Plenary Session
Chapter 7 – Energy Systems

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Chapter 7 - Energy Systems

Energy and Power Sector elements at the forefront of the Resilience discussion

Aligning Resilience efforts with current Sector activities
- Reliability
- Energy Assurance

Current performance levels of the Sector
- Electric Power
- Liquid Fuels
- Natural Gas
- Emergency and Standby power

Performance goals

Regulatory environment and codes/standards

Strategies for implementing community resilience plans
Resilience and Energy Systems

Presidential Policy Directive 21 Four R’s of Resilience

**Robustness** - ability to withstand external demands without degradation or loss of functionality

**Rapidity** - the speed to restore safety, services, and financial stability

**Resourcefulness** - capacity to mobilize needed resources and services in emergencies

**Redundancy** - allow for alternate options, choices, and substitutions under stress
Current State: Electric Power Example

- **Key Sector Elements**
  - Generation
  - Transmission
  - Distribution

- All elements are subject to multiple different hazards
- Disparate performance based on hazard or sector element and geographic location of the elements/assets

- Challenges with understanding hazards and impacts
  - No consistent definition of hazards (one stakeholder’s extreme hazard is another stakeholder’s routine event)
  - Performance expectations between suppliers and users are not uniform or consistent
### Performance Goals Scoring Example

<table>
<thead>
<tr>
<th>Functional Category: Cluster</th>
<th>(4) Support Needed</th>
<th>(5) Target Goal</th>
<th>Overall Recovery Time for Hazard and Level Listed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>Expected Hazard Level</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Phase 1 – Short-Term Days</td>
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<td></td>
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<td>Phase 2 – Intermediate Wks</td>
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<td>Phase 3 – Long-Term Mos</td>
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<td>0</td>
<td>1</td>
<td>1-3</td>
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<td></td>
<td>1-4</td>
<td>4-8</td>
<td>8-12</td>
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<td></td>
<td>4</td>
<td>4-24</td>
<td>24+</td>
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</tbody>
</table>

**Power - Electric Utilities**

- **Generation**
  - Critical Facilities and Infrastructure Systems: R/C 90% X
  - Emergency Housing and Support Systems: R/C 90% X
  - Housing and Neighborhood infrastructure: R/C 90% X
  - Community Recovery Infrastructure: R/C 90% X

**Transmission (including Substations)**

- Critical Response Facilities and Support Systems
  - Hospitals, Police and Fire Stations / Emergency Operations Centers: R/C 90% X
  - Disaster debris / recycling centers/ Related lifeline systems: 60% 90% X

**Restoration times**

<table>
<thead>
<tr>
<th>(2)</th>
<th>30%</th>
<th>Restored</th>
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<tbody>
<tr>
<td></td>
<td>60%</td>
<td>Restored</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>Restored</td>
</tr>
<tr>
<td>(3)</td>
<td>X</td>
<td>Current</td>
</tr>
</tbody>
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**Example Matrix**

- **Power Generation** - 4 Subcategories
- **Transmission** - 9 Subcategories
- **Distribution** - 9 Subcategories
External Considerations

- Regulatory Environment
  - Federal (FERC, NERC, NRC, others)
  - State (PSCs, ISOs, RSOs, and other pools)
  - Local

- Codes and Standards
  - Existing - Older facilities/asset and vulnerabilities
  - Existing - Newer facilities/asset and vulnerabilities
  - New Construction

- Non-construction issues

- Vegetation Management
- Community Planning and Involvement
Impacts from Emerging Technologies

Smart Grid Technologies
• Ubiquitous communications enables situational awareness and command and control
• Distribution Automation
• Substation Automation
• Demand Side Management
• Renewable Energy Integration
• Internet of Things (IoT)

Energy Storage
• Renewable Energy + Storage = Energy Resiliency Killer App

Microgrids
• Well-defined boundaries
• Grid-connected or islanded
Implementation Strategies

- **CALeap – California Local Energy Assurance Planning**
  - Common methodology for developing plan for resiliency, energy management, and restoration

- **DOE Energy Assurance Program**
  - Guidelines for managing energy resilience

- **National Association of State Energy Officials (NASEO) State Energy Assurance Guidelines**
  - More guidelines for managing energy resilience

**Sources**
- CaLEAP Methodology
- ENERGY.GOV
  - Office of Electricity Delivery & Energy Reliability
- State Energy Assurance Guidelines
Implementation Strategies

- NIST Disaster Resilience Framework
  - Community resiliency focus
  - Variety of domains
    - Energy
    - Buildings and transportation
    - Communications
    - Water and waste water
  - Tools, metrics, etc
Needs from this Workshop

• Is the approach on point?
• Is it helpful to communities dealing with resilience issues in the Energy Sector?
• What gaps/perceived gaps exist in our approach?
• Will these performance metrics, if implemented, create resiliency in the Sector?
• Will the plan laid out here impact your day-to-day business?