



State of Michigan ENERGY SECTOR RISK PROFILE



Michigan State Facts



POPULATION

10.00 M



HOUSING UNITS

4.61 M



BUSINESS ESTABLISHMENTS

0.22 M

ENERGY EMPLOYMENT: 84,765 jobs

PUBLIC UTILITY COMMISSION: Michigan Public Service Commission

STATE ENERGY OFFICE: Michigan Department of Environment, Great Lakes, and Energy

EMERGENCY MANAGEMENT AGENCY: Michigan State Police, Emergency Management and Homeland Security Division

AVERAGE ELECTRICITY TARIFF: 11.40 cents/kWh

ENERGY EXPENDITURES: \$3,247/capita

ENERGY CONSUMPTION PER CAPITA: 278 MMBtu (31st highest out of 50 states and Washington, D.C.)

GDP: \$527.1 billion

Data from 2020 or most recent year available.

For more information, see the Data Sources document.

ANNUAL ENERGY CONSUMPTION

ELECTRIC POWER: 113,740 GWh

COAL: 26,300 MSTN

NATURAL GAS: 969 Bcf

MOTOR GASOLINE: 109,500 Mbbbl

DISTILLATE FUEL: 28,400 Mbbbl

ANNUAL ENERGY PRODUCTION

ELECTRIC POWER GENERATION: 255 plants, 116.7 TWh, 31.7 GW total capacity

Coal: 13 plants, 37.3 TWh, 9.4 GW total capacity

Hydro: 55 plants, 1.6 TWh, 0.4 GW total capacity

Natural Gas: 64 plants, 34.4 TWh, 12.0 GW total capacity

Nuclear: 3 plants, 32.9 TWh, 4.3 GW total capacity

Petroleum: 39 plants, 0.9 TWh, 0.6 GW total capacity

Wind & Solar: 43 plants, 6.0 TWh, 2.3 GW total capacity

Other sources: 38 plants, 3.5 TWh, 2.8 GW total capacity

COAL: 0 MSTN

NATURAL GAS: 80 Bcf

CRUDE OIL: 5,100 Mbbbl

ETHANOL: 8,300 Mbbbl

Data from EIA (2018, 2019).

This State Energy Risk Profile examines the relative magnitude of the risks that the state of Michigan's energy infrastructure routinely encounters in comparison with the probable impacts. Natural and man-made hazards with the potential to cause disruption of the energy infrastructure are identified. Certain natural and adversarial threats, such as cybersecurity, electromagnetic pulse, geomagnetic disturbance, pandemics, or impacts caused by infrastructure interdependencies, are ill-suited to location-based probabilistic risk assessment as they may not adhere to geographic boundaries, have limited occurrence, or have limited historic data. Cybersecurity and other threats not included in these profiles are ever present and should be included in state energy security planning. A complete list of data sources and national level comparisons can be found in the Data Sources document.

Michigan Risks and Hazards Overview

- The natural hazard that caused the greatest overall property loss between 2009 and 2019 was **Flooding** at \$232 million per year (leading cause nationwide at \$12 billion per year).
- Michigan had 26 Major Disaster Declarations, 1 Emergency Declaration, and 0 Fire Management Assistance Declarations for 5 events between 2013 and 2019.
- Michigan registered 8% fewer Heating Degree Days and 28% greater Cooling Degree Days than average in 2019.
- There are 2 Fusion Centers in Michigan. The Primary Fusion Center is located in Lansing.

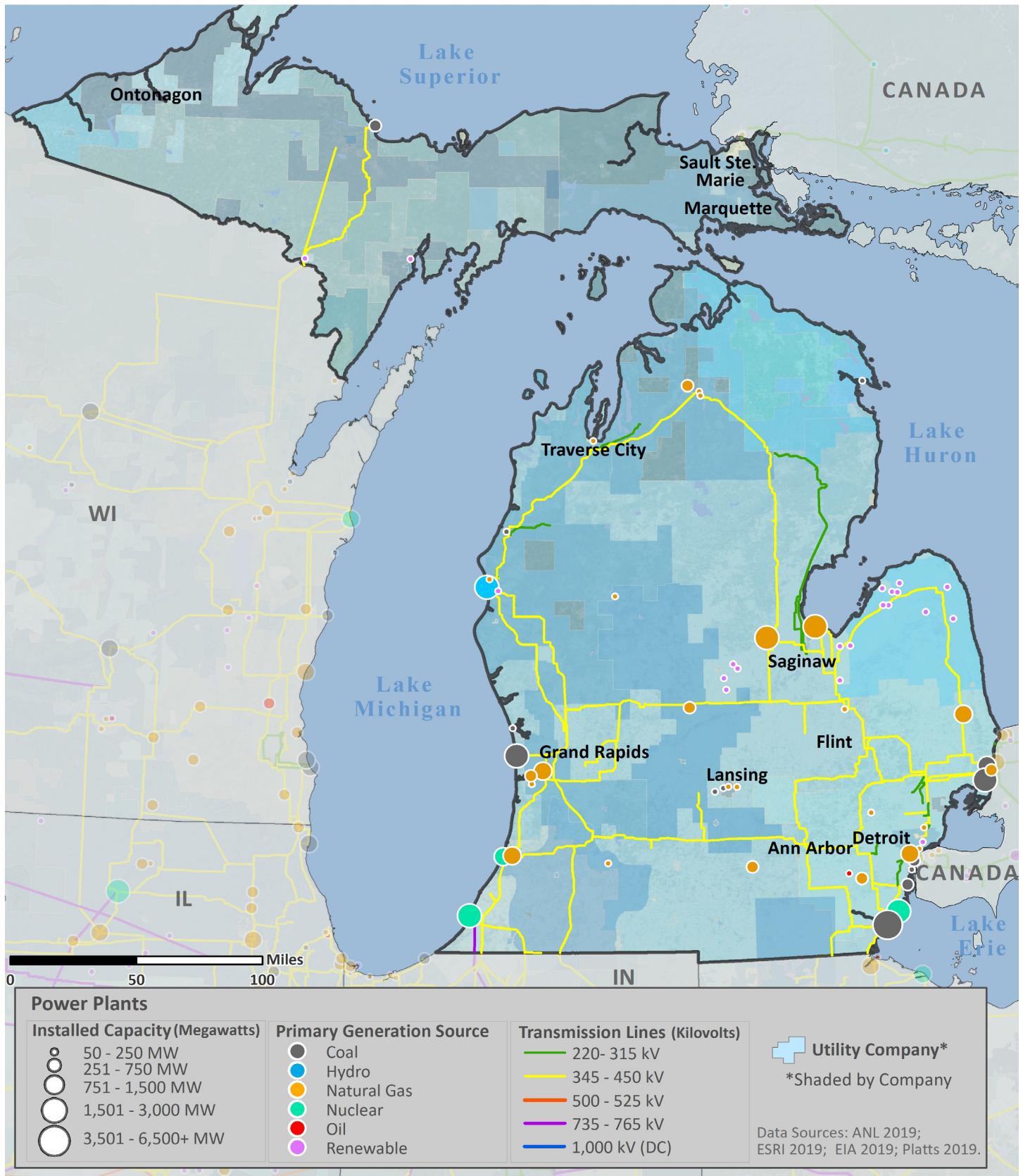
Annualized Frequency of and Property Damage Due to Natural Hazards, 2009 – 2019

	HAZARD FREQUENCY – Annualized	PROPERTY DAMAGE – Annualized (\$Million per year)
Drought	<1	\$0
Earthquake (≥ 3.5 M)	<1	\$0
Extreme Heat	1	\$0
Flood	13	\$232
Hurricane	0	\$0
Landslide	0	\$0
Thunderstorm & Lightning	85	\$109
Tornado	8	\$11
Wildfire	1	\$2
Winter Storm & Extreme Cold	62	\$12

Data Sources: NOAA and USGS



ELECTRIC









Electric Infrastructure

- Michigan has 66 electric utilities:
 - 4 Investor owned
 - 11 Cooperative
 - 40 Municipal
 - 11 Other utilities
- Plant retirements scheduled by 2025: 46 electric generating units totaling 4,672 MW of installed capacity.

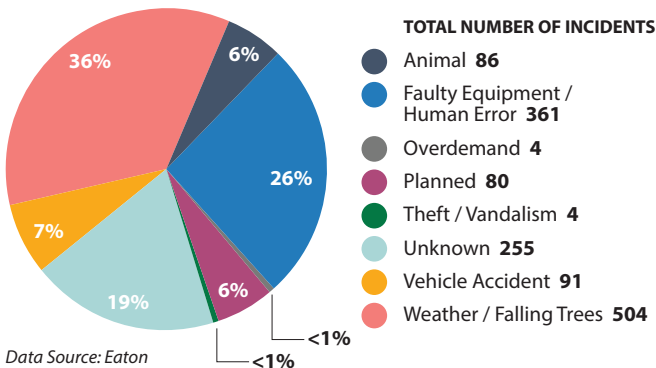
- In 2018, the average Michigan electric customer experienced 1.4 service interruptions that lasted an average of 7.4 hours.
- In Michigan, between 2008 and 2017:
 - The greatest number of electric outages occurred in **June** (2nd for outages nationwide)
 - The leading cause of electric outages was **Weather or Falling Trees** (leading cause nationwide)
 - Electric outages affected 1,264,206 customers on average

Electric Customers and Consumption by Sector, 2018

	 CUSTOMERS	 CONSUMPTION
Residential 	89%	34%
Commercial 	11%	37%
Industrial 	<1%	29%
Transportation 	<1%	<1%

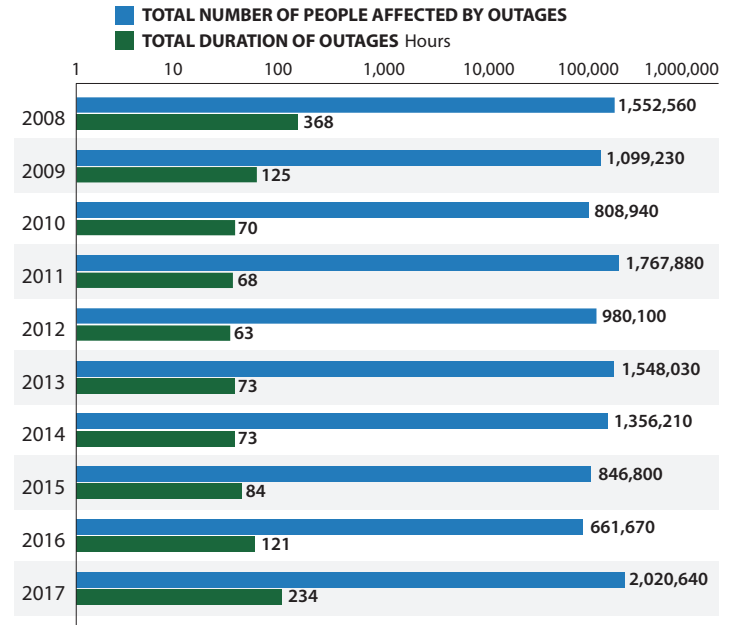
Data Source: EIA

Electric Utility-Reported Outages by Cause, 2008 – 2017



Data Source: Eaton

Electric Utility Outage Data, 2008 – 2017

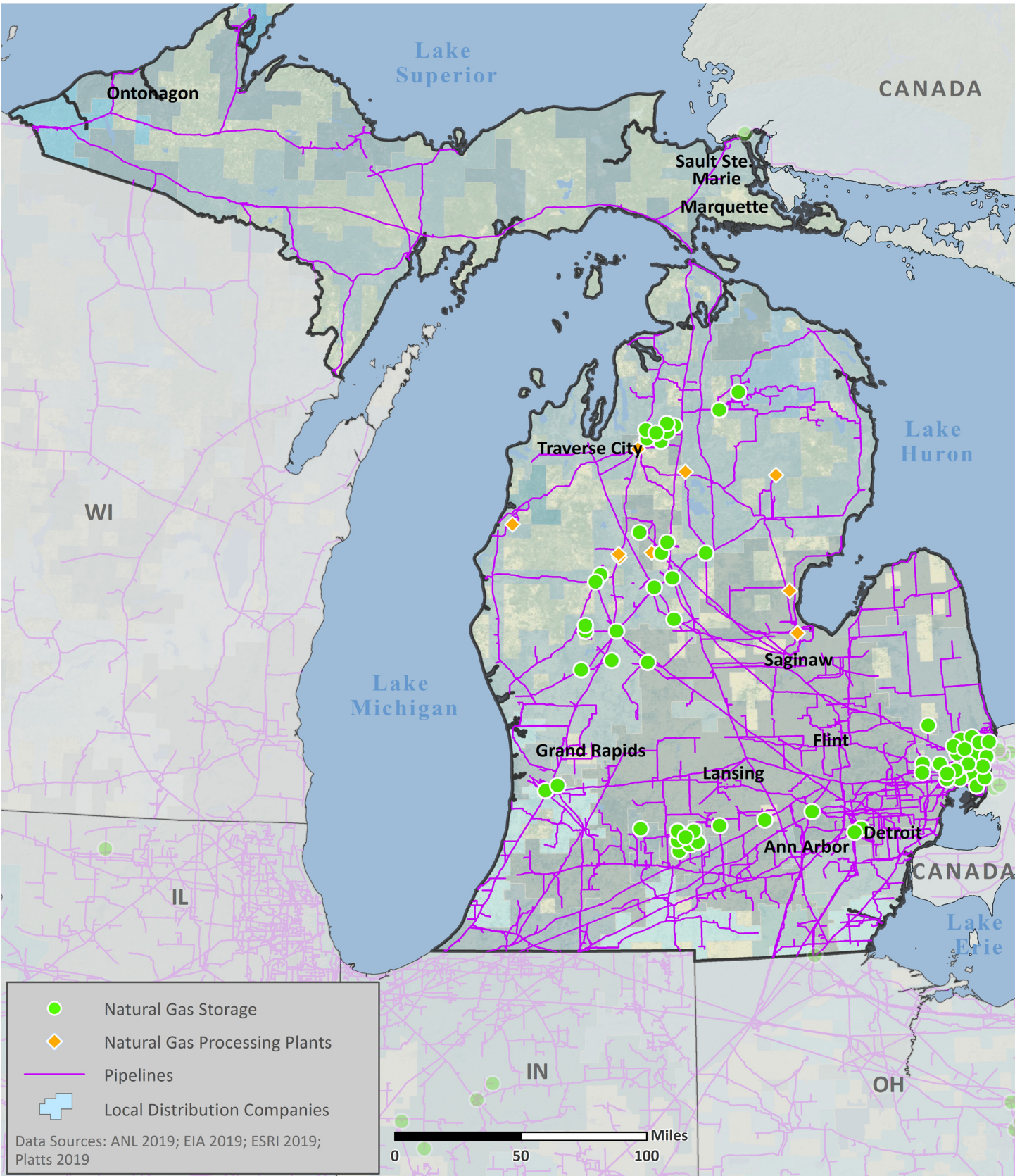


Note: This chart uses a logarithmic scale to display a very wide range of values.
Data Source: Eaton



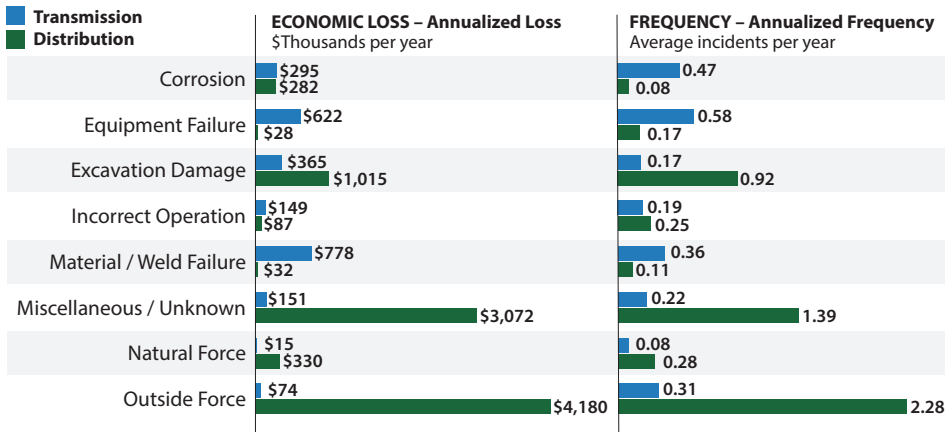


NATURAL GAS



Natural Gas Transport

Top Events Affecting Natural Gas Transmission and Distribution, 1984 – 2019



Data Source: DOT PHMSA

- As of 2018, Michigan had:
 - 8,774 miles of natural gas transmission pipelines
 - 59,730 miles of natural gas distribution pipelines
- 65% of Michigan’s natural gas transmission system and 25% of the distribution system were constructed prior to 1970 or in an unknown year.
- Between 1984 and 2019, Michigan’s natural gas supply was most impacted by:
 - **Material Failures** when transported by transmission pipelines (leading cause nationwide at \$28.43M per year)
 - **Outside Forces** when transported by distribution pipelines (leading cause nationwide at \$76.59M per year)

Natural Gas Processing and Liquefied Natural Gas

Natural Gas Customers and Consumption by Sector, 2018

	CUSTOMERS	CONSUMPTION
Residential	93%	35%
Commercial	7%	19%
Industrial	<1%	19%
Transportation	<1%	<1%
Electric Power	<1%	27%
Other	<1%	<1%

Data Source: EIA

- Michigan has 9 natural gas processing facilities with a total capacity of 101 MMcf/d.
- Michigan has 0 liquefied natural gas (LNG) facilities.



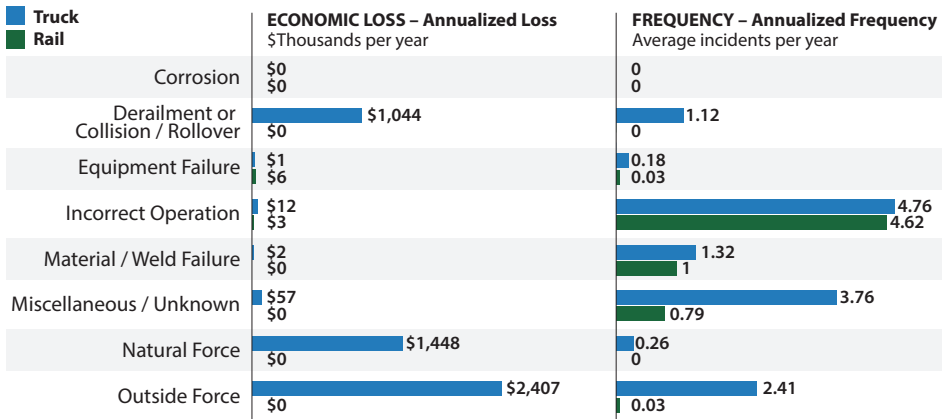


PETROLEUM



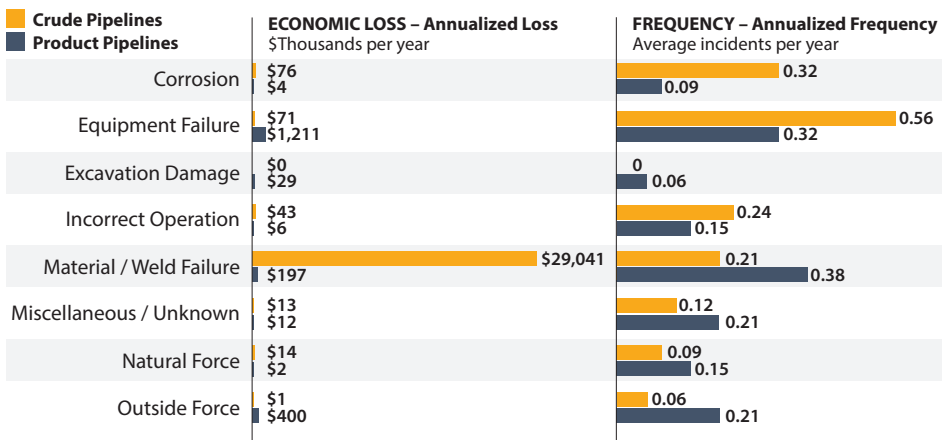
Petroleum Transport

Top Events Affecting Petroleum Transport by Truck and Rail, 1986 – 2019



Data Source: DOT PHMSA

Top Events Affecting Crude Oil and Refined Product Pipelines, 1986 – 2019



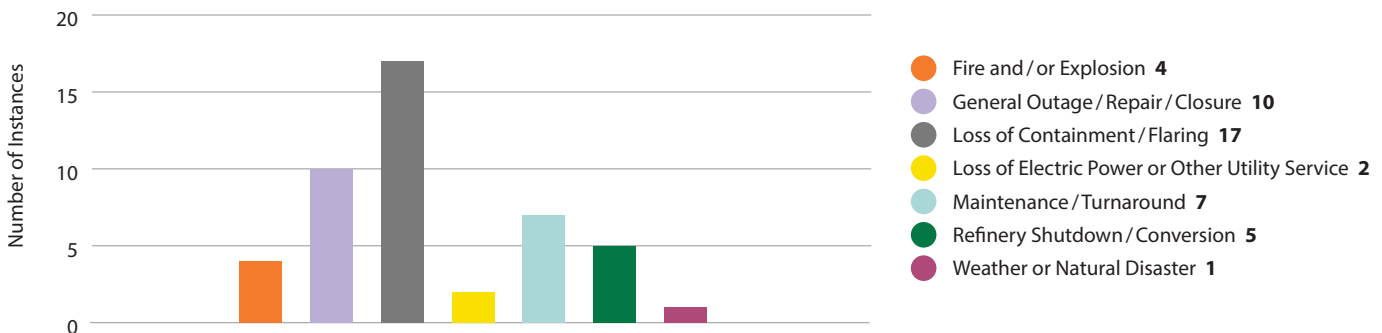
Data Source: DOT PHMSA

- As of 2018, Michigan had:
 - 1,564 miles of crude oil pipelines
 - 1,422 miles of refined product pipelines
 - 0 miles of biofuels pipelines
- 61% of Michigan’s petroleum pipeline systems were constructed prior to 1970 or in an unknown year.
- Between 1986 and 2019, Michigan’s petroleum supply was most impacted by:
 - **Outside Forces** when transported by truck (2nd leading cause nationwide at \$60.45M per year)
 - **Equipment Failures** when transported by rail (7th leading cause nationwide at \$0.02M per year)
 - **Material Failures** when transported by crude pipelines (leading cause nationwide at \$41.36M per year)
 - **Equipment Failures** when transported by product pipelines (6th leading cause nationwide at \$4.66M per year)
- Disruptions in other states may impact supply.

Petroleum Refineries

- Michigan has 1 petroleum refinery with a total operable capacity of 140 Mb/d.
- Between 2009 and 2019, the leading cause of petroleum refinery disruptions in Michigan was:
 - **Loss of Containment or Flaring** (leading cause nationwide)

Causes and Frequency of Petroleum Refinery Disruptions, 2009 – 2019



Data Source: Hydrocarbon Publishing