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

HAWAII STATE FACTS

**State Overview**
- Population: 1.40 million (<1% total U.S.)
- Housing Units: 0.53 million (<1% total U.S.)
- Business Establishments: 0.03 million (<1% total U.S.)

**Annual Energy Consumption**
- Electric Power: 9.6 TWh (<1% total U.S.)
- Coal: 800 MSTN (<1% total U.S.)
- Natural Gas: 3 Bcf (<1% total U.S.)
- Motor Gasoline: 10,400 Mbarrels (<1% total U.S.)
- Distillate Fuel: 5,200 Mbarrels (<1% total U.S.)

**Annual Energy Production**
- Electric Power Generation: 10.5 TWh (<1% total U.S.)
  - Coal: 1.5 TWh, 15% [0.2 GW total capacity]
  - Petroleum: 7.5 TWh, 71% [2.2 GW total capacity]
  - Natural Gas: 0 TWh, 0% [0 GW total capacity]
  - Nuclear: 0 TWh, 0% [0 GW total capacity]
  - Hydro: 0.1 TWh, 1% [0 GW total capacity]
  - Other Renewable: 0.4 TWh, 4% [0.2 GW total capacity]
- Coal: 0 MSTN (0% total U.S.)
- Natural Gas: 0 Bcf (0% total U.S.)
- Crude Oil: 0 Mbarrels (0% total U.S.)
- Ethanol: 0 Mbarrels (0% total U.S.)

**NATURAL HAZARDS OVERVIEW**

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

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Annual Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>7</td>
</tr>
<tr>
<td>Earthquake</td>
<td>1</td>
</tr>
<tr>
<td>Extreme Heat</td>
<td>55</td>
</tr>
<tr>
<td>Flood</td>
<td>0</td>
</tr>
<tr>
<td>Hurricane</td>
<td>36</td>
</tr>
<tr>
<td>Thunderstorms &amp; Lightning</td>
<td>13</td>
</tr>
<tr>
<td>Tornado</td>
<td>9</td>
</tr>
<tr>
<td>Wildfire</td>
<td>2</td>
</tr>
</tbody>
</table>

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

- Drought: $0.0 million per year
- Earthquake: $2.9 million per year
- Extreme Heat: $0.0 million per year
- Flood: $6.8 million per year
- Hurricane: $0.0 million per year
- Thunderstorms & Lightning: $0.0 million per year
- Tornado: $0.5 million per year
- Wildfire: $0.3 million per year
- Winter Storm & Extreme Cold: $0.1 million per year

**According to NOAA, the most common natural hazard in Hawaii is Flood, which occurs once every 6.7 days on the average.**

**The second-most common natural hazard in Hawaii is Other, which occurs once every 10.1 days on the average.**

**As reported by NOAA, the natural hazard in Hawaii that caused the greatest overall property loss during 1996 to 2014 is Flood at $6.8 million per year.**

**The natural hazard with the second-highest property loss in Hawaii is Earthquake at $2.9 million per year.**
Electric Power Plants: 39 (<1% total U.S.)
- Coal-fired: 1 (<1% total U.S.)
- Petroleum-fired: 20 (1% total U.S.)
- Natural Gas-fired: 0 (0% total U.S.)
- Nuclear: 0 (0% total U.S.)
- Hydro-electric: 8 (<1% total U.S.)
- Other Renewable: 10 (<1% total U.S.)

Transmission Lines:
- High-Voltage (>230 kV): 177 Miles
- Low-Voltage (<230 kV): 731 Miles
Electric Transmission

- According to NERC, the leading cause of electric transmission outages in Hawaii is Natural Disaster - Earthquake.
- Hawaii experienced 1 electric transmission outages from 1992 to 2009, affecting a total of 291 electric customers.
- Natural Disaster - Earthquake affected the largest number of electric customers as a result of electric transmission outages.

### Electric Customers Disrupted by NERC-Reported Electric Transmission Outages by Cause (1992–2009)

- **Natural Disaster - Earthquake**: 291 customers
- **All Other**: 0 customers

Data Source: NERC

Electric Distribution

- Between 2008 and 2013, the greatest number of electric outages in Hawaii has occurred during the month of December.
- The leading cause of electric outages in Hawaii during 2008 to 2013 was Unknown.
- On average, the number of people affected annually by electric outages during 2008 to 2013 in Hawaii was 217,217.
- The average duration of electric outages in Hawaii during 2008 to 2013 was 1,205 minutes or 20.1 hours a year.

### Electric Utility Outage Data (2008–2013)

- Total number of people affected by outages
- Total duration of outages (minutes)

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: 2 (1% total U.S.)
- Terminals: 21 (1% total U.S.)
- Crude Pipelines: 0 Miles (0% total U.S.)
- Product Pipelines: 2,700 Miles (<1% total U.S.)
- Bio-Refineries (Ethanol): 0 (0% 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 truck in Hawaii during 1986 to 2014 was Incorrect Operation, with an average 0.7 incidents per year (or one incident every 1.4 years). Petroleum product does not appear to be transported by rail in the State of Hawaii.

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

The leading event type affecting petroleum product pipelines in Hawaii during 1986 to 2014 was Corrosion, with an average 0.28 incidents per year (or one incident every 3.6 years). There are no crude oil pipelines in the State of Hawaii.

Petroleum Refinery

The leading cause of petroleum refinery disruptions in Hawaii from 2003 to 2014 was Equipment Failure or Damage. Hawaii’s petroleum refineries experienced 28 major incidents from 2003 to 2014. The average production impact from disruptions of Hawaii’s refineries from 2003 to 2014 is 22.6 thousand barrels per day.


Average Production Impact (thousand barrels per day) from Petroleum Refinery Outages in Hawaii (2003–2014)
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: 540 Miles (<1% total U.S.)
Local Distribution Companies: 1 (<1% total U.S.)
Natural Gas Transport

The leading event type affecting natural gas transmission and distribution pipelines in Hawaii during 1986 to 2014 was Outside Force for Transmission Pipelines and Outside Force for Distribution Pipelines, with an average 0.03 and 0.06 incidents per year (or one incident every 31 and 15.5 years), respectively.

Top Events Affecting Natural Gas Transmission and Distribution in Hawaii (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


*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.
  - 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: energyresponsecenter@hq.doe.gov