This State Energy Risk Profile examines the relative magnitude of the risks that the state of Minnesota’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. Certain natural and adversarial threats, such as cybersecurity, electromagnetic pulse, geomagnetic disturbance, pandemics, or impacts caused by infrastructure interdependencies, are ill-suited to location-based probabilistic risk assessment as they may not adhere to geographic boundaries, have limited occurrence, or have limited historic data. Cybersecurity and other threats not included in these profiles are ever present and should be included in state energy security planning. A complete list of data sources and national level comparisons can be found in the Data Sources document.

**Minnesota Risks and Hazards Overview**

- The natural hazard that caused the greatest overall property loss between 2009 and 2019 was **Flooding** at $23 million per year (leading cause nationwide at $12 billion per year).
- Minnesota had 160 Major Disaster Declarations, 0 Emergency Declarations, and 0 Fire Management Assistance Declarations for 7 events between 2013 and 2019.
- Minnesota registered 0% greater Heating Degree Days and 6% greater Cooling Degree Days than average in 2019.
- There is 1 Fusion Center located in St. Paul.

**Annualized Frequency of and Property Damage Due to Natural Hazards, 2009 – 2019**

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Frequency – Annualized</th>
<th>Property Damage – Annualized ($ Million per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>7</td>
<td>$0</td>
</tr>
<tr>
<td>Earthquake (≥ 3.5 M)</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Extreme Heat</td>
<td>3</td>
<td>$0</td>
</tr>
<tr>
<td>Flood</td>
<td>33</td>
<td><strong>$23</strong></td>
</tr>
<tr>
<td>Hurricane</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Landslide</td>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>Thunderstorm &amp; Lightning</td>
<td>111</td>
<td><strong>$9</strong></td>
</tr>
<tr>
<td>Tornado</td>
<td>25</td>
<td><strong>$21</strong></td>
</tr>
<tr>
<td>Wildfire</td>
<td>1</td>
<td>$0</td>
</tr>
<tr>
<td>Winter Storm &amp; Extreme Cold</td>
<td>67</td>
<td><strong>$12</strong></td>
</tr>
</tbody>
</table>

*Data Sources: NOAA and USGS*
Electric Infrastructure

• Minnesota has 174 electric utilities:
  – 4 Investor owned
  – 44 Cooperative
  – 121 Municipal
  – 5 Other utilities

• Plant retirements scheduled by 2025: 19 electric generating units totaling 2,011 MW of installed capacity.

Electric Customers and Consumption by Sector, 2018

<table>
<thead>
<tr>
<th>Sector</th>
<th>Customers</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>89%</td>
<td>33%</td>
</tr>
<tr>
<td>Commercial</td>
<td>11%</td>
<td>34%</td>
</tr>
<tr>
<td>Industrial</td>
<td>&lt;1%</td>
<td>33%</td>
</tr>
<tr>
<td>Transportation</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

Data Source: EIA

Electric Utility-Reported Outages by Cause, 2008 – 2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Animal</th>
<th>Faulty Equipment / Human Error</th>
<th>Planned</th>
<th>Theft / Vandalism</th>
<th>Unknown</th>
<th>Vehicle Accident</th>
<th>Weather / Falling Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>26</td>
<td>120</td>
<td>38</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
<tr>
<td>2009</td>
<td>26</td>
<td>92</td>
<td>45</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
<tr>
<td>2010</td>
<td>26</td>
<td>51</td>
<td>51</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
<tr>
<td>2011</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
<tr>
<td>2012</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
<tr>
<td>2013</td>
<td>32</td>
<td>44</td>
<td>44</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
<tr>
<td>2014</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
<tr>
<td>2015</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
<tr>
<td>2016</td>
<td>27</td>
<td>27</td>
<td>27</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
<tr>
<td>2017</td>
<td>71</td>
<td>71</td>
<td>71</td>
<td>1</td>
<td>88</td>
<td>42</td>
<td>145</td>
</tr>
</tbody>
</table>

Data Source: Eaton

Electric Utility Outage Data, 2008 – 2017

- In 2018, the average Minnesota electric customer experienced 1 service interruption that lasted an average of less than 1 hour.
- In Minnesota, between 2008 and 2017:
  - The greatest number of electric outages occurred in March (7th for outages nationwide)
  - The leading cause of electric outages was Weather or Falling Trees (leading cause nationwide)
  - Electric outages affected 356,918 customers on average
Natural Gas Transport

As of 2018, Minnesota had:
- 5,465 miles of natural gas transmission pipelines
- 32,874 miles of natural gas distribution pipelines
- 63% of Minnesota’s natural gas transmission system and 17% of the distribution system were constructed prior to 1970 or in an unknown year.
- Between 1984 and 2019, Minnesota’s natural gas supply was most impacted by:
  - Miscellaneous or Unknown events when transported by transmission pipelines (5th leading cause nationwide at $16.77M per year)
  - Outside Forces when transported by distribution pipelines (leading cause nationwide at $76.59M per year)

Natural Gas Processing and Liquefied Natural Gas

- Minnesota has 0 natural gas processing facilities.
- Minnesota has 3 liquefied natural gas (LNG) facilities with a total storage capacity of 1,528,000 barrels.
Petroleum Transport

Top Events Affecting Petroleum Transport by Truck and Rail, 1986 – 2019

- **Equipment Failure / Damage / Interruption**
  - Frequency: 2
  - Economic Loss: $0 (Truck), $0 (Rail)

- **Fire and / or Explosion**
  - Frequency: 5
  - Economic Loss: $0 (Truck), $0 (Rail)

- **General Outage / Repair / Closure**
  - Frequency: 11
  - Economic Loss: $0 (Truck), $0 (Rail)

- **Loss of Containment / Flaring**
  - Frequency: 14
  - Economic Loss: $0 (Truck), $0 (Rail)

- **Loss of Electric Power or Other Utility Service**
  - Frequency: 6
  - Economic Loss: $0 (Truck), $0 (Rail)

- **Maintenance / Turnaround**
  - Frequency: 24
  - Economic Loss: $0 (Truck), $0 (Rail)

- **Material Failures**
  - Frequency: 10
  - Economic Loss: $0 (Truck), $0 (Rail)

- **Re/f_inery Shutdown / Conversion**
  - Frequency: 1
  - Economic Loss: $0 (Truck), $0 (Rail)

- **Re/f_inery Maintenance / Turnaround**
  - Frequency: 2
  - Economic Loss: $0 (Truck), $0 (Rail)

- **Weather or Natural Disaster**
  - Frequency: 1
  - Economic Loss: $0 (Truck), $0 (Rail)

- **All Other Causes**
  - Frequency: 1
  - Economic Loss: $0 (Truck), $0 (Rail)

Data Source: DOT PHMSA

Top Events Affecting Crude Oil and Refined Product Pipelines, 1986 – 2019

- **Corrosion**
  - Frequency: 2,88
  - Economic Loss: $0 (Crude Pipelines), $10 (Product Pipelines)

- **Crude Pipelines**
  - Frequency: 69
  - Economic Loss: $0 (Crude Pipelines), $94 (Product Pipelines)

- **Excavation Damage**
  - Frequency: 562
  - Economic Loss: $0 (Crude Pipelines), $62 (Product Pipelines)

- **Incorrect Operation**
  - Frequency: 11
  - Economic Loss: $0 (Crude Pipelines), $868 (Product Pipelines)

- **Material / Weld Failure**
  - Frequency: 1
  - Economic Loss: $0 (Crude Pipelines), $423 (Product Pipelines)

- **Miscellaneous / Unknown**
  - Frequency: 66
  - Economic Loss: $0 (Crude Pipelines), $746 (Product Pipelines)

- **Natural Force**
  - Frequency: 5
  - Economic Loss: $0 (Crude Pipelines), $163 (Product Pipelines)

- **Outside Force**
  - Frequency: 5
  - Economic Loss: $0 (Crude Pipelines), $180 (Product Pipelines)

Data Source: DOT PHMSA

Petroleum Refineries

- Minnesota has 2 petroleum refineries with a total operable capacity of 418.5 Mb/d.
- Between 2009 and 2019, the leading cause of petroleum refinery disruptions in Minnesota was:
  - **Maintenance** (2nd leading cause nationwide)

Causes and Frequency of Petroleum Refinery Disruptions, 2009 – 2019

- As of 2018, Minnesota had:
  - 2,566 miles of crude oil pipelines
  - 1,821 miles of refined product pipelines
  - 0 miles of biofuels pipelines
- 52% of Minnesota's petroleum pipeline systems were constructed prior to 1970 or in an unknown year.
- Between 1986 and 2019, Minnesota's petroleum supply was most impacted by:
  - Derailments, Collisions, or Rollovers when transported by truck (8th leading cause nationwide at $0.07M per year)
  - Derailments, Collisions, or Rollovers when transported by rail (leading cause nationwide at $19.71M per year)
  - Incorrect Operations when transported by crude pipelines (6th leading cause nationwide at $4.23M per year)
  - Material Failures when transported by product pipelines (4th leading cause nationwide at $9.47M per year)
- Disruptions in other states may impact supply.