State of Wyoming
ENERGY SECTOR RISK PROFILE

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

WYOMING STATE FACTS

<table>
<thead>
<tr>
<th>State Overview</th>
<th>Annual Energy Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population: 0.58 million (&lt;1% total U.S.)</td>
<td>Electric Power Generation: 49.6 TWh (1% total U.S.)</td>
</tr>
<tr>
<td>Housing Units: 0.27 million (&lt;1% total U.S.)</td>
<td>Coal: 43.4 TWh, 88% [6.8 GW total capacity]</td>
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<tr>
<td>Business Establishments: 0.02 million (&lt;1% total U.S.)</td>
<td>Petroleum: 0.1 TWh, &lt;1% [0 GW total capacity]</td>
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<tr>
<td></td>
<td>Natural Gas: 0.5 TWh, 1% [0.2 GW total capacity]</td>
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<td></td>
<td>Nuclear: 0 TWh, 0% [0 GW total capacity]</td>
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<td></td>
<td>Hydro: 0.9 TWh, 2% [0.3 GW total capacity]</td>
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<tr>
<td></td>
<td>Other Renewable: 4.4 TWh, 9% [1.4 GW total capacity]</td>
</tr>
<tr>
<td>Annual Energy Consumption</td>
<td>Coal: 27,800 MSTN (3% total U.S.)</td>
</tr>
<tr>
<td>Electric Power: 17 TWh (&lt;1% total U.S.)</td>
<td>Natural Gas: 2,020 Bcf (8% total U.S.)</td>
</tr>
<tr>
<td>Coal: 27,800 MSTN (3% total U.S.)</td>
<td>Crude Oil: 57,800 Mbarrels (2% total U.S.)</td>
</tr>
<tr>
<td>Natural Gas: 74 Bcf (&lt;1% total U.S.)</td>
<td>Ethanol: 300 Mbarrels (&lt;1% total U.S.)</td>
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<tr>
<td>Motor Gasoline: 8,500 Mbarrels (&lt;1% total U.S.)</td>
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<tr>
<td>Distillate Fuel: 16,000 Mbarrels (1% total U.S.)</td>
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</tbody>
</table>

NATURAL HAZARDS OVERVIEW

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

- According to NOAA, the most common natural hazard in Wyoming is Thunderstorm & Lightning, which occurs once every 4 days on the average during the months of March to October.

- The second-most common natural hazard in Wyoming is Winter Storm & Extreme Cold, which occurs once every 9.3 days on the average during the months of October to March.

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

- As reported by NOAA, the natural hazard in Wyoming that caused the greatest overall property loss during 1996 to 2014 is Thunderstorm & Lightning at $5.3 million per year.

- The natural hazard with the second-highest property loss in Wyoming is Flood at $1.1 million per year.
ELECTRIC

Electric Power Plants: 61 (<1% total U.S.)
- Coal-fired: 15 (1% total U.S.)
- Petroleum-fired: 3 (<1% total U.S.)
- Natural Gas-fired: 3 (<1% total U.S.)
- Nuclear: 0 (0% total U.S.)
- Hydro-electric: 16 (1% total U.S.)
- Other Renewable: 20 (1% total U.S.)

Transmission Lines:
- High-Voltage (>230 kV): 2,585 Miles
- Low-Voltage (<230 kV): 1,715 Miles

Power Plants

<table>
<thead>
<tr>
<th>Nameplate Capacity</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Oil</th>
<th>Uranium</th>
<th>Water</th>
<th>Renewable</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 - 250 (MW)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>251 - 750</td>
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<td></td>
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</tr>
<tr>
<td>751 - 1,500</td>
<td></td>
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<td></td>
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<tr>
<td>1,501 - 3,000</td>
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<td></td>
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<tr>
<td>3,501 - 6,500+</td>
<td></td>
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</tr>
</tbody>
</table>

Transmission Lines

Utility Company®

*Shaded by Company

Data Sources:
ANL 2013; ESRI 2012; EIA 2014; Platts 2014.
Electric Transmission

- According to NERC, the leading cause of electric transmission outages in Wyoming is **Faulty Equipment/Human Error**.
- Wyoming experienced **32 electric transmission outages** from 1992 to 2009, affecting a total of **178,679** electric customers.
- **Transmission Line Faults and Overloads** affected the largest number of electric customers as a result of electric transmission outages.

### Electric Customers Disrupted by NERC-Reported Electric Transmission Outages by Cause (1992–2009)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number of Outages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faulty Equipment / Human Error</td>
<td>110,000</td>
</tr>
<tr>
<td>Transmission Line Faults and Overloads</td>
<td>17,241</td>
</tr>
<tr>
<td>Severe Weather - Lightning</td>
<td>438</td>
</tr>
<tr>
<td>Protection System Misperepation</td>
<td>35,000</td>
</tr>
<tr>
<td>Severe Weather - Ice Storm</td>
<td>16,000</td>
</tr>
<tr>
<td>All Other Causes</td>
<td>0</td>
</tr>
</tbody>
</table>

Data Source: NERC

### Electric Distribution

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

- Between 2008 and 2013, the greatest number of electric outages in Wyoming has occurred during the month of **September**.
- The leading cause of electric outages in Wyoming during 2008 to 2013 was **Weather/Falling Trees**.
- On average, the number of people affected annually by electric outages during 2008 to 2013 in Wyoming was **28,958**.
- The average duration of electric outages in Wyoming during 2008 to 2013 was **357 minutes or 5.9 hours a year**.


- **Animal**: 14 incidents
- **Faulty Equipment / Human Error**: 11 incidents
- **Over-demand**: 10 incidents
- **Planned**: 2 incidents
- **Theft / Vandalism**: 1 incident
- **Unknown**: 4 incidents
- **Vehicle Accident**: 0 incidents
- **Weather / Falling Trees**: 3 incidents

#### Utility Outage Data (2008–2013)

- Total number of people affected by outages
- Total duration of outages (minutes)

Data Source: Eaton

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

Petroleum Infrastructure Overview
- Refineries: 6 (4% total U.S.)
- Terminals: 23 (1% total U.S.)
- Crude Pipelines: 3,561 Miles (7% total U.S.)
- Product Pipelines: 16,800 Miles (3% total U.S.)
- Bio-Refineries (Ethanol): 2 (1% total U.S.)

![Petroleum Infrastructure Map of Wyoming]
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 Wyoming during 1986 to 2014 was Incorrect Operation for rail transport and Miscellaneous/Unknown for truck transport, with an average 1.0 and 2.2 incidents per year, respectively.

Petroleum Refinery

The leading cause of petroleum refinery disruptions in Wyoming from 2003 to 2014 was Fire and/or Explosion. Wyoming’s petroleum refineries experienced 51 major incidents from 2003 to 2014. The average production impact from disruptions of Wyoming’s refineries from 2003 to 2014 is 11.9 thousand barrels per day.
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NATURAL GAS

Natural Gas Infrastructure Overview
Gas Wells: 23,014 (5% total U.S.)
Processing Plants: 37 (7% total U.S.)
Storage Fields: 8 (2% total U.S.)
Interstate Pipelines: 16,320 Miles (3% total U.S.)
Local Distribution Companies: 11 (1% total U.S.)

Produced by Department of Energy (DOE), Office of Electricity Delivery & Energy Reliability (OE)
Natural Gas Transport

The leading event type affecting natural gas transmission and distribution pipelines in Wyoming during 1986 to 2014 was Miscellaneous/Unknown for Transmission Pipelines and Outside Force for Distribution Pipelines, with an average 0.42 and 0.45 incidents per year (or one incident every 2.4 and 2.2 years), respectively.


Natural Gas Processing

According to data derived from DOE’s Energy Assurance Daily, the leading cause of natural gas processing plant disruptions in Wyoming from 2005 to 2014 is Fire and/or Explosion.

Wyoming’s natural gas processing plants experienced 5 disruptions from 2005 to 2014.

The average production impact from disruptions of Wyoming’s natural gas processing plants from 2005 to 2014 is 547 million cubic feet per day (MMcfd).


Average Production Impact (MMcfd) from Natural Gas Processing Plant Disruptions in Wyoming (2005–2014)
**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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