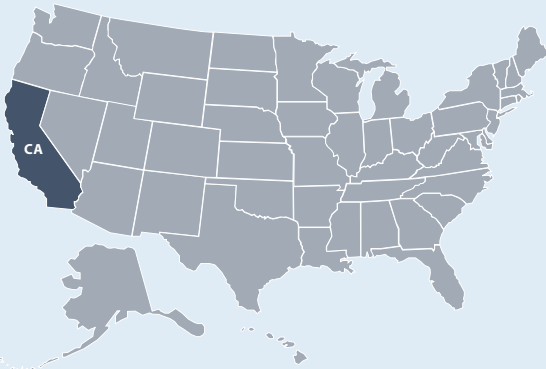




State of California ENERGY SECTOR RISK PROFILE



California State Facts



POPULATION

39.56 M



HOUSING UNITS
14.28 M



BUSINESS ESTABLISHMENTS
0.92 M

ENERGY EMPLOYMENT: 411,812 jobs

PUBLIC UTILITY COMMISSION: California Public Utilities Commission

STATE ENERGY OFFICE: California Energy Commission

EMERGENCY MANAGEMENT AGENCY: California Governor's Office of Emergency Services

AVERAGE ELECTRICITY TARIFF: 16.58 cents/kWh

ENERGY EXPENDITURES: \$3,166/capita

ENERGY CONSUMPTION PER CAPITA: 200 MMBtu (48th highest out of 50 states and Washington, D.C.)

GDP: \$2,997.7 billion

Data from 2020 or most recent year available.

For more information, see the Data Sources document.

ANNUAL ENERGY CONSUMPTION

ELECTRIC POWER: 303,300 GWh

COAL: 1,400 MSTN

NATURAL GAS: 2,094 Bcf

MOTOR GASOLINE: 334,900 Mbbl

DISTILLATE FUEL: 89,800 Mbbl

ANNUAL ENERGY PRODUCTION

ELECTRIC POWER GENERATION: 1,502 plants, 201.8 TWh, 80.7 GW total capacity

Coal: 1 plant, 0.2 TWh, 0.1 GW total capacity

Hydro: 251 plants, 38.4 TWh, 10.1 GW total capacity

Natural Gas: 312 plants, 85.8 TWh, 40.2 GW total capacity

Nuclear: 1 plant, 16.2 TWh, 2.2 GW total capacity

Petroleum: 19 plants, 0.1 TWh, 0.6 GW total capacity

Wind & Solar: 712 plants, 42.1 TWh, 19.0 GW total capacity

Other sources: 206 plants, 19.1 TWh, 8.6 GW total capacity

COAL: 0 MSTN

NATURAL GAS: 200 Bcf

CRUDE OIL: 161,500 Mbbl

ETHANOL: 5,300 Mbbl

Data from EIA (2018, 2019).

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

California Risks and Hazards Overview

- The natural hazard that caused the greatest overall property loss between 2009 and 2019 was **Wildfires** at \$1.7 billion per year (3rd leading cause nationwide at \$2.1 billion per year).
- California had 159 Major Disaster Declarations, 14 Emergency Declarations, and 107 Fire Management Assistance Declarations for 107 events between 2013 and 2019.
- California registered 10% fewer Heating Degree Days and 31% greater Cooling Degree Days than average in 2019.
- There are 6 Fusion Centers in California. The Primary Fusion Center is located in Mather.

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

	HAZARD FREQUENCY – Annualized	PROPERTY DAMAGE – Annualized (\$Million per year)
Drought	7	\$0
Earthquake (≥ 3.5 M)	125	\$554
Extreme Heat	8	\$0
Flood	59	\$123
Hurricane	0	\$0
Landslide	15	\$62
Thunderstorm & Lightning	124	\$21
Tornado	13	\$2
Wildfire	30	\$1,743
Winter Storm & Extreme Cold	73	\$2

Data Sources: NOAA and USGS



ELECTRIC









Electric Infrastructure

- California has 99 electric utilities:
 - 5 Investor owned
 - 3 Cooperative
 - 50 Municipal
 - 41 Other utilities
- Plant retirements scheduled by 2025: 71 electric generating units totaling 9,060 MW of installed capacity.

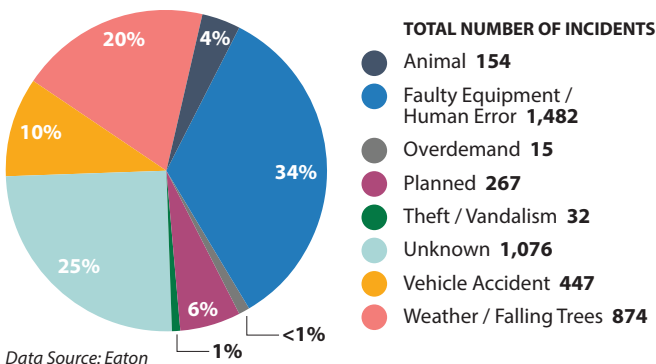
- In 2018, the average California electric customer experienced 1 service interruption that lasted an average of 3.3 hours.
- In California, between 2008 and 2017:
 - The greatest number of electric outages occurred in **December** (4th for outages nationwide)
 - The leading cause of electric outages was **Faulty Equipment or Human Error** (2nd leading cause nationwide)
 - Electric outages affected 3,024,631 customers on average

Electric Customers and Consumption by Sector, 2018

	 CUSTOMERS	 CONSUMPTION
Residential 	88%	35%
Commercial 	11%	45%
Industrial 	<1%	19%
Transportation 	<1%	<1%

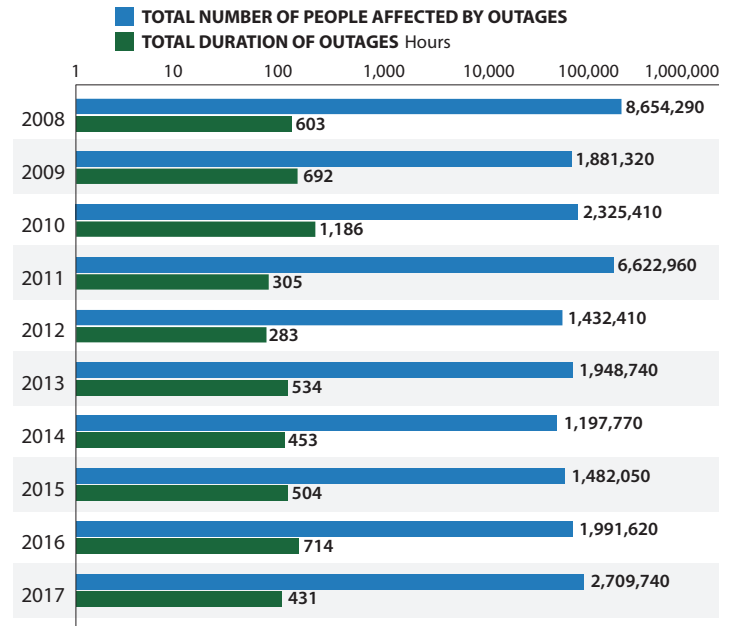
Data Source: EIA

Electric Utility-Reported Outages by Cause, 2008 – 2017



Data Source: Eaton

Electric Utility Outage Data, 2008 – 2017

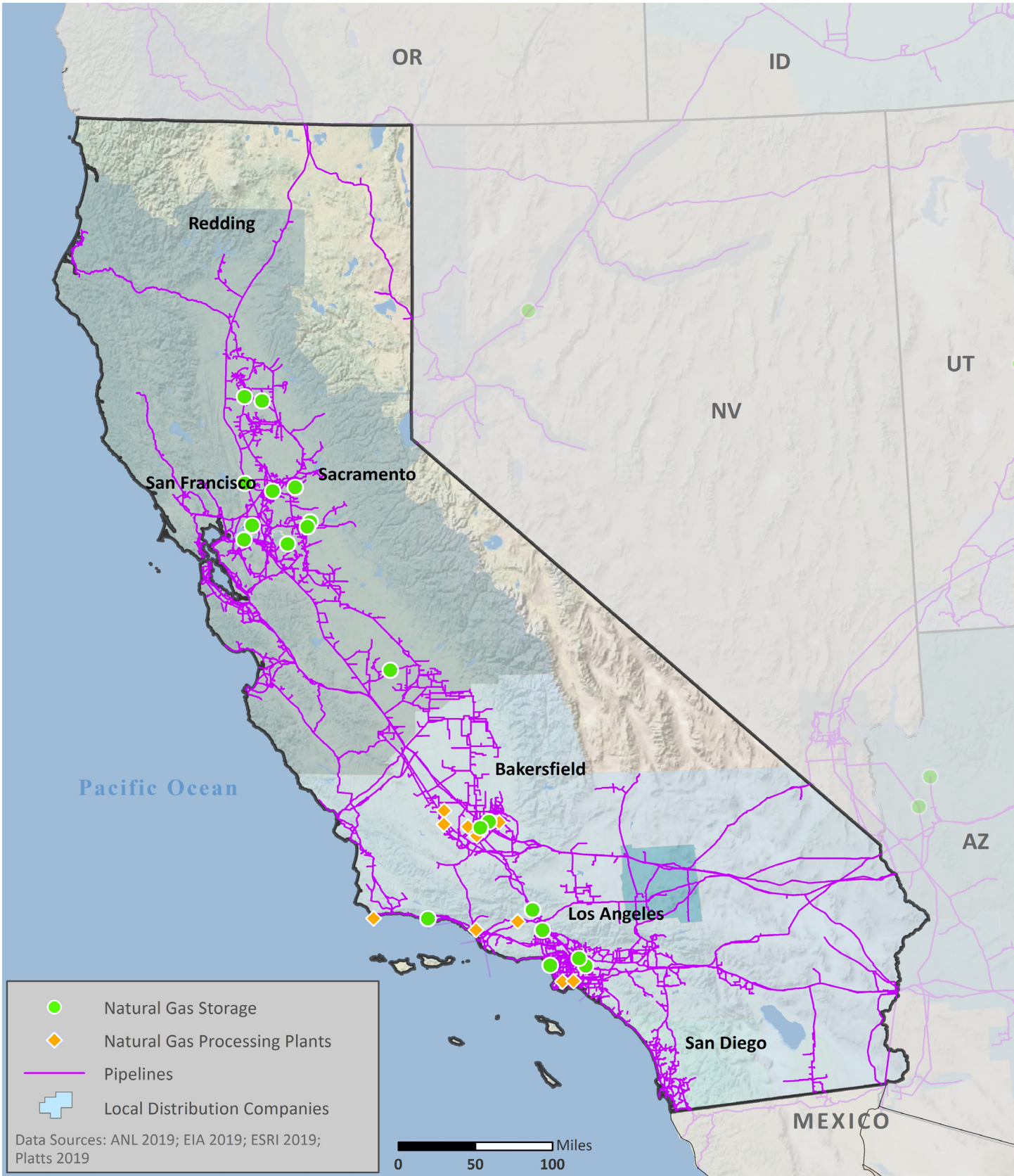


Note: This chart uses a logarithmic scale to display a very wide range of values.
Data Source: Eaton



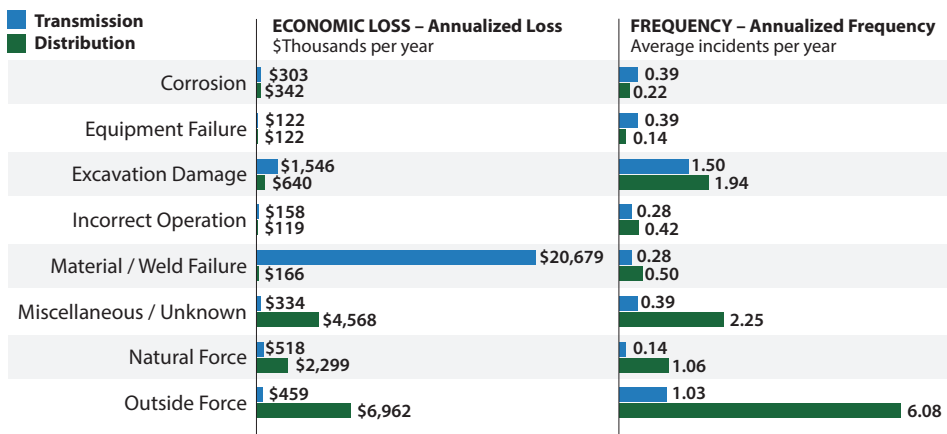


NATURAL GAS



Natural Gas Transport

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








Data Source: DOT PHMSA

- As of 2018, California had:
 - 12,289 miles of natural gas transmission pipelines
 - 106,853 miles of natural gas distribution pipelines
- 56% of California’s natural gas transmission system and 33% of the distribution system were constructed prior to 1970 or in an unknown year.
- Between 1984 and 2019, California’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 	96%	22%
Commercial 	4%	13%
Industrial 	<1%	39%
Transportation 	<1%	<1%
Electric Power 	<1%	25%
Other	<1%	<1%

Data Source: EIA

- California has 10 natural gas processing facilities with a total capacity of 392 MMcf/d.
- California has 1 liquefied natural gas (LNG) facility with a total storage capacity of 333 barrels.



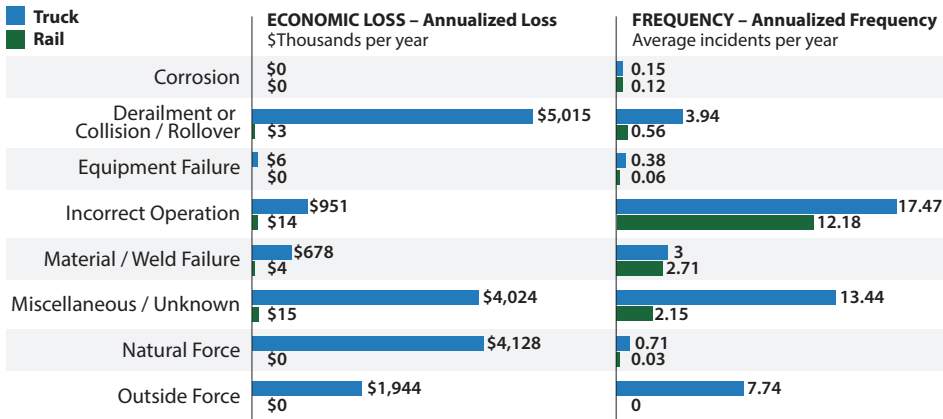


PETROLEUM



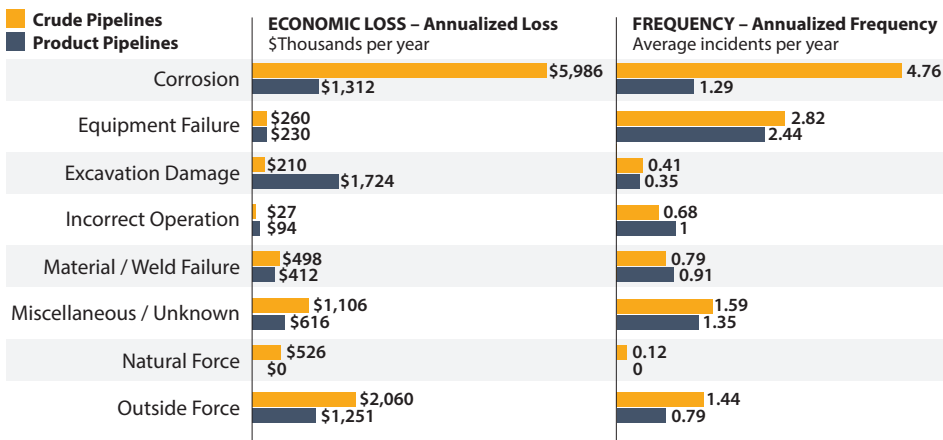
Petroleum Transport

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



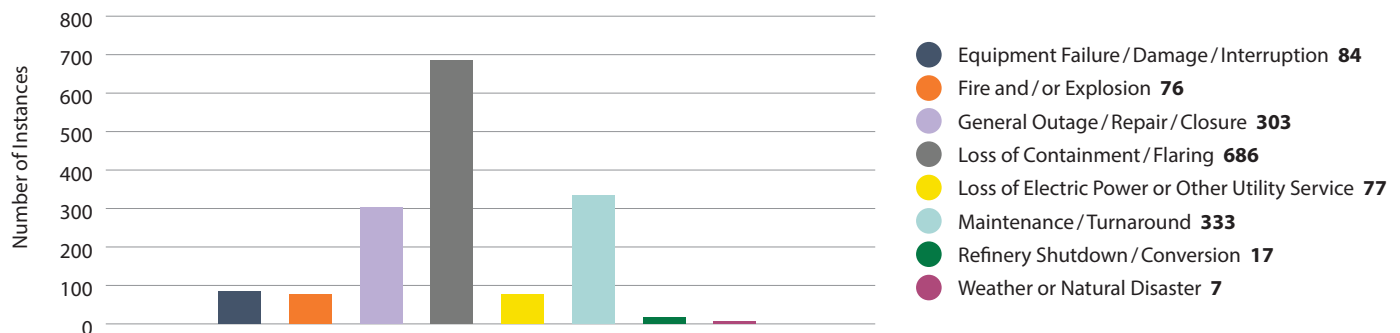
Data Source: DOT PHMSA

- As of 2018, California had:
 - 3,642 miles of crude oil pipelines
 - 3,264 miles of refined product pipelines
 - 15 miles of biofuels pipelines
- 55% of California’s petroleum pipeline systems were constructed prior to 1970 or in an unknown year.
- Between 1986 and 2019, California’s petroleum supply was most impacted by:
 - **Derailments, Collisions, or Rollovers** when transported by truck (8th leading cause nationwide at \$0.07M per year)
 - **Miscellaneous or Unknown events** when transported by rail (3rd leading cause nationwide at \$6.11M per year)
 - **Corrosion** when transported by crude pipelines (3rd leading cause nationwide at \$14.51M per year)
 - **Excavation Damage** when transported by product pipelines (5th leading cause nationwide at \$5.74M per year)
- Disruptions in other states may impact supply.

Petroleum Refineries

- California has 15 petroleum refineries with a total operable capacity of 1,909.7 Mb/d.
- Between 2009 and 2019, the leading cause of petroleum refinery disruptions in California was:
 - **Loss of Containment or Flaring** (leading cause nationwide)

Causes and Frequency of Petroleum Refinery Disruptions, 2009 – 2019



Data Source: Hydrocarbon Publishing