Modernizing Electric Grids to Meet the Demands of a Modern World

CAPER Spring 2018 Meeting

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March 12, 2018

Why do we need to modernize America's electric Grid?

Aging Infrastructure

- Our electrical infrastructure is aging and inadequate for modern times
- Built in the Eisenhower era and designed primarily for transmitting electricity from large centralized power plants fueled by coal or natural gas

Environmental concerns

- Fossil fuels are the main source of energy in America and modernization would allow us to tap into renewable energy sources
- Establish a voluntary market for trading electricity between states via automated systems

Managing Variability Inherent to wind and solar power

- Renewable energy use requires modern grids that address variability in energy production and distribution
- Grids need to be flexible enough to connect local sources of electrical generation to areas of high energy demand
- Flexible modern systems have to be able to accommodate rooftop solar and battery storage

Economic loss

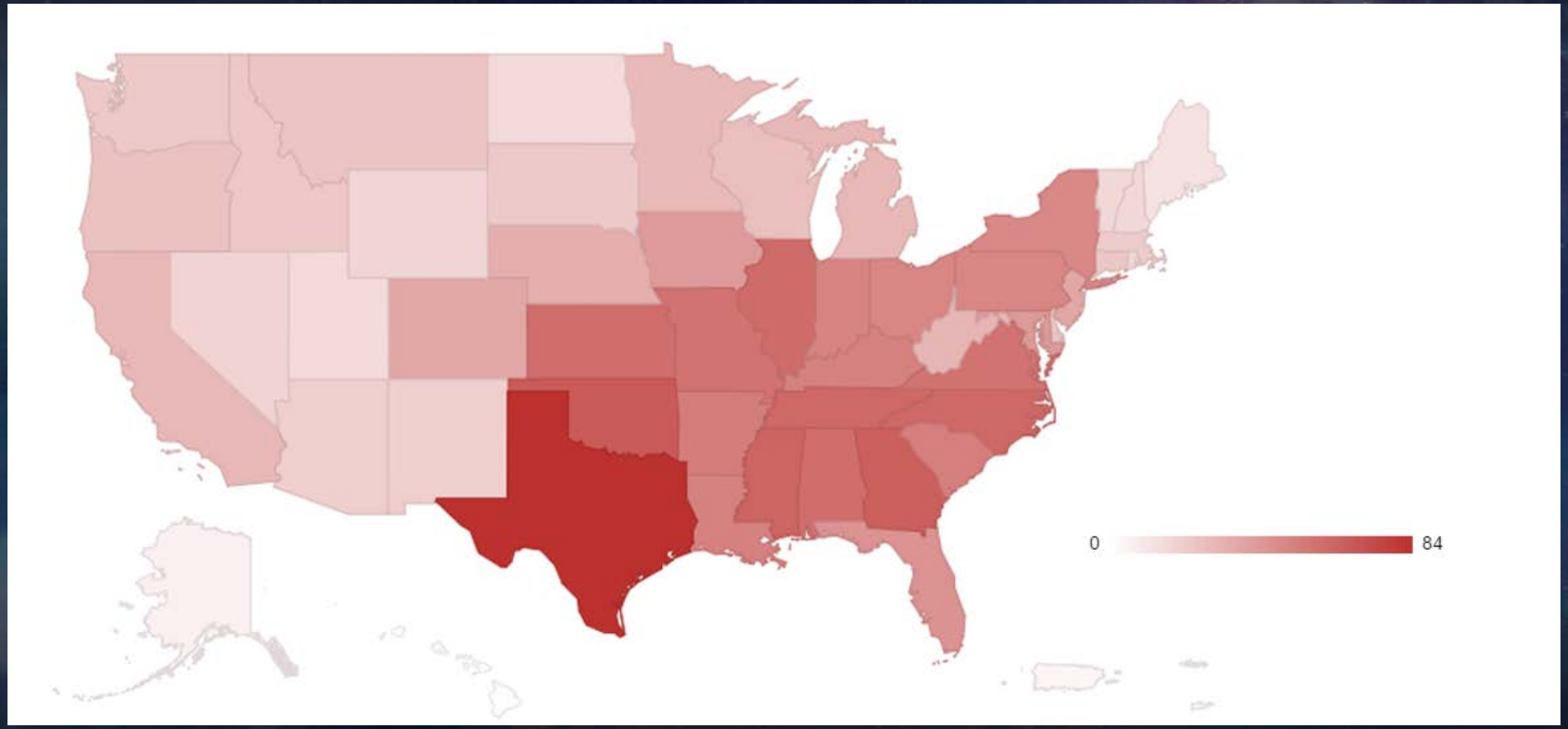
Economic loss

- Weather-related outages cost the U.S. billions annually (estimated)
- Costs take various forms:
  - Lost output and wages
  - Spoiled inventory
  - Delayed production
  - Inconvenience
  - Damage to the electric grid

Economic Loss

- Economic loss due to power outages during Hurricane Katrina caused bankruptcy of the investor-owned utility
- Restoration costs ranged from $260 - $325 million, and the loss of customer revenue was estimated at $147 million
- After Hurricane Rita, utility providers in affected areas reported needing $2.5 billion to recover

Distribution of billion-dollar disasters



Modernizing to ensure Resiliency

Modernizing to ensure Resiliency

- A modern power grid = a resilient power grid
- A resilient power grid is:
  - **Robust, stable, and adaptive**
    - It is able to withstand unexpected destructive events without degraded performance and data from events must be utilized for future adaptation of the grid
  - **Flexible**
    - It is able to switch between modes of operation to protect system integrity

Modernizing to ensure Resiliency

- **Resourceful and Agile**
  - It is capable of identifying environmental patterns so it can switch modes prior to disruption
- **Capable of Coordination and Foresight**
  - It is able to be connected to a larger system so preparation and recovery actions can be coordinated
- **Redundant**
  - It contains redundant components available to maintain grid operation in the case of failure in other components

Modernizing to ensure Resiliency

- **Diverse**
  - Its infrastructure should consist of diverse patterns, structure, supply resources, providers, and output methods
- **Collaborative**
  - It should be designed with input from an extensive range of stakeholders to ensure a wide range of opinions and expertise are considered
- **Efficient**
  - It should have a high-energy return on available resources

Resiliency Through Data Science

- Resiliency calls for the use of modern technology that gathers, stores, and processes data in real time
- This is achieved through data science

How Can we move forward?

Taking a data science-based approach

- Transformative ideas
- Convert ideas into practical, innovative solutions
- Public policy
- Building the right workforce