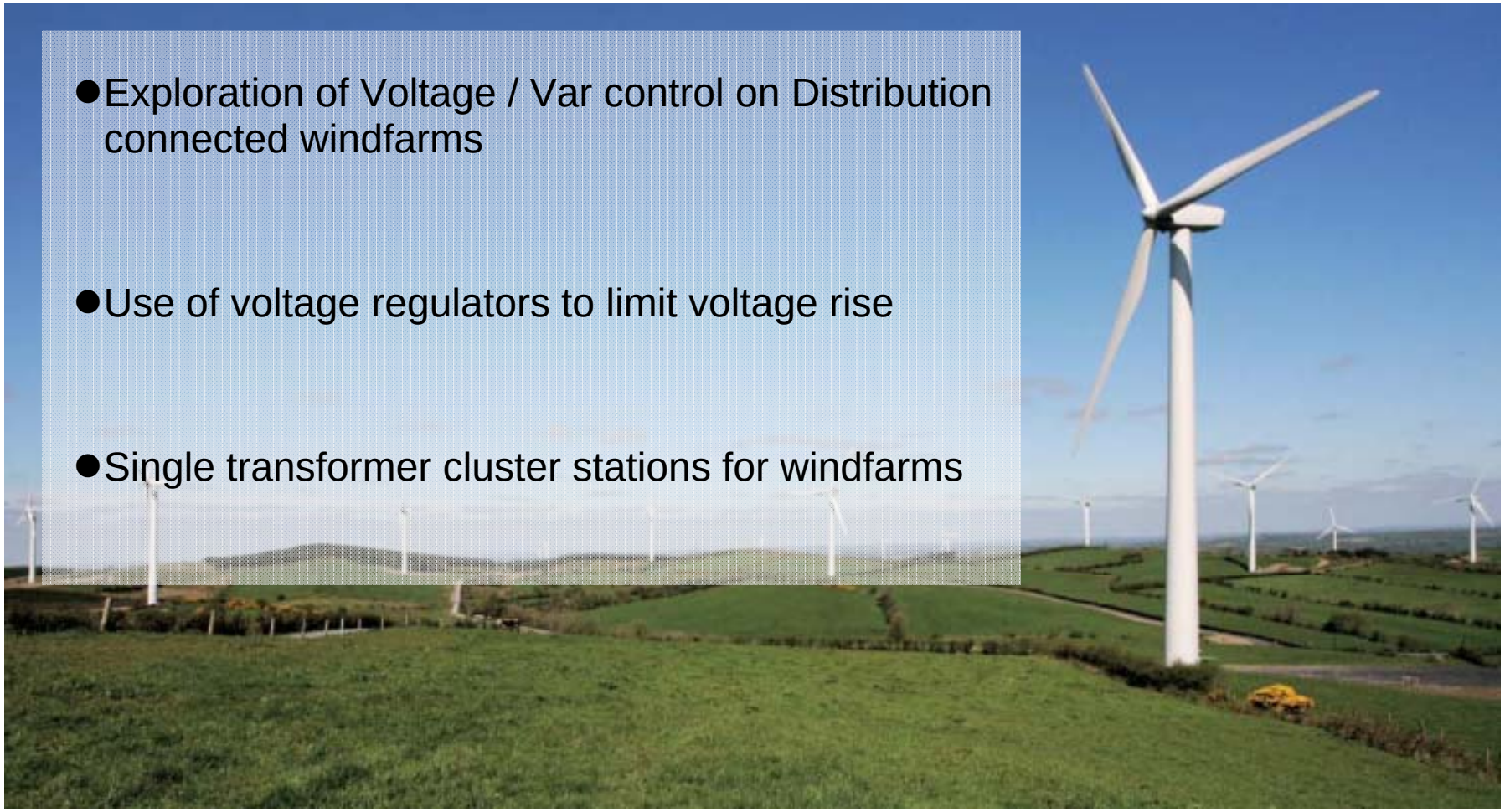
ESBN Wind Demonstration Project



- Exploration of Voltage / Var control on Distribution connected windfarms
- Use of voltage regulators to limit voltage rise
- Single transformer cluster stations for windfarms

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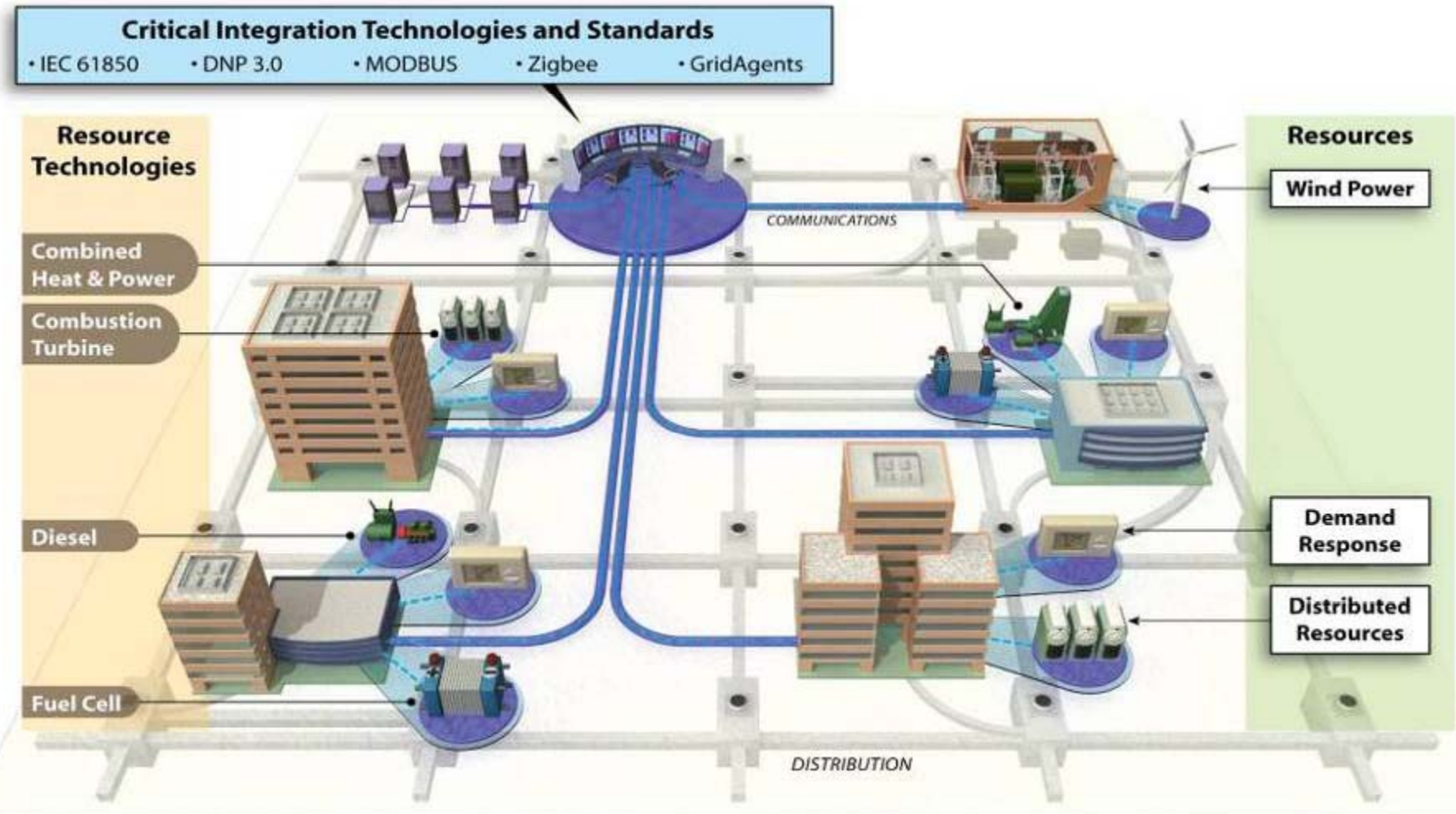
Con Edison Demonstration Project



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conEdison

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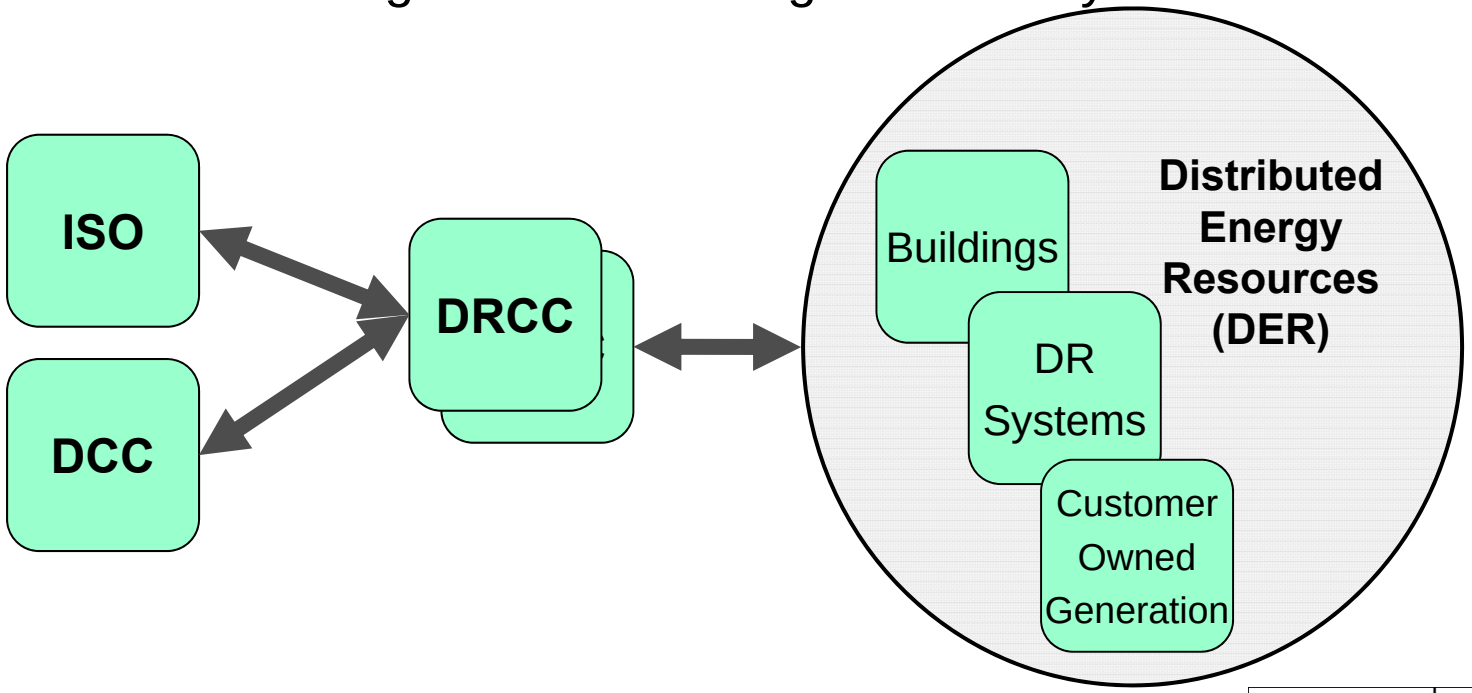
Consolidated Edison Company of New York

Distribution Control Center (DCC)

- Added visibility into customer domain
- Additional capabilities for distributed resources
- Early detection / prediction allows proactive response
- Enable treatment of DER as virtual generation
- Planned API integration with next generation systems



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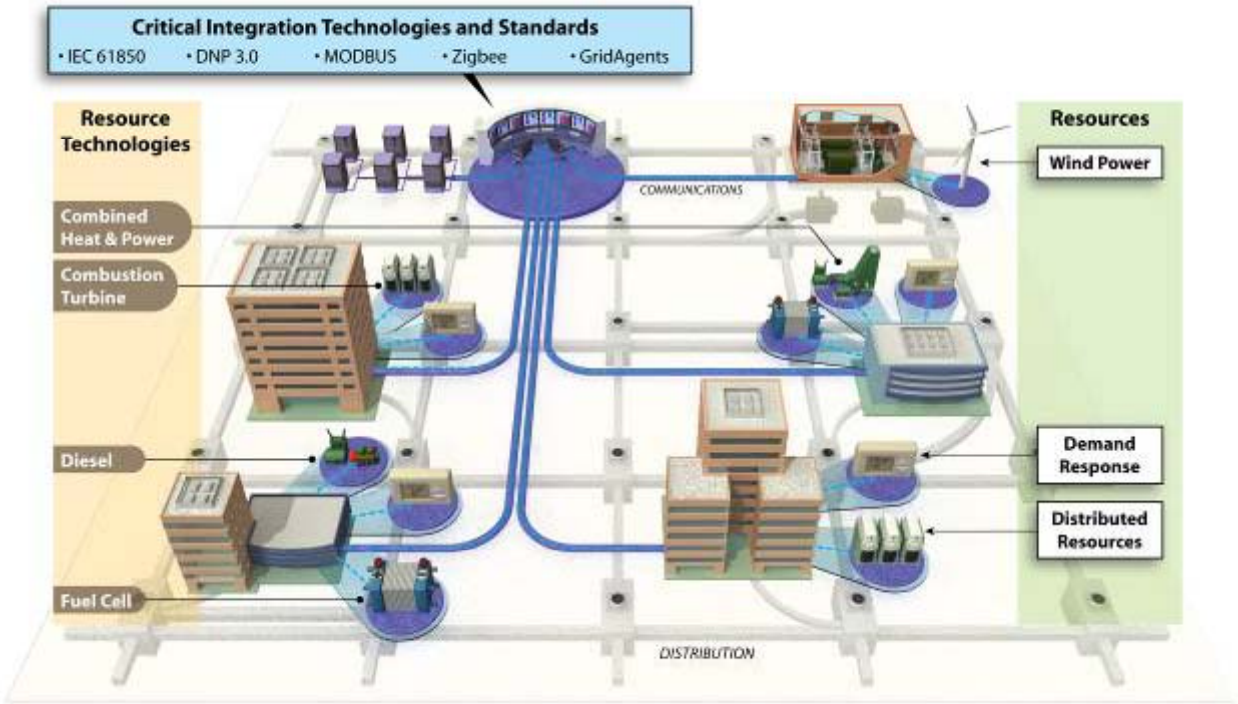
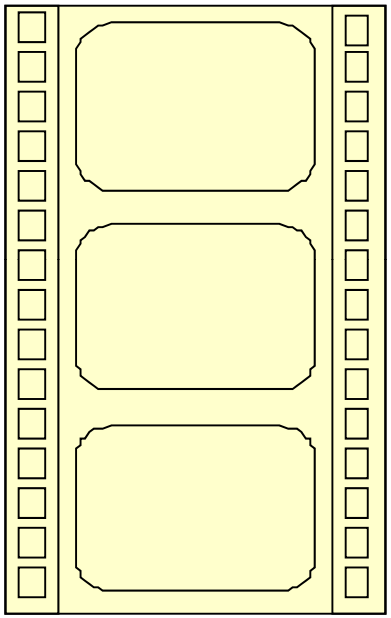
Con Edison Smart Grid Demonstration Project
Animation





EPRI You Tube Channel:

http://www.youtube.com/user/EPRIvideos

This Animation:

http://www.youtube.com/watch?v=uBdO7N88o98

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Questions

Together…Shaping the Future of Electricity

Thank You

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