PREPTalks
New perspectives for emergency managers

Discussion Guide
Left in the Dark:
Power Outages in an Interconnected World
Kate Konschnik

PrepTalks Discussion Guides provide a framework for community leaders to translate insights from the PrepTalk into community planning and outreach. Community leaders can use the PrepTalks materials at meetings, workshops, and conferences to address critical emergency management topics with whole community partners.

## Kate Konschnik – Left in the Dark: Power Outages in an Interconnected World

Kate Konschnik is the Director of the Climate & Energy Program at the Nicholas Institute for Environmental Policy Solutions, Duke University. Her research focuses on policy options for public electric utility regulation, electricity market reforms to accommodate new technologies, electrification of other sectors, and air quality and climate issues.

In her PrepTalk, Konschnik explains the fundamentals of how electricity is generated in the U.S., how aging electrical infrastructure increases the chances of catastrophic failures, and offers considerations for emergency managers to prepare their communities for extended power outages events.

## Partners for the Discussion

We encourage you to bring together those involved in all aspects of emergency management, power supply, public works, and community outreach. This may include other emergency management agencies, public officials, business and community leaders, safety officers, and organizations involved with educating, informing, and training the public in disaster preparedness and response.

> *The grid is a hodgepodge of overlapping physical and regulatory structures working in uneasy alliance to deliver power in real time.*
>
> — Kate Konschnik

After viewing Konschnik's video, use this discussion guide and additional resources to improve relationships, identify best practices and strategies that can be utilized to reduce vulnerabilites associated with a catastrophc power failure, and build resilient community infrastructure.

## Discussion Topics

### Topic 1: Fundamental of Electricity

Thousands of facilities generate electricity, and serve approximately 145 million customers, in the United States. From these generating facilities electricity is conducted through wires, which have a carrying capacity

measured in megawatts, to wherever it is needed instanteously. Once power reaches a community it is stepped down through transformers to distribution lines in a neighborhood.

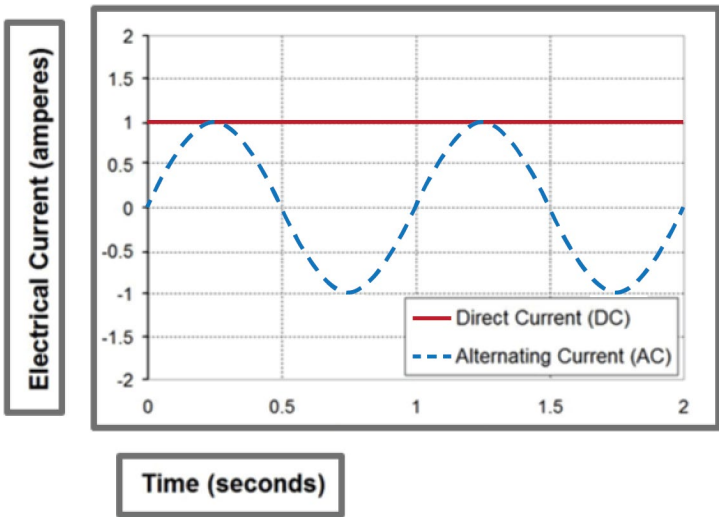
| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| **Generating Station** Electricity is typically generated by a steam- or hydro-driven turbine at the power plant. | **Step-Up Transformer** The power is then ramped up to high voltage for long-distance transmission. | **Transmission** Next, a series of high voltage lines transmit the electricity through the power grid. | **Step-Down Transformer** Power is then reduced to a lower voltage for use in homes and businesses. | **Subtransmission Customer** The electricity then passes through a series of switches to distribution lines. | **Customers** Power is then delivered to customers via local lines. |

CREDIT: NYISO

There are millions of miles of high and low voltage power lines with ever-changing conditions due to the supply and demand for power. Carrying capacity of the line is measured in megawatts:

- Voltage of line (the pressure the line can take)
- Distance needed to travel

American power lines conduct alternating current. The current switches direction as it travels (from positive to negative voltage). One cycle is one Hertz. The frequency of the switching must be kept relatively constant for the system to work. U.S. electric power is managed through 66 balancing authorities including public and private utilities and competitive electricity markets. The grid must be managed as one integrated system.




> *The American Society of Civil Engineers gives our Energy infrastructure a grade of D+*
>
> — Kate Konschnik

## Questions for Discussion

In order to understand your community's vulnerabilities and ensure the right people are part of the planning process, consider the following questions:

- ❑ Who are the electricity providers in your community?
- ❑ Where are the generating stations that serve your community  located? Where are the substations, which convert high voltage to low voltage? Are they located in areas that could be affected by flooding, wildfires, or other hazards?
- ❑ Are electric utilities part of your planning teams?  Do they participate in your exercises?
- ❑ Are there other sources of power in your community (e.g., a significant presence of solar on homes or business; wind farms; hydroelectric dams)?

## Topic 2: Vulnerabilities and Power Outages

Konschnik presents an overview of the national power grid and and examines various vulnerabilites and potential threats to electrical power infrastructure.

- Most U.S. power lines were built in the 1950s and 1960s. When built, they had a life expectancy of 50 years
- On any given day, about a half million people in the U.S. lose power for two hours or more
- The biggest threat to the grid are storms. From 2003 – 2012, storm events caused 700 major power outages in the U.S.
- Some other causes of power outages include fallen trees, cyber attacks, earthquakes, and system overloading

### *Causes of Power Outages*

- Storms:
    - High winds knock out power lines
    - Storm-caused flooding of power plants
    - Ice buildup weighs down power lines
    - Trees coming in contact with power lines:
    - Falling trees or limbs from high winds
    - High temperature cause lines to sag and connect with trees
- Cyber:
    - Faulty code
    - Human error
    - Cyberattacks or hacking

> *Today, we are taxing this system because we are moving towards more distributed and more variable generation and we are experiencing multi-directional current. As we plug more of our lives into this complex grid, we become that much more reliant on this energy source and, potentially, more vulnerable.*
>
> — Kate Konschnik

- Other hazards: earthquakes, system overloading, brownouts, frozen piles of coal

### *Consequences of Power Outages*

- Loss of:
    - Heating and cooling systems
    - Water systems
    - Food refrigeration
    - Medicine refrigeration
    - Medical equipment
    - Fuel
    - Communications
    - Money/ATMs
- Store closures or limited operations
- Traffic control issues
- Security concerns
- Danger from downed power lines

> *States may need to revisit how they think about cost-benefit allocations. For instance, most states don't consider the lost economic productivity caused by a blackout. If they did more of these, [mitigation] programs might start to make sense.*
>
> — Kate Konschnik

Mitigation strategies include storm hardening programs like replacing wooden poles with concrete, burying power lines, and tree trimming or technology solutions such as use of smart meters and self-healing grids.

### Questions for Discussion

- ❑ How did the example of Ocracoke make you think about a prolonged power outage in your community?
- ❑ What is the history of power outages in your area? What was the cause of these outages? What was the consequence? What went well and what could have been improved?
- ❑ Are there plans in place to mitigate power outages in your community? What is the process to approve funding proposals?
- ❑ How is your emergency management team preparing for an extended power outage? Have you conducted exercises to test how you would operate without power? How can you be more strategic now to ensure basic community functions during a prolonged power outage?

## Discussion of Next Steps

What are the next steps your community can take to build resilience for power outages? Discuss the following suggestions to develop an action plan.

- Establish relationships with utility companies
- Develop a "Storm Hardening Program" for your community
- Work with communities to establish "Nano-Grid Response Zones"
- Conduct community outreach to educate the community on the impact of an extended power outage
- Identify analog backups for community functions and strategic priorities for generators and other alternative energy sources
- Pre-determine solar powered nano-grid zones to serve community needs
- Encourage community leaders to hold trainings and exercises in the workplace, neighborhoods, faith-based settings, and schools. Include community members in government organized preparedness exercises.
- Coordinate with amateur radio groups to ensure communication capabilities
- Identify low-tech solutions: laminated paper maps, solar-charged lanterns and USB ports, wheelbarrows

**For the companion Facilitator Slides and Resource List for this PrepTalk, visit:**
https://www.fema.gov/blog/preptalks-kate-konschnik-left-dark-power-outages-interconnected-world