State of Alabama
ENERGY SECTOR RISK PROFILE

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

ALABAMA STATE FACTS

State Overview
Population: 4.83 million (2% total U.S.)
Housing Units: 2.19 million (2% total U.S.)
Business Establishments: 0.10 million (1% total U.S.)

Annual Energy Consumption
Electric Power: 86.2 TWh (2% total U.S.)
Coal: 24,300 MSTN (3% total U.S.)
Natural Gas: 87 Bcf (<1% total U.S.)
Motor Gasoline: 47,300 Mbarrels (2% total U.S.)
Distillate Fuel: 27,900 Mbarrels (2% total U.S.)

Annual Energy Production
Electric Power Generation: 152.9 TWh (4% total U.S.)
Coal: 45.6 TWh, 30% [12.6 GW total capacity]
Petroleum: 0.1 TWh, <1% [0.05 GW total capacity]
Natural Gas: 55.7 TWh, 36% [13.5 GW total capacity]
Nuclear: 40.8 TWh, 27% [5.3 GW total capacity]
Hydro: 7.4 TWh, 5% [3.3 GW total capacity]
Other Renewable: 0 TWh, 0% [0 GW total capacity]

Coal: 19,500 MSTN (2% total U.S.)
Natural Gas: 220 Bcf (1% total U.S.)
Crude Oil: 9,500 Mbarrels (<1% total U.S.)
Ethanol: 0 Mbarrels (0% total U.S.)

NATURAL HAZARDS OVERVIEW

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

- According to NOAA, the most common natural hazard in Alabama is Thunderstorm & Lightning, which occurs once every 2.8 days on the average during the months of March to October.
- The second-most common natural hazard in Alabama is Flood, which occurs once every 12.2 days on the average.

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

- As reported by NOAA, the natural hazard in Alabama that caused the greatest overall property loss during 1996 to 2014 is Tornado at $99.0 million per year.
- The natural hazard with the second-highest property loss in Alabama is Flood at $20.5 million per year.
### Electric Power Plants: 79 (1% total U.S.)
- Coal-fired: 10 (1% total U.S.)
- Petroleum-fired: 4 (<1% total U.S.)
- Natural Gas-fired: 26 (1% total U.S.)
- Nuclear: 2 (2% total U.S.)
- Hydro-electric: 24 (1% total U.S.)
- Other Renewable: 13 (<1% total U.S.)

### Transmission Lines:
- High-Voltage (>230 kV): 2,470 Miles
- Low-Voltage (<230 kV): 3,816 Miles

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#### Power Plants

<table>
<thead>
<tr>
<th>Nameplate Capacity (MW)</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Oil</th>
<th>Uranium</th>
<th>Water</th>
<th>Renewable</th>
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<tbody>
<tr>
<td>50 - 250</td>
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<tr>
<td>251 - 750</td>
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<td>751 - 1,500</td>
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<td>1,501 - 3,000</td>
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<tr>
<td>3,501 - 6,500+</td>
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</tbody>
</table>

#### Transmission Lines

- 220kV - 315kV
- 345kV - 450kV
- 500kV - 525kV
- 735kV - 765kV

*Utility Company*

*Shaded by Company*

Data Sources:
Electric Transmission

- According to NERC, the leading cause of electric transmission outages in Alabama is Severe Weather - Thunderstorm.
- Alabama experienced 33 electric transmission outages from 1992 to 2009, affecting a total of 4,550,157 electric customers.
- Natural Disaster - Hurricane/Tropical Storm affected the largest number of electric customers as a result of electric transmission outages.


<table>
<thead>
<tr>
<th>Cause</th>
<th>Number of Customers Disrupted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe Weather - Thunderstorm</td>
<td>619,710</td>
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<tr>
<td>Natural Disaster - Hurricane / Tropical Storm</td>
<td>2,285,411</td>
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<tr>
<td>Faulty Equipment / Human Error</td>
<td>83,132</td>
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<tr>
<td>Natural Disaster - Tornado</td>
<td>850,000</td>
</tr>
<tr>
<td>Transmission Line Faults and Overloads</td>
<td>711,904</td>
</tr>
<tr>
<td>All Other Causes</td>
<td></td>
</tr>
</tbody>
</table>

Data Source: NERC

Electric Distribution

- Between 2008 and 2013, the greatest number of electric outages in Alabama has occurred during the month of August.
- The leading cause of electric outages in Alabama during 2008 to 2013 was Weather/Falling Trees.
- On average, the number of people affected annually by electric outages during 2008 to 2013 in Alabama was 267,232.
- The average duration of electric outages in Alabama during 2008 to 2013 was 1,968 minutes or 32.8 hours a year.

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

- Data Source: Eaton

Utilities Outage Data (2008–2013)

- Data Source: Eaton
PETROLEUM

Petroleum Infrastructure Overview
- Refineries: 3 (2% total U.S.)
- Terminals: 42 (2% total U.S.)
- Crude Pipelines: 345 Miles (1% total U.S.)
- Product Pipelines: 6,480 Miles (1% total U.S.)
- Bio-Refineries (Ethanol): 0 (0% total U.S.)

Data Sources: ACE 2012; ANL 2013; EIA 2014; ESRI 2012; NPMS 2011.
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 Alabama during 1986 to 2014 was Incorrect Operation for rail transport and Miscellaneous/Unknown for truck transport, with an average 1.5 and 5.0 incidents per year, respectively.

Petroleum Refinery

The leading cause of petroleum refinery disruptions in Alabama from 2003 to 2014 was Weather or Natural Disaster. Alabama’s petroleum refineries experienced 6 major incidents from 2003 to 2014. The average production impact from disruptions of Alabama’s refineries from 2003 to 2014 is 19.2 thousand barrels per day.
NATURAL GAS

Natural Gas Infrastructure Overview
Gas Wells: 6,068 (1% total U.S.)
Processing Plants: 16 (3% total U.S.)
Storage Fields: 2 (<1% total U.S.)
Interstate Pipelines: 14,400 Miles (3% total U.S.)
Local Distribution Companies: 98 (6% total U.S.)

Produced by Department of Energy (DOE), Office of Electricity Delivery & Energy Reliability (OE)
Natural Gas Transport

The leading event type affecting natural gas transmission and distribution pipelines in Alabama during 1986 to 2014 was **Material/Weld Failures** for Transmission Pipelines and **Outside Force** for Distribution Pipelines, with an average 0.39 and 1.00 incidents per year (or one incident every 2.6 years and 1 year), respectively.

Top Events Affecting Natural Gas Transmission and Distribution in Alabama (1986-2014)

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

### Economic Loss

- **Corrosion**: $326,333
- **Equipment Failure**: $113,040
- **Excavation Damage**: $10,000
- **Incorrect Operation**: $8,000
- **Material/Weld Failures**: $115,000
- **Miscellaneous/Unknown**: $260,000
- **Natural Forces**: $692,000
- **Outside Force**: $50,000

### Frequency

- **Transmission**: 0.00
- **Distribution**: 0.78

### Data Source: DOT PHMSA

Natural Gas Processing

According to data derived from DOE’s Energy Assurance Daily, the leading cause of natural gas processing plant disruptions in Alabama from 2005 to 2014 is **Downstream Infrastructure**.

Alabama’s natural gas processing plants experienced 1 disruption from 2005 to 2014.

The average production impact from disruptions of Alabama’s natural gas processing plants from 2005 to 2014 is 600 million cubic feet per day (MMcfd).

### Top Cause of Natural Gas Processing Plant Disruptions in Alabama (2005–2014)

- **Downstream Infrastructure**: 1

### Average Production Impact (MMcfd) from Natural Gas Processing Plant Disruptions in Alabama (2005–2014)

- **Downstream Infrastructure**: 600
- **Failure**: 0
- **Flaring**: 0
- **Plant Conversion**: 0
- **N.A.**: 0

Data Source: DOE OE
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.

FOR MORE INFORMATION CONTACT:
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