The Future is Bright

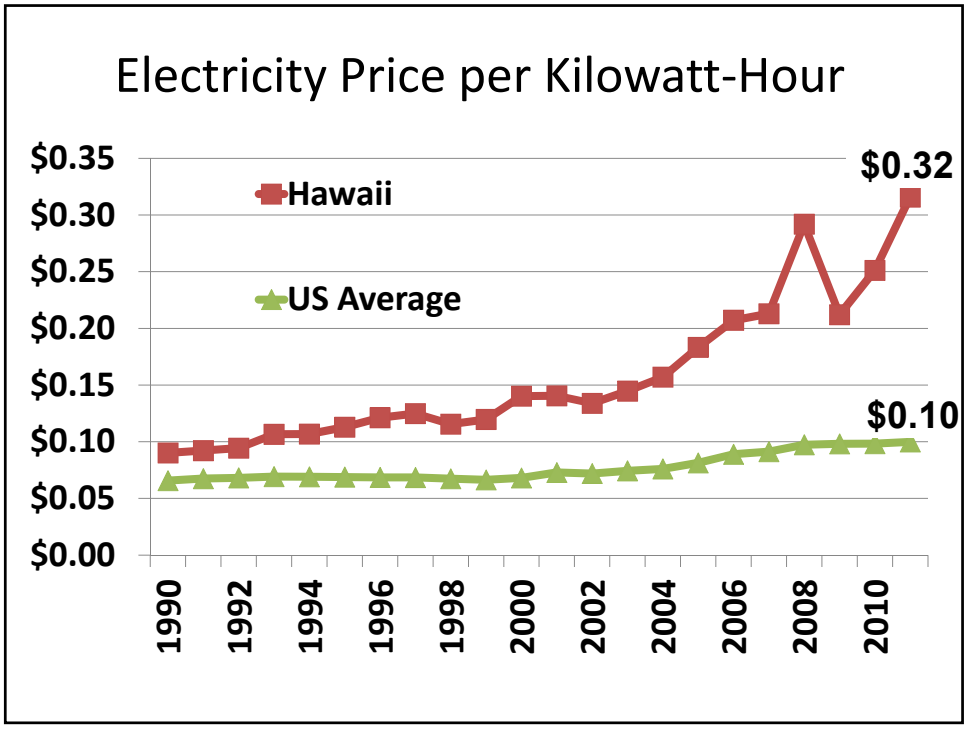
Building a clean energy economy for Hawaii

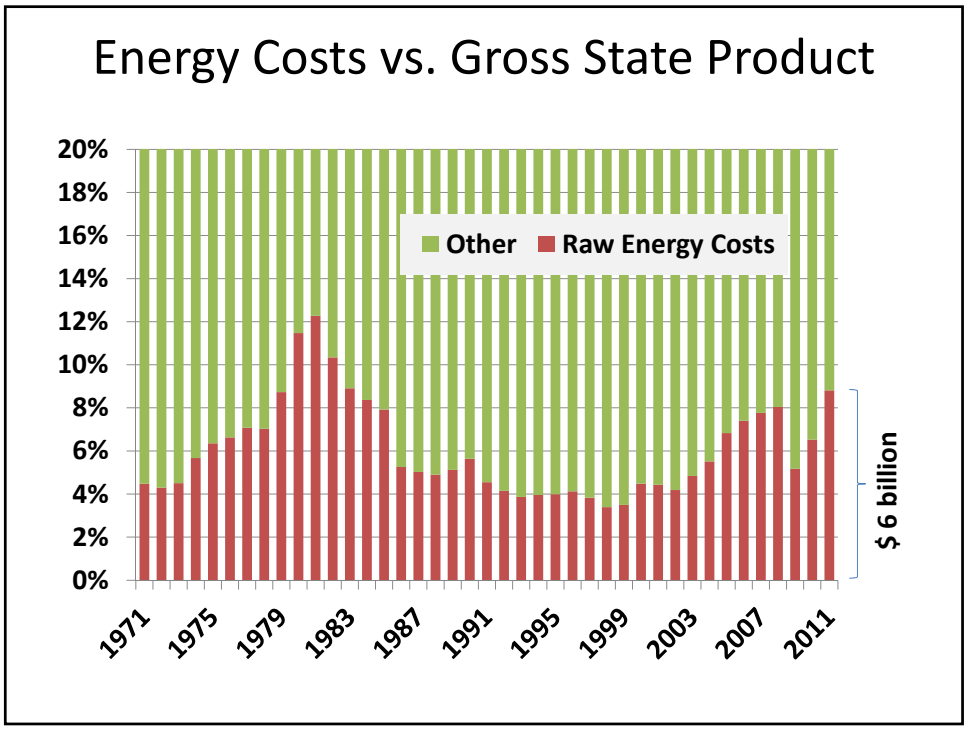
DBEDT
STATE OF HAWAII

Agenda

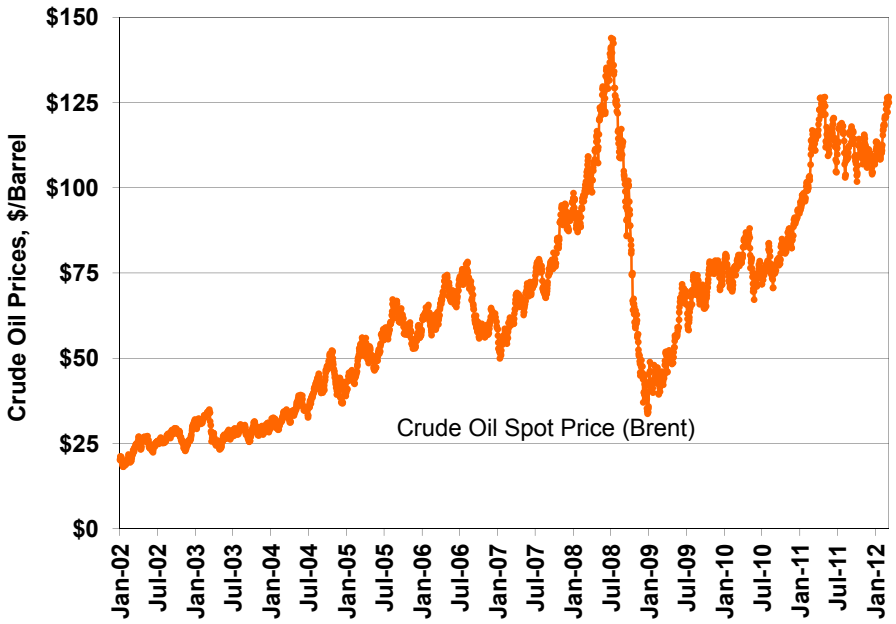
- Context
- Resources
- Interisland Cable
- Summary

DBEDT


Electricity Price per Kilowatt-Hour
$0.35
$0.30
$0.25
$0.20
$0.15
$0.10
$0.05
$0.00
Hawaii
US Average
$0.32
$0.10
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

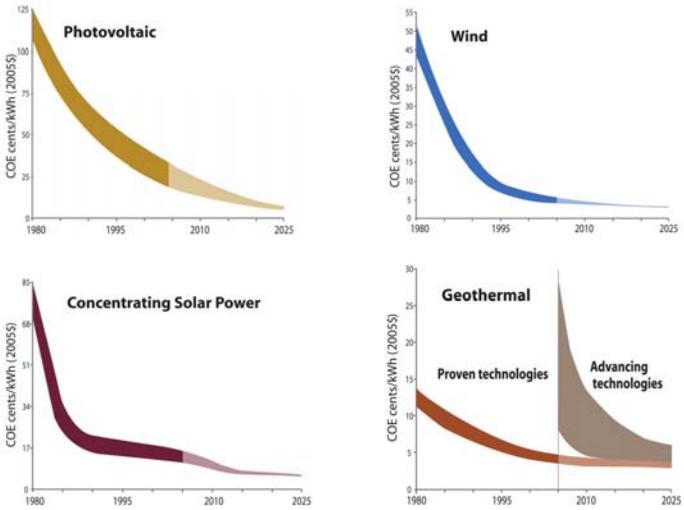

Energy Costs vs. Gross State Product
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
Other
Raw Energy Costs
$ 6 billion
1971
1975
1979
1983
1987
1991
1995
1999
2003
2007
2011

Crude Oil Spot Prices, 2002-2012



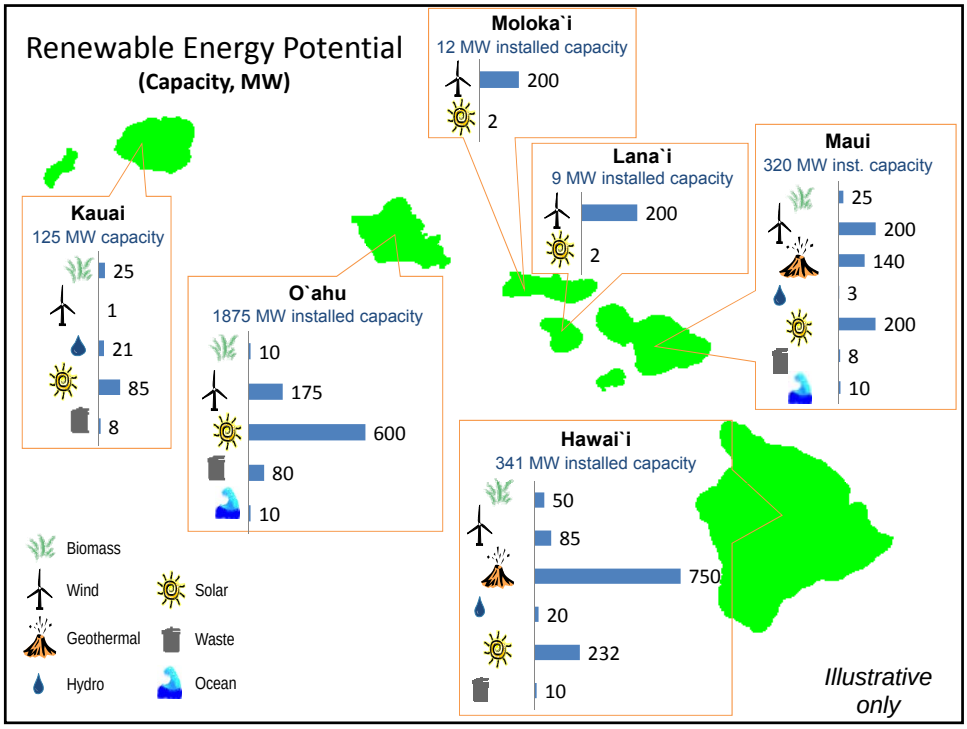
Renewable Energy Cost Trends

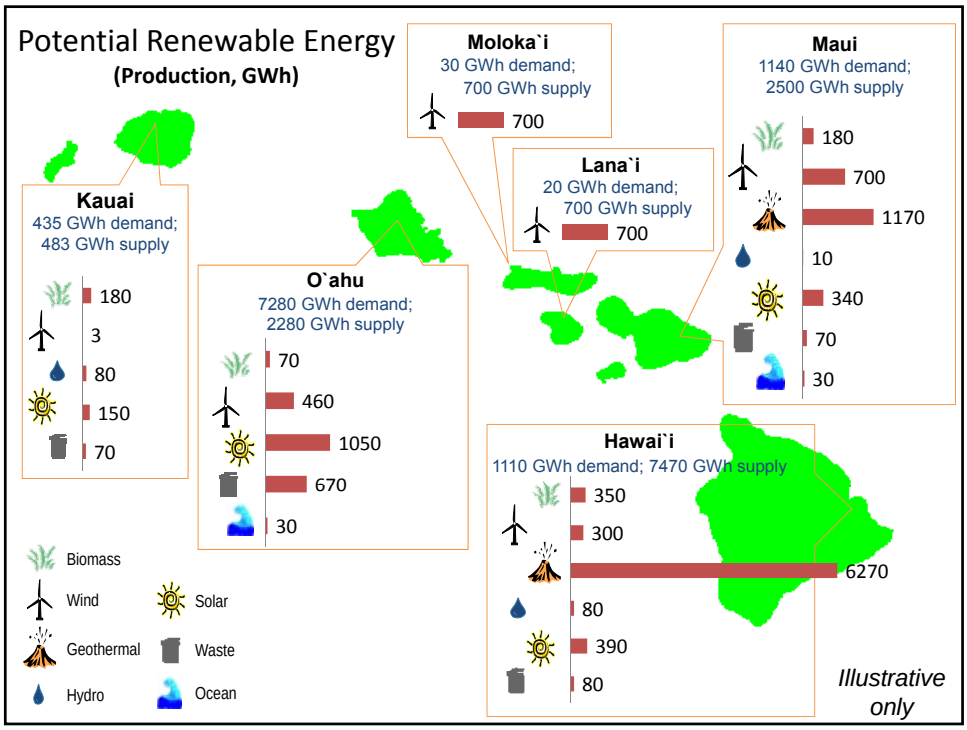
Levelized cost of energy in constant 2005$[1]

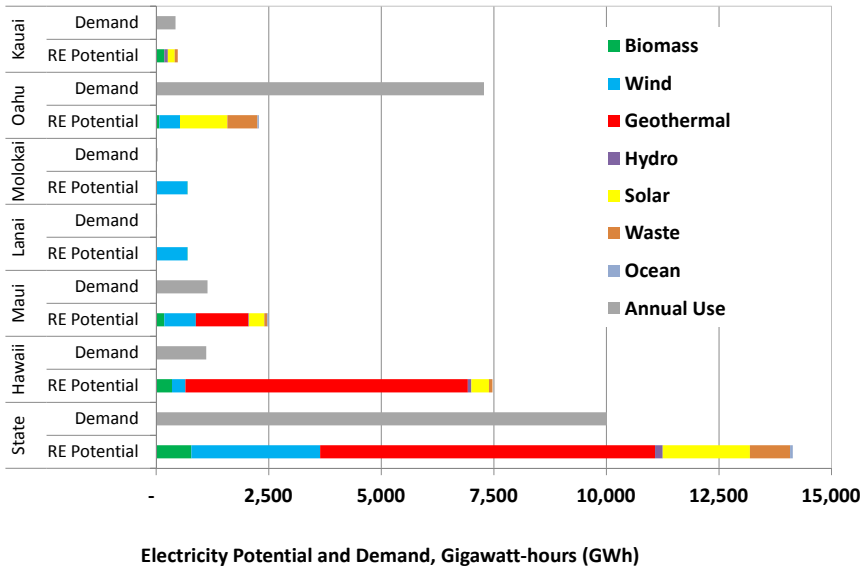


Source: NREL Energy Analysis Office (www.nrel.gov/analysis/docs/cost_curves_2005.ppt)

[1]These graphs are reflections of historical cost trends NOT precise annual historical data. DRAFT November 2005

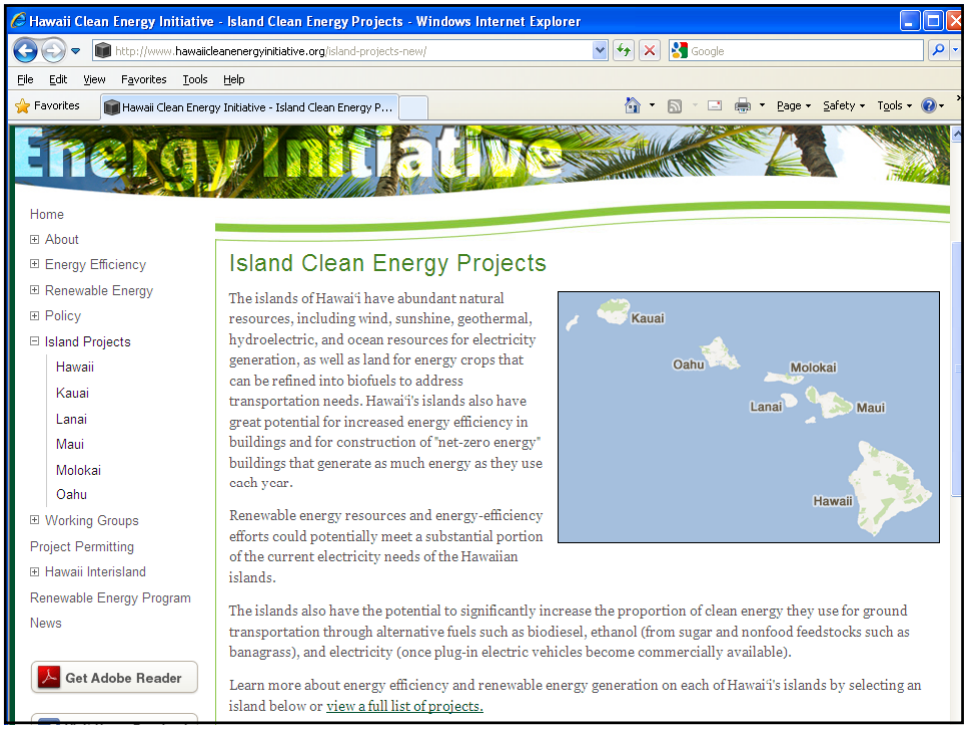

Renewable Energy Potential
(Capacity, MW)
Moloka`i
12 MW installed capacity
200
2
Lana`i
9 MW installed capacity
200
2
Maui
320 MW inst. capacity
25
200
140
3
200
8
10
Kauai
125 MW capacity
25
1
21
85
8
O`ahu
1875 MW installed capacity
10
175
600
80
10
Hawai`i
341 MW installed capacity
50
85
750
20
232
10
Biomass
Wind
Solar
Geothermal
Waste
Hydro
Ocean
Illustrative only


Potential Renewable Energy
(Production, GWh)
Moloka`i
30 GWh demand;
700 GWh supply
700
Lana`i
20 GWh demand;
700 GWh supply
700
Maui
1140 GWh demand;
2500 GWh supply
180
700
1170
10
340
70
30
Kauai
435 GWh demand;
483 GWh supply
180
3
80
150
70
O`ahu
7280 GWh demand;
2280 GWh supply
70
460
1050
670
30
Hawai`i
1110 GWh demand; 7470 GWh supply
350
300
6270
80
390
80
Biomass
Wind
Solar
Geothermal
Waste
Hydro
Ocean
Illustrative only



Renewable Resource Abundance by Island (GWh)

	Oahu	Kauai	Maui	Hawaii	Lanai	Molokai	State
Biomass	70	180	180	350	-	-	780
Wind	460	-	700	300	700	700	2,860
Geothermal	-	-	1,170	6,270	-	-	7,440
Hydro	-	80	10	80	-	-	170
Solar	1,050	150	340	390	4	4	1,938
MSW	670	70	70	80	-	-	890
Ocean	30	-	30	-	-	-	60
RENEWABLE POTENTIAL	**2,280**	**480**	**2,500**	**7,470**	**704**	**704**	**14,138**
DEMAND	7,280	430	1,140	1,110	20	30	10,010
%	*31%*	*109%*	*220%*	*673%*	*2822%*	*2240%*	*141%*


Hawaii Clean Energy Initiative - Island Clean Energy Projects - Windows Internet Explorer
http://www.hawaiicleanenergyinitiative.org/island-projects-new/
File Edit View Favorites Tools Help
Favorites
Hawaii Clean Energy Initiative - Island Clean Energy P...
Page Safety Tools
Energy Initiative
Home
About
Energy Efficiency
Renewable Energy
Policy
Island Projects
Hawaii
Kauai
Lanai
Maui
Molokai
Oahu
Working Groups
Project Permitting
Hawaii Interisland
Renewable Energy Program
News
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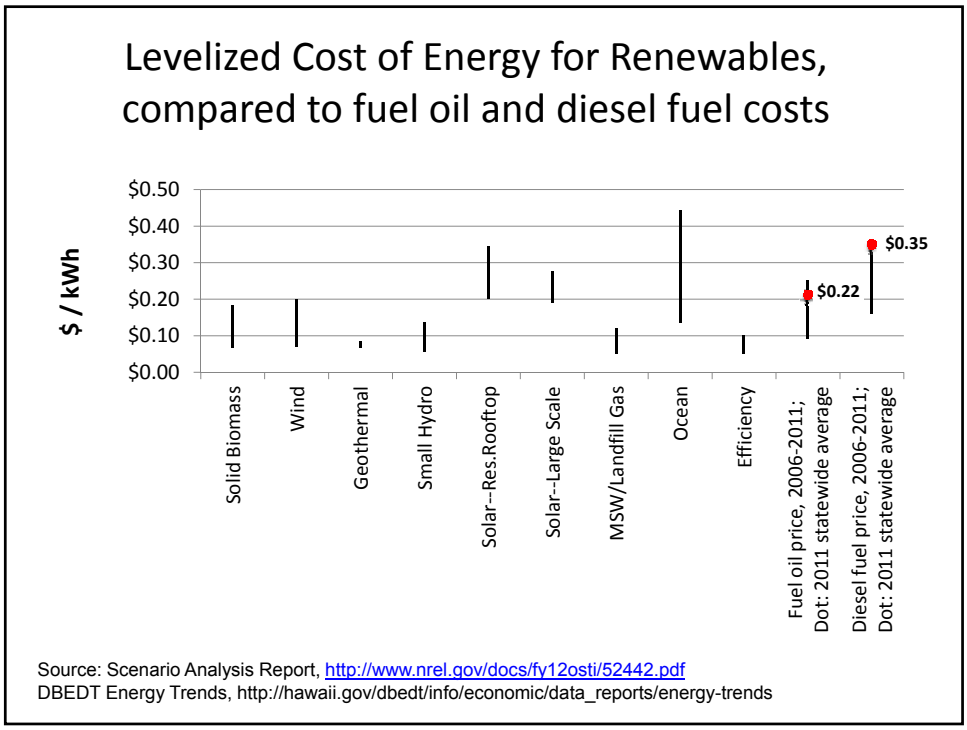
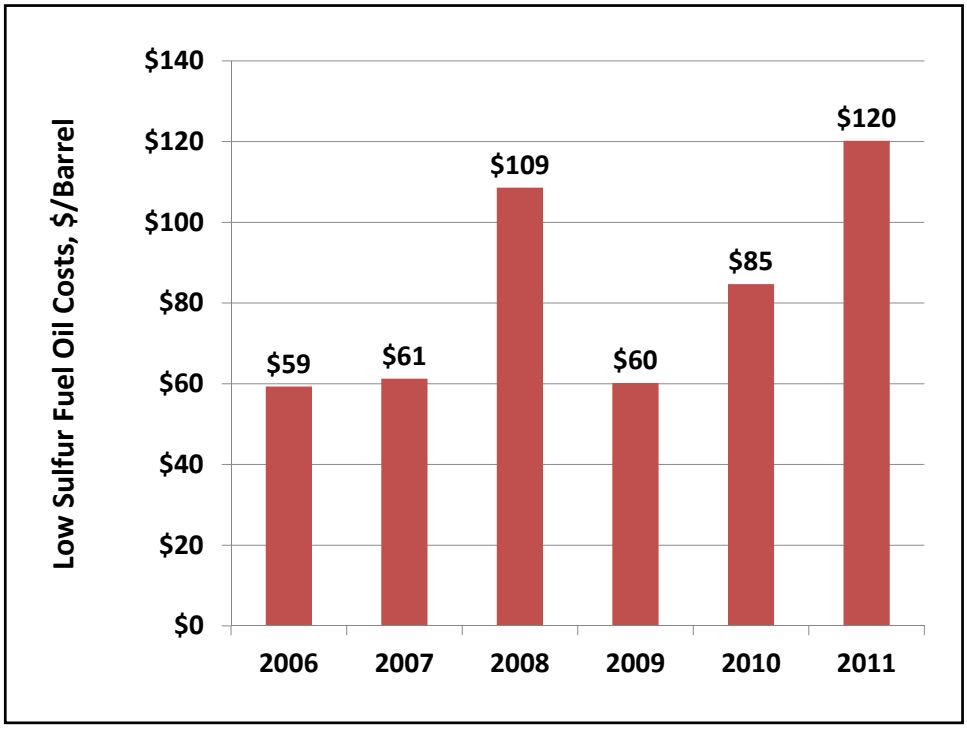
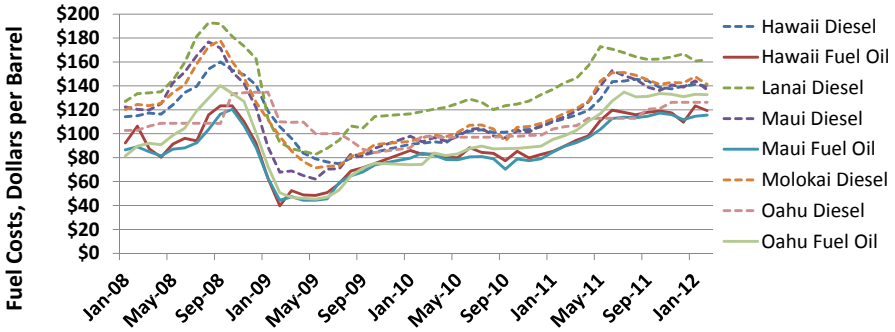
Island Clean Energy Projects
The islands of Hawai'i have abundant natural resources, including wind, sunshine, geothermal, hydroelectric, and ocean resources for electricity generation, as well as land for energy crops that can be refined into biofuels to address transportation needs. Hawai'i's islands also have great potential for increased energy efficiency in buildings and for construction of "net-zero energy" buildings that generate as much energy as they use each year.
Kauai
Oahu
Molokai
Lanai
Maui
Hawaii
Renewable energy resources and energy-efficiency efforts could potentially meet a substantial portion of the current electricity needs of the Hawaiian islands.
The islands also have the potential to significantly increase the proportion of clean energy they use for ground transportation through alternative fuels such as biodiesel, ethanol (from sugar and nonfood feedstocks such as banagrass), and electricity (once plug-in electric vehicles become commercially available).
Learn more about energy efficiency and renewable energy generation on each of Hawai'i's islands by selecting an island below or view a full list of projects.


Levelized Cost of Energy for Renewables, compared to fuel oil and diesel fuel costs
$ / kWh
$0.50
$0.40
$0.30
$0.20
$0.10
$0.00
$0.35
$0.22
Solid Biomass
Wind
Geothermal
Small Hydro
Solar--Res.Rooftop
Solar--Large Scale
MSW/Landfill Gas
Ocean
Efficiency
Fuel oil price, 2006-2011; Dot: 2011 statewide average
Diesel fuel price, 2006-2011; Dot: 2011 statewide average
Source: Scenario Analysis Report, http://www.nrel.gov/docs/fy12osti/52442.pdf
DBEDT Energy Trends, http://hawaii.gov/dbedt/info/economic/data_reports/energy-trends



Fuel Costs by Island



Inter-Island Transmission Cable

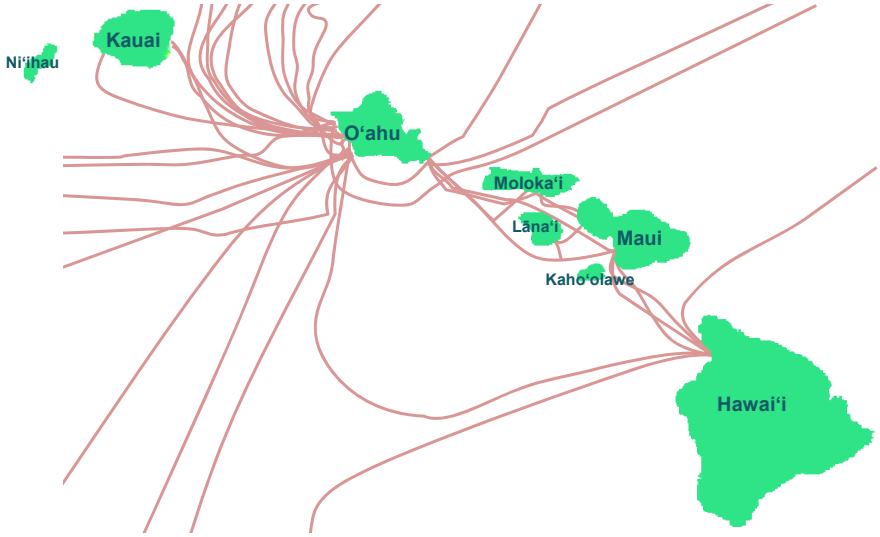
In 1881, Hawaii's King David Kalakaua discussed with Thomas Edison the possibility of transmitting power by submarine cable between the islands.

Proven Technology

High voltage direct current (HVDC) cables: more than 70 projects worldwide. Many undersea.

- **Baltic Cable (Germany - Sweden)**, 155 miles undersea: 500 megawatts (MW) installed in 1994.
- **Basslink (Victoria – Tasmania, Australia)**, 183 miles undersea: 500 MW installed in 2006.
- **BritNed (Britain – Netherlands)**, 162 miles undersea: 1000 MW installed in 2011.
- **Cross Sound Cable (New York - Connecticut)**, 24 miles undersea: 330 MW installed in 2002.
- **Estlink (Estonia - Finland)**, 65 miles undersea: 350 MW installed in 2006.
- **Fenno-Skan (Sweden - Finland)**, 124 miles undersea: 572 MW installed in 1989; 800 MW in 2011.
- **Cross-Channel (UK - France)**, 28 miles undersea: 2000 MW installed in 1986.
- **Gotland (Sweden) (1st commercial HVDC submarine cable)**, 60 mi: 20 MW in 1954; 260 MW in 1987.
- **Hokkaido-Honshu (Japan)**, 27 miles undersea: 150 MW in 1979; 300 MW in 1980; 600 MW in 1993.
- **Inter-Island (New Zealand)**, 26 miles undersea: 700 MW installed in 1965.
- **Italy-Greece**, 75 miles undersea: 500 MW installed in 2001.
- **Jeju Island Cable (Korea)**, 60 miles undersea: 300 MW installed in 1998.
- **Kii Channel (Japan)**, 31 miles undersea: 1400 MW installed in 2000.
- **Kontek (Germany - Denmark)**, 32 miles undersea: 600 MW installed in 1995.
- **Konti-Skan (Sweden - Denmark)**, 54 miles undersea: 300 MW installed in 1988.
- **Leyte - Luzon (Philippines)**, 13 miles undersea: 440 MW installed in 1997.
- **Neptune (US, New York-New Jersey)**, 50 miles undersea: 660 MW installed in 2007.
- **NorNed (Netherlands – Norway) (longest HVDC submarine cable)**, 360 miles: 700 MW in 2008.
- **SACOI (Sardinia-Corsica, Italy-France)**, 75 miles undersea: 300 MW installed in 1967.
- **SAPEI (Italy) (deepest HVDC submarine cable, at 5380 feet)**, 261 miles: 1000 MW installed in 2011.
- **Swepol (Poland and Sweden)**, 152 miles undersea: 600 MW installed in 2000.
- **Trans Bay Cable (US, California)**, 53 miles undersea: 660 MW installed in 2010.

Hawaii's Existing Undersea (Telecom) Cables



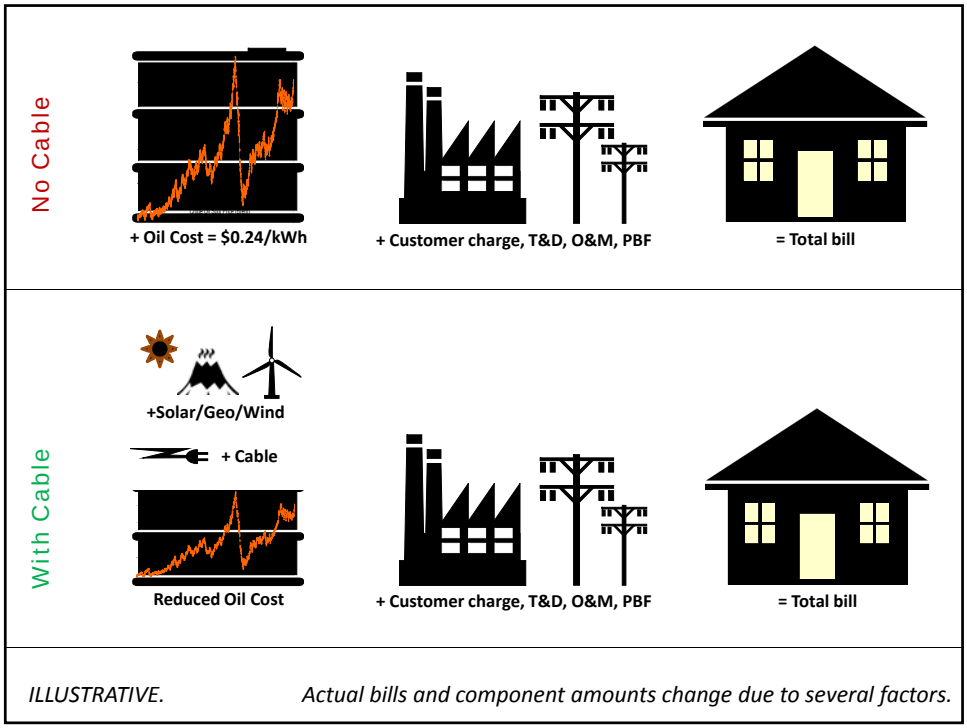
Inter-Island Undersea Power Cable

1. **Legislation (SB 2785)**

   Reduce financing costs for inter-island undersea power cables by having a clear regulatory structure in place.

2. **Programmatic EIS**
   - Analyzes the environmental impacts associated with the development and implementation of a broad program with several parts.
   - Describes best management practices and mitigation measures for the program.
   - In addition to environmental reviews that will be conducted for each project.
   - Project-level reviews may reference and be informed by (i.e. tier off from) a programmatic EIS.

3. **HECO RFP**
   - 200 MW Intermittent, may include cable
   - Based on PUC order
   - Firm power RFP (300 MW) and geothermal RFPs being issued separately



ILLUSTRATIVE. *Actual bills and component amounts change due to several factors.*

Electricity

- **Energy Efficiency**
- **Customer-Sited Generation**
- **Renewable Resources**
  - Solar
  - Wind
  - Biomass / Biofuels
  - Geothermal
  - Hydropower
  - Ocean (OTEC & Wave)
- **Energy Storage**
- **Smart Grids**
- **Inter-Island Cable**
- **Regulatory Changes**
  - Delinking – from oil price
  - Decoupling revenues & sales
  - Customer Sited Generation
- **Diversified Fossil**

Transportation

- **Land Use** (Reduce Need to Travel)
- **Transportation System**
  - Congestion Reduction
  - Alternative Modes
- **Vehicle Efficiency**
- **Alternative Fuel Vehicles**
  - Electric, Plug in Hybrid
  - Biofuels, Hydrogen, Natural Gas
- **Fuels & Infrastructure**
  - Liquid Fuels
    - Ethanol, Renewable Gasoline
    - Biodiesel, Renewable Diesel
    - Biojet
  - Gaseous Fuels
    - Hydrogen, Natural Gas
  - Electric Vehicle Charging

Mahalo

The Future is Bright

Building a clean energy economy for Hawaii

energy.hawaii.gov

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