

# Building Energy Resilience



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Cooperative Association



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Tom Hughes  
State Hazard Mitigation  
Officer, Pennsylvania  
Emergency Management  
Agency; Lead, NEMA SHMO  
Subcommittee





**NEMA 2024 Mid-Year Forum | Washington, D.C.**

# **Energy Resilience Workshop**

## Puerto Rico's Moonshot Opportunity

**03.18.24**

**Manuel Laboy, PE, MBA**  
**Executive Director, COR3**  
**Governor's Authorized Representative (GAR)**





# Modern Infrastructure, Resilience and Sustainability are the foundations for Puerto Rico's Economic Development

Electrical System      Roads & Bridges      Water System

Health Facilities      Education      Public & Industrial Buildings      Parks & Recreation

## Public Assistance

### Permanent Work Sections 406 & 428

Repair, Restore or Replace Damaged Facilities after Natural Disasters

Coastal Erosion Measures      Soil Stabilization & Localized Flood Control

Energy Resiliency      Structural Resiliency

## HMGP

### Section 404

Mitigate Future Hazards and Build Climate Resiliency

## Public Assistance

### Permanent Work Sections 406 & 428

Obligated (Federal + Cost Share) for María, Earthquakes and Fiona Disasters

# \$28 Billion

## HMGP

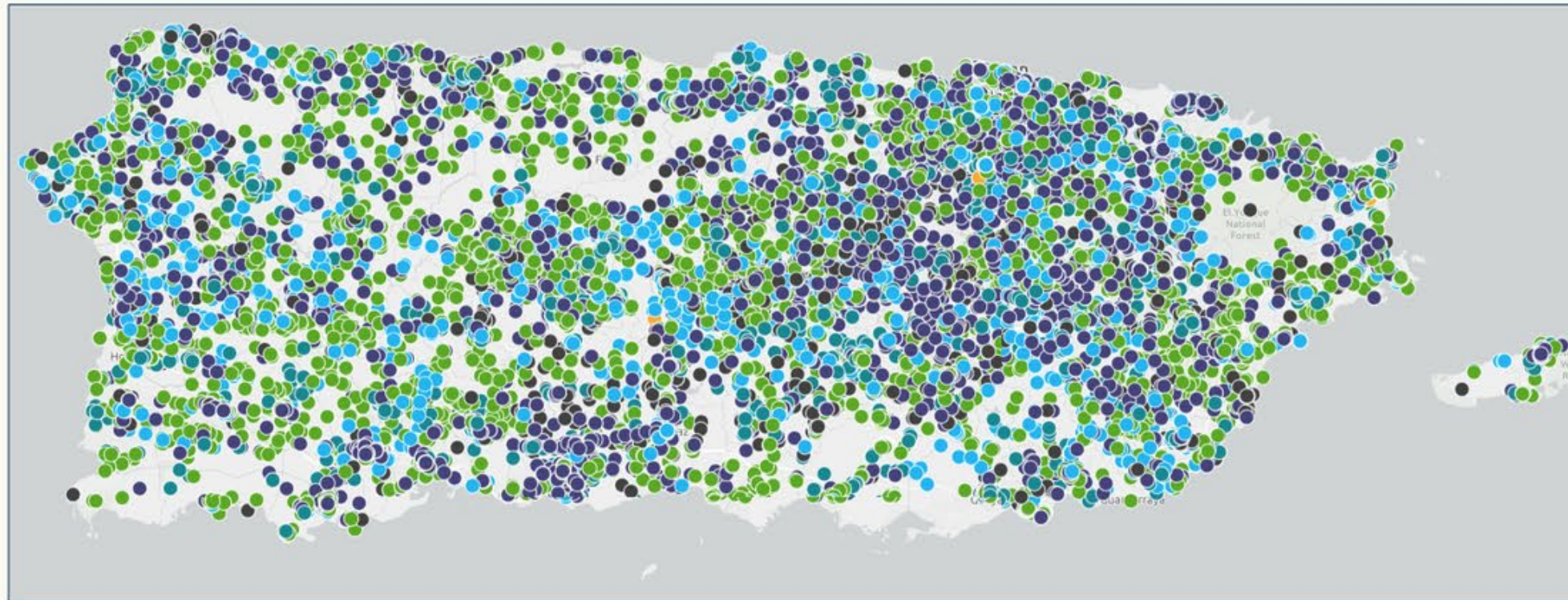
### Section 404

Allocated Funding (Federal + Cost Share) for Irma, María, Earthquakes, COVID and Fiona Disasters

# \$5 Billion



# Puerto Rico's Road to Long-Term Recovery and Resilience is Full Steam Ahead: María (2017), Earthquakes (2020) and Fiona (2022)

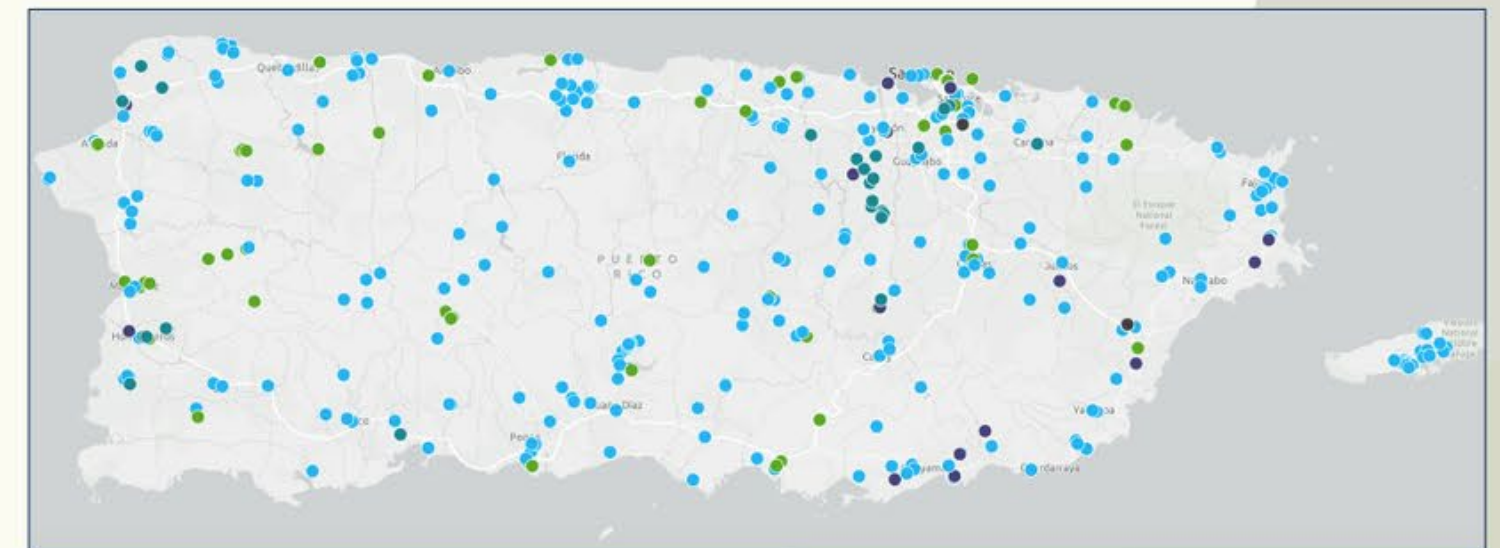


## Public Assistance (María, Earthquakes)

Permanent Work Sections 406 & 428 (>9,500 PW's, >24,000 DI's)



PA (Fiona) >800 PW's, >1,400 DI's



HMGP > 171 projects – Phase 1, Phase 2, Full



# **\$18 Billion FEMA Funding** under María DR (428/406) has been obligated and/or allocated for Puerto Rico's **Electrical Infrastructure**

## **COR3**

Recipient & Pass-Thru Entity

## **PREPA**

Sub-Recipient; Responsible for Water Assets and Hydro Power

## **LUMA Energy**

Agent acting on behalf of PREPA; Responsible for Transmission & Distribution O&M

## **Genera PR**

Agent acting on behalf of PREPA; Responsible for Legacy Generation Assets O&M





# Transmission & Distribution Projects

Public  
Assistance  
428/406

## Equipment & Materials

A Project Worksheet obligated to allow the procurement of Long Lead Items and critical components while construction projects are authorized by FEMA, from transformers to peaking units and battery energy storage.

## Advance Metering Infrastructure (AMI)

1.5 million customers; obtain accurate data; prevent power outages; allow Virtual Power Plant and Battery Emergency Demand Response projects.

## Energy Management System (EMS)

Monitors and controls the distribution of power across transmission system and support infrastructure; a crucial element to integrate renewables and battery storage

## Substations & Transmission Lines

Multiple projects to repair and build new substations, transmission centers, switchyards and transmission lines island-wide.

## One-Time Vegetation Clearance

A mitigation measure targeted to reduce 70% of current power outages due to hurricane María island-wide devastation.

## Micro-Grid for Vieques & Culebra

Installation of Solar PV + BESS to infuse reliability and resiliency to these Island-Municipalities.



# Generation & Renewable Energy Projects

PA & HMGP  
406/404



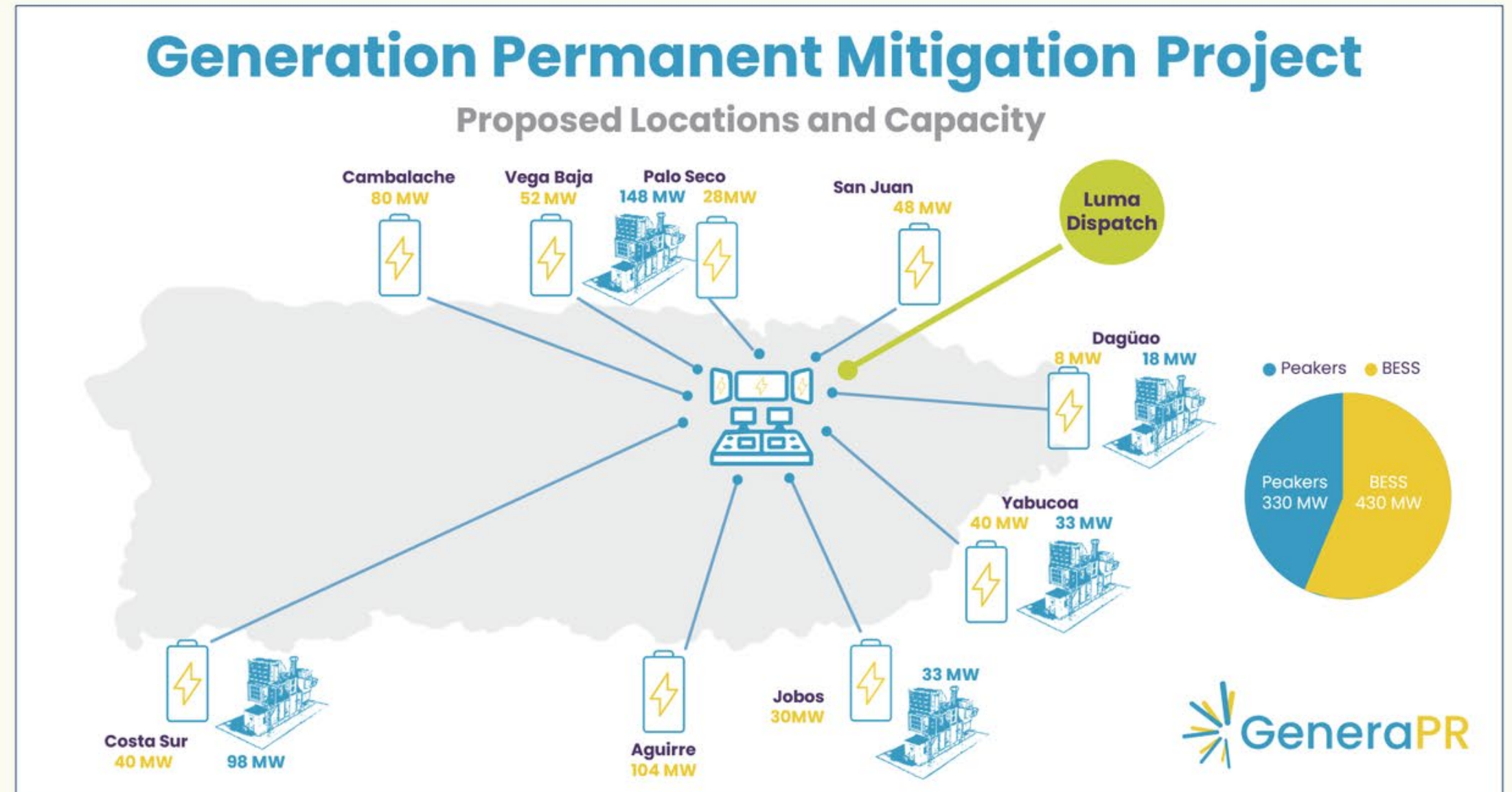
## Grid Stabilization Centers

### Blackstarts & Peakers

Four (4) Blackstarts and eleven (11) peakers to provide redundancy and synchronous condenser capabilities to mitigate risks from grid disturbances (voltage regulation, short-circuit strength). **Hydrogen-ready systems.**

### Battery Energy Storage

BESS will offer immediate response for fast spinning reserve, frequency, and voltage variations caused by disasters, mitigating the risk of blackouts and providing critical energy services during prolonged generation deficiencies.





# Generation & Renewable Energy Projects (cont.)

PA & HMGP  
406/404



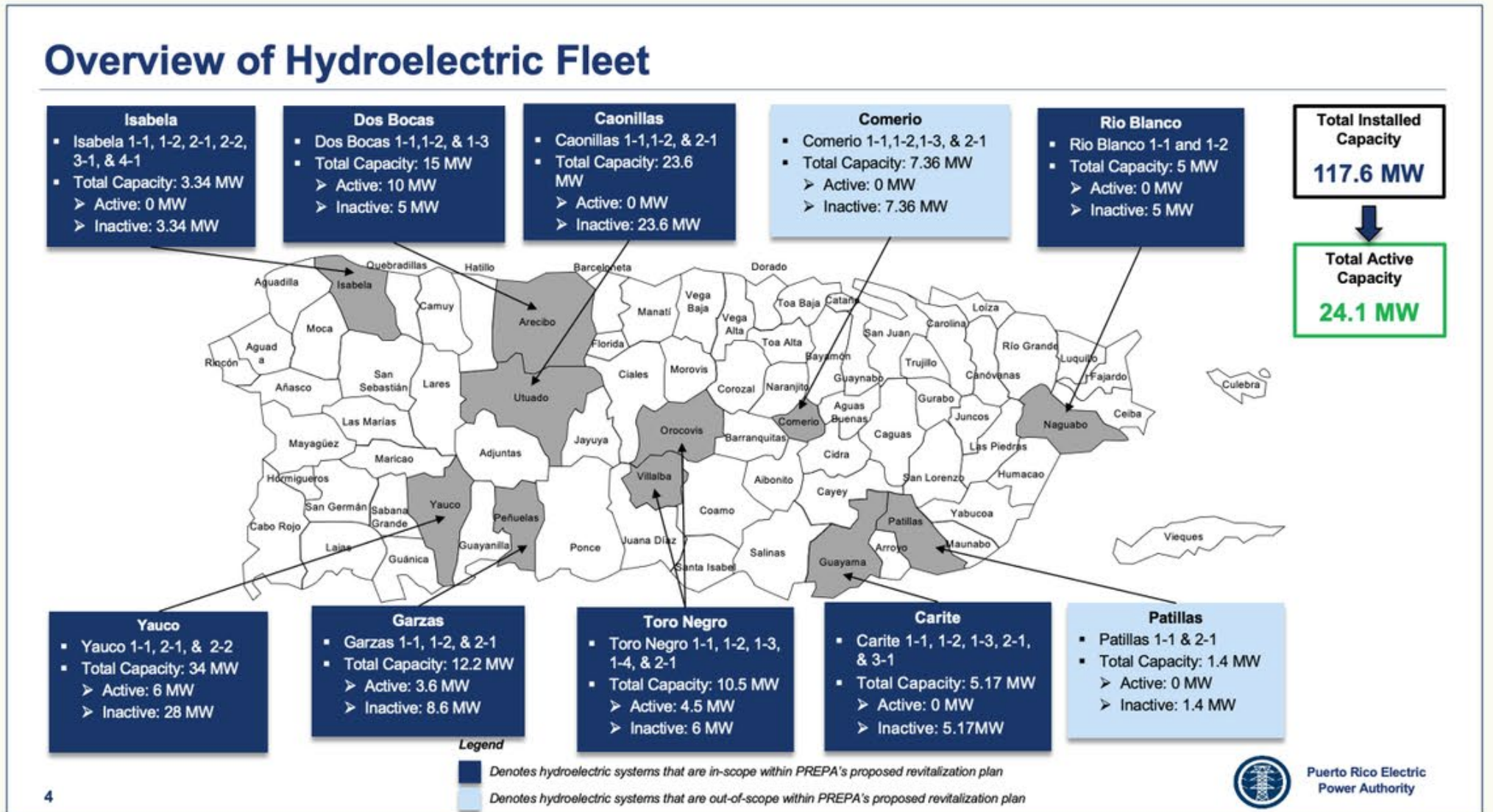
## Hydropower Fleet Retrofit (16 Facilities)

### Project #1

Ten (10) hydroelectric facilities to be enhanced to ensure hurricane protection, operational efficiency, and power supply reliability. This will enable PREPA to operate the plants in island-mode (as microgrids).

### Project #2

Six (6) hydroelectric facilities to be enhanced to ensure hurricane protection, operational efficiency, and power supply reliability. This will enable PREPA to operate the plants in island-mode (as microgrids).





# Generation & Renewable Energy Projects (cont.)

PA & HMGP  
406/404



## Ocean Thermal Energy Conversion (OTEC)

### 10 MW Offshore Plant

Mitigate loss of power and provide **baseload (24 hours/7 days a week) renewable/clean** electric power to critical infrastructure and facilities off the southeast coast of Puerto Rico (Yabucoa), where hurricane María entered in 2017. Conceptual design and cost based on Lockheed Martin/NAVFAC work.

### Natural Disaster Recovery

Marine Energy (like OTEC) could **aid natural disaster recovery in certain places like Puerto Rico, USVI, HI and Guam** by providing affected communities with a resilient source of energy. Supported by **NOAA, NREL and PNNL**. Aligned with recent **FEMA action** to help communities reduce greenhouse gas emissions, building back stronger, cleaner and more resilient.

CONTRACT REPORT  
CR11.002-OCN

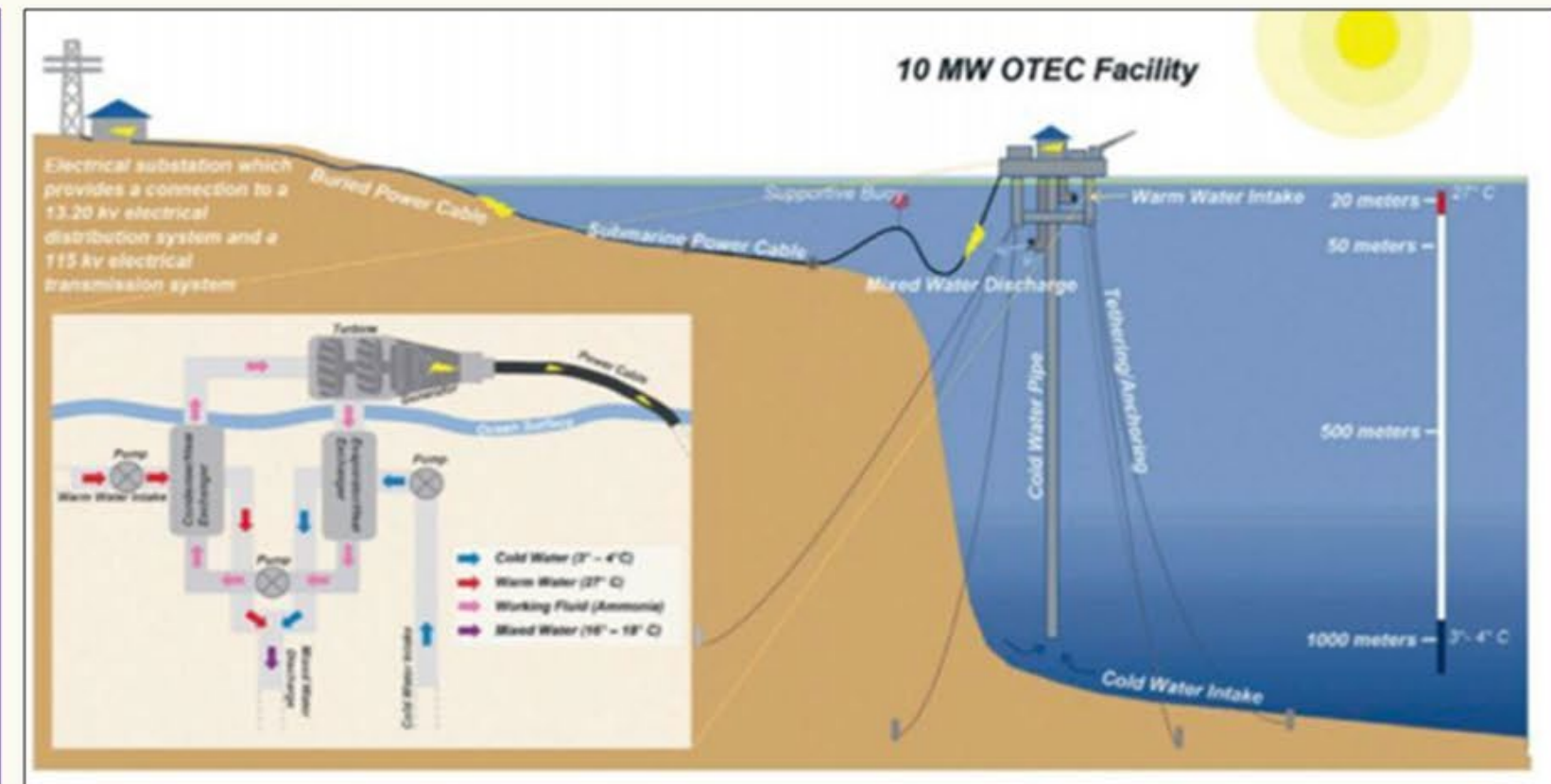
**NAVFAC Ocean Thermal Energy Conversion (OTEC) Project**

**OTEC System Design Report**  
Contract N62583-09-C-0083, CDRL A003

Prepared for:  
Naval Facilities Engineering Service Center (NAVFAC ESC)

Prepared by:  
Lockheed Martin MS2  
9500 Godwin Drive  
Manassas, VA 20108

Approved for public release. Distribution is unlimited.





**An Energy Integrated Resilience Plan** was requested by FEMA to ensure mitigation measures are articulated in a comprehensive manner

## Holistic Approach

Projects under Sections 404 & 406

## Multiple Assets

Generation, Transmission & Distribution, and Water

## Island-wide Benefits

Considers direct and indirect benefits across asset categories

## Reliability & Performance

Improvements to reduce vulnerability to future major disasters

Integrated Resilience Plan develop by:  
Central Office for Recovery, Reconstruction and Resiliency,  
Puerto Rico Electric Power Authority, Genera PR & LUMA Energy

March 7, 2024

# PUERTO RICO INTEGRATED RESILIENCE PLAN

*A Strategic Approach to Optimizing Puerto Rico Electrical Grid*

CENTRAL OFFICE FOR RECOVERY, RECONSTRUCTION AND RESILIENCY  
COR3

Autoridad de Energía Eléctrica

GeneraPR

FEMA

LUMA

## Draft Plan

Submitted to  
FEMA on 3/11/24



On February 7, 2024, **the Department of Energy** presented the final results for the **PR100 Study**

### **Federal Partnership**

Financed by FEMA, prepared by the National Renewable Energy Lab

### **Long Term Plan**

Roadmap to achieve 100% renewable energy power by 2050

### **State Policy**

In accordance with Puerto Rico Law 17 of 2019

### **Diversified Portfolio**

Utility scale and distributed energy; recognizes potential and resources for marine energy



**Puerto Rico Grid Resilience and Transitions to 100% Renewable Energy Study (PR100)**



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**Thank you!**



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# Being A Catalyst: The Tale of an Embedded State Energy Official

**Ben Bolton, NEMAA** | Senior Energy Programs Administrator





## **U.S. Department of Energy Acknowledgement and Disclaimer**

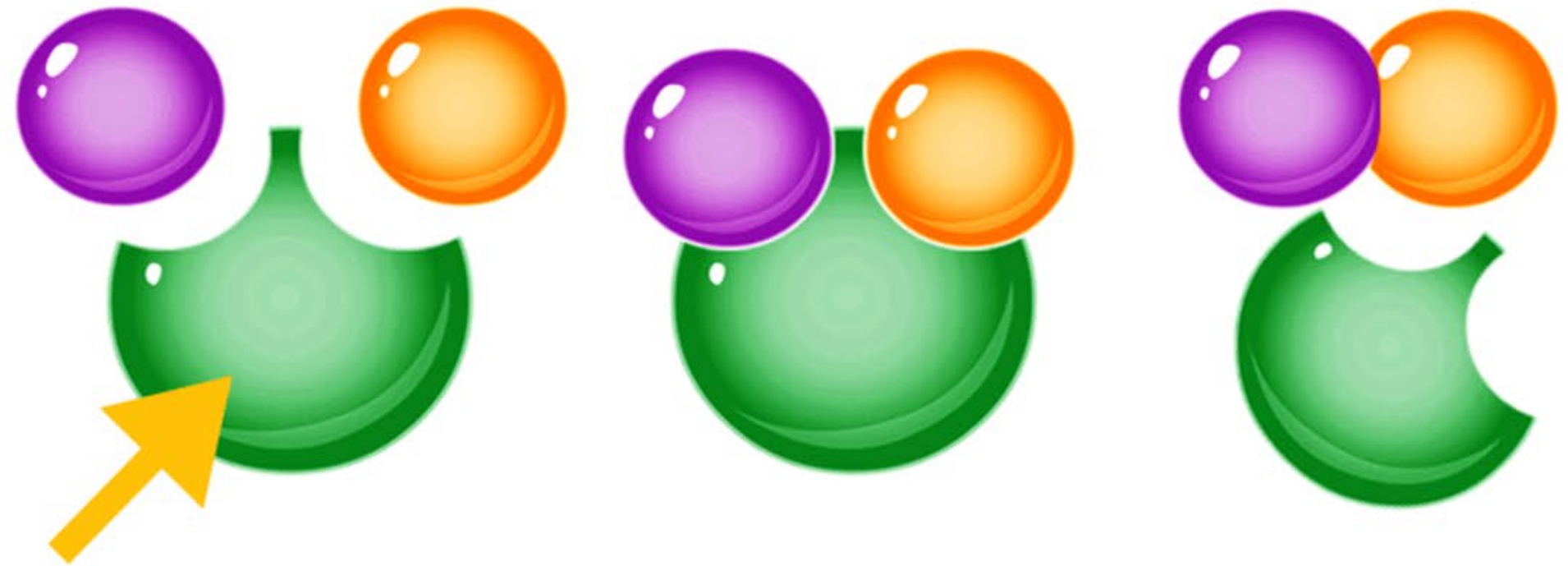
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**Disclaimer:** The information, data, or work presented herein was funded in part by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.



# Be a Catalyst

A substance that speeds up a chemical reaction by reducing the activation energy



**catalyst**  
GameSmartz

Source: Gamesmartz.com



## Colonial Pipeline Leak in September, then October 31<sup>st</sup> explosion

NEWS

### Emergency Declaration Made To Avoid Petroleum Supply Disruptions

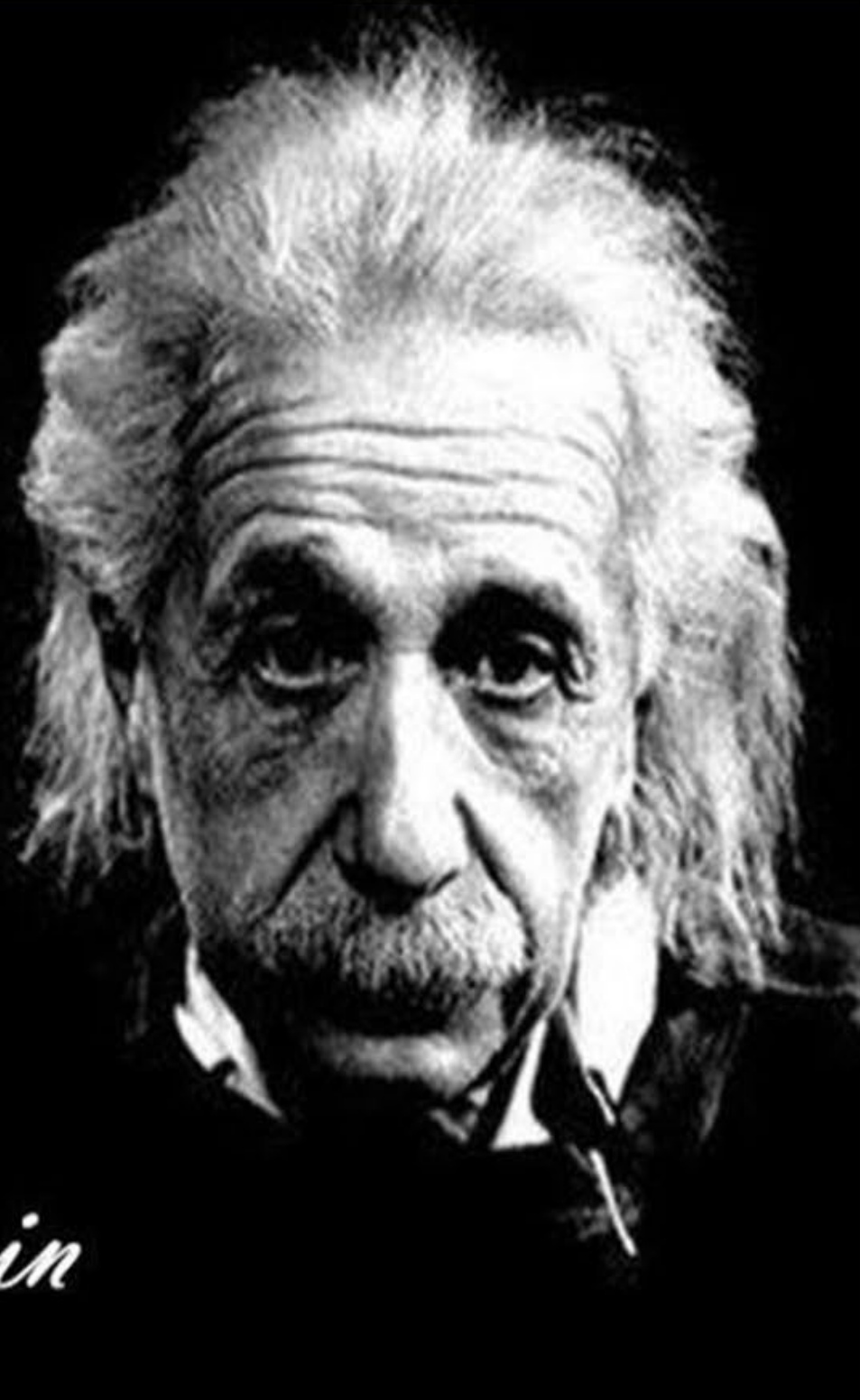


Several injured in explosion near site of AL gas leak



WE CANNOT SOLVE  
OUR PROBLEMS WITH  
THE SAME THINKING  
WE USED WHEN  
WE CREATED THEM

*~ Albert Einstein*

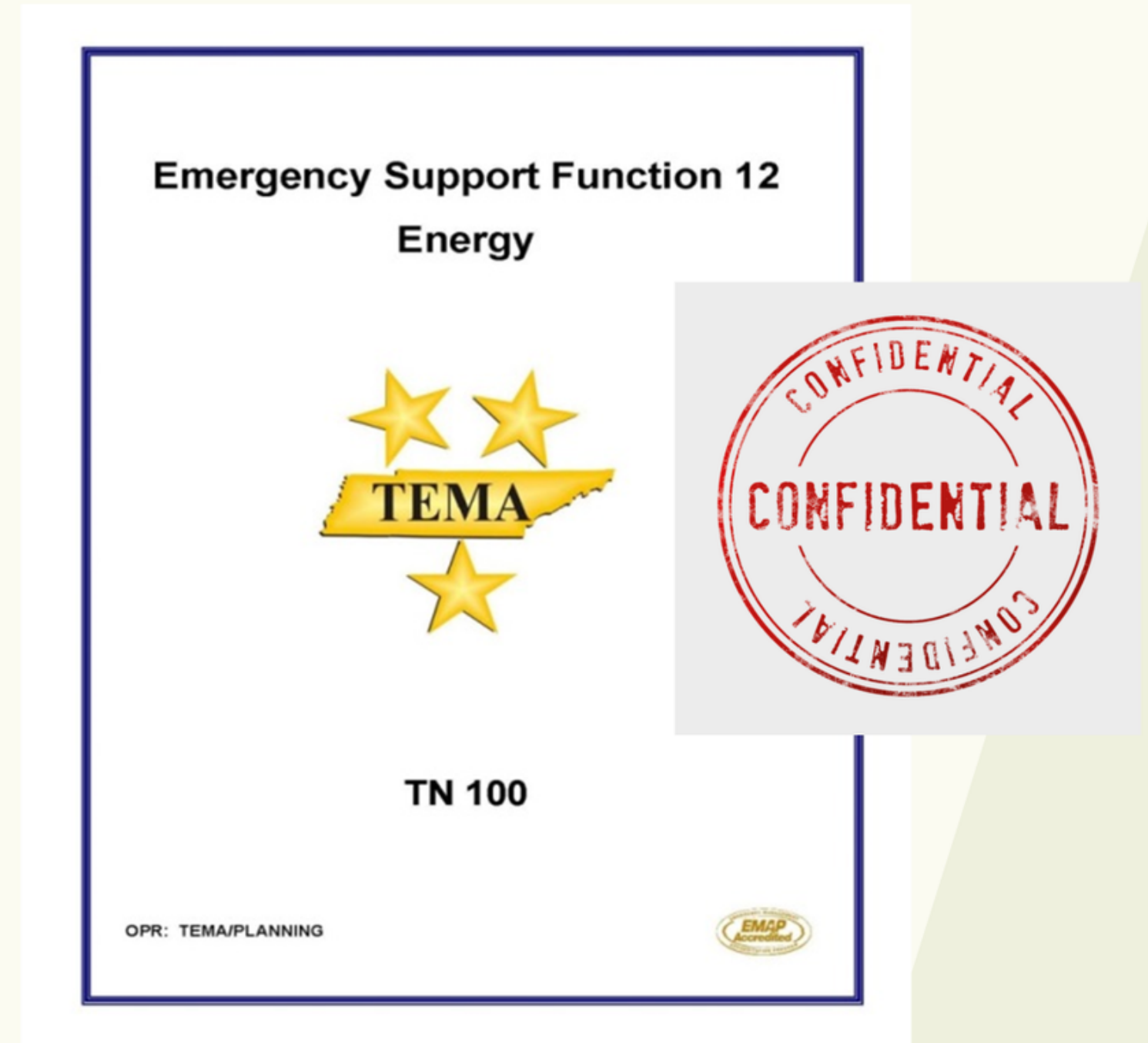


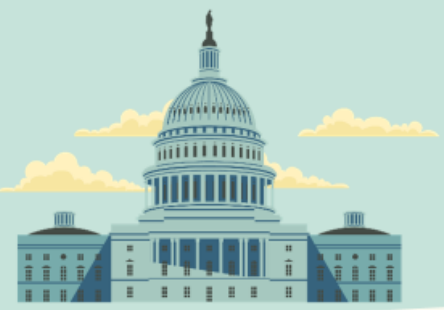


## Energy Security Legal Authority & Confidentiality Clause

### Tennessee Code Annotated:

- 4-3-510 The Office of Energy Programs has the duty and responsibility to...
  - (5) promote state and local energy emergency preparedness in coordination with other appropriate state agencies, such as the military department;
- 4-3-513 Office of Energy Programs -- Set-aside program for petroleum products
- 4-3-514 Office of Energy Programs -- Additional powers – Confidentiality
  - (b)(1) The office shall maintain the confidentiality of all proprietary information it may acquire.





## Energy Security Program 101

### Energy Security Plan

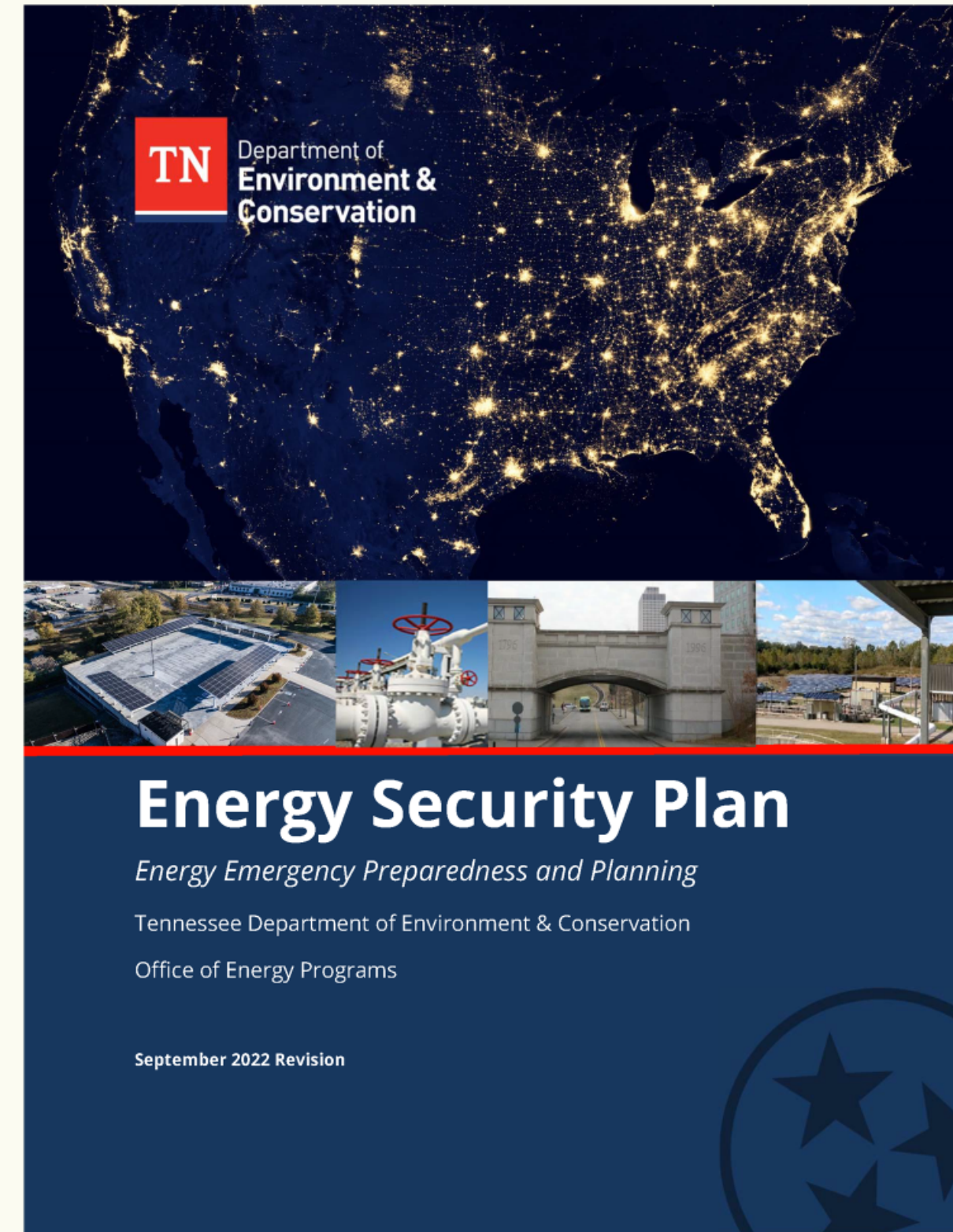
Facilitate energy emergency preparedness and planning to create a rapid response capability for recovery from disasters.

- Outlines the State's responsibilities during an energy emergency, and the coordination of federal and State resources, when required.
- 2022 Revision: Cyber, All Hazards, Mitigation, Risk Profile
- New Infrastructure Investment and Jobs Act requirements. [Section 40108](#)

### Petroleum Shortage Response Guidance

Provides plan to manage a motor fuel shortage with the least disruption to the economy.

- Modular with contingency options





## Energy Security Program 101

A great program relies on

- Relationships
- Training
- Planning
- Responding

**“The challenge is the future doesn’t look like the past.”**

- Randall Spalding-Fecher, energy advisor





## Mission Moon Pie, 2019

Success Stories

# Southeastern States Plan for Emergency Response and Workforce Development



### Fuel Disruption Tabletop Exercise 70 participants

- 4 Federal agencies
  - DOE, TVA, FMCSA, CISA
- 6 State agencies
- 7 local governments
- 5 private sector fuel partners
- 3 NGOs
- 2 PIOs

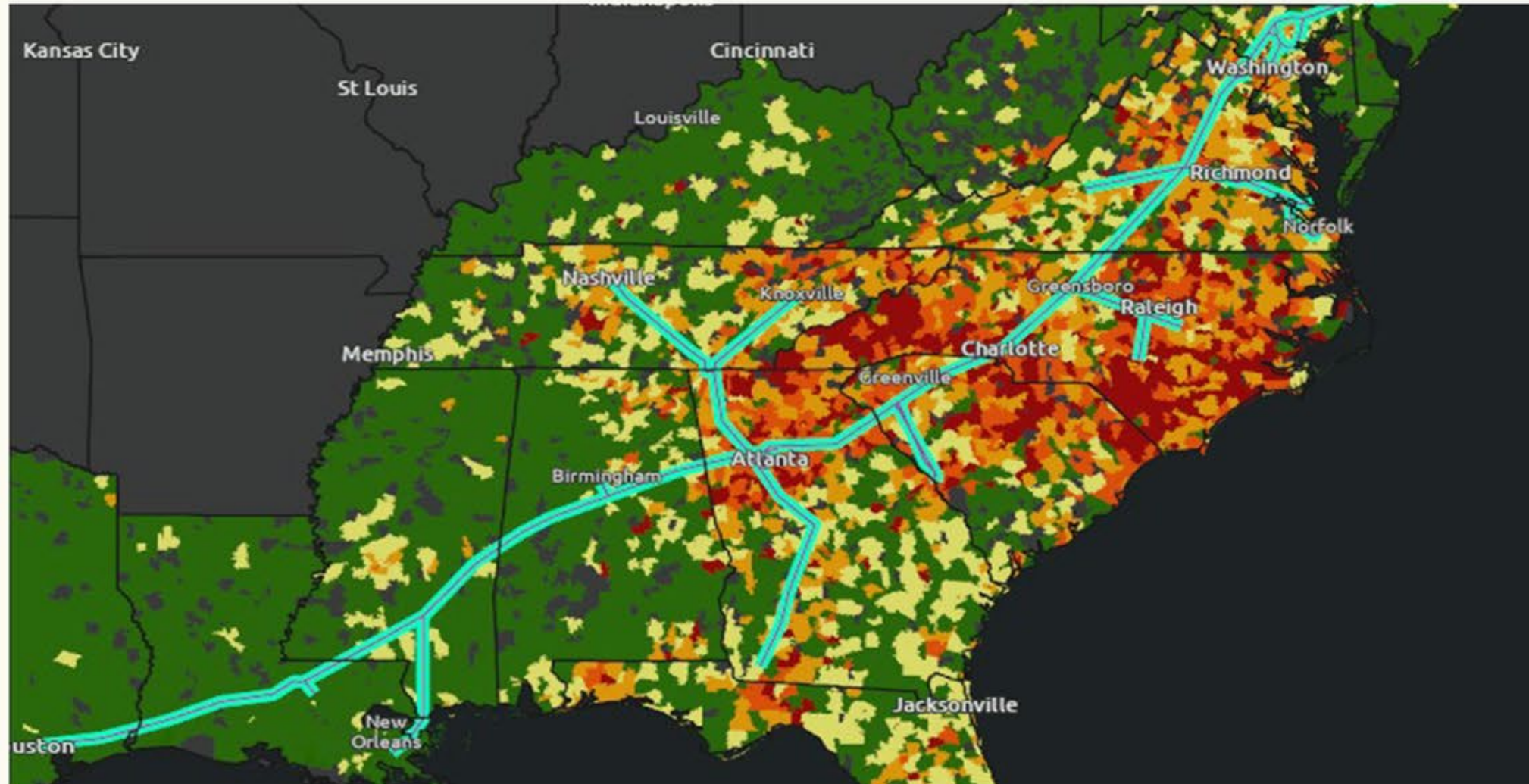
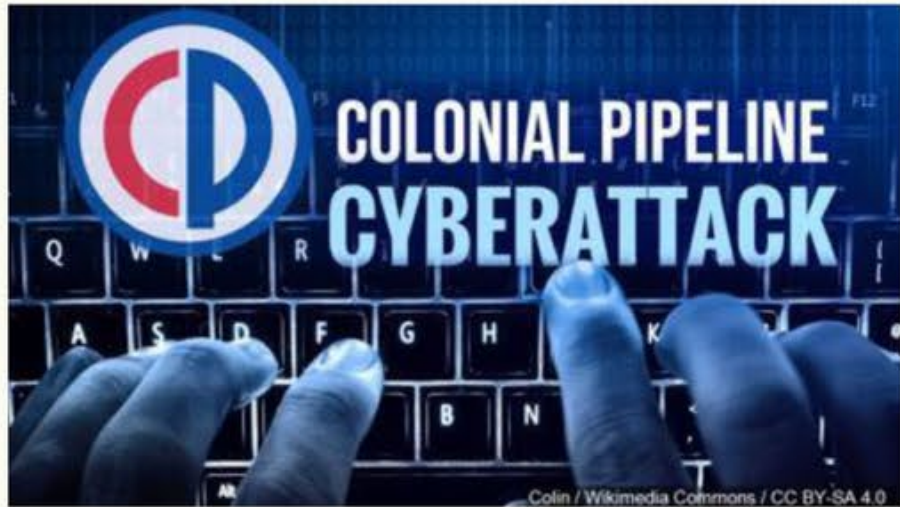
State Energy Officials from 5 states

SitMan and materials available to other states upon request.



# “Nashville suffered less than regional cities throughout Colonial Pipeline shutdown”

-Janey Camp, P.E. Ph.D, Vanderbilt University Center for Transportation and Operational Resiliency





# Regional Messaging

↳ Governor Ralph Northam Retweeted



**Virginia Department of Emergency Management** @VDEM · 3h

Remember when it wasn't a good idea to panic buy toilet paper last year? Please don't do it with gas now. This can create spot shortages at stations, which is what we DON'T want to happen. Colonial Pipeline hopes to resume normal operations soon.



AAA Mid-Atl VA News and 2 others

77 659 1.1K



**T\_E\_M\_A** @T\_E\_M\_A · 2h

Please don't panic buy gas. This can create shortages at stations. Only buy what you need and NEVER use unapproved containers for fuel.

**US Consumer Product Safety Commission** @USCPSC · 5h

Do not fill plastic bags with gasoline.

[Show this thread](#)



**Governor Roy Cooper** @NC\_Governor · May 11

I have talked today with federal officials including Energy Secretary Jennifer Granholm and we have a full court press to get the Colonial Pipeline back up and fully operating quickly. Report price gouging and please don't rush to top off your tanks. – RC

295 836 2.7K



**Governor Kay Ivey** @GovernorKayIvey · May 11

Spoke w/ @ENERGY earlier re: the #pipelinecyberattack Folks, it should be operational in a few days. Please do not fill up your car unless you need to and do not fill multiple containers. Overreacting creates more of a shortage. Please use common sense and patience! #alpolitics

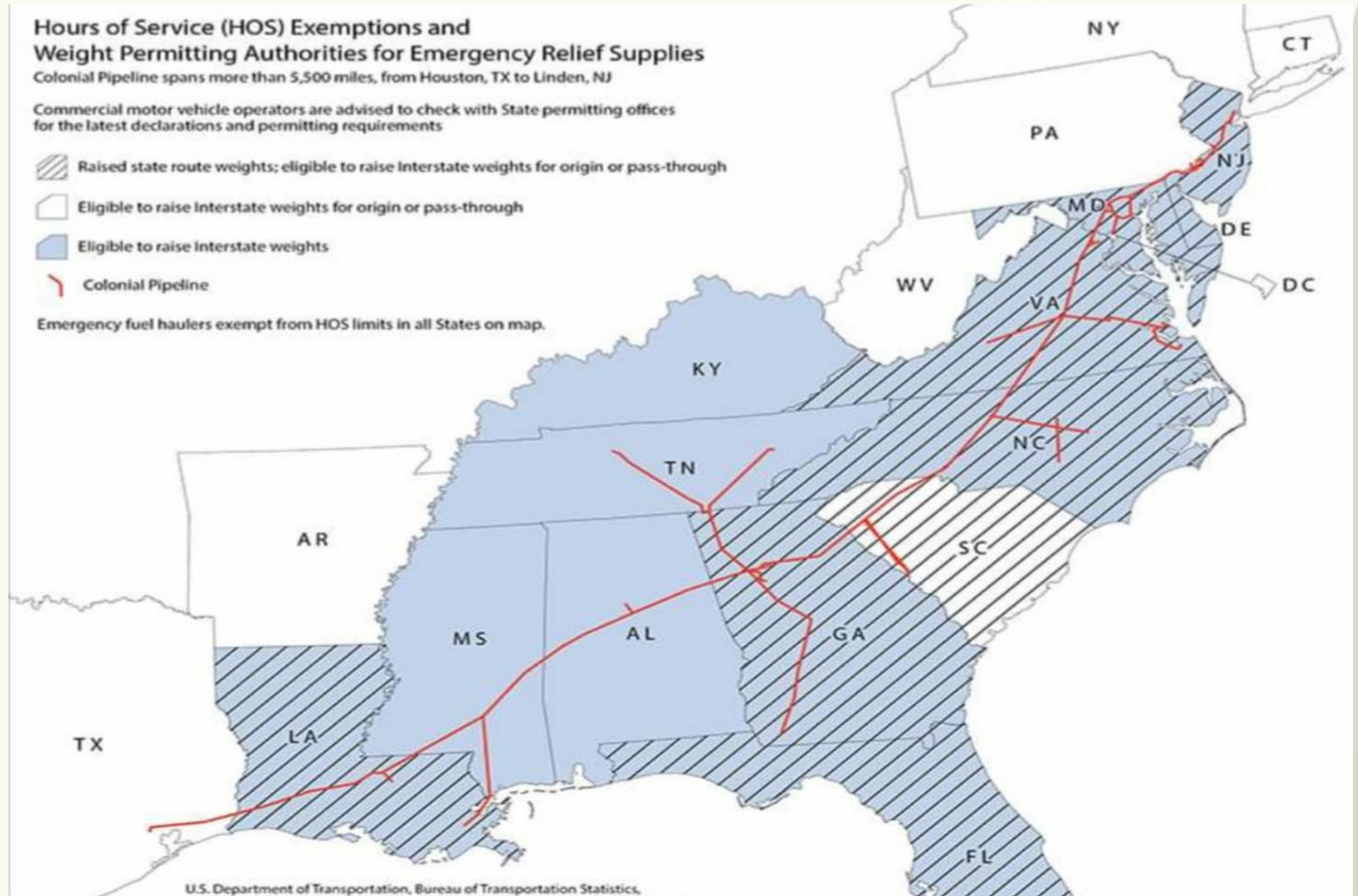
50 357 726

**GA AG Chris Carr** @Georgia\_AG · May 11  
CONSUMER ALERT  
@GovKemp has declared a State of Emergency as a result of the petroleum shortage from the May 7, 2021 cyber-attack on the Colonial Pipeline.





# Regional Response





# Regional Petroleum Shortage Collaborative

## NEMA, NASEO, and DOE facilitated

- Western region states developed a petroleum collaborative to respond to energy emergencies
- Southeast and Midwest developed same in 2022-2023.

## NASEO Petroleum Shortage Resources

<https://www.naseo.org/petroleum-shortage-response-planning>

MIDWESTERN PETROLEUM SHORTAGE RESPONSE

## COLLABORATIVE REGIONAL FRAMEWORK

September 2023

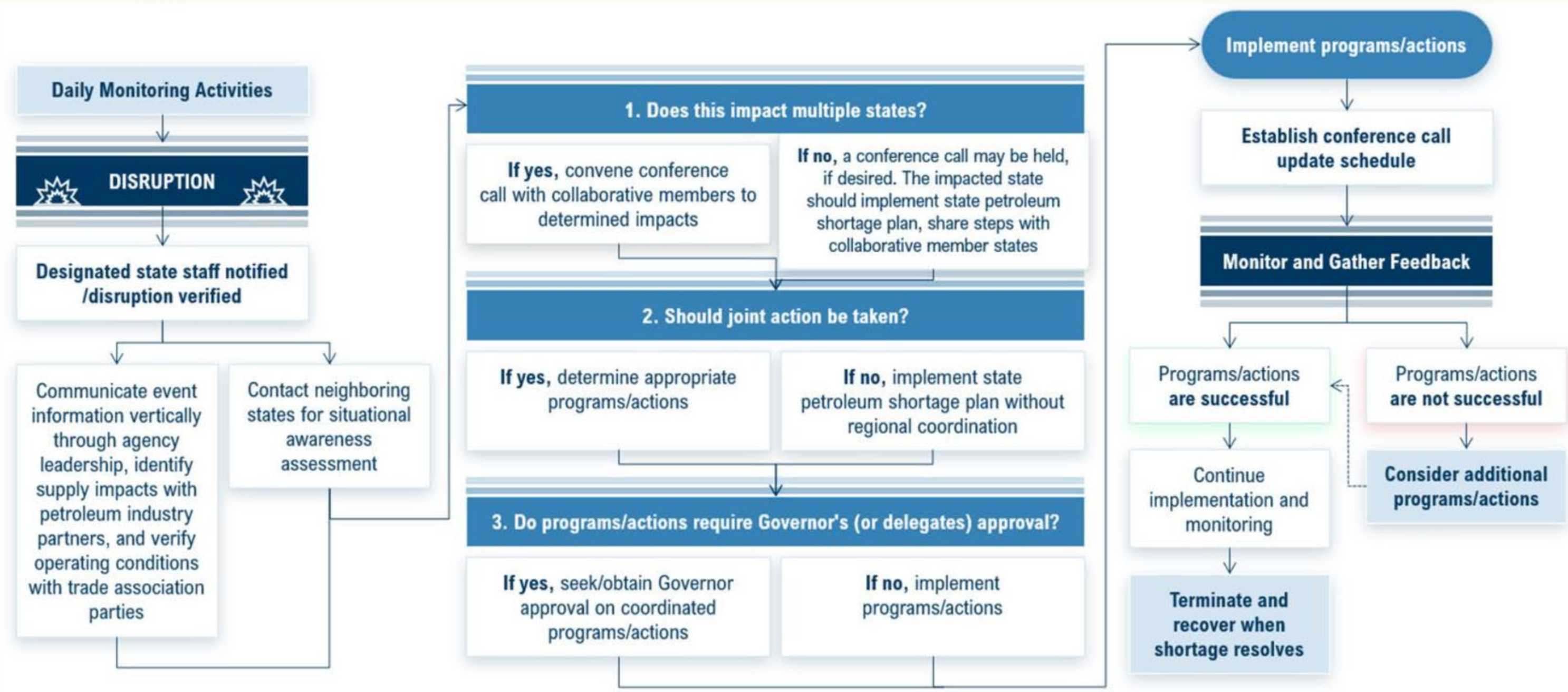


U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Cybersecurity, Energy Security,  
and Emergency Response

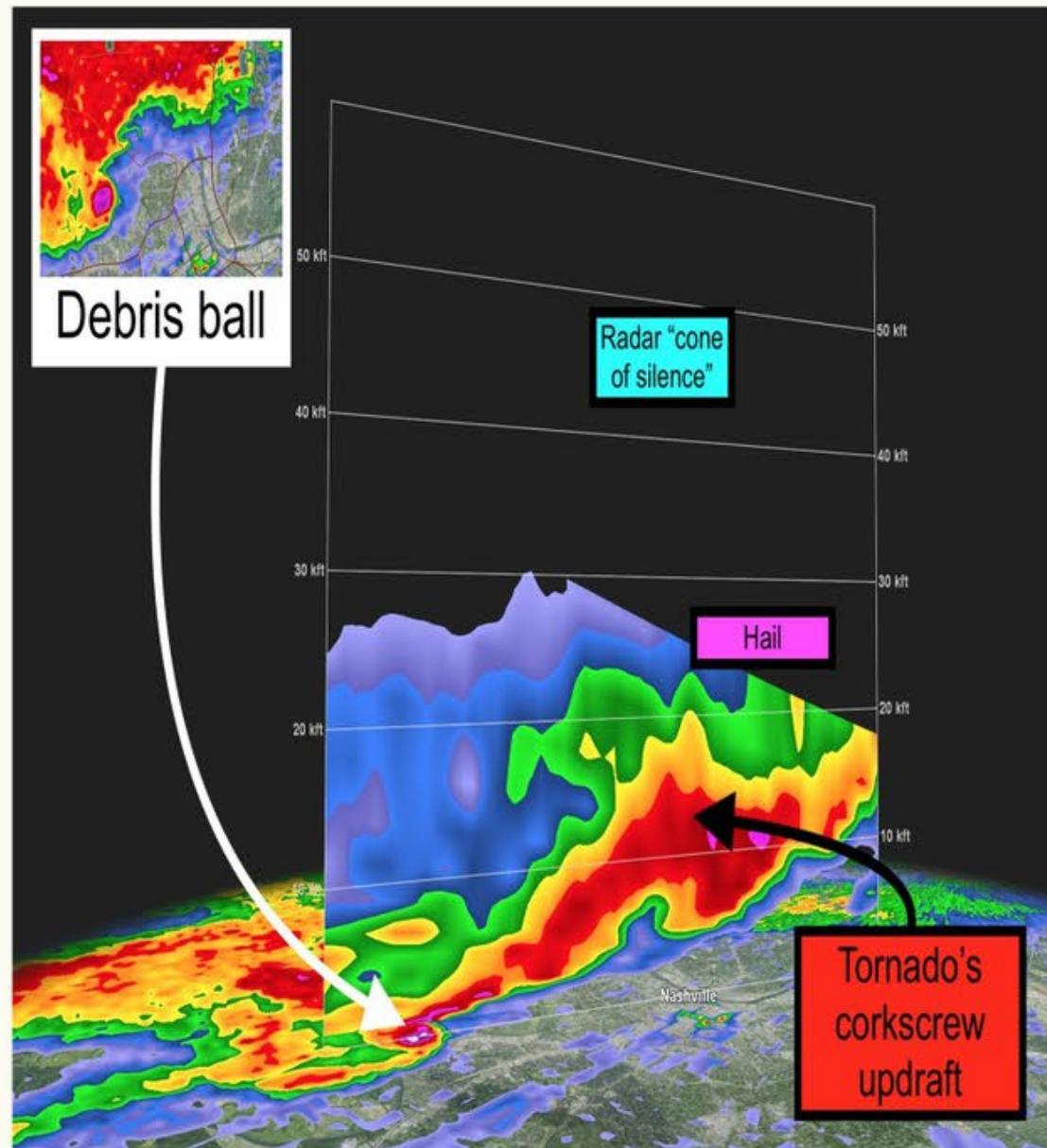


# Regional Coordination for Response





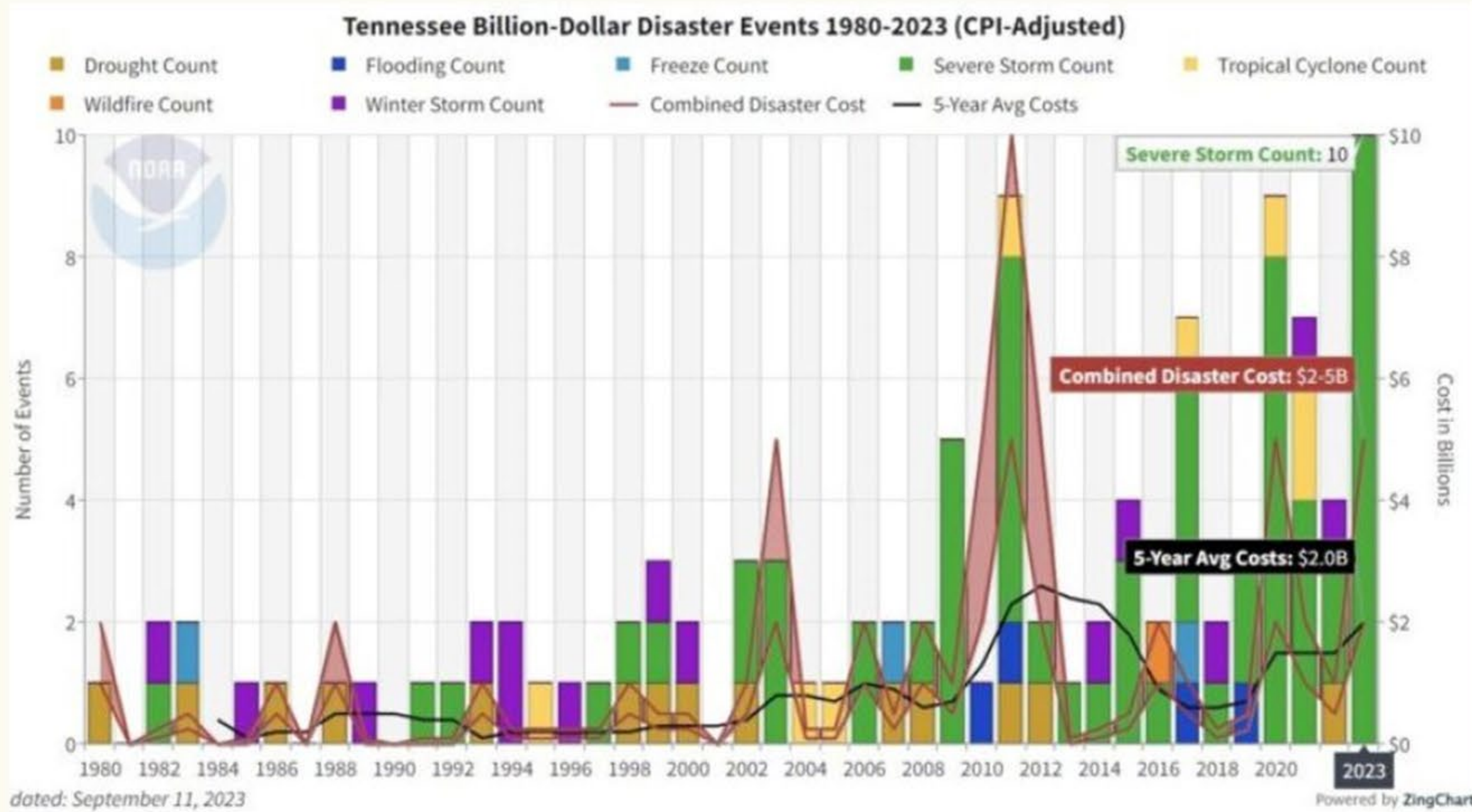
# March 3<sup>rd</sup> 2020 Tornadoes



TVA transmission tower extracted from the Cumberland River. (TVA)



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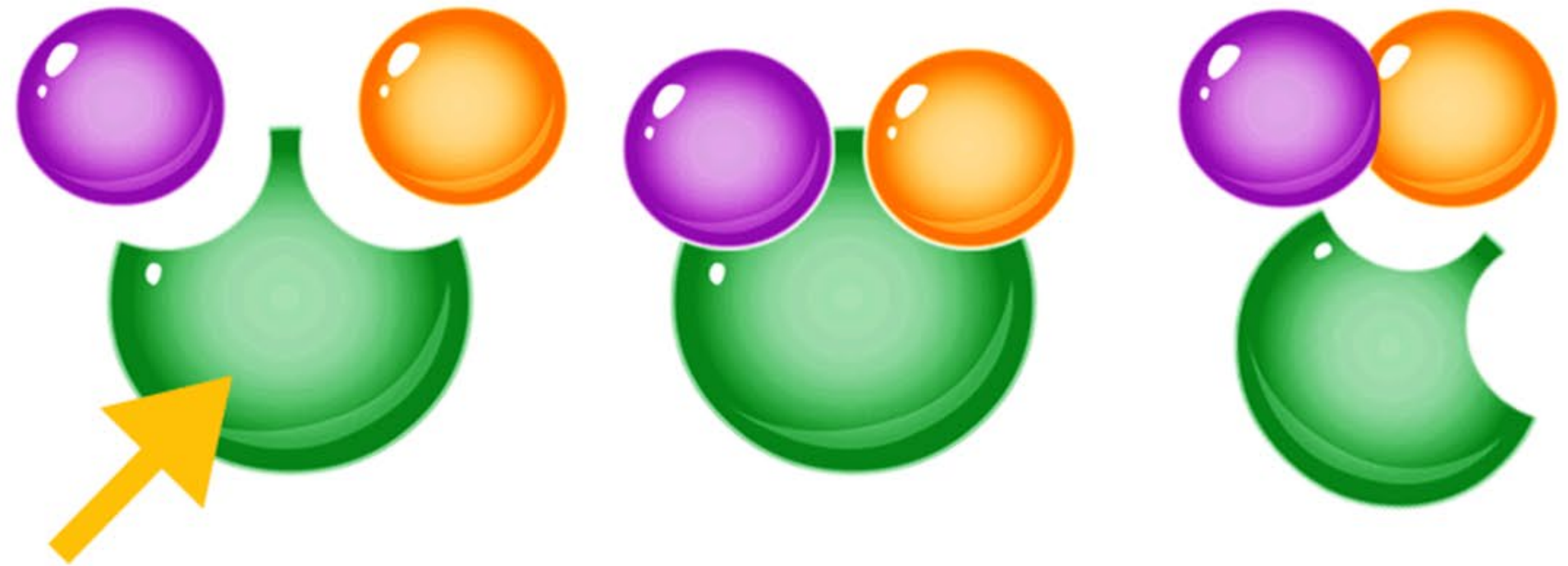


In 2021, the National Oceanic and Atmospheric Administration (NOAA) determined that Tennessee endured six (6) different billion-dollar disasters caused from severe storms, hurricanes, and winter weather. One of those included the catastrophic torrential rain and flooding event in Waverly, Humphreys County, that took the lives of 20 Tennesseans that day.



# Be a Catalyst

A substance that speeds up a chemical reaction by reducing the activation energy



**catalyst**  
GameSmartz

Source: Gamesmartz.com



# Ways to Work with State Energy Offices

## Examples

- DOE Energy Sector Monthly Brief
- Winter Storm Heather TDEC Water – After Action Seminar
- Backup generator request form template
- Energy/Fuel Myths Busters
  - Rumor control: TVA “Outage”
- Funding programs – braiding funds
- Private Sector Stakeholders – power/grid brief
- Electric Vehicles (EVs) – power, EV chargers, disposal, fire
  - Training for Fire Academy
- Mitigation/Resilience
  - Technical Assistance for BRIC projects – DOE Labs
  - RNG project, permitting, resilience
  - Industrial Assistance Center evaluations
  - U.S. Army Corps of Engineers generator evaluation



# What We Can Do



## Data Tracking & Monitoring

- Energy profile
- Capacity and flows
- Critical infrastructure
- Threats and hazards and related risk



## Authorities & Responsibilities

- Emergency declarations and waivers
- Connection to other state plans
- Emergency electrical procedures
- Petroleum shortage plans
- Federal frameworks (e.g., National Infrastructure Protection Plan, National Response Framework)

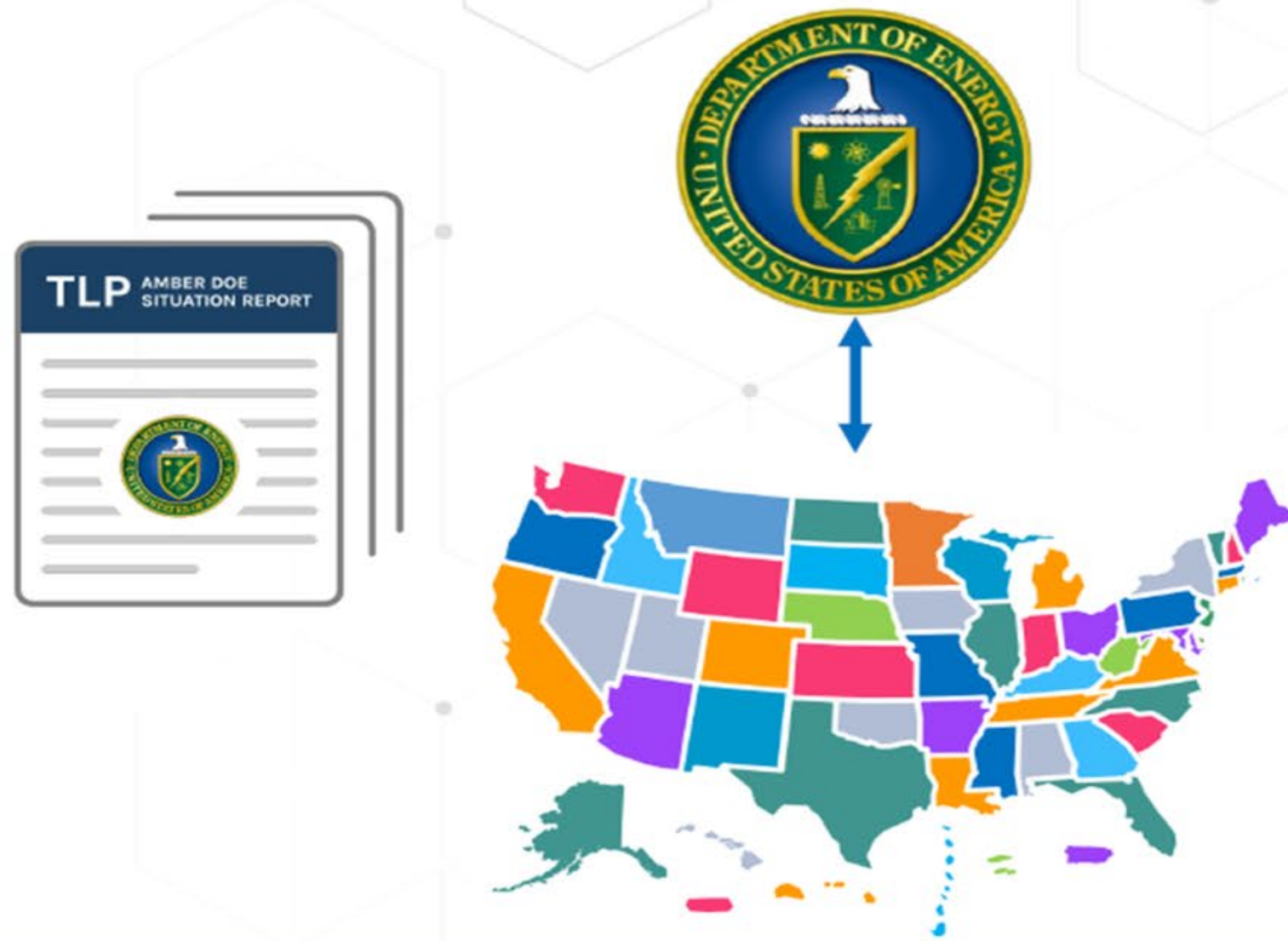


## Contacts & Coordination

- Local governments
- General public
- Other state agencies
- Neighboring States
- Petroleum suppliers
- Gas and electric utilities
- Distribution companies
- Industry associations

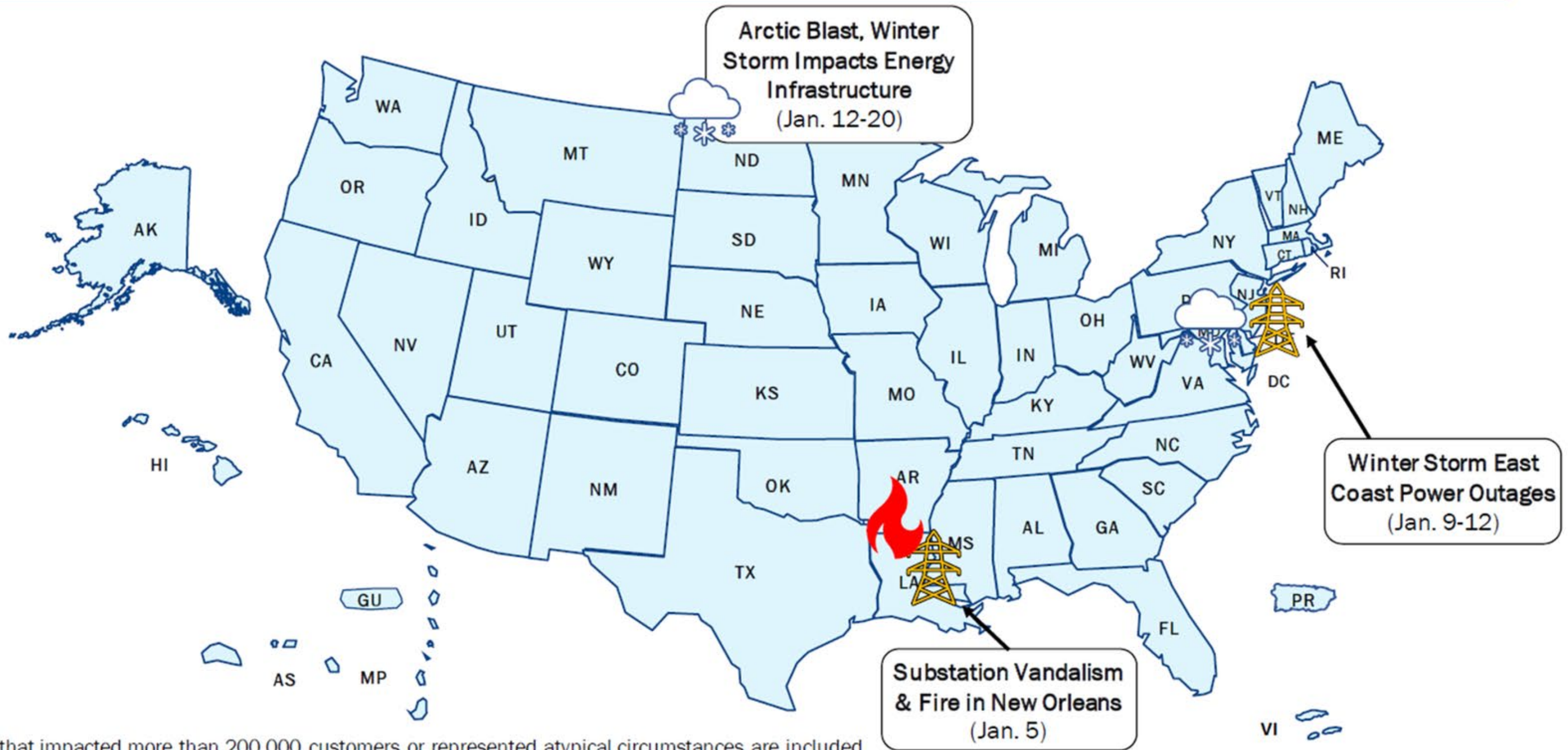


**Energy Emergency Assurance Coordinator (EEAC) Program** facilitates 2-way information sharing between DOE and states leading up to and during an energy disruption or emergency





# January 2024 Energy Events Overview



Events that impacted more than 200,000 customers or represented atypical circumstances are included.



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## Energy Waivers Library

Office of Cybersecurity, Energy Security, and Emergency Response

<https://www.energy.gov/ceser/energy-waivers-library>

	CATEGORIES			
	Production and Supply	Transportation and Distribution	Fuel Use	Clean Up and Event Recovery
GRANTING AGENCY	Department of Energy	Federal Power Act Section 202(c)		
Department of Homeland Security		Jones Act for Maritime Commerce		
Department of Transportation		<ul style="list-style-type: none"> <li>Pipeline Emergency Special Permits</li> <li>Driver Hours of Service Requirements</li> </ul>		<ul style="list-style-type: none"> <li>Hazardous Materials Regulations for Oil and Hazardous Materials Incidents</li> <li>Waivers of Drone Regulations</li> </ul>
Environmental Protection Agency	Generator-Related Emissions Regulations	Emissions Regulations at Distribution Terminals	<ul style="list-style-type: none"> <li>Reformulated Gasoline (RFG) Requirements</li> <li>Gasoline Reid Vapor Pressure (RVP) Regulations</li> <li>E15 RVP Regulations</li> </ul>	
Federal Energy Regulatory Commission		Emergency Prioritization of Pipeline Shipments		
Internal Revenue Service			Red Dye Diesel Regulations	
Multiple Agencies	Defense Production Act			



## **Critical Facility Infrastructure Survey**

Collaborative with TEMA and TN Safety & Homeland Security

- Pilot 3 counties, 1 in each region
- Local EMA Directors and staff complete
- Integrate with Hazard Mitigation Planning process
- Reviewed every 3 years
- Involves all 95 counties
- U.S. DOE EAGLE-I data layers

Central U.S. Earthquake Consortium (CUSEC) Critical Infrastructure Template, ArcGIS

<https://cusec.maps.arcgis.com/home/item.html?id=8f80ff61024c41a989c04f2e187c2bc>



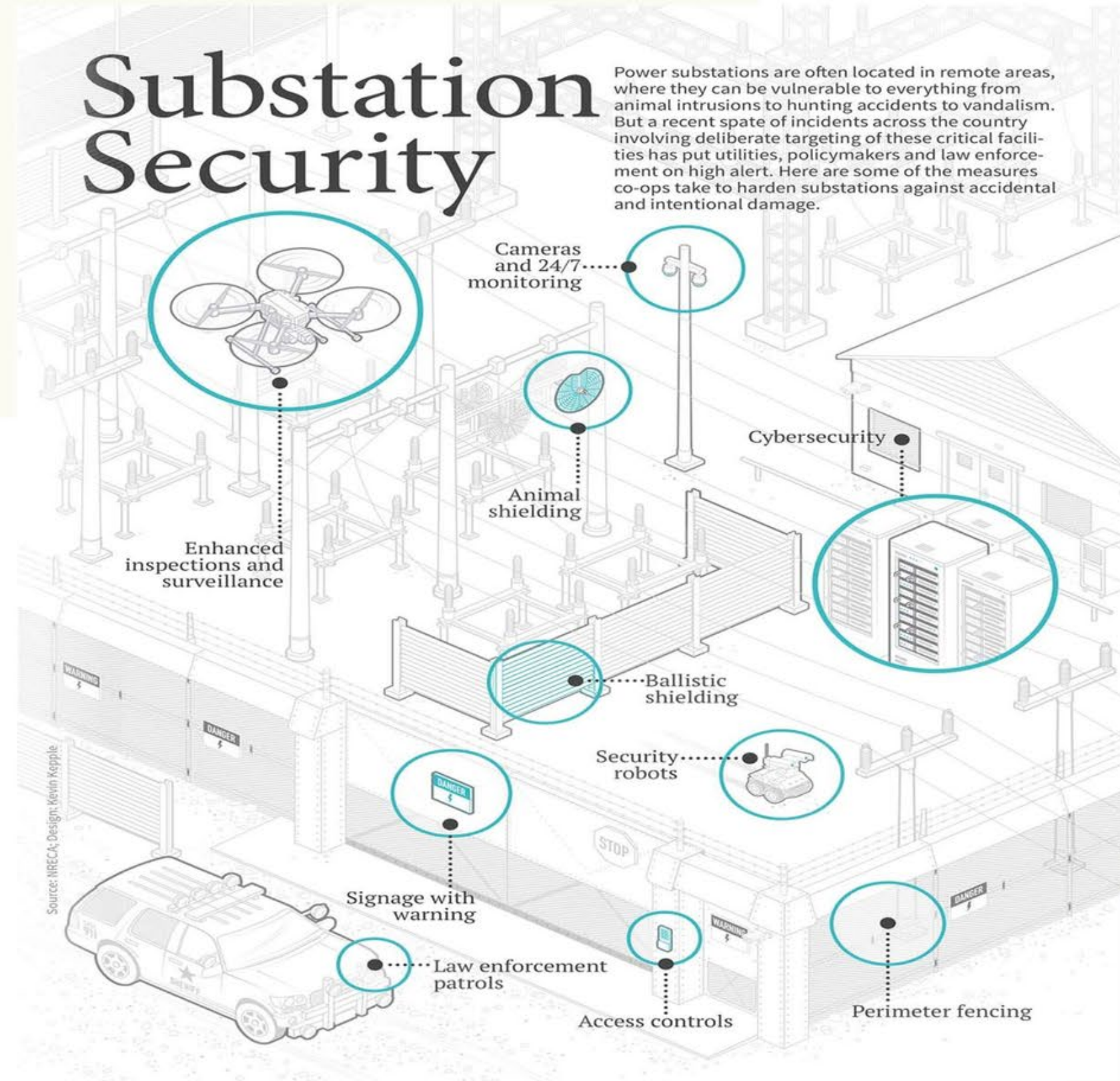
# Emerging Energy Sector Issues

## Substation Security & Grid Threats

- National Rural Electric Cooperative graphic

## Cyber Ransomware Attack

- Alerted to small town hit by ransomware
- Contacted TDEC Water inspector to reach out to water and wastewater systems in that town
- Contacted TEMA District Coordinator
- Alerted State Special Agent for Cybersecurity





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Bald Eagle Photo by Park Ranger  
Steve Ward, Radnor Lake State Park,  
Nashville, TN

Ben Bolton

Senior Energy Programs Administrator

Emergency Services Coordinator 12 for Energy

Office of Energy Programs

Tennessee Department of Environment and Conservation

Cell 615.306.5908

[Ben.Bolton@tn.gov](mailto:Ben.Bolton@tn.gov)

<https://www.tn.gov/environment/program-areas/energy/state-energy-office--seo-/programs-projects/programs-and-projects/energy-security.html>





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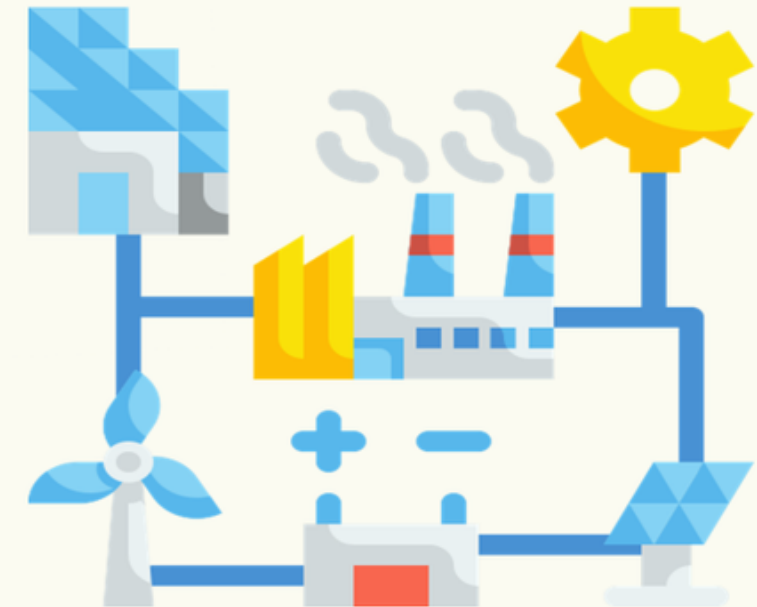
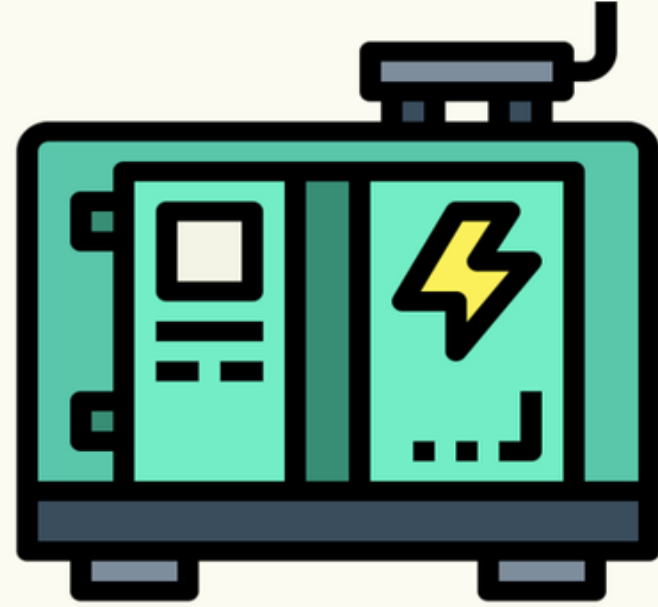


## So - you want a Generator?





## Standby Generators vs. Microgrids



Standby Generators	Microgrids
<ul style="list-style-type: none"><li>• Typically runs on diesel fuel (diesel emissions, heavily reliant on supply chain logistics)</li><li>• Supplies power to local loads during an outage</li><li>• A brief loss of power is typical</li><li>• Rated to run <math>\approx</math> 500 hours/year at 70% capacity</li><li>• Cannot operate in parallel with or put energy onto the grid</li></ul>	<ul style="list-style-type: none"><li>• Can incorporate any DER (diesel, NG, RE, etc.)</li><li>• Senses grid conditions; can react more nimbly</li><li>• Reduce or eliminate experienced power loss</li><li>• Can typically run indefinitely at or near capacity</li><li>• Can be configured to interact with the grid and create revenue streams</li></ul>



## **PEMA and the PA DEP Energy Office Collaboration**

- FEMA Region III Risk Reduction Consultation Meeting
- 2020 Building Resilient Infrastructure & Communities (BRIC) - Awarded – Using Funds for Updates to Energy Codes Material (Contracted Vendor)
- NASEO, NEMA, Business Council for Sustainable Energy (BCSE) Virtual Workshop: “Enhancing Community Energy Resilience through the FEMA BRIC” (August 24-26, 2021)
- National Association of State Energy Officials (NASEO) State Action Guide for Energy Resilience Projects Under FEMA’s BRIC Program Technical Guide (November 2022)
- 2021/2022 “Improving Critical Facility Energy Resilience with On-Site Generation Storage (3 Webinars in March 2022)
- 2022 Site Surveys for up to 5 Pennsylvania Sites for Webinar Participants
- 2023 All-Hazard Consortium Application (much like VDEM did in 2022) with AHC and Westmoreland County



**Kerry Campbell**  
Environmental  
Program Manager  
Energy Programs Office  
PA Department of  
Environmental Protection



**Brian Moore**  
Director, Environmental  
Emergency Response Program  
PA Department of  
Environmental Protection



**Tom Hughes**  
Director, Emergency Mgmt.  
Mitigation, Insurance and  
Resilient Communities Office  
PA Emergency Mgmt. Agency



**Kevin Wright**  
President and co-founder  
ProtoGen, Inc.



## Power Projects

- Fixed-Site Generators
- Mobile Generators
- Power Hook-Ups/Power Surveys

### Combustion-Based

- On-Site Generation (OSG) – Gas-fired Turbine
- (OSG) Reciprocating genset
- (OSG) Microturbine

### Non-Combustion

- Solar Photo-Voltaic (PV)
- Battery Energy Storage System (BESS)





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## Wait -- There's More? PEMA, PUC, PA DEP Energy Office and Many, many others Collaborating on Microgrid Study

Smart Electric Power Alliance

**Pennsylvania Department of Environmental Protection Microgrid Study**

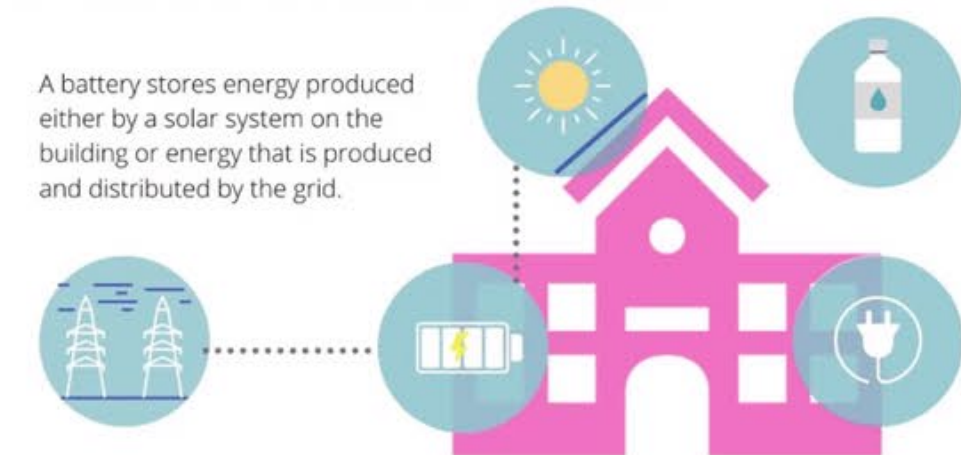
Microgrid Suitability and Analysis

March 2024

### Timeline



### How do Resilience Hubs work?



The battery provides power for certain key functions needed during an outage, like lighting, heating and AC, and charging for electronic devices.

The battery is not meant to cover the electricity needs of the entire building--that would require a very large and expensive battery!

