Efficiency and Resilience in Critical Facilities

MEEA
MIDWEST ENERGY EFFICIENCY ALLIANCE

2023

Housekeeping

- Attendees please stay muted
- Questions? Enter them in the question box
- Presentation will be recorded and sent out after

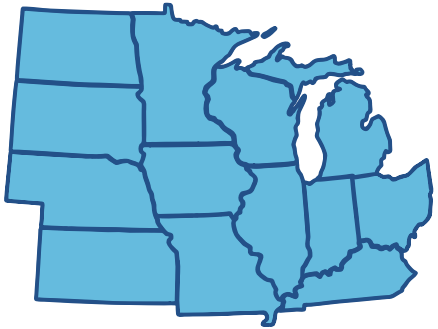
Overview

General Agenda

- What is MEEA?
- Why is the resilience of critical facilities important to discuss and act upon?
- Three presenters to give state, federal and research perspectives
  - How are critical facilities defined?
  - Who has the capacity to research the energy needs of these facilities?
  - What are funding sources states and tribe can leverage to tackle this?
- Q&A

Midwest Energy Efficiency Alliance

At MEEA, we leverage our unique position as the **Midwest's trusted resource on energy efficiency policy and programs** to help identify, understand, and implement cost-effective strategies that provide economic and environmental benefits.



MEEA is a non-profit membership organization with 160+ members, including:

Energy service companies & contractors

State & local governments

Academic & Research institutions

Electric & gas utilities

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Themes

- Efficiency can enhance resilience of critical facilities and their ability to recover from or entirely withstand disruption during extreme weather events
- "Critical facilities" are defined differently by different entities
- Entities in the Midwest are reacting to and preparing for more frequent extreme weather events in different ways
- Increased critical facility resilience supports the health and safety of nearby residents

Presenters

Amanda LeMaster

Energy Assurance and Efficiency Coordinator, Office of Energy Policy, Kentucky Energy and Environment Cabinet

Megan Levy

State, Local, Tribal & Territorial Program Project Manager, Office of Cybersecurity, Energy Security and Emergency Response, U.S. Department of Energy

Eliza Hotchkiss

Senior Resilience Analyst and Manager, Resilient Systems Design and Engineering Group, Energy Security and Resilience Center, National Renewable Energy Laboratory

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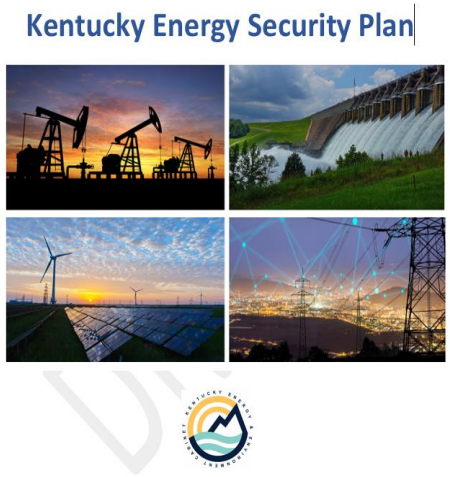
Energy Security Planning-Local Engagement



TEAM KENTUCKY
ENERGY AND ENVIRONMENT CABINET

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U.S. DEPARTMENT OF ENERGY | *Office of* Cybersecurity, Energy Security, and Emergency Response

Critical Facilities – Why Energy Efficiency Matters

Megan Levy, SLTT Project Manager

March 15, 2022

CESER Mission & Energy Threat Landscape

To enhance the security of U.S. critical energy infrastructure to all hazards, mitigate the impacts of disruptive events and risk to the sector overall through preparedness and innovation, and respond to and facilitate recovery from energy disruptions in collaboration with other Federal agencies, the private sector, and State, local, tribal, and territory governments.

Collaboration and Coordination is Essential

State, Local, Tribal, and Territorial (SLTT) Governments

NASEO
National Association of State Energy Officials

National Association of Regulatory Utility Commissioners

American Public Power Association

NCSL

NEMA™

National Governors Association

Energy Government Coordinating Council (EGCC)

NASEO NARUC NGA

Industry Councils

ESCC
Electricity Subsector Coordinating Council

Oil and Natural Gas Subsector Coordinating Council

Physical Security Threats

- Rogue actors and domestic violent extremists are targeting critical energy infrastructure
- Of the physical security incidents shared with E-ISAC between 2020-2022, 3% resulted in outages or other grid impacts.
- Notable increase in repeat and clustered incidents

CNN

A vulnerable power grid is in the crosshairs of domestic extremist groups

... fired at two power substations in Moore County, North Carolina, ... In 2022 there were 25 “actual physical attacks” reported on power...

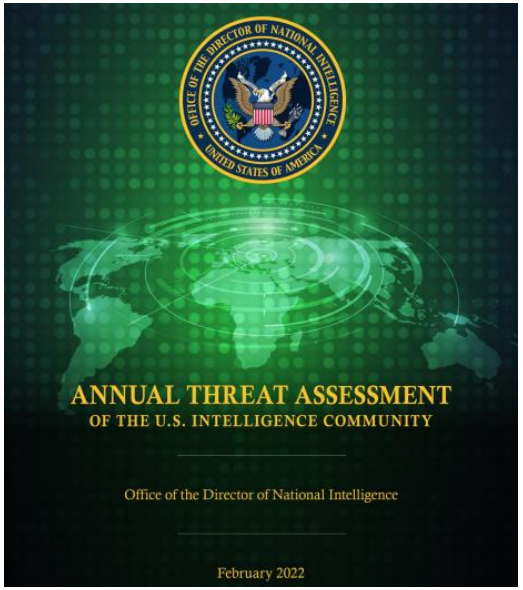
The New York Times

Pair Charged With Plotting to Attack Baltimore Electrical Grid

WASHINGTON — Federal law enforcement officials have arrested two ... the plot to jarring details of her personal and physical travails.

Information provided by E-ISAC

Cybersecurity Threats



Bloomberg.com

Russian Hackers Tried Damaging Power Equipment, Ukraine ...

... military intelligence agency launched a cyberattack on Ukrainian energy facilities, according to Ukrainian cybersecurity officials.

The New York Times

Cyberattack Forces a Shutdown of a Top U.S. Pipeline

The operator, Colonial Pipeline, said it had halted systems for its 5,500 miles of pipeline after being hit by a ransomware attack.

May 13, 2021

Critical Infrastructure

1) Systems and assets, whether physical or virtual, so vital that the incapacity or destruction of such may have a debilitating impact on the security, economy, public health or safety, environment, or any combination of these matters, across any local, State, Tribal and Federal jurisdiction.

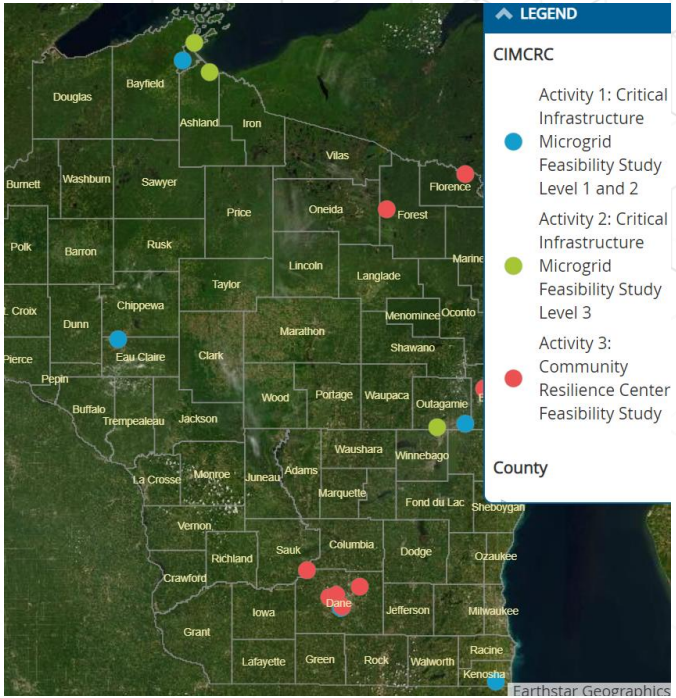
2) Critical infrastructure includes any system or asset that, if disabled or disrupted in any significant way, would result in catastrophic loss of life or catastrophic economic loss. Some examples of critical infrastructure include:
   • Public water systems serving large population centers.
   • Primary data storage and processing facilities, banking centers.
   • Chemical facilities located in close proximity to large population centers.
   • Major power generation facilities exceeding 2,000 MW and supporting the regional electric grid.
   • Hydroelectric facilities and dams producing power in excess of 2,000 MW that could cause catastrophic loss of life if breached.
   • Nuclear power plants., water, phone and electrical supplies.

Critical Facilities

- FEMA's Public Assistance Guide (FEMA 322) states that "A critical facility is **a structure that, if flooded, would present an immediate threat to life, public health, and safety**. Critical facilities include hospitals, facilities that produce toxic materials, and emergency operations centers.

Innovative Mitigation Measures By States

- Wisconsin: Critical Infrastructure Microgrid and Community Resilience Center Feasibility Studies (map)
- Modeled on programs from New Jersey BPU, NYSERDA, MASS DOER, Maryland, Connecticut, and California.
- WI's Refueling Readiness grant program- modeled on Oregon's program. Read more here
- Statewide Assistance For Energy Resilience and Reliability SAFER2 Local fuel and ESF-12 planning program, templates, guidance, exercise in-a-box, HSEEP compliant: PSC Statewide Assistance for Energy Resilience and Reliability



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Disaster Recovery and Resilience Research

Eliza Hotchkiss
Senior Resilience Analyst
Manager Resilient Systems Design and Engineering Group, NREL

3,056

Workforce, including

193 postdoctoral researchers

132 graduate students

89 undergraduate students

World-class

facilities, renowned technology experts

More than 1,000

Partnerships

with industry, academia, and government

Campus

3 campuses operating as living laboratories

Billion-Dollar Disasters by the Numbers (1980-2022)

8 Average number of **billion-dollar disasters per year** since 1980

15 Average number of **billion-dollar disasters per year** since 2012

22 Number of U.S. **billion-dollar disasters in 2020,** the most on record

50

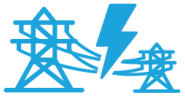
Number of states that have had **at least one billion-dollar disaster**

$2.275 trillion

Total cost of **332 billion-dollar disasters,** the total since 1980

8.2 million

Number of customers who **lost power in Hurricane Sandy,** 2012*



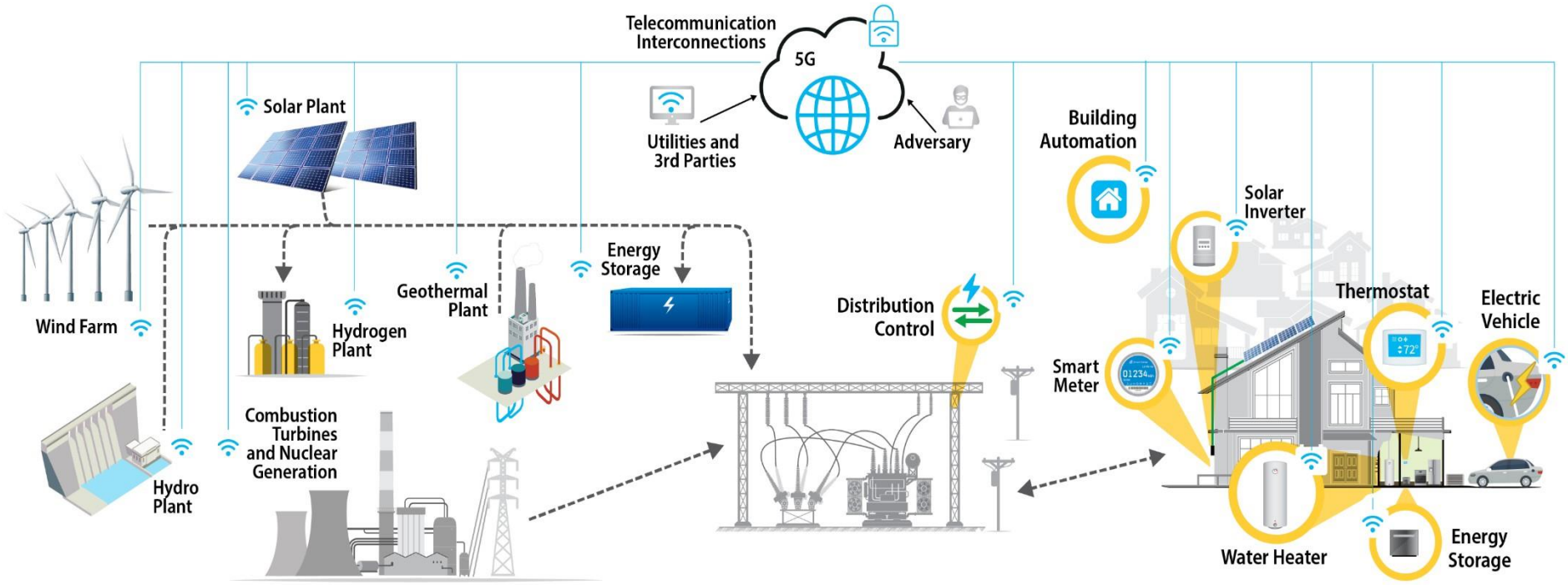
11 months

Duration of power outages in Puerto Rico following Hurricanes Irma and Maria in 2017

125+

Number of deaths in Texas caused or contributed to by the 2021 winter storm

*Source: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2022). https://www.ncei.noaa.gov/access/billions/, DOI: 10.25921/stkw-7w73



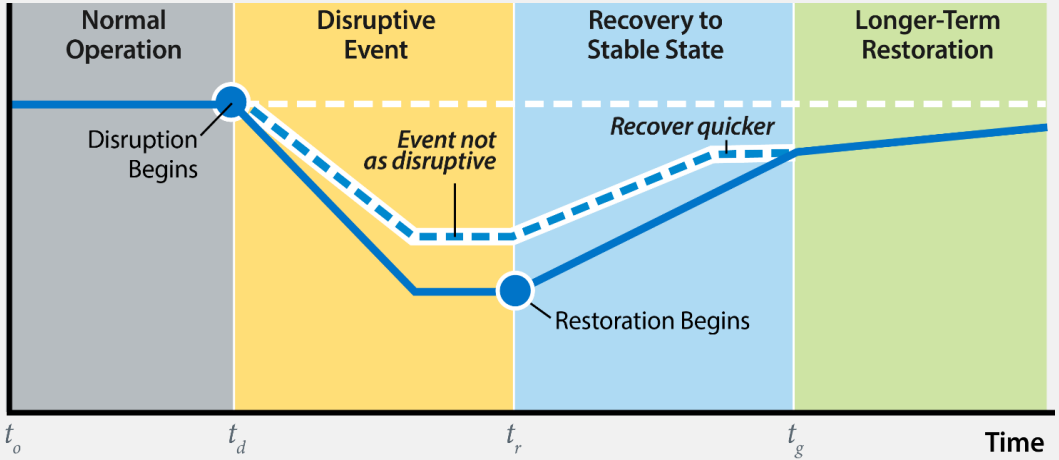
A New Frontier:

The grid is evolving to become more distributed, intelligent, and complex.

Coupled with aging infrastructure, the vulnerabilities of emerging energy systems to disruption are not yet well understood.

What is Resilience?

The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions *through adaptable and holistic planning and technical solutions*.*



* Hotchkiss, Eliza; Dane, Alex. 2019. *Resilience Roadmap: A Collaborative Approach to Multi-Jurisdictional Resilience Planning*. Golden, CO. National Renewable Energy Laboratory. *Graphic by NREL.*

Disaster Recovery and Resilience

NREL's disaster recovery work, largely through DOE and FEMA, has led to a deeper understanding of resilience and how it can be built into research across the laboratory.

NREL is currently providing expertise on 50 resilience projects, covering:

- Grid stability
- Community planning
- Capacity building
- Transportation development codes


Rebuilt LEED hospital in Greensburg, Kansas


Hurricane Sandy damage in New Jersey


Flood recovery in Galena, Alaska


Hurricane damage to a solar PV array in the U..S Virgin Islands

Historic Recovery Projects

2005

New Orleans, Louisiana

Sustainable building codes for rebuilding.

2006

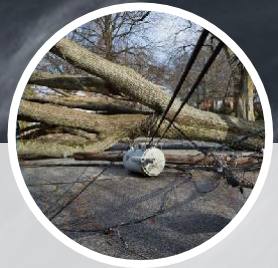
Greensburg, Kansas

Sustainable building codes for rebuilding and wind farm analysis for development.

2012

New York and New Jersey

Resilient rebuilding, energy efficiency, transportation and mobility, and sustainability.



2016

Oglala Sioux, South Dakota

Culturally appropriate capacity building for efficiency and renewable energy solutions.

2016

West Virginia

Technological review for economic development repurposing mine lands for renewable energy development enhancing economic stability.

2017

USVI and Puerto Rico

Integrating efficiency and renewables into the grid, developing microgrids, analyzing critical infrastructure, and ongoing technical assistance.

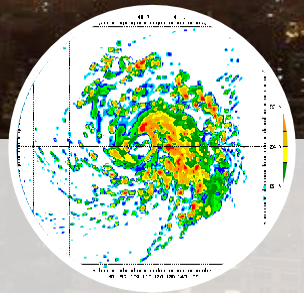
Key Research Areas for Resilience

Metrics

Performance based
Attributes based
Scale

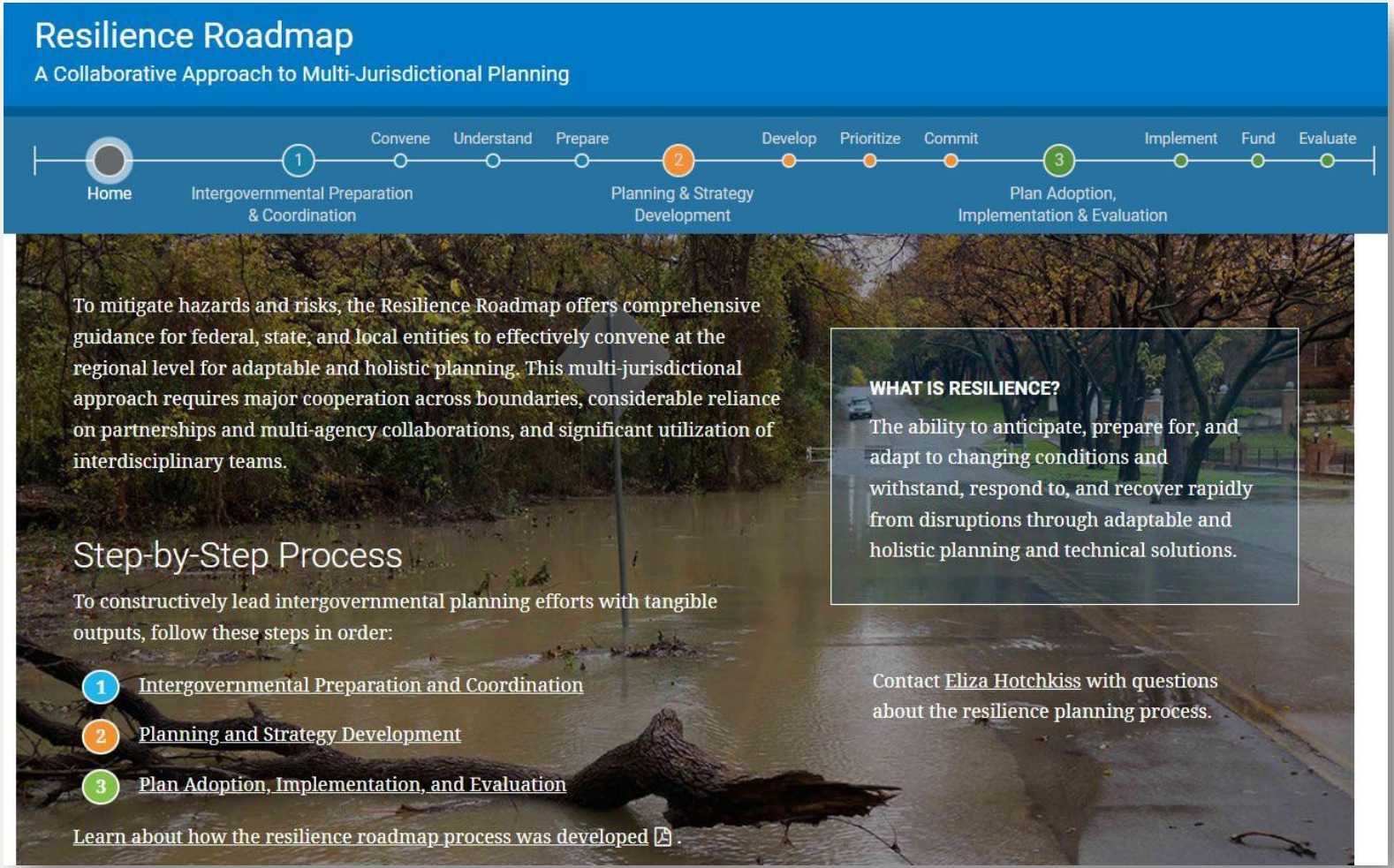
Value of Resilience

Price vs. Value
Investments
Return on Investment



Modeling

Grid simulation
Community infrastructure
Building performance



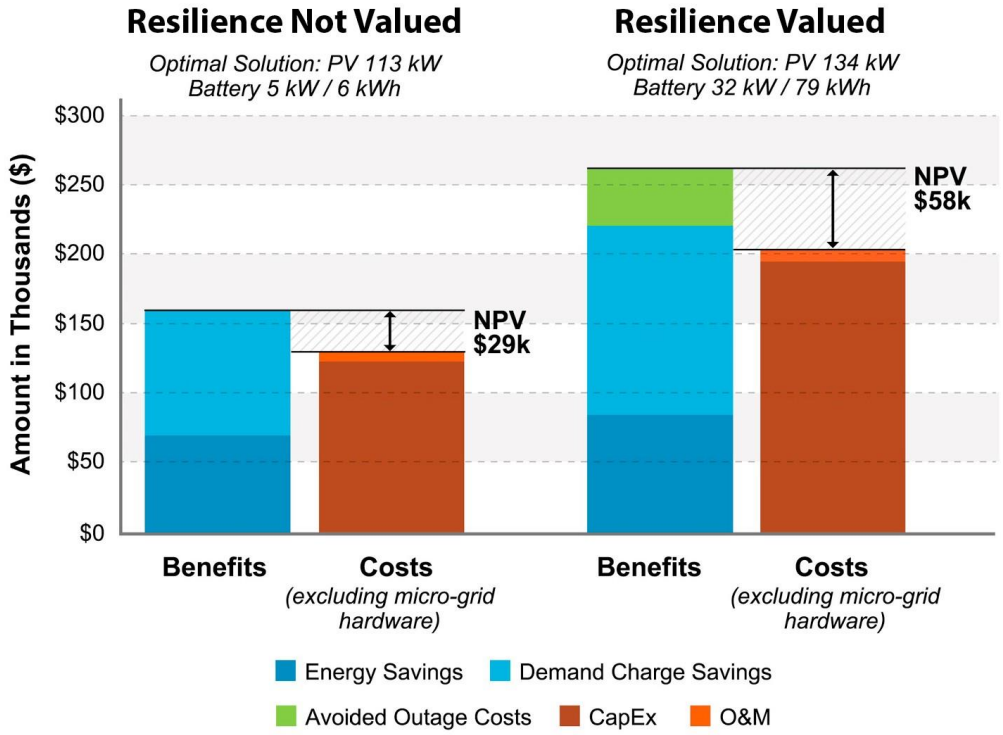
https://www.nrel.gov/resilience-planning-roadmap/

Resilience Valuation

Resilience investments often take the form of a cost-benefit decision, so we must be able to weigh the cost of an investment against the value, or benefit, it provides. NREL focuses on:

- How value of lost load evolves over time
- System-wide consequences due to interdependencies
- The potential for distributed energy resources to mitigate long-duration outages
- The associated impacts on societal welfare through health, safety, and the economy.

https://cdfc.nrel.gov/



Critical Facilities Mapping for States

Funded by DOE's State Energy Program for a nine-state cohort initially.

1

Prioritize Statewide Critical Facilities

Develop a spatial inventory of facility locations and identify highest-priority facilities for energy resilience investments using a combination of site-specific characteristics and county-level metrics.

2

Select One Facility for Energy Analysis

Work with stakeholders to select one high-priority facility in each state for in-depth onsite energy system analysis.

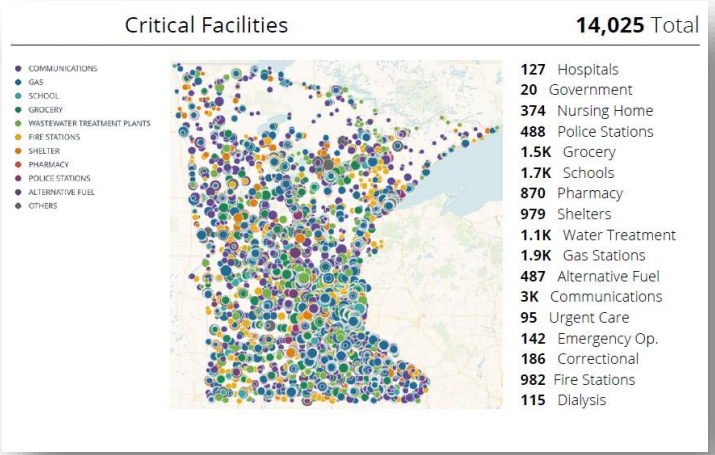
3

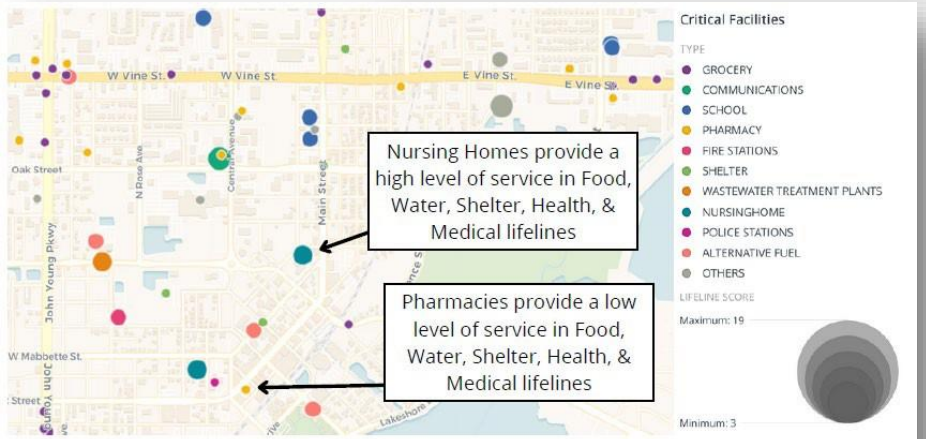
Identify Resilient Energy Solution for Facility

Collect energy load data for selected facility and use NREL's Renewable Energy Optimization (REOpt) - modeling tool to identify a cost-optimal onsite energy system to increase resilience.

Mapping Critical Facilities and Resilience Hubs

Using a prioritization process with stakeholder engagement can help identify areas for resilience hubs. Paired with ReOpt analyses systems can be sized for renewable energy + batteries for different loads and outage durations.





Critical facilities color-coded by type and sized according to Lifeline Scores.

Resources for Resilience

Resilience Roadmap for Resilience Planning
https://www.nrel.gov/resilience-planning-roadmap

Customer Damage Function Calculator for Valuing Resilience
https://cdfc.nrel.gov/

Technical Resilience Navigator: DOE FEMP funded NREL and PNNL to develop a detailed resilience assessment tool
https://trn.pnnl.gov/

Other Resources:
https://www.nrel.gov/security-resilience/
https://www.energy.gov/scep/state-energy-program

Thank You

Eliza Hotchkiss, Senior Resilience Analyst and Resilient Systems Design and Engineering Group Manager

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www.nrel.gov

NREL
Transforming ENERGY

Flood Recovery in Galena, Alaska

In May 2013, the **Yukon River overflowed its banks** with water and ballistic ice, severely damaging 90% of the homes and businesses in the remote Alaskan community of Galena.

The NREL Solution

NREL received funding from the Federal Emergency Management Agency to conduct site assessments that analyzed **the potential to adopt water and energy efficiency measures, deploy on-site renewable energy generation technologies, and prepare for future flooding.**

Impact

Renewable energy projects previously discussed by the town were able to be realized, with community input and **buy-in from the bottom up**. Adding green technologies has given Galena a greater degree of **energy independence.**

Sponsors: Federal Emergency Management Agency

Solar PV Storm Preparation Checklists for Puerto Rico

In 2017, **hurricanes Irma and Maria** left 1 million Puerto Rico residents without power. Assessments show that **much of the damage to photovoltaic (PV) systems could have been avoided** by taking relatively simple pre-storm preventative measures.

The NREL Solution

The storm-hardening checklists provide concrete actions to **assist PV owners and operators.** The guide describes the components of a PV system and lists **pre-storm measures** for utility-scale ground-mounted systems, distributed roof-mounted systems, and distributed ground-mounted systems.

Impact

Operational post-storm distributed PV systems could serve customers when the grid is damaged, and larger-scale PV systems can power essential services.

Sponsors: Federal Emergency Management Agency (FEMA), and DOE Office of Electricity

Questions?

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Thank you!

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