Missouri Public Service Commission

Smart Grid Workshop 1
5-18-10

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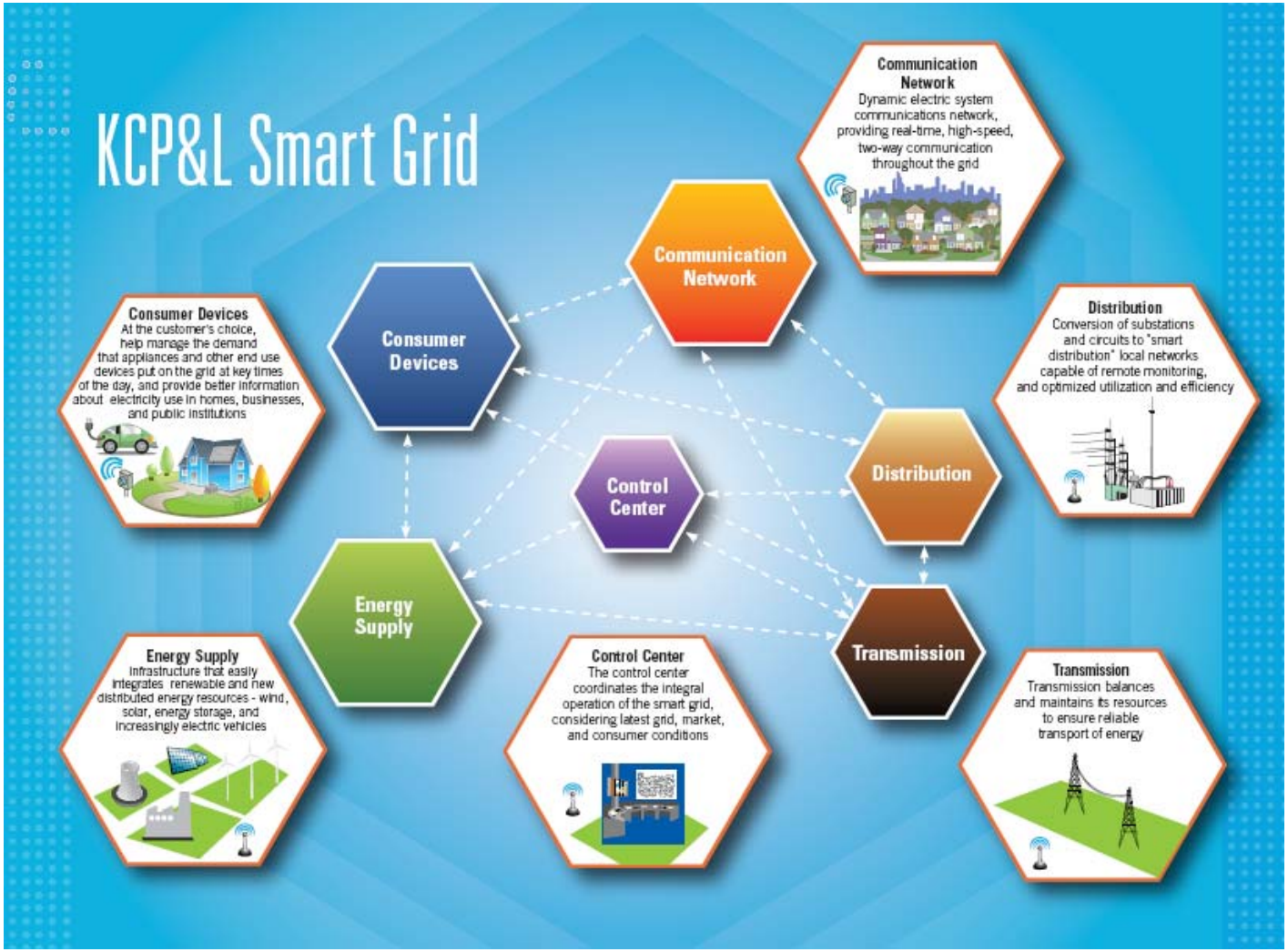
KCP&L Smart Grid Vision



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KCP&L Smart Grid Demonstration Project – Evaluating where and how Smart Grid can make a difference

KCP&L has been awarded ARRA Stimulus funding to conduct a Smart Grid demonstration project in the Kansas City, MO metro area. Total cost of the project was estimated at $48M with Federal matching funds for approximately $24M.

- **KCP&L Smart Grid Demonstration Project Highlights**
  - **Smart Distribution**
    - Smart Substation
    - Distribution Management System (DMS)
    - IP/RF 2-way Field Area Network (FAN)
    - "First Responder" DA Functions
  - **Smart Generation**
    - Residential/Commercial Rooftop Solar
    - Grid & Residential Battery Storage
    - DER Management System
    - DR Programs and Experimental Rates
  - **Smart End-Use**
    - Home Energy (Web) Portals
    - Residential & Commercial EMS Demonstration
    - In-Home Display with Interval Data
    - PHEV Charging
    - DR Programs and CPP Rates

Expected Benefits

Customer/Community

- Greater reliability
- Improve energy information
- Increase capabilities to control usage and minimize utility bills
- Greater environmental stewardship

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- Evaluate new business models
- Reduce costs
- Greater asset utilization
- Improve environmental impacts
- Increase customer satisfaction

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The KCP&L Smart Grid Demo Project - Today

- Where we are
  - Completing an approved Project Planning Phase
  - Working to finalize the project agreement with the DOE for the remainder of the project (hopefully sometime in June)
- What we believe
  - Smart Grid technologies and capabilities have significant potential to better engage and benefit our customers
  - The demonstration project will allow us to:
    - Test “readiness” of new Smart Grid technologies as well as what works and what doesn’t
    - Evaluate Smart Grid costs and benefits
    - Make informed, responsible decisions regarding the right Smart Grid path forward
- How we will operate
  - In partnership with the DOE and EPRI
  - Collaboratively with the Commission, OPC, and the MDNR

The KCP&L Smart Grid Demo is proud to be associated with and contribute to the broader KC Green Impact Zone effort

Green Impact Zone

- Socially and economically challenged 150-square block area (39th to 51st between Troost and Prospect).
- Comprehensive set of programs using grant funds and other resources for:
  - Economic development
  - Community policing & community service centers
  - Training and employment
  - Grant funds include
    - KCP&L Smart Grid Demonstration Project - $48M
    - Transportation Investments Generating Economic Recovery (TIGER) grant - $26M (of $50M total grant),
    - Energy Efficiency Conservation Block Grant (KC MO) — share of $20M
    - Brownfields Grant — $1M (Pending)
    - MDNR Innovative Weatherization Grant ($TBD)
  - Involves over 25 stakeholder groups including a dozen neighborhood groups, Congressman Cleaver, MARC, KCP&L, and UMKC

KCP&L Smart Grid Demo Project

- Primary DOE Objectives
  - Verify smart grid viability – technical, operational, and business-model
  - Use cases for national replication
  - Quantify costs and benefits
  - Rigorous DOE financial and reporting requirements
- Smart Consumption
  - AMI (14,000 meters)
  - Home Energy Portals (14K)
  - Energy Displays (1,600)
  - Smart Thermostats (1,600)
  - Home Area Networks (400)
  - Commercial EMS (2)
  - PHEV Charging Stations (10)
- Smart Distribution
  - Smart Substation (Midtown)
  - Distribution Automation
- Smart Generation
  - Rooftop Solar (5 - 10)
  - Utility-scale Battery Storage
  - Cyber Security & Interoperability

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The Smart Grid Demo will deliver and integrated set of system and solution capabilities

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PHEV/PEV Public Charging
V-EMS
GridPoint

18

Facility and Asset Management
GIS
Intergraph

13

Siemens - Intergraph

Customer Care & Billing
CIS
Oracle CIS+

1

8

24

Oracle
Outage Mgmt. System
OMS

7

Bulk Pwr. Grid & Market Operations
SPP-KCPL

20

Utility Managed Resources
DRMS
OATI

14

Demonstration Control Center
DMS
D-SCADA | DNA | OMS

10

Operational Meter Data Management
MDMS

tbd

2

28

15

b

9

a

12

6

3

Substation Controller
DCADA

21

EMS
SCADA
Siemens

Meter and Consumer Communication
AMI
L+G

ESI

16

17

Consumer Managed Resources
H-EMP
GridPoint

23

26

PHEV

27

Solar

Batteries

Consumer Managed Resources

25

4

11

5

Win

Solar

Batteries

Utility Managed DER

Recloser

Switch

Capacitr Bank

Field & Sub Equipment

Industrial

Commercial

Residential

Intelligent Meters

22

KCP&L will partner with leading players in the Smart Grid space

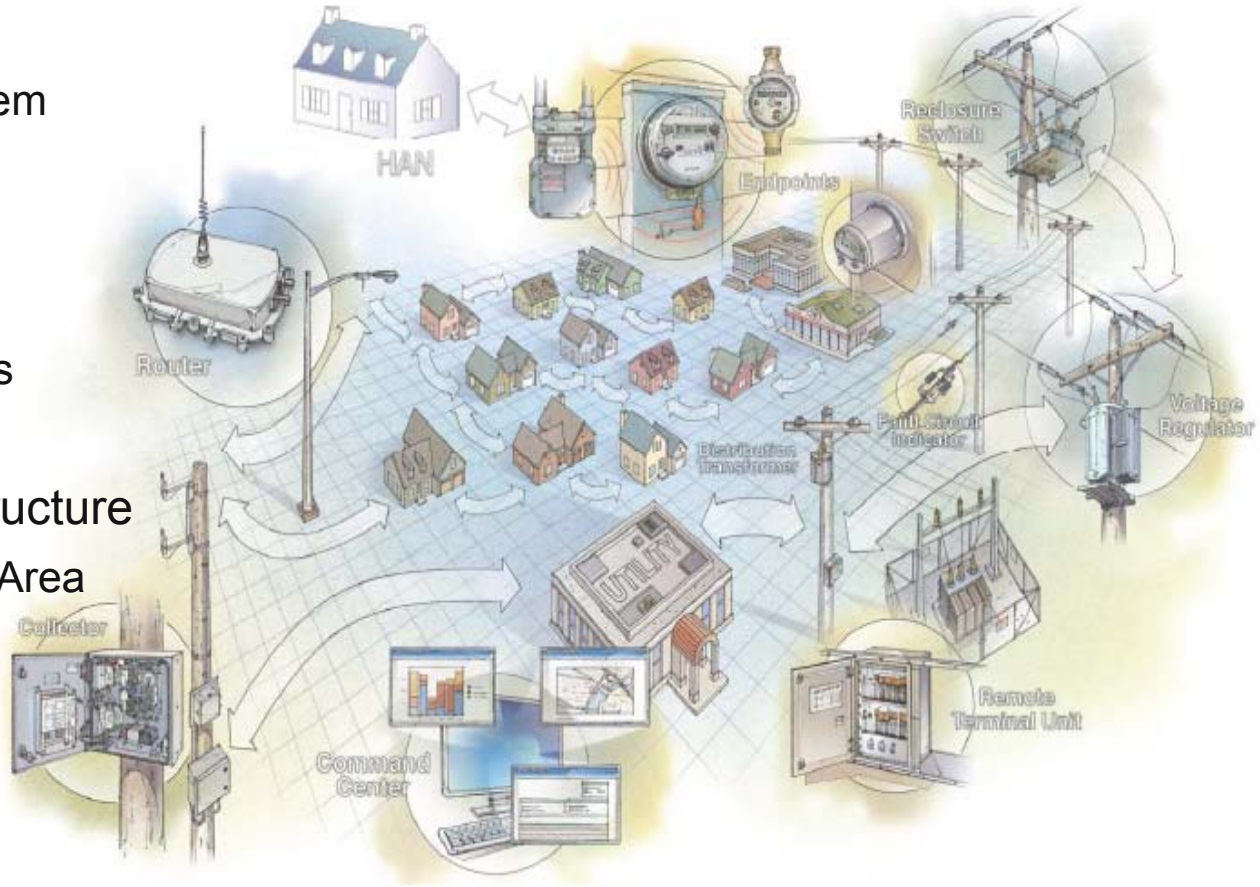
Components	Partner
Automated Metering Infrastructure	**Landis+Gyr**
AMI & DA Field Area Network (FAN)	
AMI Meters	
Meter Data Management (MDM)	**Siemens**
Distribution Management System (DMS)	
Smart Sub-Station	
Residential & Commercial EMS Portals	**GridPoint**
Home Area Network & Automation	
PHEV Charge Management	
Distributed Energy Resource Mgt.	**OATI**
Grid-Scale Battery	**Kokam America (Exergonix)**
Home Automation Devices	tbd
Solar	tbd

Smart Grid Demonstration Project Phases

Phase 1	**Project Definition and Compliance (2010)** ▪Ensure project definition, scope and objectives, and implementation methodology are aligned with the Department of Energy objectives ▪Install advanced communication infrastructure, smart metering and measurement devices in the demonstration area ▪Begin public outreach and education plan ▪Increase awareness and adoption of KCP&L's portfolio of energy-efficiency programs
Phase 2	**Project Performance Baseline (2010-2011)** ▪Detail technology requirements and system design ▪Compile historical consumer usage data to create baseline ▪Develop Smart End-Use program models that allow customers access to data
Phase 3	**Smart Grid Infrastructure Deployment (2011-2012)** ▪Upgrade Smart Substation technology (substation network, control and distribution system and electronic relays) ▪Upgrade Smart Distribution grid automation to proactively manage energy flow and communications with substation ▪Implement Distribution Management System to allow grid managers to monitor system and make decisions
Phase 4	**Distributed Energy Resource Deployment (2011-2012)** ▪Implement Smart End-Use technology (in-home displays, demand-response thermostats, home energy portal) ▪Implement Smart Generation technologies (roof-top solar, grid-connected battery and plug-in electric vehicle charging) ▪Implement Distributed Resource Management System to optimize and manage power system ▪Implement pilot pricing structures to allow customers to better manage usage
Phase 5	**Data Collection, Reporting & Project Conclusion (2012-2014)** ▪Evaluate operation of integrated demonstration systems ▪Collect performance and end-use consumption data ▪Analyze grid efficiency and performance improvements ▪Evaluate new enterprise business models

AMR/AMI Programs

- Automated Meter Reading
  - First Production AMR System
  - 1-way communication
  - Began Deployment 1995
  - Daily Reads
  - 500,000 KCPL AMR meters
- Smart Grid Network Infrastructure
  - Smart Grid Demonstration Area
  - 2-way communications
  - 14,000 Smart Meters
  - Single Field Network for AMI, DA, DR, HAN



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Goal: The right capabilities + the right information = active customer energy management participation

Provided by GridPoint

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Google PowerMeter

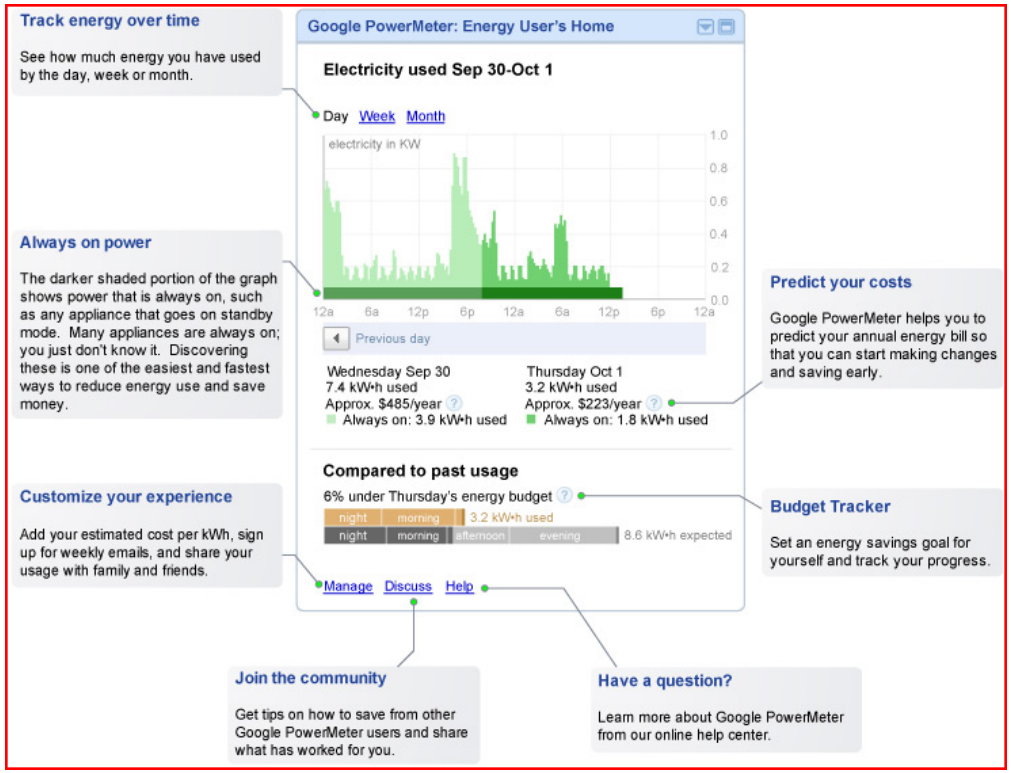
- Several Internet Browser Collaborations Underway
  - Google PowerMeter
  - Microsoft Hohm

- New Platforms will continue to emerge

Google PowerMeter

What is Google PowerMeter?

- Google PowerMeter is a free energy monitoring tool that helps you save energy and money. Using energy information provided by utility smart meters and energy monitoring devices, Google PowerMeter enables you to view your home's energy consumption from anywhere online.



Source: Google - http://www.google.com/powermeter/about/about.html

- Google PowerMeter is one of several online energy monitoring tools
- Access to timely usage information can help customers manage and reduce their energy usage
- Concerns – data security and privacy
- Similar Capability will be provided in Demo Proj. with Residential EMS Portal

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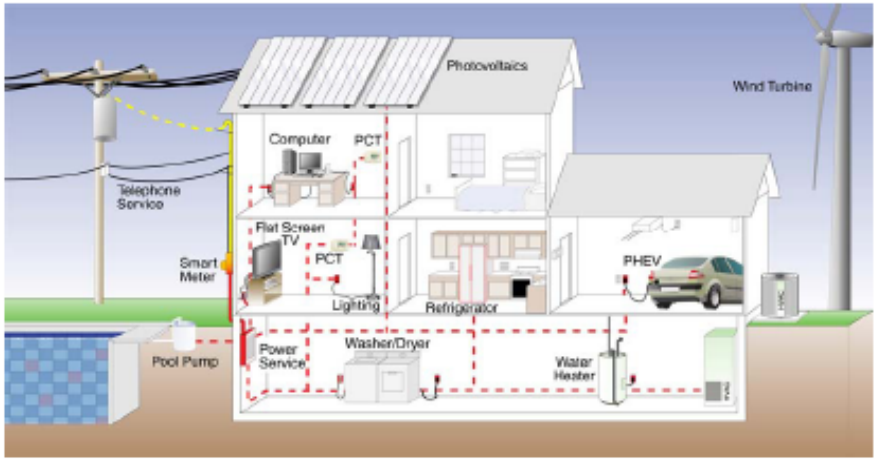
Sample Home Energy System Screen View – KCP&L

Sample Home Energy System Screen View – KCP&L

Smart Appliances – Many Challenges to Overcome

- Appliance Life vs Technology Life
  - EPRI leading a “universal plug” standard to isolate communication media from appliance
- Consumer Friendly & Ease of Use
  - Avoid the VCR clock headache
  - Must be “Set it and Forget it”
- Savings Require Price Incentives
  - TOU or real time rates and/or critical peak pricing
  - DR incentives
- Utility or 3rd Party Control

Smart Energy Application Profile 2.0



Source: EPRI

- Universal Language is Key to Large Scale Penetration
  - NIST and it’s Interoperability Framework is accelerating the Standards process
  - Smart Energy Profile appears to be leader (adopted by ZigBee, HomePlug, & WiFi Alliance)

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Smart Appliances – Interoperability will be key to development and adoption

A textbook example of a ubiquitous and successful standard

"Utility" side

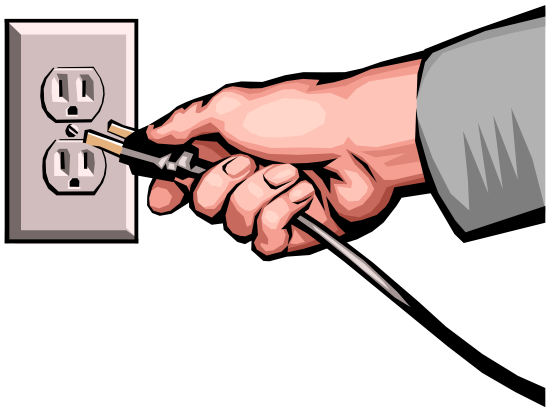
Common Physical Interface, backward compatible

Alternating Current: 60 Hertz Sine

110 Volts +/-

Occasional outage

Occasional PQ Event, sometimes harmonics



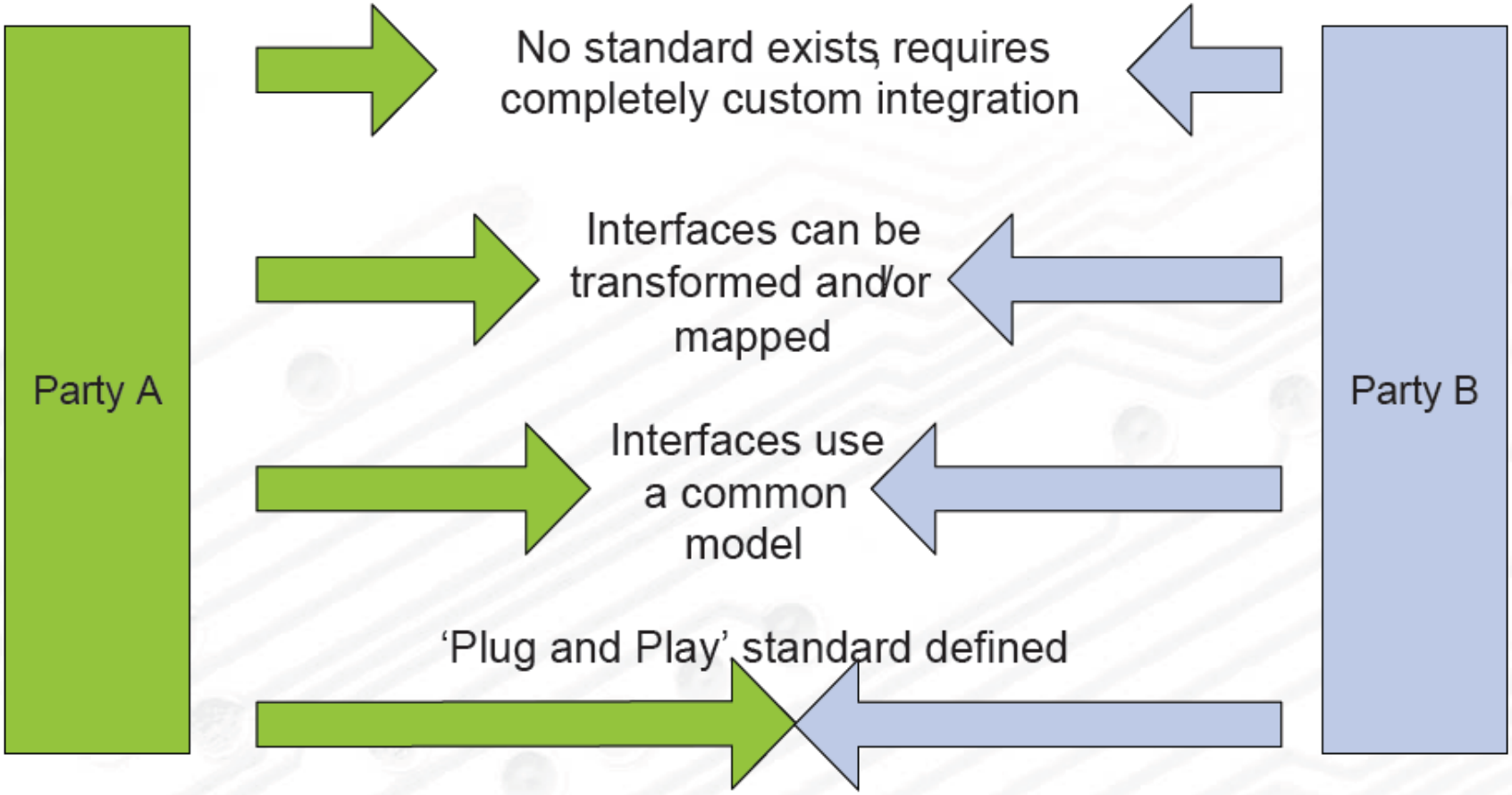
"Customer" side

"interoperates" with billions of devices in North America

Thousands of manufacturers have adopted it…

Stable design, not overly constraining

Smart Appliances – Interoperability - Distance and Cost to Integrate



Credit: Scott Neumann, UISol position paper

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Smart Appliances – Interoperability – A Long Road to Success

Standardizing Key Points as opposed to...

4 =

Look at the diversity of USB drives and the combinations of functions - colors, forms, caps, part of keychain, switchblade.

…several end to end solutions

7 ≠

Current computer with a 7 card adapter to support a single memory devices. Invariably, the first time you needed to use it for getting pictures from your camera or a friends camera you'll find it isn't compatible

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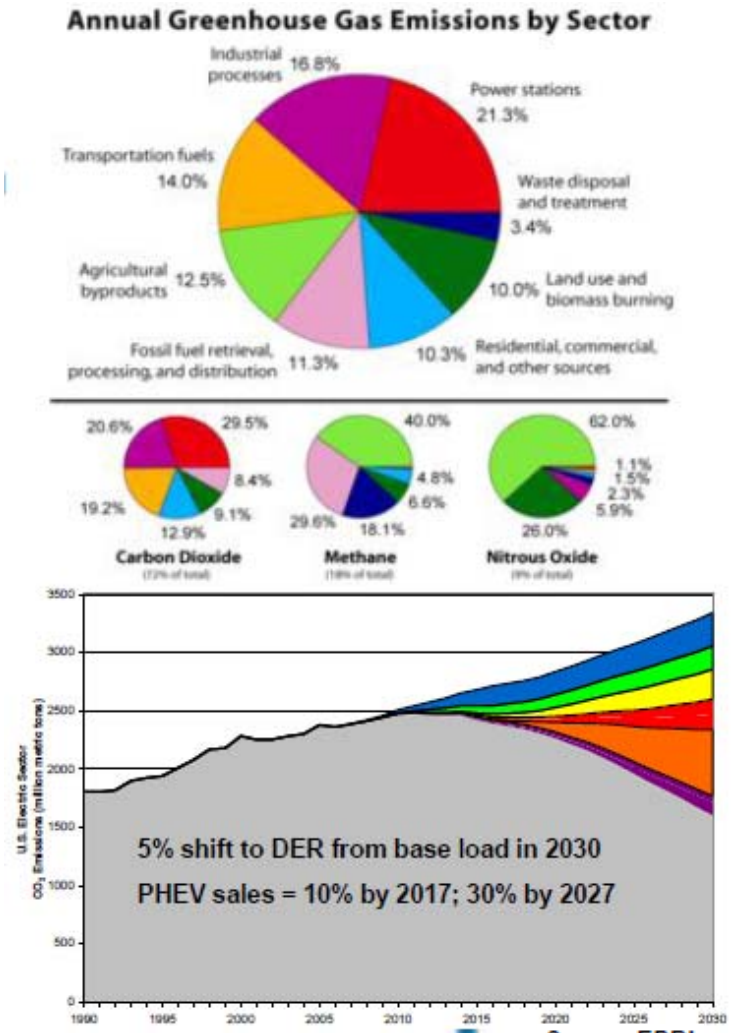
Plug-in Hybrid Electric Vehicle

- Addresses
  - CO2 emission abatement
    - transportation sector
    - utility sector
  - Utility resource adequacy
    - Vehicle-to-grid (V2G)
- Initiatives
  - MARC Clean-Cities PHEV
  - 10 charging stations via DOE grants
- Issues
  - Non-housed PEV charging infrastructure
  - Public charging business model
  - G2V and V2G tariffs



Source EPRI

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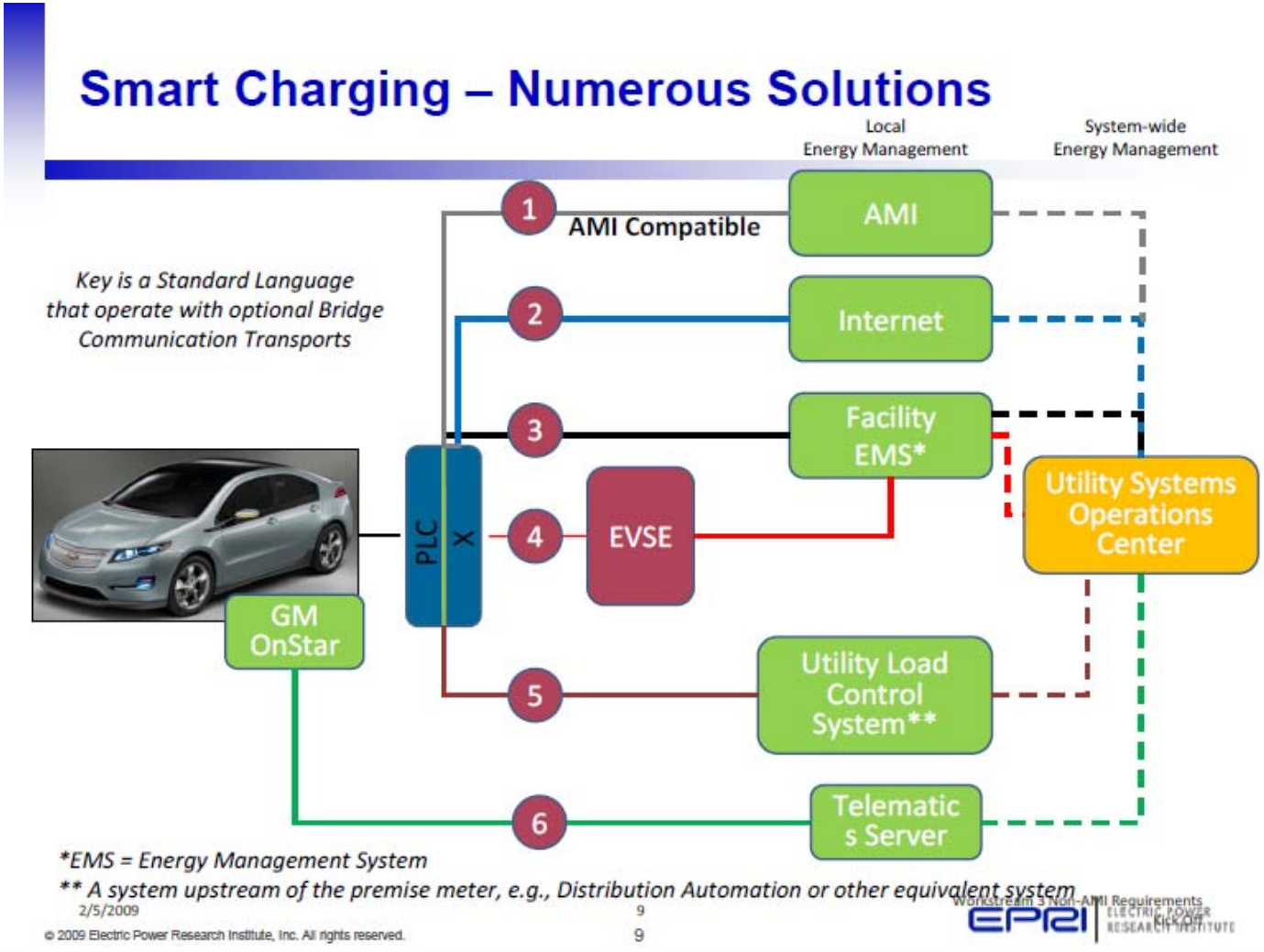
Plug-in Hybrid Electric Vehicle – Smart Charging



Extent and role of voltage regulation technology and equipment

- Capacitor Automation
  - Began in legacy KCP&L in 1992
  - Over 1200 units on legacy KCP&L system
  - Installed 70 units in St. Joe area in 2009
  - Reduces losses and O&M costs
  - Plans to install over 100 in legacy Aquila 2010/2011
- Dynamic Voltage Control (DVC)
  - Began in legacy KCP&L in 2006
  - 203 substation buses currently have DVC
  - Capacitor Automation works in concert with DVC
  - Managed voltage reduction brings about load reduction
- Smart Grid
  - Integrates this technology into the Smart Substation
  - Monitor and manage voltage levels at the substation bus, feeder and customer service points

KCP&L – Working with an evolving community

Next Steps:

- DOE
- KC
- VENDORS

QUESTIONS ?

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