MICHIGAN PUBLIC SERVICE COMMISSION

Resilience & Reliability Technical Conference

Day 1- May 22, 2023
1:00 – 5:00 PM (EST)

The Resilience Technical Conference will begin shortly. Please stand by.

To enable closed captioning:

1. Click the “more” button at the top of your Teams window
2. Click on “Language and speech”
3. Click on “Turn on live captions”

For IT assistance, e-mail:
LARA-MPSC-EVENT-IT@michigan.gov

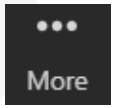
To submit a comment

Written Comments

1. Email to:
   LARA-MPSC-commissioners2@michigan.gov

2. Mail to:
   Michigan Public Service Commission
   P.O. Box 30221
   Lansing, MI 48909

For IT assistance, e-mail: LARA-MPSC-EVENT-IT@michigan.gov

To enable closed captioning: 1.) Click the "more" button 

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MPSC Commissioners

Welcome and Introductory Remarks

1:05 pm – 1:15 pm

Dan Scripps
MPSC Chair

Katherine Peretick
MPSC Commissioner

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Weather or Not

Extreme Weather in Michigan

Charyl Kirkland

Energy Operations Division

May 22, 2023

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Commission Investigations

- Historically, the Commission has launched investigations into the response of Michigan's utilities during extreme weather events.

  - U-17542 (2014): December 2013 Ice Storm Investigation
  - U-18346 (2017): March 2017 Wind Storm Investigation
  - U-20464 (2019): Polar Vortex Investigation & SEA Report
  - U-21122 (2021): August 2021 Storms
  - U-21305 (2022): August 2022 Storms
  - U-21388 (2023): February 2023 Storms

U-17542: December 2013 Ice Storm

- Reported Outages
  - Consumers Energy: 388,950
  - DTE Electric: 257,000
- Restoration Issues
  - ¾ inch ice accumulation
  - 10-20 mph wind gusts
  - Staffing due to Holidays
  - Slower Municipality Restoration
- Outcome
  - Hazardous Tree Removal
  - Annual Power Quality Reporting
  - Outage Credit Info on Websites

U-18346: March 2017 Wind Storm

- Wind Gusts 60mph+
- Restoration Challenges
  - Sustained Winds 30mph
  - Widespread tree damage
  - 23,000+ Downed Wires
- Reported Outages
  - Consumers Energy: 358,000
  - DTE Electric: 750,000
- Recommendations
  - Increased Tree Trimming
  - Continued Smart Meter Integration
  - Infrastructure Improvements

U-20464: 2019 Polar Vortex

- January 30-31, 2019
  - Temperatures below -25° F
  - RTO Emergency Declaration for electric utilities
  - Ray Compressor Station Fire
    - Public Appeal to Lower Thermostats
- Gov. Whitmer Letter to MPSC
  - Launched investigation into Michigan's ability to withstand extreme weather events.
- Dockets Initiated:
  - MI Power Grid Initiative
    - U-20628: Demand Response
    - U-20629: Service Quality Rules
    - U-20630: Technical Std. Rules
    - U-20631: Mutual Aid Agreements
    - U-20632: Gas Curtailment Proc.
    - U-20147: Five Year Distribution Plans

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U-21122: August 2021 Storms

- Wind Gusts 70mph+
- Widespread tree and pole damage
- Reported Outages
  - Consumers Energy: 372,000
  - DTE Electric: 500,000
  - I&M: 20,000

- Outcomes
  - October 2021 Technical Conference on Emergency Preparedness, Distribution Reliability, and Storm Response
  - MPSC Webpage on Reliability
  - Outage Reporting Template (November 2022)

U-21305: August 2022 Storms

- Restoration Challenges
  - Wind Gusts 70mph +
  - Widespread tree and pole damage
  - Energized Downed Wires

- Reported Outages
  - Consumers Energy: 197,000
  - DTE Electric: 265,000

- Outcomes
  - 3rd Party Audit of Michigan's Electric Distribution System

U-21388: 2023 Winter Storms

- February 22, 2023- Initial Storm
- Restoration Issues
  - Additional Storms: February 27, 2023, and March 3, 2023
  - Extensive downed wires
  - Call Centers Offline
  - Inaccurate Restoration Estimates
- Reported Outages
  - Consumers Energy: 427,000
  - DTE Electric: 630,000

Summary

- Extreme weather conditions are becoming an annual occurrence in Michigan.
- Need for a distribution system that can withstand extreme cold, heat, wind and water conditions.
- Need for better communication and more accurate restoration estimates.
- Need for more equitable and consistent investments in the distribution system.

- Up Next: Introduction to Grid Resilience Panel
  - Moderated by Julie Ginevan, MPSC

Questions from Commissioners

Up Next:

1:20 pm Intro to Grid Resilience

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Panel: Intro to Grid Resilience

Moderator:

Julie Ginevan
Energy Security Analyst
MPSC

Karma Sawyer, Ph.D.
Director
Electricity Infrastructure & Buildings Division
PNNL

Kiera Zitelman
Technical Manager
Center for Partnerships & Innovation
NARUC

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Regulatory Considerations for Energy Resilience
Michigan Public Service Commission technical conference

May 22, 2023

Kiera Zitelman
Technical Manager
(202) 898-2212
kzitelman@naruc.org

About NARUC

The National Association of Regulatory Utility Commissioners (NARUC) is a non-profit organization founded in 1889.

Our Members are the state utility regulatory Commissioners in all 50 states & the territories. FERC & FCC Commissioners are also members. NARUC has Associate Members in over 20 other countries.

NARUC member agencies regulate electricity, natural gas, telecommunications, and water utilities.

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About NARUC's Center for Partnerships & Innovation

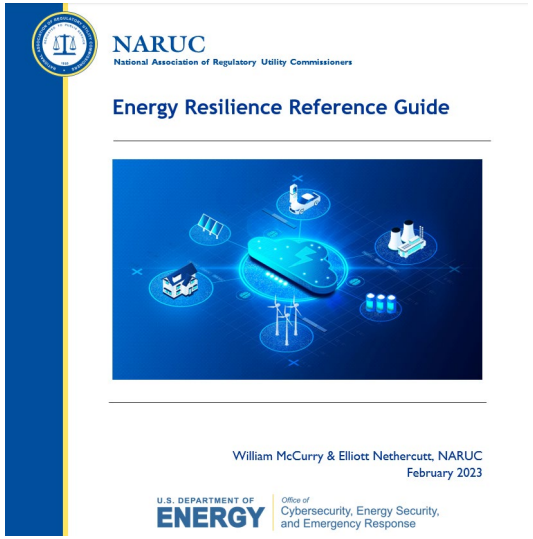
Grant-funded team dedicated to providing technical assistance to members.

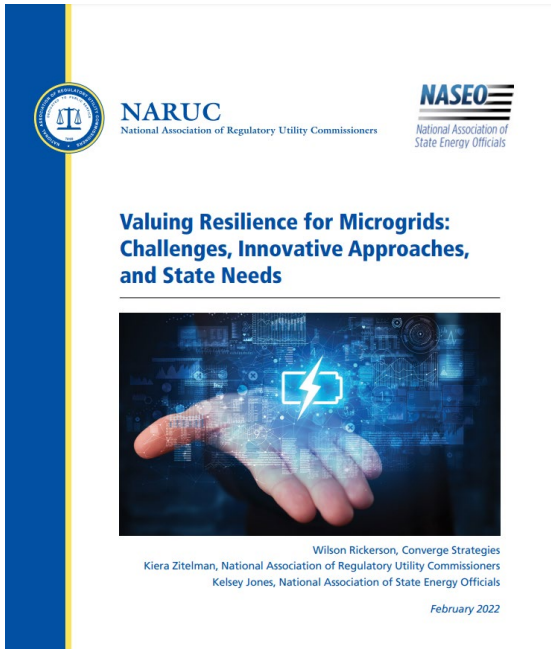
CPI identifies emerging challenges and connects state commissions with expertise and strategies to inform their decision making.

CPI builds relationships, develops resources, and delivers trainings.

Regularly updated CPI fact sheet with recent publications & upcoming events under Quick Links at:

https://www.naruc.org/cpi-1/





Recent Publications

- Demand Flexibility within a Performance-Based Regulatory Framework (Feb 2023)
- State Energy Justice Roundtable Series: Customer Affordability and Arrearages; Participation in Decision Making; Energy Justice Metrics (Feb 2023)
- Mini Guide on PUCs and the Investment Community (Feb 2023)
- Energy Resilience Reference Guide: Chapters 1 & 2 (Jan & Feb 2023)
- Potential State Regulatory Pathways to Facilitate Low-Carbon Fuels (Dec 2022)
- Digitalization in Electric Power Systems and Regulation: A Primer (Dec 2022)
- Interoperability for Electric Vehicle Charging: A Case Study (Dec 2022)
- Electric Vehicle Interoperability: Considerations for Utility Regulators (Nov 2022)
- Models for Incorporating Equity in Transportation Electrification (Nov 2022)
- Mini Guide on Transportation Electrification (Nov 2022)
- Grid Data Sharing: Brief Summary of Current State Practices (Nov 2022)
- Regulator's Financial Toolbox Briefs: Community Solar for LMI Customers; Electrification; ADMS/DERMS (Oct 2022)
- Defense Energy Resilience Resources Guide & FAQ for Commissioners (Oct 2022)
- Workforce Development Toolbox: Recruitment Templates and Social Media Engagement Materials (Sept 2022)

Forthcoming Publications

- Black Sky Playbook
- Energy Resilience Reference Guide Chapter 3: Climate Resilience
- State Microgrid Policy, Programmatic, and Regulatory Framework
- Renewable Energy Microgrids
- Considerations of Advanced Nuclear in Resource Planning

Upcoming Virtual Learning Opportunities

- **Modern DER Capabilities and Deployment. March 8:** Next in the virtual interconnection workshop series, NREL will address PUC questions on DER technical capabilities, deployment concerns, and benefits. *Contact Jeff*
- **Resilience for Regulators Webinar Series. March 9**: Climate Informed Mitigation Strategies. Find past presentations on critical infrastructure resilience, climate resilience, defense energy resilience, and more. *Contact William*
- **Monthly Innovation Webinars. March 16:** Advances in Resource Adequacy. Register | past recordings. *Contact Jessica*
- **On-Demand, Video-Based Learning Modules.** Dozens of training videos in English and Spanish on electricity system planning, distribution systems and planning, smart grid and EV interoperability. *Contact Danielle*

Upcoming In Person Events *Travel stipends available*

- **Cybersecurity Training, Indianapolis, IN. March 22-24**: Experts will provide content on cybersecurity topics through the lens of utility regulators with presentations, engaging activities, and more. (Commissioners and staff) *Contact Lynn*
- **Nuclear Energy Partnership Pacific Northwest National Lab Site Visit. April 25-28:** Tour PNNL and NW nuclear sites. Advanced Nuclear State Collaborative kickoff workshop will also take place. (Commissioners and staff) *Contact Kiera*
- **Natural Gas Partnership Site Visit, Savannah, GA. May 2023:** Tour the Elba Island liquefied natural gas export facility, Port of Savannah compressed natural gas fueling station, and more. (Commissioners only) *Contact Kiera*
- More Info Available Soon: **Energy Justice Midwest Regional Workshop (early May)**; **Grid Data Sharing Collaborative Demonstration Workshop (mid-May** in Washington, DC); **Resilience Planning Regional Workshops** *Contact Danielle*

Join a Member Working Group! *For Commissioners and Commission Staff*

- Integrated Distribution System Planning. Register for presentations by subject matter experts and commissions followed by questions and facilitated discussions among members. Six sessions: **Feb 27 – Jun 12.** *Contact Jeff*
- NARUC-NASEO Advanced Nuclear State Collaborative. Exchange questions, needs, and challenges relating to the planning and deployment of new advanced nuclear generation. *Contact Kiera*
- NARUC-NASEO Microgrids State Working Group. Explore capabilities, costs, benefits, and deployment strategies for microgrids with PUCs and State Energy Offices. *Contact Kiera*
- Electric Vehicles State Working Group. Learn and discuss regulatory questions around transportation electrification, including charging infrastructure buildout, rate design, equity considerations, V2G, and more. *Contact Danielle*
- Performance-Based Regulation State Working Group. Examine approaches to performance-based regulation and alternative ratemaking across states in a collaborative peer group setting. *Contact Elliott*
- i2X Working Groups. DOE/National Lab effort for commissions and stakeholders to identify grid interconnection challenges and discuss solutions. *Contact Jeff*
- **Workforce Development Peer Advisory Group.** Supporting recruitment & retention for commissions. *Contact Hyleah*

www.naruc.org/cpi

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Key Questions

What is grid resilience?

Why is it important?

How is it measured?

What can be done to increase it?

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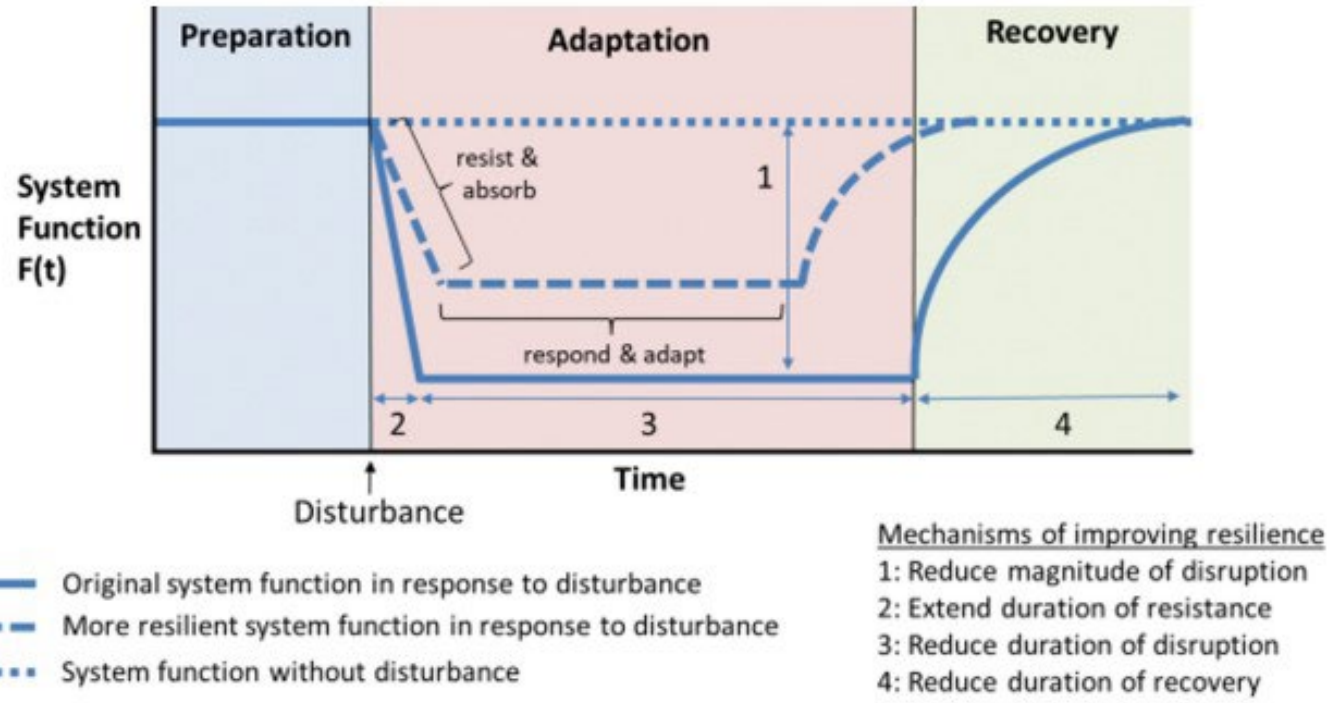
Reliability Versus Resilience: Common Characteristics

Reliability	Resilience
Routine, expected (though, not 'planned', normally localized, resource adequacy, shorter duration interruptions of electric service	Infrequent, unplanned, widespread/long duration power interruptions, ability of the system to adapt to changed environmental conditions

'Resilience Trapezoid'



Source: Converge Strategies on behalf of NARUC & NASEO https://pubs.naruc.org/pub/1B571AB6-1866-DAAC-99FB-2509F05E4A67

Extreme events are increasing in frequency and severity. How can policymakers & regulators respond?

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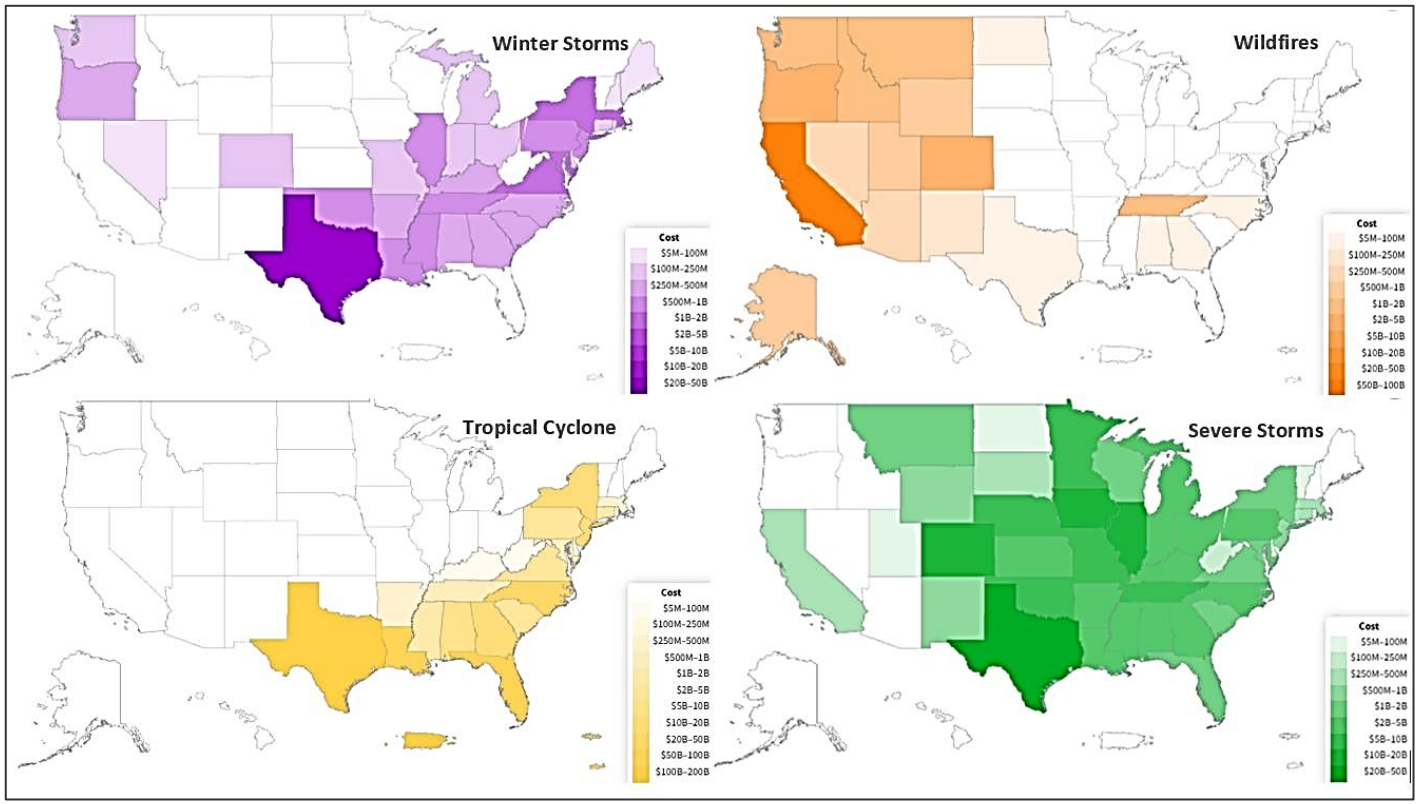
Clear and Present Need for Resilience-Informed Grid Management Strategies

State Cost and Frequency, 2013-2021



Courtesy: Elliott Nethercutt, NARUC 2022

- Costs are increasing – regulators and investor-owned utilities need to adapt
- There is no "one-size-fits-all" solution for resilience metrics and investments as they are dependent on various factors — regional, functional, regulatory, and business
- NARUC doesn't advocate for any specific mitigation strategy

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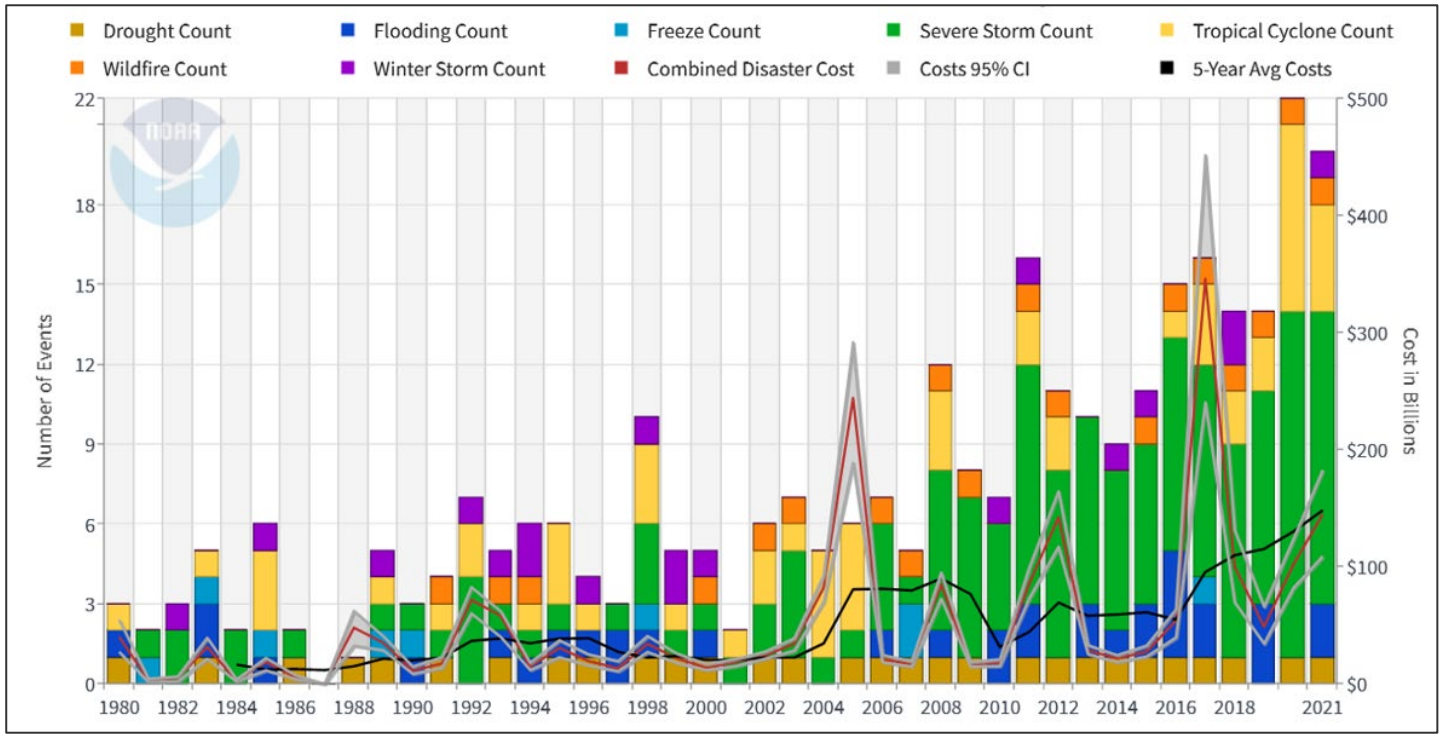
The Role of the Regulator

- Opening investigatory dockets to pursue state energy resilience and related policy objectives
- Establishing resiliency targets for regulated utilities
- Tracking of project implementation and performance
- Approving a regulated utility's investments into grid improvements via rate case or special tariff

U.S. Billion-Dollar Disaster Events, 1980-2021 (CPI-adjusted)



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Assessing Appropriate Mitigation Strategies

- Regulators work in conjunction with their regulated utilities to determine the best hazard mitigation strategy (sometimes these are incentivized or mandated by state law)
- Cost-benefit ratio – quantifiable benefits to resilience investments
- PUC primary concerns are safety of distribution system, affordable rates for utility services, and reliability of system during crises

Infrastructure Climate Adaptation and Resilience Framework

Courtesy: Andrew Bochman, Protecting Energy Infrastructure from Extreme Weather and other Physical Climate Risks: An introduction to an Infrastructure Climate Adaptation and Resilience Conceptual Framework for Decision Makers, Idaho National Laboratory, September 2022.

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Quantifying Resilience Benefits

What	Who	When
Interruption Cost Estimator (ICE) 2.0 Tool	Lawrence Berkeley National Laboratory Edison Electric Institute	Expected 2023
Customer Damage Function Calculator Tool	National Renewable Energy Laboratory	2021
Social Burden Method	Sandia National Laboratories University of Buffalo	Pilot 2021 – 2022
FEMA Benefit-Cost Analysis Tool	Federal Emergency Management Agency (FEMA)	2021
Power Outage Economics Tool (POET)	Lawrence Berkeley National Lab Commonwealth Edison (ComEd)	Pilot 2021 – 2022

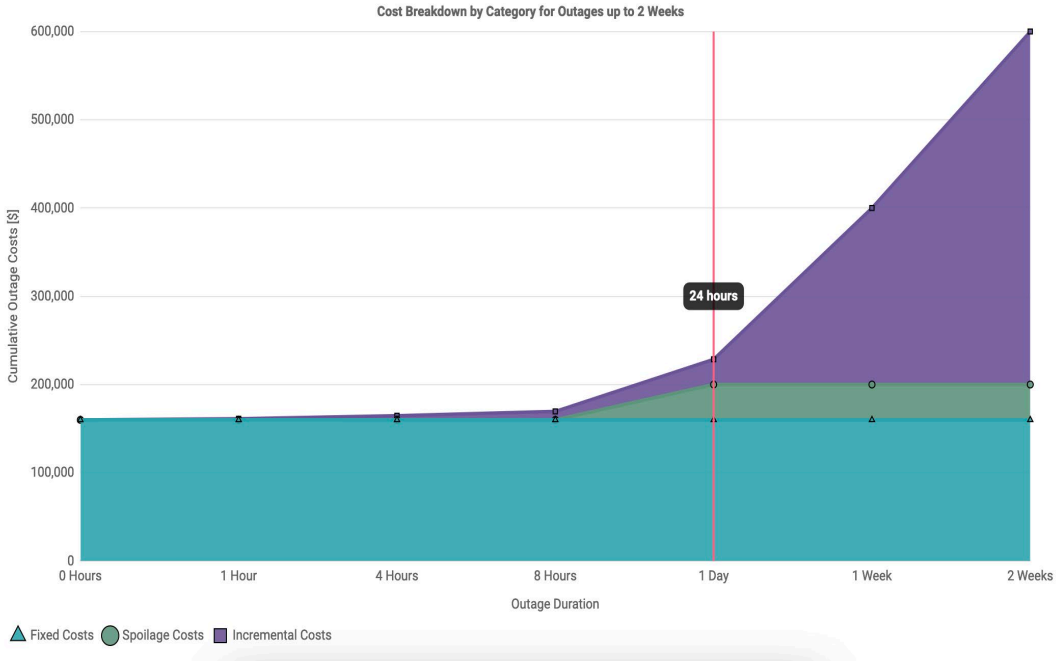
Innovations in Survey-Based Methods

Bottom Up Approaches

DOE ICE Calculator 2.0 (2023)
- Updated regional surveys
- Longer duration outages

NREL CDF Calculator (2022)
- Facility-specific calculator
- Self—guided questions

Social Burden Metrics (2022)
- Social need v. infrastructure
- Ability v. willingness to pay



Pictured: Example output from the Customer Damage Function (CDF) Calculator (Source: NREL)

FEMA Benefit-Cost Analysis Toolkit Values

Cost of Lost Emergency Service

Values for lost fire, police, and medical services

NYSERDA NY Prize microgrid BCA adds FEMA values to ICE value

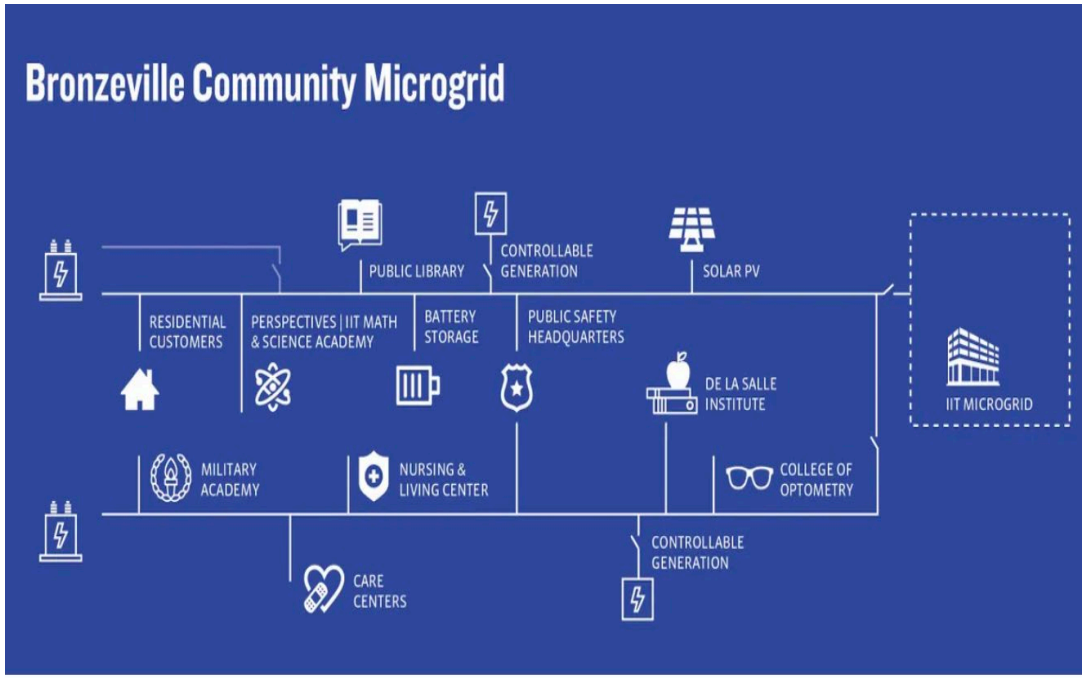
Pre-calculated hospital values ($12.62./sq. ft. in rural areas)

Pictured: Proposed microgrid for City of Reno Public Safety Center that was awarded FEMA Building Resilient Infrastructure and Communities (BRIC) funding (Source: Ameresco)

Power Outage Economics Tool (POET) (2022)

Hybrid Economy-Wide Approach

- Surveys to assess customer adaptive behavior
- Economic model costs of long-term power outages
- Direct and indirect cost impacts within region and beyond



Pictured: The POET analysis focuses on the Bronzeville Community Microgrid in Chicago, IL (Source: ComEd)

Planned NARUC Activities on Grid Resilience Assistance for PUCs

BIL Grid Resilience Technical Assistance Opportunities

- Regional Objective-setting workshops
- Comprehensive Needs Assessment
- Ongoing National Lab Partnership & Training

NARUC's Energy Resilience Reference Guide

- Chapters 1 & 2 available now
- Planned Climate Resilience Chapter 3

NARUC Working Groups

- Microgrids State Working Group
- Performance-Based Regulation
- NIST Smart Grid Technical Assistance

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NARUC's Energy Resilience Reference Guide

Challenge Statement: 'Resilience' is increasingly used as a catch-all term to describe numerous aspects within energy policy. New commissioners and public utility commission staff are expected to quickly develop expertise around resiliency topics that are complex and multifaceted.

https://pubs.naruc.org/pub/1C098515-1866-DAAC-99FB-3FBA6FA3AB0B

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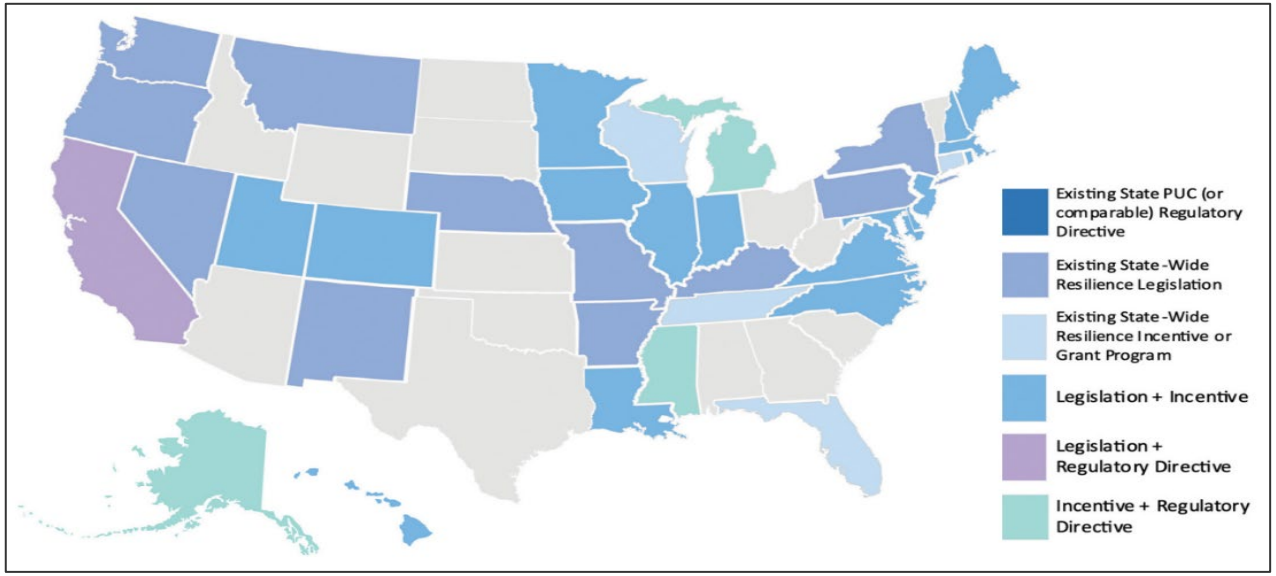
Purpose and Vision

Create a reference guide that succinctly summarizes topics within the 'resilience umbrella'

"Living Resource" – allows for continual updates based on latest developments in industry and regulatory policy

Content divided into sections/chapters that cover a specific topic within the range of resilience topical areas

U.S. State-Level Resilience Activities (EPRI, 2021)



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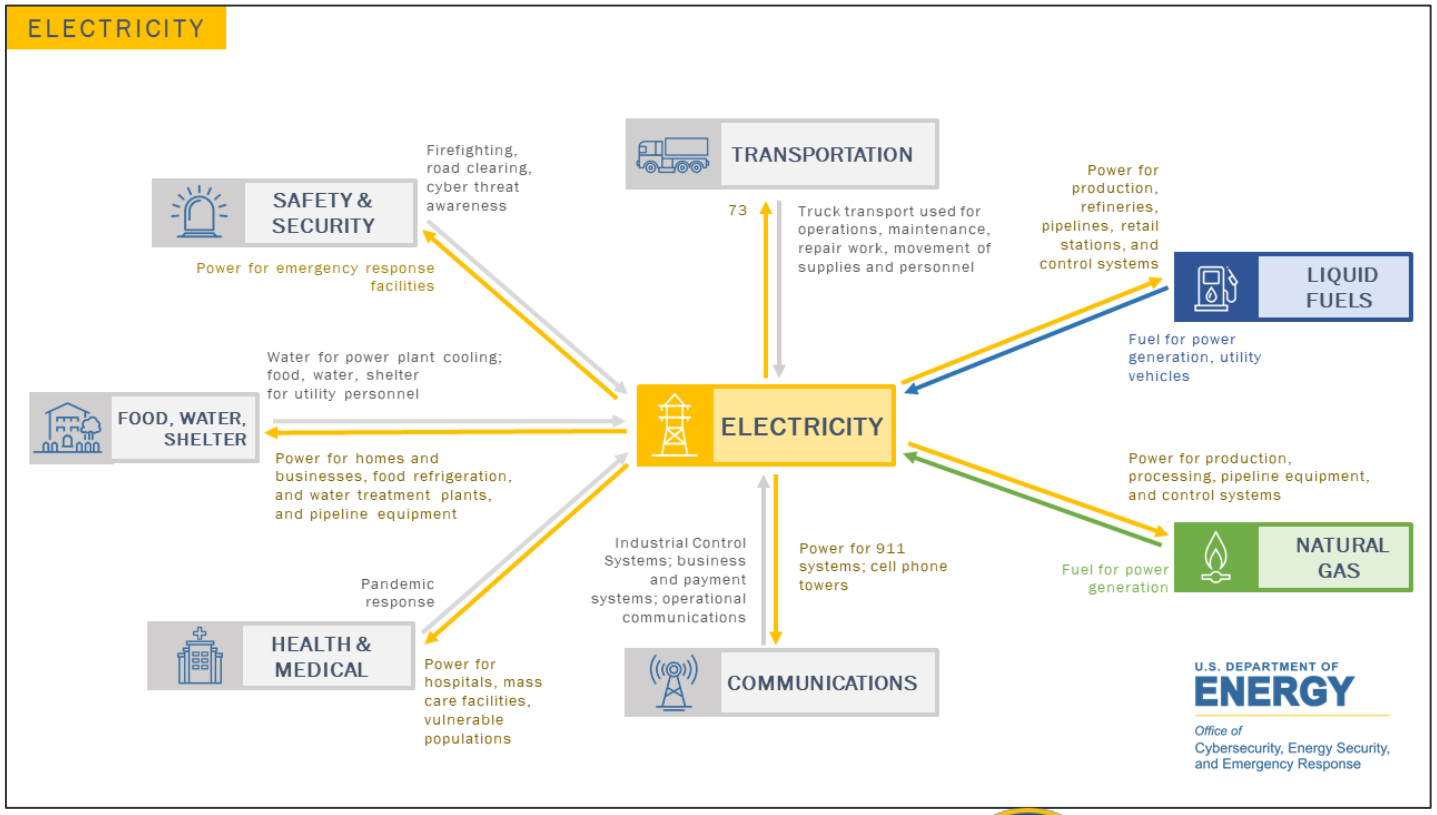
Chapter 1:
Developing a Shared Definition of Energy Resilience

- Summarizes existing definitions of energy resilience – noting unique interdependencies among several utility sectors
- Encourages state public utility commissions to develop a shared definition to guide regulatory policy
- Poises several energy resilience questions for regulatory community to consider

Electric Sector Resilience Interdependencies (DOE CESER, 2022)



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Chapter 2:
Developing a Shared Framework to Value Resilience Investments

Resilience Analysis Process (Sandia National Laboratory, 2015)

- Describes various frameworks to place a value on energy resilience investments
- Encourages state public utility commissions to develop a shared valuation framework to guide regulatory policy
- Discusses consequence prioritization and regulatory cost-benefit analysis

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Commission Actions on Energy Resilience

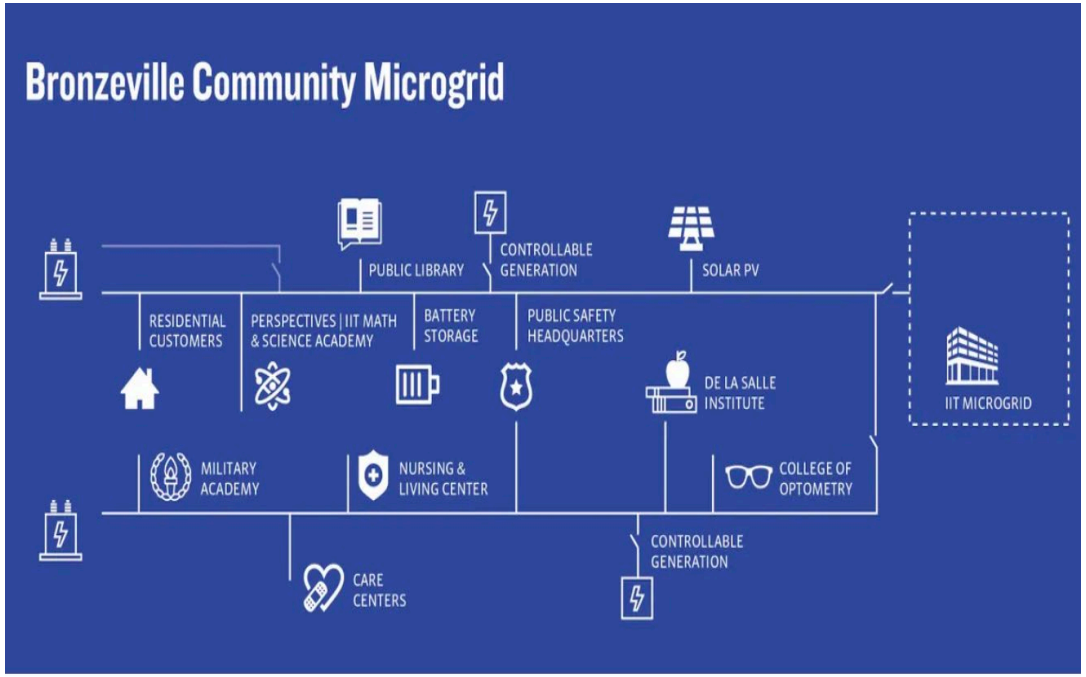
California	Colorado	Michigan
• Rulemaking on Climate Change Adaptation R1804019 (2020) • Investor-owned utilities required to file climate vulnerability assessments • Guides investment prioritization • Order Instituting Rulemaking to Modernize the Electric Grid for a High Distributed Energy Resources Future R.21-06.017 (2021) • Significant equity / stakeholder engagement criteria	• 4 CCR 723-3525 – Rules Regulating Electric Utilities (2022) • Establishes cost-benefit methodology for resilience investments • Mandates community engagement for energy justice communities	• Case No. U-20464-0063 – Commission Order in response to Governor Whitmer request to review state energy emergency preparedness • Commission empowered to evaluate whether electric distribution system is designed to account for changing climate conditions and extreme weather events

Microgrids to Enhance Community Resilience

- California SB 1339 – required commission to develop policies related to microgrids (Rulemaking 19-09-009)
- Large amount of state funding – Microgrid Incentive Program ~$200 million
- Equity & resilience considerations

Photo source: Clean Coalition; 'Santa Barbara Unified School District Solar Microgrids' https://clean-coalition.org/community-microgrids/goleta-load-pocket/santa-barbara-unified-school-district/

- Illinois Commerce Commission approves Bronzeville Community Microgrid pilot project
- Community benefits considered



Pictured: The POET analysis focuses on the Bronzeville Community Microgrid in Chicago, IL (Source: ComEd)

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Thank you!

Kiera Zitelman
Technical Manager
(202) 898-2212
kzitelman@naruc.org

Questions from Commissioners

Up Next:

1:50 pm Cross Sector Interdependence

Panel: Cross Sector Interdependence

Moderator:

Alex Morese
Energy Security Manager
MPSC

Peter Hoffman
Detroit Southeast Michigan Information and Intelligence Center (DSEMIIC)

Megan Levy
Office of Cybersecurity, Energy Security, and Emergency Response (CESER)
U.S. Department of Energy

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

Michigan PSC Resiliency Tech Conference

Megan Levy, SLTT Project Manager

May 22, 2023

CESER Mission & Energy Threat Landscape

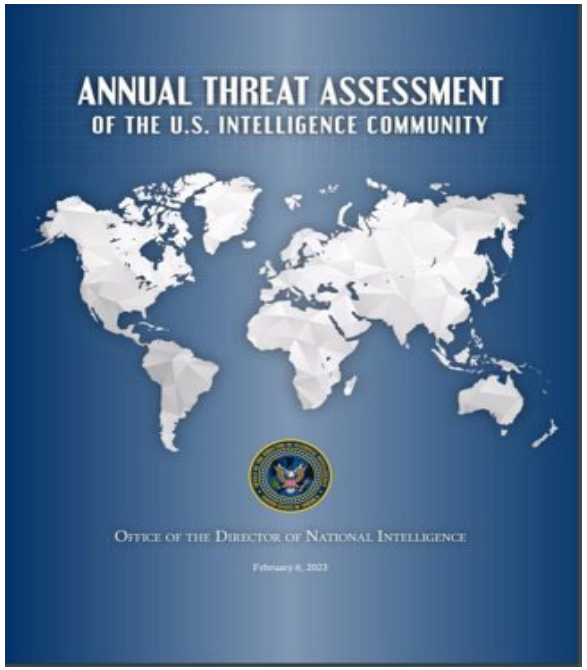
To enhance the security of U.S. critical energy infrastructure to all hazards, mitigate the impacts of disruptive events and risk to the sector overall through preparedness and innovation, and respond to and facilitate recovery from energy disruptions in collaboration with other Federal agencies, the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

CESER's Responsibilities

DOE is the ***Sector Risk Management Agency*** for the Energy Sector

DOE is the federal coordinating agency for Emergency Support Function #12 (Energy)

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

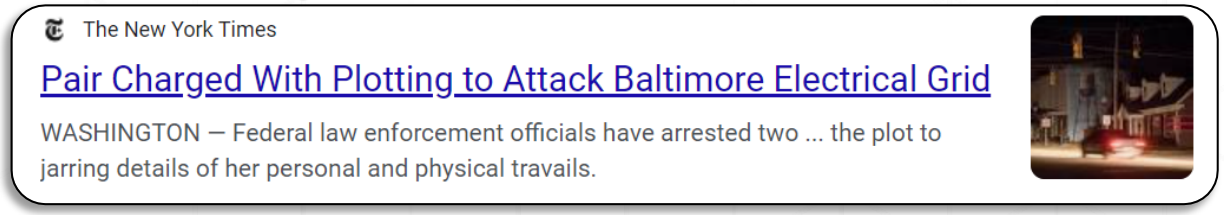
Cyberattack Forces a Shutdown of a Top U.S. Pipeline

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

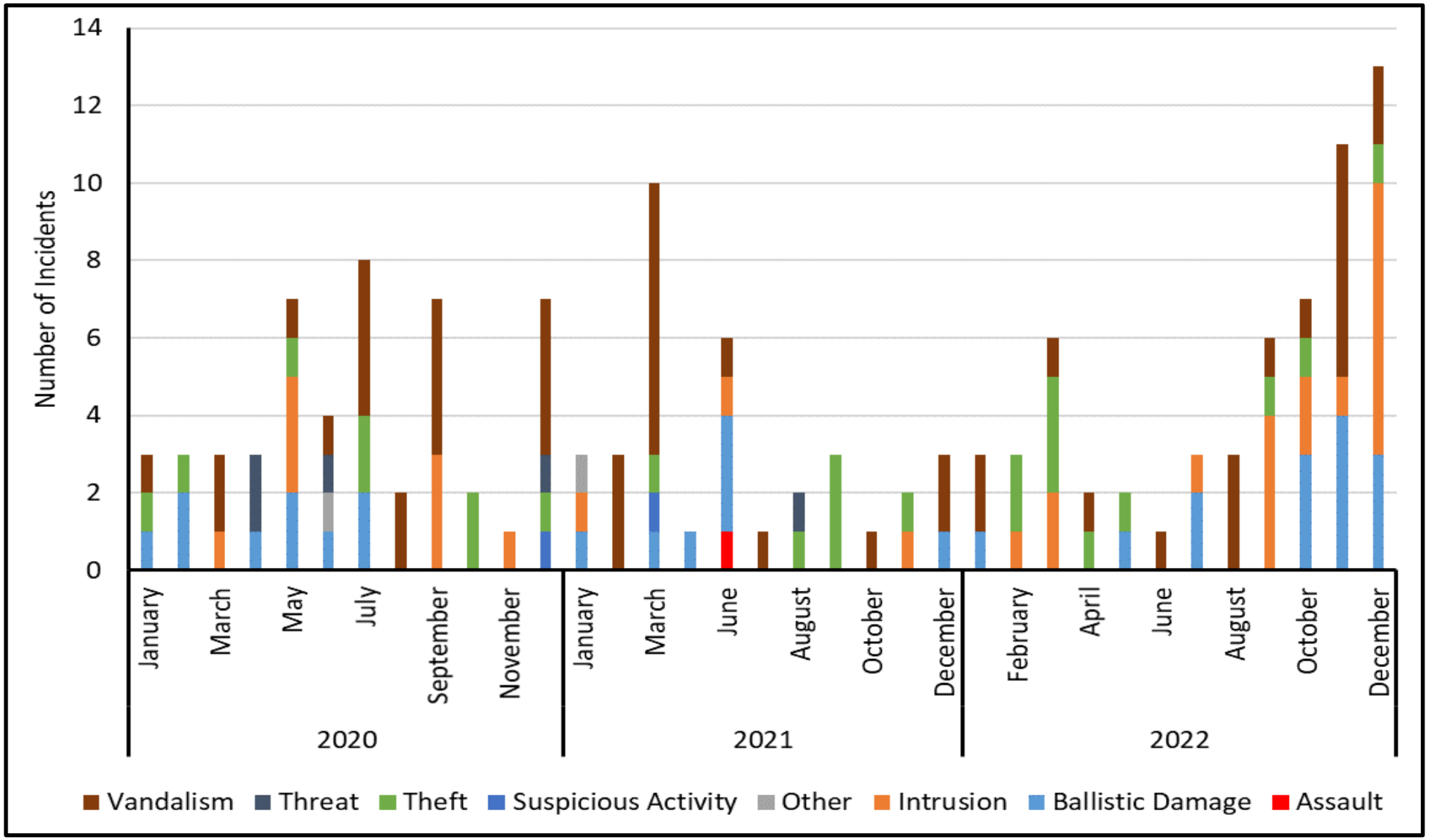
Physical Security Threats

- 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

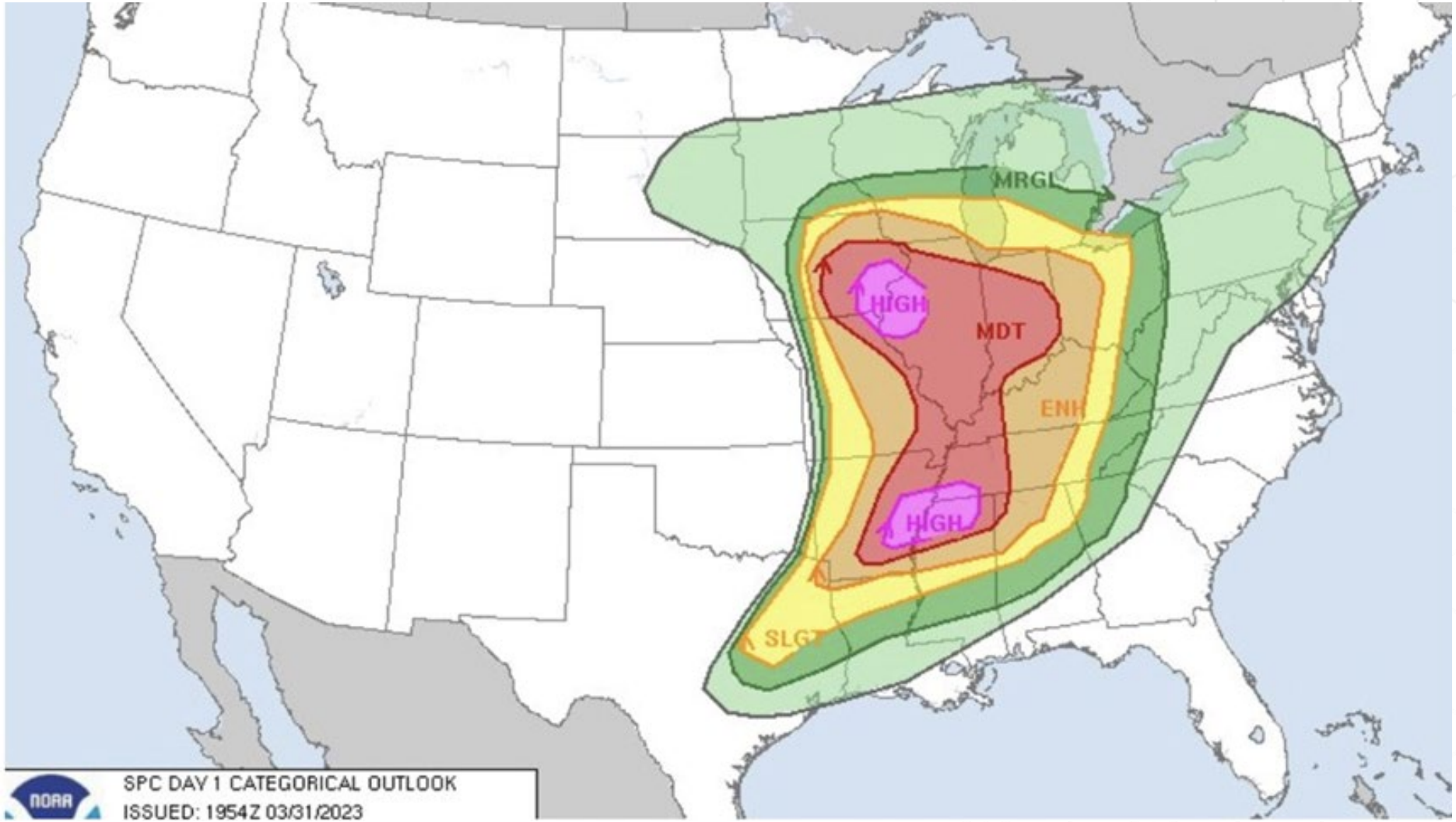


Information provided by E-ISAC

Incident Summary



Emerging Extreme Weather Threats



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

Bipartisan Infrastructure Law (BIL) Key Opportunities

Investing in a Secure, Resilient, and Clean Energy Future

The IIJA includes over $62B for the U.S. Department of Energy to deliver a more equitable clean energy future

Provisions to review:

- Grid resilience **40101**, 40103, 40107
- State energy security plan: **40108**
- Cyber-related: **40124**

DOE BIL Homepage

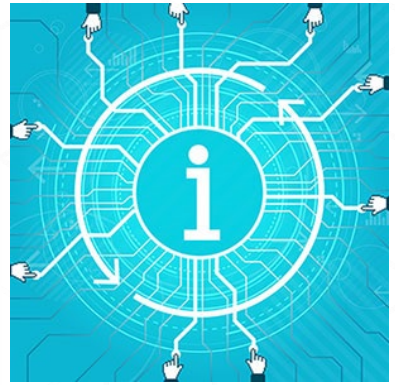
BIL Programs at Department of Energy

40124: Rural and Municipal Utility Advanced Cybersecurity Grant and Technical Assistance (RMUC) Program

Funding: $250 million over 5 years (FY22-26) via grants, technical assistance, and cooperative agreements

Objectives:

1. Deploy cybersecurity technology, operational capability, or services that *enhance the security posture* of electric utilities through improvements in the ability to **protect** against, **detect**, **respond** to, or **recover** from a **cybersecurity threat**.
2. Increase the participation of eligible entities in cybersecurity **threat** ***information sharing*** **programs**.



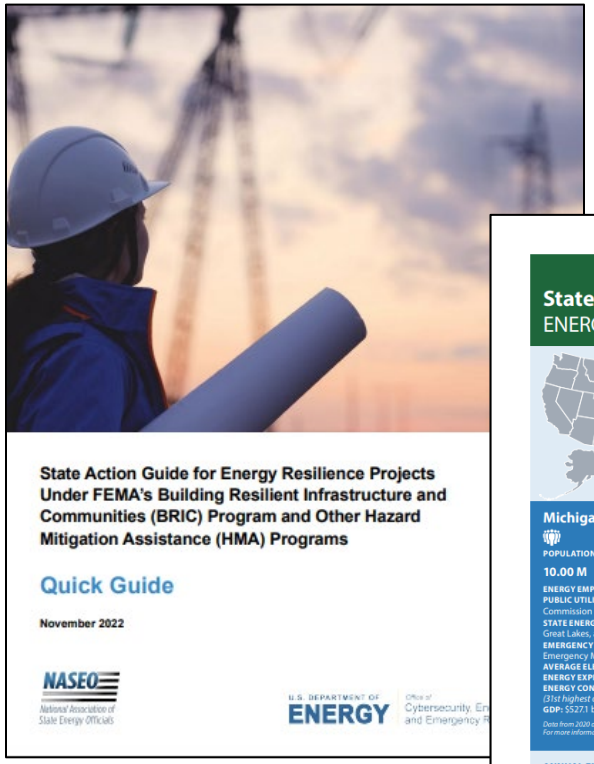
Eligibility:

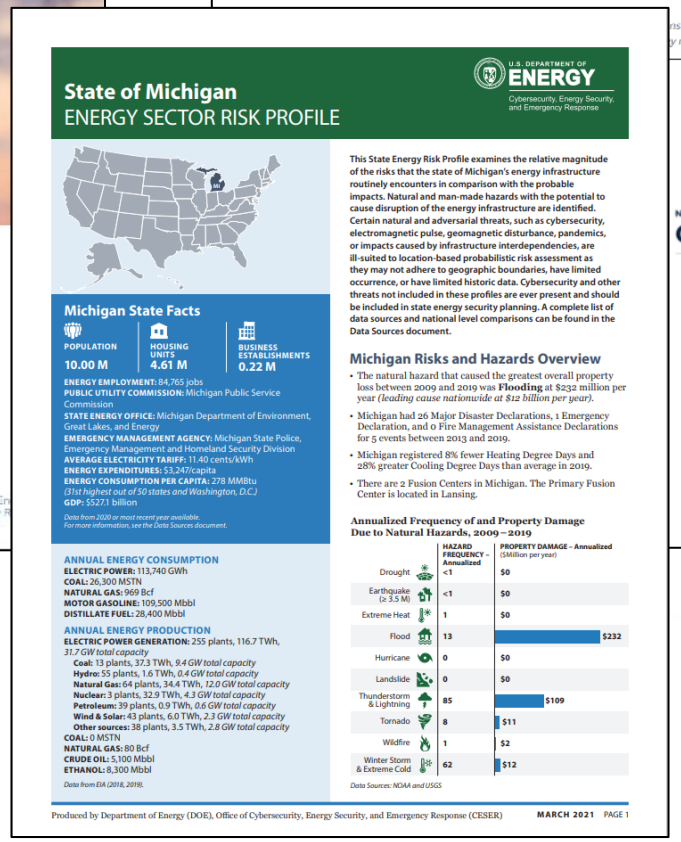
- Rural electric cooperatives
- Municipal electric utilities
- Not-for-profits in partnership with rural or municipal electric utilities
- Investor-owned electric utilities that sell < 4,000,000 MWh/year

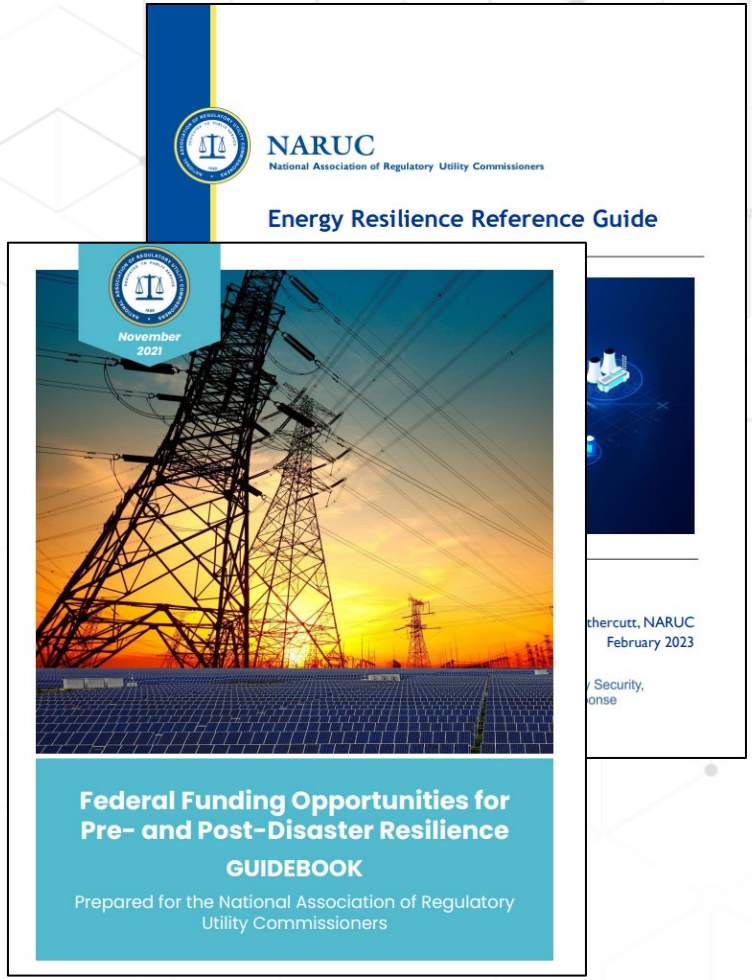
The Bipartisan Infrastructure Law provides $13B for grid resilience over the next five years

Program	Funding Amount	Important Dates
Grid Resilience Formula Grants *Sec. 40101(d)*	$2.3B	Applications Due: March 31, 2023 (FY22 and FY23)
Grid Resilience Innovation Partnership (GRIP)		
Grid Resilience Industry Grants *Sec. 40101(c)*	$2.5B	Concept Papers Submitted: December 16, 2022 DOE Responses: February 2023 Applications Due: April 6, 2023
Smart Grid Grants *Sec. 40107*	$3B	Concept Papers Submitted: December 16, 2022 DOE Responses: February 2023 Applications Due: March 17, 2023
Grid Innovation Program *Sec. 40103(b)*	$5B	Concept Papers Submitted: January 13, 2023 DOE Responses: March 2023 Applications Due: May 19, 2023

CESER's Resources







[SLTT Program Resource Library | Department of Energy]

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linkedin.com/company/office-of-cybersecurity-energy-security-and-emergency-response

energy.gov/CESER

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

Questions from Commissioners

Up Next:

2:20 pm Customer Communications During Outages

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

Panel: Customer Communications During Outage Events

Moderator:

Julie Ginevan
Energy Security
MPSC

Therese Cremonte
Emergency Manager
Livingston County

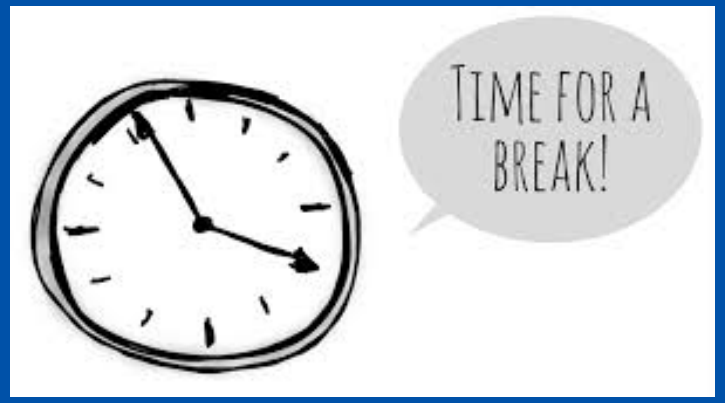
Mike Kennedy
Fire Chief
City of Ann Arbor

Jake Thelen
Customer Assistance Division
MPSC

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

Questions from Commissioners

Up Next: 2:50 pm BREAK



3:00 pm Challenges to Enhance Resilience

Panel: Challenges to Enhanced Resilience

Moderator:

Julie Baldwin
Director
Energy Operations Division
Michigan Public Service Commission

John Albers
Senior Associate with the Midwest Policy & Strategy Team
SunPower

Joshua Williams
Midwest Regional Manager
Market Development
Highland Electric Fleets

Mike Stone
Major General (Retired)
Senior Counsel
Warner Norcross & Judd

Diane Mills, CEM
President
Occupant Care

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

SUNPOWER®

May 22, 2023

MPSC Resiliency Barriers Panel

John Albers

Policy & Strategy Team

Who is SunPower?

An industry leader in solar sustainability and social responsibility

About SunPower

1. Focus is residential solar, battery storage, and grid services
2. Incorporated in 1985 – one off the oldest solar companies in the U.S.
3. Headquartered in California
4. ≈4,700 employees worldwide, ≈3,500 in the U.S.
5. Network of more than 700 independent dealers serving 49 states
6. A partner with General Motors, Ikea, Sierra Club, KB Home, and others to change the way our would is powered

About SunPower in Michigan

1. Serving Michigan residents through our subsidiary Blue Raven Solar and 4 independent local dealers:
    a. Oak Electric
    b. The Green Panel
    c. Climax Solar
    d. Viking Solar

Michigan Backdrop

Areas of concern

1. Based on 2020/2021 EIA data, Michigan ranks:
    a. 43rd in reliability (46th prior year)
    b. 39th in affordability (34th prior year)
    c. 36th in emissions (35th prior year)
2. Average electricity price (per EIA): 13.4 ¢/kWh
3. Residential solar penetration rate as of 12/31/22: 0.39%
4. Recent prolonged outages following weather events
5. Significant appetite for improved reliability and energy cost savings among MI consumers

Barriers to Improvement

Improved resiliency is possible, but impediments exist

1. Uncertainty regarding ability to interconnect, i.e., the DG cap
2. Limited hosting capacity
3. Limited or no access to grid and/or customer data
4. Need to update home load panel and amperage
5. Roof strength, age of roof surface
6. Limits on system size can impede electrification
7. Lack of statutory/regulatory framework for DER aggregation
8. Overall system cost (solar system + battery (?) + grid upgrade (?) + load panel upgrade (?) + roof work (?))

Opportunities for Improvement

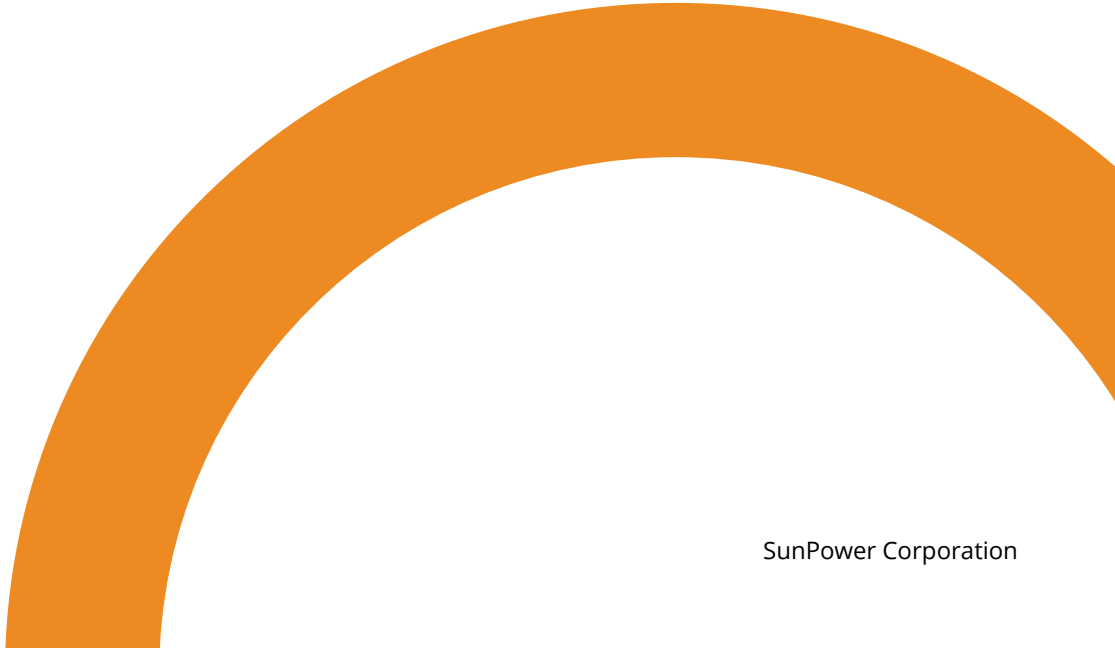
Technical and policy barriers can be overcome

1. From residential perspective, batteries are usually paired with solar and not installed alone
   a. Cost
   b. Ensure some level of renewably sourced energy
2. As threshold, need statutory and regulatory landscape that allows solar and battery storage
   a. Eliminate DG cap
   b. Reasonable limits on system size to ensure resiliency and promote electrification
   c. Encourage utility grid planning that accommodates new DG
3. Provide for DER aggregation that ensures fair compensation for grid services (different from purchase incentives)
4. Time of use rates (covering household and EV charging)
5. Purchase incentives, particularly for low income
   a. Include load panel upgrades and roof work
   b. Comparison of cost to ratepayers of privately owned/maintained DG with utility owned/maintained plant

SUNPOWER®

Thank You

Changing the way our world is powered



Highland

MPSC Resilience Tech Conference
Electric School Buses and V2G

The Highland story

Founded in 2019

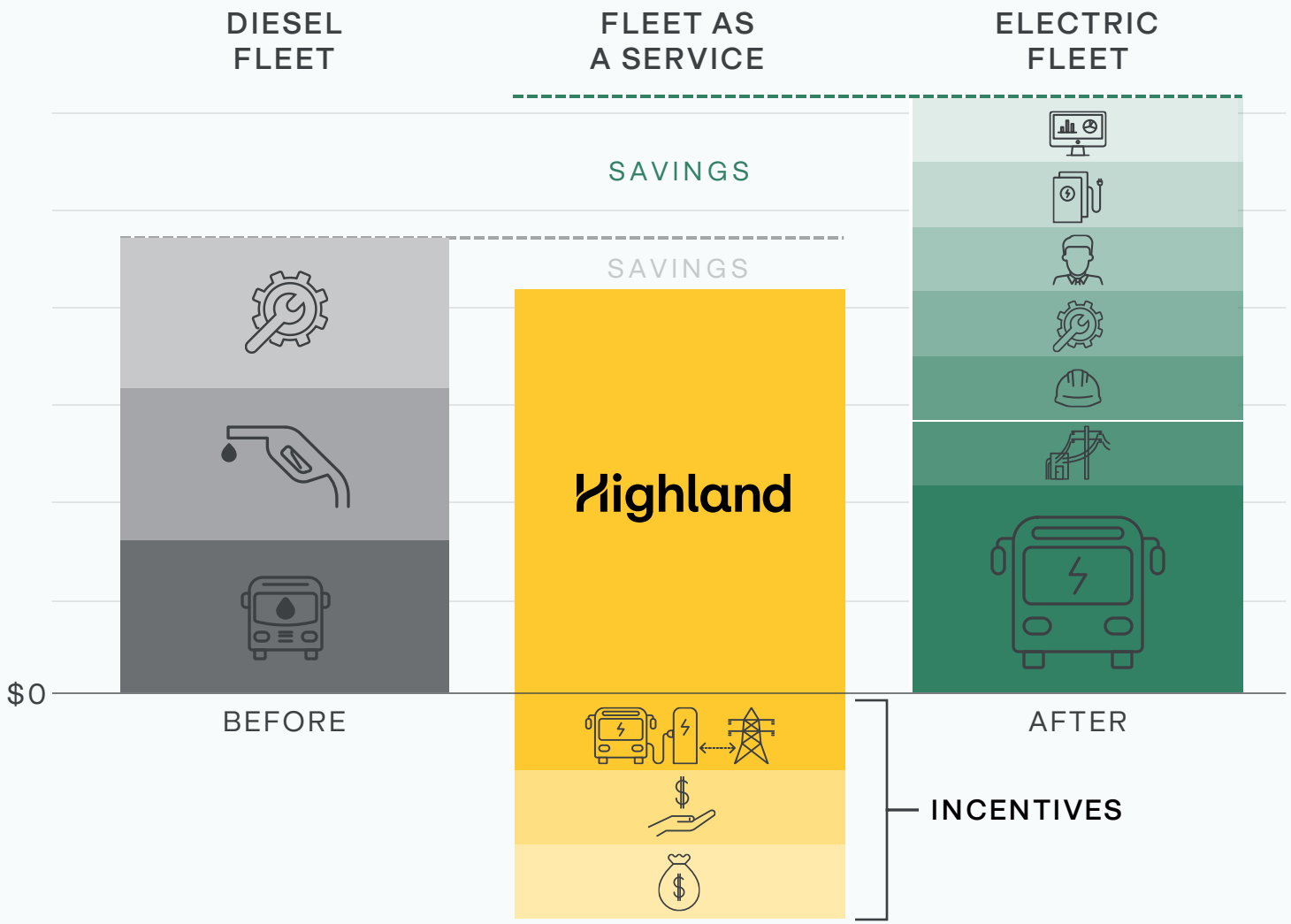
$253M capital raised

Largest electric school bus project in North America:
MCPS, Maryland

First commercial electric school bus V2G program in the U.S.

Leader in public-private partnerships: 410+ buses under contract

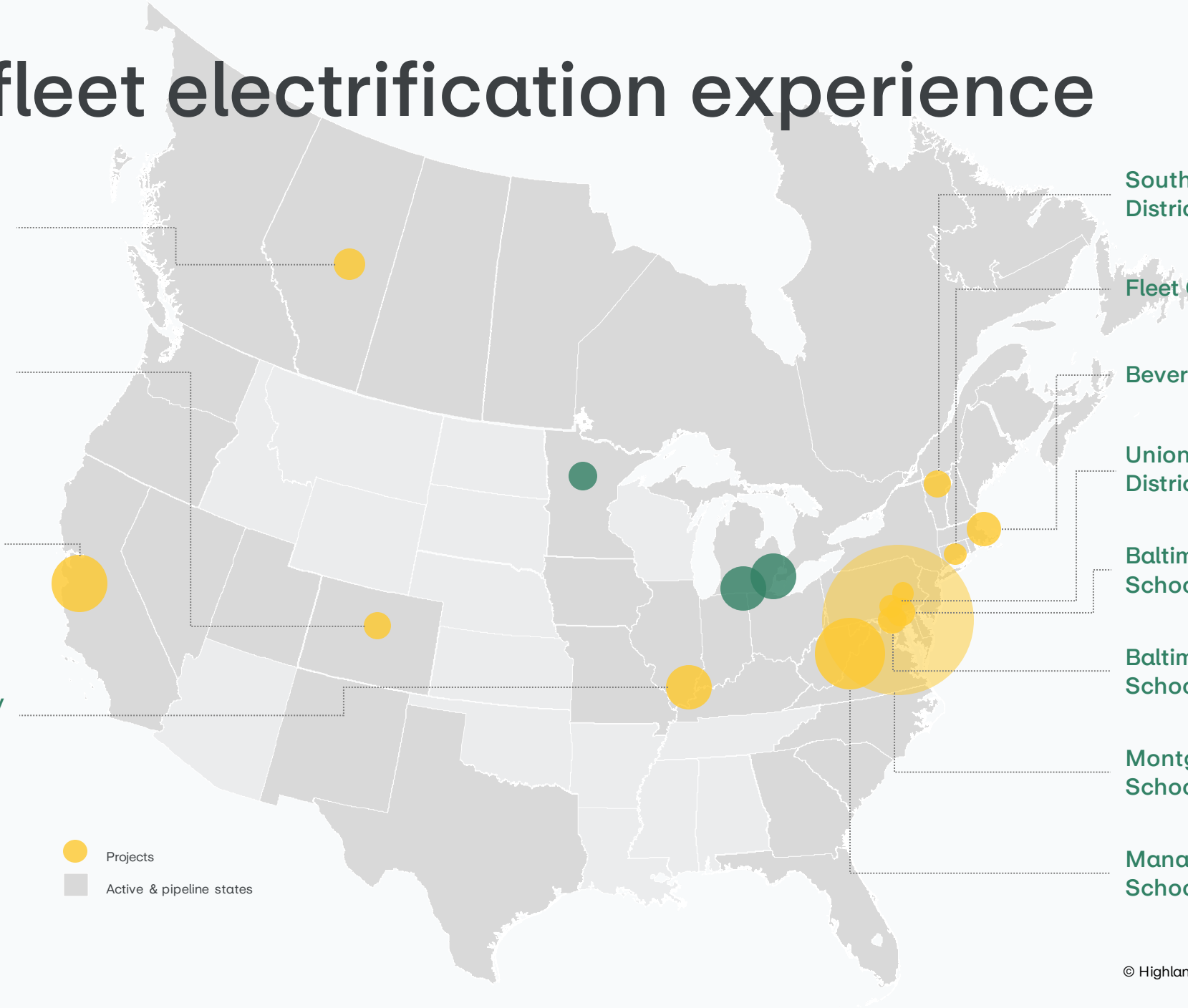
A better electric fleet, for less



Highland makes it affordable.

- No Upfront Cost / No Bond Funds
- Turn-Key Solution
- Save Year 1
- Lower Total Program Cost
- Monetize Tax Incentives
- Aligned Partnership
- Operations & Maintenance Included
- Performance Guarantee

Broad fleet electrification experience



Cunningham Transport, Alberta, Canada

Peak to Peak Charter Schools, Inc., CO

Salinas City Elementary School District, CA

Hardin County Community District No. 1, IL

South Burlington School District, VT

Fleet Contractor, MA

Beverly Public Schools, MA

Unionville-Chadds Ford School District, PA

Baltimore City Public Schools, MD

Baltimore County Public Schools, MD

Montgomery County Public Schools, MD

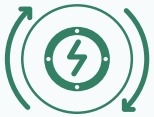
Manassas City Public Schools, VA

Vehicle-to-grid (V2G) with Highland

# OF BUSES	ENERGY CAPACITY	IMPACT TO COMMUNITY
25	5 MWh	116 Local Homes for 1 Day
275	58 MWh	1,400 Local Homes for 1 Day
1,100	231 MWh	5,500 Local Homes for 1 Day

Electric school buses are essentially batteries on wheels. They're ideally suited to provide capacity, stability, and emergency power to the grid.

500k electrified buses add 60GWh of storage capacity.



Highland uses V2G participation to offset the upfront cost of electric buses and make fleets more affordable.

REAL RESULTS

In the summers of 2021 and 2022, Highland orchestrated a commercial V2G program with National Grid in Massachusetts, that sent **10.8 MWh** back to the grid over **158 hours**.

V2G Conceptual Diagram

Provide up to **nine hours of 60kW output** with a three-bus bidirectional charging system:

600 kWh of mobile dual-use EDSI assets[1]

Three interconnected 60 kW bidirectional chargers[2]

Single 60 kW bidirectional inverter for charge / discharge[3]

Backflow energy to anywhere with a bidirectional charger: installation distribution grid, microgrid, or critical infrastructure[4]

A single 3-bus system (pictured) services a peak electric power output of 60 kW for 9 hours

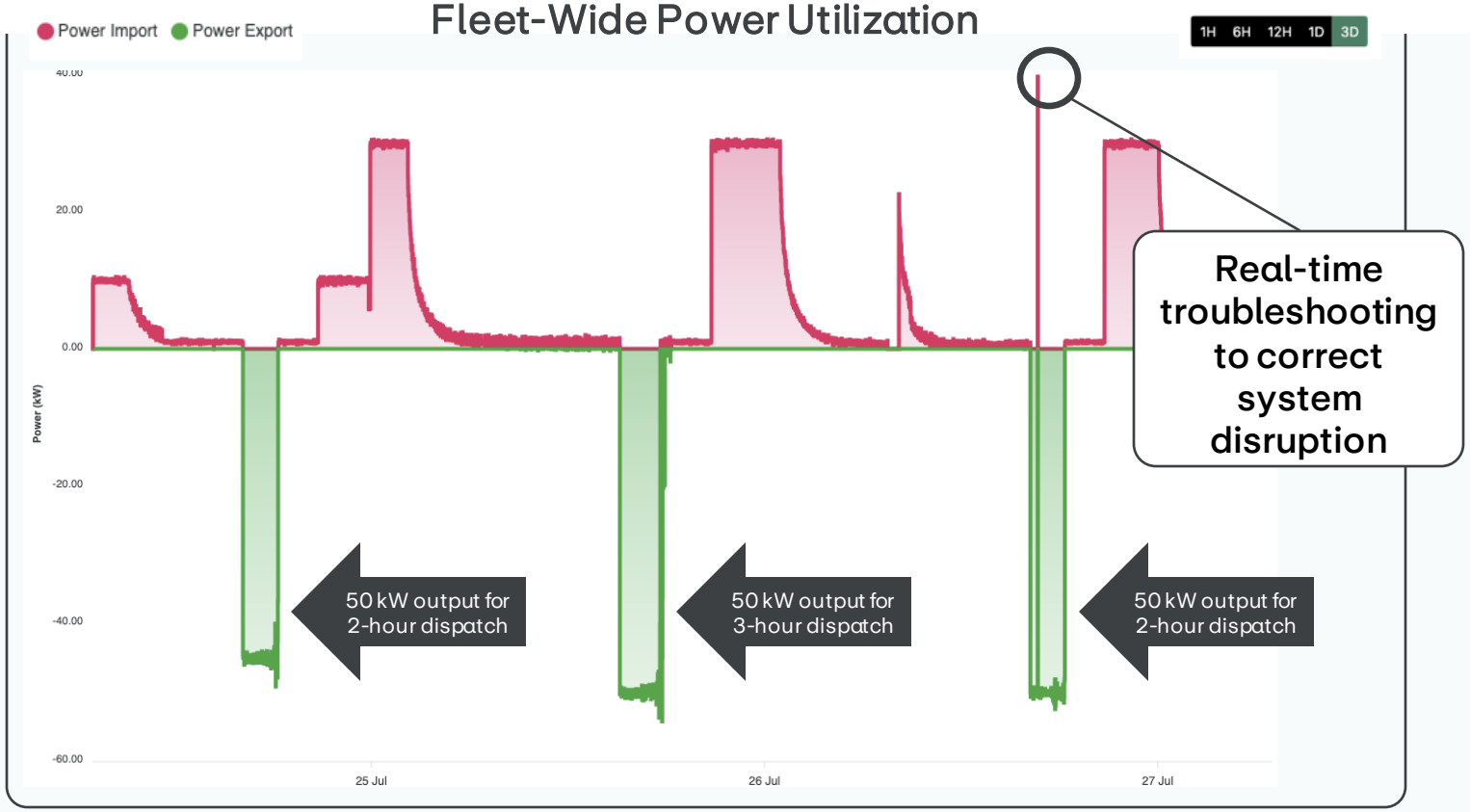
40 systems (4,000-amps) will support 2.4 MW of power output for 9 hours (or 60 kW for 360 hours)

1. Based on 200kWh of usable battery capacity on Thomas Built Jouley (2022 vintage); actual capacity varies by OEM model
2. Sequential discharge format requires cycling between ports; simultaneous discharge capabilities expected in 2023
3. System capable of continuous backflow of 60 kW until bus batteries are depleted; DC-to-AC conversion results in approximately 5% line losses in Highland operating projects
4. Additional electrical panels and controls required for interconnection; dependent on localized project dynamics

V2G Operating Experience

Highland has two operating Vehicle-to-Grid projects for peak shaving

Single Bus V2G Performance Summer 2022 – Massachusetts[1]



1. Snapshot from Highland's energy management software system, developed in coordination with partner Synop. Output not a guarantee of future performance.

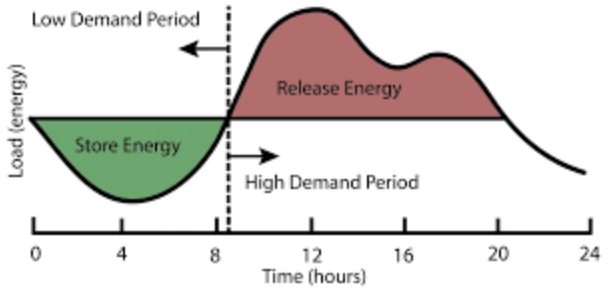
V2G Market Mechanisms: Peak Demand Reduction Incentive Programs

V2G is possible in active demand response programs today

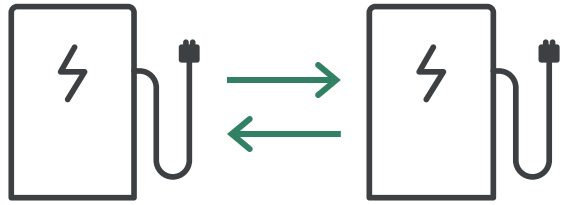
GREEN MOUNTAIN POWER

nationalgrid

Program administrators identify peak periods when stored electricity can help



School buses respond to performance-based incentive payments



Get Paid to Discharge at Peak!

Partnership is Critical to Success

Primary Infrastructure

Secondary Equipment

Bus & Battery

V2G & DR Programs

Student Transportation

Key Questions for Developing Projects

- How can school buses complement the service area?
- Capturing full amount of grants & incentives?
- Utility involvement
  - Make-Ready
  - Direct Investment
  - V2X & Energy Services
  - Regulatory and Legislative Barriers

Thank you.

Joshua Williams
Joshua@highlandfleets.com

Microgrid and Energy Storage Lessons Learned from Fort Custer, Michigan

Major General (Retired) Mike Stone
Senior Counsel at Warner, Norcross + Judd

May 22, 2023

Warner Norcross + Judd

The Opportunity and The Team

In 2015, the Department of Defense (DoD) Environmental Security Technology Certification Program (ESTCP) recognized the critical need for power system resiliency, soliciting environmental and energy technologies for demonstration and validation to improve energy security on military installations. A team was formed between Eaton, the Michigan Army National Guard, MK Advisors and Consumers Energy under the leadership of Electricore Inc.

-Edward Buck, Senior Specialist Engineer, Eaton
https://www.eaton.com/content/dam/eaton/services/eess/eess-documents/eaton-gov-fort-custer-white-paper-wp027019en-en-us.pdf

Why Fort Custer in Augusta, Michigan?

Photo By Master Sgt. Helen Miller | The new solar array at the Fort Custer Training Center in Augusta, Mich., is comprised of 780 panels each rated at 330 watts yielding a capacity of 257,400 kilowatts of power. Construction of the solar field began in early May 2015.

The Battle Creek area is home to the Fort Custer Training Center (Army), the Defense Logistics Agency, the 110th Air Wing (Air National Guard), US Marine Corps Reserves, the Michigan Youth Challenge Program (State and Federal) as well as the Veterans Affairs Agency. At the time of these projects, Fort Custer was a finalist for an East Coast Missile Defense site projected to come with $2.2B in new investments to the area.

The Requirements

I wanted the lights to stay on when the grid went down, so the National Guard could respond when needed; to make sure we were competitive for the Missile program; and to make other federal assets competitive with other States to protect federal jobs.

The Department of Defense wanted to analyze potential replication of the lessons learned for other military installations.

- Utilization of existing assets to improve the economic feasibility of a microgrid
- Engineering of a cost recovery mechanism for exported power
- Investigation of the potential to share resources between Fort Custer and neighboring federal facilities

The Solution

The microgrid solution required the management of a mix of geographically distributed energy resources across the facility. To build this microgrid, advanced control system expertise was required to integrate an existing solar photovoltaic (PV) plant, new energy storage assets and existing backup diesel generators for grid-connected operation. Grid connection of the microgrid required extensive interaction with the region's utility provider and regulatory officials, as well as the development of new energy export approaches, policies and procedures. To demonstrate improved economic feasibility, the team developed the microgrid by maximizing existing assets.

-Buck, Eaton

The Results 1 of 2

The customized microgrid infrastructure created a modular and scalable solution that can be applied to sites throughout the U.S. where military bases are closely located. The ability to seamlessly island, control the demand to a set point, and even export excess energy onto the utility grid to support other loads on the regional distribution system can be used by the neighboring federal facilities or Consumers Energy to optimize grid stability and reliability. The model also shows how utilizing existing backup power infrastructure to build a customized microgrid can dramatically reduce the cost to implement energy surety goals.

-Buck, Eaton

The Results 2 of 2

A key accomplishment of the project was adding grid-connection support alongside advanced automation and control features to legacy diesel generator, solar PV and battery storage assets to maximize economic viability. During grid outages, the solar PV system is supported by energy storage to regulate local demand and even enable Fort Custer to support closely sited facilities. This over-the fence powering capability can also help reduce the investment required for neighboring facilities to support mission-critical energy resiliency initiatives.

-Buck, Eaton

Key Findings 1 of 2

Project findings prove the demonstration is able to effectively enhance power surety, energy resilience, distributed generation management and demand response, while contributing to the critical power needs of nearby military installations.

-Buck, Eaton

Key Findings 2 of 2

An additional challenge for future applications involves the depth of communication and coordination required between grid operators and microgrid operators, especially in the context of power export to nearby facilities and ownership of infrastructure and equipment. If nearby microgrid facilities coordinate with each other, they must keep in mind the electrical infrastructure separating their facilities is generally owned by the local utility, which will seek to mitigate risk to its own equipment. Eaton recommends the application of equipment protection measures such as fault detection and surge protective devices to help in this regard.

-Buck, Eaton

The ‘So What’ for the MPSC

-This project was part of a grander vision to enable energy security and resiliency. We were close to offering the MPSC the opportunity to bring 11-12 M/Ws of new power online (funded by DoE on Fort Custer) to service a 4 to 6 square mile area encompassing federal assets and local businesses.

-The project took a monumental effort on the part of the stakeholders. For instance, MK Advisors volunteered all of their time to make sure that this was a success. Consumer’s Energy committed a significant amount of time without compensation.

-It required more professionals than originally projected and the technology ‘was not ready for prime time’. For instance, the energy storage costs were beyond the budget.

-Lots of learning must occur (and/or training) for future projects like this to succeed.

Michigan Public Service Commission

Challenges to Enhanced Resilience Community Resilience Hubs

May 22, 2023

By
Diane Mills CEM
President, Occupant Care

Agenda

1. What are “Community Resilience Hubs” and their purpose?
2. How vulnerable are they to grid outages in Michigan?
3. What are the key challenges to enhanced resilience?
4. Two Examples: DOE GRIP* grant Concept Paper** and DOE Renew America’s School Concept Paper*** and Application***
5. Economic Barriers
6. Technical, Design, and Procurement Barriers
7. Utility and Collaboration Barriers
8. Community Benefits

* Grid Resilience and Innovation Partnerships
** Written and submitted in partnership with Occupant Care, 5 Lakes Energy, MPSC, and EGLE
*** Written and submitted in partnership with Occupant Care and Pewamo-Westphalia Community Schools

What are Community Resilience Hubs and their purpose?

- **HUBS**
  - Warming / Cooling Centers
  - Warming / Cooling Centers with limited food/snacks
  - Typically smaller, community-owned or municipal buildings
  - Most not available overnight or evenings
  - Information and services

- **SHELTERS**
  - Overnight Emergency Shelters (personal emergencies)
  - Disaster Shelters (emergency disaster relief and shelter usually in coordination with ARC/FEMA)
    - Safe place to sleep, eat, hydrate, shower, obtain health services
    - Typically large, publicly owned buildings
    - Information and services

"Grid resilience doesn't stop at the point the power goes out. It ends when people feel safe and have recovered. Hubs and shelters help fill that gap."

- Diane Mills CEM, Occupant Care

How vulnerable are hubs and shelters to grid outages?

- Nationwide, outages caused by extreme weather events have increased 67 percent since 2000, according to a Climate Central analysis. Michigan fared the worst, with 111 major weather-related outages between 2000 and 2019. (https://www.climatecentral.org/research)
- The problems with grid outages are more complex in rural communities.
- Hubs: Could be less vulnerable to grid outages with solar and batteries backup
- Disaster Emergency Shelters:
  - Building pre-identified by FEMA/ARC not energy ready for grid outages
  - Requires solar, batteries, and generators
  - Buildings often are middle schools and/or high schools which have commercial kitchens, showers (locker rooms), & gymnasiums capable of overnight sheltering and require additional building upgrades

"I don't use 'if'. … It is when, when these emergencies happen."

- Lucy Easthope, Disaster Recovery Expert and author of "When the Dust Settles"

What are the challenges to Enhanced Resilience at Community Resilience Hubs?

- Last mile of grid resilience
- Economic barriers
- Technical barriers
- Design barriers
- Utility barriers
- Collaboration barriers
- Procurement barriers

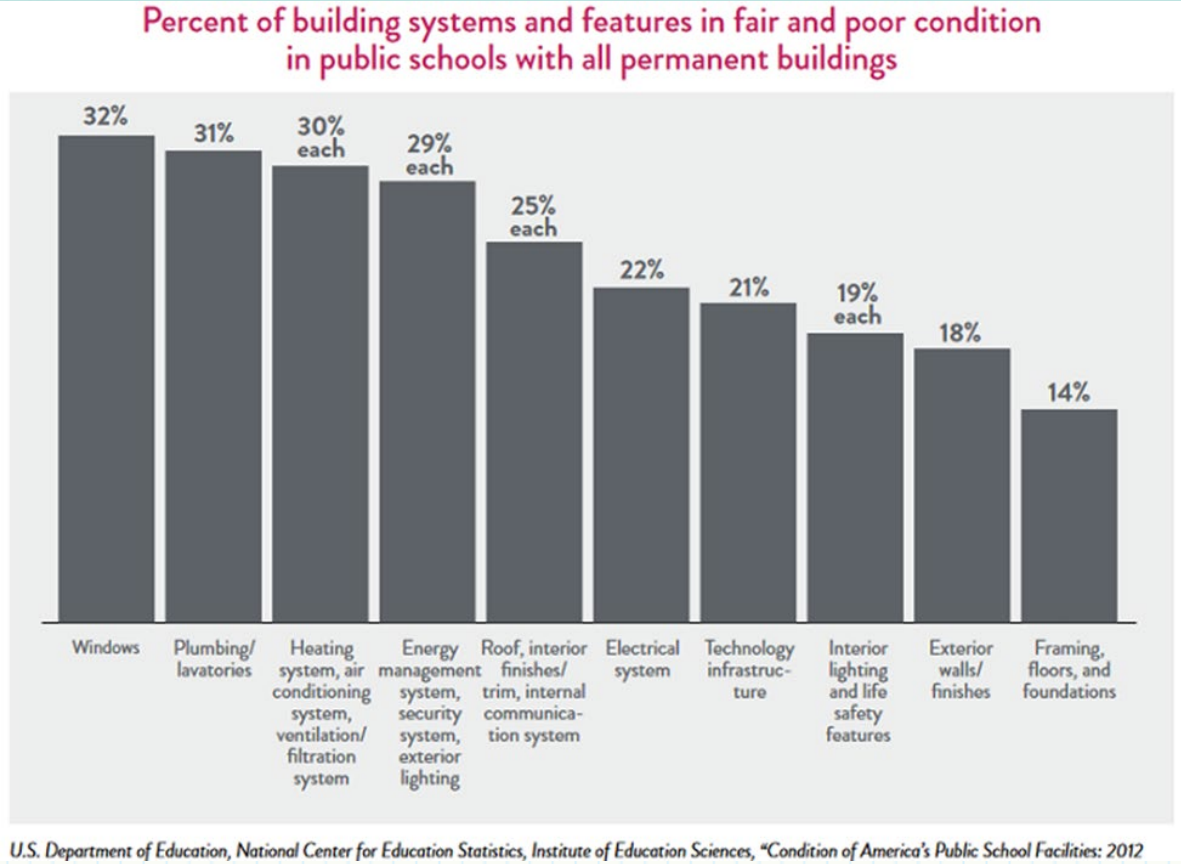
“The key reason for failure is denial.”

- Peter Drucker

Two Examples

- GRIP GRID RESILIENCY GRANT CONCEPT PAPER focused on the “last mile” or “weak link” in building grid resiliency: What happens to people during a grid outage due to disaster event?
  - $150M to provide “Electrification” and renewable energy to 10-15 MS/HS already identified as possible disaster shelters located in disadvantages communities as defined by the Justice40 Initiative
  - Upgrade electrical systems, convert HVAC to geothermal (provides AC), add solar, batteries, and generators capable of running 24/7 for days
  - Used a database of schools Occupant Care had already audited to estimate costs
- RENEW AMERICA’S SCHOOLS GRANT APPLICATION
  - Concept Paper accepted and Application submitted focused on rural school district (disadvantaged per Justice 40 Initiative).
  - Convert steam/hydronic boilers to geothermal, LED light upgrade, new roof, solar, batteries and generator, collaborations, and included student outcomes.
  - $15M to provide “Electrification”

Economic Barriers



U.S. Department of Education, National Center for Education Statistics, Institute of Education Sciences, "Condition of America's Public School Facilities: 2012

Technical, Design, and Procurement Barriers

Updated Project Cost Estimates January 23, 2023	
Traditional HVAC Upgrade	
Traditional HVAC Upgrade	$ 2,750,000.00
Traditional Controls Upgrade	$ 250,000.00
LED Lighting Upgrade	$ 250,000.00
Electrical Service Upgrade	$ 50,000.00
Roof and Building Envelope	$ 1,000,000.00
Traditional HVAC Upgrade Total	**$ 4,300,000.00**
Convert to Geothermal additional cost	$ 5,000,000.00
Microgrid Solar, Battery, and Generators	$ 3,000,000.00
Total Upgrade Estimated Cost	$ 12,300,000.00
With 20% contingency	**$ 14,760,000.00**

Utility and Collaboration Barriers

- Decision makers
  - School Boards and Administrators
  - Governing Entities and Building Codes
  - Utilities – Demand response programs and special rates
  - MISO – Capacity requirements
  - Emergency Operations (188 disaster relief organizations in MI)
    - American Red Cross, FEMA, Salvation Army, Michigan State Police
    - County programs
    - Municipal programs
- Vendors and solution providers
  - Engineering and design (mechanical, electrical, structural)
  - Procurement (HVAC, controls, solar, LED lighting, electrical, …
  - Funding and financing (ESPC, PPA, Michigan Saves, grants, rebates, better rates, DR)
  - Staff training
  - Measurement and Verification plans
  - EV Charging Stations

Community Benefits
(Justice40 Priorities in DAC)

- Decrease in energy burden
- Decrease environmental exposure
- Increase clean energy jobs, job pipeline and access, and career track job training
- Increase clean energy enterprise creation and contracting
- Increase energy democracy
- Increased access to low-cost capital
- Increase parity in clean energy technology access and adoption
- Increase reliability, resilience, and infrastructure to support reliability and resilience

Using 2 examples:
Cost for one shelter per county in 83 MI counties: $830M - $1.245B
Estimate cost ratios 60/40 to 50/50 Electrification/Shelter energy infrastructure
Approximately 42,500+ people shelter capacity
Approximately 83 MW added grid capacity – very flexible

Questions from Commissioners

Up Next:

4:00 pm MPSC Reliability Data Collection Template

MPSC Reliability Webpage

Jessica Duell, MPSC

4:00-4:15pm

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

Questions from Commissioners

Up Next:

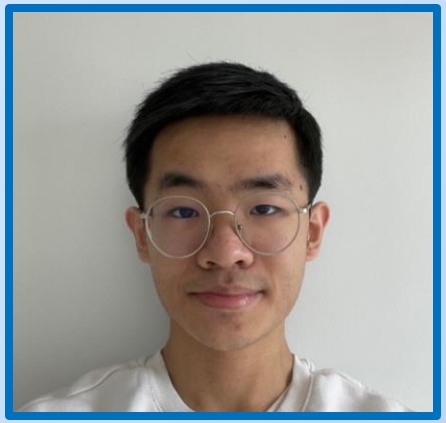
4:15 pm Data and Mapping

Panel: Data & Mapping – Gaps & Solutions

Moderator:

Joy Wang, Ph.D.
Manager
Distribution Planning
Michigan Public Service Commission

Amy Bandyk
Executive Director
Citizens Utility Board of MI



Eric Lau
Senior Software Engineer
The Michigan Daily

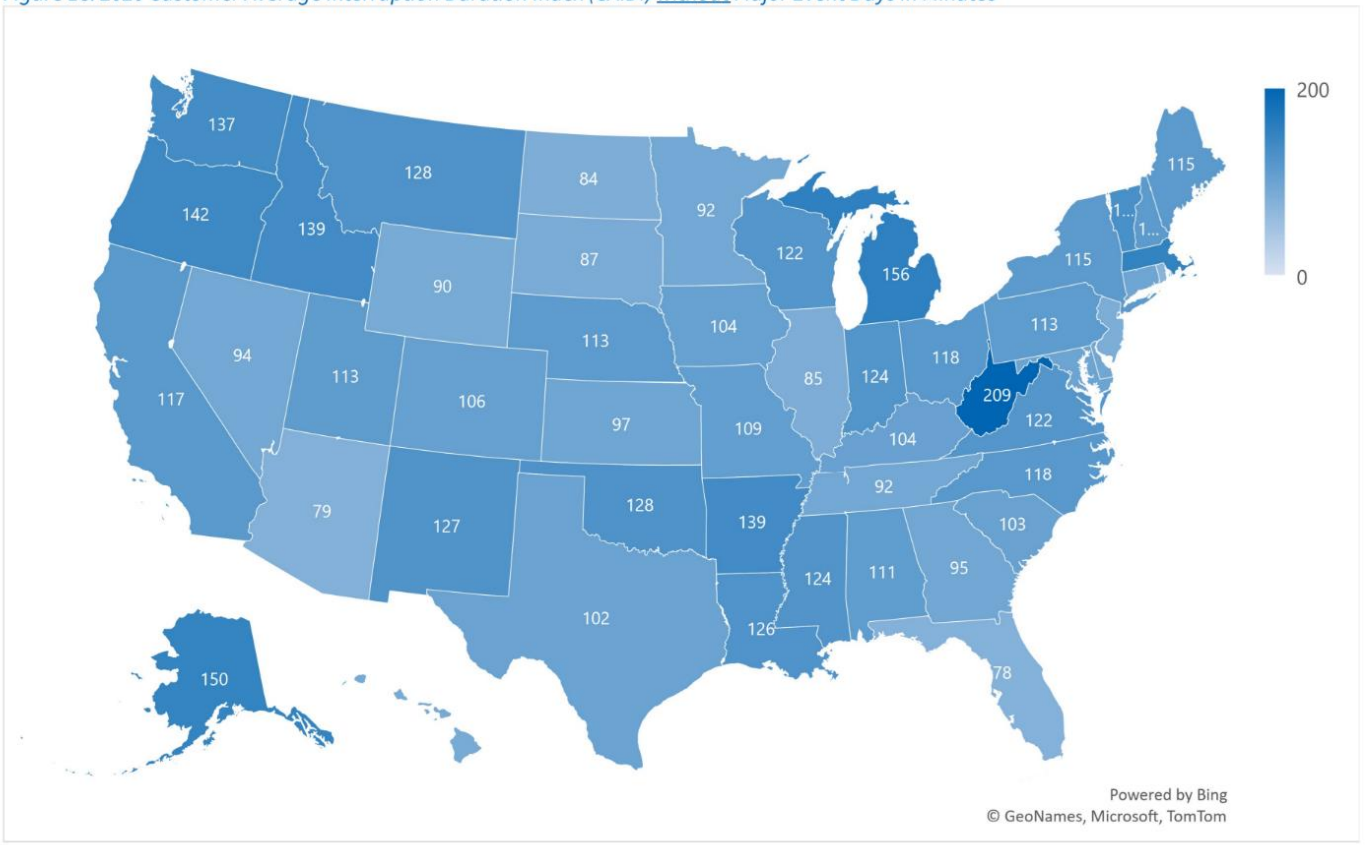
Tera Dornfeld, Ph.D.
Analyst & Public Engagement Specialist
Minnesota Public Utilities Commission

Hanna Terwilliger
Senior Rates Analyst
Minnesota Public Utilities Commission

MPSC
MICHIGAN PUBLIC SERVICE COMMISSION

Reliability In Michigan

Figure 18: 2020 Customer Average Interruption Duration Index (CAIDI) without Major Event Days in Minutes



Source: CUB of Michigan Utility Performance Report

Circuit-Level Picture Not Enough

Consumers Energy (electric)

1.64 million residential customers

/

2,355 distribution circuits

= **696.4 res. customers per circuit**

DTE Electric

2.04 million residential customers

/

3,486 distribution circuits

= **585.2 res. customers per circuit**

New Template Asks for Census Tract/Zip Code-Level Data

WORST PERFORMING CIRCUITS DURING THE MONTH AND YEAR

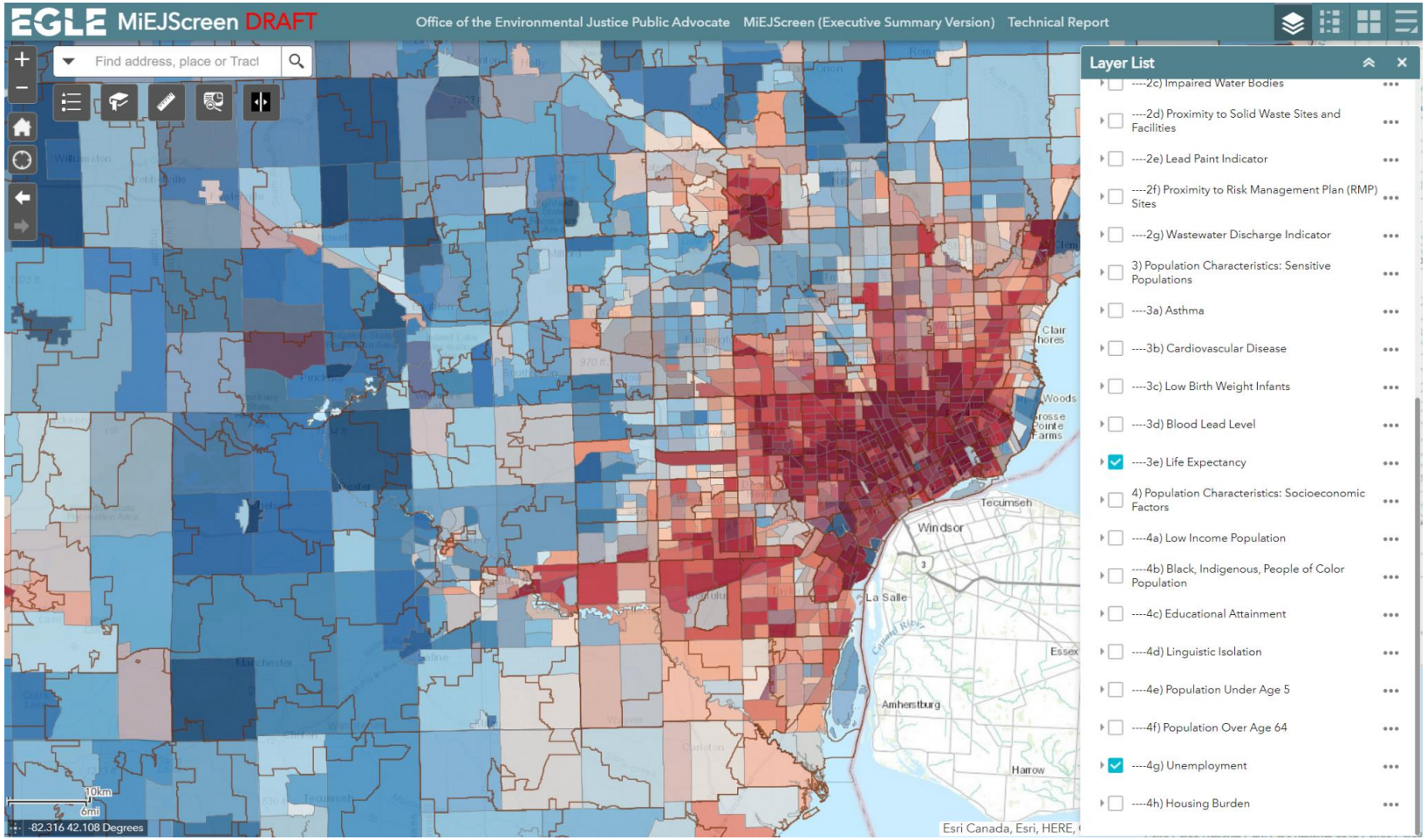
(1) For each electric utility with 1,000,000 or more customers, a list of its 10 worst performing circuits for the prior month in terms of SAIDI and SAIFI. For each listed circuit, provide the following information below.

(2) For each electric utility or cooperative with less than 1,000,000 customers, a list of the worst performing 1% of circuits for the prior month in terms of SAIDI and SAIFI. For each listed circuit, provide the following inform

Item/Area		Circuit 1	Circuit 2	Circuit 3	Circuit 4	Circuit 5	Circuit 6	Circ
Circuit Name								
Circuit Number								
SAIDI all weather (monthly)	*Residential*							
	Commercial							
	Industrial							
	Overall							
SAIDI excluding MEDs (annual only)	*Residential*							
	Commercial							
	Industrial							
	Overall							
Circuit Length (miles)								
Number of Customers Served	*Residential*							
	Commercial							
	Industrial							
Substation Name								
Location of Circuit Span - Zip Codes								
Location of Circuit Span - Census Tracts								
Last Circuit Trim								
List of Outages and Causes								

MiEJScreen

- Developed by Michigan EGLE
- Example of data that could be combined with outage data



Mapping Reliability and Equity

Hanna Terwilliger, Rates Analyst

Tera Dornfeld, Public Engagement Regulatory Specialist

MINNESOTA
PUBLIC UTILITIES COMMISSION

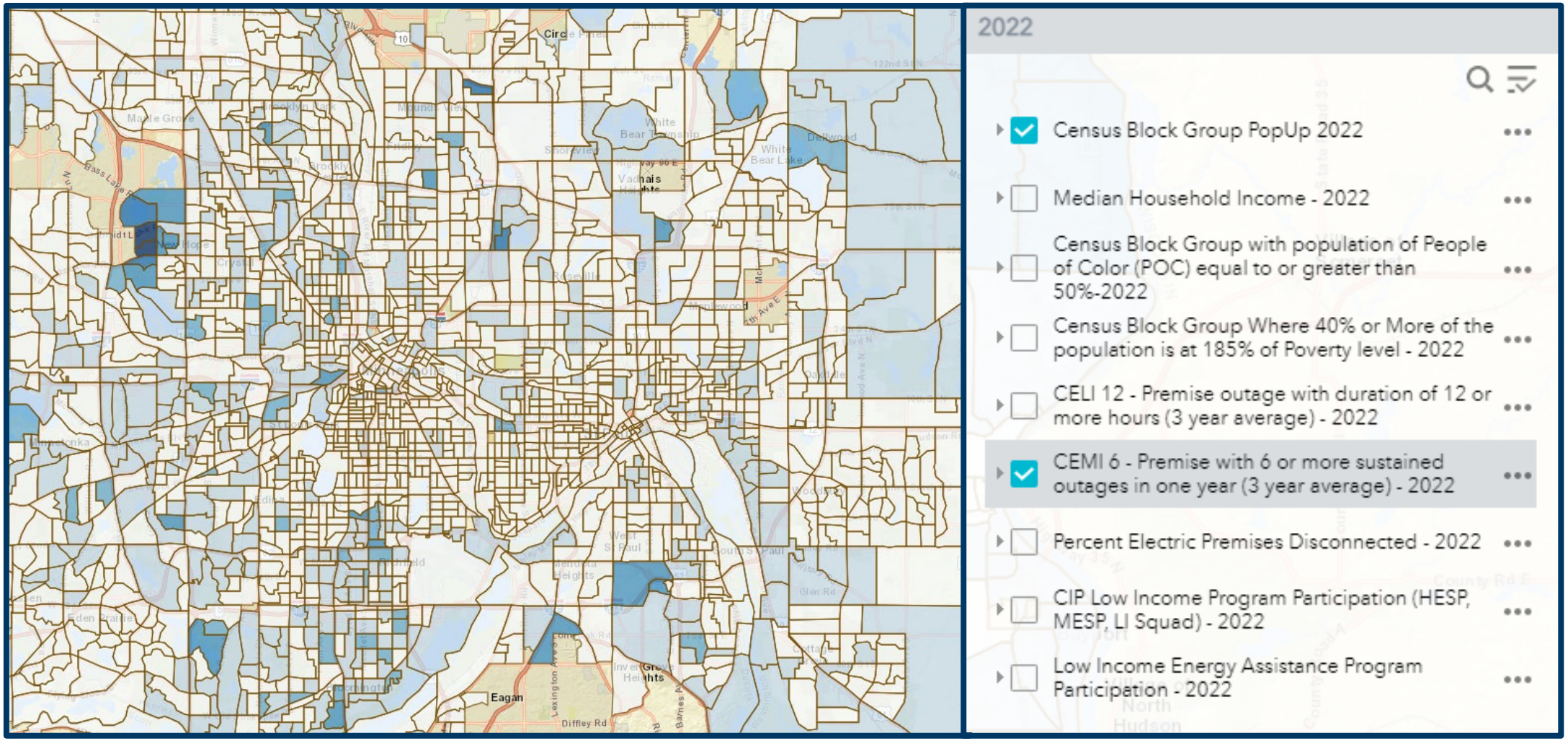
The ideas expressed are the views of the presenter, and not the Minnesota Public Utilities Commission.

Creation of the Interactive Map

- Map developed as part of Performance Based Ratemaking (PBR) docket for Xcel Energy
- Reliability metrics
  - Customers Experiencing Multiple Interruptions (CEMI) – 6 or more sustained interruptions in a year
  - Customers Experiencing Lengthy Interruptions (CELI) – 12 hours or longer interruption in a year
- Demographic indicators: using Minnesota Pollution Control Agency "Environmental Justice Areas of Concern" thresholds
  - Census tracts that have at least 40% of people reported income less than 185% of the federal poverty level
  - Census tracts that have 50% or more people of color
  - Federally recognized Indian Tribes

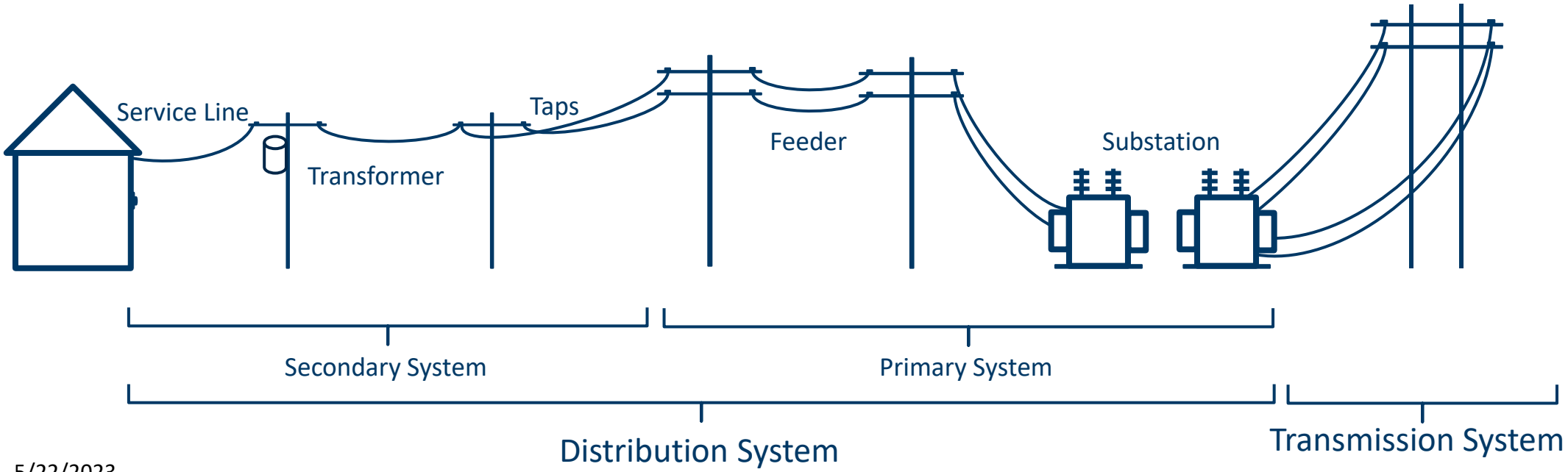
Xcel Electric Service Quality Interactive Map

https://xeago.maps.arcgis.com/apps/webappviewer/index.html?id=6b87f4d407864b939bcea05aad05bdd1



Data challenges

- Aligning geographic boundaries
- System vs customer level metrics
- Data privacy and security concerns



MINNESOTA
PUBLIC UTILITIES COMMISSION

Thank You!

Hanna Terwilliger & Tera Dornfeld

Hanna.Terwilliger@state.mn.us & *Tera.Dornfeld@state.mn.us*

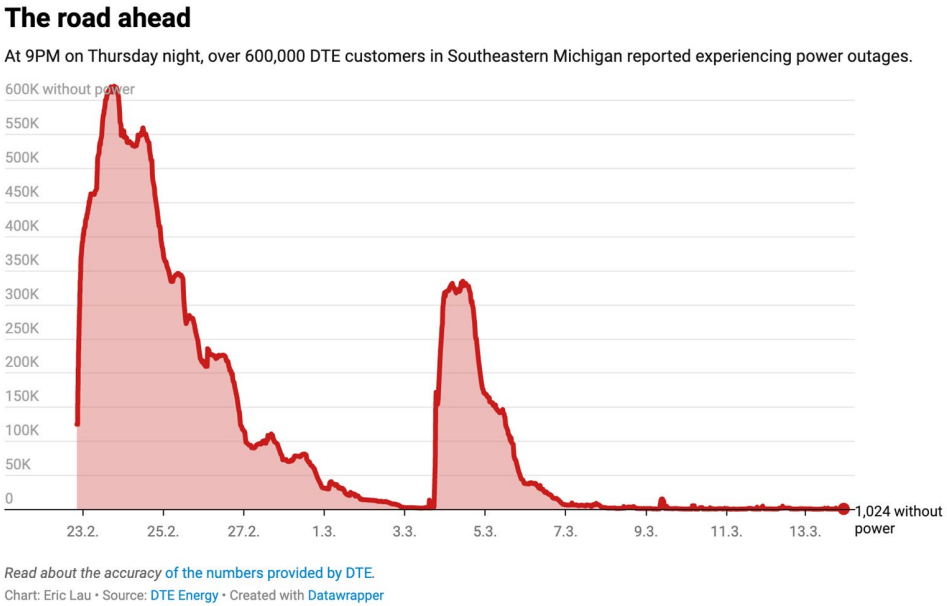
DTE Data Dive

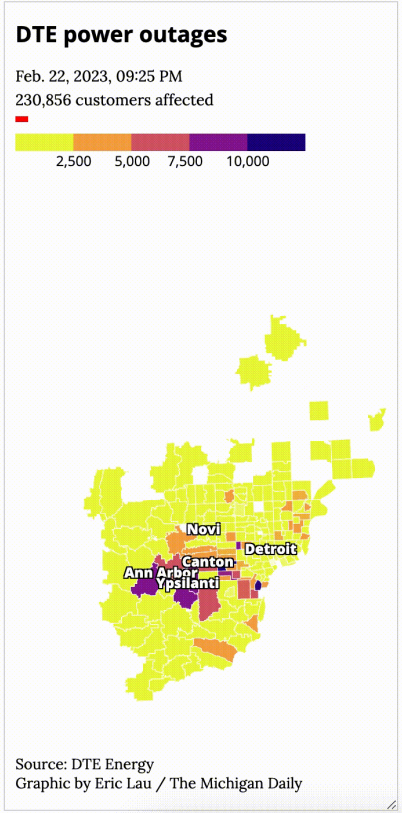
A reflection on data from the February power outages

Eric Lau (ericlau@umich.edu)
The Michigan Daily
Senior Software Engineer

Michigan Public Service Commission
Resilience Tech Conference — Data and Mapping: Gaps and Solutions
May 22, 2023

Data temporality





References

Massive power outage in Ann Arbor leaves thousands in the dark (The Michigan Daily)

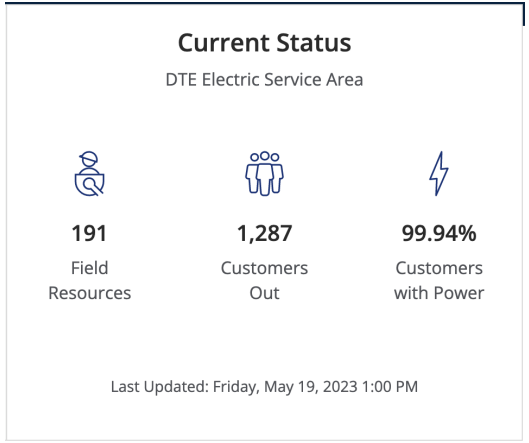
DTE Outage Tracker (GitHub)

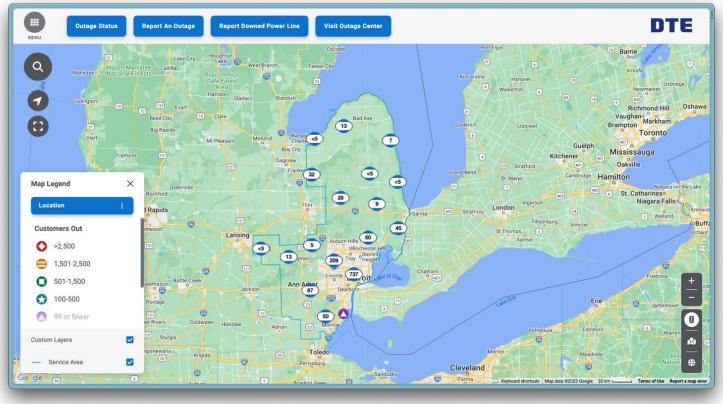
Data discrepancies

The disparity in DTE's outage numbers

The number of customers without power as reported by DTE on their outage homepage has been consistently lower than the number reported through their outage map API.

Note: Dashboard data prior to February 26th came from a compilation of Twitter screenshots of the dashboard.
Source: DTE Energy
Graphic by Eric Lau / The Michigan Daily

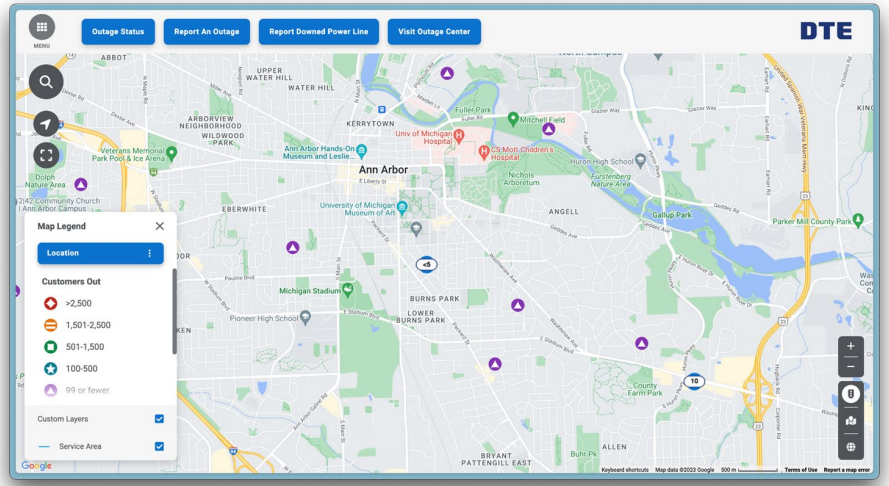


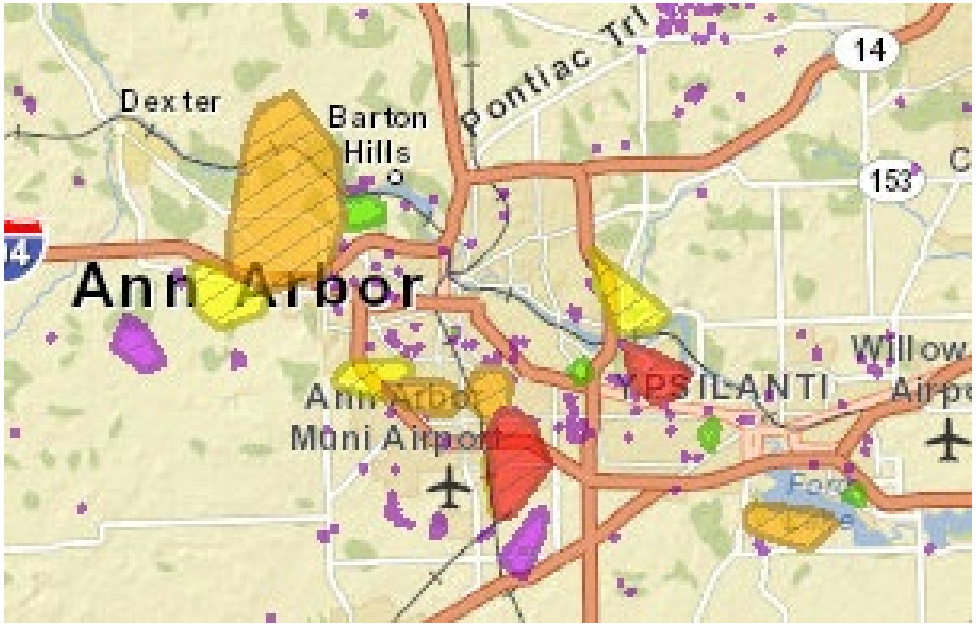


References

DTE Energy undercounts service interruptions on power outage website (WDET)
The disparity in DTE's outage numbers (Twitter)
DTE outage center (DTE)
DTE outage map (DTE)

Data granularity





References

[DTE outage map](#) (DTE)
[Damn Arbor](#) (Twitter)

Questions from Commissioners

Up Next:

4:45 pm How to submit comments

4:50 pm Closing Remarks

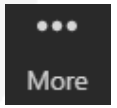
To submit a comment

Written Comments – Case No. U-21388

1. Email to:
   LARA-MPSC-commissioners2@michigan.gov

2. Mail to:
   Michigan Public Service Commission
   P.O. Box 30221
   Lansing, MI 48909

For IT assistance, e-mail: LARA-MPSC-EVENT-IT@michigan.gov

To enable closed captioning: 1.) Click the "more" button 

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2.) Click on "Language and speech" 3.) Click on "Turn on live captions"

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By Phone: 1-800-292-9555

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Information on filing a complaint is available at Michigan.Gov/UtilityComplaints

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