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

DELWARE STATE FACTS

**State Overview**
- Population: 0.93 million (<1% total U.S.)
- Housing Units: 0.41 million (<1% total U.S.)
- Business Establishments: 0.02 million (<1% total U.S.)

**Annual Energy Consumption**
- Electric Power: 11.5 TWh (<1% total U.S.)
- Coal: 700 MSTN (<1% total U.S.)
- Natural Gas: 28 Bcf (<1% total U.S.)
- Motor Gasoline: 8,800 Mbarrels (<1% total U.S.)
- Distillate Fuel: 2,100 Mbarrels (<1% total U.S.)

**Annual Energy Production**
- Electric Power Generation: 8.6 TWh (<1% total U.S.)
  - Coal: 1.4 TWh, 16% [0.8 GW total capacity]
  - Petroleum: 0 TWh, <1% [0.1 GW total capacity]
  - Natural Gas: 6.8 TWh, 79% [2.5 GW total capacity]
  - Nuclear: 0 TWh, 0% [0 GW total capacity]
  - Hydro: 0 TWh, 0% [0 GW total capacity]
  - Other Renewable: 0 TWh, 0% [0 GW total capacity]

**NATURAL HAZARDS OVERVIEW**

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

<table>
<thead>
<tr>
<th>Natural Hazard</th>
<th>Annual Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>3</td>
</tr>
<tr>
<td>Earthquake (3.5 M)</td>
<td>5</td>
</tr>
<tr>
<td>Extreme Heat</td>
<td>16</td>
</tr>
<tr>
<td>Flood</td>
<td>0</td>
</tr>
<tr>
<td>Hurricane</td>
<td>8</td>
</tr>
<tr>
<td>Landslide</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
</tr>
<tr>
<td>Tornado</td>
<td>32</td>
</tr>
<tr>
<td>Wildfire</td>
<td>0</td>
</tr>
<tr>
<td>Winter Storm &amp; Extreme Cold</td>
<td>1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Natural Hazard</th>
<th>Annualized Property Loss (Million per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>$1.3</td>
</tr>
<tr>
<td>Earthquake (3.5 M)</td>
<td>$0.0</td>
</tr>
<tr>
<td>Extreme Heat</td>
<td>$0.0</td>
</tr>
<tr>
<td>Flood</td>
<td>$3.4</td>
</tr>
<tr>
<td>Hurricane</td>
<td>$0.8</td>
</tr>
<tr>
<td>Landslide</td>
<td>$0.0</td>
</tr>
<tr>
<td>Other</td>
<td>$0.6</td>
</tr>
<tr>
<td>Tornado</td>
<td>$0.5</td>
</tr>
<tr>
<td>Wildfire</td>
<td>$0.0</td>
</tr>
<tr>
<td>Winter Storm &amp; Extreme Cold</td>
<td>$0.0</td>
</tr>
</tbody>
</table>

- According to NOAA, the most common natural hazard in Delaware is Thunderstorm & Lightning, which occurs once every 11.5 days on the average during the months of March to October.
- The second-most common natural hazard in Delaware is Flood, which occurs once every 23.2 days on the average.
- As reported by NOAA, the natural hazard in Delaware that caused the greatest overall property loss during 1996 to 2014 is Flood at $3.4 million per year.
- The natural hazard with the second-highest property loss in Delaware is Drought at $1.3 million per year.
Electric Power Plants: 21 (<1% total U.S.)
- Coal-fired: 2 (<1% total U.S.)
- Petroleum-fired: 5 (<1% total U.S.)
- Natural Gas-fired: 9 (<1% total U.S.)
- Nuclear: 0 (0% total U.S.)
- Hydro-electric: 0 (0% total U.S.)
- Other Renewable: 5 (<1% total U.S.)

Transmission Lines:
- High-Voltage (>230 kV): 517 Miles
- Low-Voltage (<230 kV): 10 Miles
Electric Transmission

- According to NERC, the leading cause of electric transmission outages in Delaware is Faulty Equipment/Human Error.
- Delaware experienced 10 electric transmission outages from 1992 to 2009, affecting a total of 243,389 electric customers.
- Faulty Equipment/Human Error affected the largest number of electric customers as a result of electric transmission outages.

Electric Distribution

- Between 2008 and 2013, the greatest number of electric outages in Delaware has occurred during the month of September.
- The leading cause of electric outages in Delaware during 2008 to 2013 was Weather/Falling Trees.
- On average, the number of people affected annually by electric outages during 2008 to 2013 in Delaware was 55,807.
- The average duration of electric outages in Delaware during 2008 to 2013 was 720 minutes or 12.0 hours a year.

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: 4 (<1% total U.S.)
Crude Pipelines: 0 Miles (0% total U.S.)
Product Pipelines: 900 Miles (<1% 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 Delaware during 1986 to 2014 was Incorrect Operation for rail transport and Miscellaneous/Unknown for truck transport, with an average 0.1 and 1.6 incidents per year, respectively.

Petroleum Refinery

The leading cause of petroleum refinery disruptions in Delaware from 2003 to 2014 was Operational Upset or Process Problem. Delaware’s petroleum refineries experienced 156 major incidents from 2003 to 2014. The average production impact from disruptions of Delaware’s refineries from 2003 to 2014 is 25.3 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: 1,620 Miles (<1% total U.S.)
Local Distribution Companies: 6 (<1% total U.S.)

Data Sources: ANL 2013; EIA 2014; ESRI 2012; Platts 2014; NPMS 2011.
Natural Gas Transport

The leading event type affecting natural gas distribution pipelines in Delaware during 1986 to 2014 was Outside Force, with an average 0.32 incidents per year (or one incident every 3.1 years). There are natural gas transmission pipelines in the State of Delaware.

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