Role of Energy Resiliency in Emergency Response

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Critical Infrastructure Security & Resilience

- Presidential Policy Directive (PPD) -21 February 12, 2013

Select Excerpts

- “It is the policy of the United States to strengthen the security and resilience of its critical infrastructure against both physical and cyber threats.”

- “These efforts shall seek to reduce vulnerabilities, minimize consequences, identify and disrupt threats, and hasten response and recovery efforts related to critical infrastructure.”

- “The term "resilience" means the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.”

Categories of Resilience-Enhancing Measures

Global Security Sciences Division, Argonne National Laboratory December 2016
Framework for Defining Resilience

For a community, loss of resilience, $R$, can be measured as the expected loss in quality (probability of failure) over the time to recovery, $t_1 - t_0$.

Source: Multidisciplinary Center for Earthquake Engineering Research framework for defining resilience (Bruneau and Reinhorn, 2007; Bruneau et al., 2003)

Resilience results from a sustained commitment to four factors:

- **Robustness** -- The ability to operate or stay standing in the face of disaster
- **Resourcefulness** -- Skillfully managing a disaster once it unfolds
- **Rapid Recovery** -- The capacity to get things back to normal as quickly as possible after a disaster
- **Learning Lessons** -- Having the means to absorb the new lessons that can be drawn from a catastrophe

**Preparedness and Resiliency**

*Two sides of a coin*

- **Plan and Respond** to events that disrupt energy supply and assure a rapid return to normal conditions. This is a coordinated effort involving the private energy sector’s response, augmented by local, state, and federal governments as needed.

- **Mitigate Risks** through policies, programs and investments that provide for a more secure and resilient energy infrastructure that also reduces interdependencies impacts.

  *Where risk is a function of consequences, vulnerabilities and threats.*
State Energy Assurance Planning

Responding to energy emergencies & reducing risk to critical energy infrastructure

- Nearly all states, some territories, and 43 local governments have prepared energy assurance plans to:
  - Respond to energy supply disruptions, assure the continued operations of essential public services, and mitigate or reduce risks
  - Create and sustain expertise on preparedness, response, cybersecurity, interdependencies, and communications, etc.
  - Develop processes for tracking energy supply disruptions
  - Prepare workforce development plans and training
  - Conduct energy emergency exercises
  - Revise or new state policies, procedures, and practices

- Benefits for States and Local Governments:
  - Enhance the speed and effectiveness of the energy emergency response
  - Improve coordination across state agencies multi-state regions
  - Expand situational awareness and consequence assessment
  - Improve recovery and restoration capabilities and reduce risks

For more information visit: naseo.org/energyassurance
Coordination of Plans
Planning interfaces

Government

Federal Response Plans

State Disaster Plan

State Energy Assurance Plan

Local Energy Assurance Plan

Private Sector

Petroleum refiners and pipelines

Petroleum local retail jobbers/distributors

Natural Gas producers interstate pipelines

Natural Gas Local Distribution Utilities

Private Sector

Electric ISO

Electric Transmission

Electric Local Distribution Utilities

Other Critical End Used Sectors
State Energy Resilience Framework

**RESILIENCE** — Ability of an entity — e.g., asset, organization, community, region — to anticipate, resist, absorb, respond to, adapt to, and recover from a disturbance

1. **Understand Stakeholders Needs and Requirements**
   - Consider subsystems of concern
   - Determine energy production and usage

2. **Determine Threat and Hazard Susceptibilities and Vulnerabilities**

3. **Develop a Resilience Plan**
   - Use state energy resilience planning
     - Define generic options
     - Determine barriers to resilience

4. **Implement Resilience Enhancement Options**
   - Prepare for energy service disruptions
   - Mitigate risks from system hazards
   - Recover and restore energy service
   - Respond to disruptions to energy service

5. **Review and Maintenance**
   - Develop after action reports and lessons learned
   - Evaluate and update resilience options
   - Revise resilience planning

**System Goal**
Maintain energy availability to customers and consumers
Interdependencies Among Critical Infrastructure

- Banking and Finance
- Petroleum
- Transportation Systems
- Communications and Information Technology
- Natural Gas
- Water and Wastewater Systems

Interactions include:
- Fuel for Generators
- Financial Transactions, Insurance
- Shipping
- Fuel Transport
- Power for Control Systems
- Power for Switches
- Financial Transactions, Insurance
- Power for Pumping Stations, Storage, Control Systems
- SCADA, Communications
- Fuel for Generators, Lubricants
- Power for Signaling Switches
- Power for Pumps, Lift Stations, Control Systems
- Water for Cooling, Emissions Reduction
- SCADA, Communications
- Heat
Investments that Reduce Risks, Enhance Resiliency, Economic Efficiency, and the Environment

- Net zero energy buildings have greater self sufficiency
- Combined heat and power can reduce fuel use, improve conversion efficiency, and operate independently of the power grid
- Microgrids can supply highly-reliable power during times of natural disaster
- Alternative fuel and electric vehicles diversify energy resource usage
- Well-insulated homes and buildings that hold heat longer in a winter power outage
- Smart Grids rapidly detect the size of power outages reducing response time
- Grid modernization can reduce line losses and transmission congestion.
- Energy storage (e.g., batteries, fuel cells, and emergency fuel reserves)
Additional Ways of Improving Resiliency

- Infrastructure hardening
- Improving efficiency
- Replacement of aging/failing infrastructure
- Physical and cyber security
- Understanding critical interdependencies
- Sustain and improving emergency response capabilities
- Increase multi-state coordination
- Utilizing new technologies
- Removing supply chain choke points
- Shortening supply chains
- Diversification of supply resources
- Continuity of business/government operations
- Public-private partnerships
- Supporting investments in infrastructure
- Initiatives to increase local government resiliency
- Back-up generators and fuel for critical public/private facilities
Thank you!

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References and further reading

- Guidance on Updating State Energy Emergency Plans -- NASEO
- Guidance For States on Petroleum Shortage Response Planning – NASEO February 2018
- A series of publications on Initiative for Resiliency in Energy through Vehicles (iREV) effort are available at https://naseo.org/publications
- Energy Efficiency is Not Enough: Rethinking Building Energy Performance for Good Times and Bad -- 2018 ACEEE Summer Study on Energy Efficiency in Buildings
References and further reading (Cont.)

- **Liberty Eclipse Exercise** -- U.S. Department of Energy and NASEO December 2016 examined the response to a large scale power outage cause by a cyber-attack which cause major petroleum shortages.
