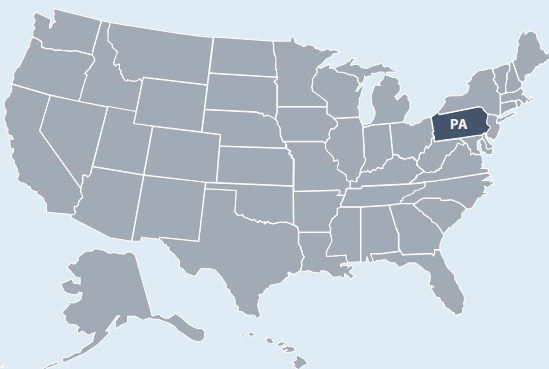




State of Pennsylvania

ENERGY SECTOR RISK PROFILE



Pennsylvania State Facts



POPULATION

12.81 M



HOUSING
UNITS

5.71 M



BUSINESS
ESTABLISHMENTS

0.30 M

ENERGY EMPLOYMENT: 117,458 jobs

PUBLIC UTILITY COMMISSION: Pennsylvania Public Utility Commission

STATE ENERGY OFFICE: Pennsylvania Department of Environmental Protection, Energy Programs Office

EMERGENCY MANAGEMENT AGENCY: Pennsylvania Emergency Management Agency

AVERAGE ELECTRICITY TARIFF: 10.10 cents/kWh

ENERGY EXPENDITURES: \$3,434/capita

ENERGY CONSUMPTION PER CAPITA: 298 MMBtu
(26th highest out of 50 states and Washington, D.C.)

GDP: \$783.2 billion

Data from 2020 or most recent year available.

For more information, see the Data Sources document.

ANNUAL ENERGY CONSUMPTION

ELECTRIC POWER: 248,130 GWh

COAL: 29,700 MSTN

NATURAL GAS: 1,324 Bcf

MOTOR GASOLINE: 85,300 Mbbl

DISTILLATE FUEL: 52,600 Mbbl

ANNUAL ENERGY PRODUCTION

ELECTRIC POWER GENERATION: 239 plants, 229.0 TWh,
52.1 GW total capacity

Coal: 18 plants, 37.9 TWh, 10.5 GW total capacity

Hydro: 17 plants, 3.5 TWh, 0.9 GW total capacity

Natural Gas: 64 plants, 98.0 TWh, 25.3 GW total capacity

Nuclear: 4 plants, 83.2 TWh, 9.5 GW total capacity

Petroleum: 35 plants, 0.2 TWh, 2.0 GW total capacity

Wind & Solar: 56 plants, 3.3 TWh, 1.5 GW total capacity

Other sources: 45 plants, 2.8 TWh, 2.3 GW total capacity

COAL: 49,100 MSTN

NATURAL GAS: 6,900 Bcf

CRUDE OIL: 6,500 Mbbl

ETHANOL: 2,700 Mbbl

Data from EIA (2018, 2019).

This State Energy Risk Profile examines the relative magnitude of the risks that the state of Pennsylvania'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.

Pennsylvania Risks and Hazards Overview

- The natural hazard that caused the greatest overall property loss between 2009 and 2019 was **Flooding** at \$51 million per year (leading cause nationwide at \$12 billion per year).
- Pennsylvania had 67 Major Disaster Declarations, 7 Emergency Declarations, and 0 Fire Management Assistance Declarations for 6 events between 2013 and 2019.
- Pennsylvania registered 12% fewer Heating Degree Days and 40% greater Cooling Degree Days than average in 2019.
- There are 3 Fusion Centers in Pennsylvania. The Primary Fusion Center is located in Harrisburg.

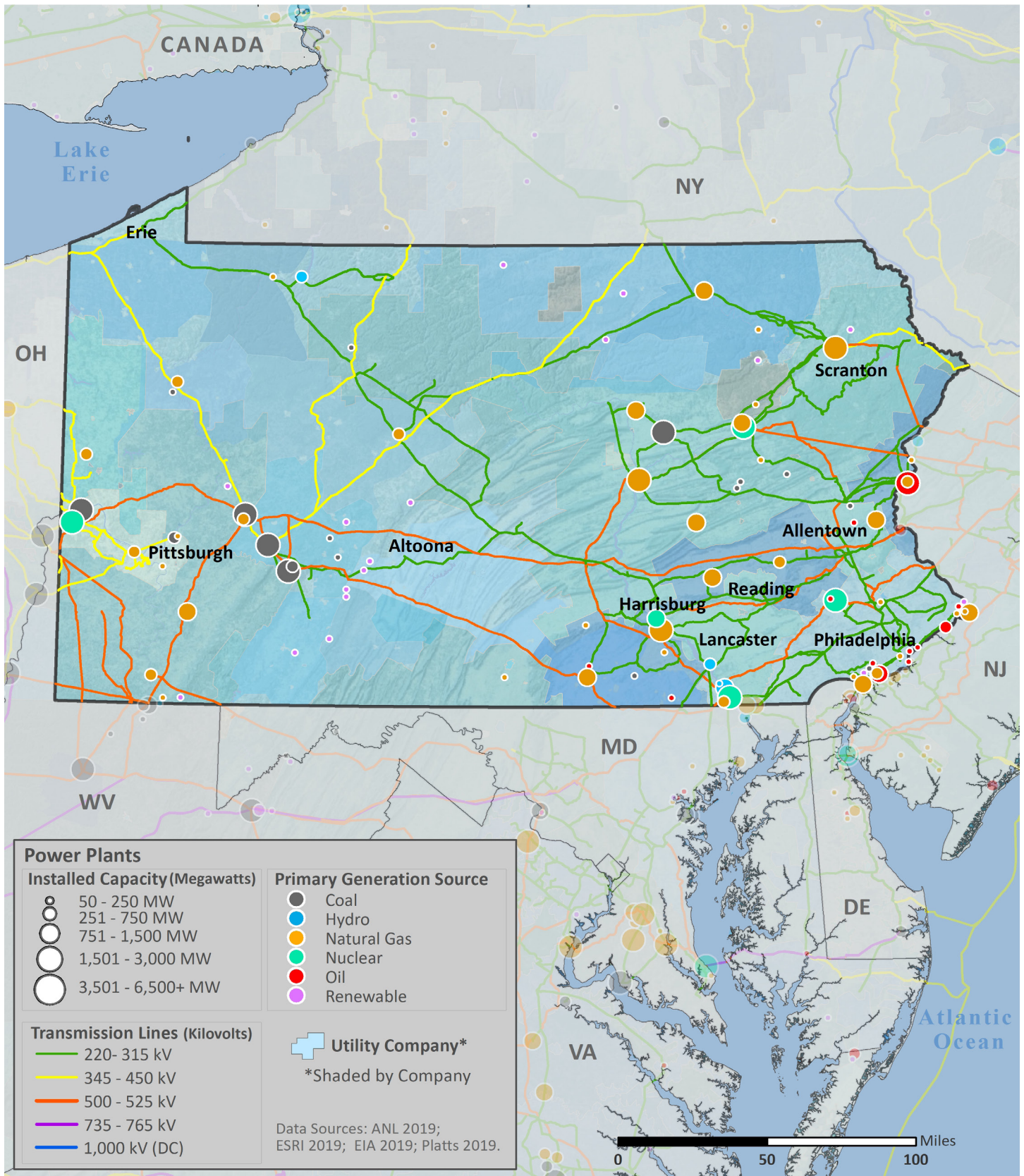
Annualized Frequency of and Property Damage Due to Natural Hazards, 2009 – 2019

	HAZARD FREQUENCY – Annualized	PROPERTY DAMAGE – Annualized (\$Million per year)
Drought	1	\$0
Earthquake (≥ 3.5 M)	0	\$0
Extreme Heat	5	\$0
Flood	53	\$51
Hurricane	<1	\$0
Landslide	<1	\$0
Thunderstorm & Lightning	121	\$11
Tornado	16	\$4
Wildfire	1	\$0
Winter Storm & Extreme Cold	51	\$7

Data Sources: NOAA and USGS



ELECTRIC



Electric Infrastructure

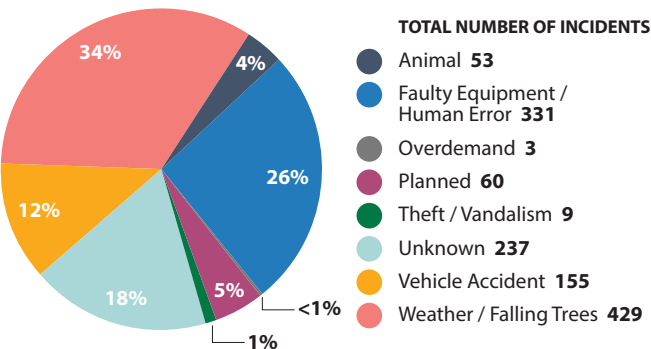
- Pennsylvania has 72 electric utilities:
 - 11 Investor owned
 - 15 Cooperative
 - 35 Municipal
 - 11 Other utilities
- Plant retirements scheduled by 2025: 15 electric generating units totaling 5,893 MW of installed capacity.

Electric Customers and Consumption by Sector, 2018

	 CUSTOMERS	 CONSUMPTION
Residential 	88%	38%
Commercial 	12%	29%
Industrial 	<1%	33%
Transportation 	<1%	<1%

Data Source: EIA

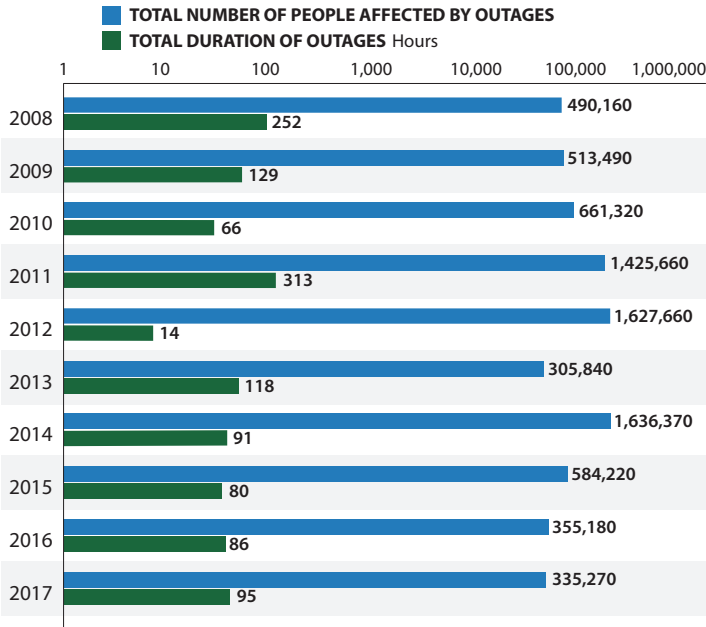
Electric Utility-Reported Outages by Cause, 2008 – 2017



Data Source: Eaton

- In 2018, the average Pennsylvania electric customer experienced 1.4 service interruptions that lasted an average of 8.6 hours.
- In Pennsylvania, between 2008 and 2017:
 - The greatest number of electric outages occurred in **July** (leading month for outages nationwide)
 - The leading cause of electric outages was **Weather or Falling Trees** (leading cause nationwide)
 - Electric outages affected 793,517 customers on average

Electric Utility Outage Data, 2008 – 2017

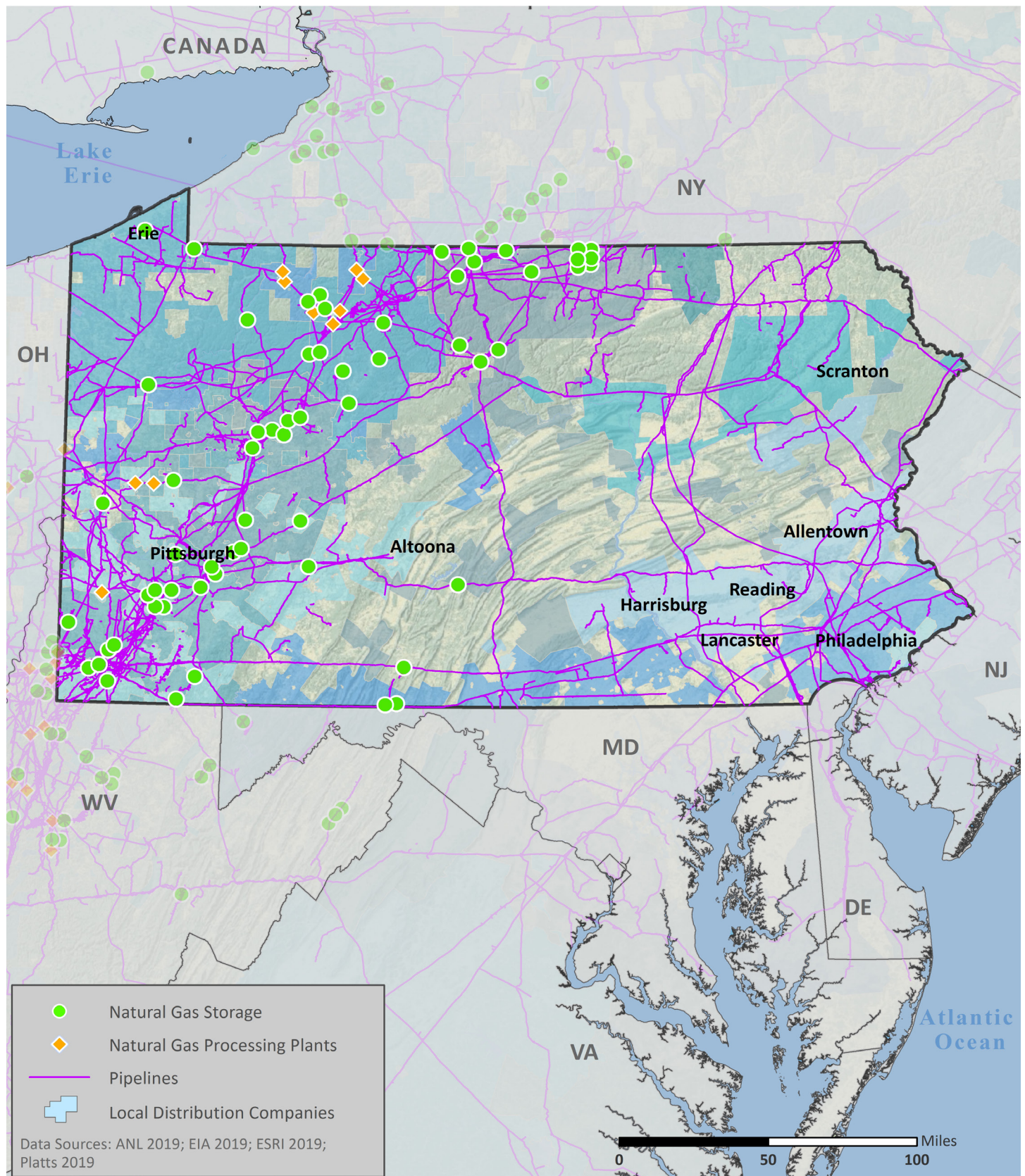


Note: This chart uses a logarithmic scale to display a very wide range of values.
Data Source: Eaton



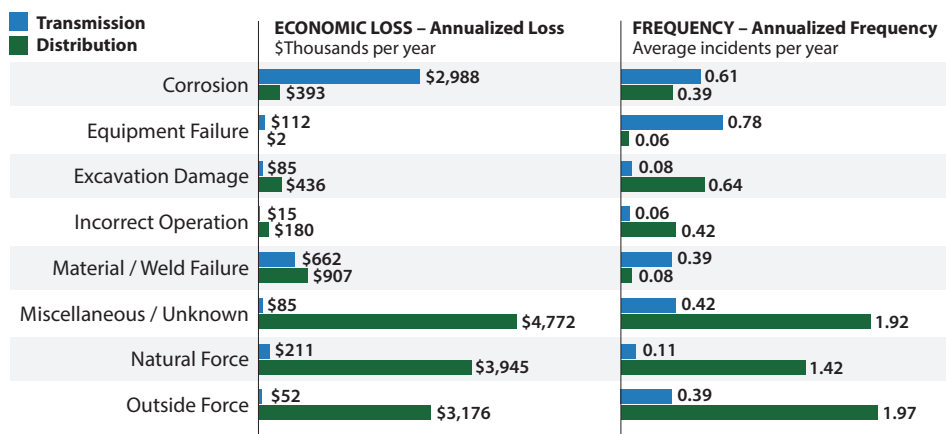


NATURAL GAS



Natural Gas Transport

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



Data Source: DOT PHMSA

- As of 2018, Pennsylvania had:
 - 10,365 miles of natural gas transmission pipelines
 - 48,500 miles of natural gas distribution pipelines
- 47% of Pennsylvania's natural gas transmission system and 18% of the distribution system were constructed prior to 1970 or in an unknown year.
- Between 1984 and 2019, Pennsylvania's natural gas supply was most impacted by:
 - Corrosion** when transported by transmission pipelines (4th leading cause nationwide at \$20.15M per year)
 - Miscellaneous or Unknown** events when transported by distribution pipelines (2nd leading cause nationwide at \$67.89M per year)

Natural Gas Processing and Liquefied Natural Gas

Natural Gas Customers and Consumption by Sector, 2018

	CUSTOMERS	CONSUMPTION
Residential	92%	21%
Commercial	8%	14%
Industrial	<1%	19%
Transportation	<1%	<1%
Electric Power	<1%	46%
Other	<1%	<1%

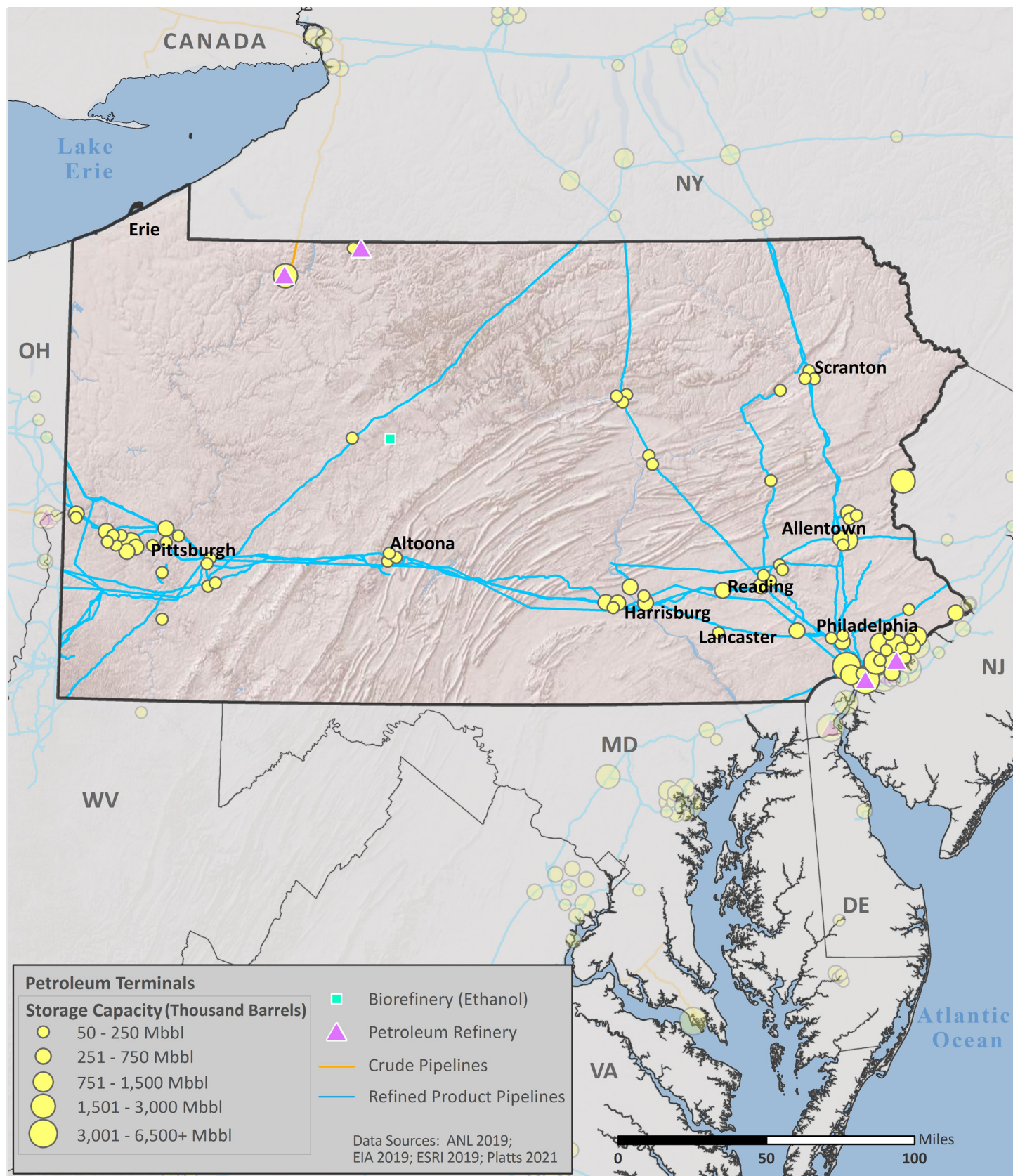
Data Source: EIA

- Pennsylvania has 10 natural gas processing facilities with a total capacity of 1,120 MMcf/d.
- Pennsylvania has 7 liquefied natural gas (LNG) facilities with a total storage capacity of 2,063,069 barrels.



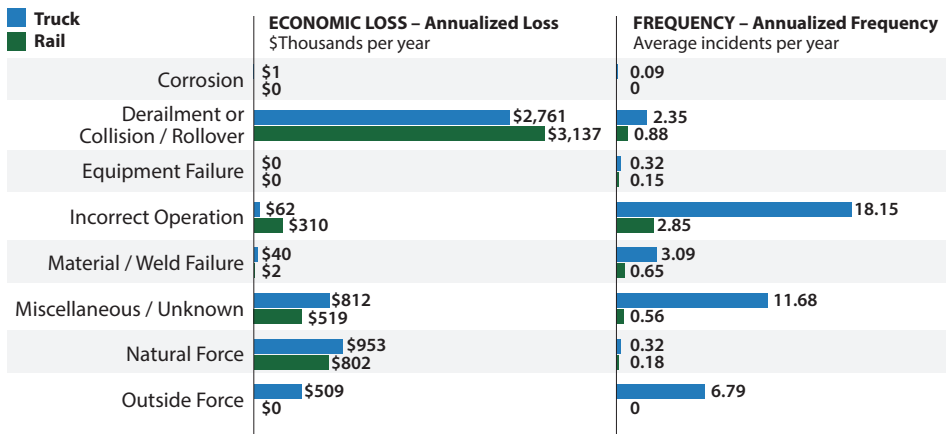


PETROLEUM



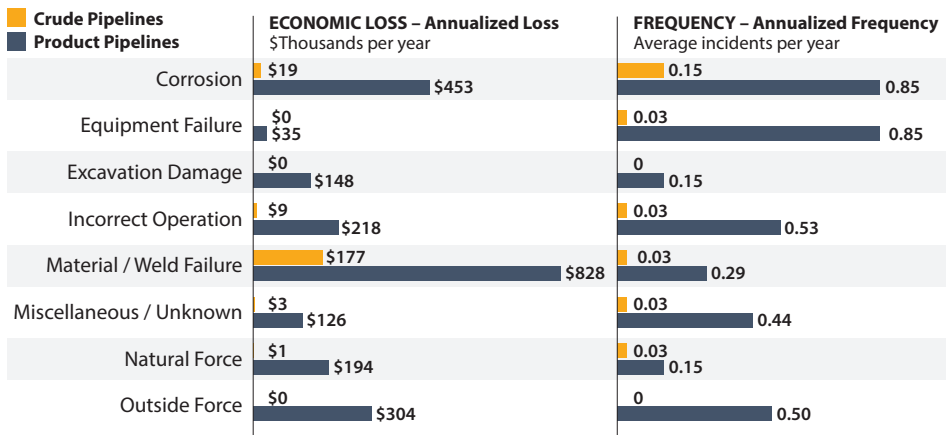
Petroleum Transport

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



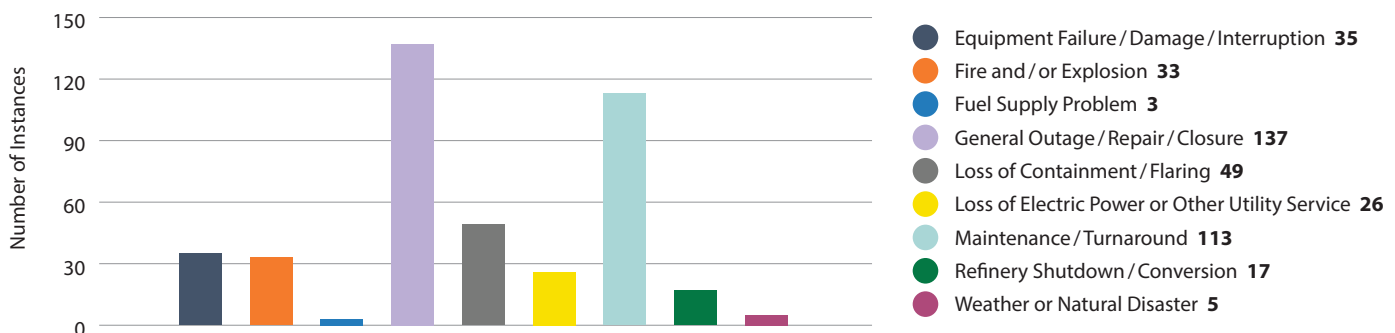
Data Source: DOT PHMSA

- As of 2018, Pennsylvania had:
 - 24 miles of crude oil pipelines
 - 1,911 miles of refined product pipelines
 - 0 miles of biofuels pipelines
- 87% of Pennsylvania's petroleum pipeline systems were constructed prior to 1970 or in an unknown year.
- Between 1986 and 2019, Pennsylvania's petroleum supply was most impacted by:
 - **Derailments, Collisions, or Rollovers** when transported by truck (8th leading cause nationwide at \$0.07M per year)
 - **Derailments, Collisions, or Rollovers** when transported by rail (leading cause nationwide at \$19.71M per year)
 - **Material Failures** when transported by crude pipelines (leading cause nationwide at \$41.36M per year)
 - **Material Failures** when transported by product pipelines (4th leading cause nationwide at \$9.47M per year)
- Disruptions in other states may impact supply.

Petroleum Refineries

- Pennsylvania has 4 petroleum refineries with a total operable capacity of 601 Mb/d.
- Between 2009 and 2019, the leading causes of petroleum refinery disruptions in Pennsylvania were:
 - **General Outages, Repairs, and/or Closures** (3rd leading cause nationwide)

Causes and Frequency of Petroleum Refinery Disruptions, 2009 – 2019



Data Source: Hydrocarbon Publishing