



Distribution System Research Priorities

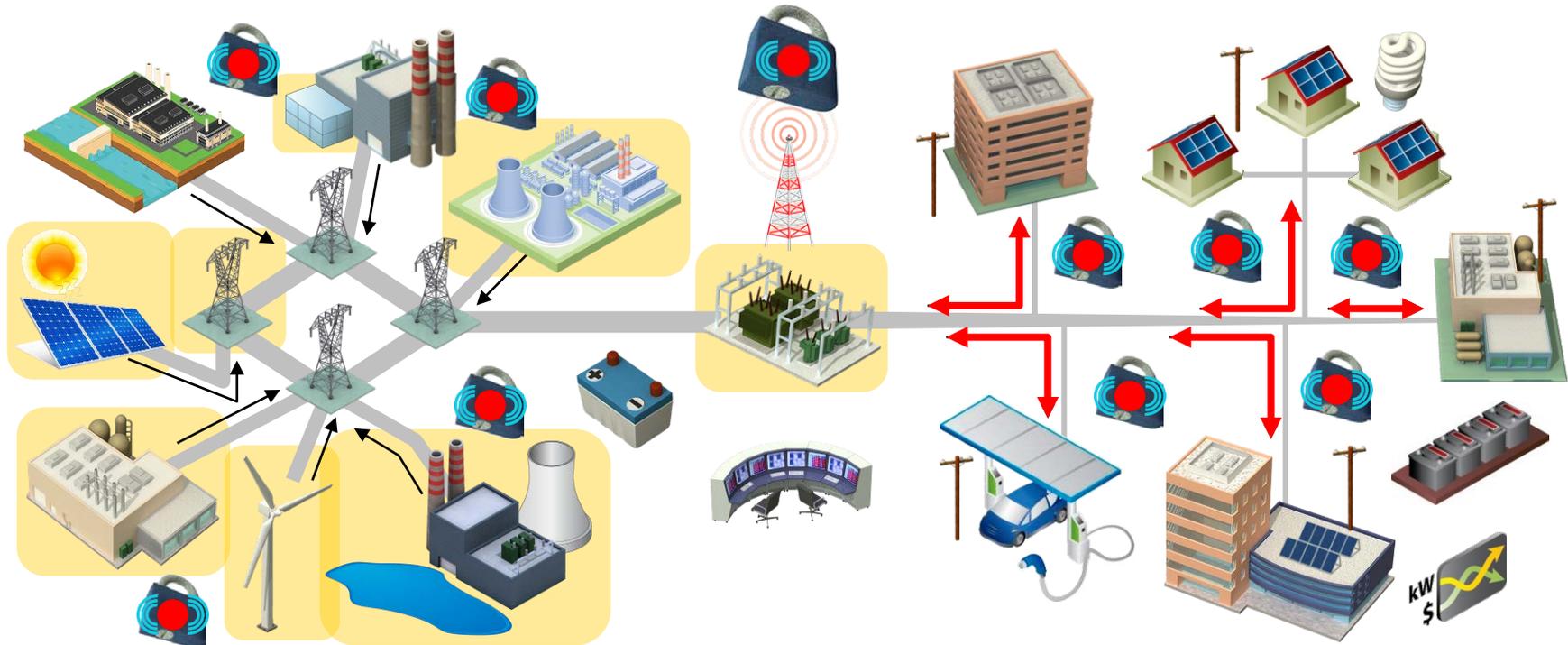
Mark McGranaghan
EPRI

ELECTRICITY DISTRIBUTION SYSTEM WORKSHOP

Crystal City, VA

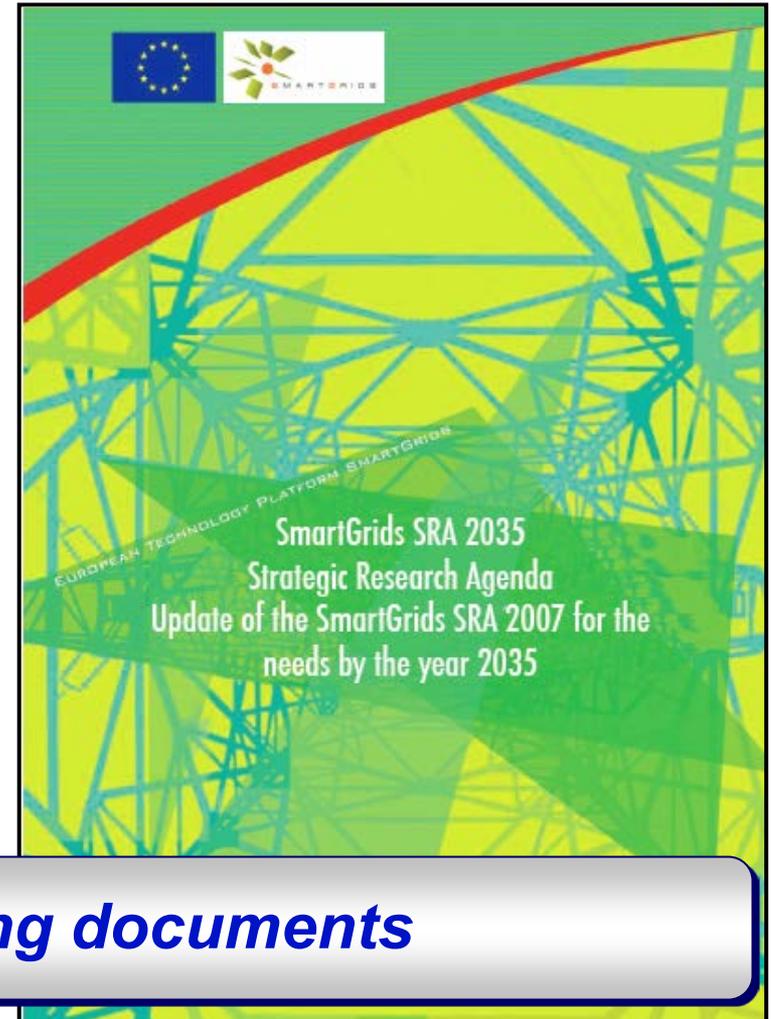
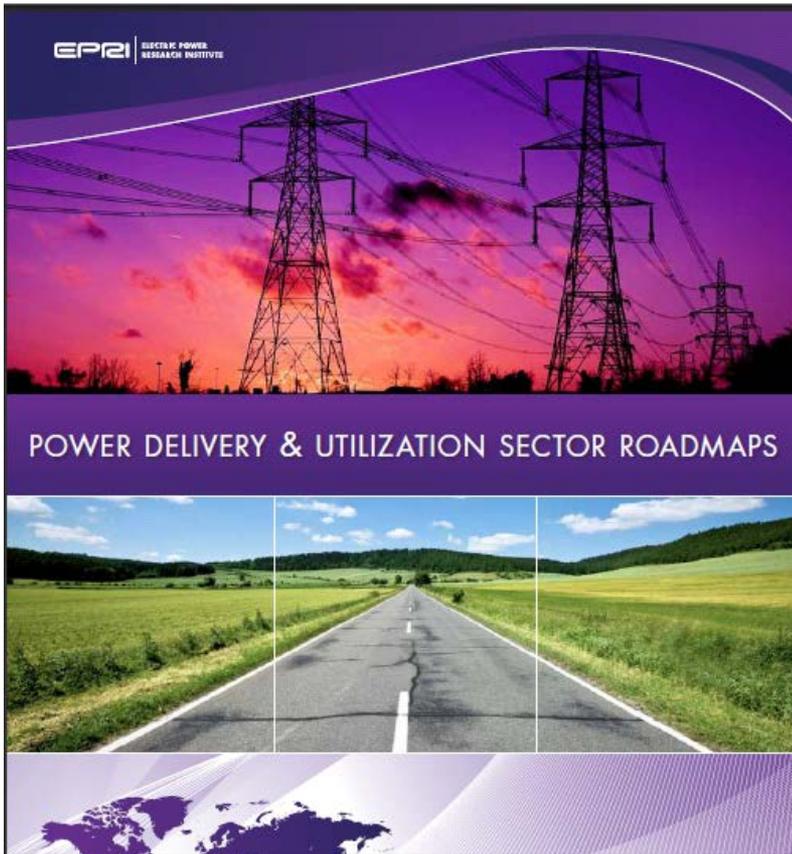
September 24, 2012

Roadmaps start with a Vision



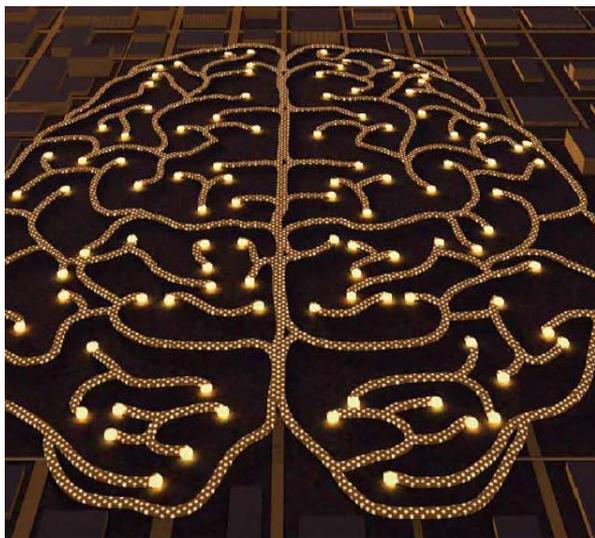
**Future Power System will require new technologies,
infrastructure, and control systems**

R&D Roadmaps – Coordination is Critical



Roadmaps are living documents

Developing the next generation grid



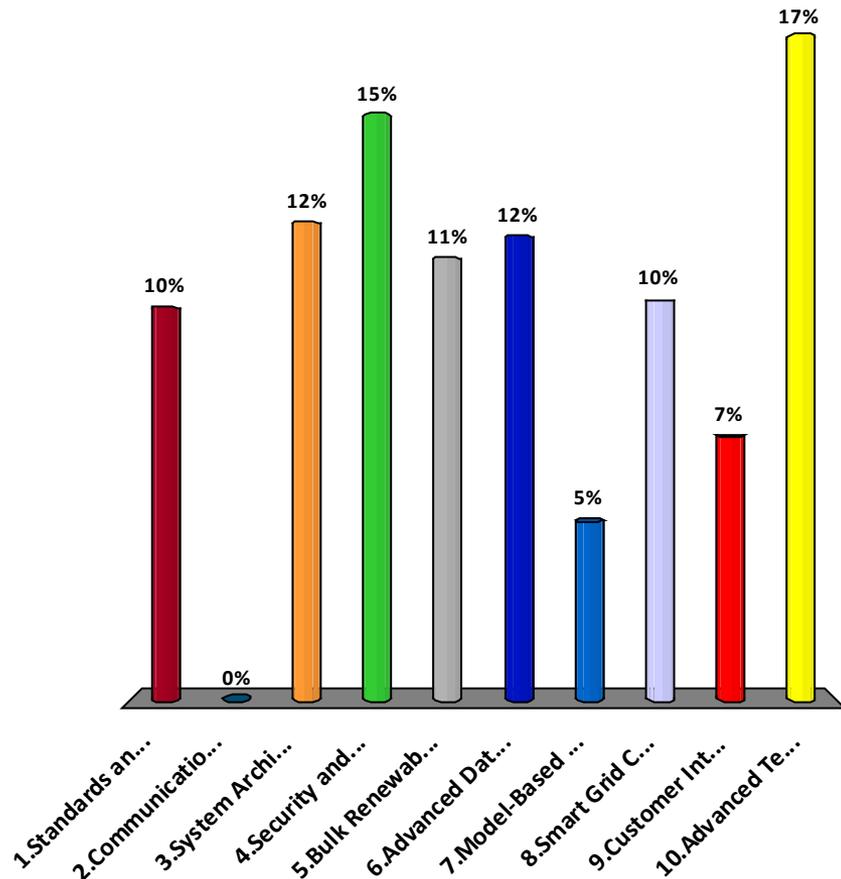
- Industry needs new technologies, communication protocols, and information management methods
 - More variable generation sources and controllable loads
 - Aging infrastructure
- Functional requirements, interoperability, and cyber security standards still evolving
- Holistic view needed:
 - Transmission
 - Distribution
 - End-use

Smart Grid – Top R&D Challenges

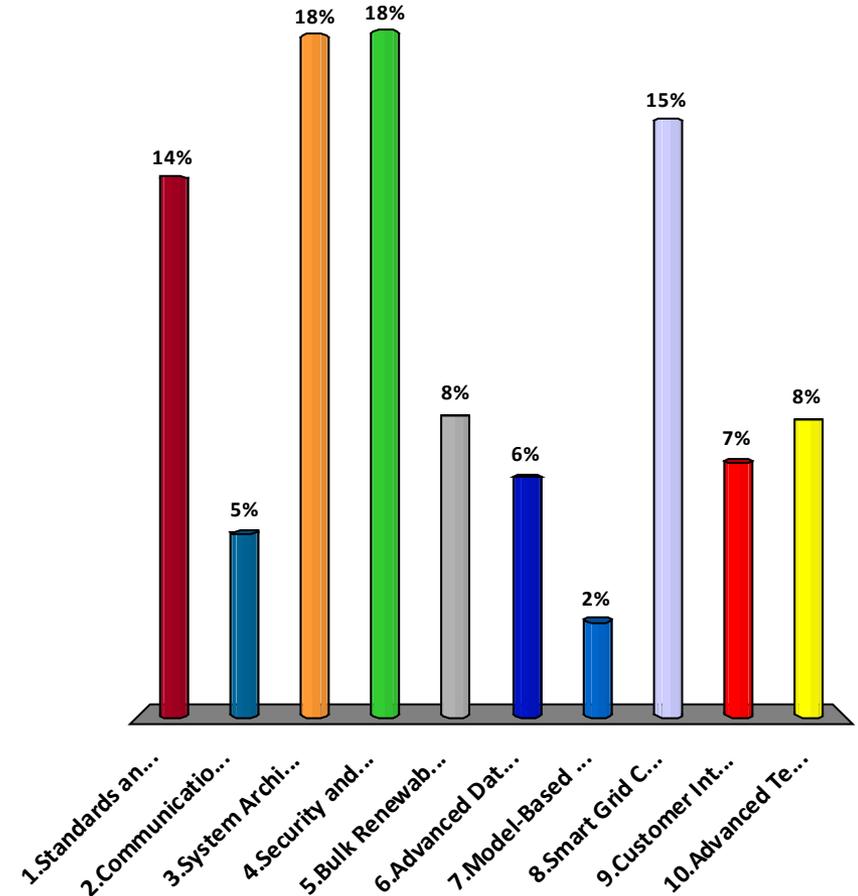
1. Standards and Interoperability
2. Communications Technology
3. System Architecture, Integration and Next Generation Energy Management Systems
4. Security and Privacy
5. Bulk Renewable Generation and Distributed Energy Resource Integration
6. Advanced Data Management, Analysis and Visualization (Including Wide Area)
7. Model-Based Management and Planning of the Grid
8. Smart Grid Cost Benefit Analysis
9. Customer Integration Strategies including Behavior, Communications and Automation
10. Advanced Technology Development and Assessments including Power Electronics, Energy Storage and Sensors

Smart Grid: Please identify the top three technical challenges?

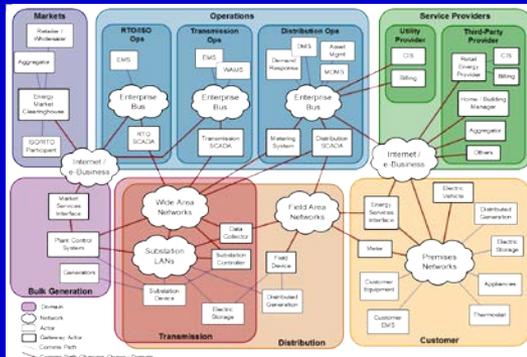
Board Results – Fall 2011



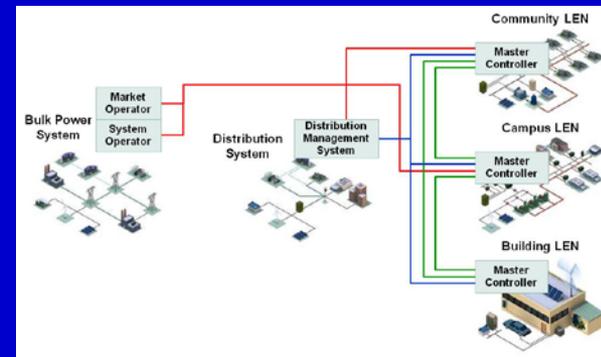
RAC Results – Fall 2011



Key Challenges for Discussion



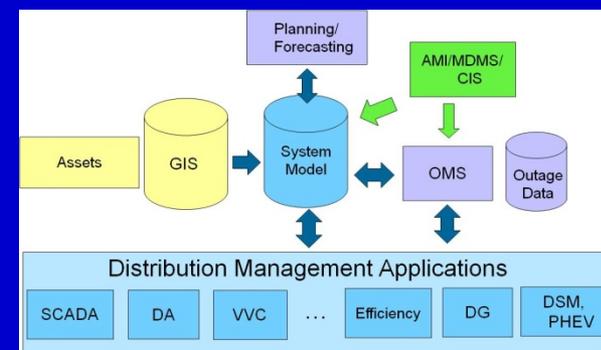
Architecture and Interoperability



Distributed Controls Integration



Monitoring, Sensors, and Data



Model Based Management

Challenges and R&D Needs Cut Across All Levels of the Grid

The Challenge of Integrating Renewables – Flexibility



Smart Appliances



Distributed Energy Storage



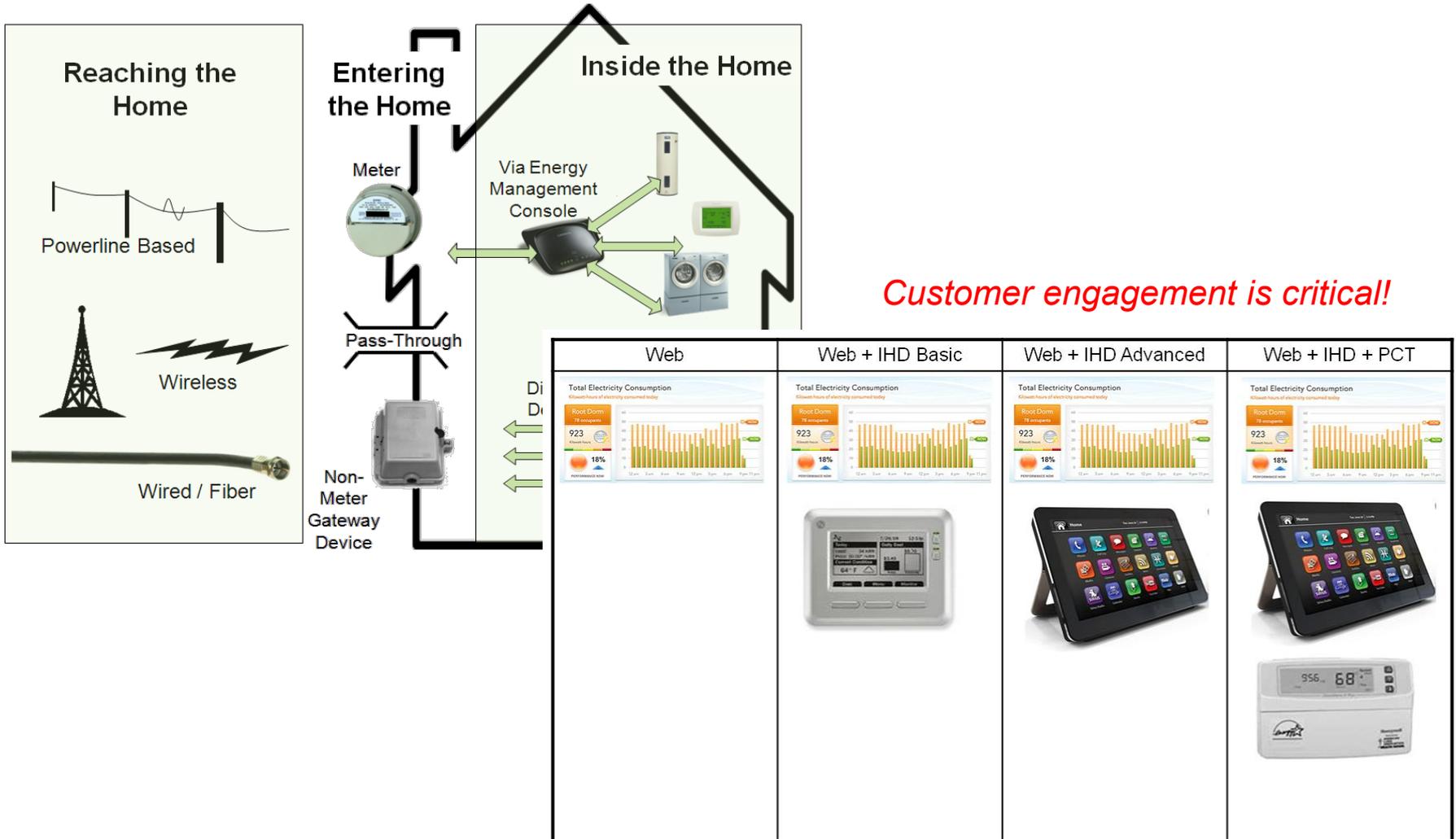
Renewable Generation



Electric Vehicles

DMS and EMS Integration

Integrating the Customer – Opportunity and Challenge



The Imperative for Grid Modernization

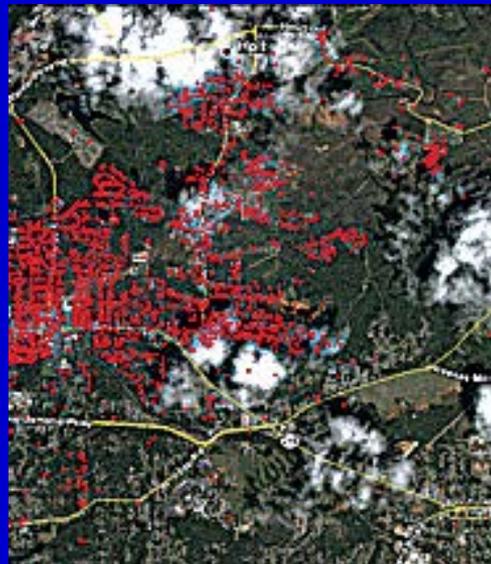


Reliability Assurance with an Aging Infrastructure

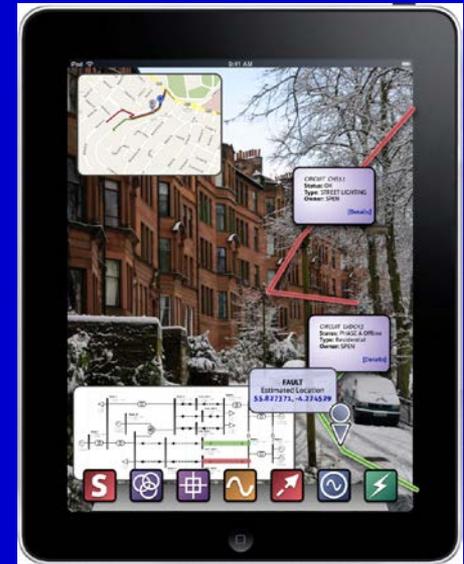
Next Generation Technologies – Improving Grid Resiliency



Using UAVs for
damage assessment



Integrating OMS and
GIS with AMI systems



Enabling the
field workforce

**Leverage Damage Assessment Technology with Integrated Operational
and Asset Information for Improved Response**

Survivability – Also Opportunities on the Customer Side

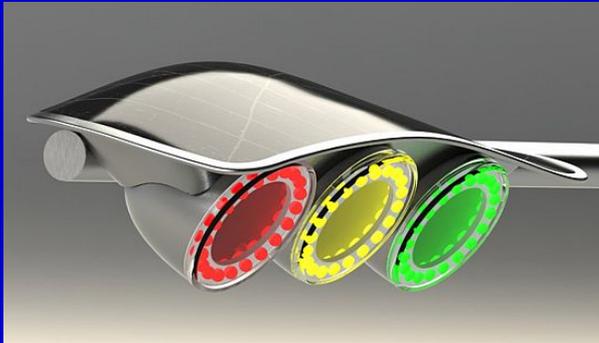
EV
Power
Source



Courtesy: Nissan



Micro Grid



PV+Storage+LED Traffic Lights

Solar
Chargers
for Cell
Phones



Continuation of Essential Missions even after the Grid has Failed

Courtesy: Carnegie Mellon Electricity Industry Center (CEIC).

Coordinating R&D with Demonstrations and Deployments

Communications and IT

Communication Infrastructure

Information Systems Integration

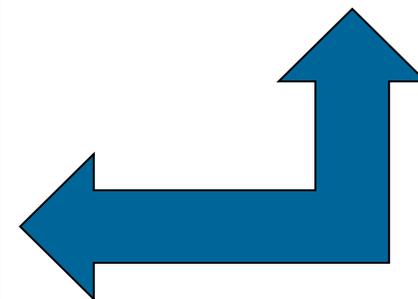
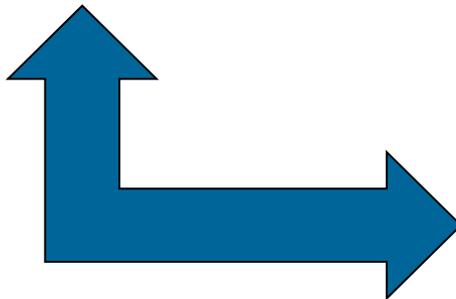
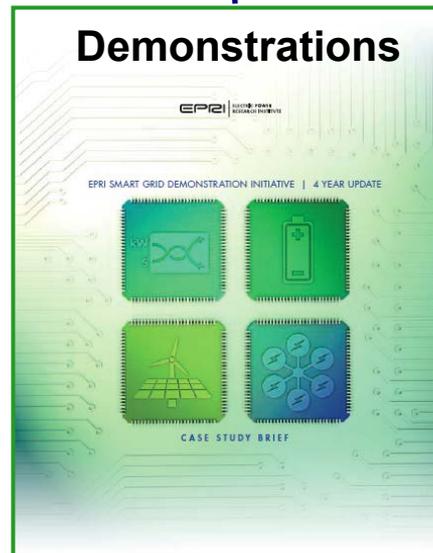
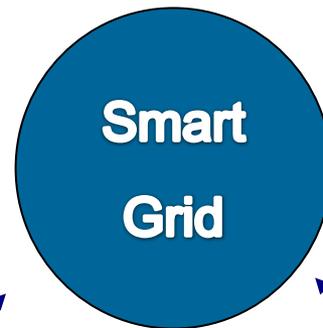
Security

Applications and Technology

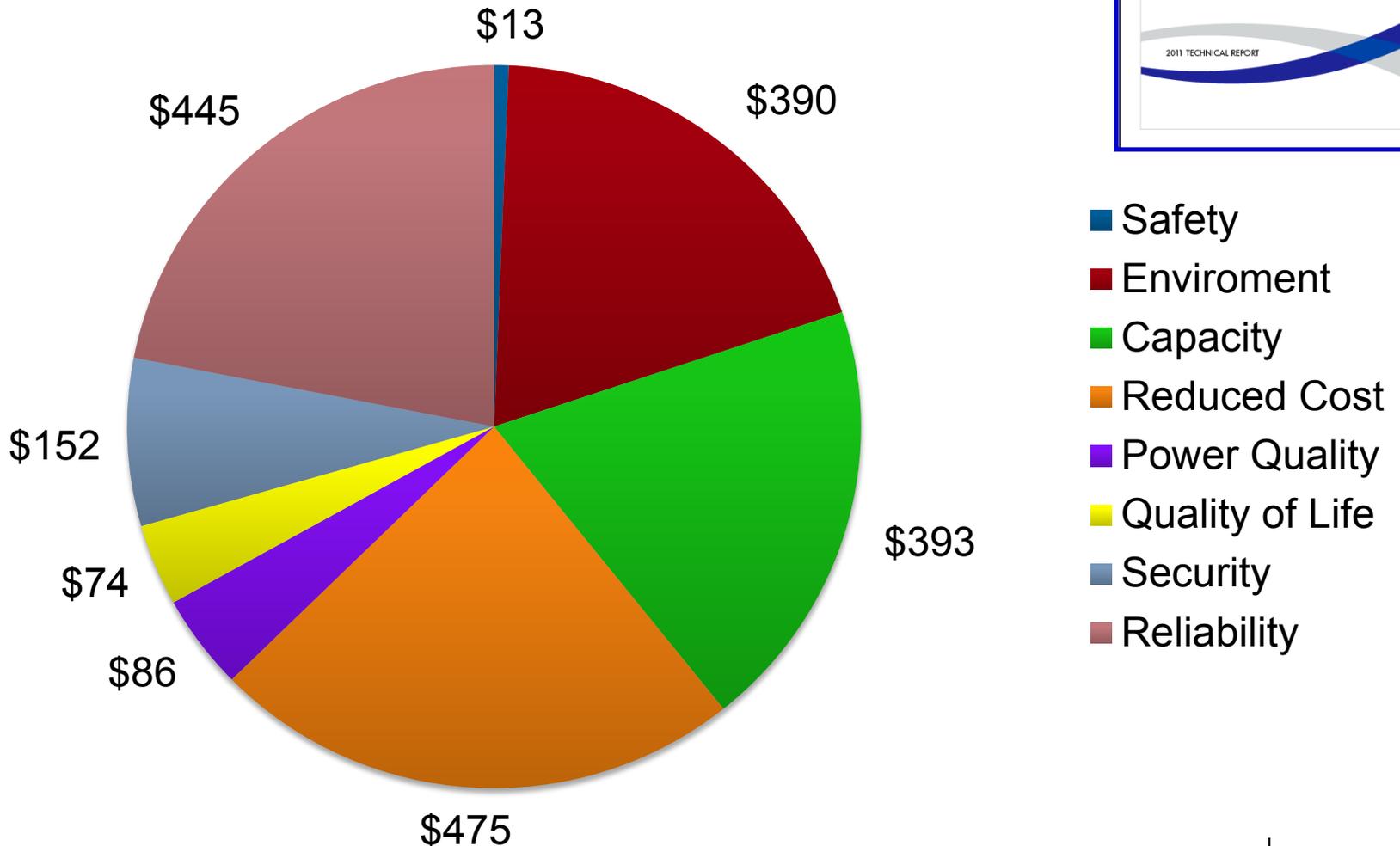
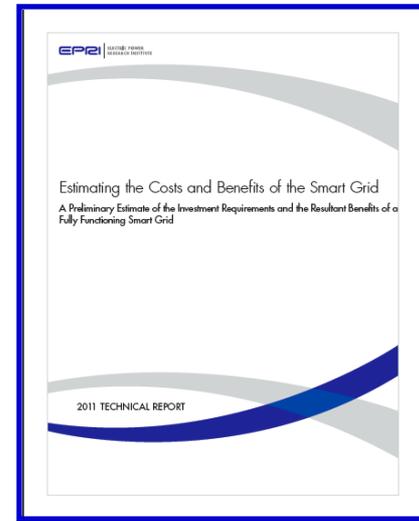
Technology Assessments

New Technologies

New Applications and Systems



Cost/Benefit Assessment - Justifying the Investment



Together...Shaping the Future of Electricity