

## National Association of Regulatory Utility Commissioners

## Committee on Energy Resources & The Environment

## Technology Panel

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# Outline

- Overview of the Electricity Technology Roadmap
- Relationship between the various players in technology development
- Some interesting technologies required for precision power

# Overview of the ETR

- The Electricity Technology Roadmap (ETR) provides a global vision for realizing electricity's essential value to 21<sup>st</sup> century society
  - Precision Power
  - Clean Power
  - Power for All



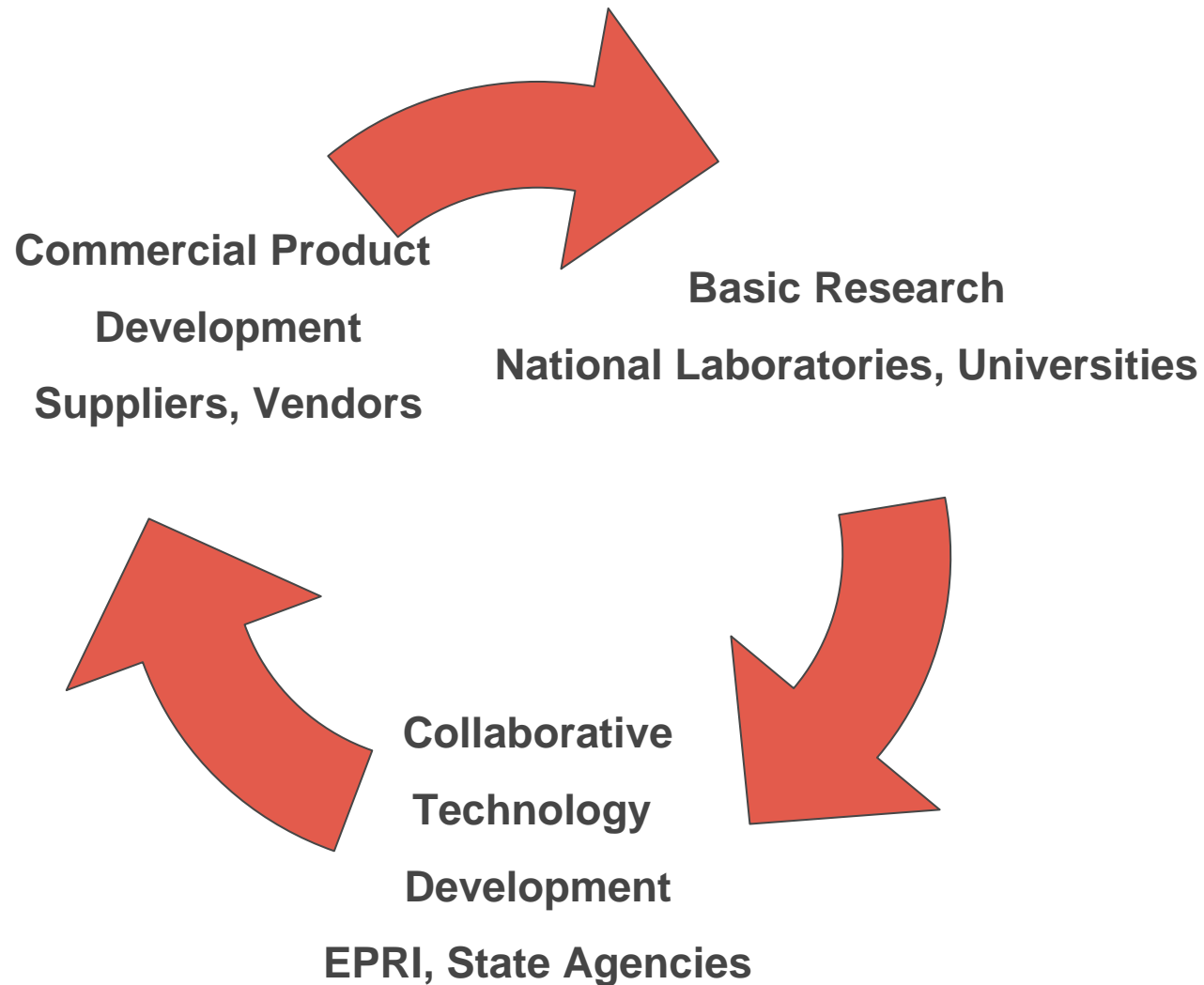
*To Electrify the World*

# What is Precision (Electric) Power?

- The right quantity of power
- The right quality of power
- To the right consumer
- At the right time
- At the right price
- Every time

**Imprecise Power Costs the U.S. Economy \$80B to \$170B Annually**

# Relationship Between Parties in the Technology Process in the Electricity Enterprise



# Technologies Required for Precision Power

- Fast simulation and modeling –  
Faster than real-time grid simulation
- Self healing electricity system –  
System will anticipate disturbances and respond proactively

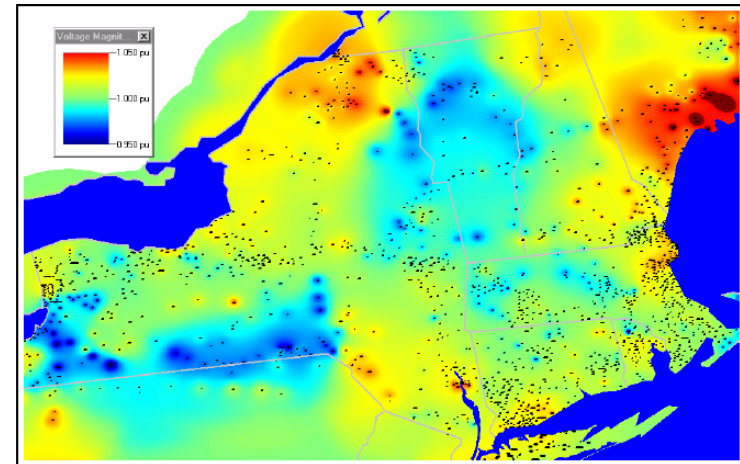


Figure 9: Voltages Magnitudes at 115/138 kV Buses in New York and New England



# Nearer Term: Faster Than Real-Time Grid Simulation

- What will be different?
  - Model electricity grid dynamics, statics in faster-than real time
  - System for grid monitoring, control, response to disturbances
  - Grid and generation planning will be integrated
  - Planning and operations will address deregulated market structures, policy goals (e.g., climate), introduction of new technologies
- Why?
  - Optimize grid performance
  - Balance technical constraints and markets
  - Use capability to assess other what-ifs – fleet asset management, environmental policies, generation and grid planning, deployment of distributed energy resources, impact of couple electricity/H<sub>2</sub> system
  - Need this capability first to develop coherent technology strategy relative to existing grid

# Nearer Term: Faster Than Real-Time Grid Simulation

- Who wants it/needs it?
  - Grid operators/planners
  - Asset managers
  - Regulators
  - Technology researchers
- When
  - Technology in next 5 years
  - Implementation 5-10 years beyond that
- What is happening now?
  - EPRI R&D program on fast simulation & modeling
  - University consortia like PSERC
  - IEC working groups on standards issues

# Further Out: Self-Healing Electricity System

- What will be different?
  - The grid will anticipate disturbances and respond.
  - Scope of outages, quality disturbances will be bounded (adaptive “islanding”)
  - Distributed control and intelligent software agents will incorporate, balance priorities for local areas, control areas, transmission regions, national grid
  - We will be able to successfully introduce new technologies (e.g., microgrids, widespread distributed resources, energy storage) into the electricity system with minimal physical modification
  - We will be able to successfully support full deregulated operations
- Why?
  - Increase value of electricity system to our economy and society (higher reliability, more adaptability)
  - Address increasing speed and complexity of electricity system dynamics through automation
  - Focus human attention, intervention at appropriate levels, timeframes

# Further Out: Self-Healing Electricity System (continued)

- Who wants it/needs it?
  - Utility companies, transmission companies, distribution companies
  - Consumers, particularly electricity-intensive industries
  - Policymakers
  - Financial community – stabilizes risk, asset values
- When
  - 2040-2050
- What is happening now?
  - EPRI R&D program – IntelliGrid<sup>SM</sup> Consortium (CEIDS)
  - University consortia like PSEERC
  - U.S. Department of Energy

# Conclusions

- Principal Destinations of the Roadmap define three central areas of technology development
  - Smart Power
  - Clean Power
  - Power for All
- Technology pathways exist to reach the Destinations
- The amount spend on R&D must be increased by 250%
- Magnitude of technical challenges demand a concerted development effort starting **now**

