State of North Dakota
ENERGY SECTOR RISK PROFILE

This State Energy Risk Profile examines the relative magnitude of the risks that the State of North Dakota'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.

NORTH DAKOTA STATE FACTS

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<tr>
<th>State Overview</th>
<th>Annual Energy Production</th>
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</thead>
<tbody>
<tr>
<td>Population: 0.72 million (&lt;1% total U.S.)</td>
<td>Electric Power Generation: 36.1 TWh (1% total U.S.)</td>
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<td>Housing Units: 0.34 million (&lt;1% total U.S.)</td>
<td>Coal: 28.2 TWh, 78% [4.2 GW total capacity]</td>
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<td>Business Establishments: 0.02 million (&lt;1% total U.S.)</td>
<td>Petroleum: 0.03 TWh, &lt;1% [0.1 GW total capacity]</td>
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<tr>
<td>Annual Energy Consumption</td>
<td>Natural Gas: 0.02 TWh, &lt;1% [0.1 GW total capacity]</td>
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<td>Electric Power: 14.7 TWh (&lt;1% total U.S.)</td>
<td>Nuclear: 0 TWh, 0% [0 GW total capacity]</td>
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<td>Coal: 22,900 MSTN (3% total U.S.)</td>
<td>Hydro: 2.5 TWh, 7% [0.6 GW total capacity]</td>
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<td>Natural Gas: 267 Bcf (1% total U.S.)</td>
<td>Other Renewable: 5.3 TWh, 15% [1.8 GW total capacity]</td>
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<td>Motor Gasoline: 9,900 Mbarrels (&lt;1% total U.S.)</td>
<td>Coal: 27,500 MSTN (3% total U.S.)</td>
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<td>Distillate Fuel: 22,600 Mbarrels (2% total U.S.)</td>
<td>Natural Gas: 180 Bcf (1% total U.S.)</td>
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<td>Natural Oil: 242,500 Mbarrels (10% total U.S.)</td>
<td>Ethanol: 8,700 Mbarrels (3% total U.S.)</td>
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NATURAL HAZARDS OVERVIEW

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

- According to NOAA, the most common natural hazard in North Dakota is Thunderstorm & Lightning, which occurs once every 4.8 days on the average during the months of March to October.
- The second-most common natural hazard in North Dakota is Winter Storm & Extreme Cold, which occurs once every 16.4 days on the average during the months of October to March.
- As reported by NOAA, the natural hazard in North Dakota that caused the greatest overall property loss during 1996 to 2014 is Thunderstorm & Lightning at $43.2 million per year.
- The natural hazard with the second-highest property loss in North Dakota is Flood at $30.4 million per year.
Electric Power Plants: 40 (<1% total U.S.)
- Coal-fired: 9 (1% total U.S.)
- Petroleum-fired: 7 (<1% total U.S.)
- Natural Gas-fired: 0 (0% total U.S.)
- Nuclear: 0 (0% total U.S.)
- Hydro-electric: 1 (<1% total U.S.)
- Other Renewable: 23 (1% total U.S.)

Transmission Lines:
- High-Voltage (>230 kV): 2,474 Miles
- Low-Voltage (<230 kV): 4,782 Miles
Electric Transmission

› According to NERC, the leading cause of electric transmission outages in North Dakota is Electrical System Separation – Islanding.
› North Dakota experienced 13 electric transmission outages from 1992 to 2009, affecting a total of 16,030 electric customers.
› Faulty Equipment/Human Error 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

› Between 2008 and 2013, the greatest number of electric outages in North Dakota has occurred during the month of October.
› The leading cause of electric outages in North Dakota during 2008 to 2013 was Faulty Equipment/Human Error.
› On average, the number of people affected annually by electric outages during 2008 to 2013 in North Dakota was 39,062.
› The average duration of electric outages in North Dakota during 2008 to 2013 was 1,212 minutes or 20.2 hours a year.

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


Utility Outage Data (2008–2013)

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

Petroleum Infrastructure Overview
- Refineries: 1 (1% total U.S.)
- Terminals: 20 (1% total U.S.)
- Crude Pipelines: 1,605 Miles (3% total U.S.)
- Product Pipelines: 9,600 Miles (2% total U.S.)
- Bio-Refineries (Ethanol): 5 (2% total U.S.)
Petroleum Transport

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

[Graph showing economic loss and frequency for different event types, with the leading event type being Incorrect Operation for rail transport and Incorrect Operation for truck transport, with an average of 0.4 (or one incident every 2.5 years) and 1.0 incidents per year, respectively.]

Petroleum Refinery

[Graph showing top causes of petroleum refinery disruptions in North Dakota (2003–2014), with the leading cause being Maintenance/Turnaround, and the average production impact from disruptions is 14.7 thousand barrels per day.]

Top Four Causes of Petroleum Refinery Disruptions in North Dakota (2003–2014)

[Pie chart showing the top causes of disruptions, with Maintenance/Turnaround being the most common.]
Natural Gas Infrastructure Overview
Gas Wells: 200 (<1% total U.S.)
Processing Plants: 13 (3% total U.S.)
Storage Fields: 0 (0% total U.S.)
Interstate Pipelines: 6,240 Miles (1% total U.S.)
Local Distribution Companies: 6 (<1% total U.S.)
Natural Gas Transport

- The leading event type affecting natural gas transmission and distribution pipelines in North Dakota during 1986 to 2014 was Equipment Failure for Transmission Pipelines and Outside Force for Distribution Pipelines, with an average 0.13 and 0.16 incidents per year (or one incident every 7.8 and 6.2 years), respectively.

Top Events Affecting Natural Gas Transmission and Distribution in North Dakota (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 North Dakota from 2005 to 2014 is Fire and/or Explosion.
- North Dakota's natural gas processing plants experienced 1 disruption from 2005 to 2014.
- The average production impact from disruptions of North Dakota's natural gas processing plants from 2005 to 2014 is 100 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

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.

*The NERC disturbance reports are not published after 2009.

FOR MORE INFORMATION CONTACT:
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy
Phone: 202-586-2264
Email: energypromptresponsecenter@hq.doe.gov