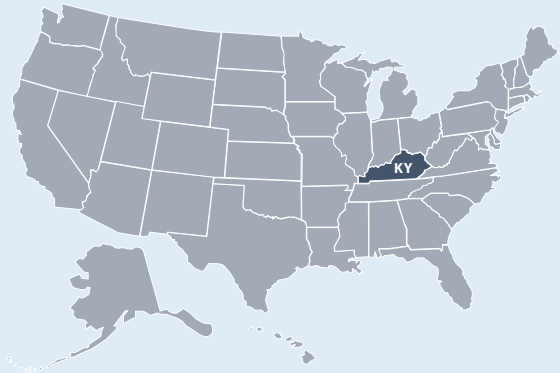
State of Kentucky
ENERGY SECTOR RISK PROFILE

U.S. DEPARTMENT OF ENERGY
Cybersecurity, Energy Security, and Emergency Response



Kentucky State Facts

POPULATION 4.47 M

HOUSING UNITS 2.00 M

BUSINESS ESTABLISHMENTS 0.09 M

ENERGY EMPLOYMENT: 42,797 jobs
PUBLIC UTILITY COMMISSION: KY Public Service Commission
STATE ENERGY OFFICE: KY Energy and Environment Cabinet
EMERGENCY MANAGEMENT AGENCY: KY Emergency Management
AVERAGE ELECTRICITY TARIFF: 8.52 cents/kWh
ENERGY EXPENDITURES: $3,893/capita
ENERGY CONSUMPTION PER CAPITA: 372 MMBtu
(15th highest of 50 states and Washington, D.C.)
GDP: $208.1 billion

Data from 2020 or most recent year available.
For more information, see the Data Sources document.

ANNUAL ENERGY CONSUMPTION

ELECTRIC POWER: 76,610 GWh
COAL: 29,300 MSTN
NATURAL GAS: 317 Bcf
MOTOR GASOLINE: 48,100 Mbbl
DISTILLATE FUEL: 22,700 Mbbl

ANNUAL ENERGY PRODUCTION

ELECTRIC POWER GENERATION: 57 plants, 71.8 TWh, *9.7 GW total capacity*
- **Coal:** 14 plants, 51.7 TWh, *13.5 GW total capacity*
- **Hydro:** 10 plants, 4.2 TWh, *1.1 GW total capacity*
- **Natural Gas:** 15 plants, 15.3 TWh, *8.5 GW total capacity*
- **Petroleum:** 1 plant, 0.1 TWh, *0.0 GW total capacity*
- **Wind & Solar:** 6 plants, 0.0 TWh, *0.0 GW total capacity*
- **Other sources:** 11 plants, 0.4 TWh, *0.1 GW total capacity*

COAL: 41,800 MSTN
NATURAL GAS: 90 Bcf
CRUDE OIL: 2,500 Mbbl
ETHANOL: 900 Mbbl

Data from EIA (2018, 2019).

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

Kentucky Risks and Hazards Overview

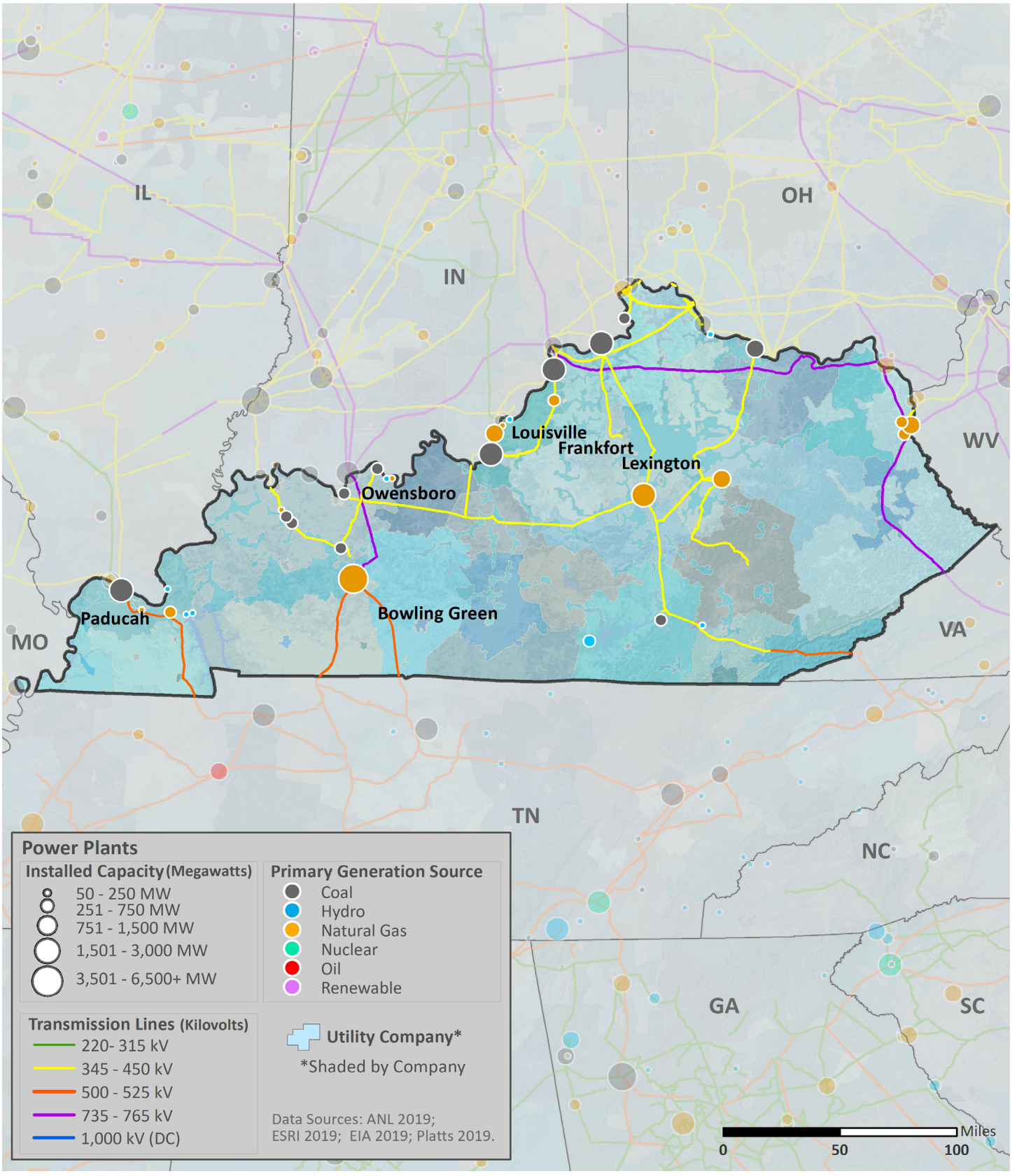
- The natural hazard that caused the greatest overall property loss between 2009 and 2019 was **Winter Storms & Extreme Cold** at $33 million per year *(7th leading cause nationwide at $418 million per year)*.
- Kentucky had 305 Major Disaster Declarations, 0 Emergency Declarations, and 5 Fire Management Assistance Declarations for 11 events between 2013 and 2019.
- Kentucky registered 14% fewer Heating Degree Days and 23% greater Cooling Degree Days than average in 2019.
- There is 1 Fusion Center located in Frankfort.

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

	HAZARD FREQUENCY – Annualized	PROPERTY DAMAGE – Annualized ($Million per year)
Drought	2	$0
Earthquake (≥ 3.5 M)	<1	$0
Extreme Heat	6	$0
Flood	72	$18
Hurricane	0	$0
Landslide	1	$0
Thunderstorm & Lightning	131	$8
Tornado	18	$20
Wildfire	1	$0
Winter Storm & Extreme Cold	34	$33

Data Sources: NOAA and USGS

ELECTRIC


IL
IN
OH
WV
VA
MO
TN
NC
GA
SC
Louisville
Frankfort
Lexington
Owensboro
Bowling Green
Paducah
Power Plants
Installed Capacity (Megawatts)
50 - 250 MW
251 - 750 MW
751 - 1,500 MW
1,501 - 3,000 MW
3,501 - 6,500+ MW
Primary Generation Source
Coal
Hydro
Natural Gas
Nuclear
Oil
Renewable
Transmission Lines (Kilovolts)
220- 315 kV
345 - 450 kV
500 - 525 kV
735 - 765 kV
1,000 kV (DC)
Utility Company*
*Shaded by Company
Data Sources: ANL 2019; ESRI 2019; EIA 2019; Platts 2019.
Miles
0
50
100

Electric Infrastructure

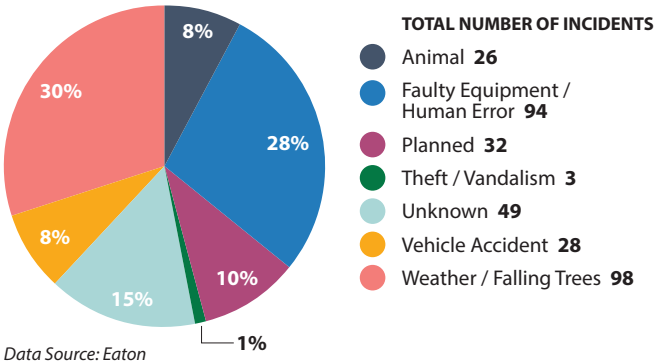
- Kentucky has 56 electric utilities:
  - *3 Investor owned*
  - *24 Cooperative*
  - *29 Municipal*
  - *0 Other utilities*
- Plant retirements scheduled by 2025: 7 electric generating units totaling 2,294 MW of installed capacity.
- In 2018, the average Kentucky electric customer experienced 1.8 service interruptions that lasted an average of 6.8 hours.
- In Kentucky, between 2008 and 2017:
  - *The greatest number of electric outages occurred in **January** (6th for outages nationwide)*
  - *The leading cause of electric outages was **Weather or Falling Trees** (leading cause nationwide)*
  - *Electric outages affected 203,086 customers on average*

Electric Customers and Consumption by Sector, 2018

	CUSTOMERS	CONSUMPTION
Residential	86%	36%
Commercial	13%	26%
Industrial	<1%	38%
Transportation	<1%	<1%

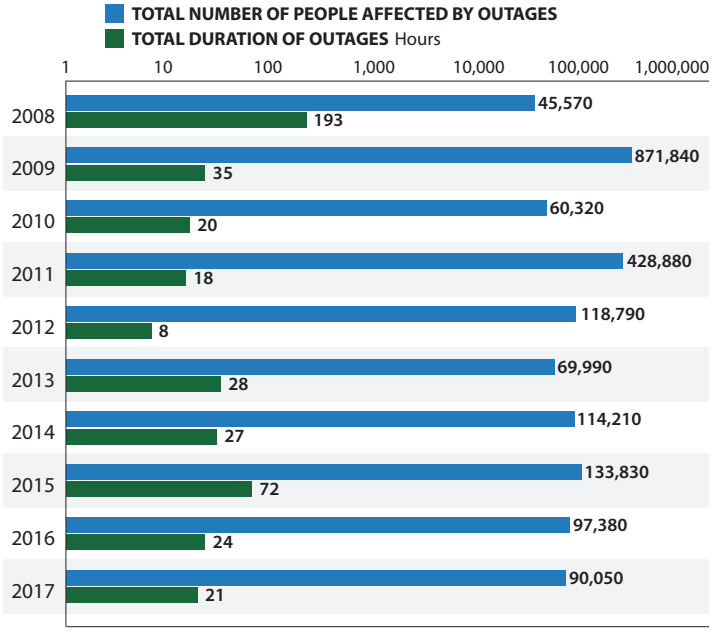
Data Source: EIA

Electric Utility-Reported Outages by Cause, 2008 – 2017



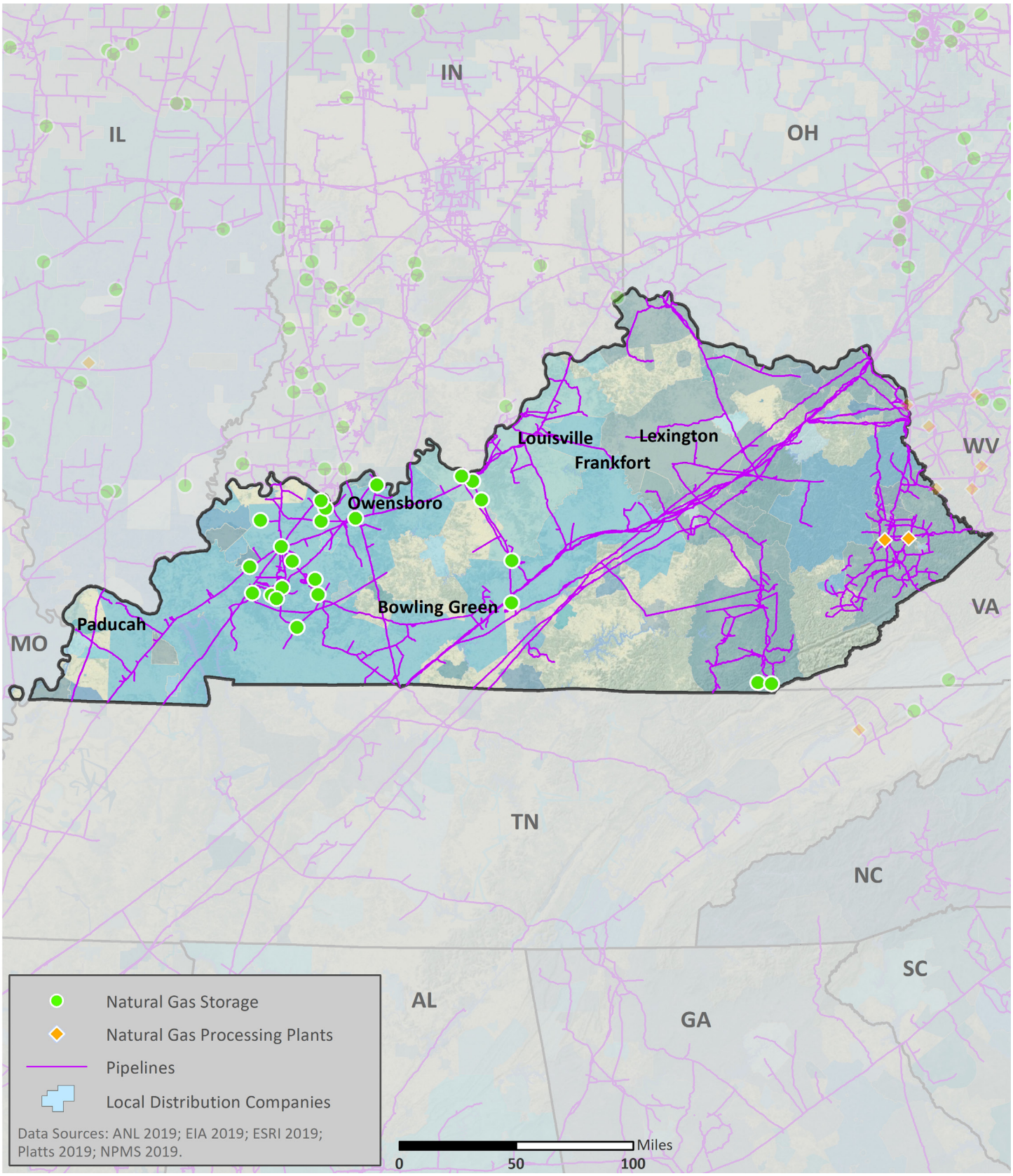
Data Source: Eaton

Electric Utility Outage Data, 2008 – 2017



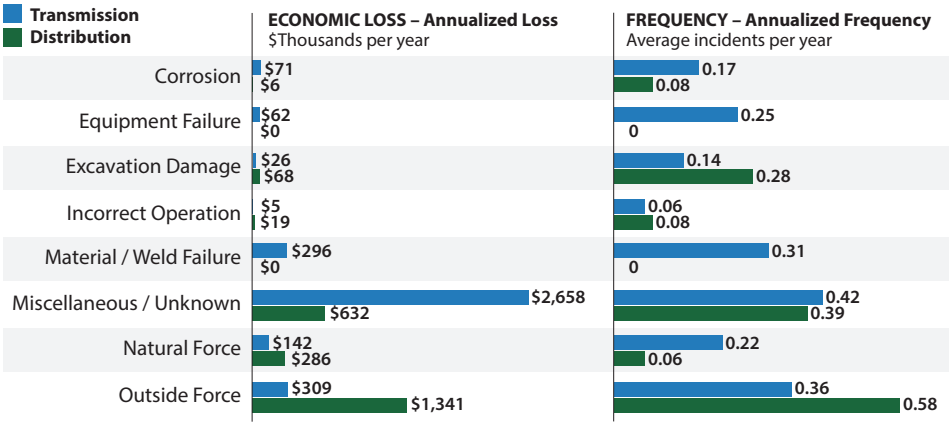
Note: This chart uses a logarithmic scale to display a very wide range of values.
Data Source: Eaton

NATURAL GAS


IN
IL
OH
WV
VA
MO
TN
NC
SC
AL
GA
Louisville
Lexington
Frankfort
Owensboro
Bowling Green
Paducah
Natural Gas Storage
Natural Gas Processing Plants
Pipelines
Local Distribution Companies
Data Sources: ANL 2019; EIA 2019; ESRI 2019; Platts 2019; NPMS 2019.
0
50
100
Miles

Natural Gas Transport

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



Data Source: DOT PHMSA

- As of 2018, Kentucky had:
  - *6,769 miles of natural gas transmission pipelines*
  - *18,834 miles of natural gas distribution pipelines*
- 72% of Kentucky's natural gas transmission system and 24% of the distribution system were constructed prior to 1970 or in an unknown year.
- Between 1984 and 2019, Kentucky's natural gas supply was most impacted by:
  - ***Miscellaneous or Unknown*** *events when transported by transmission pipelines (5th leading cause nationwide at $16.77M per year)*
  - ***Outside Forces*** *when transported by distribution pipelines (leading cause nationwide at $76.59M per year)*

Natural Gas Processing and Liquefied Natural Gas

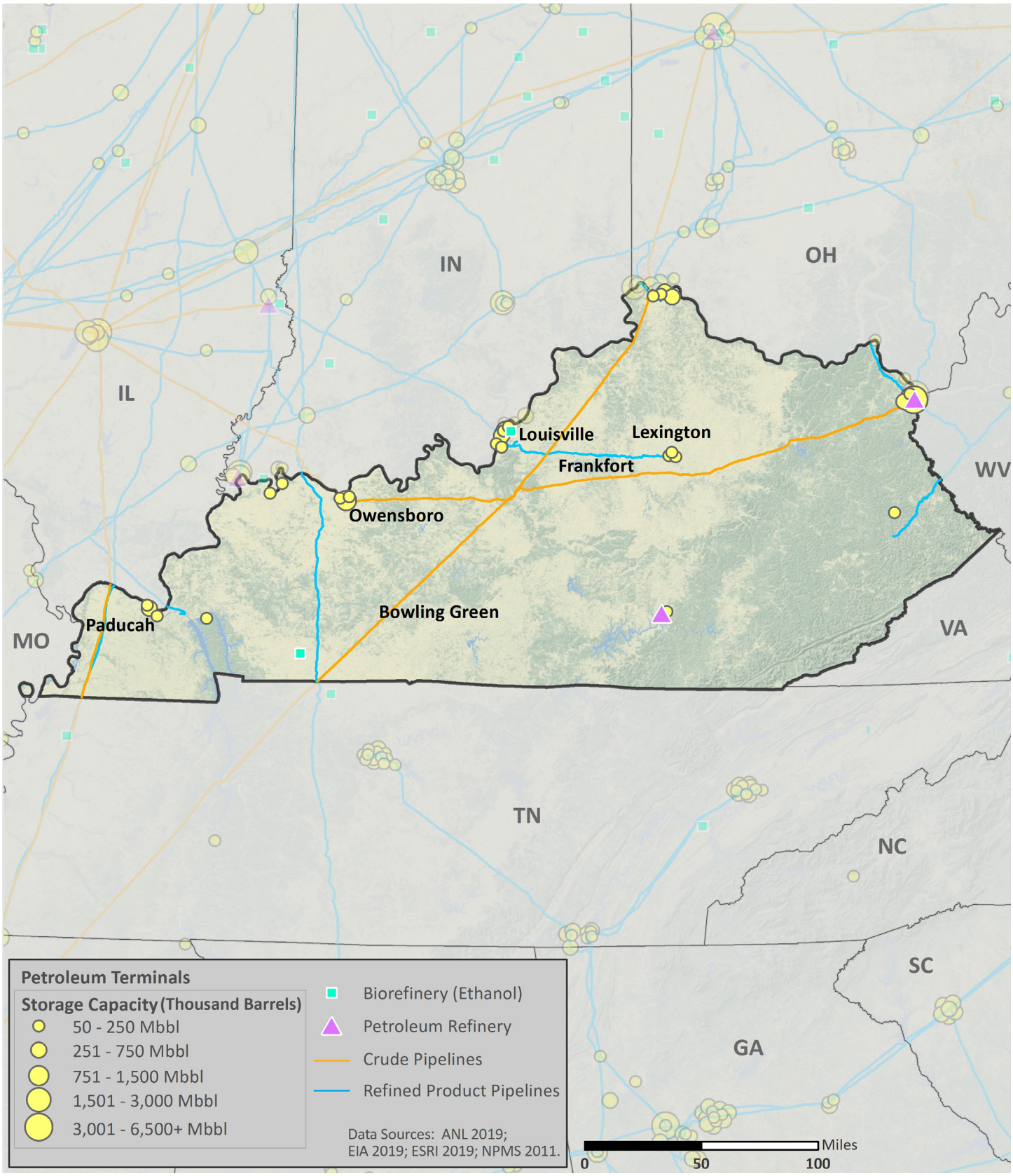
Natural Gas Customers and Consumption by Sector, 2018

	CUSTOMERS	CONSUMPTION
Residential	90%	16%
Commercial	10%	12%
Industrial	<1%	37%
Transportation	<1%	<1%
Electric Power	<1%	36%
Other	<1%	<1%

Data Source: EIA

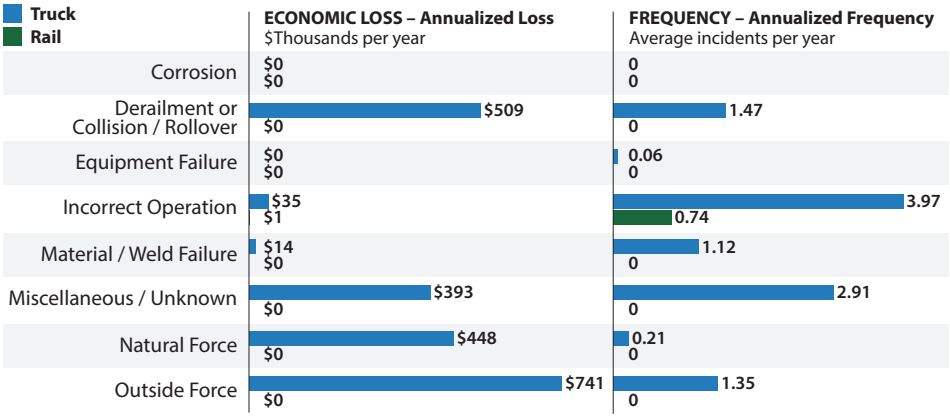
- Kentucky has 2 natural gas processing facilities with a total capacity of 365 MMcf/d.
- Kentucky has 0 liquefied natural gas (LNG) facilities.

PETROLEUM


IN
OH
IL
WV
MO
VA
TN
NC
SC
GA
Louisville
Lexington
Frankfort
Owensboro
Bowling Green
Paducah
Petroleum Terminals
Storage Capacity (Thousand Barrels)
50 - 250 Mbbl
251 - 750 Mbbl
751 - 1,500 Mbbl
1,501 - 3,000 Mbbl
3,001 - 6,500+ Mbbl
Biorefinery (Ethanol)
Petroleum Refinery
Crude Pipelines
Refined Product Pipelines
Data Sources: ANL 2019;
EIA 2019; ESRI 2019; NPMS 2011.
Miles
0
50
100

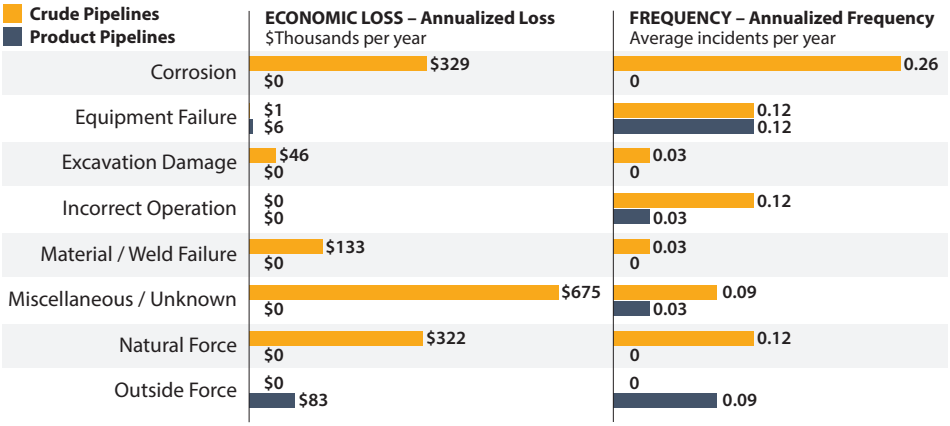
Petroleum Transport

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



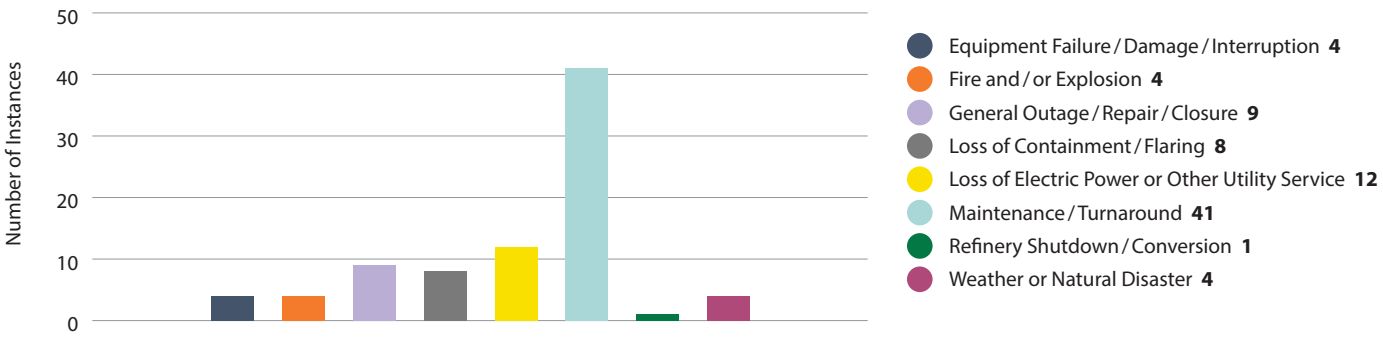
Data Source: DOT PHMSA

- As of 2018, Kentucky had:
  - *601 miles of crude oil pipelines*
  - *275 miles of refined product pipelines*
  - *0 miles of biofuels pipelines*
- 53% of Kentucky's petroleum pipeline systems were constructed prior to 1970 or in an unknown year.
- Between 1986 and 2019, Kentucky's petroleum supply was most impacted by:
  - ***Outside Forces*** *when transported by truck (2nd leading cause nationwide at $60.45M per year)*
  - ***Incorrect Operations*** *when transported by rail (4th leading cause nationwide at $2.02M per year)*
  - ***Miscellaneous or Unknown*** *events when transported by crude pipelines (5th leading cause nationwide at $4.71M per year)*
  - ***Outside Forces*** *when transported by product pipelines (leading cause nationwide at $19.06M per year)*
- Disruptions in other states may impact supply.

Petroleum Refineries

- Kentucky has 2 petroleum refineries with a total operable capacity of 282.5 Mb/d.
- Between 2009 and 2019, the leading cause of petroleum refinery disruptions in Kentucky was:
  - ***Maintenance*** *(2nd leading cause nationwide)*

Causes and Frequency of Petroleum Refinery Disruptions, 2009 – 2019



Data Source: Hydrocarbon Publishing