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The Economic Impact of Michigan's Unreliable Power Grid

LOCAL SOLAR FOR ALL

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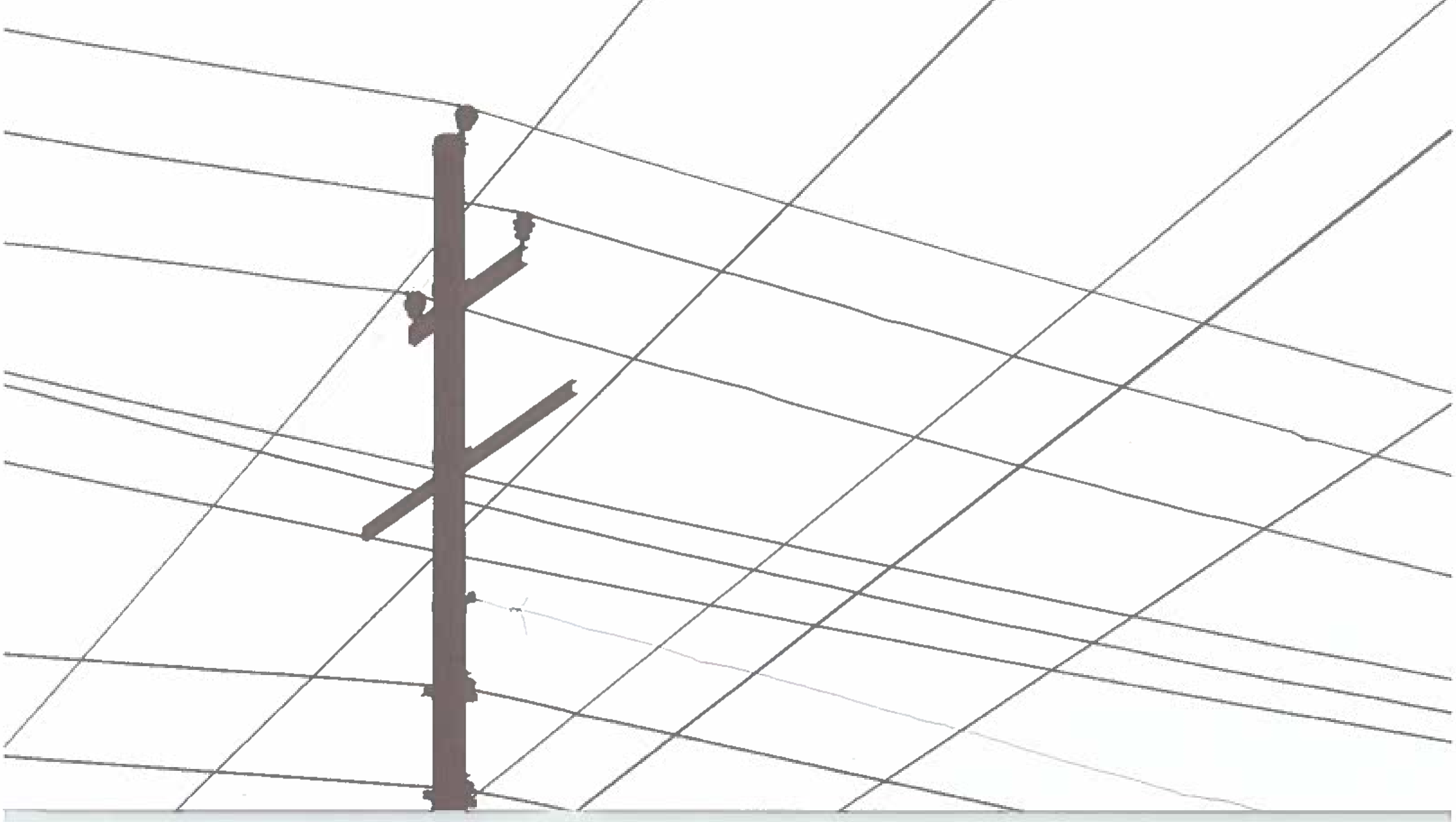


Executive Summary

The electric grid is increasingly being defined not by what services it is providing, but by what services energy consumers are not receiving from electric utilities in periods of unreliability. They can occur due to a wide range of critical events, including cyber attacks, physical attacks on grid infrastructure, extreme weather causing downed power lines, and energy shortfalls exacerbated by weather. This is the reality in Michigan, just as in any state. Michigan suffers from below-average electric reliability. Michigan must already deal with poor grid reliability track records and the North American Electric Reliability Corporation (NERC) has raised long term concerns that the burdens Michiganders must shoulder in their daily lives as a result of this poorly performing electric grid could continue.

This report utilized public methodologies to estimate the economic impact of Michigan's power outages, utilizing data published by the U.S. Energy Information Agency for 2020 and 2021. The Federal Energy Management Agency (FEMA) has published values and criteria to measure the cost of disasters on communities, including how to calculate the economic impact of the loss of electric service. Using that methodology, it was calculated that Michigan power outages had an economic impact of over $1.6 billion during the 2020-2021 period. This calculation narrowly defines the value of lost electric service, and does not include values such as the Value of Lost Time and the Loss of Communications/IT Services, which can be implications of the loss of electric service.

Table ES 1 summarizes the economic impacts, as calculated using the Interruption Cost Estimator (ICE) Calculator, developed at Lawrence Berkeley National Laboratory (LBNL) using funding from the U.S. Department of Energy. By these calculations, power outages in Michigan in just two years–2020 and 2021–accounted for a $4.9 billion economic impact. And, as reported and analyzed by groups such as the Citizen Utility Board of Michigan, the years 2020 and 2021 were not outliers in the trend of Michigan electric reliability.

		COST PER EVENT		TOTAL COST		
Sector	**Customers**	**2020**	**2021**	**2020**	**2021**	**2020-21**
Residential	3,976,729	$10.29	$16.77	$56,279,976	$109,855,711	
Small C&I	198,572	$2,886.72	$6,237.53	$788,179,430	$2,039,971,193	
Medium / Large C&I	22,488	$18,878.62	$36,127.69	$583,745,719	$1,338,087,725	
TOTAL	4,197,789	$247.44	$504.49	$1,428,205,125	$3,487,914,629	**$4,916,119,754**

Table ES 1: Estimated Economic Impact of Michigan 2020-21 Reliability Performance, Using 2020 Census Data

Minimizing economic loss due to the loss of electric service is imperative, but it does not automatically justify expensive programs to be paid for by Michigan families and businesses. All potential solutions must be on the table. One such path that should be considered is one that sites clean energy generation and battery storage close to customers, in order to provide local reliability benefits directly to consumers and to communities at-large. These types of distributed, local clean energy systems have the benefit of being installed on rooftops, parking canopies, and in communities who will consume that electricity.

Local solar, which can include residential rooftop systems and community solar, can help better maintain the electric grid by being local resources, especially when paired with battery storage. A 2021 LBNL report showed that distributed clean energy like solar and storage can provide cost-effective benefits to the electric grid, both at the distribution and transmission levels. Some of Local Solar for All's previous work estimated that a clean electric grid that leverages local solar and battery storage can be $88 billion less expensive to run across the country than the grid we have today.

Background

Electricity is the life blood of our society. It powers our computers and refrigerators at home, the freezers in local supermarkets, and the industrial machinery building things in manufacturing hubs. Electricity keeps our hospitals and schools safe and secure, and ensures first responders can do their jobs. Our transportation systems are increasingly reliant on electricity, from electric school buses to our personal vehicles. So, what happens when the electric grid fails, and we lose power? In the most extreme cases, people can die due to extreme heat or cold, or due to the electricity knocking out critical medical equipment. More common examples include our food spoiling in the warming refrigerator, and supermarkets unable to keep perishable food cold or connect to the internet to process sales. Manufacturing plants could be forced to halt production, causing potential ripple effects throughout the economy. Simply put: our entire lives are disrupted.

For as crucial as electricity is to our society, it is often overlooked unless it is not there. Power outages can occur due to a range of potential scenarios. As a society, we notice most often with extreme storms, such as tornadoes and hurricanes, but there are many more scenarios where entire communities lose electric service. Then, once there is an outage, or communities must contend with blackouts and brownouts, electricity becomes *the* issue. Cyber attacks, physical attacks on grid infrastructure, extreme weather causing downed power lines, and energy shortfalls exacerbated by weather are just some of the higher profile examples.

- We saw this in the early 2000's, when the Enron scandal brought rolling blackouts to California. It brought national attention to both the manipulation of power markets and on-the-ground human suffering.

- More recently, Texas families and businesses endured massive grid failures in February 2021, when Winter Storm Uri disrupted natural gas pipelines and central grid infrastructure not maintained to operate in those cold temperatures. In order to prevent a statewide grid failure, the Electric Reliability Council of Texas used a grid maintenance strategy known as "shedding load" in the industry, to ration electricity through rolling blackouts. Those blackouts were more persistent and less rolling, as many families dealt with power outages that lasted multiple days. This was all detailed across local and national news, as well as a University of Texas at Austin Energy Institute report.[1]

- More than a quarter million Michiganders went without electricity for six hours in August 2022 because of grid failures started by bad weather. Equipment failures left Ann Arbor in the dark for six hours on February 1, 2023, disrupting university and municipal operations.

Electric service must be reliable, resilient, and secure/sustainable. Reliable means electric service is available when needed, in the amount needed, and of the quality needed. Resilient means that the system that provides electric service can "take a punch," whether from extreme weather, negligence, or attack. "Secure" and "sustainable" are different sides of the same coin – people and businesses must experience freedom from fear of loss of electric service, today and tomorrow. Secure and sustainable energy is affordable, and provided at the lowest reasonable economic, environmental, and social cost.

If the electric grid cannot provide service that is consistently reliable, resilient, secure, and sustainable, we as a society must either learn to adapt to the costs of those disruptions or invest in solutions that can prevent those disruptions from happening. Michiganders are no different than residents in any other state in terms of relying on electricity. Parents need electricity to safely get their children off to school. Car companies cannot assemble the next generation of vehicles without electricity. The electric distribution grids are systems that cost billions of dollars every year to maintain. Michigan families and businesses are disrupted every time their electric service fails, costing them time and money.

KEY TERMS

KILOWATT-HOUR (kWh) A unit of energy often used to measure how much electricity a household consumes. Residential electric bills are measured in terms of kWh, and the price of electricity is measured in dollars per kWh.

ROOFTOP SOLAR Small-scale solar projects that are installed on the roofs of homes and businesses, rooftop solar offers people control over where their electricity is produced and lowers their monthly utility bill.

COMMUNITY SOLAR Small-scale solar installations typically built on landfills, former industrial sites, or private parcels of farmland. People can sign up as subscribers, and, in turn, receive credits on their electricity bills based on their share of the project's generation. Proven solution for enabling broader clean energy access among families and small businesses, regardless of whether they rent or own their property.

ELECTRIC GRID The entire system that generates and transmits electricity to all electricity consumers. There are two major pieces of the electric grid, the bulk power system and the distribution grid.

BULK POWER SYSTEM Large power plants and the high-voltage transmission lines that bring that power from those plants to population centers, often over great distances. Transmission lines run across fields and non-populated areas due to the sheer amount of electricity they constantly transmit.

DISTRIBUTION GRID The part of the grid that serves neighborhoods, business campuses, and industrial facilities. The distribution grid is often operated and maintained by the local electric utility. It takes electricity from the transmission grid and carries it to the end consumer. In a state with multiple utilities, there are actually multiple distribution grids.

There are many metrics used to track electric grid reliability[16]: **SAIDI** stands for System Average Interruption Duration Index; it measures the minutes of without power that the average customer experienced in a given year. **SAIFI** stands for System Average Interruption Frequency Index; it is the number of non-momentary electric interruptions that the average customer experienced in a given year. **CAIDI** stands for Customer Average Interruption Duration Index. It is the average number of minutes it takes to restore non-momentary electric interruptions.

Grid Problems for Michiganders

Michigan's electric service providers don't have the best record of reliability. As reported by the Citizens Utility Board (CUB) of Michigan, "Michigan utilities, compared to those in the 50 states plus the District of Columbia, have below average performance on most metrics that measure the primary purposes of a utility: the delivery of reliable and affordable energy service to customers."[2] CUB further explains[3]:

> *When it comes to everyday delivery of electricity under normal conditions, Michigan utilities continue to struggle, especially on power restoration times. Climate change has made weather events more severe on average, but also more variable, implying that "good" years with relatively fewer instances of severe weather can be expected along with the "bad" years with relatively more. Compared to previous years, 2020 was relatively "good" for Michigan weather. A key takeaway is that even in a good year, Michigan utilities show a vulnerability to power outages and poor restoration performance that is likely to be magnified in "bad" years.*
>
> *The role of extreme weather is significant across the categories of this report, not just regarding reliability. Extreme weather is on the rise due to climate change, and the extent to which weather events affect how well utilities can perform is rising with it. Over time, however, some utilities are more prepared than others for the challenges posed by extreme weather, and Michigan utilities show signs of an underlying vulnerability that should be concerning.*

CUB relies on information from the U.S. Energy Information Administration (EIA), which shows that Michigan has worse reliability than the U.S. average, both in terms of hours of electric service interruption and the number of interruptions.[4]

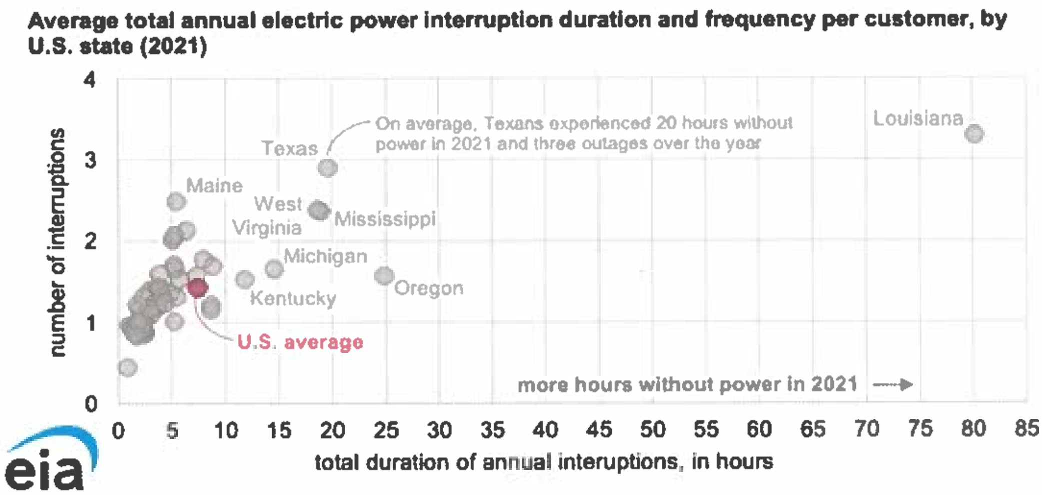
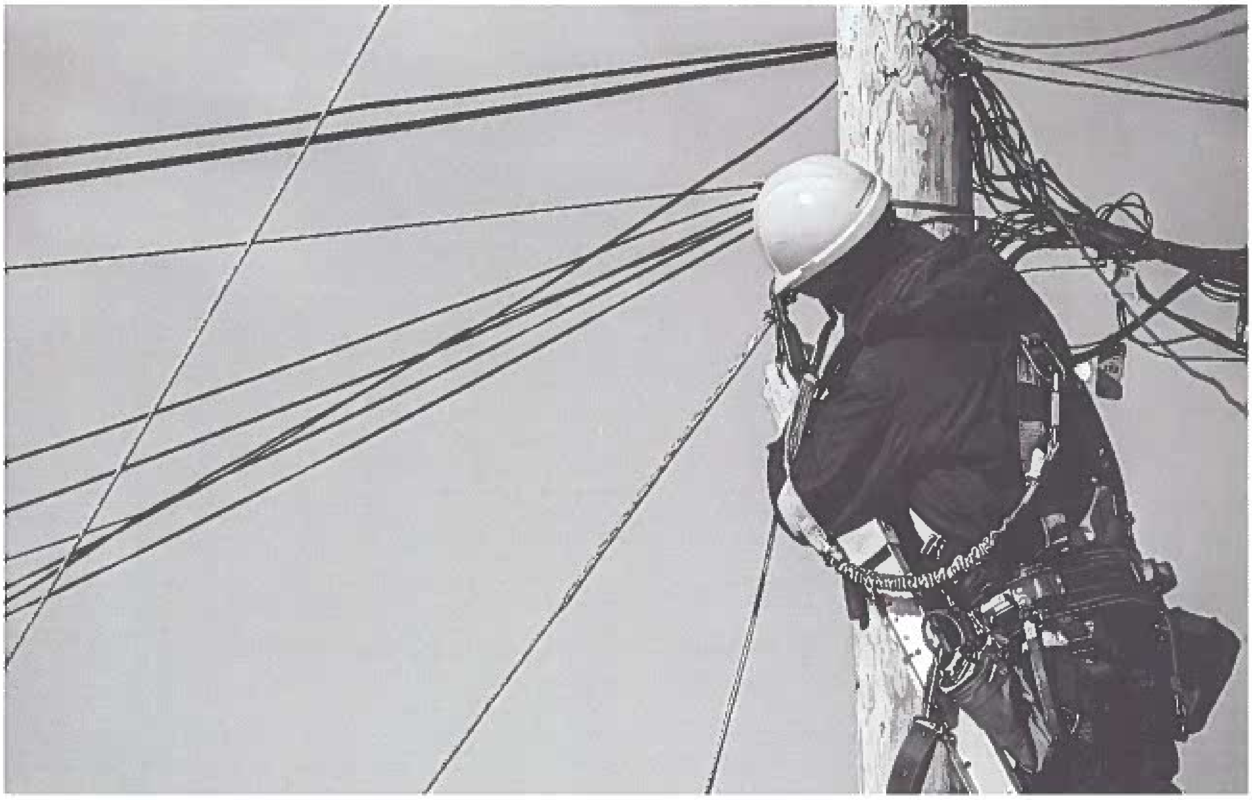


Figure 1: Average Total Annual Electric Power Interruption Duration and Frequency per customer, by U.S. State (2021); Source: U.S. Energy Information Agency

The North American Electric Reliability Corporation (NERC) produces regular seasonal reports on the condition of the electric grids to meet the needs of energy consumers across North America. For the 2022-2023 winter season, they predicted that there should be enough electric generation to meet everyone's needs during normal/historic scenarios. This is where extreme weather contributes to lower electric reliability without causing physical damage to the grid. In the event of unexpected cold events, NERC cautions that utilities may need to engage in "load shedding", "rolling blackouts," and "rolling brownouts"—the same kind of electricity rationing that was instituted in Texas in 2021.[5] NERC considers the need for load shedding to be unlikely but may be needed under wide-area cold weather events. This concern is not isolated to the current winter. According to the NERC Long-Term Reliability Assessment, Michigan's electric grid operator and wholesale energy market, the Mid-Continent Independent System Operator (MISO), is facing resource shortfalls across this entire assessment period of 2022-2027.[6] MISO is at "high risk" for reliability failure, meaning that energy shortfalls could occur even under normal peak demand conditions.[7] All told, between the poor grid reliability track record and the experts' long term concerns raise red flags to the burden Michiganders must shoulder in their daily lives as a result of this poorly performing electric grid.

This report estimates the economic impact of Michigan's unreliable electric grid in the years 2020 and 2021 using economic modeling tools developed through funding from the U.S. Department of Energy. It builds off of the excellent work by CUB of Michigan by taking their analysis one step further. We will outline the reliability performance that CUB breaks down in their annual reports, and use it as the data to estimate the economic impacts homes and businesses must shoulder. We provide a county-by-county breakdown of the 2020 economic impacts in order to show which regions and communities are shouldering the most burden of Michigan's electric grid. In the conclusion, we offer an alternative path forward to Michigan policymakers, so that Michigan can move beyond just maintaining the same grid system and suffering from increasingly poor performance.



Quantifying the Economic Impact of Power Outages

Quantifying resilience and the value of a reliable electric grid is most often seen by society during and after natural disasters. Businesses can measure lost output from the lack of electric service by the inability to offer their services or manufacture their goods. Families can place value on reliable electric service through both costs and feelings of insecurity. There are easily quantified costs, such as purchases for disaster preparedness or loss of goods such as spoiled perishables. Then, there is the harder to quantify, such as the cost of disrupting routines or the actual value of one's time. Below are two examples of quantifying the loss of electric service to different energy consumers.

Business Type	Event Description	Economic Cost (2002$)	Economic Cost (2023$)
Manufacturer of silicon-chip fabrication equipment	Voltage sags and short-term voltage interruptions	$350,000	$570,500
Silicon-chip fabrication	Even an outage of a few minutes can lead to 1-1.5 days of downtime	Up to $500,000 per day in lost revenue	Up to $815,000 per day in lost revenue
Automotive manufacturing	From a few seconds to one half-hour of downtime	Less than $1,000,000	Less than $1.63 million
	More than 1 hour of downtime	In the millions	In the millions to tens of millions
Financial clearinghouse	30 minutes of downtime because of a lightning strike	$12,000,000	$19,560,000

Table A: The Economic Costs of Electricity Reliability and Power Quality to Businesses

Lawrence Berkeley National Laboratory

The U.S. Department of Energy's Lawrence Berkeley National Laboratory (LBNL) has conducted a wide range of research on valuing reliability over the past twenty-plus years.[8] A seminal analysis by LBNL in 2002 of the costs of outages to individual businesses revealed high costs with single instances of power outages that could be passed down to their customers.[9] The original study illustrated costs in 2002 nominal dollars. Here we convert them to 2022 dollars.

As we will describe in a later section, LBNL has provided much of the research behind the Interruption Cost Estimate Calculator, utilized heavily in this report.

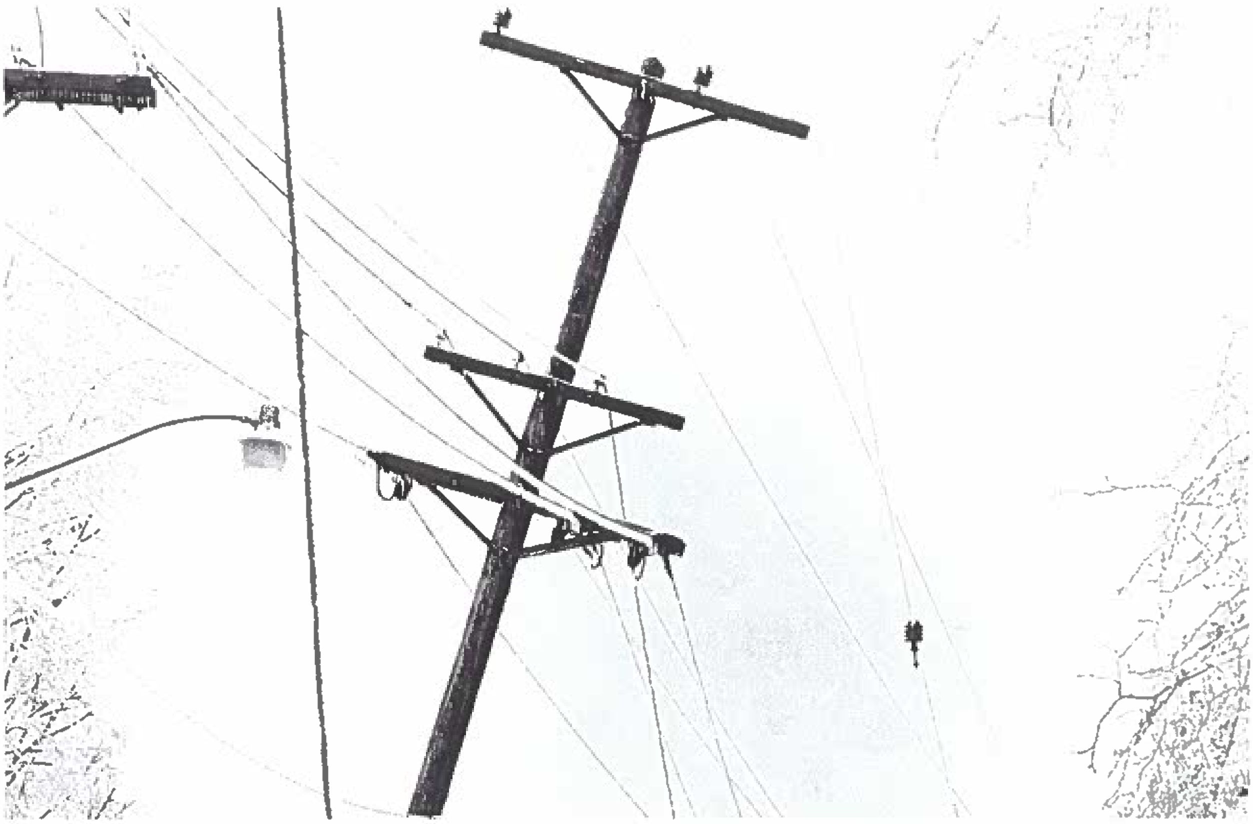
2021 Texas Winter Storms

The 2021 winter storms Uri and Viola that hit Texas stand out as an example how quickly the costs of severe weather events can mount up. The Texas chapter of the American Society of Civil Engineers[10] issued a report[11] on the storms' impacts on the grid and Texans that found:

The twin impacts of Winter Storms Uri and Viola on Texas and its energy system was catastrophic. The consequences for Texans was tragic. These impacts included at least 210 Texans casualties during the storm and substantial and lingering economic impact to the entire region that is estimated to exceed $200 - $300 billion[12] in addition to disputes and securitizations. The economic impact of Uri and Viola was greater than the impact from either of the two most costly hurricanes[13] in US history, Harvey ($145B) or Katrina ($161B). In comparison, in 2019 Texans spent around $37B on retail power during the year.[14]

The Federal Reserve Bank of Dallas also examined the costs of the winter storms in Texas, focusing just on the cost, from a utility perspective, of electricity that was not delivered as a result of service interruptions.[15] Of course, customers were not compensated for the loss of service, and the economic losses cannot be recovered. The amount of power lost was estimated at over $4 billion. However, that is nothing compared to the estimated $130 billion in Texas economy-wide losses, according to the Dallas Fed.

These methodologies have been primarily applied to the economic losses in major disaster events. However, the loss of electric service does not only occur during major events. Families and businesses can face reliability concerns on an annual basis even without a major disaster. Whenever communities lose electric service, there is an economic cost.



Methodologies

The analysis and conclusions in this report are based on public, government survey data and calculators that allow us to estimate the cost of Michigan power outages in 2020 and 2021. This report will estimate the economic cost to Michigan based on the power outages they faced in 2020 and 2021. For 2020 data, we will pair the reliability data with 2020 Census data to break down the economic impact estimates by county. For 2021 data, we will only provide statewide economic impact estimates because county-level census date specific to 2021 is not available.

RELIABILITY DATA

The EIA collects various forms of electric grid reliability data through surveying electric distribution utilities annually. So, while released by the federal government, this reliability data comes from the utilities themselves. This is the SAIFI, SAIDI, and CAIDI data that will be used as inputs to the economic impact calculator.

SAIFI, SAIDI, and CAIDI are also often qualified by calculating the reliability with and without "major event days". These event days are often serious weather events, and would be pulled out of annual data because severe weather can be viewed as an outlier. This report only utilizes the reliability data with major event days, since that best reflects the daily realities in Michigan. Weather causing major event days is also becoming more common. Major event days are no longer outliers, and should not be categorized as such. Table B shows Michigan reliability data for 2020 and 2021, including all major event days.

	REGION	SAIFI	SAIDI	CAIDI
2020	Michigan - Statewide	1.375	416.7	300.8
	DTE Energy	1.286	351.82	273.6
	Consumers Energy	1.348	510.3	378.6
2021	Michigan - Statewide	1.647	890.9	540.8
	DTE Energy	1.581	927.404	586.593
	Consumers Energy	1.601	911.2	569.144

Table B: Michigan Reliability Data Highlighting Largest Utilities, 2020 and 2021

In 2020, Michigan reliability statistics when including major weather events reflect middling performance when compared to the rest of the states. The statewide SAIDI, where the average customer had 416.7 minutes of interrupted electric service, was the 18th highest in the country among states and the District of Columbia. The Michigan SAIFI data, where the average customer experienced 1.375 non-momentary power outages in a year, was middle of the road, at 25th highest in the country. And, Michigan's 2020 CAIDI metric, showing that customers who lost power experienced 300.8 minutes of no electric service per outage, was ranked 12th highest in the country. Across all metrics, Michigan electric reliability in 2020 was not among the best in the country.

In 2021, Michigan reliability statistics reflected poorer performance compared to the previous year. SAIDI, SAIFI, and CAIDI statewide metrics were all worse compared to 2020, but they were also worse when compared to the electric service reliability in other states and the District of Columbia. Michigan SAIDI, SAIFI, and CAIDI ranked as the 6th most, 13th highest, and 4th highest, respectively.

COUNTY-LEVEL DATA

The U.S. Census data available at data.census.gov breaks down 2020 survey data by county, both for the number of households and the number of physical businesses. Home offices were not included in the business count, as that would have resulted in double-counting households.

CATEGORY	ECONOMIC IMPACT
Impact on Economic Activity	$385.75
Impact on Residential Customers	$75.64
Total Economic Impact	$462.28

Table C: FEMA Economic Impacts of Loss of Electrical Power per Household per Day (2021)

TYPE OF ECONOMIC IMPACT	VALUE	UNIT
Loss of Communications / IT Services	$130	Per Capita Per Day
Loss of Water Service	$116	Per Capita Per Day
Value of Lost Time	$38.07	Per Hour Per Capita

Table D: FEMA Standard Economic Impact Values

ECONOMIC IMPACT CALCULATOR

Federal Emergency Management Agency

FEMA calculates and regularly updates its methods and values for the cost of loss of electric services,[17] as shown in the table below. This latest update occurred in September 2022, and presents the economic impact in a per household unit. The "Impact on Economic Activity" refers generally to the business output lost from the loss of electric services. The "Impact on Residential Customers" refers to survey data conducted by FEMA to determine how households value their "willingness to pay" for improved electric reliability. This willingness to pay comes from survey data, and is an attempt to quantify how individuals' feelings can create an economic value for electric service reliability.

Depending on what services are impacted during a loss of electric service, the duration of outage, and the geographic area where the loss occurs, other FEMA estimated calculations could be relevant. These economic impacts would be calculated in addition to the economic impact of the loss of electrical service.

ICE Calculator

The Interruption Cost Estimator (ICE) Calculator is a tool developed by LBNL and Nexant, Inc. through funding provided by the U.S. Department of Energy. It can be used to estimate the economic cost across residential, commercial, and industrial electric customers. The calculator was developed using survey inputs conducted by LBNL and Nexant, researching sample universes of residential, commercial, and industrial utility customers. It was launched in 2009, and has been updated in 2015 and 2018. Essentially, the commercial and industrial economic impact of power loss is tied to the lack of productivity, either to provide a service or manufacture a product.

The residential economic impact of power loss is tied to individual survey responses of the "hassle, inconvenience, and personal disruptions of the" power outage.[18] Direct costs, such as out of pocket expenses meant to withstand during the power outage or recover afterwards, are not actually included in the calculator. This is much narrower than other cost estimators, such as what guides FEMA disaster cost estimates. Therefore, it is reasonable to consider the economic impact of residential power outages to be underestimated by the ICE Calculator.

For the county-level ICE Calculator inputs, counties fully served by one electric utility utilized that utility's reliability data. Michigan Public Service Commission data was used to determine which counties were served by one or more electric utilities.[19] A county that is served by more than one investor-owned utility or electric cooperative would have statewide reliability data used for the ICE Calculator. For example, Wayne County is fully served by DTE Energy so DTE-specific data was used. Cheyboygan County is served by Consumers Energy, Great Lakes Cooperative, and Presque Isle Electric & Gas Co-op, so statewide reliability data was used.

We also recognize that these are economic impact estimates, using appropriate data and rigorous models. The ICE Calculator does not take into account the impacts of the COVID-19 pandemic, which obviously had its own economy-wide impacts in addition to health and safety for everyone. The results are not meant to reflect any actual measurements of economic impact caused by power outages in Michigan in 2020 and 2021 but instead provide estimates based on widely accepted public tools to assist utilities, planners, and policymakers.

Michigan 2020: Economic Impact of Power Outages

Based on the outputs from the ICE Calculator, Michigan suffered from negative economic impacts related to power outages in 2020 estimated to total over $1.4 billion. This covers economic impacts across residential households and businesses of all sizes across Michigan. Most of this economic loss stems from the estimated loss in business output due to the lack of electricity. The $56 million in economic loss in the residential sector does not include any estimated recovery costs, such as for spoiled food, medicine, or lost productivity.

SECTOR	CUSTOMERS	COST PER EVENT	TOTAL COST
Residential	3,976,729	$10.29	$56,279,976
Small C&I	198,572	$2,886.72	$788,179,430
Medium / Large C&I	22,488	$18,878.62	$583,745,719
TOTAL	**4,197,789**	**$247.44**	**$1,428,205,125**

Table E: Estimated Economic Impact of Michigan 2020 Reliability Performance, Using 2020 Census Data

The average Michigander and Michigan business suffered from 6.9 hours of power interruption in 2020, which is expressed as SAIDI in minutes in Table B. Those served by Consumers Energy dealt with 8.5 hours of power outages in 2020.

COUNTY	UTILITY TERRITORY	CUSTOMERS	COST PER EVENT	TOTAL COST
Oakland	DTE Energy	559,416	$288.51	$207,559,915.89
Wayne	DTE Energy	718,221	$191.00	$176,410,028.45
Kent	Consumers Energy	266,782	$388.15	$139,586,362.58
Macomb	DTE Energy	370,592	$213.24	$101,627,352.70
Genesee	Consumers Energy	172,433	$270.42	$62,855,785.36
Washtenaw	Mixed	155,407	$248.50	$53,100,769.04
Ottawa	Consumers Energy	113,592	$343.97	$52,669,916.70
Ingham	Multiple	120,824	$237.38	$39,437,413.66
Kalamazoo	Multiple	110,873	$236.68	$36,082,440.09
Saginaw	Consumers Energy	82,121	$309.40	$34,250,572.19
TOTAL		**2,670,261**		**$903,580,556.66**

Table F: Top 10 Counties With Highest Economic Impact (Estimated) — 2020

Table F shows the ten counties that faced the greatest economic impact, based on the ICE Calculator. Three counties solely served by DTE are in the top five most economically impacted by power outages. Part of that is due to population density and the higher number of businesses in those counties, since DTE actually had better reliability performance than the statewide average in 2020 (5.9 hours of power outages versus 6.9 hours). Table G shows how those reliability issues plagued the Detroit/Tri-County region in 2020. The ICE Calculator estimated that just over one-third of Michigan's economic impact from power outages came from Oakland, Wayne, and Macomb counties.

COUNTY	CUSTOMERS	TOTAL COST
Oakland County	559,416	$207,559,915.89
Wayne County	718,221	$176,410,028.45
Macomb County	370,592	$101,627,352.70
Michigan 2020	**4,197,789**	**$1,428,205,125**
Tri-County Area Total	**1,648,229**	**$485,597,297.04**

Table G: Tri-County Power Loss Economic Impact (Estimated) - 2020

Utilities that suffer from reliability issues and serve metropolitan areas of any size will cause greater volumes of economic loss, by virtue of that density, than utilities covering more rural areas. And power loss can disrupt an entire local economy. The counties in this Top 10 list contain the metropolitan areas of Detroit, Grand Rapids, Flint, Ann Arbor, Lansing, East Lansing, Kalamazoo, and Saginaw.

Alternatively, the FEMA methodology calculating total economic impacts on a per household per day of power outage basis estimates that the loss of electric service in Michigan in 2020 was roughly $529 million. This figure includes the aggregate impact of estimated impact on economic activity, as well as a residential household's willingness to pay. It does not include other FEMA variables estimating the economic impacts of disasters, such as the Value of Lost Time and the Loss of Communications/IT Services, which can be implications of the loss of electric service.

Michigan 2021: Economic Impact of Power Outages

Michigan electric utility reliability took a dive in 2021, even when one considers 2020 reliability levels to be middling to subpar. Table D shows an approximate doubling of the number of minutes the average household dealt with power outages in 2021, compared to the previous year. As such, in 2021, the ICE Calculator estimates that Michigan power outages created a negative economic impact of nearly $3.5 billion.

SECTOR	CUSTOMERS	COST PER EVENT	TOTAL COST
Residential	3,976,729	$16.77	$109,855,711
Small C&I	198,572	$6,237.53	$2,039,971,193
Medium and Large C&I	22,488	$36,127.69	$1,338,087,725
TOTAL	4,197,789	$504.49	$3,487,914,629

Table H: Estimated Impact of Michigan 2021 Reliability Performance, Using 2020 Census Data

The average Michigander and Michigan business suffered from 14.8 hours of power interruption in 2021, according to SAIDI data submitted to the U.S. Energy Information Agency. For the largest utilities, DTE Energy and Consumers Energy, the average customer suffered through 15.5 hours and 15.2 hours of power outages, respectively, that year.

When applying the FEMA methodology, the loss of electric service in Michigan in 2021 is estimated to be $1.13 billion. This figure includes the aggregate impact of estimated impact on economic activity, as well as a residential household's willingness to pay. It is normalized over the average time a Michigan household has lost electricity, 14.8 hours, to the economic impact of loss of electric service as outlined in Table B. It does not include other FEMA variables estimating the economic impacts of disasters, such as the Value of Lost Time and the Loss of Communications/IT Services, which can be implications of the loss of electric service.

The Human Toll

It can be costly and dangerous for any one home, or any one business, to lose power. Regionally, lack of power can create problems across systems, such as necessitating boil water advisories and closing schools. Families with young children might face the prospect of spoiling food such as milk. And, in the most extreme examples, a lack of electricity can directly lead to deaths when there is severe heat or cold, or indirectly cause death and suffering when essential, electrically-powered medical equipment fails.. While this report is trying to quantify the economic cost of these disruptions, it is important to not only discuss the impacts of power outages in economic terms but in human terms.

Let's use a recent major incident to tie together aggregate data with the on-the-ground realities. Serious thunderstorms hit much of Michigan in August 2022, which caused power losses for about 400,000 homes.[20] There were downed power lines–which can cause loss of life,[21] boil water advisories, and school closures during the week that followed the storm on August 29, a Monday evening. The storm caused power outages not only across the Detroit metropolitan area, but also as far as Lansing, Saline, and Armada. That night, DTE Energy reported at least 235,000 homes and businesses without power, and Consumers Energy reported an additional 156,000 homes and businesses suffering from outages. As reported by The Oakland Press, by that following Thursday evening, DTE was still working to restore power to over 88,000 customers while Consumers Energy was still dealing with over 3,000 customers without power.

The economies of Detroit, Ann Arbor, Lansing, and everywhere in between were completely disrupted, but more importantly families were out of power, without air conditioning, and without any ability to keep perishable food and medicine from spoiling. Hundreds of thousands of families had no power for multiple days. That week, Detroit daily high temperatures were in the mid-to-high 80 degrees Fahrenheit.[22] In all, those affected by the storm and storm damage suffered through a week of disaster and recovery, since life cannot immediately return to normal. There is time needed to pick up the pieces, metaphorically and literally.

It is the combined human and economic cost of power outages that drives the need to improve the electric grid. Unreliable, easily breakable, and unsustainable electric service is ultimately unaffordable for those who suffer during losses of power, even if the regulated prices are low. Low-quality electric service is prone to outage and disruption, surprise costs, and expensive regulatory compliance costs. Our system should be as secure, resilient, and reliable as possible. In the name of preventing as much disruption and suffering as possible, policymakers need to consider all possible solutions.

What Comes Next?

Michigan's electric service quality is below average. Improving grid performance comes at a massive cost, at least according to utility proposals. DTE Energy proposed their $7 billion, five-year grid investment plan in November 2021. Consumers Energy also filed their grid investment plan in 2021, which includes $5.4 billion in investments over five years. The Michigan Public Service Commission is considering, or has ruled on parts of both of these plans. These $12.4 billion in proposed new costs will not automatically be added to Michiganders' electric bills. The MPSC will weigh the justification for added costs to these utilities' customers through rate cases. A big chunk of the costs relates to tree-trimming programs, which while important, don't really address the basic limitations of the current grid, and certainly don't bring innovative technologies and approaches to grid management and maintenance. These are costly proposals, but so are the economic impacts of an unreliable grid. Minimizing economic loss due to the loss of electric service is imperative, but it does not automatically justify expensive programs to be paid for by Michigan families and businesses. All potential solutions must be on the table.

Any path forward must be grounded in a net societal benefit and a net customer benefit, since it is individuals, businesses, and the community at-large who participate in the electric grid. That means that policymakers must consider the entire spectrum of options with regards to upgrading the electric grid.

One alternate path to maintaining the current electric grid that relies on transmitting electricity from large power plants over long distances is to build in risk management and redundancies close to where families and businesses use electricity. A 2021 report from LBNL found that distributed energy resources like local solar and storage has inherent value in avoiding grid costs, especially in geographic areas where there are greater concentrations of customers and electric demand. Distributed clean energy and battery storage has the benefit of being installed on rooftops, parking canopies, and in communities who will consume that electricity. Local solar, which can include residential systems and community solar, can help better maintain the electric grid by being that local alternative.

- Local solar and storage can lower electric bills for its customers, and even provide back-up power when the grid goes down. That back-up power can be a clean and crucial resource for critical infrastructure like emergency shelters and hospitals.

- If communities adopt distributed clean energy and local solar solutions, then together they could even help utilities manage the electric grid to make it more reliable and more affordable.

- Unlike the utility investment plans whose costs are socialized across their customers, distributed clean energy often leverages private capital to finance, install, and maintain the projects. Families and businesses can directly benefit financially, while the community enjoys socialized benefits as well.

- Public programs could help lower the cost of adoption, and attract that capital. While these would be publicly funded, these programs would represent a fraction of the total cost. They would also likely represent a fraction of comparable utility grid investment plans.

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Local Solar for All released a roadmap in 2020 for distributed solar and storage adoption. We found that distributed clean energy like local solar could provide energy consumers as much as $473 billion by 2050 as part of the clean energy transition that is already underway. In Michigan, ratepayers would experience direct benefits of $379,966 annually from local solar and storage expansion - representing just the beginning of local solar's community benefits. Our roadmap also showed that a clean electric grid that leverages local solar and battery storage can be $88 billion less expensive to run across the country than the grid we have today.

If this were to become a reality, Michigan energy policy would need to be updated to allow for more customer choice. Any utility customer would have the option to adopt local clean energy and battery storage. For families and businesses who rent, community solar would allow them to subscribe to a portion of a larger solar project that they share with their neighbors. State laws would need to be aligned to encourage adoption as well, versus regulations that do not provide basic choice for all consumers to take charge of their energy decisions. As the data shows, Michigan's current path is just unreliable.

APPENDIX A

Ranking County-by-County Estimated Economic Impacts According to ICE Calculator

Jurisdiction	Utility Territory*	Customers	Total Cost	Rank
Michigan 2021		**4,197,789**	**$3,487,914,629**	
Michigan 2020		**4,197,789**	**$1,428,205,125**	
Alcona	Consumers Energy	4,982	$1,572,142	74
Alger	Mixed	3,293	$1,495,871	76
Allegan	Consumers Energy	46,677	$20,197,839	16
Alpena	Alpena Power Co	13,379	$5,114,734	46
Antrim	Mixed	10,656	$3,549,570	63
Arenac	Consumers Energy	6,610	$2,634,301	67
Baraga	Mixed	3,337	$1,127,256	79
Barry	Consumers Energy	25,025	$7,678,145	32
Bay	Consumers Energy	47,047	$17,049,992	19
Benzie	Consumers Energy	7,272	$3,738,973	61
Berrien	Indiana Michigan Power Co	66,856	$22,321,167	15
Branch	Consumers Energy	17,422	$6,638,216	36
Calhoun	Consumers Energy	55,606	$20,117,839	17
Cass	Indiana Michigan Power Co	21,446	$4,887,349	50
Charlevoix	Mixed	12,571	$5,152,974	44
Cheboygan	Mixed	11,406	$4,717,574	53
Chippewa	Cloverland Electric Cooperative	14,522	$4,946,291	49
Clare	Consumers Energy	12,257	$4,751,297	52
Clinton	Consumers Energy	32,171	$11,182,520	24
Crawford	Consumers Energy	6,000	$2,450,169	69
Delta	Mixed	16,673	$6,280,932	37
Dickinson	Upper MI Energy Resources Corp	12,196	$5,147,667	45
Eaton	Consumers Energy	47,034	$17,836,966	18
Emmet	Mixed	15,814	$9,721,168	27
Genesee	Consumers Energy	172,433	$62,855,785	5
Gladwin	Consumers Energy	11,119	$3,406,253	64
Gogebic	Xcel	7,119	$2,272,674	70
Grand Traverse	Consumers Energy	41,906	$27,742,900	12

*Counties fully or partially served by an investor-owned utility or electric cooperative other than DTE Energy and Consumers Energy utilized their utility-specific reliability data. All other counties utilized statewide reliability data for the ICE Calculator modeling.

Gratiot	Consumers Energy	15,572	$5,952,996	40
Hillsdale	Consumers Energy	18,429	$6,253,441	38
Houghton	Mixed	14,750	$5,568,870	42
Huron	DTE Energy	14,376	$4,819,815.24	51
Ingham	Mixed	120,824	$39,437,414	8
Ionia	Consumers Energy	23,641	$7,226,650	35
Iosco	Consumers Energy	12,002	$4,979,609	48
Iron	Mixed	5,430	$2,203,051	71
Isabella	Consumers Energy	25,925	$11,143,114	25
Jackson	Consumers Energy	64,827	$24,946,341	14
Kalamazoo	Mixed	110,873	$36,082,440	9
Kalkaska	Mixed	7,331	$2,156,550	72
Kent	Consumers Energy	266,782	$139,586,363	3
Keweenaw	Mixed	1,098	$380,822	83
Lake	Mixed	4,497	$978,829	82
Lapeer	DTE Energy	35,686	$9,230,218	29
Leelanau	Consumers Energy	9,855	$6,117,173	39
Lenawee	Consumers Energy	40,438	$14,779,433	22
Livingston	Mixed	78,297	$28,188,715	11
Luce	Cloverland Electric Cooperative	2,288	$1,017,016	81
Mackinac	Mixed	5,502	$2,803,647	66
Macomb	DTE Energy	370,592	$101,627,353	4
Manistee	Consumers Energy	10,239	$4,623,173	55
Marquette	Mixed	28,316	$10,340,744	26
Mason	Mixed	12,854	$4,630,807	54
Mecosta	Consumers Energy	16,498	$5,835,782	41
Menominee	Mixed	10,171	$2,893,455	65
Midland	Consumers Energy	35,836	$14,519,042	23
Missaukee	Consumers Energy	6,144	$2,473,332	68
Monroe	Mixed	63,814	$15,087,621	21
Montcalm	Consumers Energy	24,706	$8,544,506	30
Montmorency	Mixed	4,506	$1,298,520	78
Muskegon	Consumers Energy	69,218	$25,821,569	13
Newaygo	Mixed	19,717	$5,389,051	43
Oakland	DTE Energy	559,416	$207,559,916	1
Oceana	Consumers Energy	10,257	$3,910,323	60
Ogemaw	Consumers Energy	9,553	$4,563,797	56
Ontonagon	Mixed	2,871	$1,029,222	80
Osceola	Consumers Energy	9,120	$3,690,225	62

Oscoda	Consumers Energy	3,481	$1,557,770	75
Otsego	Mixed	11,244	$5,072,654	47
Ottawa	Consumers Energy	113,592	$52,669,917	7
Presque Isle	Mixed	6,158	$2,032,690	73
Roscommon	Consumers Energy	11,541	$4,401,742	57
Saginaw	Consumers Energy	82,121	$34,250,572	10
Sanilac	Consumers Energy	17,883	$4,317,119	59
Schoolcraft	DTE Energy	3,817	$1,346,353	77
Shiawassee	Mixed	28,824	$9,404,836	28
St. Clair	DTE Energy	68,367	$16,299,917	20
St. Joseph	Mixed	24,786	$7,271,385	33
Tuscola	DTE Energy	22,124	$4,366,066	58
Van Buren	Mixed	17,438	$8,040,815	31
Washtenaw	Mixed	155,407	$53,100,769	6
Wayne	DTE Energy	718,221	$176,410,028	2
Wexford	Consumers Energy	13,884	$7,267,004	34

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