Hawaiian Electric Companies Overview

Briefing for World Bank
May 23, 2016

Scott Seu
VP System Operation
Hawaiian Electric Company
Founded By the Vision of a King
Hawaiian Electric’s Evolution Symbiotic with the Economic Development of the Islands

- Light and power service extended to Waikiki in 1897
- Ice and refrigeration a major business by start of 20\(^{th}\) century
- Electric appliance sales begin 1915; electric service pushing out to suburbs and rural areas
- Small electric companies support sugar and coffee plantations on all islands
- World War II and post-war boom years
- Continued growth through early 2000s
The Hawaiian Electric Companies: 3 Electric Utilities; 5 Separate Grids

**Hawaiian Electric**
- Founded: 1891
- Customers: 302,000
- Generating Capacity: 1,727 MW
- Approximate System Peak: 1,246 MW

**Hawaii Electric Light**
- Founded: 1894
- Customers: 83,000
- Generating Capacity: 286 MW
- Approximate System Peak: 185 MW

**Maui Electric**
- Founded: 1921
- Customers: 70,000
- Generating Capacity: 290 MW
- Approximate System Peak:
  - Maui 207 MW
  - Lanai 5 MW
  - Molokai 5.5 MW

Kauai, Oahu, Molokai, Lanai, Maui
Hawaiian Electric’s Energy Mix

2014 Total Sales = 6,781,665 MWhrs

*Sources of energy for HECO’s generation as a % of sales:

- Fossil Fuel: 84.8%
- Biofuel: 0.5%
- Wind: 2.7%
- Biomass: 5.8%
- PV: 6.2%
Large Power Generation:
Over 40% of energy sold to Oahu customers is produced by Independent Power Producers

**Hawaiian Electric Plants**
- Kahe
- CIP
- Waiau

**Kalaeloa Renewable Energy Park**

**AES**

**IPPs**
- AES
- IPPs
- Kahuku Wind
- Kalaeloa Cogen
- H-Power
Maui Electric Generation

- **Auwahi Wind Farm**: 21 MW (wind)
- **Kaheawa Wind Farms**: 51 MW (wind)

*Net generation capability*
Maui Electric’s Energy Mix

2014 Total Sales = 1,132,056 MWhrs

*Sources of energy for MECO’s generation as a % of sales:

- Fossil Fuel: 66.4%
- Wind: 22.8%
- Biomass: 3.8%
- Hydro: 0.7%
- PV: 6.3%
Hawaii Island Electricity Generation

- **Hamakua Energy Partners**
  - Energy Source: Oil
  - Firm Generation: 60 MW

- **Waimea**
  - Energy Source: Oil
  - Firm Generation: 8.3 MW

- **Keahole**
  - Energy Source: Oil
  - Firm Generation: 80.6 MW

- **Puna**
  - Energy Source: Oil
  - Firm Generation: 38 MW

- **Puueo & Waiau**
  - Energy Source: Hydro
  - As-Available Generation: 4.3 MW

- **Hill & Kanoelehua**
  - Energy Source: Oil
  - Firm Generation: 57.3 MW

- **Wailuku River Hydro**
  - Energy Source: Hydro
  - As-Available Generation: 12 MW

- **Tawhiri**
  - Energy Source: Wind
  - As-available Generation: 20.5 MW

- **Hawi Renewable Development**
  - Energy Source: Wind
  - As-Available Generation: 10.6 MW

- **Puna Geothermal Venture**
  - Energy Source: Geothermal
  - Firm Generation: 38 MW

**Hawaiian Electric**

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Challenges and Opportunities
Our Dependence on Oil Drives High Energy Prices

Consumer Price Index, "Energy"
(Honolulu vs. U.S. City Average)

1982~4=100

Source: U.S. Bureau of Labor Statistics
Moving our Electric System to the Future

100% Renewable Energy by 2045
Renewable progress – Hawaiian Electric Companies’ RPS

- O‘ahu: 17%
- Moloka‘i: 35%
- Lāna‘i: 49%
- Hawai‘i: 49%
- Consolidated: 23%

- RPS as of 12/31/15
- RPS is renewable energy as percent of utility sales
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<tbody>
<tr>
<td>Biomass (including municipal solid waste)</td>
<td>385,846</td>
<td>30,870</td>
<td>416,716</td>
<td>433,164</td>
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<tr>
<td>Geothermal</td>
<td>230,495</td>
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<td>230,495</td>
<td>255,027</td>
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<tr>
<td>Photovoltaic and Solar Thermal&lt;sup&gt;1&lt;/sup&gt;</td>
<td>40,750</td>
<td>2,557</td>
<td>7,904</td>
<td>51,212</td>
<td>44,255</td>
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<tr>
<td>Hydro&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>63,275</td>
<td>9,823</td>
<td>73,098</td>
<td>51,155</td>
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<tr>
<td>Wind&lt;sup&gt;1&lt;/sup&gt;</td>
<td>216,197</td>
<td>132,293</td>
<td>264,291</td>
<td>612,782</td>
<td>577,868</td>
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<tr>
<td>Biofuels</td>
<td>52,424</td>
<td>988</td>
<td>53,412</td>
<td>37,093</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td>695,218</td>
<td>428,620</td>
<td>313,877</td>
<td>1,437,715</td>
<td>1,398,561</td>
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<tr>
<td>Customer-Sited, Grid-Connected&lt;sup&gt;2&lt;/sup&gt;</td>
<td>464,412</td>
<td>643,060</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td>464,412</td>
<td>643,060</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1,159,630</td>
<td>1,913,561</td>
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<tr>
<td><strong>TOTAL SALES</strong></td>
<td>6,754,083</td>
<td>8,976,242</td>
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<th>RPS PERCENTAGE</th>
<th>2015</th>
<th>2014</th>
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<td>(Not Counting Energy Efficiency and Solar Water Heating)</td>
<td>17.2%</td>
<td>23.2%</td>
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Ref. 2015 RPS Status Report
A 100% Renewable Future That is Affordable and Reliable
Hinges on the Entire System, not Just Generators

A
Reduced electrical losses.

B
Improved management of outages.

C
Reduced (or eliminated) manual processes.

D
Near real-time access to energy information for customers

E
Dynamic tariffs and more payment options.

F
Better visibility of generation resources.

G
The potential for Demand Response for grid operations.

H
A platform for future applications and services (electric vehicle charging, smart inverters, energy storage, building energy management systems, street lights, and more).
For stable operation of the grid, supply and demand across the island must be in perfect balance at all times.
Oahu System Load & Frequency on a **Typical Day**

![Graph showing system load and frequency on a typical day.](image-url)
Changes in Loads and Generating Resources Have Greater Affect on Small Island Grids
Our Transition Has Been Dramatic:
Oahu System Load Curve
Other Challenges: Resiliency
Hawaiian Electric: Embracing Our Energy Future!