



#### Digital Grid Symposium Smart Grid Research at EPRI

Mark McGranaghan Vice President, Power Delivery and Utilization 06 September 2013

#### **Electric Power Research Institute**

#### **Objective and Independent Research**

- Renewable, Nuclear and Fossil Generation
- Transmission and Distribution
- Energy Efficiency and Utilization
- Environmental Studies



500 EPRI engineers and scientists working with 1,400 electric utility industry experts across 30 countries to *Shape the Future of Electricity* 



# **The Challenge**



#### **Environmentally Responsible**



#### **EPRI Power Delivery and Utilization Research Areas**



Transmission



Distribution



End Use



Information and Communications



Strong Collaborative: ~100 members ~\$96M Annual R&D Funding Resources (Laboratories, Technical Staff) as Extensions of our Member's Staff





#### **PDU Strategies**

#### Collaboration

### **Industry Participation** and Coordination

# **International Cooperation**









# **Roadmap starts with a Vision**



Power System that is Highly Flexible, Resilient and Connected and Optimizes Energy Resources



# Examples of Important Challenges for the Smart Grid



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

#### Challenge – Integrating Generation, Storage, and Demand Response







#### **Distributed Generation Commercial Applications**



Fuel Cell installed at Whole Foods in Fairfield, CT Source: Whole Foods

- Lower gas prices has made distributed generation attractive in commercial installations
- Low LCOE at present day prices, even without CHP

#### LCOE for DG in Commercial Applications





#### **Distributed Generation Residential Applications**





- DG is less convincing in residential applications
- But DG may be attractive in the long run, especially through market programs (CHP programs in PJM) and state policy (SGIP in California)



#### **Grid Resiliency is becoming the new driver**





#### **Utility Challenge – Integration**





#### **Coordinating R&D with Demonstrations and Deployments**



### EPRI Smart Grid Demonstrations – Integrating Distributed Resources

- 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





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#### **Five Year Update**

- Economics of the Smart Grid
- Case Studies
- Progress on Standards
- Integrating the Customer
- 23 Members from around the world
- 15 Large Scale Demonstrations





#### **Industry Coordination**

- Use Case and Information Repository
- Cost Benefit Analysis
   Methodology & Framework
- Smart Grid Interoperability Standards







National Institute of Standards and Technology





#### **Role of the Digital Grid Router**

- Integrate distributed generation
- Energy storage
- Critical loads/resiliency
- Voltage Control
- Electric charging
- Demand response





#### www.smartgrid.epri.com



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, and reduce costs and improve efficiency.

#### Newsletters

Smart Grid Advisory Update November 2011 (20, 120, MB) August 2011 (20, 680, KB) IntelliGrid Advisory Update September 2011 (20, 680, KB) June 2011 (20, 163, KB) View All Newsletters

# Smart Grid in the News Recent Archive EPRI Developing Electric Industry Applications February 02, 2012 EPRI to develop transmission line insulator inspection robot - February 02, 2012 If Power Lines Fall, Why Don't They Go Underground? - February 01, 2012 Subscribe to "Smart Grid in the News"

#### Upcoming Events

Modular Communication Interface – Interoperability Workshop ₪ Nov 28 - Nov 30, 2011 Groveport, Ohio

Open ADR Kick-Off Meeting Apr 3-4, 2012 Knoxville, Tennessee

Smart Grid Demonstration Advisory Meeting Mar 6-8, 2012 Houston, Texas

EPR

ELECTRIC POWER RESEARCH INSTITUTE

#### Next Big Demonstration Initiative – Advanced Applications for Data Analytics



Source: EPRI and CMU

# Our Challenge – A Power System That Is . . .



#### **Environmentally Responsible**





# Flexible

#### Resilient



### Connected

#### ... and Optimizes Energy Resources



#### **Together...Shaping the Future of Electricity**

