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Critical Utility Infrastructures: The U.S. Experience

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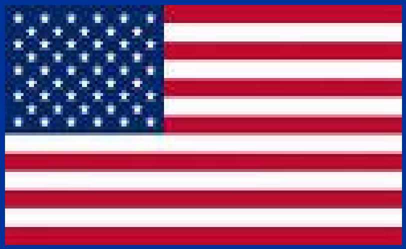

EU-US Energy Regulators Roundtable

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Overview

I. What is "Critical Infrastructure?"

II. Examples of Critical Infrastructure and disaster preparation from the United States

III. Critical Infrastructure in the 21st Century

I. What Is Critical Infrastructure?

A. Electricity

B. Natural Gas

C. Telecommunications

D. Economic Function

E. Political Goals

A. What Is Critical? Electricity

- When there is an outage, the productivity losses to commercial and industrial customers can be tremendous, ranging from thousands to millions of dollars for a single event. The cost to manufacturing facilities can be even higher.
  - More and more commercial and industrial customers are purchasing or renting generators to provide backup power in case their electric service is interrupted.
- Today, even voltage dips that last less than 100 milliseconds can have the same effect on industrial process as an outage that lasts several minutes or more.

⇒ **High Quality electricity delivery is a critical need, and the infrastructure needed to deliver high quality electricity is critical.**

B. What is Critical? Natural Gas

- Space Heating: The vast majority of US citizens depend on natural gas for space heating.

- Industrial Process: Many industrial processes depend on natural gas a fuel for steam and in some cases for products.

- Electricity Production: Natural gas provides both intermediate and peaking sources of electricity for the US power grid.

⇒ **Natural Gas is a critical input and the pipelines and local delivery systems are critical infrastructure.**

C. What Is Critical? Telecommunications

- Communications are essential for our economy
- Businesses cannot function without data/information accessed through telecommunications
- Security systems depend on telecommunications to provide quick response when security is breached.
- Utilities are interconnected and rely on each other; analysis is incomplete without reference to all public services.
- **Telecommunications and the associated investments are a critical component of the US infrastructure.**

D. Economic conditions or advances in technology can change what meets the definition of critical infrastructure

- Communications networks are critically important to the function and monitoring of utility services

- Economic Conditions may mandate a certain level of reliability not expected before, therefore, identifying new critical infrastructure

E. Definition of "Critical Infrastructure" can evolve depending on political trends and policy decisions.

- **Some nations have taken the reduction of energy dependence on imports as a goal.**
  - **Redundancy, alternative supplies or general increases in security**

- **Some nations have taken the reduction of environmental pollution as a goal.**
  - **Renewable Portfolio Standards**

II. Recent US Experience with Critical Infrastructure: Disaster planning and recovery

A. **Protection and Quick Recovery from disasters (man-made, natural & accidental)**

B. **State Regulator's Role**

C. **Interdependencies and limitations**

New Orleans, September 2005

The Blackout

The New York Times

Hurricanes Katrina and Rita

What are the Threats?

All Hazards Approach

- Sabotage/Terrorism
- Civil Disturbance
- Flooding
- Natural Disasters
- Infrastructure Failures
- Public Health Emergencies

Utility Systems & Response to Disasters: State Regulator's Role

- Address interconnections and interdependencies of various utilities and systems
- Pre-disaster planning
- Identification of critical infrastructure
- Requirement to have protections in place for infrastructure
- Redundancy
- Security
- Focus on Reliability and resiliency
- Address infrastructure expansions and upgrades
- Continuity of Operations

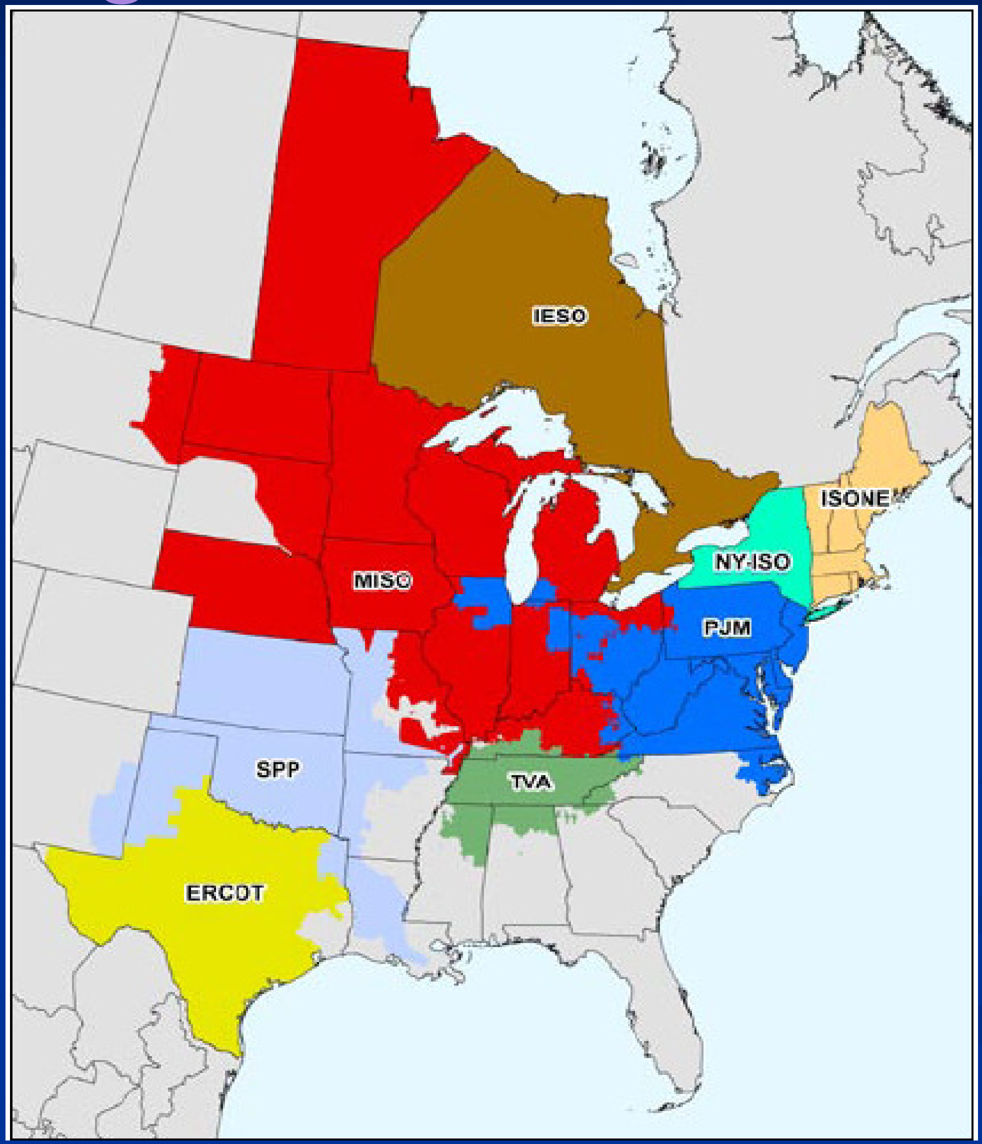
Interdependencies?

- The functional reliance of an essential service (e.g., networked utility service) on another network/system
- Disruption/outage in one area/sector has implications beyond that area/sector, and vice versa

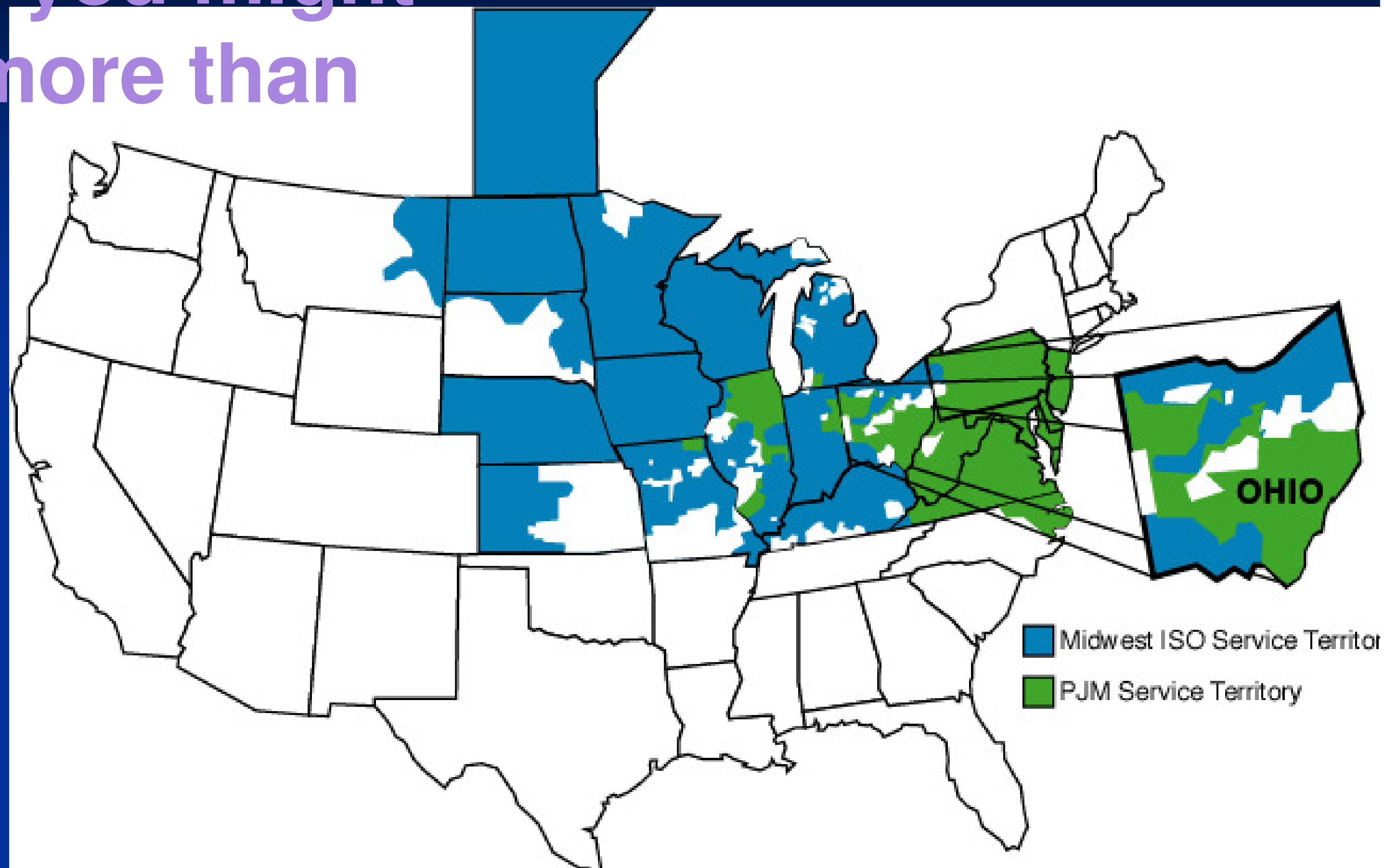
What interdependencies exist among your utility systems?

How can a domino effect be avoided?

RTO Regions



… and you might be in more than one



What regions do you belong to?

How do you communicate: exercises, conference calls, and/or websites?

State Role: Review and Approval of Cost Recovery

- Who pays?
- How do we pay?
- How do Commissions process CI information in rate cases?
- What level of information detail is sufficient to determine a prudent expenditure?
- How can shared information be protected?

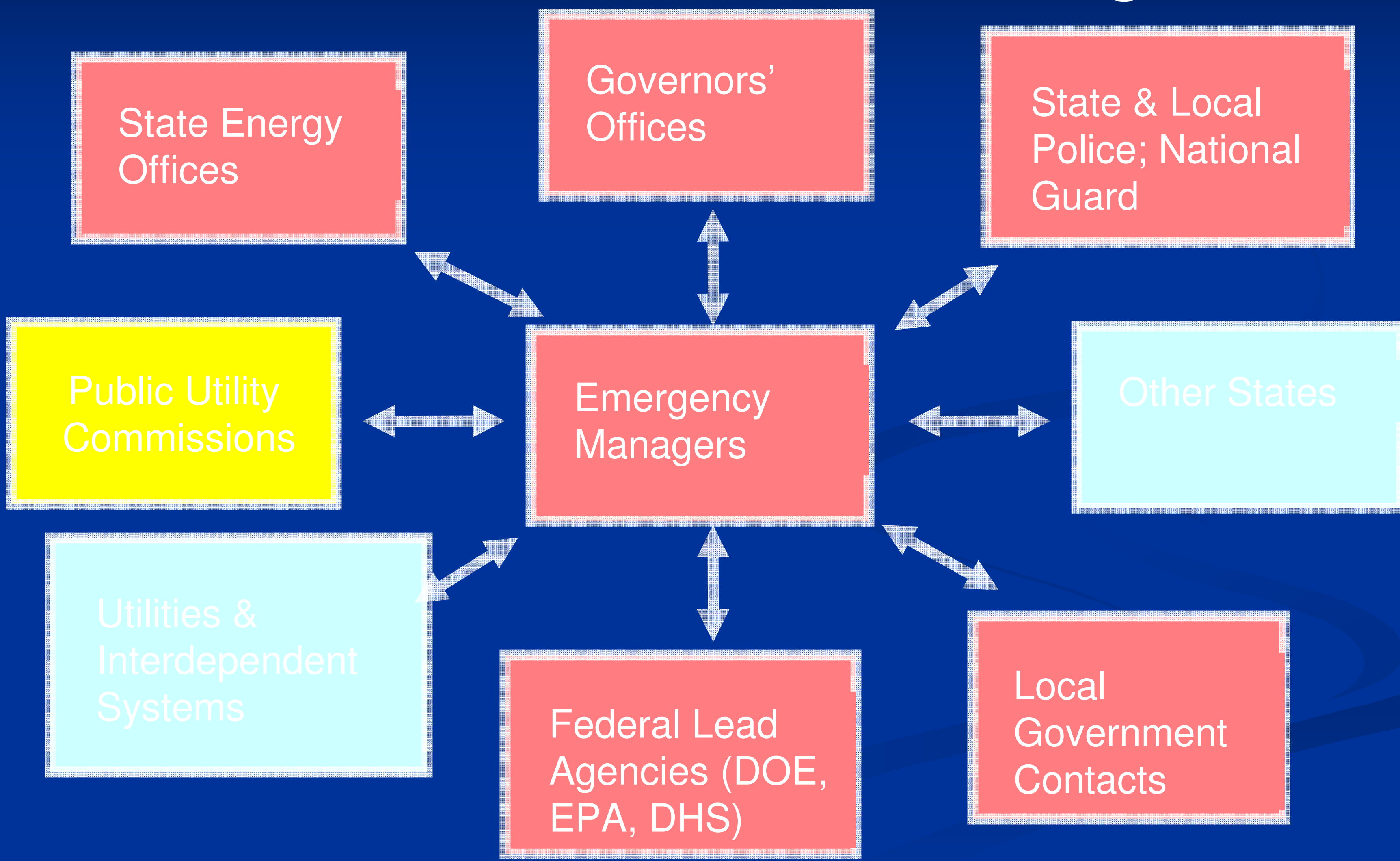
Regulatory Models May Challenge Infrastructure Protection

- Procedural openness
- *Ex parte* restrictions
- Regulatory lag
- Rulemaking processes
- Regulatory incentives
- Policy consistency

Transparency, participation, and accountability may challenge some aspects of critical infrastructure protection needs

Each State will need to approach critical infrastructure protection uniquely

Other Organizations to Know in Critical Infrastructure Emergencies



III. Critical Infrastructure in the 21st Century

A. **EPACT 2005: National interest Electric Transmission Corridors**

B. **DOE's Modern Grid Initiative**

C. **Wind Integration into US Generation Supply**

National Interest Electric Transmission Corridors: Federal Rule

- EPACT 2005 gives FERC the authority to require transmission to be built when it finds that significant transmission constraint or congestion problems exist.
- Secretary of Energy Samuel W. Bodman said. "The goal is simple – to keep reliable supplies of electric energy flowing to all Americans. By designating these National Corridors, we are encouraging stakeholders in these regions to identify solutions and take prompt action."

DOE's Recent Findings

- U.S. Department of Energy (DOE) announced (October 2, 2007) the Department's designation of two National Interest Electric Transmission Corridors
  - the Mid-Atlantic Area National Interest Electric Transmission Corridor, and the Southwest Area National Interest Electric Transmission Corridor.

- These corridors include areas in two of the Nation's most populous regions with growing electricity congestion problems. The Department based its designations on data and analysis showing that persistent transmission congestion exists in these two areas.

B. DOE's Modern Grid Initiative

- America's global competitiveness and quality of life depend on plentiful, reliable electric power.
  - Every industry is becoming more electric-dependent
  - A blackout cost Sun Microsystems up to $1 M per minute.
  - A recent rolling blackout caused and estimated $75 M in losses in Silicon Valley alone.
  - During a 1 hour loss of power at the Chicago Board of Trade during the summer of 2000, trades worth $20 trillion could not be executed.
  - Today, nearly 10% of electricity is delivered to digital devices that require high quality, digital grade power.

Five Driving Technologies

- Integrated Communications
- Sensing and Measurement Technologies
- Advanced Components
- Advanced Control Methods
- Improved Interfaces and Decision Support

Modern Grid Functions

Functional Areas	Descriptions of Functions Associated with A Smart Grid
Customer	Smart meters record and report power use with great precision, allowing vast improvements in pricing, demand response, outage response and consumer choices.
	Building automation systems "talk" to the grid, allowing commercial and industrial customers to be more efficient about their own energy usage.
Distribution	Monitoring and smart controls will reduce voltage dips and improve power quality by appropriate corrective actions taken before they become significant.
	Plug-and-play interconnection allows renewables and other new sources to connect quickly and seamlessly to the grid
	Remote sensors spot problems with substations, transformers and other
Transmission	expensive equipment.
	Sensor, monitor and report line conditions in real time, allowing more power to flow over existing lines. Advanced cables carry 50-300% more power.
	Intelligent electronic devices inside the substation talk to each other and the control room.
Systems Control	Smart controls and equipment throttle back electricity use when the grid is under stress
	Modernized control rooms and software give operators full information and split-second control.
	Intelligence and communications allow the grid to accommodate all forms of generation, whether large or small, centralized or distributed.

C. Wind Integration

- There are regions in the US where wind power is "high quality," meaning that the amount of wind power that can be produced relative to the investment in wind infrastructure is relatively good compared to other regions where output per dollar invested is poor.

- In order to deliver this wind power from areas rich in natural resources (wind) to poor areas requires a significant investment in transmission infrastructure. Moreover, to increase the amount of energy generated from renewable power sources, transmission becomes a critical infrastructure.

- Currently, the DOE is performing wind integration studies in conjunction with multi-regional planning studies by SPP, MISO, PJM and TVA.
  - These studies are designed to determine the transmission infrastructure needed to deliver from 20% to 30% wind energy throughout those regions.
  - These studies are just now beginning (first meeting was Nov 1, 2007), and may involve additional areas of the US, including the East Coast and the Southwest.
  - To what extent the transmission needed for wind is seen as "critical infrastructure" investment will depend on political decisions as to the need for renewable portfolio standards within the states as well as by the US congress.
  - In order for this transmission to be built, there will need to be new agreements concerning who will pay for the return of and on the investment needed to deliver the wind throughout a multi-region footprint.
  - In turn, in order for this to succeed, it needs to be designed as a win-win situation for all of the regions involved.

Wind Integration: Key Issues

- Benefits of geographic diversity of wind power
- Long distances for higher quality wind vs. shorter distances for lower quality wind.
- Operating impacts on and costs for
  - Regulation
  - Day Ahead Unit Commitment
  - Real Time Load Following
- Sizing of balancing authorities
- Capacity values for Wind

Questions?

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