State of Massachusetts
ENERGY SECTOR RISK PROFILE

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

MASSACHUSETTS STATE FACTS

<table>
<thead>
<tr>
<th>State Overview</th>
<th>Annual Energy Production</th>
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<tbody>
<tr>
<td>Population: 6.69 million (2% total U.S.)</td>
<td>Electric Power Generation: 36.2 TWh (1% total U.S.)</td>
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<td>Housing Units: 2.81 million (2% total U.S.)</td>
<td>Coal: 2.1 TWh, 6% [1.6 GW total capacity]</td>
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<td>Business Establishments: 0.17 million (2% total U.S.)</td>
<td>Petroleum: 0.2 TWh, &lt;1% [3.4 GW total capacity]</td>
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<td>Natural Gas: 24.7 TWh, 68% [7.3 GW total capacity]</td>
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<td>Nuclear: 5.9 TWh, 16% [0.7 GW total capacity]</td>
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<td>Hydro: 0.6 TWh, 2% [1.8 GW total capacity]</td>
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<td>Other Renewable: 0.1 TWh, &lt;1% [0.2 GW total capacity]</td>
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<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: 0 Mbarrels (0% total U.S.)</td>
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<tr>
<th>Annual Energy Consumption</th>
<th>Annualized Property Loss due to Natural Hazards in Massachusetts (1996–2014)</th>
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<tbody>
<tr>
<td>Electric Power: 55.3 TWh (1% total U.S.)</td>
<td>Annualized Property Loss (Million per year)</td>
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<tr>
<td>Coal: 1,000 MSTN (&lt;1% total U.S.)</td>
<td>Drought</td>
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<td>Natural Gas: 68 Bcf (&lt;1% total U.S.)</td>
<td>Earthquake (1.3%)</td>
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<td>Motor Gasoline: 59,300 Mbarrels (2% total U.S.)</td>
<td>Extreme Heat</td>
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<td>Distillate Fuel: 24,000 Mbarrels (2% total U.S.)</td>
<td>Flood</td>
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<td>Thunderstorm &amp; Lightning</td>
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<td>Tornado</td>
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<td>Winter Storm &amp; Extreme Cold</td>
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Data Source: NOAA

According to NOAA, the most common natural hazard in Massachusetts is Thunderstorm & Lightning, which occurs once every 6.3 days on the average during the months of March to October.

The second-most common natural hazard in Massachusetts is Winter Storm & Extreme Cold, which occurs once every 19 days on the average during the months of October to March.

As reported by NOAA, the natural hazard in Massachusetts that caused the greatest overall property loss during 1996 to 2014 is Flood at $12.3 million per year.

The natural hazard with the second-highest property loss in Massachusetts is Tornado at $9.2 million per year.
Electric Power Plants: 132 (1% total U.S.)
- Coal-fired: 4 (<1% total U.S.)
- Petroleum-fired: 27 (1% total U.S.)
- Natural Gas-fired: 34 (1% total U.S.)
- Nuclear: 1 (1% total U.S.)
- Hydro-electric: 31 (1% total U.S.)
- Other Renewable: 35 (1% total U.S.)

Transmission Lines:
- High-Voltage (>230 kV): 596 Miles
- Low-Voltage (<230 kV): 1,717 Miles
**Electric Transmission**

- According to NERC, the leading cause of electric transmission outages in Massachusetts is **Faulty Equipment/Human Error**.
- Massachusetts experienced **24 electric transmission outages** from 1992 to 2009, affecting a total of **815,137** electric customers.
- **Faulty Equipment/Human Error** affected the largest number of electric customers as a result of electric transmission outages.


![Bar chart showing electric customers disrupted by cause.](image)

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

![Pie chart showing causes of outages.](image)

**Electric Distribution**

- Between 2008 and 2013, the greatest number of electric outages in Massachusetts has occurred during the month of **October**.
- The leading cause of electric outages in Massachusetts 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 Massachusetts was **518,293**.
- The average duration of electric outages in Massachusetts during 2008 to 2013 was **3,597 minutes or 59.9 hours a year**.

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

![Line chart showing monthly outages.](image)


![Pie chart showing causes of outages.](image)

**Utility Outage Data (2008–2013)**

![Line graph showing outage data.](image)

**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: 22 (1% total U.S.)
Crude Pipelines: 0 Miles (0% total U.S.)
Product Pipelines: 300 Miles (<1% total U.S.)
Bio-Refineries (Ethanol): 0 (0% total U.S.)
Petroleum Transport

The leading event type affecting the transport of petroleum product by rail and truck in Massachusetts during 1986 to 2014 was Incorrect Operation for rail transport and Miscellaneous/Unknown for truck transport, with an average 0.4 (or one incident every 2.5 years) and 6.2 incidents per year, respectively.

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 Massachusetts during 1986 to 2014 was Incorrect Operation, with an average 0.07 incidents per year (or one incident every 14.5 years). There are no crude oil pipelines in the State of Massachusetts.

Top Events Affecting Crude Oil and Refined Product Pipelines in Massachusetts (1986–2014)
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: 600 Miles (<1% total U.S.)
Local Distribution Companies: 18 (1% total U.S.)
Natural Gas Transport

The leading event type affecting natural gas transmission and distribution pipelines in Massachusetts during 1986 to 2014 was Outside Force for Transmission Pipelines and Miscellaneous/Unknown for Distribution Pipelines, with an average 0.13 (or one incident every 7.8 years) and 1.35 incidents per year, respectively.

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

Data Source: DOT PHMSA
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/ngProd_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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