This State Energy Risk Profile examines the relative magnitude of the risks that the State of Oklahoma’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.

The Risk Profile highlights risk considerations relating to the electric, petroleum and natural gas infrastructures to become more aware of risks to these energy systems and assets.

**OKLAHOMA STATE FACTS**

**State Overview**
- Population: 3.85 million (1% total U.S.)
- Housing Units: 1.68 million (1% total U.S.)
- Business Establishments: 0.09 million (1% total U.S.)

**Annual Energy Consumption**
- Electric Power: 59.3 TWh (2% total U.S.)
- Coal: 18,300 MSTN (2% total U.S.)
- Natural Gas: 587 Bcf (3% total U.S.)
- Motor Gasoline: 47,200 Mbarrels (2% total U.S.)
- Distillate Fuel: 32,300 Mbarrels (2% total U.S.)

**Annual Energy Production**
- Electric Power Generation: 77.9 TWh (2% total U.S.)
  - Coal: 29.3 TWh, 38% [5.8 GW total capacity]
  - Petroleum: 0 TWh, 0% [0 GW total capacity]
  - Natural Gas: 39 TWh, 50% [15 GW total capacity]
  - Nuclear: 0 TWh, 0% [0 GW total capacity]
  - Hydro: 1 TWh, 1% [1.1 GW total capacity]
  - Other Renewable: 8.2 TWh, 10% [3.2 GW total capacity]
- Coal: 1,100 MSTN (<1% total U.S.)
- Natural Gas: 2,020 Bcf (8% total U.S.)
- Crude Oil: 89,300 Mbarrels (4% total U.S.)
- Ethanol: 0 Mbarrels (0% total U.S.)

**NATURAL HAZARDS OVERVIEW**

**Annual Frequency of Occurrence of Natural Hazards in Oklahoma (1996–2014)**

- Drought
- Earthquake
- Extreme Heat
- Flood
- Hurricane
- Landslide
- Other
- Thunderstorm & Lightning
- Tornado
- Wildfire
- Winter Storm & Extreme Cold

**Annualized Property Loss due to Natural Hazards in Oklahoma (1996–2014)**

- Drought: $72.0 million per year
- Earthquake: $0.2 million per year
- Extreme Heat: $0.0 million per year
- Flood: $3.4 million per year
- Hurricane: $0.0 million per year
- Landslide: $0.0 million per year
- Other: $0.0 million per year
- Thunderstorm & Lightning: $58.2 million per year
- Tornado: $33.2 million per year
- Wildfire: $53.2 million per year
- Winter Storm & Extreme Cold: $3.2 million per year

According to NOAA, the most common natural hazard in Oklahoma is Thunderstorm & Lightning, which occurs once every 2.3 days on the average during the months of March to October.

The second-most common natural hazard in Oklahoma is Flood, which occurs once every 10.6 days on the average.

As reported by NOAA, the natural hazard in Oklahoma that caused the greatest overall property loss during 1996 to 2014 is Drought at $72.0 million per year.

The natural hazard with the second-highest property loss in Oklahoma is Thunderstorm & Lightning at $58.2 million per year.
Electric Power Plants: 85 (1% total U.S.)
- Coal-fired: 7 (1% total U.S.)
- Petroleum-fired: 13 (1% total U.S.)
- Natural Gas-fired: 28 (1% total U.S.)
- Nuclear: 0 (0% total U.S.)
- Hydro-electric: 11 (<1% total U.S.)
- Other Renewable: 26 (1% total U.S.)

Transmission Lines:
- High-Voltage (>230 kV): 2,741 Miles
- Low-Voltage (<230 kV): 1,212 Miles
Electric Transmission

- According to NERC, the leading cause of electric transmission outages in Oklahoma is Severe Weather – Ice Storm.
- Oklahoma experienced 8 electric transmission outages from 1992 to 2009, affecting a total of 1,090,663 electric customers.
- Severe Weather – Ice Storm affected the largest number of electric customers as a result of electric transmission outages.


Number of NERC-Reported Electric Transmission Outages by Cause (1992–2009)

Electric Distribution

Electric Utility Reported Power Outages by Month (2008–2013)

- Between 2008 and 2013, the greatest number of electric outages in Oklahoma has occurred during the month of August.
- The leading cause of electric outages in Oklahoma during 2008 to 2013 was Weather/Falling Trees.
- On average, the number of people affected annually by electric outages during 2008 to 2013 in Oklahoma was 186,115.
- The average duration of electric outages in Oklahoma during 2008 to 2013 was 927 minutes or 15.4 hours a year.


Utility Outage Data (2008–2013)

- NOTE: # of Incidents – The number within each pie slice is the number of event incidents attributable to each cause.

Produced by Department of Energy (DOE), Office of Electricity Delivery & Energy Reliability (OE)
PETROLEUM

Petroleum Infrastructure Overview
Refineries: 6 (4% total U.S.)
Terminals: 68 (3% total U.S.)
Crude Pipelines: 3,775 Miles (8% total U.S.)
Product Pipelines: 23,040 Miles (4% total U.S.)
Bio-Refineries (Ethanol): 0 (0% total U.S.)
Petroleum Transport

Top Events Affecting Petroleum Transport by Truck and Rail (1986–2014)

- The leading event type affecting the transport of petroleum product by rail and truck in Oklahoma during 1986 to 2014 was Derailment/Rollover for rail transport and Miscellaneous/Unknown for truck transport, with an average 0.3 (or one incident every 3.3 years) and 4.8 incidents per year, respectively.

Petroleum Refinery

- The leading cause of petroleum refinery disruptions in Oklahoma from 2003 to 2014 was Equipment Failure or Damage. Oklahoma’s petroleum refineries experienced 221 major incidents from 2003 to 2014. The average production impact from disruptions of Oklahoma’s refineries from 2003 to 2014 is 21.3 thousand barrels per day.


- Equipment Failure or Damage
- Maintenance/Turnaround
- Operational Upset or Process Problem
- Cause Not Specified
- All Other Causes

Average Production Impact (thousand barrels per day) from Petroleum Refinery Outages in Oklahoma (2003–2014)

- Equipment Failure or Damage: 13.9
- Maintenance/Turnaround: 23.3
- Operational Upset or Process Problem: 15.3
- Cause Not Specified: 10.0
- All Other Causes: 9.0

Data Source: DOE OE
NATURAL GAS

Natural Gas Infrastructure Overview
- Gas Wells: 39,776 (8% total U.S.)
- Processing Plants: 67 (13% total U.S.)
- Storage Fields: 12 (3% total U.S.)
- Interstate Pipelines: 26,280 Miles (5% total U.S.)
- Local Distribution Companies: 64 (4% total U.S.)
Natural Gas Transport

The leading event type affecting natural gas transmission and distribution pipelines in Oklahoma during 1986 to 2014 was Miscellaneous/Unknown for Transmission Pipelines and Outside Force for Distribution Pipelines, with an average 0.94 and 0.74 incidents per year (or one incident every 1.1 and 1.3 years), respectively.

Top Events Affecting Natural Gas Transmission and Distribution in Oklahoma (1986-2014)

Natural Gas Processing

According to data derived from DOE's Energy Assurance Daily, the leading cause of natural gas processing plant disruptions in Oklahoma from 2005 to 2014 is Weather or Natural Disaster.

Oklahoma's natural gas processing plants experienced 1 disruption from 2005 to 2014.

The average production impact from disruptions of Oklahoma's natural gas processing plants from 2005 to 2014 is 200 million cubic feet per day (MMcfd).
**DATA SOURCES**

### Overview Information
- Census Bureau (2012) State and County QuickFacts [http://quickfacts.census.gov/qfd/download_data.html]

### Production Numbers

### Consumption Numbers

#### Electricity
- Platts (2014 Q2) Transmission Lines (Miles by Voltage Level)
- Platts (2014 Q2) Power Plants (Production and Capacity by Type)

#### Petroleum
- Argonne National Laboratory (2012) Petroleum Terminal Database
- Argonne National Laboratory (2014) Ethanol Plants
- NPMS (2011) Petroleum Product Pipeline (Miles of Interstate Pipeline)
- NPMS (2011) Crude Pipeline (Miles of Interstate Pipeline)

#### Natural Gas
- EIA (2013) Number of Producing Gas Wells [http://www.eia.gov/dnav/ng/ng_prod_wells_s1_a.htm]
- NPMS (2011) Natural Gas Pipeline (Miles of Interstate Pipeline)
- Platts (2014 Q2) Local Distribution Companies (LDCs)

### Event Related

*The NERC disturbance reports are not published after 2009.*

### Notes
- Natural Hazard, Other, includes extreme weather events such as astronomical low tide, dense smoke, frost/freeze, and rip currents.
- Each incident type is an assembly of similar causes reported in the data source. Explanations for the indescribable incident types are below.
  - Outside Force refers to pipeline failures due to vehicular accident, sabotage, or vandalism.
  - Natural Forces refers to damage that occurs as a result of naturally occurring events (e.g., earth movements, flooding, high winds, etc.)
  - Miscellaneous/Unknown includes releases or failures resulting from any other cause not listed or of an unknowable nature.
  - Overdemand refers to outages that occur when the demand for electricity is greater than the supply, causing forced curtailment.
- Number (#) of Incidents – The number within each pie chart piece is the number of outages attributable to each cause.

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**FOR MORE INFORMATION CONTACT:**
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<thead>
<tr>
<th>Bcf – Billion Cubic Feet</th>
<th>GW – Gigawatt</th>
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<tbody>
<tr>
<td>KV – Kilovolt</td>
<td>Mbars – Thousand Barrels</td>
</tr>
<tr>
<td>MMcf/d – Million Cubic Feet per Day</td>
<td>MSTN – Thousand Short Tons</td>
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<tr>
<td>TWh – Terawatt hours</td>
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**Definitions:**
- **Mile** – 1.609 kilometers or 5280 feet
- **Billion:** 1,000 million
- **Quadrillion:** 1,000 trillion
- **Tera:** 1,000 gigawatt hours
- **Gigawatt:** 1,000 megawatts
- **Kilowatt:** 1,000 watts
- **Kilovolt:** 1,000 volts
- **Barrel:** 42 U.S. gallons

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