State of Wisconsin
ENERGY SECTOR RISK PROFILE

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

WISCONSIN STATE FACTS

<table>
<thead>
<tr>
<th>State Overview</th>
<th>Annual Energy Production</th>
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<tbody>
<tr>
<td>Population: 5.74 million (2% total U.S.)</td>
<td>Electric Power Generation: 63.7 TWh (2% total U.S.)</td>
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<td>Housing Units: 2.63 million (2% total U.S.)</td>
<td>Coal: 32.8 TWh, 51% [8.8 GW total capacity]</td>
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<td>Business Establishments: 0.14 million (2% total U.S.)</td>
<td>Petroleum: 0.3 TWh, &lt;1% [0.9 GW total capacity]</td>
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<tr>
<td>Annual Energy Consumption</td>
<td>Natural Gas: 11.5 TWh, 18% [7.1 GW total capacity]</td>
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<td>Electric Power: 68.8 TWh (2% total U.S.)</td>
<td>Nuclear: 14.3 TWh, 22% [1.8 GW total capacity]</td>
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<td>Coal: 20,700 MSTN (2% total U.S.)</td>
<td>Hydro: 1.5 TWh, 2% [0.5 GW total capacity]</td>
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<td>Natural Gas: 75 Bcf (&lt;1% total U.S.)</td>
<td>Other Renewable: 1.6 TWh, 2% [0.9 GW total capacity]</td>
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<td>Motor Gasoline: 58,600 Mbarrels (2% total U.S.)</td>
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<tr>
<td>Distillate Fuel: 25,100 Mbarrels (2% total U.S.)</td>
<td>Coal: 0 MSTN (0% total U.S.)</td>
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<td></td>
<td>Natural Gas: 0 Bcf (0% total U.S.)</td>
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<td>Crude Oil: 0 Mbarrels (0% total U.S.)</td>
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<td>Ethanol: 11,700 Mbarrels (4% total U.S.)</td>
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NATURAL HAZARDS OVERVIEW

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

- According to NOAA, the most common natural hazard in Wisconsin is Thunderstorm & Lightning, which occurs once every 3.8 days on the average during the months of March to October.
- The second-most common natural hazard in Wisconsin is Winter Storm & Extreme Cold, which occurs once every 9.1 days on the average during the months of October to March.

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

- As reported by NOAA, the natural hazard in Wisconsin that caused the greatest overall property loss during 1996 to 2014 is Flood at $72.3 million per year.
- The natural hazard with the second-highest property loss in Wisconsin is Thunderstorm & Lightning at $56.6 million per year.
Electric Power Plants: 182 (1% total U.S.)
- Coal-fired: 25 (2% total U.S.)
- Petroleum-fired: 32 (1% total U.S.)
- Natural Gas-fired: 39 (1% total U.S.)
- Nuclear: 2 (2% total U.S.)
- Hydro-electric: 63 (2% total U.S.)
- Other Renewable: 21 (1% total U.S.)

Transmission Lines:
- High-Voltage (>230 kV): 4,103 Miles
- Low-Voltage (<230 kV): 2,494 Miles
Electric Transmission

- According to NERC, the leading cause of electric transmission outages in Wisconsin is **Severe Weather - Heat Wave**.
- Wisconsin experienced **12 electric transmission outages** from 1992 to 2009, affecting a total of **151,624 electric customers**.
- **Severe Weather - High Winds** 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)](chart1)

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

- Severe Weather - Heat Wave
- Faulty Equipment / Human Error
- Severe Weather - High Winds
- Protection System Misoperation
- Severe Weather - Thunderstorm
- All Other Causes

*Data Source: NERC*

Electric Distribution

- Between 2008 and 2013, the greatest number of electric outages in Wisconsin has occurred during the month of **June**.
- The leading cause of electric outages in Wisconsin during 2008 to 2013 was **Weather/Falling Trees**.
- On average, the number of people affected annually by electric outages during 2008 to 2013 in Wisconsin was **265,092**.
- The average duration of electric outages in Wisconsin during 2008 to 2013 was **5,608 minutes or 93.5 hours a year**.

![Electric Utility Reported Power Outages by Month (2008–2013)](chart2)


- 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: 1 (1% total U.S.)
- Terminals: 37 (2% total U.S.)
- Crude Pipelines: 1,173 Miles (2% total U.S.)
- Product Pipelines: 2,100 Miles (<1% total U.S.)
- Bio-Refineries (Ethanol): 9 (4% total U.S.)

Map showing the location of petroleum terminals, refineries, and pipelines in Wisconsin.
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 Wisconsin during 1986 to 2014 was Incorrect Operation for rail transport and Miscellaneous/Unknown for truck transport, with an average 0.6 (or one incident every 1.6 years) and 8.1 incidents per year, respectively.

Petroleum Refinery

The leading cause of petroleum refinery disruptions in Wisconsin from 2003 to 2014 was Loss of Electric Power or Other Utility Service. Wisconsin's petroleum refineries experienced 12 major incidents from 2003 to 2014. The average production impact from disruptions of Wisconsin's refineries from 2003 to 2014 is 7.2 thousand barrels per day.
NATURAL GAS

Natural Gas Infrastructure Overview
- Gas Wells: 0 (0% total U.S.)
- Processing Plants: 0 (0% total U.S.)
- Storage Fields: 0 (0% total U.S.)
- Interstate Pipelines: 4,800 Miles (1% total U.S.)
- Local Distribution Companies: 19 (1% total U.S.)

Data Sources: ANL 2013; EIA 2014; ESRI 2012; Platts 2014; NPMS 2011.
The leading event type affecting natural gas transmission and distribution pipelines in Wisconsin during 1986 to 2014 was Outside Force for Transmission Pipelines and Outside Force for Distribution Pipelines, with an average 0.19 and 0.74 incidents per year (or one incident every 5.2 and 1.3 years), respectively.

Top Events Affecting Natural Gas Transmission and Distribution in Wisconsin (1986–2014)
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.

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