

The Future is Bright

Creating a Clean Energy Economy

20th Annual Conservation Conference
Hawaii Conservation Alliance
August 1, 2012

Mark B. Glick, Administrator
Hawaii State Energy Office



Overview

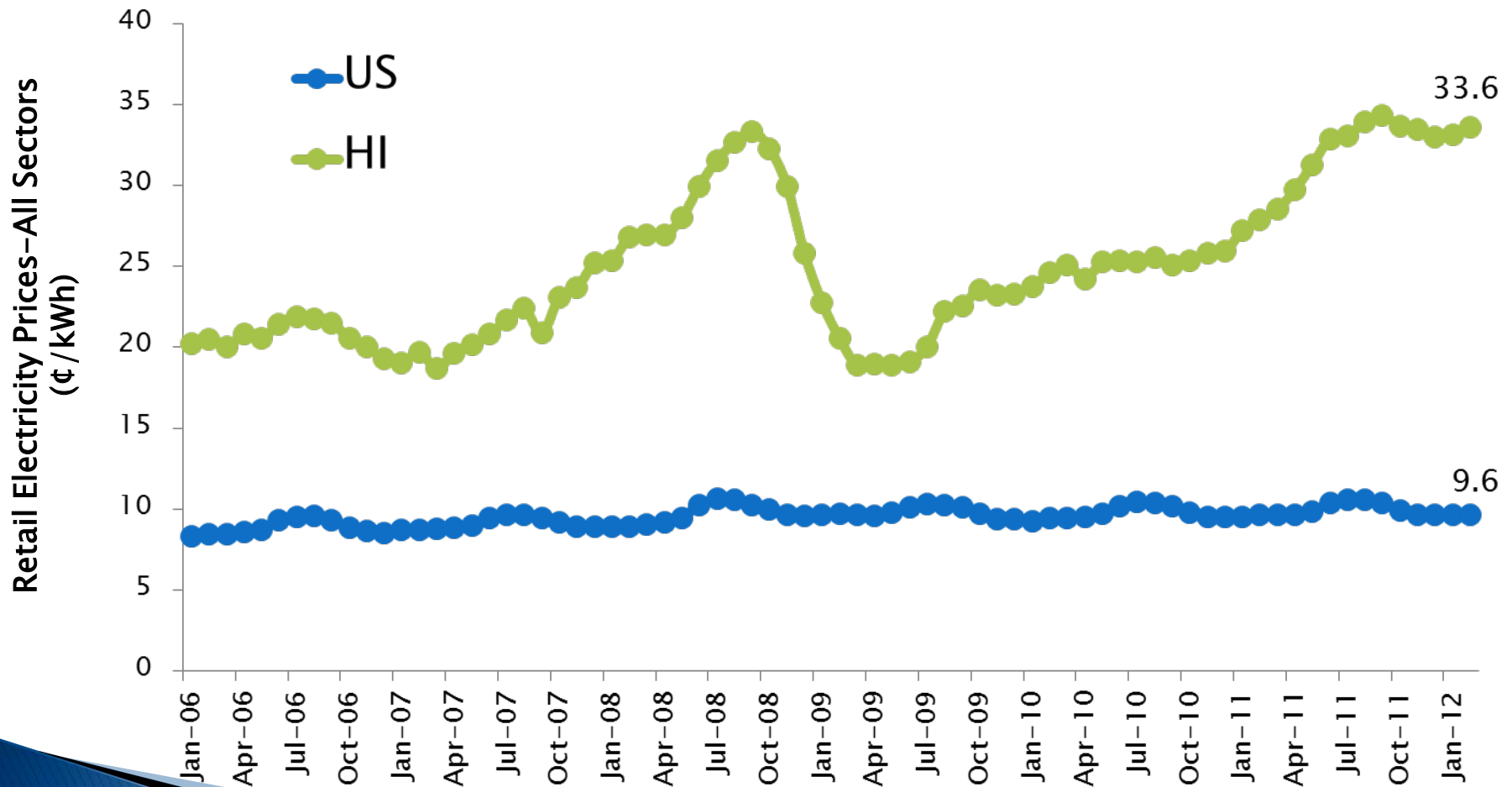
- State Energy Office purpose & role
- Clean energy as an economic development strategy for Hawaii

Most Isolated Population Center on Earth



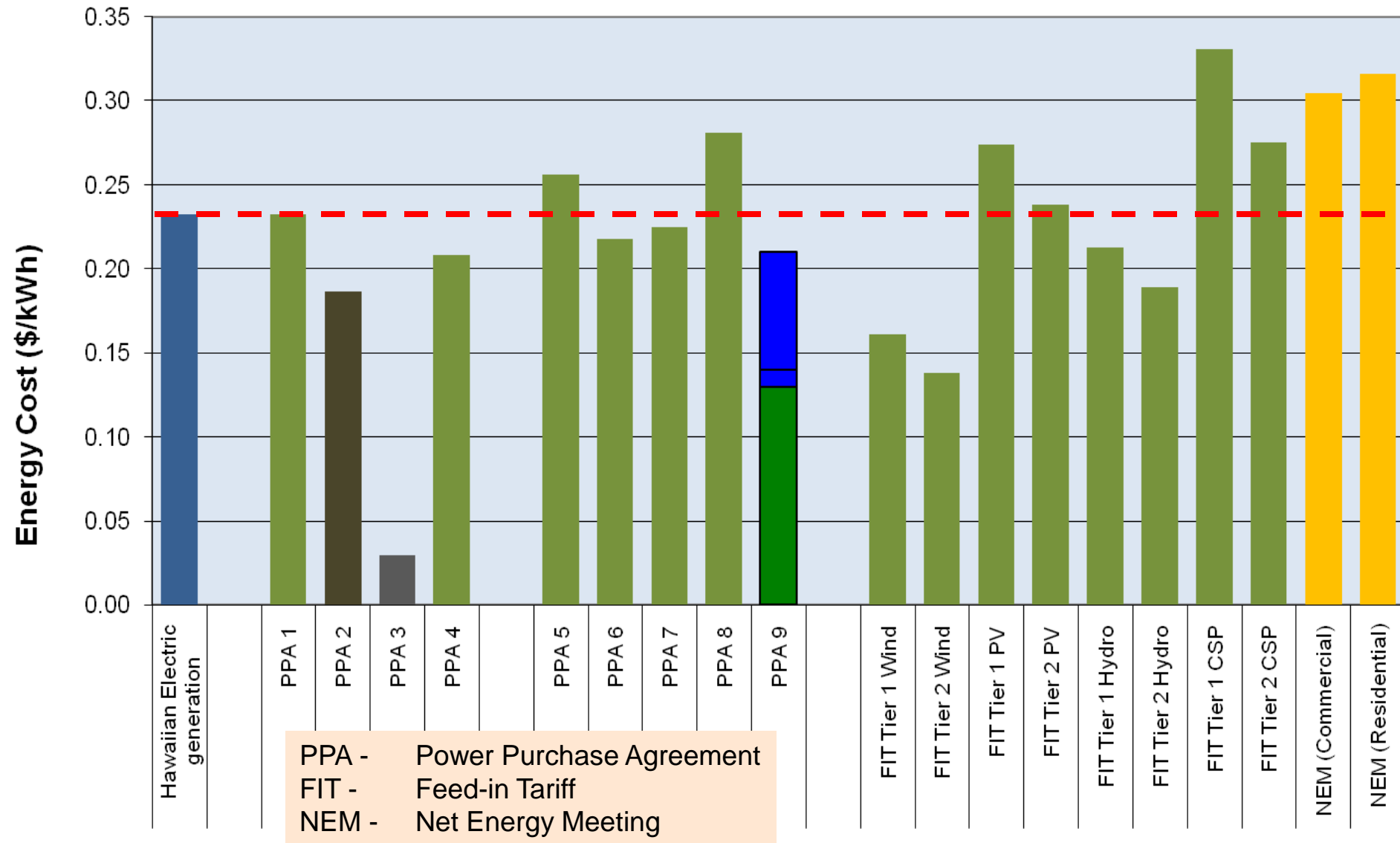
US vs Hawaii Electricity Prices

State electricity prices are currently approximately 22 cents higher than US average



Oahu Energy Cost

Fuel oil at \$132/BBL



Energy Administrator Background

7-years at Office of Hawaiian Affairs

- Office of Board Services
- Economic Development

3 terms as Chair of Sierra Club Hawaii
Chapter Executive Committee

- Lifetime Member

Carrots & Sticks

LAWS & REGS

- RPS & EEPS Goals codified as law
- FIT, Net Metering, Decoupling, RSWG
- Transportation Goals

INCENTIVES & TTA

- Tax Credits
- Public Benefits Fee Administrator
- US Dept. of Energy – formula grants, ARRA, technical assistance

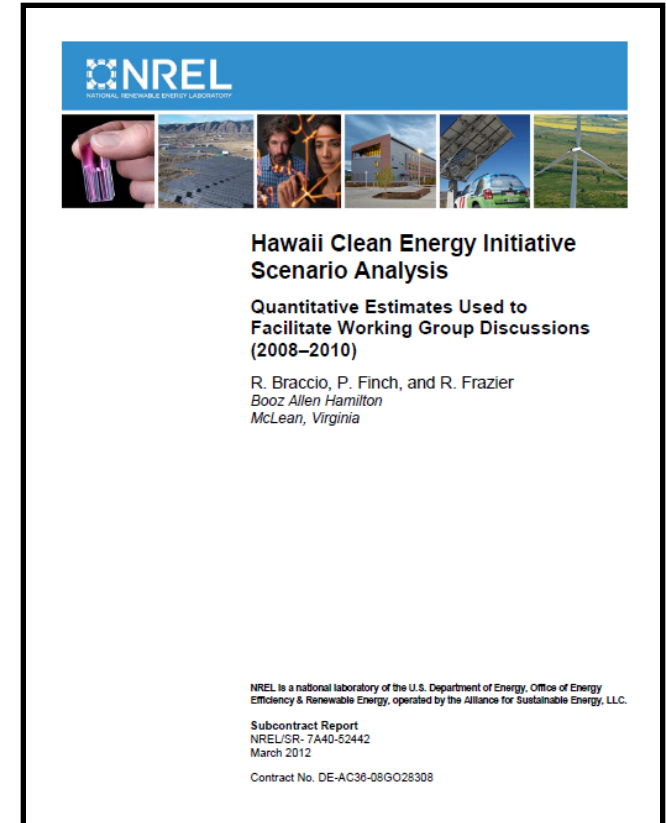
Hawaii Clean Energy Initiative Scenario Analysis

Scenario Analysis 2008–2009

- US DOE effort with input from Hawaiian energy stakeholders and US DOE National Labs.
- Techno-economic evaluation of clean energy alternatives.
- Strategies added to HCEI Roadmap.

Scenario Analysis Updates – 2012

- Updated analysis based on latest RE technology and market information.
- Incorporate several new scenarios.
- To be updated routinely.



Scenario Installation & Capital Requirements

Assumes \$16 billion NPV CAPEX & “break-even” when oil is \$65 to \$85 per barrel (bbl).

Renewable Energy Sources (\$ / kWh)	Scenario 8	Capital Cost Range
Solid Biomass	83 MW	\$2,000 – \$6,000
Wind	1,060 MW	\$2,400 – \$2,800
Geothermal	102 MW	\$3,000 – \$5,000
Small Hydro	24 MW	\$2,500 – \$4,000
Solar – Residential Roofs	179 MW	\$8,125 – \$9,375
Solar PV (large roof/utility scale)	651 MW	\$6,500 – \$7,500
MSW/Landfill Gas	77 MW	\$2,100 – \$3,500
Ocean Energy (wave)	53 MW	\$2,000 – \$7,600
Energy Efficiency	495 MW	\$70 – \$100

A Focused Strategic Plan

Mission:

Deploy clean energy infrastructure as a catalyst for economic growth, innovation, and test bed investments.

Strategies & Tactics: FOCUS

On high-impact clean energy solutions that maximize economic development, especially in innovation sector ...

- Identify clean energy RD&D opportunities and promote business development for local companies.
- Concentrate on implementing high-impact clean energy solutions for near term and midterm.
- Improve core competencies in economic development, quantitative analysis, and communication.

Smart Grid: A Promising Innovation

❖ Benefits

- Allows for increased renewable energy penetration
- Demand response/load shedding reduces the need for spinning reserves
 - Reduces the amount of oil imported
- Allows for quicker voltage balancing → Increases grid reliability

❖ Strong Market Potential

- \$3.4 billion in recent DOE grants for smart grid projects & grid upgrades

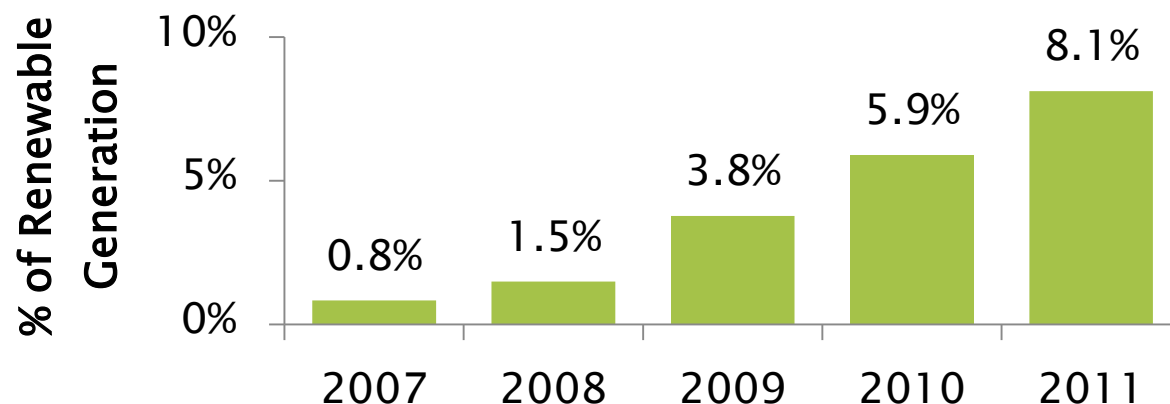
Peak Electricity Demand and Total Generation Capacity

	Oahu	Hawaii	Maui	Lanai	Molokai	Kauai
Total Capacity (MW)	1672	270	261	9.3	11.8	128
Statewide Capacity (%)	71.1%	11.5%	11.1%	0.4%	0.5%	5.4%
Net peak demand (MW)	1216	203	204	5.4	6.3	78
Total Reserves (MW)	456	67	57	3.9	5.5	50

Solar: Shining Bright in Hawaii

Solar industry growing at rapid rate as a result of incentives and component price drops.

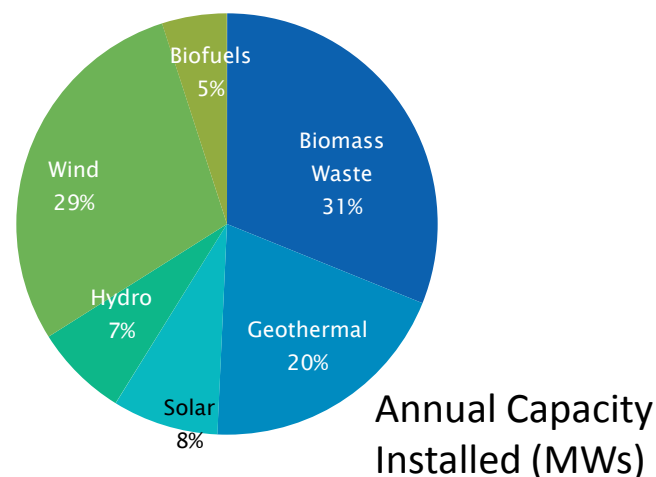
Solar generation increased from less than 1% of total renewable generation in 2007 to more than 8% in 2011. Solar generation is approximately 1% of total electricity generation.



Source: 2007–2011 Annual RPS Reports, PUC

Cost per watt for PV installation has dropped by half in the past decade.

Estimated Cost \$/Watt Installed	2002	2012	%Δ
Residential PV	\$ 10.60	\$ 5.50	–48%
Commercial PV	\$ 8.82	\$ 3.75	–57%



Wind: Advancing

❖ Existing and Under Development Projects

- Wind currently makes up 31% of total renewable generating capacity.
- 2012 will see the addition of 3 new wind farms, totaling over 100 Mw of new capacity doubling Hawaii's installed capacity.

❖ Challenges of Wind In Hawaii

- Small non-interconnected electrical grids make adding additional intermittent generating capacity harder and more expensive than traditional generators.
- Limited land, cultural and social issues are challenging.
- Hawaii's endangered birds and plants complicate siting a wind farm.

❖ Solutions

- Undersea cable linking electricity grids will make adding more intermittent wind easier as well as bring the outer island resources to the load center on Oahu.
- Increased battery storage and greater EV use can stabilize local grids.
- Habitat conservation banks will reduce the cost of mitigating for incidental endangered species takes.

Biofuels: Obstacles Remain

- ❖ **Shares of total fuel use:** transportation (ground + marine=33%, aviation=32%), electricity (35%)
- ❖ **Higher prices in Hawaii:**
 - Fuels (+30%), co-products (+200%), electricity (+300%), gas (+500%)
- ❖ **High productivity:** Average 22 dry tons/acre/year; 45 tons possible
- ❖ **Year-round growing season:** 3+ crops per year
- ❖ **Major land owners invested:** HC&S = 35k acres; HBE = 141k; Fed; State...
- ❖ **U.S. intellectual property protection**
- ❖ **Agricultural expertise**
 - Highly skilled crop scientists, geneticists (UH-CTAHR, HARC ...)
 - BASF, Dow AgroSciences, Monsanto, Pioneer Hi-Bred, Syngenta
- ❖ **Long-term purchasing contracts**
 - HECO RFP for up to 215 mg / 20 year
 - DoD RFI for up to 32 mg
- ❖ **Consensus:** Need for secure, accessible fuels and co-products

Geothermal: Enormous Potential

- ❖ **Cheaper** than oil and most other renewable resources
 - LCOE estimated \$0.08–\$0.12 / kWh
- ❖ **Utility Scale** potential only on Big Island and Maui with **potential to provide 74%–210%** of the state's 2030 RPS target if islands were interconnected
- ❖ **Fully commercial & mature industry:** Ormat is industry leader
 - Operates only geothermal power plant in Hawaii (since 1993)
 - 30 MW Puna Geothermal Venture; permitted for 60 MW total
 - 8 MW addition → dispatchable
- ❖ **Local developers:** Innovations Development Group; Moku Power
- ❖ **High upfront costs**
 - Exploration costs as much as 42% of development expenses
 - Production wells cost up to \$10 million each; initial success rate only 25%
 - Estimated 5 year minimum lead time to production
- ❖ **Demand Constraints**
 - Limited need for base load power
 - Resource is greater than island grids can accept

Strategies & Tactics: LEVERAGE

Resources through federal, county and private sector partnerships using HCEI as a key driver ...

- Serve as business systems integrator, resolve project implementation and permitting barriers.
- Advocate for programs, policies and incentives to make clean energy development cost-effective.
- Connect partnerships and resources to develop business opportunities, resolve policy barriers, and technical hurdles.
- Seek federal funding and private investment opportunities.

Interconnection/Reliability Standards

- ❖ **KIUC Proposed Tariff Docket – Doc. No. 2006–0498 (closed 2008)**
 - Created KIUC Tariff 2 Distributed Generation Interconnection Policies and Procedures
- ❖ **Feed-in Tariff – Doc. No. 2008–0273 (open)**
 - Created HECO FIT, Reliability Standards Working Group (RSWG), Tech Supp Group, Tech Review Comm
 - PUC to re-examine FIT Program Fall 2012
- ❖ **Hawaiian Electric Rule 14H – Doc. No. 2010–0015 (open)**
 - Requires IRS review/approval by HECO companies for distribution grids w/ high renewable penetration
 - IRS process streamlined by PUC in 2011
- ❖ **Implementation of Reliability Standards – Doc. No. 2011–0206 (open)**
 - Following FIT, directs HECO to develop standards to reliably integrate high renewable penetration
 - RSWG (Independent Facilitator) to recommend by end of 2012 streamlined interconnection screening processes for HECO
 - Incorporate different KIUC and HECO screening processes
- ❖ **SB2787 (2012)**
 - PUC to (1) develop, adopt, enforce reliability standards and interconnection requirements, (2) contract 3P Hawaii Energy Reliability Administrator, and (3) create electricity reliability surcharge
 - HERA to implement RSWG/IRS docket findings, new interconnection Hawaii Admin Rules likely req'd
- ❖ **Integrated Resource Planning – Doc. No. 2012–0036 (open)**
 - HECO to incorporate scenario planning to capture variations in planning assumptions/forecasts
 - RSWG to ID overlaps between IRS and IRP dockets
 - RSWG to develop recommended list of reliability issues and/or related studies
 - Created Advisory Group to represent interests affected by HECO resource plans

Permitting: Breaking Down Barriers

❖ Legislative Actions (recent)

- Act 97 (2012) – Removes Geothermal Subzone designation, impacts county geothermal resource permit
- Act 217 (2011) – Allows solar on limited B and C agricultural lands (10% or parcel/20 acres)
- HRS 201N (Renewable Energy Facility Siting Process)
 - HSEO developing REFSP to assist projects responding to HECO 200MW RFP

❖ Regulatory/Policy Actions

- Ongoing HSEO consultation and coordination w/ agencies, developers, stakeholders
- Priority permit processing for renewable energy projects by all state agencies
- Priority to place renewable energy projects on State-owned lands, can directly negotiate leases w/out RFP
- City & County of Honolulu: 2012/INT-1 (guidance for utility-scale solar installations)
- Maui County: Procedure No. DSA 18.0 (guidance on ground and roof mounted solar/wind)
- Hawaii County: 2012 Ordinance (guidance for alternative energy project permitting)
- Counties developing policies to appropriately assess renewable energy project property taxes

❖ Electronic Processing

- HSEA Online Permitting Wizard (ARRA) – Beta form available, expected completion Summer 2012
 - Creates electronic Permit Plan for individual projects, compliments DRAFT Permitting Guidebook
- DOH ePermitting Portal (ARRA/ESSF) – Beta form available, expected completion Summer 2012
 - DOH/Windsor refining tool after initial public testing period, uploading all DOH permit applications
- DPP Online Building Permits
 - Obtain solar and electric vehicle Building Permits from City and County of Honolulu
- HSEO/Office of Planning GIS for Renewable Energy Resource Mapping – expected completion Winter 2012
 - BEI Consulting to develop GIS to ID energy resource layers and relevant development information
- Electric Vehicle Website/Application – under procurement
 - HSEO developing website/mobile application to identify EV charging stations and relevant information

Strategies & Tactics: REACH

Objectives and maintain strong communication and outreach to key stakeholders and public ...

- Analyze data and results to identify best practices and ensure goals are met.
- Provide access to clean energy data, tools and information online.
- Communicate achievements and provide outreach through mass media, select events and public briefings.

2012 Asia Pacific Clean Energy Summit and Expo

High-level global networking:

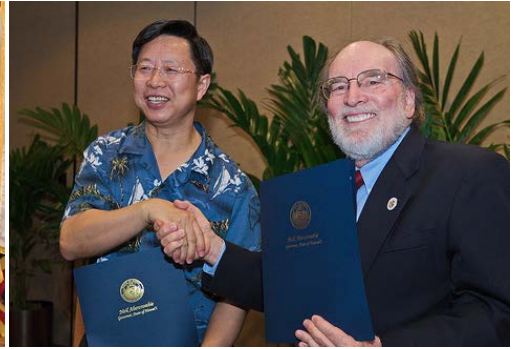
- ❖ Present your technology, initiative or company
- ❖ Find project support from DOD, Hawaii, Korea, Japan, China & Global Partners
- ❖ Participate in Defense Energy Challenge



Building a clean energy economy
AUGUST 13-15, 2012
HONOLULU, HAWAII
HAWAII CONVENTION CENTER
www.asiapacificcleanenergy.com

Energy Office International Agreements

International agreements advance Hawaii's clean energy infrastructure deployment and solidify Hawaii as the clean energy test-bed of the Asia Pacific.



Projects	Japan-US Island Grid Project	Korea Smart Grid Project	Clean Energy Investment and Deployment Program
Description	Smart grid community demo involving Kihei residential and commercial utility customers	Micro smart grid demo and EV sharing program involving Oahu hotels and resorts	Program facilitating Chinese investment and deployment of clean energy projects in Hawaii
Objective	Test Bed of the Asia-Pacific	Test Bed of the Asia-Pacific	Clean Energy Deployment
Partner	NEDO	KSGI	CCPIT
Participating Organizations	Japan <i>Hitachi, Mizuho, CyberDefense</i> Hawaii <i>US DOE & national labs, HECO, MECO, HNEI, MEDB, Maui County</i>	Korea <i>LG Electronics, Nara Controls, Hyundai, Hyosung, KT</i> Hawaii <i>US DOE & national labs, HECO, HNEI, Royal Hawaiian Hotel, Moana Surfrider Hotel</i>	TBD <i>CCPIT will vet and forward companies interested in investing or deploying clean energy projects in Hawaii, DBEDT to facilitate companies</i>
Status	MOU Completed Nov. 2011 <i>Volunteer Recruitment to Begin Shortly</i>	MOU Expected Oct. 2012 <i>Korean Consortium visiting Hawaii in June to negotiate MOU</i>	MOU Expected Aug. 2012 <i>DBEDT completing draft MOU for review</i>

Midterm Goals & Objectives (2015)

Implement HCEI 70% Clean Energy Benchmarks

- Meet 15% Renewable Portfolio Standard (RPS) target.
- Meet 2015 Energy Efficiency Portfolio Standard (EEPS) target.
- Displace 50 Million Gallons/Year of oil in the transportation sector.

Grow Hawaii's Clean Energy Innovation Sector

- Develop clean energy RD&D sector with annual revenues of \$100 M.
- Attract \$100 M in project financing for emerging technologies between 2011 and 2015.
- Add 400 clean energy RD&D jobs between 2011 and 2015.

Expand on Hawaii's Position as a National Clean Energy Leader

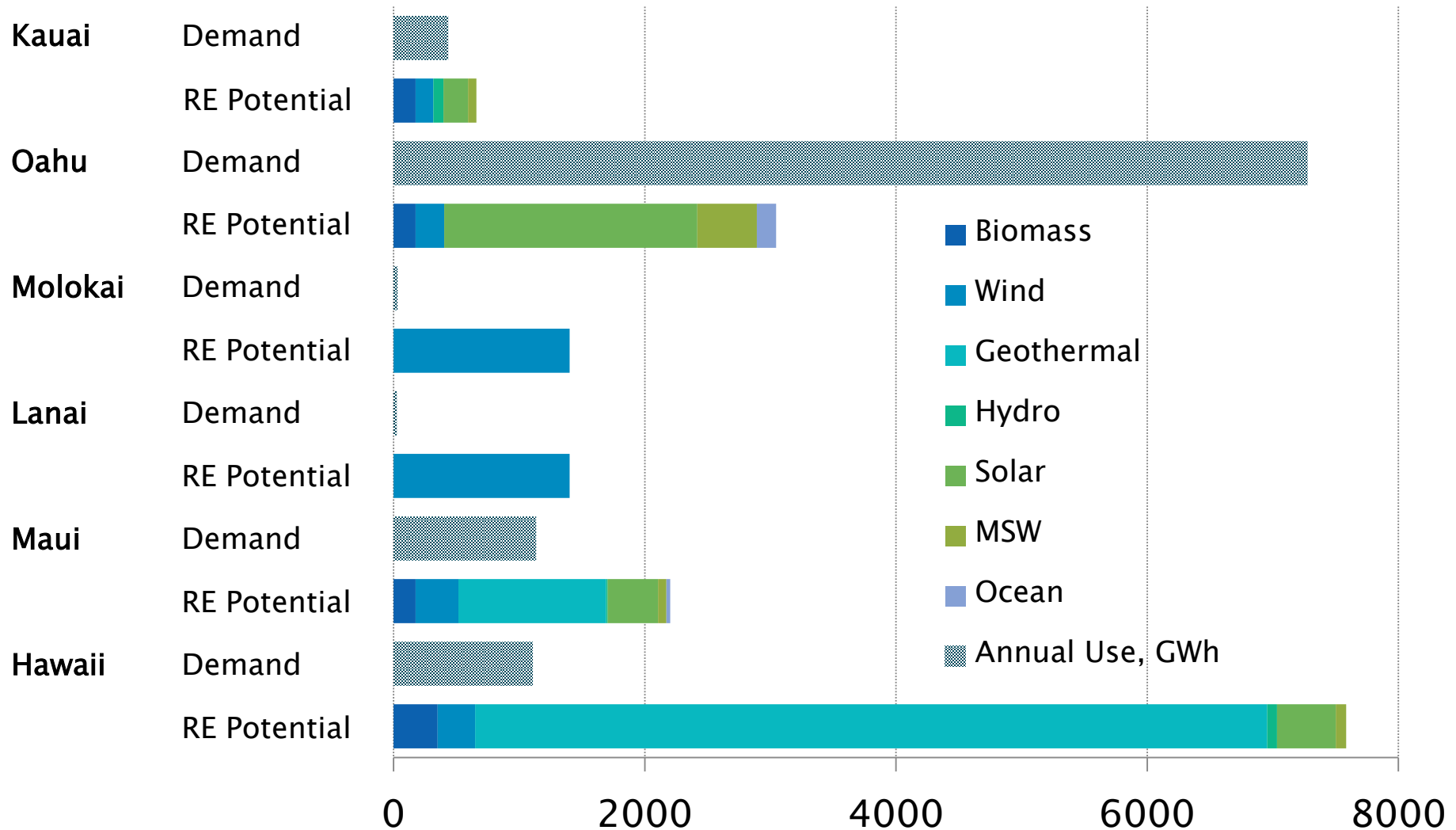
- Maintain top 5 national ranking in renewable energy penetration, performance contracting, and green job growth.
- Receive A rating for net metering and interconnection in national ranking.
- Complete interisland undersea cable project-specific EIS in preparation for permitting and construction.

Short Term Objectives (1 Year)

- Facilitate selection of cable developer.
- Contribute to comprehensive policy on net metering, interconnection and reliability standards.
- Increase federal funding opportunities.
- Serve as online clearinghouse for clean energy information and self-help permitting tools.
- Increase international clean energy trade, investment & RD&D possibilities.

Hawaii Renewable Energy Potential (GWh)

Oahu has the most energy demand, but most renewable energy sources are on the neighbor islands.

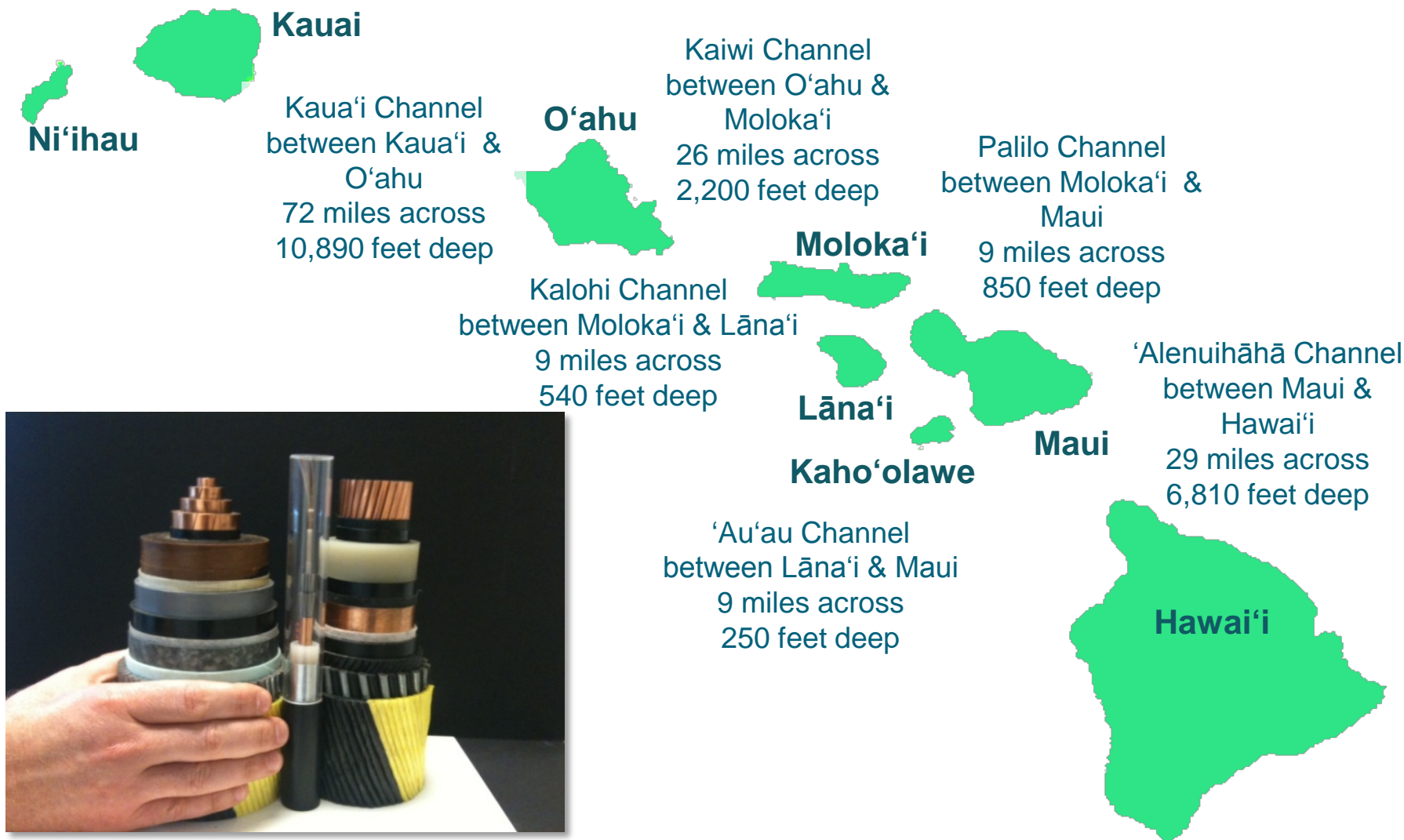


Renewable Resource Abundance by Island (GWh)

	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%	2,822%	2,240%	141%

Integrating Hawaii's Renewable Potential

Interconnection for Grid Reliability & Greater Penetration of RE



Interisland Undersea Power Cable

☒ Legislation (SB 2785)

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

☐ Programmatic EIS

NEW effort, to be led by USDOE (not yet announced)

Broad scope: all energy resources, state-wide

☐ HECO RFP

200 MW Intermittent, includes cable (PUC order from 2011)

Firm power RFP (300 MW) and geothermal RFPs are related

PUC may re-consider 2011 order

Proven Technology

More than 70 High voltage direct current (HVDC) cables in service worldwide

BritNed (Britain – Netherlands)

162 miles undersea: 1000 MW installed in 2011.

Gotland (Sweden) (1st commercial HVDC submarine cable)

60 mi: 20 MW in 1954; 260 MW in 1987..

Inter-Island (New Zealand)

26 miles undersea: 700 MW installed in 1965.

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.

SAPEI (Italy) (deepest HVDC submarine cable, at 5380 feet)

261 miles: 1000 MW installed in 2011.

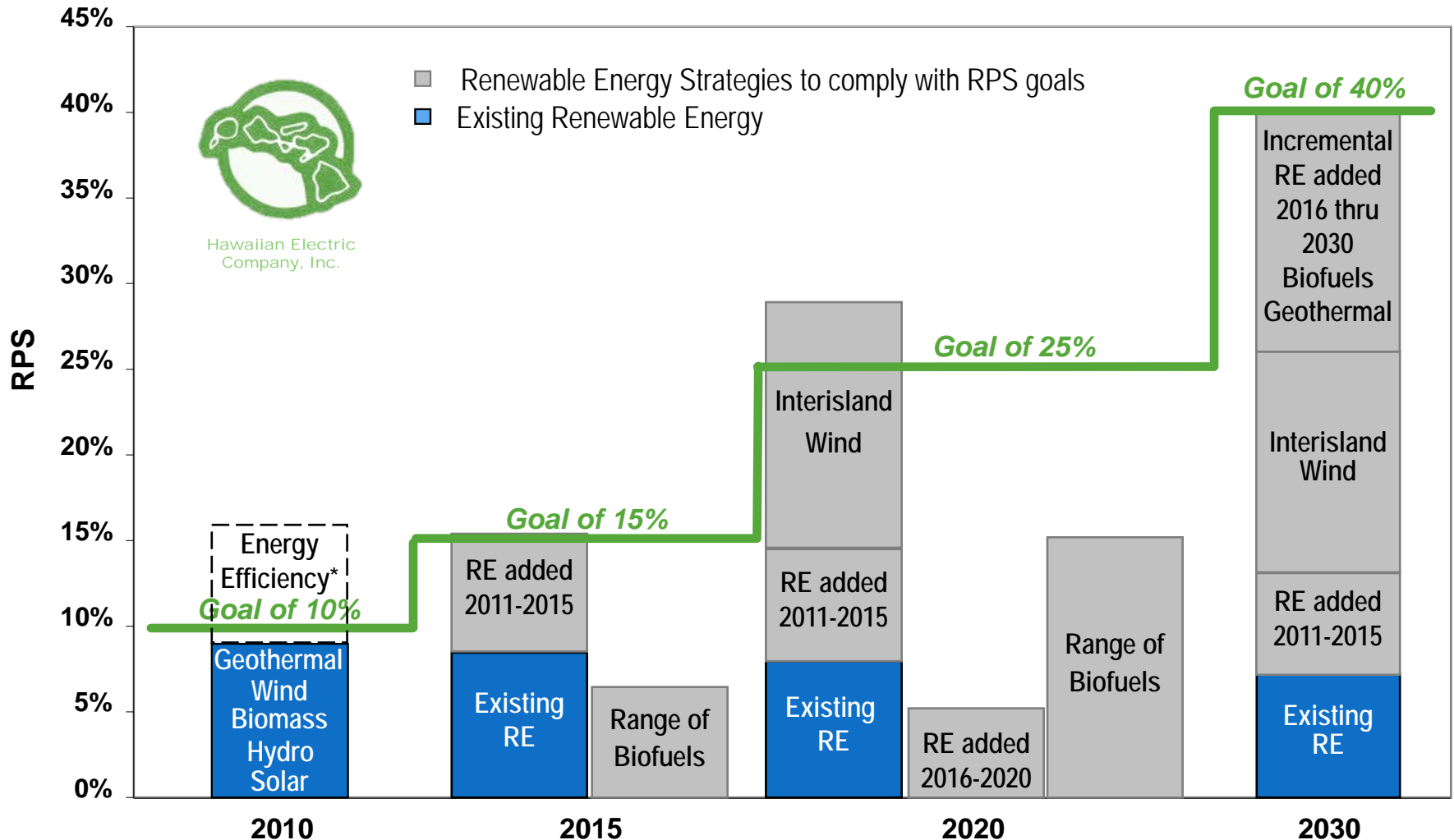
Trans Bay Cable (US, California)

53 miles undersea: 660 MW installed in 2010.

How are we doing?

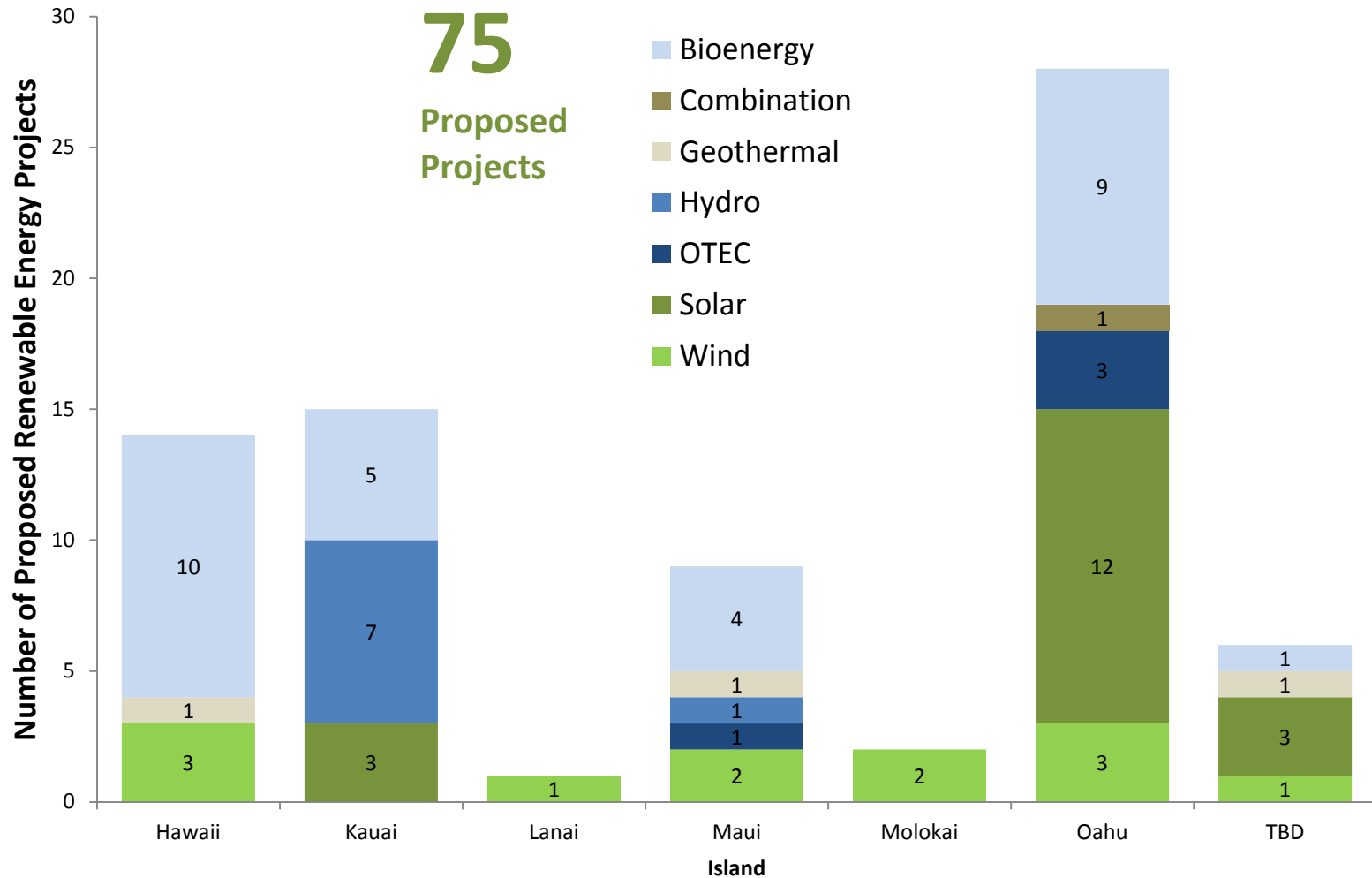
Renewable Energy Vision

On track to meet 2015 targets – Viable Scenarios for the future.



75 Projects under Development

Currently Proposed Renewable Energy Projects in Hawaii

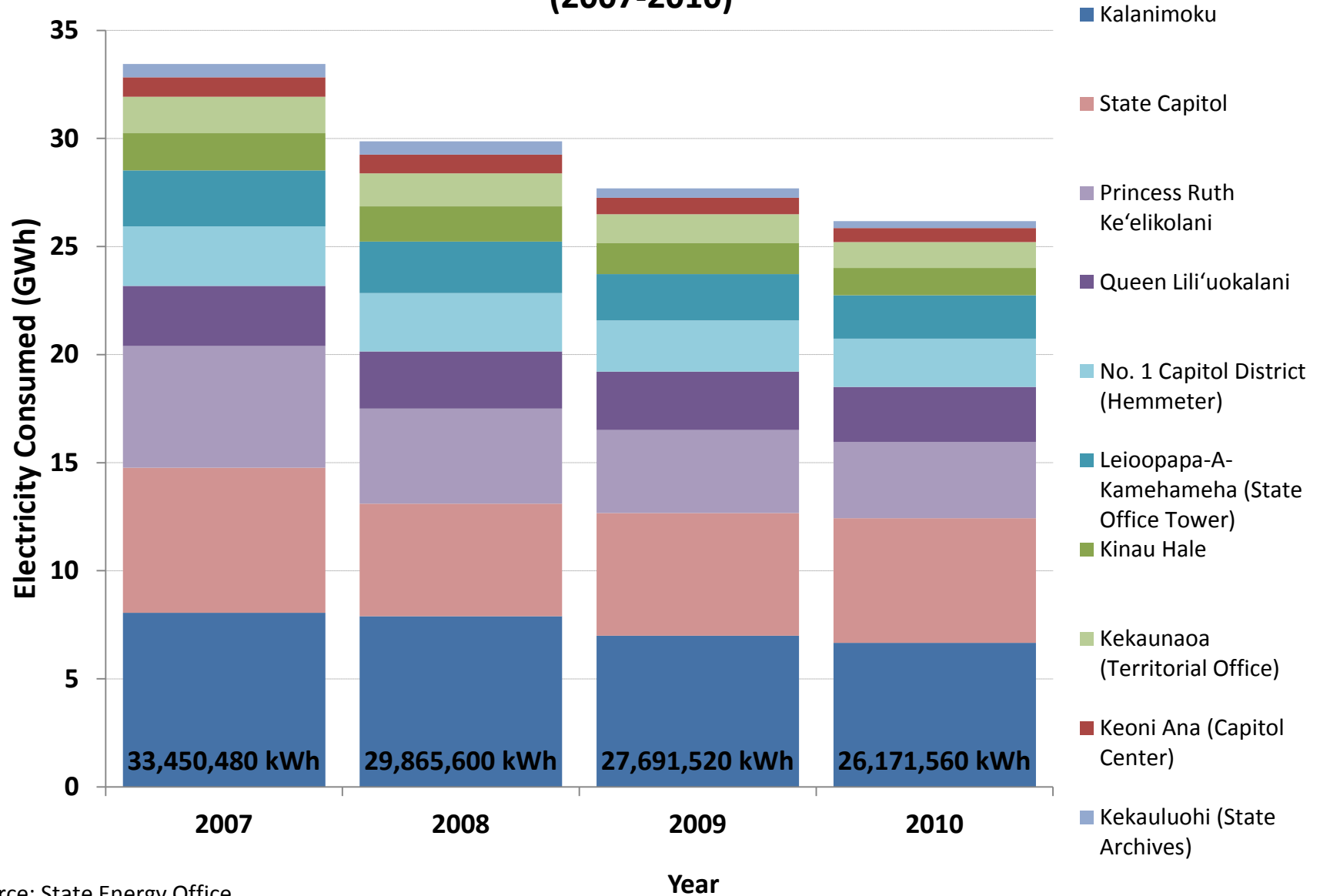


Source: Department of Business, Economic Development and Tourism, December 2011

Power Purchase Agreements at Four Airports Decrease Electricity Costs Nearly 20%



Decreased Electricity Consumption in Lead-By-Example State Buildings (2007-2010)



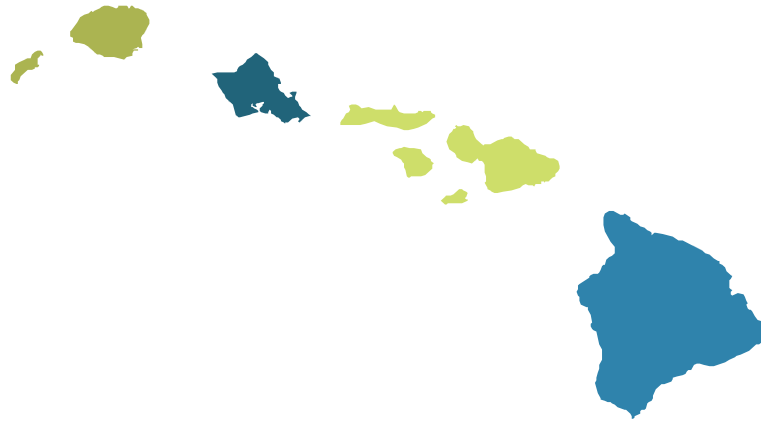
First in Nation Energy Savings Performance Contracting Per Capita

State	Dollars per Capita (\$)	Total Performance Contracting (\$)	Jobs Created (Job Year)
1. Hawaii	\$117.09	\$159,278,011	1,731
2. Kansas	\$90.81	\$259,094,503	2,816
3. Idaho	\$90.27	\$129,000,000	1,402
4. Massachusetts	\$71.53	\$457,696,106	4,975
5. Utah	\$66.89	\$165,195,000	1,796
National Average	\$31.46	\$130,846,670	1,379

Source: *Performance Contracting Impacts - State Comparison*, December 2011 (Energy Services Coalition)

Hawaii Green Jobs

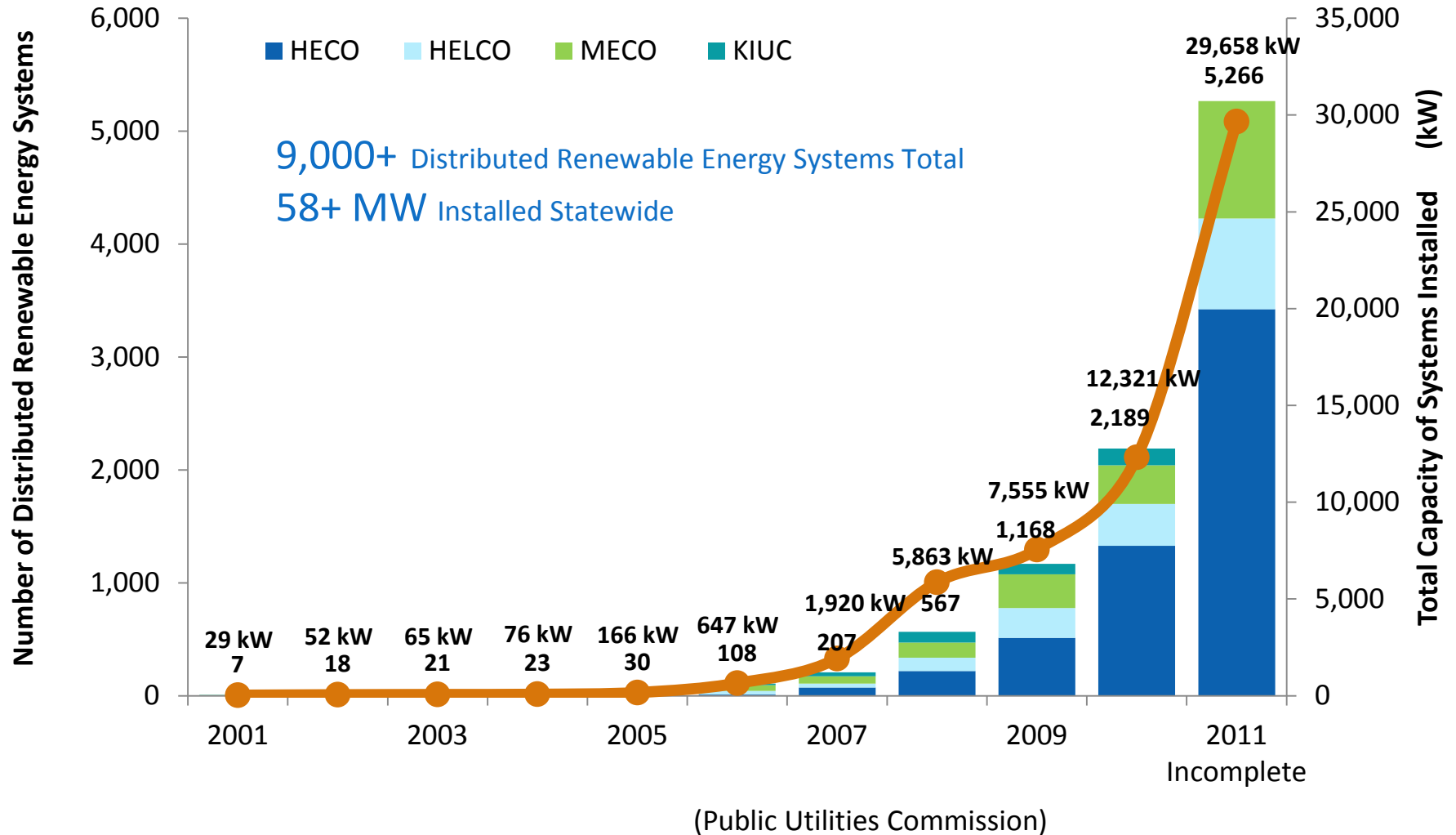
Hawaii is expected to have over 14,000 green jobs by 2012



COUNTY	PRIVATE SECTOR GREEN JOBS	% OF COUNTY JOBS	ADDITIONAL GREEN JOBS BY 2012
Hawaii	1,222	2.5	510
Honolulu	6,866	2.0	1,885
Kauai	460	1.9	71
Maui	2,597	4.6	437
State Total	11,145	2.4	2,903

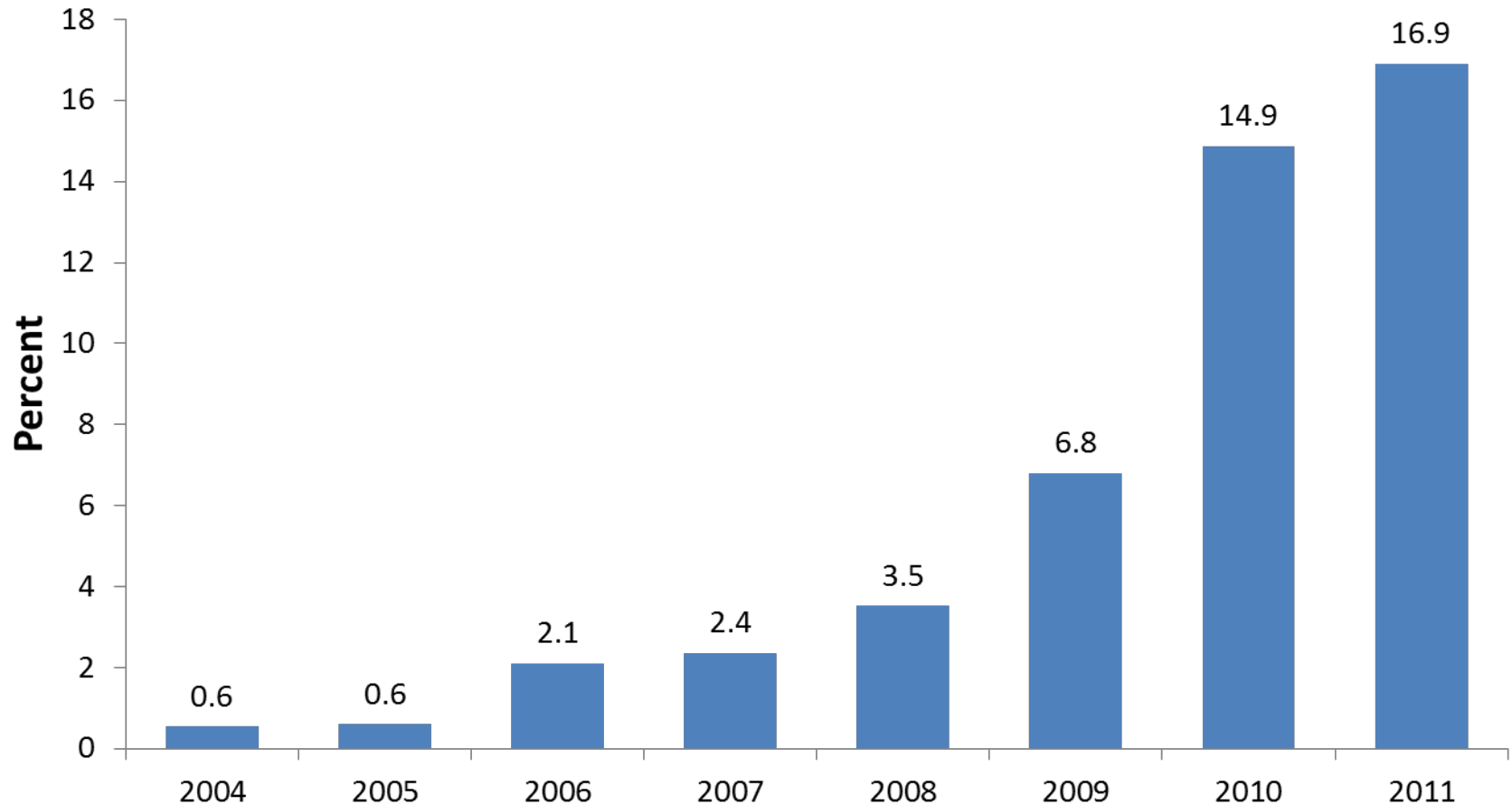
Distributed Renewable Energy Systems

As of 2011, over 9,000 distributed renewable energy systems have been installed statewide, totaling over 58 MW in capacity.



Solar-Related Construction Expenditures

Solar-related construction expenditures reached nearly 17% of total private building permit value in 2011



Second in the Nation
Cumulative Installed Photovoltaic Capacity per Capita

State	Cumulative Through 2010 (W _{DC} /person)	2010 Installations (W _{DC} /person)
1. Nevada	38.8	25.3
2. Hawaii	32.9	13.6
3. New Jersey	29.6	15.1
4. California	27.4	6.8
5. Colorado	24.1	12.3
National Average	7.0	2.9

Source: 2010 U.S. Solar Market Trends, July 2011 (IREC)

Mahalo

Visit **energy.hawaii.gov** for a more comprehensive look
at Hawaii's clean energy future.