WELCOME
to the

Michigan Public Service Commission

MPSC TECHNICAL CONFERENCE

DAY 1
October 22, 2021
9:00 – 1:00 p.m.

SESSION 1

GROUNDING IN DATA: WHERE ARE WE WORKING FROM

Katherine Peretick

MPSC Commissioner

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Session One
Grounding in Data: Where Are We Working From

Speaker Topic:
Historical Data on Outages

October 22, 2021
9:00 – 10:05 a.m.

Historical Data on Outages

October 22, 2021

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WHAT IS CONSIDERED AN OUTAGE?

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Michigan Administrative Rule 460.702 (l)

- (l) "Interruption" means the full or partial loss of service to 1 or more customers for longer than 5 minutes. The duration of a customer's interruption shall be measured from the time that the electric utility is notified or otherwise becomes aware of the full or partial loss of service to 1 or more customers for longer than 5 minutes.

NORMAL AND CATASTROPHIC CONDITIONS

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Michigan Administrative Rule 460.702

"Catastrophic conditions" means either of the following:

(i) Severe weather conditions that result in service interruptions for 10% or more of a utility's customers.

(ii) Events of sufficient magnitude that result in issuance of an official state of emergency declaration by the local, state, or federal government.

"Normal conditions" means conditions other than catastrophic conditions.

CATASTROPHIC CONDITIONS OUTAGES (DTE & CE)

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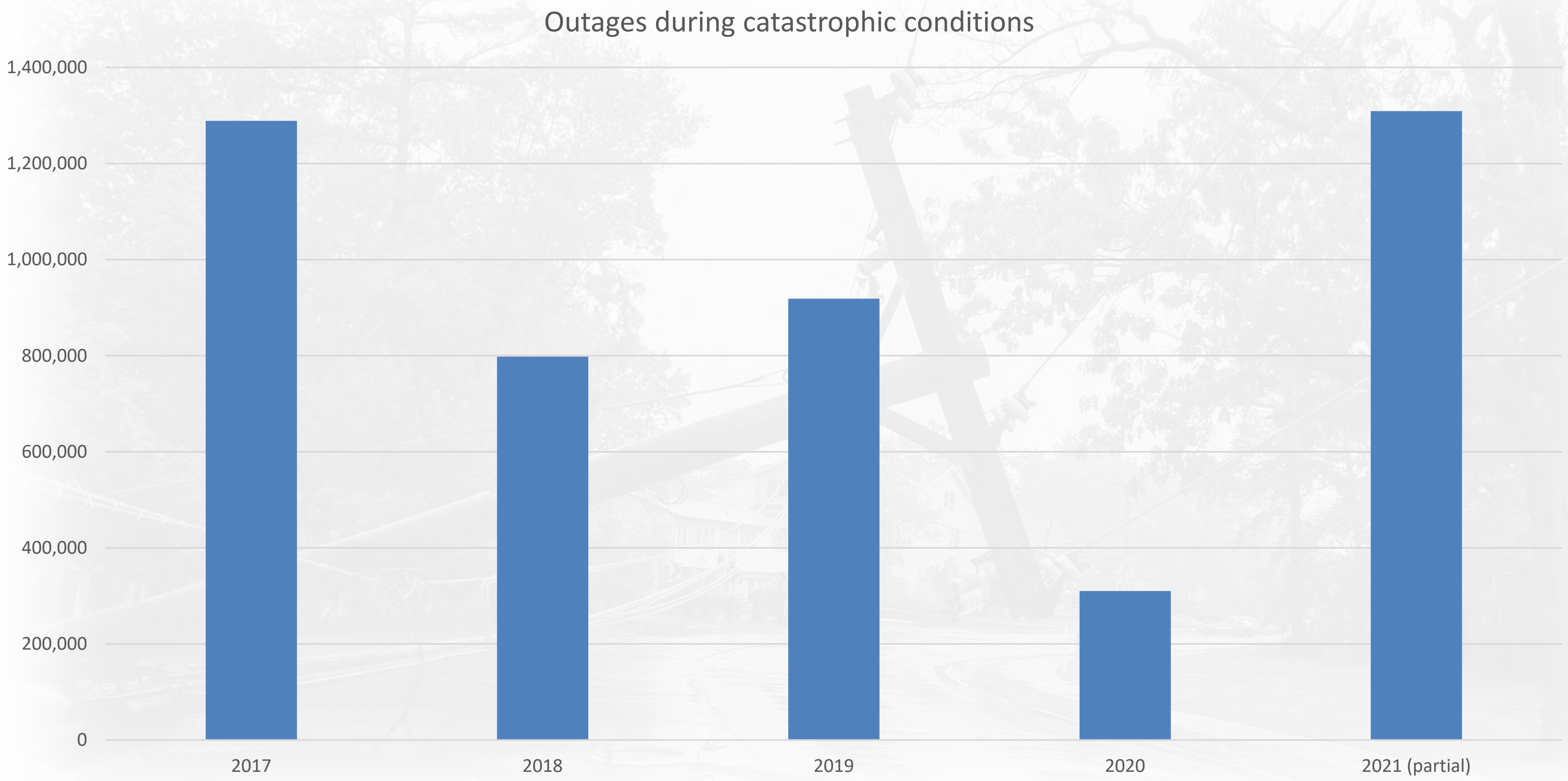

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MAJOR OUTAGE EVENTS (2013-2019)

Date	*Storm Type*	*Customers Interrupted**	*Storm Duration (Days)***	*Storm Restoration (Days)***
11/17/2013	Wind Storm	719,854	5.5	6
12/21/2013	Ice Storm	388,950	8	6.9
09/05/2014	Wind Storm	414,699	7	7.2
12/24/2015	Wind Storm	181,627	4	4.2
03/07/2017	Wind Storm	1,103,539	7	7.1
07/06/2017	Wind Storm	181,620	4	4.2
04/15/2018	Ice Storm	288,976	5	5.3
05/04/2018	Wind Storm	254,867	4	4.5
08/26/2018	Wind Storm	255,763	7	6.9
02/06/2019	Ice Storm	231,891	4	5
07/19/2019***	Wind Storm	825,505	3	5.0

* Number of customers interrupted are cumulative when more than one utility reported the same storm.
** Storm duration and storm restoration are reflected as an average when more than one utility reported the same storm.
*** Preliminary numbers at the time of this report.
Source: MPSC

MAJOR OUTAGE EVENTS (2019 - Present)

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- July 26, 2019 – 124,281 out due to wind, rain and hail
- June 9, 2020 – 501,648 out due to wind, rain and hail
- July 7, 2020 – 147,163 out due to wind, rain and heat
- July 18, 2020 – 190,781 out due to wind and rain
- November 14, 2020 – 207,039 out due to wind and rain
- June 20, 2021 – 188,433 out due to thunderstorm, winds and tornado
- June 25, 2021 – 257,000 out due to thunderstorm, heat and flooding
- July 12, 2021 – 213,000 out due to thunderstorm and high winds
- July 24, 2021 – 171,000 out due to thunderstorm and tornado
- August 10, 2021 – 1,072,000 due to thunderstorm, winds, flooding and tornados

HOW MUCH HAVE THE UTILITIES PAID OUT IN CREDITS?

2016: $25,682
2017: $1,665,836
2018: $224,453
2019: $230,981
2020: $397,713

Usually, the customer must contact the utility to ask for the credit. MPSC is proposing that these credits be given automatically.

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STORM RESTORATION COSTS (O&M ONLY)

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Consumers Energy (2015 – 2019)

- 2015: $38,167,000
- 2016: $35,504,000
- 2017: $50,172,000
- 2018: $53,924,000
- 2019: $92,100,000

DTE Electric (2014 – 2018)

- 2014: $107,775,000
- 2015: $44,278,000
- 2016: $39,597,000
- 2017: $67,023,000
- 2018: $48,182,000

LAWRENCE BERKLEY NATIONAL LABORATORY INTERRUPTION COST ESTIMATE CALCULATOR

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- Online tool that estimates interruption costs and the benefits of reliability improvements.
- Quick example: 10,000 residential customers in Michigan are out and the electric utility serving them has average reliability for MI*. Each event will cost a customer $13.45 and cost $174,786 total (in 2016 dollars)

Can be found here: https://icecalculator.com/home

*Assumed 550 all-weather SAIDI and 1.30 all-weather SAIFI.

WHAT IS ENVIRONMENTAL JUSTICE?

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The Michigan Department of EGLE defines environmental justice as the equitable treatment and meaningful involvement of all people, regardless of race, color, national origin, ability, or income, and is critical to the development and application of laws, regulations, and policies that affect the environment, as well as the places people live, work, play, worship, and learn.

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The EPA defines it as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This goal will be achieved when everyone enjoys:

- The same degree of protection from environmental and health hazards, and
- Equal access to the decision-making process to have a healthy environment in which to live, learn, and work."

SCREENING TOOLS

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EPA: Environmental Justice Screening and Mapping Tool:
https://www.epa.gov/ejscreen

University of Michigan: Screening Tool for Environmental Justice in Michigan
https://www.arcgis.com/apps/webappviewer/index.html?id=dc4f0647dda34959963488d3f519fd24

ELECTRIC RELIABILITY AND EQUITY

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- Electric service reliability is not the same everywhere in Michigan.
- DTE Electric and Consumers Energy must submit a report every year that includes a list of their worst performing circuits for the prior year.
- These reports can be accessed on the MPSC's e-dockets system: https://mi-psc.force.com/s/
  - DTE Electric: U-16065
  - Consumers Energy: U-16066
- MPSC Staff is proposing to extend this requirement to all investor-owned and electric cooperative utilities.

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Michigan's Reliability Compared to Other States

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TWO WAYS TO LOOK AT OUTAGES

- "System-wide" – reliability indices like SAIDI and SAIFI, and Michigan rule R 460.722.
- "Individual" – reliability indices like CEMI and CELID, and Michigan rules R 460.744, 460.745, and 460.746.

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IEEE 1366 RELIABILITY INDICES

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- **System Average Interruption Frequency Index (SAIFI)** – measures the average number of times a customer experiences an outage in a time period.
- **System Average Interruption Duration Index (SAIDI)** – measures the average duration (usually in minutes) of outages in a time period.
- Major Event Days (MEDs) included in comparisons.

SAIFI EXCLUDING MEDS

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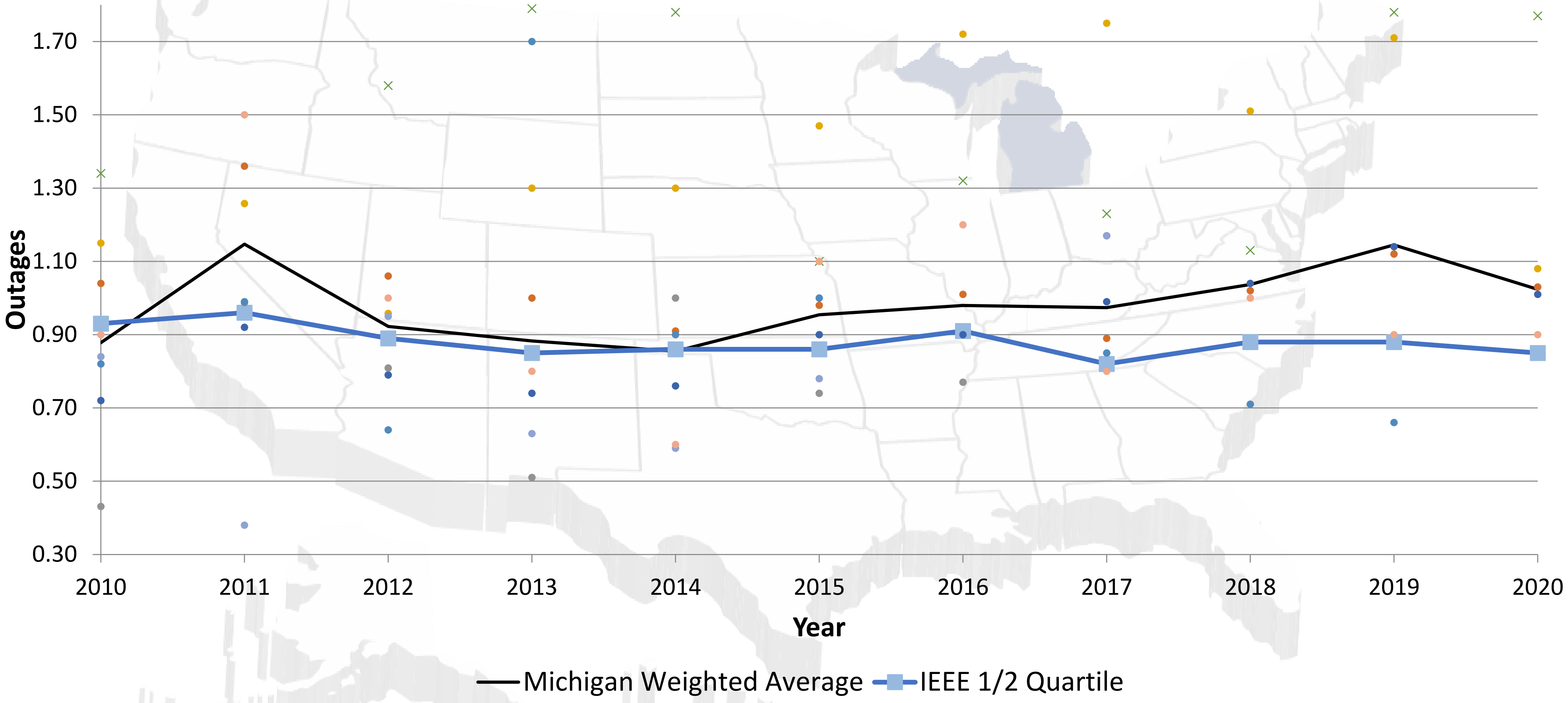

Source: IEEE DRWG Benchmarking , U-16066, U-16065, and U-12270 reports

SAIFI INCLUDING MEDS

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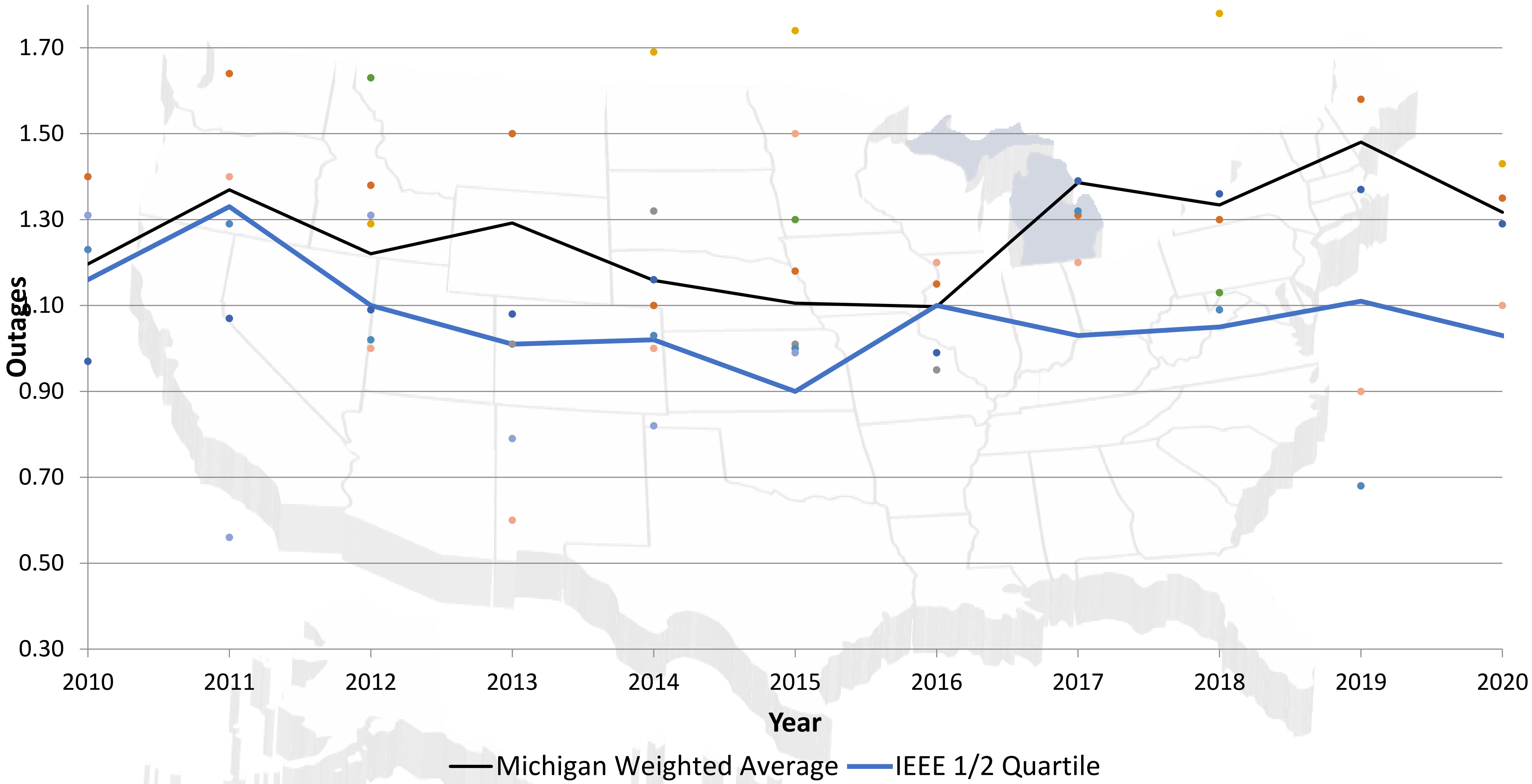

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SAIDI EXCLUDING MEDS

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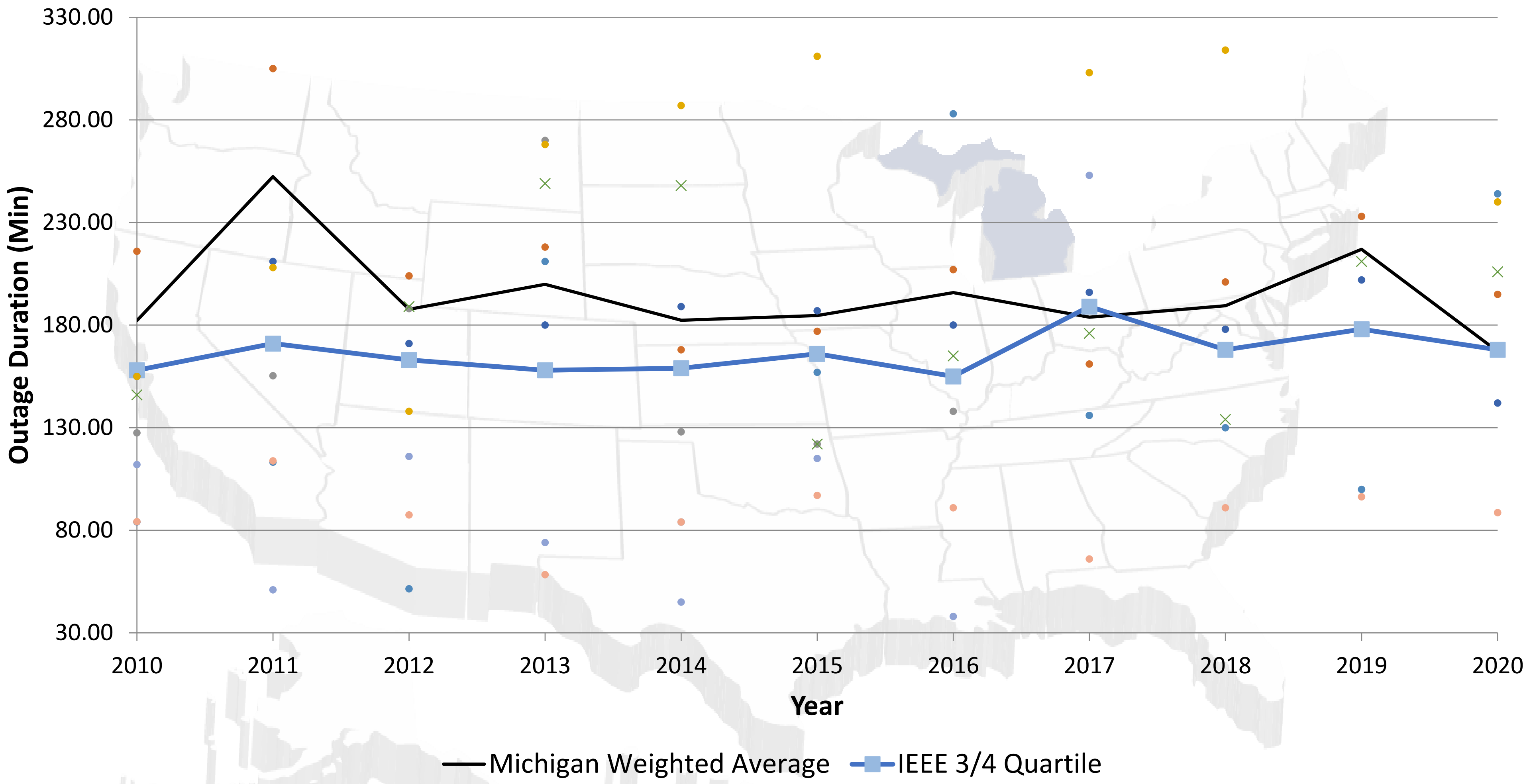

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SAIDI INCLUDING MEDS

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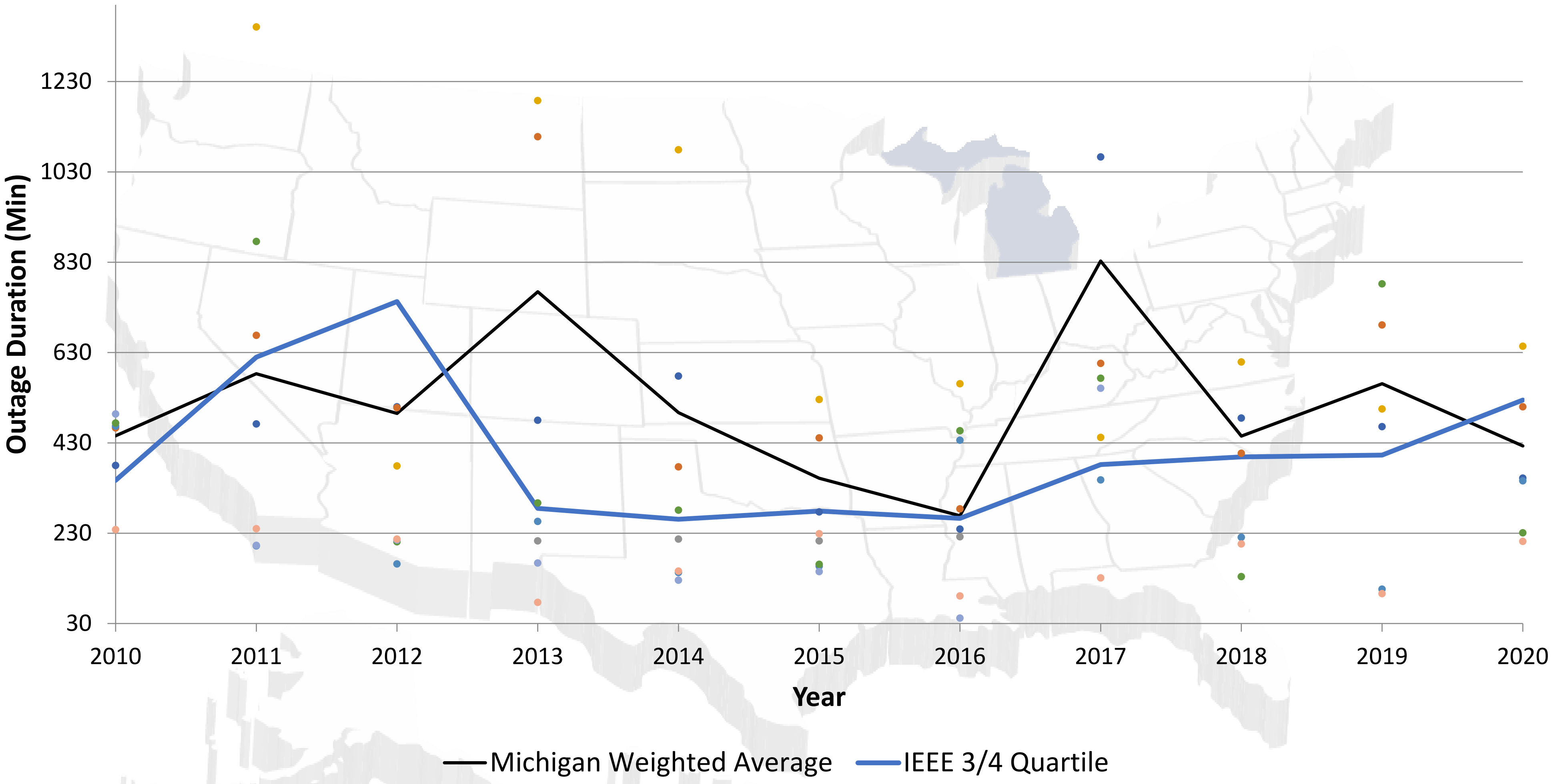

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MICHIGAN INFRASTRUCTURE REPORT CARD

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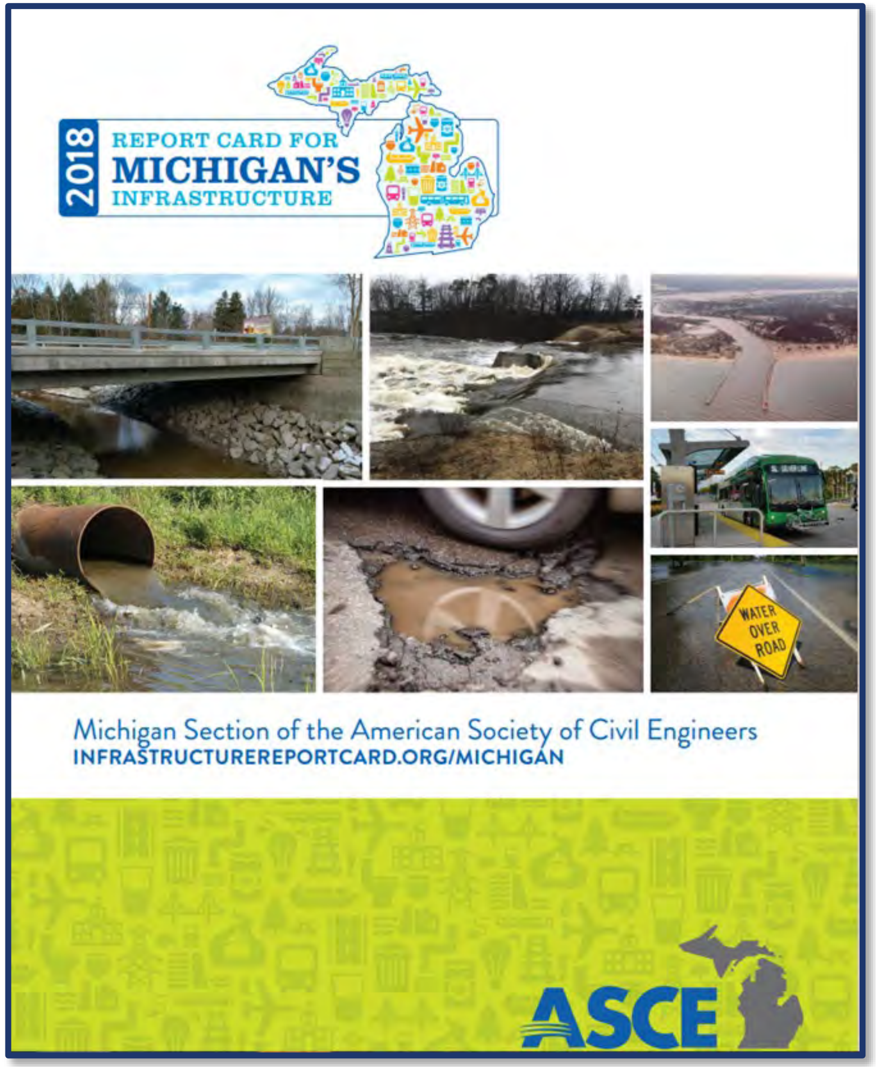
American Society of Civil Engineers (ASCE) Michigan's 2018 Report Card analysis based on eight criteria:

- Capacity
- Condition
- Funding
- Resilience
- Innovation
- Future Need
- O&M
- Public Safety

Michigan's Energy Grade: C-

Report Summary:

> "…threatened by increasing energy dependance and demand for high service reliability coupled with aging infrastructure, lack of investment to preserve function, exposure to physical and cyber threats,…"



ENERGY GRADE COMPARISON – U.S.

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ASCE's [2021 Report Card for America's Energy Infrastructure]

Michigan's Energy Grade: C- America's Energy Grade: C-

C — MEDIOCRE: REQUIRES ATTENTION
The infrastructure in the system or network is in fair to good condition; it shows general signs of deterioration and requires attention. Some elements exhibit significant deficiencies in conditions and functionality, with increasing vulnerability to risk.

D — POOR: AT RISK
The infrastructure is in poor to fair condition and mostly below standard, with many elements approaching the end of their service life. A large portion of the system exhibits significant deterioration. Condition and capacity are of significant concern with strong risk of failure.

Executive Summary:

- "…weather remains an increasing threat."
- "…distribution infrastructure struggles with reliability…"
- "…distribution infrastructure, smart planning, and improved reliability are needed to accommodate the changing energy landscape…"

ENERGY GRADE COMPARISON – MIDWEST

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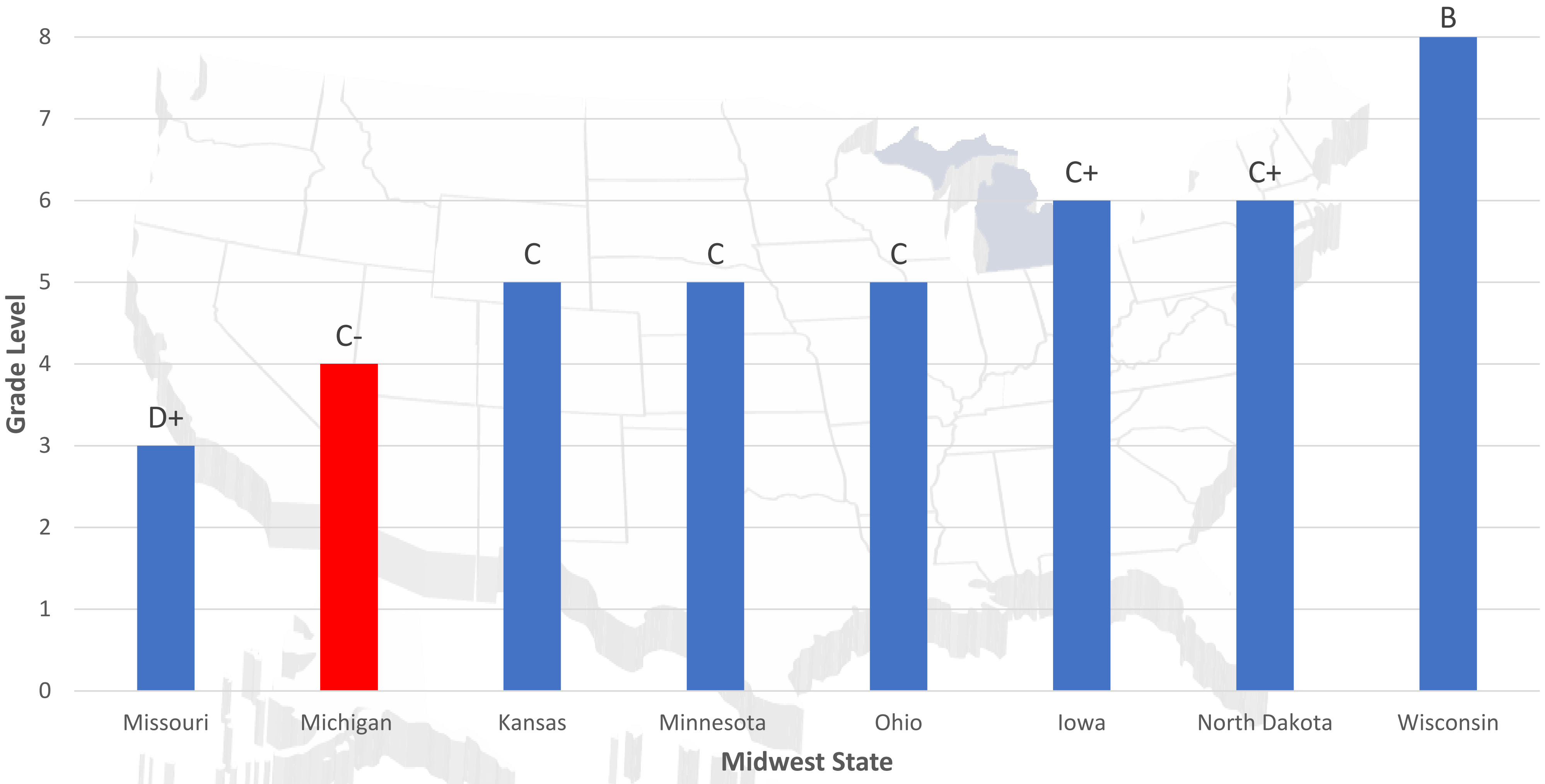

Source: https://infrastructurereportcard.org

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SUMMARY

- Michigan's weighted average SAIFI has commonly been in the 2nd quartile with some past years (before 2015) in the 1st quartile and some recent years (after 2015) in the 3rd quartile.
- Michigan's weighted average SAIDI has commonly been in the 4th quartile with some years in the 3rd quartile.
- Michigan's energy infrastructure ranks in the lower tier of Midwest states and aligns with the U.S. energy infrastructure ranking.
  - C- grade = requires attention with increasing vulnerability to risk, near poor condition.

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THE FUTURE OF ELECTRIC RELIABILITY & RESILIENCY

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OVERVIEW

Power system reliability & resilience challenges are changing. Here's why:

- Changing weather conditions and other threats to challenge reliability provision
- Evolving needs & expectations for reliability and resilience
- New ways to provide and protect reliability and resilience
- How and why regulators must respond

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RELIABILITY AND RESILIENCE

Reliability = how do we keep the lights on?

Resilience = how do we reduce consequences and recover quickly when the lights go out?

Customer view of resilience – make outages as infrequent, small and short as possible

Customers don't care why the grid goes down

- >90% of all outages due to distribution-level problems*
- Typically <10% of all outages due to major events*
- Most major (widespread customer impact) power outages due to severe weather*
- Before Hurricane Maria and 2019 western PSPS and Winter Storm Uri, <0.0001% of customer outage-hours due to generation shortfalls or fuel supply problems.

Standard industry measures for reliability assessment exclude major weather events and use customer Value of Lost Load estimates based on happily short outage events and ignoring lost productivity, morbidity and mortality -- so irrelevant for evaluating current and future conditions and threats.

Wealthier C&I and residential customers are self-providing resilience (PV, batteries, generators) so their VOLL survey answers don't represent their actual perceived costs or value of reliability.

*** Data from before 2018 and recent escalation of wildfires, hurricanes, heat waves…**

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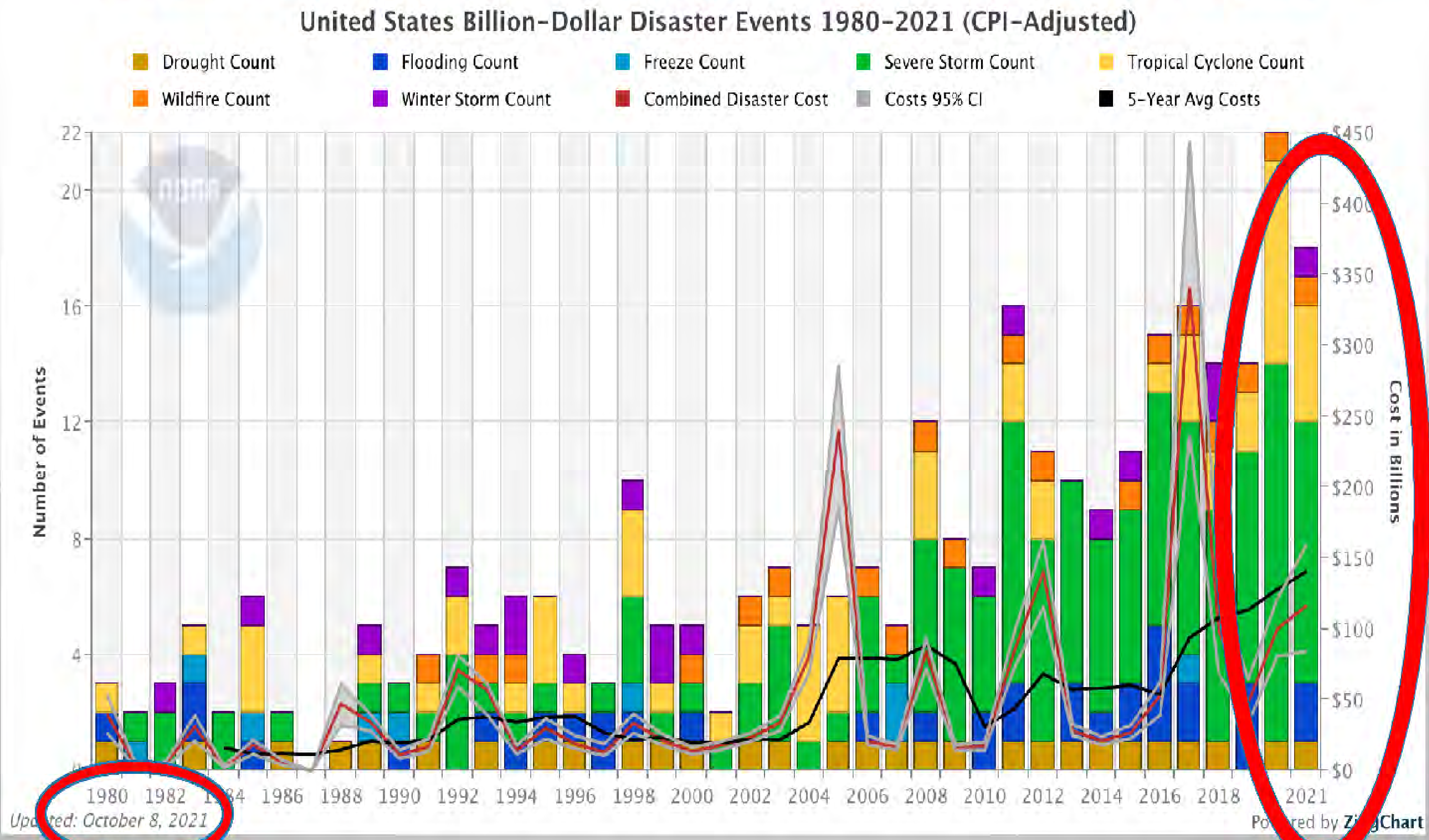
THE RELIABILITY CHALLENGE HAS CHANGED



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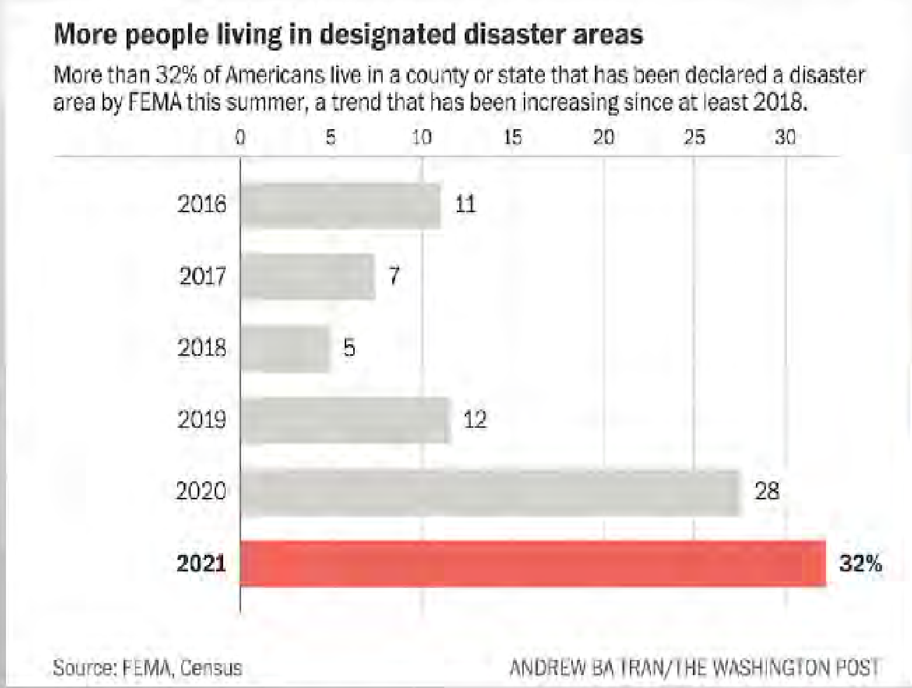
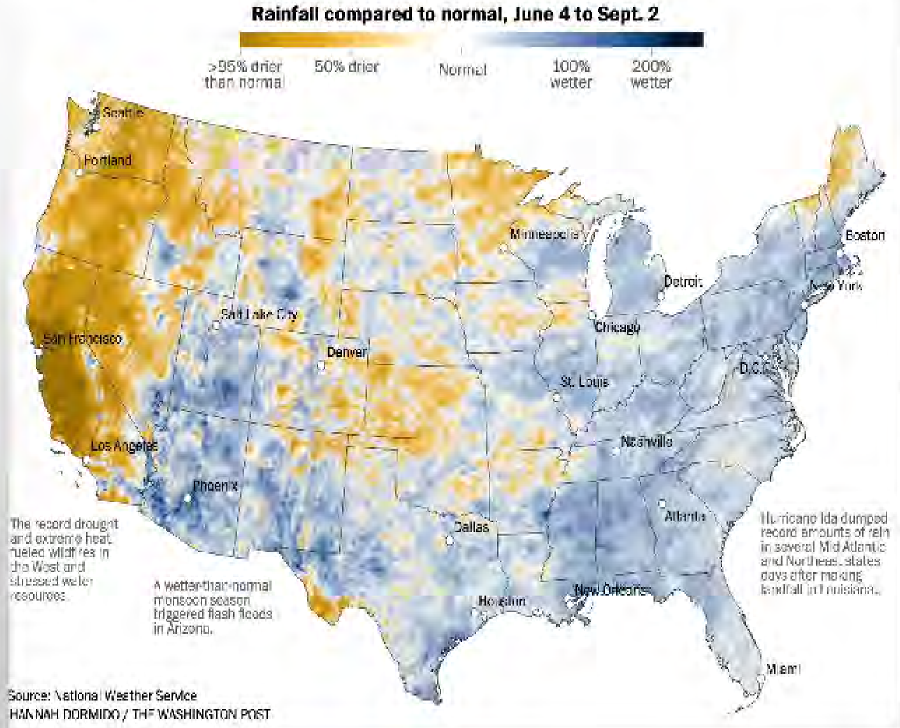
Nearly 1 in 3 Americans experienced a weather disaster this summer

Climate change has turbocharged severe storms, fires, hurricanes, coastal storms and floods — threatening millions

- "Nearly 1 in 3 Americans live in a county hit by a weather disaster in the past three months… On top of that, 64 percent live in places that experienced a multiday heat wave — phenomena that are not officially deemed disasters but are considered the most dangerous form of extreme weather…."
- "At least 388 people in the United States have died due to hurricanes, floods, heat waves and wildfires since June [2021]." (Over 200 people killed in PNW heat wave)

Washington Post, Sarah Kaplan & Andrew Ba Tran, 9/4/2021





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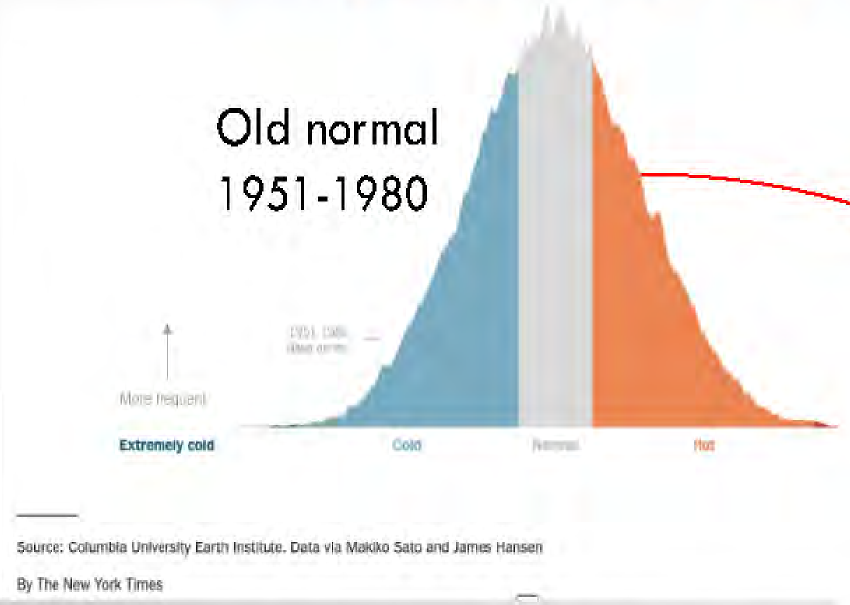
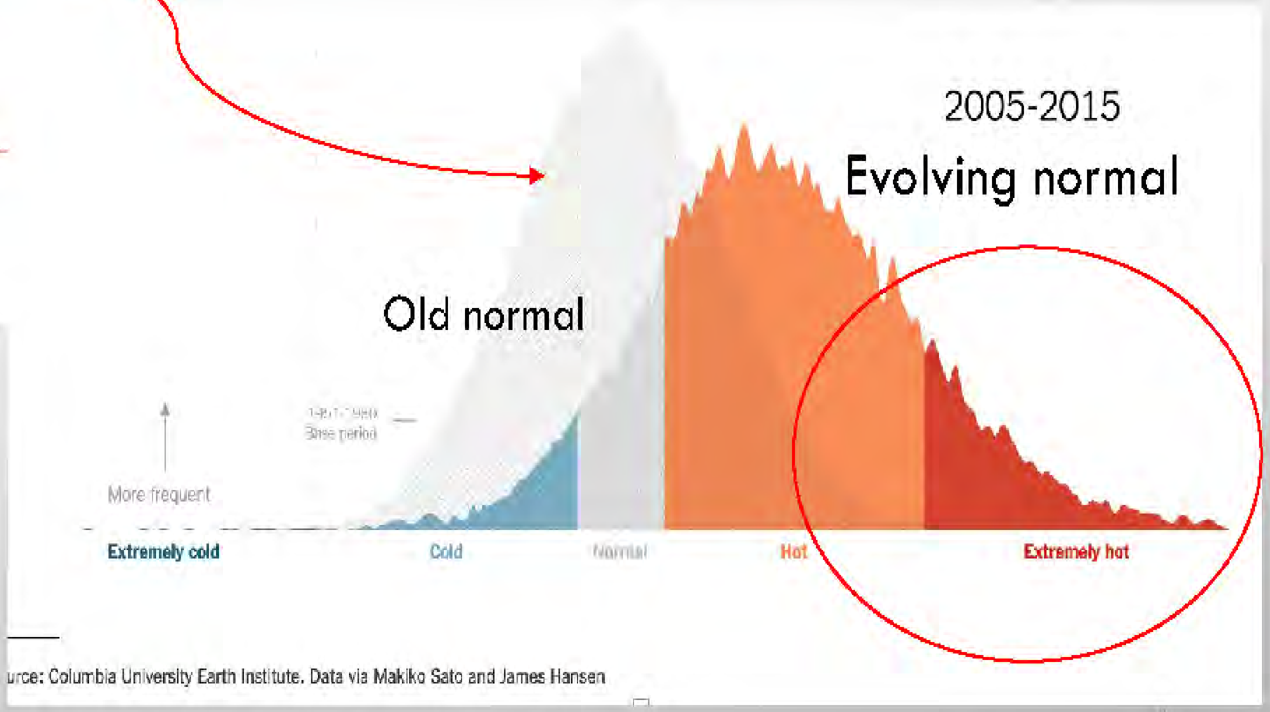
CLIMATE CHANGE AND EXTREME WEATHER

Temperatures shifted across Northern Hemisphere



So the historic, "normal" conditions and patterns we built and funded this grid for are no longer relevant (c.f., California, New Orleans, Houston, Puerto Rico)



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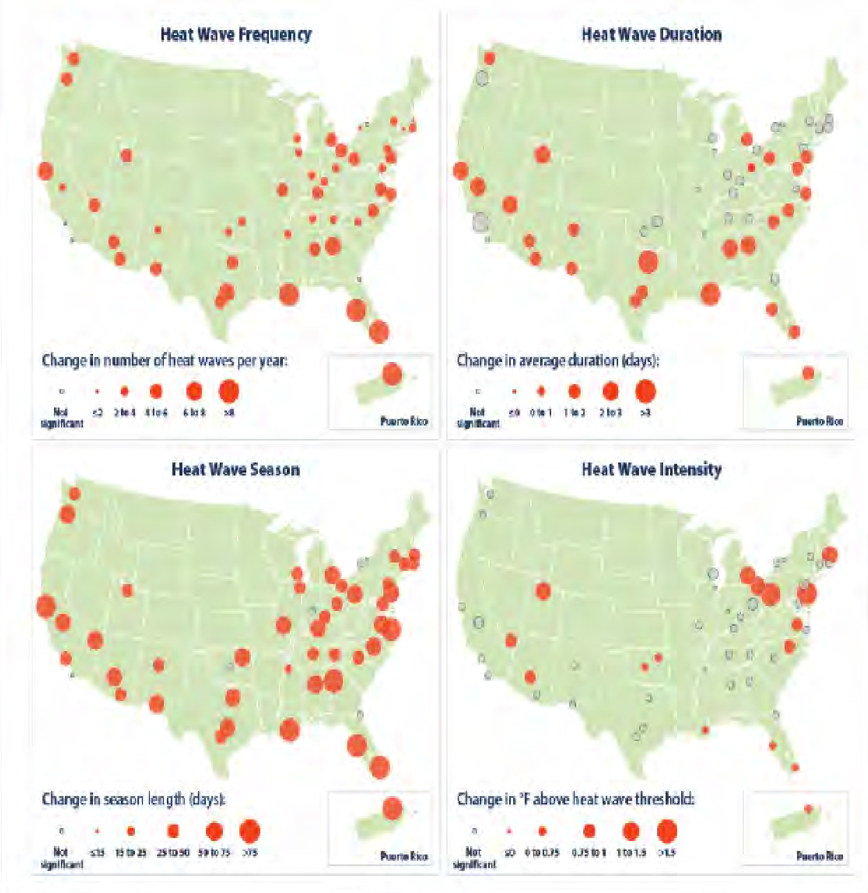
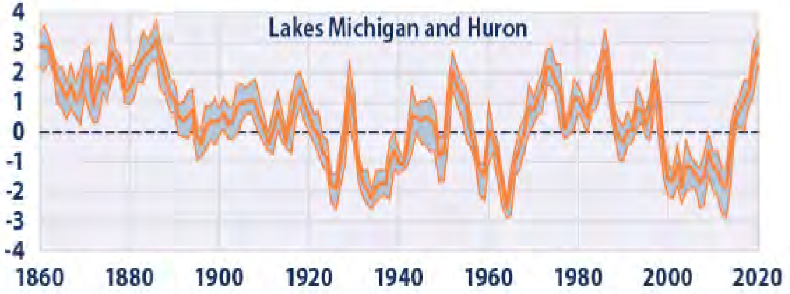
EXTREME WEATHER CHANGES

Heat waves worsening

Figure 2. Heat Wave Characteristics in 50 Large U.S. Cities, 1961–2019



Water levels of Great Lakes (anomalies in feet)



Coastal flooding accelerating

Figure 1. Frequency of Flooding Along U.S. Coasts, 2011–2020 Versus 1950–1959

Also:

- Hurricanes
- Precipitation
- Inland floods
- Wildfires
- Droughts

Sources:

https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-temperature

https://www.epa.gov/climate-indicators/great-lakes

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IMPLICATIONS FOR RELIABILITY

Higher risk to grid and society from climate change (also human threats)

- Historic ("normal") weather conditions not a relevant guide for current & future conditions
- Extreme weather no longer HILF events but High Impact Medium Frequency events
- Higher risk = (higher frequency of extreme weather events) x (worse weather events causing more grid and societal damage)

Challenge for current grid assets

- Lesser ability to withstand harsher extreme weather conditions (asset destruction, condition deterioration, overloading)
- Lower performance capability (eqpt deratings, low hydro output, faster time to failure)
- Limited ability to replace, upgrade or expand asset base to meet challenges
- Restoration challenges – wider damages require more time, eqpt, crews, $$$

Resource adequacy

- Higher demand levels (extreme weather, electrification) even with energy efficiency
- Harder to grow and operate grid supply side -- complicated by evolving resource mix -- to meet demand under extreme or surprise weather or supply failure conditions

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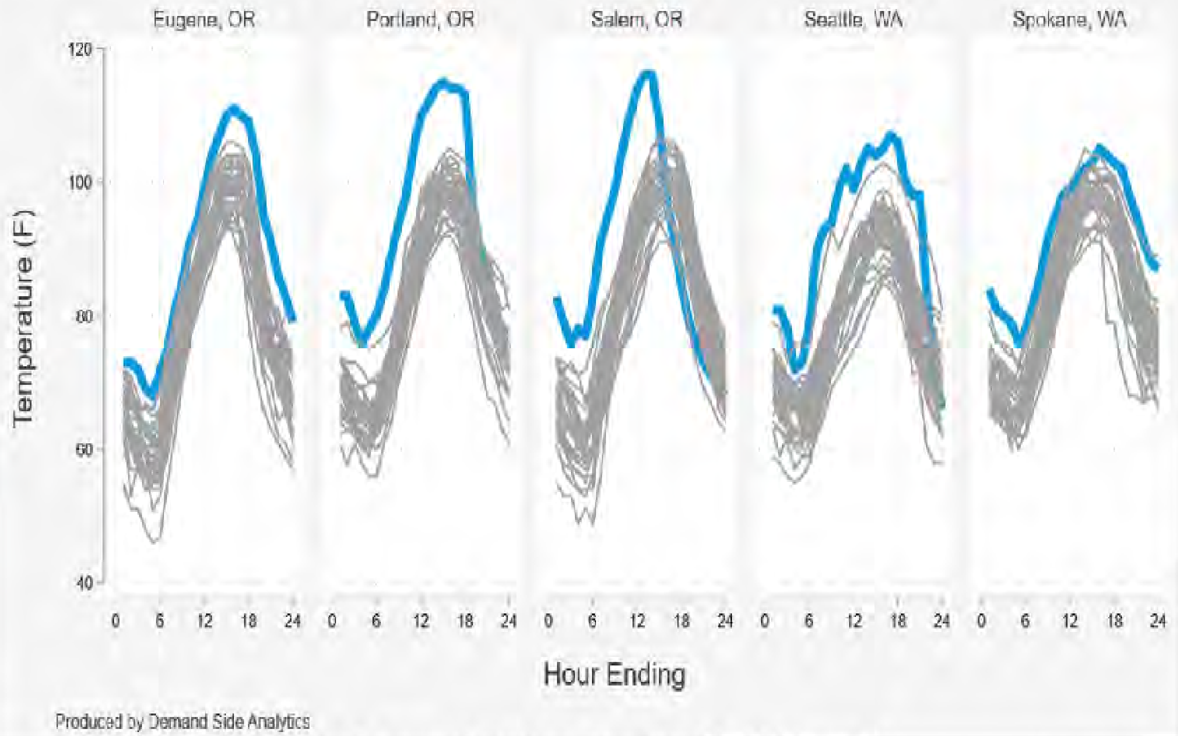
RAPID EXTREME WEATHER SHIFTS & RELIABILITY

- Most utilities & policymakers have been assuming the ability and time to adapt to gradual climate change
- But we can't adapt fast enough to rapid, abrupt, giant changes in hazardous conditions
- Given the slow speed of T&D and generation planning and construction, **we can't build our way out of this fast enough to avoid major harm to communities and individuals**

Pacific Northwest heat dome June 2021 hourly temps compared to 1990-2020 hottest week of year temps



Source: Josh Bode, Demand Side Analytics, July 12, 2021 email

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Session One
Grounding in Data: Where Are We Working From

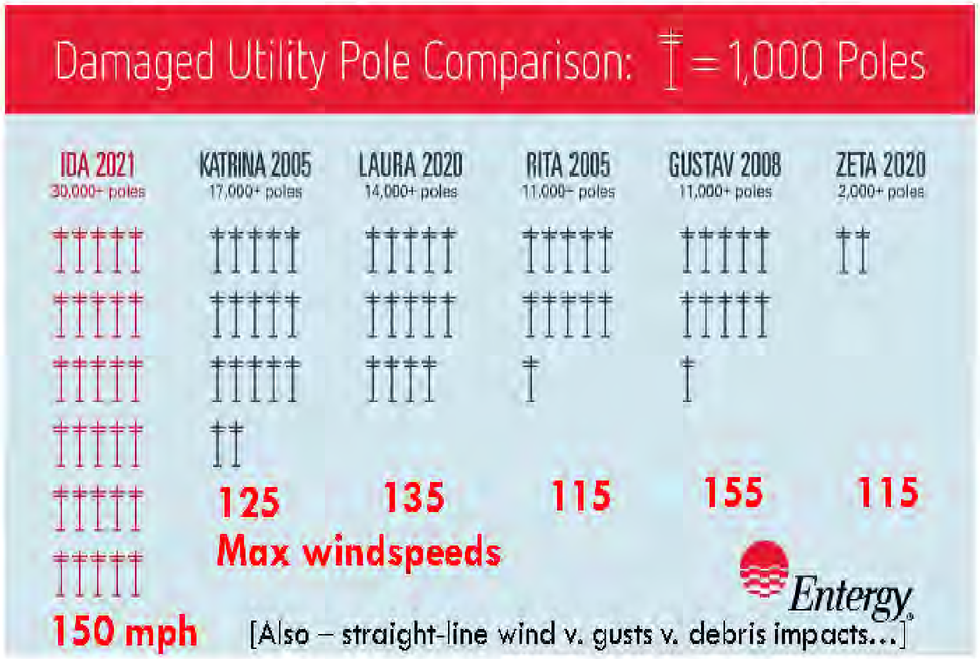
Speaker Topic:
The Future Of Electric Reliability & Resiliency

October 22, 2021
9:00 – 10:05 a.m.

EVOLVING NEEDS FOR RELIABILITY
From customer and societal perspective

What we need
- More of our human and economic activity depends on smooth electric delivery
- Climate threats pose greater risk to human & ecological safety, health and mortality

What we expect
- Our expectations for reliable service have been shaped by utility capabilities in tamer weather at the same time that loss of electricity was less noticeable and had lesser consequences
- Our expectations that lights will or should stay on are rarely informed by actual data about infrastructure and event damages



While major utility screw-ups should never be excused or waved away, there's rarely a single cause or villain behind these disastrous impacts, but customers always pay the price.

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NEW WAYS TO DELIVER RELIABILITY AND RESILIENCE

- New paradigm – until now, manage electric supply to meet customers' variable demand; in future, manage electric customers' demand as well as managing varying supply.
- Centralized resources
  - Fossil
  - Renewable
  - Storage
  - Massive transmission build needed to support all of this
- Distributed resources (PV, DG, storage, EVs, microgrids, TBD)
- Efficiency, smart efficiency and demand response
- Enabling technologies and designs to support all this – analytics, automation, communication, AI, sensors, controls, inverters, HVDC, new materials (conductors, chips, battery chemistry, Tx & Dx poles and towers, wind towers & blades), cyber-security, decentralized decision-making and coordination….
- **BUT NONE OF THIS WILL BE CHEAP, FAST OR EASY**

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FIX SUPPLY OR FIX DEMAND? DO BOTH!

- **Maximize the return from reliability and resilience investments.**
- **Protect the customer while you protect and adapt the grid to changing climate conditions.**
- Measures that reduce peak year-round help grid reliability by reducing the need for enough supply to meet high demands (building envelope improvements, more efficient heaters and AC, managing demand and creating flexibility by cycling loads such as pool pumps, water heaters, EV charging, water pumping)
- Measures that create demand flexibility are good for grid operational reliability and resilience and help to integrate all that renewable generation (intelligent controls, remote cycling, self-gen, storage) and cope with sudden Tx or generation losses.
- But measures that reduce reliance on grid electricity are **good for human and community resilience**. Building envelope improvements, backup gen and storage, more efficient appliances reduce energy bills, improve comfort and health, reduce mortality in extreme heat and cold weather, and grow local jobs and economic prosperity.
- IEA says tripling the speed of efficiency is essential for worldwide decarbonization to slow climate change.
- And sure, invest in classic physical infrastructure and harden the grid

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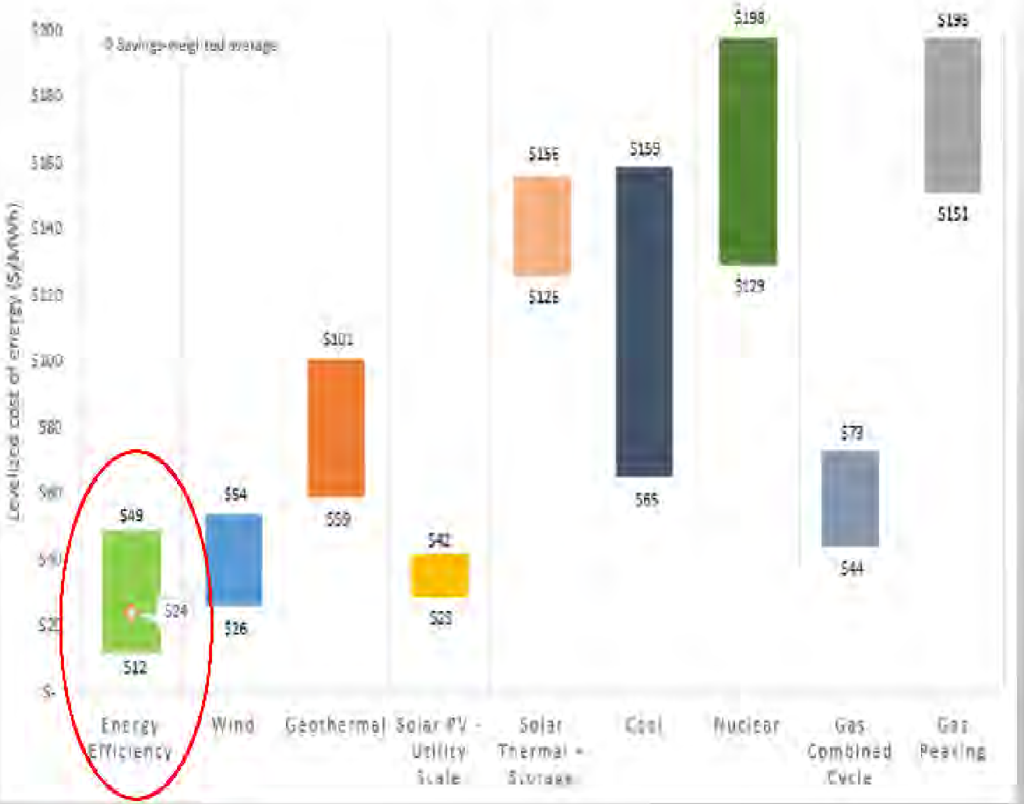
REDUCE COSTS AND MAXIMIZE VALUE FROM EE & DR

- Energy efficiency that permanently reduces peak loads will make complex grid systems less risky and easier to operate (fewer demand surprises, fewer supply shortfalls, less steep evening PV ramp).
- EE and DR deliver value to customers and the grid EVERY DAY and under multiple threat conditions -- not just extreme weather, but also protect customers through cyber failures, physical grid attacks, T&D outages, inability to pay bills…
- EE is less expensive and more dependable than other energy resources.
- EE and DR can buy us time by cutting carbon while we figure out how to adapt to climate change and operate a high-renewables grid.

RELATIVE LEVELIZED COSTS OF ELECTRIC ENERGY ($/KWH)

(SOURCE: ACEEE, JUNE 2021)



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HOW TO BALANCE BETWEEN UTILITY, CUSTOMER AND SOCIETAL OBLIGATIONS?

We're all going to pay one way or the other, both sooner and later

If we prepare in advance

- Taxpayers -- levees, dam upgrades, forest clearing, R&D, FEMA, firefighting, urban shelters
- Utility customers – managed infrastructure upgrades, veg management, more generation, EE
- Individuals – flashlights, extra food & water, PV panels, batteries, Ford F-150

If we **don't** prepare in advance

- Taxpayers – FEMA, community and infrastructure rebuild, victim payouts and buyouts
- Utility customers – mutual aid, restoration and rebuild, regulatory proceedings, angry customers & politicians, shareholder losses, higher rates and bills
- Individuals – loss of services; human and community inconvenience, damages, misery, health and deaths; property destruction; higher insurance and utility bills; personal protection or self-provision before next disaster

Regulators & policy-makers need to assess -- what are the most feasible, effective and cost-effective ways to manage preparation v. reaction and allocate the costs and pain of these options? PS -- climate change isn't going to wait while you wrestle with this.

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ASSESSING ELECTRIC RELIABILITY FAILURES

Recent reliability failures

- Puerto Rico – Hurricane Maria destroyed gen, Tx & Dx, still rebuilding years later
- CA – wildfire threat power shutoffs, 2020 summer peak capacity shortfalls
- ERCOT – 4-day outage for 20 million people in Arctic weather due to inadequate generator prep and fuel supply failures
- Louisiana – Hurricane Ida destroyed 30k Dx poles, some Tx lines, many customer premises

A few questions to ask

- What factors contributed to or directly caused the failure? (root cause & systemic, not just the triggering event or single villain)
- Was this failure foreseeable or predictable, from credible sources?
- Did we know how to prevent or mitigate the failure and consequences?
- Were those actions reasonable and feasible before the failure? (engineering, regulation, cost, timing) If actors or institutions might have changed the outcome but didn't, why not?
- Were there equity issues from the failure that merit particular remedies or policy redirection?

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After a summer of weather horrors, adapting to climate change is an imperative

We live in a rapidly changing climate, rapid change will continue, and we are not going back to the climate of our childhoods.

"We have had the ability and the roadmap to make major strides in reducing carbon dioxide emissions and mitigating climate change for many years. In many cases, these mitigation tactics are "no regrets," with very quick monetary payback for expenditures — the insulation of houses and choosing fuel-efficient vehicles, for example. Yet we have not taken these steps at the scales that are required for effective intervention…."

"Compared with mitigation, adaptation is relatively easy. Effective mitigation requires changing human behavior, ingrained geopolitical and economic power structures, and built infrastructure on a global scale. It requires convincing people to invest for the common good of other people, often decades into the future…."

"Although adaptation can be carried out by individuals, it is better and certainly more equitable to plan on the larger scales of a community, a city or a region. As the geographical scale increases and more individuals, organizations and local governments are involved, it does get more difficult. However, the threats to life, property and the local environment often serve as motivation to challenge the barriers of cooperation and shared beneficial outcomes."

Washington Post, Richard Rood & Elizabeth Gibbons, September 11, 2021

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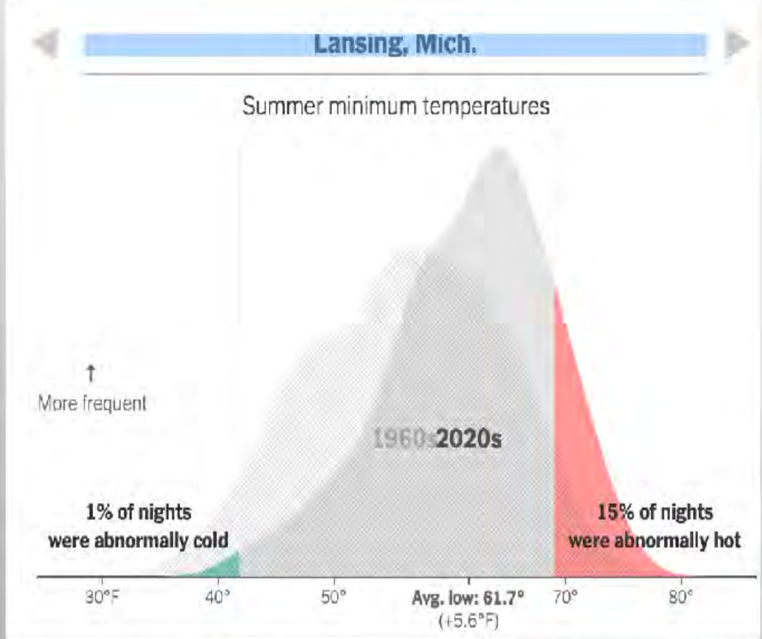
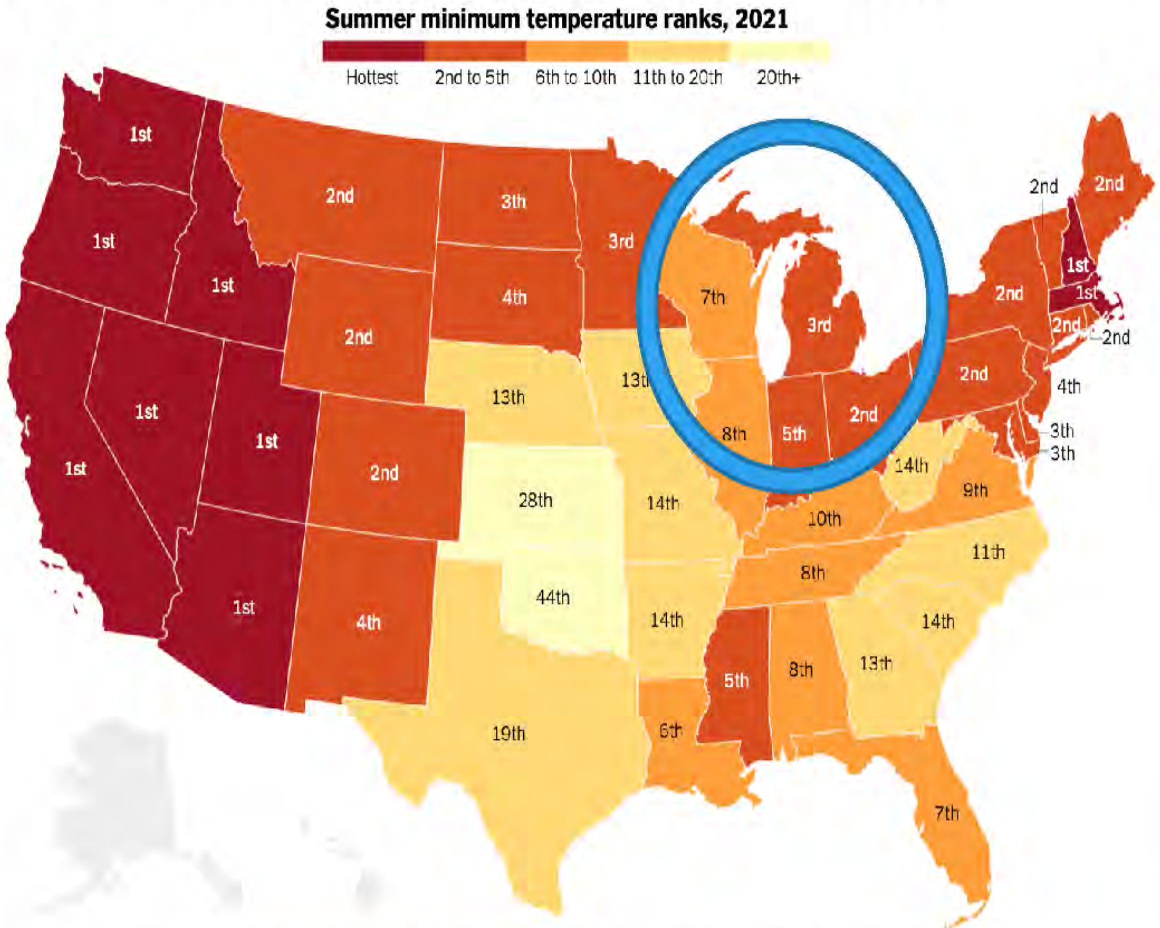
YOU ARE HERE…

- Hot nighttime temps increasingly common and the number of abnormally hot nights are rising.
- Cities have warmed at twice the rate of the planet as a whole, and the hottest neighborhoods are where people of color and poverty live.
- Climate change – “The sting is in the tail.”



Bhatia & Katz, “Why we’re experiencing so many hot summer nights,” New York Times, 9/13/21

In 2021, many states experienced their hottest summer nights since 1895



Source: NOAA’s National Centers for Environmental Information · Map shows the ranking of 2021’s summer (June-August) minimum temperatures for each U.S. state, compared with the period from 1895 to 2021. States shown in dark red experienced their hottest summer nights on record in 2021.