

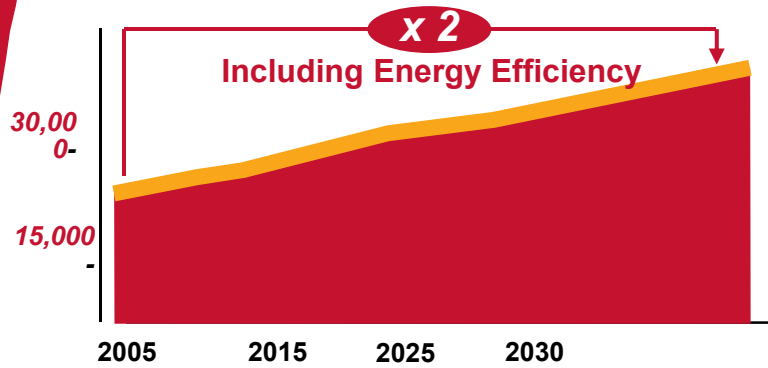
Smarter Grids: Answers to Some Questions

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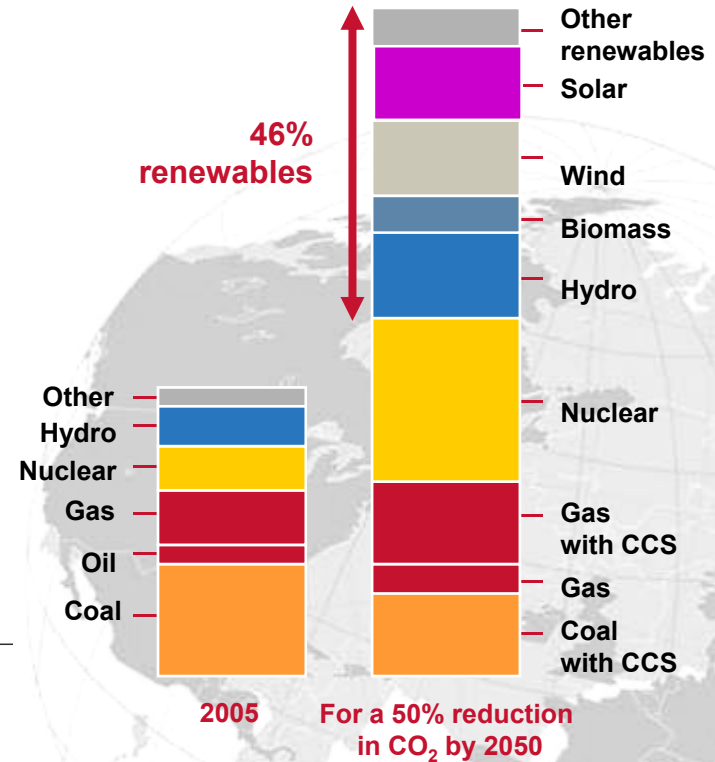
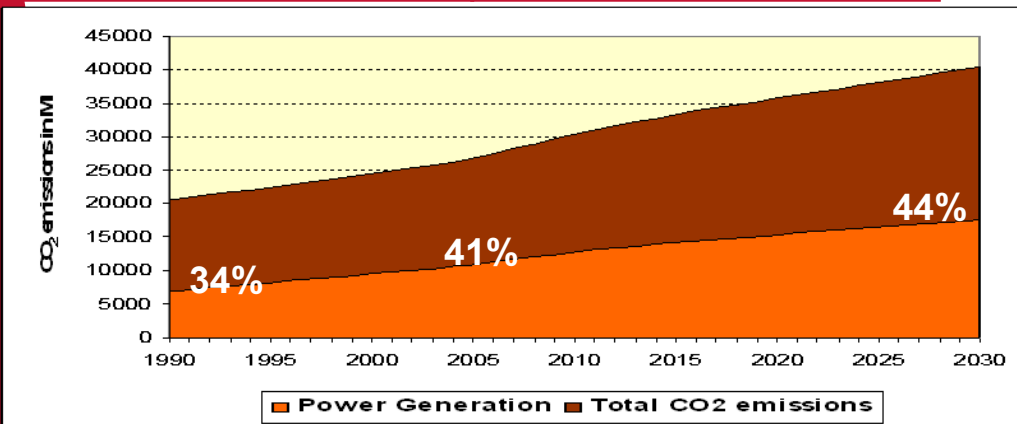
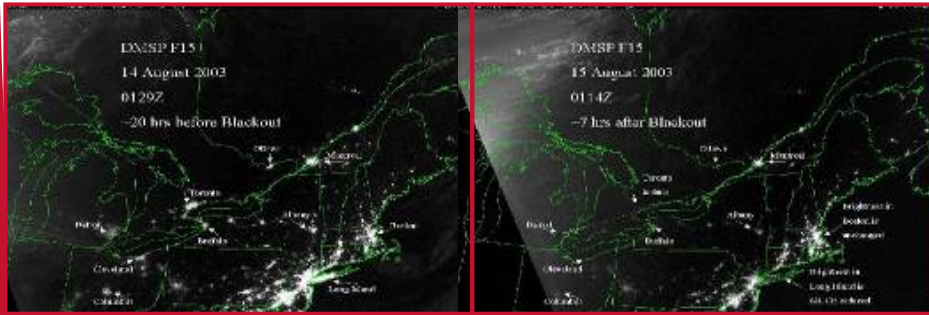
PSERC Executive Forum on Smart Grid Development
Strategies & Business Opportunities
March 6th. 2009, Austin TX

1. What is the business case for a smart grid?
2. Is the technology for smart grid deployment readily available?
 - ▶ Required R&D investment
 - ▶ Most critical R&D areas
 - ▶ Required emerging standards to assure smart grid interoperability?
3. Skills set required for smart grid deployment: Do we need a more educated workforce?
4. If you had an option to prioritize smart grid efforts to meet the stimulus bill, what would you recommend be done first?
5. How do you see the transition from the legacy solutions to smart grid solutions occurring?

Smart Grid Business Case: What are the Problems we must solve



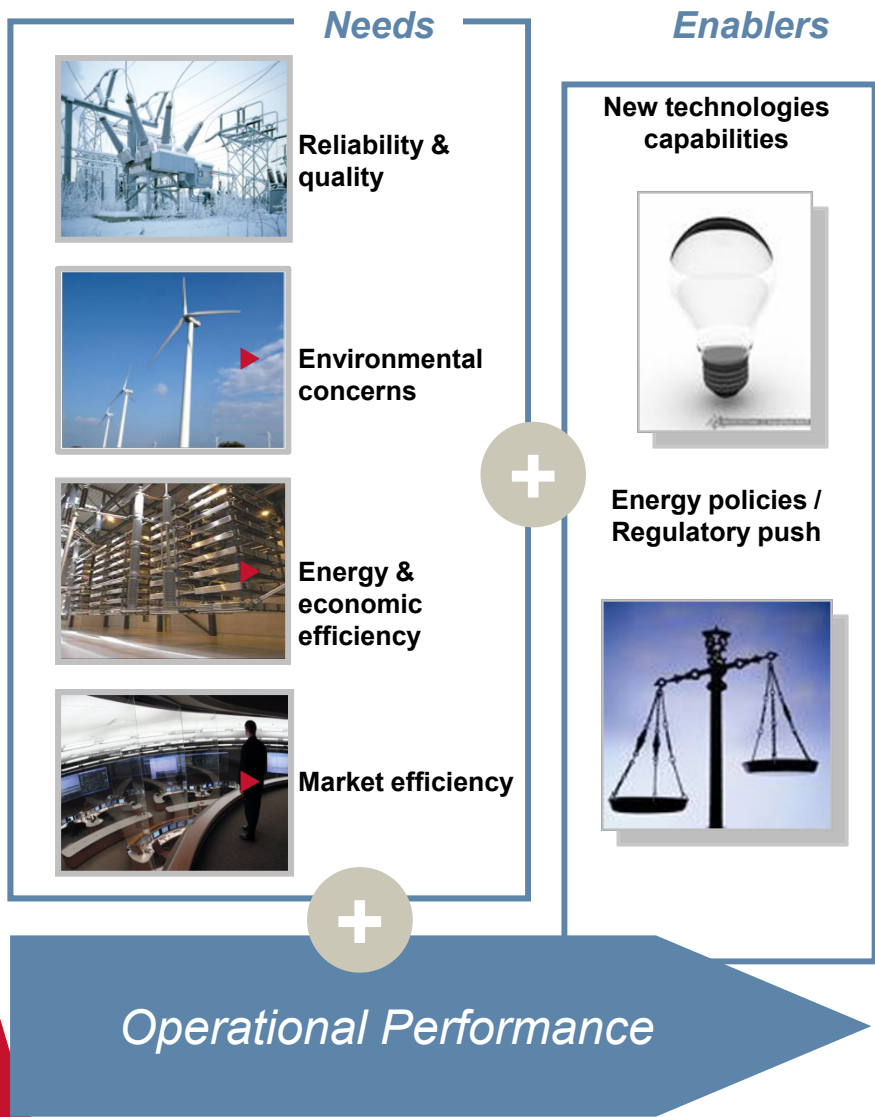
2003 Blackout: more than \$10B lost in 1 evening



- Ageing Infrastructure
- Ageing Work Force
- Increasing energy costs

The COSTS of DOING NOTHING IS EXTREMELY HIGH

Smart Grid: The Benefits



Smart Grid Objectives

- A** Blackout prevention
 - Defense plan
 - React in real-time
 - Online Stability
 - Closed Loop Control
- B** CO2 free energy sources integration
 - Nuclear
 - Centralized / Decentralized Renewables
 - Micro-renewables
 - Energy storage
- C** Transmission optimization
 - Infrastructure (incl. long distance, both energy & communication)
 - Network management
- D** Distribution optimization
 - Infrastructure (to enable bi-directional power flows, communication)
 - Network management
- E** New consumption modes integration and management
 - Smart appliances & buildings
 - Electric cars
 - μ -production and μ -grid
 - Deregulated environment

Smart Grid: The Levers & Related Technologies

1. **Energy Efficiency**
 - Efficient Generation
 - Smart consumption
 - Demand response
 - Loss Reduction
 - Asset Optimization
2. **Reduction of Environmental Impacts**
 - Massive Deployment of Renewable Energy
 - Energy Storage Technology
 - Integration of Distributed Energy Resources
3. **Enhance Grid Reliability**
 - Upgrade of Aging equipment
 - Smart Devices (FACTS, SVC, D STATCOM, Smart Transformers)
 - Micro Grids
 - WAMS
 - On-Line Stability
4. **Operational Performance of all actors of the supply chain**
5. **User's Experience**



**Priorities depend on starting Point
Emerging Standards: CIM, IEC 61850+,
AMI Standard, SOA**

Pivotal roles of integrated IT & Application Infrastructures

1. Broad Engineering Education
 - ▶ Electrical Engineering, Power Systems Engineering
 - ▶ Material Sciences, Mechanical Engineering
 - ▶ Nuclear Engineering
2. System Architects & System Integration
3. IT & Software Engineering
4. Project Management
5. Financial Engineering

Urgent to invest in Electrical, Power, & Nuclear Engineering Faculties

Priorities in Stimulus Smart Grid Projects

1. Smart Grid Technologies focused on Renewables facilitation
 2. Distribution Systems
 3. Advanced Metering
 4. Micro Grids capable of high reliability/resiliency and islanded operation
 5. Integration of Distribution Automation (DA), Feeder Automation (FA)
 6. Transmission apparatus with Smart Grid capabilities
- ▶ System Integration, Monitoring, Control, and Optimization must go along at each phase

- ▶ **Smart Grid is the convergence & intersection of:**
 - ◆ Several technologies (Power Systems, Telecommunications, IT & Applications)
 - ◆ Policy & Regulatory framework
 - ◆ Organizational transformation
 - ◆ Excellence in business processes and
 - ◆ Operational Performance

- ▶ **Developed** countries are often burdened with more legacy systems and non-standardized approaches

Develop a Roadmap



Thank You