East Coast Region
ENERGY SECTOR RISK PROFILE

This Energy Risk Profile examines the relative magnitude of the risks that the East Coast’s energy infrastructure routinely encounters in comparison with the probable impacts. The East Coast Region consists of the States of Connecticut, Delaware, Florida, Georgia, Maine, Massachusetts, Maryland, New Hampshire, New Jersey, New York, North and South Carolina, Pennsylvania, Vermont, Virginia and West Virginia. 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.

EAST COAST REGION FACTS

<table>
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<tr>
<th>Region Overview</th>
<th>Annual Energy Production</th>
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<tbody>
<tr>
<td>Population: 118.4 million (37% total U.S.)</td>
<td>Electric Power Generation: 1,295 TWh (32% total U.S.)</td>
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<td>Housing Units: 51.1 million (38% total U.S.)</td>
<td>Coal: 364.1 TWh, 28% [93.5 GW total capacity]</td>
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<td>Business Establishments: 3 million (39% total U.S.)</td>
<td>Petroleum: 4.1 TWh, &lt;1% [143.3 GW total capacity]</td>
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<td><strong>Annual Energy Consumption</strong></td>
<td>Natural Gas: 466.3 TWh, 36% [35.7 GW total capacity]</td>
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<td>Electric Power: 1,264 TWh (34% total U.S.)</td>
<td>Nuclear: 369.8 TWh, 29% [42.8 GW total capacity]</td>
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<td>Coal: 172,175 MSTN (20% total U.S.)</td>
<td>Hydro: 41.5 TWh, 3% [26.4 GW total capacity]</td>
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<td>Natural Gas: 6,000 Bcf (26% total U.S.)</td>
<td>Other Renewable: 47.1 TWh, 4% [13.4 GW total capacity]</td>
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<td>Motor Gasoline: 1,034,400 Mbarrels (34% total U.S.)</td>
<td>Coal: 197,200 MSTN (19% total U.S.)</td>
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<td>Distillate Fuel: 398,900 Mbarrels (29% total U.S.)</td>
<td>Natural Gas: 2,990 Bcf (13% total U.S.)</td>
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NATURAL HAZARDS OVERVIEW

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

- According to NOAA, the most common natural hazard in the East Coast is Flood, which occurs once every 0.8 days on the average during the months of March to October.
- The second-most common natural hazard in the region is Other, which occurs once every 1.7 days on the average.

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

- As reported by NOAA, the natural hazard in the East Coast Region that caused the greatest overall property loss during 1996 to 2014 is Flooding at $1,027.1 million per year.
- The natural hazard with the second-highest property loss in the region is Hurricanes at $712.4 million per year.

Data Source: NOAA
Energy Sector Risk Profile

East Coast Region

**Electric**

Electric Power Plants: 1,858 (30% total U.S.)
- Coal-fired: 167 (30% total U.S.)
- Petroleum-fired: 369 (33% total U.S.)
- Natural Gas-fired: 439 (26% total U.S.)
- Nuclear: 32 (48% total U.S.)
- Hydro-electric: 516 (35% total U.S.)
- Other Renewable: 335 (23% total U.S.)

Transmission Lines:
- High-Voltage (>230 kV): 25,760 Miles
- Low-Voltage (<230 kV): 28,540 Miles
Electric Transmission

- According to NERC, the leading cause of electric transmission outages in the East Coast Region is **All Other Causes**.
- The region experienced **456 electric transmission outages** from 1992 to 2009, affecting a total of **45.2 million electric customers**.
- **Natural Disasters – Hurricanes/Tropical Storms** 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)**

**Electric Distribution**

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

- Between 2008 and 2013, the greatest number of electric outages occurred during the month of **July** in the East Coast Region.
- The leading cause of electric outages during 2008 to 2013 was **Weather/Falling Trees**.
- On average, the number of people affected annually by electric outages during 2008 to 2013 was **11 million**.
- The average duration of electric outages in the region during 2008 to 2013 was **52,150 minutes or 869 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: 10 (7% total U.S.)
- Terminals: 560 (29% total U.S.)
- Crude Pipelines: 557 Miles (1% total U.S.)
- Product Pipelines: 23,340 Miles (4% total U.S.)
- Bio-Refineries (Ethanol): 6 (3% total U.S.)

Produced by Department of Energy (DOE), Office of Electricity Delivery & Energy Reliability (OE)
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 during 1986 to 2014 was Incorrect Operation for rail transport and Miscellaneous/Unknown for truck transport, with an average 9.6 and 188.5 incidents per year, respectively.

Top Events Affecting Crude Oil and Refined Product Pipelines (1986–2014)

The leading event type affecting crude oil pipeline and petroleum product pipelines in the East Coast Region during 1986 to 2014 was Corrosion for crude oil pipelines and Equipment Failure for product pipelines, with an average 0.24 (or one incident every 4.1 years) and 4.69 incidents per year, respectively.

Petroleum Refinery

The leading cause of petroleum refinery disruptions in the East Coast Region from 2003 to 2014 was Other Causes. The region’s petroleum refineries experienced 615 major incidents from 2003 to 2014. The weighted average production impact from all disruptions at the refineries within the region from 2003 to 2014 is 109 thousand barrels per day.

NATURAL GAS

Natural Gas Infrastructure Overview
- Gas Wells: 125,400 (26% total U.S.)
- Processing Plants: 22 (4% total U.S.)
- Storage Fields: 121 (27% total U.S.)
- Interstate Pipelines: 42,180 Miles (8% total U.S.)
- Local Distribution Companies: 393 (23% total U.S.)
Natural Gas Transport

- The leading event type affecting natural gas transmission and distribution pipelines in the East Coast Region during 1986 to 2014 was Outside Force for Transmission Pipelines and Outside Force for Distribution Pipelines, with an average 2.55 and 12.45 incidents per year, respectively.

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

- Corrosion
- Equipment Failure
- Excavation Damage
- Incorrect Operation
- Material / Weld Failures
- Miscellaneous / Unknown
- Natural Forces
- Outside Force

Natural Gas Processing

- According to data derived from DOE’s Energy Assurance Daily, the leading cause of natural gas processing plant disruptions in the East Coast Region from 2005 to 2014 is Weather or Natural Disaster and Cause Not Specified.
- The region’s natural gas processing plants experienced 2 disruptions from 2005 to 2014.
- The weighted average production impact from all disruptions at the natural gas processing plants within the region from 2005 to 2014 is 355 million cubic feet per day (MMcfd).


- Cause Not Specified
- Weather or Natural Disaster

Average Production Impact by Disruption Type (MMcfd) at Natural Gas Processing Plants (2005–2014)

- Cause Not Specified
- Weather or Natural Disaster
- Flaring
- Plant Conversion
- N.A.
DATA SOURCES

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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