State of Iowa
ENERGY SECTOR RISK PROFILE

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

IOWA STATE FACTS

<table>
<thead>
<tr>
<th>State Overview</th>
<th>Annual Energy Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population: 3.09 million (1% total U.S.)</td>
<td>Electric Power Generation: 56.7 TWh (1% total U.S.)</td>
</tr>
<tr>
<td>Housing Units: 1.35 million (1% total U.S.)</td>
<td>Coal: 35.3 TWh, 62% [7.2 GW total capacity]</td>
</tr>
<tr>
<td>Business Establishments: 0.08 million (1% total U.S.)</td>
<td>Petroleum: 0.1 TWh, &lt;1% [1.2 GW total capacity]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Energy Consumption</th>
<th>Annual Energy Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Power: 45.7 TWh (1% total U.S.)</td>
<td>Natural Gas: 1.9 TWh, 3% [2.9 GW total capacity]</td>
</tr>
<tr>
<td>Coal: 24,100 MSTN (3% total U.S.)</td>
<td>Nuclear: 4.3 TWh, 8% [0.7 GW total capacity]</td>
</tr>
<tr>
<td>Natural Gas: 83 Bcf (&lt;1% total U.S.)</td>
<td>Hydro: 0.8 TWh, 1% [0.1 GW total capacity]</td>
</tr>
<tr>
<td>Motor Gasoline: 31,000 Mbarrels (1% total U.S.)</td>
<td>Other Renewable: 14.0 TWh, 25% [5.1 GW total capacity]</td>
</tr>
<tr>
<td>Distillate Fuel: 25,100 Mbarrels (2% total U.S.)</td>
<td>Coal: 0 MSTN (0% total U.S.)</td>
</tr>
</tbody>
</table>

NATURAL HAZARDS OVERVIEW

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

![Graph showing frequency of natural hazards]

- According to NOAA, the most common natural hazard in Iowa is Thunderstorm & Lightning, which occurs once every 3.4 days on the average during the months of March to October.
- The second-most common natural hazard in Iowa is Flood, which occurs once every 7.7 days on the average.

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

![Graph showing annualized property loss]

- As reported by NOAA, the natural hazard in Iowa that caused the greatest overall property loss during 1996 to 2014 is Drought at $302.9 million per year.
- The natural hazard with the second-highest property loss in Iowa is Flood at $125.3 million per year.
Electric Power Plants: 234 (2% total U.S.)
- Coal-fired: 23 (2% total U.S.)
- Petroleum-fired: 106 (5% total U.S.)
- Natural Gas-fired: 34 (1% total U.S.)
- Nuclear: 1 (1% total U.S.)
- Hydro-electric: 4 (<1% total U.S.)
- Other Renewable: 66 (2% total U.S.)

Transmission Lines:
- High-Voltage (>230 kV): 2,740 Miles
- Low-Voltage (<230 kV): 5,452 Miles

Power Plants

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

Transmission Lines

- 220kV - 315kV
- 345kV - 450kV
- 500kV - 525kV
- 735kV - 765kV

Utility Company

*Shaded by Company

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

- According to NERC, the leading cause of electric transmission outages in Iowa is *Severe Weather - Thunderstorm*.
- Iowa experienced 14 electric transmission outages from 1992 to 2009, affecting a total of 555,122 electric customers.
- *Severe Weather - Thunderstorm* 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)**

- **Severe Weather - Thunderstorm**: 259,600
- **Severe Weather - Heat Wave**: 207,500
- **Severe Weather - Ice Storm**: 70,000
- **Severe Weather - Winter Storm**: 18,000
- **Faulty Equipment / Human Error**: 4
- **Other Causes**: 22

Data Source: NERC

Electric Distribution

- Between 2008 and 2013, the greatest number of electric outages in Iowa has occurred during the month of *June*.
- The leading cause of electric outages in Iowa 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 Iowa was 116,995.
- The average duration of electric outages in Iowa during 2008 to 2013 was 2,722 minutes or 45.4 hours a year.

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


- **Animal**: 61
- **Faulty Equipment / Human Error**: 72
- **Overdemand**: 38
- **Planned**: 20
- **Theft / Vandalism**: 15
- **Unknown**: 5
- **Vehicle Accident**: 0
- **Weather / Falling Trees**: 0

**Utility Outage Data (2008–2013)**

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

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

**Petroleum Infrastructure Overview**
- Refineries: 0 (0% total U.S.)
- Terminals: 23 (1% total U.S.)
- Crude Pipelines: 0,295 Miles (1% total U.S.)
- Product Pipelines: 11,760 Miles (2% total U.S.)
- Bio-Refineries (Ethanol): 38 (19% total U.S.)

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**Petroleum Terminals**
- Storage Capacity (Thousand Barrels):
  - 50 - 250
  - 251 - 750
  - 751 - 1,500
  - 1,501 - 3,000
  - 3,001 - 6,500+

**Data Sources:**
Petroleum Transport

The leading event type affecting the transport of petroleum product by rail and truck in Iowa 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 7.6 incidents per year, respectively.

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

The leading event type affecting crude oil pipeline and petroleum product pipelines in Iowa during 1986 to 2014 was Material/Weld Failures for crude oil pipelines and Equipment Failure for product pipelines, with an average 0.07 and 0.9 incidents per year (or one incident every 14.5 and 1.1 years), respectively.

Top Events Affecting Crude Oil and Refined Product Pipelines in Iowa (1986–2014)
NATURAL GAS

Natural Gas Infrastructure Overview
Gas Wells: 0 (0% total U.S.)
Processing Plants: 0 (0% total U.S.)
Storage Fields: 4 (1% total U.S.)
Interstate Pipelines: 18,900 Miles (4% total U.S.)
Local Distribution Companies: 60 (4% total U.S.)
Natural Gas Transport

The leading event type affecting natural gas transmission and distribution pipelines in Iowa during 1986 to 2014 was **Outside Force** for Transmission Pipelines and **Miscellaneous/Unknown** for Distribution Pipelines, with an average 0.35 and 0.68 incidents per year (or one incident every 2.8 and 1.5 years), respectively.

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

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Economic Loss ($ Thousands per Year)</th>
<th>Frequency</th>
<th>Data Source: DOT PHMSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion</td>
<td>$170</td>
<td>0.00</td>
<td>Transmission Distribution</td>
</tr>
<tr>
<td>Equipment Failure</td>
<td>$185</td>
<td>0.00</td>
<td>Transmission Distribution</td>
</tr>
<tr>
<td>Excavation Damage</td>
<td>$105</td>
<td>0.19</td>
<td>Transmission Distribution</td>
</tr>
<tr>
<td>Incorrect Operation</td>
<td>$222</td>
<td>0.32</td>
<td>Transmission Distribution</td>
</tr>
<tr>
<td>Material / Weld Failures</td>
<td>$244</td>
<td>0.03</td>
<td>Transmission Distribution</td>
</tr>
<tr>
<td>Miscellaneous / Unknown</td>
<td>$344</td>
<td>0.03</td>
<td>Transmission Distribution</td>
</tr>
<tr>
<td>Natural Forces</td>
<td>$330</td>
<td>0.03</td>
<td>Transmission Distribution</td>
</tr>
<tr>
<td>Outside Force</td>
<td>$361</td>
<td>0.45</td>
<td>Transmission Distribution</td>
</tr>
</tbody>
</table>

Annual Loss ($ Thousands per Year)

Annual Frequency (Average per Year)
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.

FOR MORE INFORMATION CONTACT:
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