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**

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<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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<table>
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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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<tr>
<td>Electric Power: 55.3 TWh (1% total U.S.)</td>
<td>Flood: $12.3 million per year</td>
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<tr>
<td>Coal: 1,000 MSTN (&lt;1% total U.S.)</td>
<td>Hurricane: $1.2 million per year</td>
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<td>Natural Gas: 68 Bcf (&lt;1% total U.S.)</td>
<td>Thunderstorm &amp; Lighting: $0.0 million per year</td>
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<td>Motor Gasoline: 59,300 Mbarrels (2% total U.S.)</td>
<td>Tornado: $2.4 million per year</td>
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<td>Distillate Fuel: 24,000 Mbarrels (2% total U.S.)</td>
<td>Winter Storm &amp; Extreme Cold: $5.8 million per year</td>
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NATURAL HAZARDS OVERVIEW

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

- 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.

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

- 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.


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

![Graph showing the number of NERC-reported electric transmission outages by cause from 1992 to 2009.]

Data Source: NERC

Electric Distribution

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

![Graph showing electric utility reported power outages by month from 2008 to 2013.]

Data Source: Eaton


![Pie chart showing the causes of electric utility reported outages from 2008 to 2013.]

Data Source: Eaton

Utility Outage Data (2008–2013)

![Graph showing utility outage data from 2008 to 2013.]

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: 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.)

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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:**
- ACE 2012; ANL 2013;
- EIA 2014; ESRI 2012; NPMS 2011.
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 petroleum product pipelines 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 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/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.

FOR MORE INFORMATION CONTACT:
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy
Phone: 202-586-2264
Email: energysresponsecenter@hq.doe.gov