Assessment of the State of Hawaii's Ability to Achieve 2010 Renewable Portfolio Standards

Final Report

Deliverable under Task 4

Prepared for

State of Hawaii
Public Utilities Commission

by

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Executive Summary

Pursuant to Hawaii Revised Statutes (HRS) § 269-95, the University of Hawaii, Hawaii Natural Energy Institute (HNEI) assessed the capability and likelihood of the electric utility companies in the state - Hawaiian Electric Company, Inc. (HECO), Hawaii Electric Light Company, Inc. (HELCO), Maui Electric Company, Ltd. (MECO) (collectively, HECO Companies or HECO Utilities), and Kauai Island Utility Cooperative (KIUC) - to achieve the 2010 Renewable Portfolio Standard (RPS) in a cost-effective manner.

This report was developed to serve as the deliverable under Task 4 as part of the "Assessment of Renewable Portfolio Standard Goals" conducted by HNEI for the Hawaii Public Utilities Commission (PUC or Commission). In conducting this analysis, HNEI reviewed and evaluated the most recent integrated resource planning (IRP) documents being developed by the state utilities. The IRP plans are integral for evaluating how the utilities plan to meet obligations under the RPS law. The focus of these analyses was to provide the PUC with an assessment of the status of the state utilities' efforts to meet the first requirement for the RPS – 10% of electricity used in the state from renewable resources in 2010. An assessment of current end use energy efficiency and demand response plans of the utilities was also performed, since up to 50% of the RPS requirements can be met through end use energy efficiency programs.

In addition to the IRP plans, this report drew upon information provided by the utilities in their RPS status reports filed with the PUC. Each utility has filed reports on their performance on an annual basis since 2001 for the HECO Companies and since 2005 for KIUC. The utilities also provided additional information to HNEI as requested to supplement that available from the existing IRP and RPS reports.

The overall probability that the utilities will meet the 2010 RPS goal was assessed by evaluating the uncertainty existing in four areas: electricity demand, implementation of DSM programs, implementation of renewable energy programs, and uncertainty in the availability and performance of renewable energy technologies. Each of these factors can have significant influence over the ability of the utilities to meet the first RPS legislative mandate of 10% renewable energy electricity in the year 2010. The evaluation (and related expert panel comments) noted that ambiguity exists in the definitions under which the state and the utilities must operate. One conclusion from this evaluation is that the issue of clear definitions must be addressed. While this is not an issue for the utilities reaching their required goals in 2010, the ambiguity could impact the future state goals.

The review of existing plans found that, although KIUC and the HECO Companies (HECO, MECO, and HELCO) had different mixes of renewable energy and energy efficiency programs, both have been successful in applying their programs to reduce energy consumption in their respective service territories on a continuing basis. The review of renewable energy development demonstrated that each utility continued to increase the development of the renewable energy resources that were most cost-effective in their respective service territories.

For KIUC, conservative estimates were combined (Table ES-1) to provide an estimate of the probable performance of KIUC in meeting the 2010 RPS of 10% of renewable electrical energy. HNEI's evaluation based on the information available shows that KIUC will most likely exceed the 2010 standard by having an overall RPS generation of 12.0%. Of this total, it is estimated that at least 60% will come from renewable generation, which is 10% above the minimum of 50% that has been set by the Hawaii RPS legislation.

Table ES-1: Probable KIUC 2010 Renewable Portfolio Standard Measure

Year	2008	2009	2010
(1) Renewable Generation (MWh)	32,756	32,756	32,756
(2) Conserved Energy (MWh)	30,746	31,670	32,682
(3) Total Electricity Sales (MWh)	512,613	529,016	545,945
Percent of Renewable Electrical Energy in Total Sales [(1)+(2)]/(3)	12.4%	12.2%	12.0%
Percent of Renewable Generation in 10% Target (1) / [(3) x 0.10]	63.9%	61.9%	60.0%

A similar conservative approach was followed in evaluating probable performance for the HECO Utilities. The HNEI evaluation based on information available shows that the HECO Utilities will most likely exceed the 2010 standard by having an overall RPS generation of 15.7% in 2010 (Table ES-2). Of this total, it is estimated that at least 76% will come from renewable generation, which is 26% above the minimum of 50% that has been set by the Hawaii RPS legislation.

Table ES-2: Probable HECO Utilities 2010 Renewable Portfolio Standard Measure

Year	2008	2009	2010
(1) Renewable Generation (GWh)	808	808	808
(2) Total Electrical Energy Savings (GWh)	759	811	863
(3)Total Electricity Sales (GWh)	10,354	10,500	10,640
Percent of Renewable Electrical Energy in Total Sales [(1)+(2)]/(3)	15.1%	15.4%	15.7%
Percent of Renewable Generation in 10% Target (1) / [(3) x 0.10]	78.0%	77.0%	76.0%

In making these projections, some observations should be noted. Despite current achievements, challenges exist to meeting the ultimate RPS goals of 20% by the year 2020 and more aggressive goals in the future. There are important policy and technology areas that HNEI and the expert panel believe should be addressed as Hawaii moves towards its 2020 goals. These challenges – and recommendations for addressing these challenges - will be reviewed in detail in the next report of this project.

1.0 Introduction

1.1 Project Background and Scope

Under HRS § 269-95 and relevant preceding legislation, HNEI has been charged to:

> Conduct independent studies to be reviewed by a panel of experts.... [to] include findings and recommendations regarding:
>
> (A) The capability of Hawaii's electric utility companies to achieve renewable portfolio standards in a cost-effective manner and shall assess factors such as the impact on consumer rates, utility system reliability and stability, costs and availability of appropriate renewable energy resources and technologies, permitting approvals, effects on the economy, balance of trade, culture, community, environment, land and water, climate change policies, demographics, and other factors deemed appropriate by the commission; and
>
> (B) Projected renewable portfolio standards to be set five and ten years beyond the then current standards.

Pursuant to HRS § 269-95, HNEI assessed the capability and likelihood of the electric utility companies in the state (HECO, HELCO, MECO, and KIUC) to achieve the 2010 RPS in a cost-effective manner.

This report will serve as the deliverable under Task 4 of the project "Assessment of Renewable Portfolio Standard Goals" being conducted by HNEI for the PUC. In conducting this analysis, the report will review and comment upon the existing and on-going IRP documents being developed by the state utilities. The IRP plans are integral for evaluating how the utilities plan to meet obligations under the RPS law. The focus of these analyses will be to provide the PUC with an assessment of the status of the state utilities' efforts to meet the first requirement for the RPS – 10% of electricity used in the state will come from renewable resources in 2010. An assessment of current end use energy efficiency and demand response plans of the utilities will also be performed. This is because up to 50% of the RPS requirements can be met through end use energy efficiency programs.

In addition to the IRP plans, this report will draw upon information provided by the utilities in their RPS status reports filed with the PUC. Each utility has filed reports on an annual basis with reports on performance since 2005 for KIUC and since 2001 for the HECO Utilities. HNEI has also obtained additional information directly from the utilities when additional information was needed to supplement that available from the existing IRP and RPS reports. In conducting this review, the guiding focus was to review current and proposed plans in light of what those plans say about the ability of the utilities to meet the 2010 RPS goal. This is done in recognition of the fact that past and current RPS and IRP planning processes were developed through a statewide collaborative process that included the major stakeholders in Hawaii (i.e., government, private sector, and public interest groups) and was based upon numerous public workshops, formal PUC-led proceedings over many years.

Hawaii has four electric companies. KIUC is a cooperative utility and not associated with other utilities. HECO, HELCO, and MECO are affiliated utilities - the HECO Utilities. By RPS law, affiliated utilities are allowed to aggregate their renewable portfolios in order to achieve the RPS requirement. This report, however, reviews each of the HECO Utilities' performance separately. Each utility has developed its own IRP, and has a separate action plan. By reviewing them separately, it will provide a clearer picture of their performance and their combined abilities to meet the RPS requirement.

The report is composed of 6 chapters. Chapter 1 presents the background and scope of the project. This includes a brief review of the development of the Hawaii RPS, and the Hawaii IRP process. A brief overview of existing RPS activities in other states is also provided in order to illustrate the range of activities that can be covered under an RPS. Chapters 2 to 5 present the reviews of each utility's RPS performance. Chapter 6 is the combined analysis of the probability that KIUC and the HECO Utilities can achieve the RPS with their current or proposed set of plans.

1.2 Hawaii's Energy Objectives

About 90% of Hawaii's energy comes from crude oil and petroleum imports. Disruptions in the world oil market have considerable impact on Hawaii's economy. Also, Hawaii utilities do not have interconnections with utilities in other states and cannot rely on utilities from other states to provide back-up power to them when needed. Development of IRP and RPS are thus important for Hawaii in an effort to reduce oil imports, increase diversity of energy sources and provide reliable electricity to end users.

The State of Hawaii has adopted four statutory energy objectives: (1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people; (2) Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased; (3) Greater energy security in the face of threats to Hawaii's energy supplies and systems; and (4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.[1] The use of renewable energy satisfies the State's statutory energy objectives provided the availability of resources and the cost effectiveness of the technologies increase the dependability of statewide energy systems.

Renewable energy resources available in Hawaii include hydro, geothermal, wind, solar, biomass, ocean thermal and wave resources. Costs of ocean energy technologies remain relatively high. Other resources such as wind and solar are not dispatchable by the utility to meet peak load, and thus backup generation or energy storage is needed to ensure availability of power on demand.

1.3 Hawaii's Renewable Portfolio Standard

The RPS was enacted into law in Hawaii in 2001 (Act 272). The RPS law establishes the percentage of electricity sales that should come from renewable energy sources. It established the goal of 7% of electricity sales from renewable energy sources by December 31, 2003, 8% by December 31, 2005, and 9% by December 31, 2010. In 2004, the Hawaii State Legislature revised

[1] HRS § 226-18(a).

the State's RPS law by increasing the RPS goals. Specifically, Act 95, Session Laws of Hawaii 2004 stated that each electric utility company that sells electricity for consumption in Hawaii shall establish a renewable energy portfolio standard of 10% of its net electricity sales by December 31, 2010; 15% by December 31, 2015; and 20% by December 31, 2020. The RPS law allows an electric utility company and its electric utility affiliates to aggregate their renewable portfolios in order to achieve the RPS.

Act 162, Session Laws of Hawaii 2006 also stated that the PUC may establish standards for each utility that prescribe what portion of the RPS shall be met by specific types of renewable electrical energy resources; provided that (1) at least 50% of the RPS shall be met by electrical energy generated using renewable energy as the source, (2) where electrical energy is generated or displaced by a combination of renewable and nonrenewable means, the proportion attributable to the renewable means shall be credited as renewable energy; and (3) where fossil and renewable fuels are co-fired in the same generating unit, the unit shall be considered to generate renewable electrical energy (electricity) in direct proportion to the percentage of the total heat value represented by the heat value of the renewable fuels. HRS § 269-91, as amended by Act 162, specifically states that "Renewable portfolio standard" means the percentage of energy sales that is represented by "Renewable electrical energy". The term is further defined in HRS § 269-91 as:

"Renewable electrical energy" includes:

(1) Electrical energy generated using renewable energy as the source;
(2) Electrical energy savings brought about by the use of renewable displacement or off-set technologies, including solar water heating, seawater air-conditioning district cooling systems, solar air-conditioning, and customer-sited, grid connected renewable energy systems; or
(3) Electrical energy savings brought about by the use of energy efficiency technologies, including heat pump water heating, ice storage, ratepayer-funded energy efficiency programs, and use of rejected heat from co-generation and combined heat and power systems, excluding fossil-fueled qualifying facilities that sell electricity to electric utility companies and central station power projects.

"Renewable energy" means energy generated or produced utilizing the following sources:

(1) Wind;
(2) Sun;
(3) Falling water;
(4) Biogas (including landfill and sewage-based digester gas);
(5) Geothermal;
(6) Ocean water, currents and waves;
(7) Biomass (including biomass crops, agricultural and animal residues and wastes, and municipal solid waste);
(8) Biofuels; and
(9) Hydrogen produced from renewable energy sources.

A utility failing to meet the RPS is subject to penalties to be established by the PUC unless the PUC determines that the utility is unable to meet the RPS due to reasons beyond the reasonable control of the utility (e.g., natural disasters, labor strikes or lockouts, mechanical or resource

failure, etc.) The PUC has the option to either grant a waiver from the RPS or an extension for meeting the prescribed RPS.

1.4 Renewable Energy Portfolio Standards in the United States

Presently a total of 33 states are implementing RPS of various types and definitions (see Table 1.1). The targets of RPS are different in each state, for example, varying from 8% (in Illinois) to 25% (in New York) by 2013. Some states have set a target of using any combined qualified renewable energy resources to meet their RPS while other states have separated qualified renewable energy resources into different classes (or tiers) and set a certain target for each resource class to be utilized to meet the RPS. Wind, photovoltaics (PV), biomass, hydroelectric, and landfill gas are the most common renewables that are qualified in the RPS of most states. Geothermal is also widely included in states' RPS. In general, the qualified geothermal utilization is geothermal for electricity production. Arizona and Hawaii, however, have allowed both geothermal electric and geothermal heat pumps, and Nevada has included geothermal electric and geothermal hot water district heating systems, in their RPS. Most states clearly stated that fuel cells must use renewable energy fuels to be qualified in their RPS. However, Connecticut, the District of Columbia, Maine, New York and Pennsylvania accounted for any fuel cells (using renewable or non-renewable fuels) in their RPS. Several states —including Colorado,[2] Connecticut, Hawaii, Illinois, Nevada, North Carolina, Pennsylvania, and Vermont—have also allowed energy efficiency technologies to be counted as part of their RPS.

Pennsylvania is implementing an "Alternative Energy Portfolio Standard" (AEPS) instead of RPS, and established two categories of energy sources. Tier I sources include (new and existing) PV energy, solar-thermal energy, wind, low-impact hydro, geothermal, biomass, biologically-derived methane gas, coal-mine methane and fuel cells. Tier II sources include (new and existing) waste coal, distributed generation systems, demand-side management (DSM), large-scale hydro, municipal solid waste (MSW), wood pulping and manufacturing byproducts, and integrated gasification combined cycle (IGCC) coal technology. The AEPS calls for utilities to generate 8% of their electricity by using Tier I energy sources, and 10% using Tier II sources by May 31, 2021.

[2] Only in Fort Collins.

Table 1.1: Renewable Energy Portfolio Standards in the U.S.

States	Wind	PV	Solar Thermal	Bio-mass	Geo-thermal	Hydro electric	Fuel Cells	Land fill gas	Tidal/ Ocean	Wave	CHP/ Cogen	Anaerobic digestion	MSW	Bio diesel	Etha-nol	Co firing	Hy-dro gen	Energy Efficiency
Arizona	X	X	X	X	X1/	X	X	X			X	X						
California	X	X	X	X	X	X	X	X	X	X		X	X	X				
Colorado	X	X		X	X	X	X	X				X						X2/
Connecticut	X	X	X	X		X	X	X	X	X	X		X					X
Delaware	X	X	X	X	X	X	X	X	X	X		X						
District of Columbia	X	X	X	X	X	X	X	X	X	X			X			X		
Florida	X	X		X				X					X					
Hawaii	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**
Illinois	X	X	X	X		X		X						X				X
Iowa	X	X		X		X		X				X	X					
Maine	X	X	X	X	X	X	X	X	X		X		X					
Maryland	X	X	X	X	X	X	X	X	X	X		X	X					
Massachusetts	X	X	X	X			X	X	X	X								
Michigan	X	X		X		X		X										
Minnesota	X	X	X	X		X		X				X	X			X	X	
Missouri	X	X	X	X	X	X		X										
Montana	X	X	X	X	X	X	X	X				X						
Nevada	X	X	X	X	X3/	X	X	X	X			X	X	X				X
New Hampshire	X	X	X	X	X	X		X	X	X		X		X	X		X	
New Jersey	X	X	X	X	X	X	X	X	X	X		X						
New Mexico	X	X	X	X	X	X	X	X				X						
New York	X	X		X		X	X	X	X	X		X		X	X			
North Carolina	X	X	X	X	X	X		X	X	X		X					X	X
North Dakota	X	X	X	X	X	X		X									X	
Oregon	X	X	X	X	X	X		X	X	X		X					X	
Pennsylvania4/	X	X	X	X	X	X	X	X	X		X	X	X					X
Rhode Island	X	X		X	X	X	X	X	X	X		X		X				
South Dakota	X	X	X	X	X	X		X				X	X				X	
Texas	X	X	X	X	X	X		X	X	X								
Vermont	X	X	X	X		X	X	X				X						X
Virginia	X	X	X	X	X	X			X	X		X	X					
Washington	X	X	X	X	X	X		X	X	X		X		X				
Wisconsin	X	X	X	X	X	X	X	X	X	X								

Notes: 1/Includes both geothermal electric and geothermal heat pump
2/Energy efficiency is included only in the RPS of Fort Collins and is not applied to other cities in Colorado.
3/Includes geothermal electric and geothermal hot water district heating systems
4/Pennsylvania called it "Alternative Energy Portfolio Standards" and included "waste coal, coal mine methane, coal gasification, and other distributed generation technologies.

Source: Database of State Incentives for Renewable & Efficiency, see www.dsireusa.org

Other qualified renewable energy resources in states' RPS (in addition to the ones shown in Table 1.1) include low E renewables[3](Connecticut), recycled energy[4] (Colorado), electricity produced from waste heat (North Dakota and South Dakota), waste tires using microwave reduction (Nevada), methanol (New York and Hawaii), seawater air conditioning (AC) (Hawaii), solar AC (Hawaii), and electricity generated by resource-recovery facilities (New Jersey).

1.5 Integrated Resource Planning in Hawaii

All utilities in the State of Hawaii are required by law to develop an Integrated Resource Plan. In 1992, the PUC developed "A Framework for Integrated Resource Planning" as a guideline for utilities to use in developing their plans. In the IRP process, utilities are required to forecast future demand for electric power and analyze supply options to meet that demand in an efficient and reliable manner, and at the lowest reasonable cost. The IRP Framework was established in Decision and Order No. 11523, filed on March 12, 1992, as amended by Decision and Order No. 11630, filed on May 22, 1992, in Docket No. 6617. Decision and Order No, 22490 that was filed on May 26, 2006, in Docket No. 05-0075, further modified the framework.

The IRP Framework stated the goal of IRP, governing principles and responsibilities of related parties (including utilities, the PUC, and the Department of Commerce and Consumer Affairs, Division of Consumer Advocacy (Consumer Advocate)). Among other things, the IRP Framework also stated cost recovery mechanisms of the utility's IRP and implementing pilot and full-scale DSM programs.

The goal of IRP is the identification of the resources or the mix of resources for meeting near and long-term consumer energy needs in an efficient and reliable manner at the lowest reasonable cost. While the utilization of renewable energy is not explicitly encouraged in the original IRP Framework, the utilities are now including significant renewable energy as a scenario option in current IRP plans.

The IRP Framework stated that each utility is responsible for developing a plan for meeting the energy needs of its customers, and coordinating with state and county environmental, health, and safety laws and formally adopted state and county plans. The planning period for an IRP is 20 years, beginning on January 1 following the completion of the plan (unless otherwise ordered by the PUC). The utility has to provide program plans that are scheduled for implementation over a five-year period. In addition, the

[3]Low E (emission) advanced renewable energy conversion technology. The Connecticut Department of Public Utility Control can designate a novel energy production technology to this category. An example is the Differential Pressure Generator (DPS), developed by RETX which recycles energy that is otherwise lost during natural gas transmission and distribution.

[4]Recycled energy is defined as "energy produced by a generation unit with a nameplate capacity of not more than 15 MW that converts the otherwise lost energy from the heat from exhaust stacks or pipes for electricity and that does not combust additional fossil fuel."

utility must annually examine and evaluate its achievements in attaining its objectives, and submit an annual IRP update to the PUC in the interim years between IRP filings.

Each utility has to conduct a major review of its IRP every three years. In that review, a new 20-year time horizon shall be adopted, the planning process repeated, and the utility's resource programs fully re-analyzed.

The utility has to submit its IRP and program implementation schedule to the PUC for approval at the times specified by the PUC. The PUC will review the utility's IRP, its program implementation schedule and its evaluations, and may approve, reject, or require modifications of the utility's IRP and program implementation schedule. The PUC will determine whether the utility's plan represents a reasonable course for meeting the energy needs of the utility's customers and is in the public interest and consistent with the goals and objectives of IRP. In addition, the PUC will monitor the utility's implementation of its plan.

The utility may revise or amend its IRP or its program implementation schedule at any time as a result of its annual evaluation or change in conditions, circumstances, or assumptions.

Hawaii's IRP is an open public process. Public and governmental agencies participate in the development and in the PUC review of IRPs. The Consumer Advocate has the statutory responsibility to represent, protect, and advance the interest of consumers of utility services. The Consumer Advocate thus has the duty to ensure that the utility's IRP promotes the interests of utility consumers. Public participation is also provided through advisory groups to the utility, public hearings, and interventions in formal proceedings before the PUC. The utility has to form an advisory group comprised of representatives of public and private entities (such as state and county agencies and environmental, cultural, business and community interest groups) from each county in which the utility provides service or conducts utility business to advise the utility in the development of its IRP. Public hearings will also be conducted to secure the input of those members of the public who are not represented by entities constituting advisory groups. In addition, the utility has to make available a copy of the proposed utility plan and the supporting analysis for public review.

1.6 Updates to the Regulatory Framework

Since the State developed the IRP Framework in 1992, there have been several updates to the regulatory framework that impact the implementation of the utilities' RPS. These include the development of a Public Benefits Fund (PBF) and net metering.

1.6.1 Public Benefits Fund

The establishment of a PBF was provided for in HRS § 269-121, which stated that:

> The Public Utilities Commission, by order or rule, may redirect all or a portion of the funds collected through the current demand-side management surcharge by

> Hawaii's electric utilities into a public benefits funds that may be established by the public utilities commission.

The establishment of a PBF administrator, the requirements for the PBF administrator, and the transition from utility DSM programs to the PBF were then provided for in HRS § 269-122 through HRS § 269-124. It is important to note that HRS § 269-124 specifically states that if the Commission establishes a PBF, "the Commission shall develop a transition plan that ensures that utility DSM programs are continued, to the extent practicable, until the transition date."

The Commission then determined in Docket No. 05-0069, Decision and Order No. 23258 (February 13, 2007) that "a non-utility market structure third-party administrator is appropriate for design and implementation of Energy Efficiency programs for the investor-owned electric utilities". In the order, the Commission also set the date of January 1, 2009 (now scheduled for July 1, 2009) to begin the transition to the new non-utility market structure where the DSM programs of the HECO Companies will be administered by non-utility third party administrators. This does not include the utilities' load management programs and solar saver pilot program, which will continue to be administered by the utilities. Under the Non-Utility Market Structure, the PUC will appoint a PBF Administrator to administer DSM Programs. The Commission further stated in Decision and Order No. 23258 that:

> A new Docket shall be opened to select a PBF administrator and to refine details of the new market structure. Until the new market structure is effective, the HECO companies shall continue to be responsible for overseeing their Energy Efficiency programs.
>
> Most recently, in Docket Number 2007-0323 filed on July 2, 2008, the PUC directed HECO to continue administering its DSM programs during the transition period of January 1, 2009-June 30, 2009. The transition to a PBF has the potential to impact the level of energy efficiency for the HECO Companies and therefore the level of RPS in the 2009-2010 timeframe. It is not possible to quantify the impact, if any, of this transition as part of this analysis.

This change will not affect KIUC. The PUC approved KIUC's request to continue its DSM operation under the Utility Market Structure.

1.6.2 Net Metering

Act 272 of the 2001 Hawaii State Legislature makes net energy metering available to eligible customers until the total rated generating capacity of eligible customers equals 0.5 percent of the electric utility's system peak demand. The law states that eligible customers (residential and small commercial customers) who own and operate a solar, wind turbine, biomass or hydroelectric energy generating facility or a hybrid system consisting of two or more of these facilities, with a capacity of not more than 10 kW, shall be credited at the retail rate (of the rate class the customer is normally assigned to) for electrical energy generated by the eligible customer and fed back to the electric grid.

Over a monthly billing period, the difference between the customer-generated electrical energy and the electrical energy supplied through the electric grid is determined. In essence, customers are able to "bank" the renewable energy they generate for later use. Excess kilowatt-hours generated during this period are retained by the utility unless the customer enters into a purchase agreement with the electric utility. The law was updated in 2004 to include renewable systems up to 50 kW and further updated in 2005 to give the Commission the authority to increase the allowable amount of the total rated generating capacity and the individual system capacity. In 2008, the Commission increased the allowable amount of total rated generating capacity to 1.0 percent of the electric utility's system peak demand. The Commission further determined that for HECO, up to 50 percent of the net energy metered systems would be reserved for systems 10 kW or smaller, and for HELCO and MECO, up to 40 percent of the net energy metered system would be reserved for systems 10 kW or smaller. The Commission also increased the allowable system size to 100 kW and provided for future updates of the allowable amounts and system size for net energy metering through the Advisory Group meetings in the utilities' IRP process.

1.6.3 Competitive Bidding

Competitive bidding is a mechanism for acquiring or building new energy generation in Hawaii. The PUC adopted the Framework for Competitive Bidding on December 8, 2006 by Decision and Order No. 22588. The Framework outlines the use and scope of competitive bidding, relationship to IRP, and the request for proposals process, for example, which electric utilities in Hawaii have to follow when acquiring or building new energy generation. Under certain circumstances, an electric utility may request a waiver to the PUC on the grounds that competitive bidding is not appropriate. Those circumstances, are, for example, when competitive bidding will unduly hinder the ability to add needed generation in a timely manner, when the utility and its customers will benefit more if the generation resource is owned by the utility rather than by a third-party, when it is related to the expansion or repowering of existing utility generation units, or when the acquisition of power supplies is needed to respond to an emergency situation. Furthermore, the PUC may waive competitive bidding upon a showing that the waiver will likely result in a lower cost supply of electricity to the utility's general body of ratepayers, increase the reliable supply of electricity to the utility's general body of ratepayers, or is otherwise in the public interest.

The Framework for Competitive Bidding does not apply to (1) generating units with a net output available to the utility of 1% or less of a utility's total firm capacity, including that of independent power producers (IPP), or with a net output of 5 MW or less, whichever is lower (for systems that cover more than one island, the system firm capacity will be determined on a consolidated basis); (2) distributed generating units at substations and other sites installed by the utility on a temporary basis to help address reserve margin shortfalls; (3) customer-sited, utility-owned distributed generating units that have been approved by the PUC in accordance with the requirements of Decision and Order No. 22248, issued January 27, 2006, as clarified by Order No. 22375, issued April 6, 2006 in Docket No. 03-0371; and (4) renewable energy or new technology generation projects under 1 MW installed for "proof-of-concept" or demonstration purposes. The

Framework also does not apply to qualified facilities and non-fossil fuel producers with respect to: (1) power purchase agreements (PPA) for as-available energy, provided that an electric utility is not required to offer a term for such PPAs that exceed five years if it has a bidding program that includes as-available energy facilities; (2) PPAs for facilities with a net output available to the utility of 2 MW or less; (3) PPA extensions for three years or less on substantially the same terms and conditions as the existing PPA and/or on more favorable terms and conditions; (4) PPA modifications to acquire additional firm capacity or firm capacity from an existing facility, or from a facility that is modified without a major air permit modification; and (5) renegotiations of PPAs in anticipation of their expiration, approved by the PUC.

2.0 Kauai Island Utility Cooperative

KIUC is a not-for-profit, member-owned electric cooperative. KIUC was the successor of Kauai Electric Division (KE) previously owned by Citizens Utilities Corporation in Stamford, Connecticut. KIUC was founded in 2002 when the ownership was converted to a cooperative from the investor-owned utility. A nine-member Board of Directors elected by the KIUC membership provides KIUC governance. KIUC is responsible for providing electricity to about 34,000 customers in the island of Kauai. As of 2006, KIUC's customers were composed of 76% residential, 13% commercial, 10% street lighting, 0.4% industrial, and less than 0.1% irrigation. KIUC operates the smallest generating system among the four Hawaiian utilities. Total electricity sales from KIUC in 2007 were about 497 GWh.

2.1 KIUC's Existing Electric System

KIUC owns and operates 116 MW of firm, net generating capacity. KIUC currently uses diesel and naphtha for over 90% of its energy supply. A small portion of power (less than 1% of total electricity sales) is generated from hydropower at the Lihue Lower and Lihue Upper Plants. KIUC also purchases excess electrical power (which is 100% renewable energy) from other firms—including Gay & Robinson (bagasse and hydro), Kauai Coffee (hydro), and Kekaha Agriculture Association (KAA) (hydro).[5] As of 2008, KIUC reports that system wide solar PV is now 1 MW. Electricity rates on Kauai are higher than on other islands. For example, the average KIUC residential rate was 32.8 cents/kWh as compared to 31.0 cents/kWh on the Big Island, 27.7 cents/kWh on Maui, and 20.0 cents/kWh on Oahu. The higher rates are due to the high cost of fuel used on Kauai, and the smaller number of customers (e.g., 50% as many customers as Maui or the Big Island, and only 12% as many on Oahu).

Table 2.1, on the next page, shows the installed capacity of renewable energy generation on the island of Kauai as of 2005.

[5]KAA, previously the Agricultural Development Corporation, took over the ownership of the Kekaha Sugar Mill and control of the Kekaha hydro generation facilities in 2002-2003.

Table 2.1 Installed Capacity of Kauai Renewable Energy Generation

Plant	Owner	Fuel Type	Capacity (MW)
Waimea Mauka Hydro	KAA	Hydro	1.0
Waiawa Hydro	KAA	Hydro	0.5
Lihue Lower	KIUC	Hydro	0.6
Lihue Upper	KIUC	Hydro	0.8
Wainiha Hydro	Kauai Coffee	Hydro	3.7
Kalahea Hydro	Kauai Coffee	Hydro	1.0
Waiahi Hydro	Gay & Robinson	Hydro	1.3
Lihue Plantation[1/]	Lihue Plantation	Biomass	21.8
Gay & Robinson	Gay & Robinson	Biomasa/hydro	4.0
Solar PV Systems[2/]	Various	Solar PV	0.042
Total			34.742

Note: [1/]This facility has been removed and relocated to the Philippines.
[2/]As of 2008, KIUC reports that system wide solar PV is now at 1 MW.

Source: Kauai Island Utility Coop, 2005 (KIUC) *Renewable Energy Technology Assessments.*
www.kiuc.coop/indexabout.htm

2.2 KIUC's Integrated Resource Planning

The first Integrated Resource Plan was developed by KE in 1997 and filed with the PUC on April 1, 1997 (1997 IRP). KE filed IRP Updates of the 1997 IRP in 1998, 1999, and 2000. The 2000 IRP Update replaced the second IRP, which was scheduled to be filed with the PUC in 2000. Because KE was being sold at that time, the PUC approved KE's request to defer filing an IRP in 2000 and instead submit a 2000 annual IRP update.

The PUC required KIUC to prepare and submit its proposed revisions to the IRP and DSM Programs on or before December 31, 2003. KIUC filed a letter requesting approval to defer the December 31, 2003 proposed revision requirement for one year and continue its existing DSM programs. KIUC continued to file IRP Updates in 2004, 2005, and 2006.

In addition to the IRP updates, KE/KIUC submitted the 1997, 1998, 1999, 2000, 2001, 2002, 2003 and 2006 DSM Programs Annual Modification and Evaluation Reports, which described the success of its DSM programs and the modifications, budgets, amended measure unit values and penetration schedules.

KE/KIUC also submitted 1999, 2000, 2001, 2002, and 2005 DSM Programs Annual Program Accomplishments and Surcharge reports, which described the actual recorded DSM measure information, energy savings, cost information, and a detail of accomplishments for the previous program year.

KIUC plans to file its first IRP as a member-owned cooperative in December 2008.

2.2.1 DSM Programs

The 1997 IRP included a 5-year Action Plan detailing the DSM activities and monitoring plans to measure actual achievements. The 2008 KIUC DSM program covers only commercial energy savings. The program is called the Commercial Retrofit Program (CRP). The CRP has received significant interest due to the established benefits of the DSM incentive program. Commercial customers used these incentives to install various types of energy saving devices such as energy management systems, solar hot water heating systems, compact fluorescent lights, and energy efficient motors and pumps. The CRP was popular with all commercial customers, especially with small businesses. KIUC stated in the 2006 IRP update that requests for incentive assistance had exceeded the annual budget resulting in a 100% commitment of the program funds. A larger percentage of the 2006 incentive budget was ultimately committed to large commercial entities. A few of the small businesses proceeded without incentives; the majority did not. As CRP has received high interest from commercial customers, KIUC has increased the incentive budget from $375,000 in 2006 to $490,106 in 2007.

There is no residential DSM program offered by KIUC. However, KIUC has energy service, non-DSM, programs in which residential customers can choose to participate. These non-DSM programs are categorized into Energy Efficiency Programs and Member Advantage Programs.

Energy Efficiency Programs are designed to assist members managing their electricity consumption. These programs address energy saving opportunities in residential markets that cannot be effectively integrated with DSM programs. KIUC offers four energy efficiency programs—the Solar Water Heater Loan, the Solar Water Heater Rebate, the Home Visitation / High Bill Inquiry, and the Efficiency Appliance Replacement Program.

- The Solar Water Heater Loan has been offered since 2006. The program provides an interest-free loan to participants who want to borrow money for installation of solar water heaters in existing homes and residential new construction projects. KIUC has worked with two lenders—the Kauai Community Federal Credit Union (KCFCU) and the Kauai County Housing Agency (KCHA). KIUC pays the full-term interest on the loan at the onset so the participants will receive a loan free of interest from KCFCU or KCHA. The participant repays the principal to the lender monthly, generally over a five-year period. No down payment is required to the lender. KIUC reported that, as of October 2006, 16 solar water heating systems were installed through the solar loan program.
- The Solar Water Heater Rebate Program was part of a larger DSM program between 1998 and 2004. Since then, KIUC has offered the program as a non-DSM measure. In the program, a rebate of $800 is given to the buyer for a solar water heating system. In 2006, 42 solar water heating systems were installed under this program, of which 29 systems were installed in existing homes and the rest were installed in new residential construction.

- The Home Visitation / High Bill Inquiry program assists residential customers who have energy use concerns. KIUC's Call Center will respond to high electricity consumption questions with a follow up home visit, if necessary, to help identify appliances that may be malfunctioning and causing higher than normal electricity use. During a home visit, energy efficient devices, such as compact fluorescent and energy efficient showerheads, will be installed if they are not already in use.
- The Efficient Appliance Replacement Program provides education to customers on the benefits of purchasing energy efficient appliances and provides a $50 rebate to customers who choose to replace an existing appliance with a new, more efficient one. The qualifying appliances include refrigerators, clothes washers, and dishwashers. A total of 538 members received appliance rebates in 2006.

Member Advantage Programs do not focus on electricity consumption, but provide other products and services that are of value to KIUC's members. In 2008, one Member Advantage Program is being implemented—the New Member Lighting Program. The Program offers a package of three, 20-watt compact fluorescent bulbs to new residential members at no direct cost. In 2006, a total of 2,052 bulbs were distributed to new members. KIUC is waiting for an approval of tariff revisions for the other two programs—the Generator Safety Program and the Residential Surge Protection Program.

In 2007, two new Energy Services Programs were introduced—Residential Solar Water Heater Replacement Program and Qualified Member Appliance Replacement Program.

- The Residential Solar Water Heater Replacement Program offers a rebate of $800 for the replacement of existing solar water heaters. To be eligible for the rebate, the existing solar system must be a minimum of 15 years old and have a defect in one of the major components, e.g., the storage tank or solar collectors. Incentives will be applicable to total replacement of systems and not for replacement of individual components.
- The Qualified Member Appliance Replacement Program assists qualified low-income, elderly persons in lowering their electricity use by replacing old, less efficient appliances with new, more efficient ones at no cost.[6] The qualifying appliances in this program include refrigerators and electric water heaters. KIUC will install one unit per household. To be eligible for a replacement, the existing refrigerators must be at a minimum of 11 years old and electric water heaters must be leaking hot water from the tank.

As KIUC is an electric cooperative, it was exempted from any alternative market structure. Thus, KIUC will continue its DSM programs under the Utility Market Structure when the HECO Utilities' DSM programs are administered under the Non-Utility Market Structure starting in January 2009.

[6]"Low-income" is as defined by Federal Income Poverty Guidelines, and "elderly" is defined as a person who is 60 years or older.

2.2.2 Renewable Energy Resources

In 2005, KIUC released a Request for Proposal for energy-only renewable projects. KIUC received 20 proposals in response, and in 2006, selected four projects to enter into purchase power negotiations. These projects included a 6.4 MW biomass plant, a 4.2 MW biomass plant, a 5.3 MW waste-to-energy facility, and a 10-15 MW wind farm. These four projects could supply approximately 34% of KIUC's sales if they are implemented as planned.[7]

In 2006, KIUC developed a supply candidate list for consideration in its third IRP. The supply options in the list are wind, hydro, biomass, and waste-to-energy projects.[8]

The study, by Black & Veatch for KIUC in 2005, examined renewable technology options for KIUC as part of KIUC's upcoming IRP filing to the PUC.[9] The study assessed 26 renewable and advanced energy technologies using seven weighted criteria including cost of energy (50 percent), Kauai resource potential (10 percent), fit to KIUC needs (10 percent), technology maturity (10 percent), environmental impact (7.5 percent), socioeconomic impact (7.5 percent), and incentives/barriers (5 percent). Based on the results of the screen analysis, Black & Veatch recommended five technologies that were the most promising renewable energy options for Kauai. Those technologies included landfill gas, wind, hydropower, direct-fired biomass, and MSW mass burn. Each of these technologies was further assessed in greater detail with typical project characterized, and their economics evaluated. The assessment reviewed the promising resources for Kauai from most to least as hydro, wind, MSW, landfill gas, and biomass, as shown below:

- Five promising hydro projects were identified—Wainiha (4.0 MW), Waimea Mauka (2.9 MW-upgraded from an existing 1 MW unit), Kokee (7.0 MW), Wailua (6.6 MW), and Upper Lihue (0.3 MW), with Wainiha and Wailua being the lowest cost projects at levelized costs of $58.40/MWh and $60.40/MWh (at 2009$), respectively.
- Seven wind sites were identified—Anahola (6.6 MW), Kokee (2.0 MW), Hanapepe (6.6 MW), Omao (6.6 MW), Maha'ulepu (6.6 MW), Poipu (6.6 MW), and Kalaheo (6.6 MW). No wind site stands out as being significantly better than others. With the exception of the smaller Kokee project (2.0 MW), the 6.6 MW wind projects were close in levelized cost ranging from $64/MWh to $73/MWh.
- The economics of MSW depend on the tipping fee received for waste disposal. Since the tipping fee is included as an income stream for the facility, the higher

[7]2006 Integrated Resource Plan Update of the 1997 Integrated Resource Plan, Docket No. 96-0266, Submitted to the Hawaii Public Utilities Commission by the Kaua'i Island Utility Cooperative, February 2007. KIUC reported a peak demand of about 75 MW in July of 2006, and the proposed new renewable energy projects total 28-33 MW.

[8]Although this will be the first full IRP filed by KIUC, in the overall Kauai IRP cycle, the PUC and thus KIUC refer to it as IRP-3.

[9]Kauai Island Utility Coop, 2005 (KIUC) *Renewable Energy Technology Assessments*. www.kiuc.coop/indexabout.htm

the tipping fee, the lower the power cost. The study found that at a tipping fee of $90/ton, a 7.3 MW, 300 ton per day waste-to-energy plant would produce power at a levelized cost of $20/MWh, lower than any other renewable energy options analyzed. At $56/ton, the current landfill gate fee, the levelized cost of the project was estimated to be $108/MWh, which is not as competitive as the other renewable energy options.

- The only viable landfill gas project on Kauai is located at the Kekaha landfill. This study estimated that an 800 kW project using reciprocating engines could be developed after landfill closure in 2009. The levelized cost of the project was estimated to be $99/MWh, which is competitive with KIUC's current avoided costs, but higher than several of the other renewable project options.
- Biomass projects have the least favorable economics than any of the other renewable options. The study estimated the levelized cost of supplying power from a biomass fueled power station ranged from $180/MWh to $205/MWh, depending on the fuel cost. Although having a high-levelized cost, biomass has other advantages over most renewable energy options, especially if biomass is derived from locally grown energy crops. Among other things, larger amounts of base load power could be produced from the available resource base. In addition, growing and harvesting local energy crops would provide a large stimulus for Kauai's agricultural sector and help mitigate the loss of jobs in the sugar industry. Black & Veatch thus recommended that biomass be reexamined in more detail when KIUC has greater need for capacity resources in the future.

2.3. KIUC's Renewable Portfolio Standard Status Report

KIUC has documented their performance under the RPS process through RPS status reports that were developed for the years 2005, 2006, and 2007. Each report is cumulative, so that the 2007 report provides information for the reporting period 2003-2007, as shown in Table 2.2. As seen in the table, KIUC's principal fuel used for electricity generation is oil. Power from renewable energy sources comes mainly from hydro and, at a smaller scale, bagasse for which KIUC purchases from three IPPs. Renewable generation composes only about 5 to 8% of total electricity sales. However, conserved energy from displaced sales including solar water heating, net energy metering, and DSM contributed significantly to KIUC's renewable portfolio. Together, total renewable electrical energy from KIUC is greater than 10% of total electric sales.

Table 2.2: KIUC 2007 RPS Status Report

Unit: MWh

	2003	2004	2005	2006	2007
(1) Fossil Sales	**405,825**	**412,793**	**413,355**	**419,451**	**441,154**
(2) Renewable Generation					
Hydro (KIUC owned)	558	1,684	4,232	4,561	926
Bagasse/hydro (Gay & Robinson)	2,521	2,844	3,501	3,921	2,845
Hydro (Kauai Coffee)	20,331	29,199	26,292	25,613	20,612
Hydro (KAA)	2,080	2,070	3,466	3,024	2,079
Waste Oil	NA	257	409	323	433
Total	**25,490**	**36,053**	**37,900**	**37,443**	**26,895**
(3) Conserved Energy (Displaced Sales)					
Solar Water Heating	7,387	7,558	7,659	7,831	7,937
Net Energy Metering	66	90	130	202	524
Demand Side Management	NA	19,037	20,855	21,349	21,361
Total	**7,453**	**26,685**	**28,644**	**29,382**	**29,822**
(4) Total Sales of Renewable Electrical Energy (2)+(3)	**32,943**	**62,738**	**66,544**	**66,824**	**56,717**
(5) Total Electricity Sales (1)+(2)+(3)	**438,768**	**473,608**	**477,255**	**481,461**	**496,718**
Percent of Renewable Electrical Energy in Total Sales (4)/(5)	**7.51%**	**13.25%**	**13.94%**	**13.88%**	**11.42%**
Percent of Renewable Generation in 10% Target[1/] (2) / [(5) x 0.10]	**58.1%**	**76.1%**	**79.4%**	**77.8%**	**54.1%**

Note: [1]HRS § 269-92(b)(1) states that "At least fifty per cent of the renewable portfolio standards shall be met by electrical energy generated using renewable energy as the source". This number is calculated by dividing the Renewable Energy Generation (item 2) by the RPS standard for 2010, which is 10% of total sales, or 10% of item 5.

Source: KIUC's Renewable Portfolio Standards Status Report, Year Ending December 31, 2007.

2.4. Demand Analysis

As electricity demand data for Kauai were not available, the system net output data are used as a proxy to show past performance of KIUC and its ability to plan for future electricity demand on Kauai. Table 2.3 compares the forecast system net output and actual system net output of KIUC during 1997 to 2006. The data indicated that KIUC's forecast on net system output was generally higher than actual system net output during these years. The average difference between actual output and forecast output was about 7.2%. If this trend continues, it could raise a concern whether or not KIUC would have sufficient electricity outputs to meet future demand. KIUC has also forecasted a higher amount of DSM savings than actual DSM impacts during 1998 to 2001, but forecasted a lower amount than actual savings for 2002 and 2003. The overestimation of DSM

savings in the early years followed by underestimating in latter years does show how the utilization of their DSM programs has increased over time. It also illustrates the uncertainty involved in predicting DSM impacts.

Table 2.3 Forecast vs. Actual System Net Output from KIUC System

Unit: MWh

	Forecast System Output (1)	Actual System Output (2)	System Output Difference (1)-(2)	Forecast DSM Impact (4)	Actual DSM Impact (5)	DSM Difference (4)-(5)
1997	416,855	404,180	12,675	n/a	n/a	n/a
1998	425,381	412,791	12,590	3,903	2,075	1,828
1999	440,301	423,389	16,912	12,399	6,108	6,291
2000	456,428	452,699	3,729	13,649	11,220	2,429
2001	471,136	443,798	27,338	16,748	13,993	2,755
2002	486,423	452,631	33,792	17,067	18,075	-1,008
2003	502,072	472,706	29,366	16,863	18,984	-2,121
2004	518,502	468,884	49,618	n/a	n/a	n/a
2005	535,346	469,111	66,235	n/a	n/a	n/a
2006	552,488	475,810	76,678	n/a	n/a	n/a

Source: 2006 Integrated Resource Plan Update of the 1997 Integrated Resource Plan (Docket No. 96-0266), 1997-2003 from Table 7, forecast and actual system net output without DSM impacts; 2004-2006 from Table 2, base forecast.

2.5 KIUC's Current Performance Evaluation

The records showed that KIUC has continued to utilize renewable energy resources and conserved energy through displaced sales, and that so far its RPS has exceeded the State's RPS target of 10% of net electricity sales in 2010 in 2004 through 2007. These data also show that KIUC has exceeded the target for 50% RPS renewable electrical energy to be sourced by renewable generation in each reported year from 2003-2007.

The 2007 renewable generation in Kauai was 26,895 MWh, lowered from 37,443 MWh in 2006. Electricity supplied from both hydro and baggasse facilities declined. That made renewable electrical energy as a portion of total electricity sales drop from 13.88% in 2006 to 11.42% in 2007. KIUC explained the decrease in its hydro generation from the Waiahi hydro plants as being due to (1) reduced rainfall resulting in reduced water supply, (2) ditch system repairs, and (3) shutdown of the lower Waiahi hydro to accommodate a movie production in the nearby area. In addition, KIUC explained that total power purchases from other firms were reduced compared to 2006 due to reduced rainfall. The variability seen in hydro generation illustrates the overall need to develop a broad portfolio of renewable energy options.

KIUC reports in its 2007 status report that they are taking actions to increase their hydro production. They are currently collecting water flow for their Upper Waiahi hydro plant

that will be used to determine how much capacity could be added to the existing 1.2 MW. Capital improvements are also planned for the Upper and Lower Waiahi plants which will increase their efficiency and reliability and their annual energy production.

In addition, KIUC is pursuing a long-term water lease from the Department of Land and Natural Resources. They expect the certainty of resource supply will lead to additional capital improvements that will lead to additional annual hydro energy production.

KIUC also reported in its 2007 status report that it has signed a 20-year PPA with Green Energy Team LLC to purchase power from the proposed 6.4 MW Biomass-To-Energy facilities, which are expected to begin commercial operation in 2010. KIUC is also in negotiations with a wind power developer to develop a 12.5 MW wind farm on Kauai. This project is expected to begin commercial operation in 2011. If the operations come on line as planned, KIUC should be able to not only meet its first RPS target in 2010, but continue to increase its renewable generation to meet the RPS targets in 2015 and 2020.

The displaced sales from solar water heating, net energy metering and DSM measures have constantly increased since 2003 from 7,453 MWh to 29,822 MWh in 2007. The percentage of displaced sales in total renewable electrical energy in 2007 was about 53%. Under current law, it could be difficult to continue to have increased future energy savings from displaced sales at the same high rates as in the past. Currently, KIUC has 41 net energy metering customers with a total installed capacity of 173 kW. This comprises 45% of the 384 kW that KIUC is allowed under the 0.5% cap.

3.0 Hawaiian Electric Company, Inc.

HECO is responsible for providing electricity to customers on the island of Oahu. In 2007, HECO provided electricity to about 295,000 customers with total sales of 7,675 GWh. The electricity demand on Oahu is higher than that on other islands as it is the most populated island, it is the location of Honolulu, the State capitol, and it is the main tourist attraction of the State. At present, HECO generates about 60% of the electricity sales on Oahu. IPPs provide the other 40% through HECO's electricity grids. The electricity on Oahu is mainly generated from fossil fuels—78% oil and 18% coal. About 4% of power is derived from solid waste and provided by an IPP.

3.1 HECO's Existing Electric System

HECO owns and operates 16 power generation units at three stations—Honolulu, Waiau and Kahe, plus 30 MW of distributed generation. All units are fueled by low-sulfur fuel oil (LSFO), except for two combustion turbines (CT) at Waiau that are fueled by diesel. HECO does not currently operate any renewable energy units. Two IPPs furnish firm capacity renewable energy power to the HECO grid. H-POWER provides power for HECO from its 46 MW waste-to-energy facility, and AES-Hawaii (AES) provides power from its 180 MW firm capacity plant using coal and solid waste.[10] Kalaeloa Partners, L.P., the other IPP to HECO, provides electricity from a 208 MW firm capacity facility using fuel oil. In addition to firm capacity IPPs, HECO also purchases electricity from other IPPs on a non-firm, as available basis. Those include energy from Tesoro Hawaii and Chevron. Currently, HECO also has 30 MW of distributed generation. Table 3.1 shows HECO's current sources of electricity supplies.

Table 3.1: HECO's Current Sources of Electricity Supplies

	Fuel Type	Net Capacity (MW)	Contract Expiration Date
HECO Owned			
Honolulu (2 units)	LSFO	107.3	--
Waiau (6 units)	LSFO	380.8	--
Waiau (2 units)	Diesel	100.0	--
Kahe (6 units)	LSFO	620.5	
IPP-Firm Capacity			
H-POWER	MSW	46	2015
AES Hawaii	Coal/MSW	180	2022
Kalaeloa Partners, L.P.	LSFO	208	2016
IPP-Non-Firm, As-Available Capacity			
Tesoro Hawaii	Naphtha	18	n/a
Chevron	Naphtha	9	n/a

Source: HECO IRP-3 Report (Docket No. 03-0253), Tables 8.2-1, 8.2-2, and 8.2-3

[10]AES's MSW energy reflects the amount of energy derived from shredded tires, waste oil, and used activated carbon. HRS § 269-91 lists MSW as a recognized feedstock for renewable energy.

3.2 HECO's Integrated Resource Planning

As required by law, Hawaii utilities must prepare an Integrated Resource Plan and submit it to the PUC. HECO has submitted three IRP reports to the PUC. The first IRP (referred to as IRP-93 or IRP-1) was approved by the PUC in March 1995, and was developed for the planning period of 1994-2013. The second IRP (referred to as IRP-97 or IRP-2) was filed in January 1998, covering the period of 1998-2017 (Docket No. 95-0347).[11] The third IRP (referred to as IRP-3) was for the period of 2006-2025 (Docket No. 03-0253) and filed in October 2005. At present, HECO is preparing its fourth IRP, which it expects to file with the PUC in September 2008.

In between each IRP (every 3 years), HECO filed an evaluation report. An evaluation report on IRP-2 was filed in December 2002 (for the period of 2002-2017). An evaluation report on IRP-3 was filed in May 2007 (for the period of 2007-2025). In each evaluation report, HECO assessed the validity of the forecast and assumptions used in the last submitted IRP.

HECO prepared its IRP following the IRP Framework. The IRP explained in detail the planning process, macroeconomic analysis, demand and fuel price forecasts, and resource options which include its DSM programs, renewable energy technologies, distributed generation, combined heat and power resources, and conventional generation. Each IRP included an action plan to be carried over a 5-year timeframe.

3.2.1 Demand Side Management (DSM) Programs

HECO has been implementing extensive DSM programs. Five energy efficiency programs including two residential programs and three commercial and industrial programs have been implemented since July 1996 in IRP-1 (the programs were filed and approved by the PUC in a 5-year increment). Those programs are:

- Residential Efficient Water Heating Program (REWH). The program encourages homeowners (existing customers) to install solar water heaters, electric heat pumps, or high efficiency resistance water heaters.
- Residential New Construction Program (RNC). The program encourages developers to install solar water heaters, electric heat pumps, or high efficiency resistance water heaters in new homes.
- Commercial and Industrial Energy Efficiency Program (CIEE). The program encourages commercial and industrial customers to replace existing air conditioning, electric motors, and lighting with more energy efficient equipment.
- Commercial and Industrial New Construction Program (CINC). The program provides customers with design assistance and custom rebates for the construction of energy-efficient buildings and facilities. The program covers both new buildings/facilities and old buildings/facilities undergoing major renovation.
- Commercial and Industrial Customized Rebate Program (CICR). The program encourages commercial and industrial customers to identify opportunities to

[11] IRP-2 was updated in July 1999.

increase the efficiency of electrical energy use in their businesses or facilities and implement them.

HECO's IRP-2 drew upon much of the work of IRP-1. The five energy efficiency programs were continued in IRP-2. HECO also included two load management programs in its IRP-2 for PUC approval. Those were:

- Residential Direct Load Control Program (RDLC). RDLC provides incentives in the form of monthly bill credits to participating customers in return for allowing HECO to control their electric water heaters and/or air conditioning equipment during system peak hours through the use of load control devices attached to the customers' equipment; and
- Commercial and Industrial Direct Load Control Program (CIDLC). CIDLC provides incentives in the form of monthly bill credits to participating commercial and industrial customers in return for allowing HECO to interrupt some or all of their electrical services during peak hours.

In IRP-3, HECO's plan is to enhance the five existing DSM programs to reflect future market potential, and implement two newly approved load management programs—RDLC and CIDLC, with modifications and add on an interim compact fluorescent lamp (CFL) program. HECO has been very aggressive in acquiring greater energy efficiency through the DSM programs and peak reduction through load management programs as the electricity demand on Oahu was projected to significantly increase due to improved conditions of Hawaii's economy during this IRP period, and HECO anticipates the potential for continued reserve capacity shortfalls ranging between 20 MW to 110 MW during 2009 to 2012.

In IRP-3, HECO has proposed three new DSM energy efficiency programs, including

- Energy Solutions for the Home Program (ESH). The program is designed to provide a comprehensive range of energy efficiency options suitable for several major end-use applications. The program offers cash rebates to residential customers who purchase high-efficiency electric equipment—including CFLs, high efficiency central AC, high efficiency room AC, ceiling fans, cooling equipment servicing, and Energy Star appliances including refrigerator and clothes washers.
- Residential Low Income Program (RLI). The program supports low-income customers to receive high-efficiency equipment for little or no cost. The equipment supported under the program is limited to CFLs, and low-cost water heating measures, such as faucet aerators and low flow showerheads.
- Residential Customer Energy Awareness Program (RCEA). The objectives of the RCEA are to determine if an aggressive customer communications program can change the level of residential customer awareness of energy options, encourage customers to adopt energy-efficient appliances and behavior, and result in energy savings and peak load reduction.

The ESH and RLI were approved in 2007. The RCEA was approved subject to some modifications and requirements.

It is apparent that HECO has expanded its DSM programs significantly since IRP-1. The required expenditures for the DSM programs in 2006 were estimated at $17.74 million, as compared to $6.7 million in 2003. The large increase in the DSM budget was due to an expansion of the existing programs to target additional market segments, and the addition of the new programs. HECO projected energy reductions as a result of the DSM programs at 38.9 GWh per year (as shown in Table 3.2). However, actual savings shown from the RPS update during 2006 and 2007 were significantly higher than this projection. It should be noted, as mentioned in section 1.6.1, that the administration of the DSM programs is planned to be transferred to a public fund administrator in 2009, thus the level of future DSM impacts will be determined by the public fund administrator and is uncertain at this time.

Table 3.2: Incremental Impacts of All HECO DSM Programs

	2006	2007	2008	2009	2010
Reduction of Peak Load (MW)	18.9	16.1	14.5	5.7	5.7
Reduction of Energy (GWh)	38.9	38.9	38.9	38.9	38.9
Expenditures ($000s) [1/]	17,740	18,533	18,632	16,501	16,968

Note: [1/]Includes expenditures on administration and incentives
Source: Table 15.1-3, HECO IRP-3 Report (Docket No. 03-0253)

3.2.2 Renewable Energy Resources

HECO obtained about 4% of its power from renewable energy previous to IRP-1. Renewable energy resources have proven difficult to implement on the island of Oahu. In IRP-1, wind and biomass were found to be commercially available. In IRP-2, HECO focused on developing wind and biomass projects on Oahu. Wind cost and performance data were developed for two wind sites on Oahu for 20, 30, 60 and 80 MW rated output at 30 mph wind speeds at Kahuku, and 15 MW rated output at 30 mph wind speed at Kaena Point. Biomass cost and performance data were developed for a 25 MW dedicated biomass to energy plant located at the former Waialua Sugar Company. In IRP-2, HECO had a plan to investigate the potential of offshore wind farm development as there was limited availability of land-based wind sites on Oahu. However, in 2003 when high-resolution resource maps for Oahu were available, HECO dropped the plan as the wind resource maps revealed that the offshore wind speeds were too low in areas having shallow depths, although wind resources could be available in areas that would have siting issues related to visual and other aesthetic impact, and/or the depths were too deep in areas having high wind speeds. In 2005, HECO explored the possibility of constructing a 50 MW wind farm on the ridge above the Kahe generating station, however HECO ended its efforts in response to public sentiment including the mayor of the City and County of Honolulu. During IRP-2, PV was not available in utility-scale applications and costs were very high. However, HECO added the solar parabolic dish collector with Stirling engines as a new technology in the development list.

In IRP-3, HECO expanded their renewable energy option list. Some renewable energy technologies that were not identified in IRP-2 were added to the IRP-3 process as new resource options to be reviewed. The candidate resources included waste-to-energy technologies, central-station solar PV, residential solar PV, fuel cell technologies, and ocean thermal energy conversion and ocean wave energy. HECO screened these options to determine whether a resource should be retained for further evaluation. The screening criteria included: (1) appropriate size of technology for the HECO system, (2) commercially available technology within the 20-year planning horizon, (3) availability of resource requirements, and (4) availability of capital cost requirements. The resources were then categorized as either commercial resources or developing resources. Commercial resources considered viable in the zero-to five-year time frame are those that satisfy five criteria: (1) vendor availability, (2) proven technology, (3) utility scale, (4) well-established capital and operating costs, and (5) resource availability. Developing resources considered viable in the 6-to-20 year time frame are those that satisfy four criteria: (1) sole or multiple vendors, (2) emerging technologies, (3) potential for competitive capital and operating costs, and (4) resource availability.

After the screening review, the commercial resources were biomass combustion, wind energy, MSW Mass Burn, MSW Refuse-Derived Fuel, central station solar PV, and residential PV. Fuel cells were dropped from further screening. Other non-commercial resources were defined as developing resources.

In the IRP-3 Action Plan for 2006-2010, HECO put two renewable projects high on the list—50 MW wind farm in 2009 (possible site in Kahuku) and three HECO-owned 100 kW PV systems at HECO facilities by late 2007. The 2007 Evaluation Report, however, stated that HECO determined that it was most cost-effective to seek non-utility development of the PV system due to the non-availability of federal renewable energy investment tax credits to a regulated utility. In May 2008, the PUC approved a contract for HECO to purchase power from a 218 kW PV system being developed on an IPP basis with Hoku Solar at their Archer Substation in Honolulu. The contract is for a fixed rate over 20 years and the facility is expected to be in operation by the end of 2008.

HECO, via its non-regulated subsidiary Renewable Hawaii, Inc. (RHI), released a series of Renewable Energy Request for Project Proposals for Oahu in May 2003 and March 2005. Several proposals were received by RHI. RHI signed early investment agreements for renewable energy projects that passed the screening process. At this time, for Oahu, RHI is working actively with a landfill gas-to-energy project. In all cases, the developer must independently approach the utility to negotiate a PPA at the appropriate time.

HECO has significantly increased its efforts in renewable energy. It has committed (and received Commission approval) to fuel its next generating unit, a 110 MW CT in 2009, using 100 percent biofuels. HECO is also negotiating with renewable energy developers for three projects that were grandfathered from the competitive bidding requirements. In June 2008, HECO issued a request for proposal (RFP) for up to 100 MW of renewable energy for commercial operation preferably in the 2010 to 2013 timeframe. HECO is

also exploring several renewable energy projects that have potential for future development. These include the potential utilization of liquid biofuels in existing and new power generation units, the co-firing of biomass crops (e.g., banagrass) with coal in existing coal generation facilities, and new pumped storage hydroelectric applications on Oahu. In the longer term, HECO is considering the integration of emerging new technologies, such as wave energy, into the grid. HECO has planned for up to 20 MW of non-firm energy from emerging renewable technologies, envisioned for service in the 2011 to 2013 timeframe. In addition, in its 2007 IRP Evaluation Report,[12] which is serving as the basis for IRP-4, HECO has updated its long-term capacity addition plan to identify renewable energy for all future supply-side resource needs.

3.3 HECO's Renewable Portfolio Standard Status Report

HECO has documented its performance under the RPS process through RPS status reports that have been developed for the years 2001 through 2007. Each report documents results for a single year for each of the HECO Utilities (HECO, HELCO, and MECO). In this section, the information for HECO is presented from the three reporting years 2005, 2006, and 2007.

HECO-owned generation is fueled by fuel oil. Electricity supplied by renewable energy is mainly through IPPs via PPAs. Those include the PPAs with H-POWER and AES. H-POWER derives power from MSW while AES co-fires coal with wastes such as shredded tires, waste oil, and used activated carbon. The majority of HECO renewable electrical energy comes from electrical energy savings from the DSM measures. In 2006 and 2007, the RPS percentage exceeded 10%, but the percentage of renewable generation was less than 50% of the 10% renewable electrical energy target in 2005 and 2007.

Table 3.3, on the next page, shows the total sales of electricity by HECO for Oahu during 2005-2007.

[12]Integrated Resource Plan, 2006-2025: 2007 Evaluation Report, Docket No. 03-0253, May 2007, Hawaiian Electric Company, Inc.

Table 3.3: Total Sales of Electricity by HECO

Unit: GWh

	2005	2006	2007
(1) Fossil Sales (6-5)	**7045**	**6907**	**6828**
(2) Renewable Generation			
Municipal Solid Waste (H-POWER)	293	339	302
Municipal Solid Waste (AES)	40	56	24
Total	**333**	**395**	**326**
(3) Electrical Energy Savings Using Renewable Displacement Technologies			
Solar Water Heating	51	58	66
Photovoltaic Systems	0.4	0.5	1.7
Total	**51.4**	**58.5**	**67.7**
(4) Energy Efficiency Technologies			
Total	**292**	**340**	**453**
(5) Total Renewable Electrical Energy (2)+(3)+(4)	**676**	**794**	**847**
(6) Total Electricity Sales	**7,721**	**7,701**	**7,675**
Percent of Renewable Electrical Energy in Total Sales (5)/(6)	**8.8%**	**10.3%**	**11.0%**
Percent of Renewable Generation in 10% Target[1/] (2) / [(6) x 0.10]	**43.1%**	**51.3%**	**42.5%**

Note: [1]HRS § 269-92(b)(1) states "At least fifty per cent of the renewable portfolio standards shall be met by electrical energy generated using renewable energy as the source". This number is calculated by dividing the Renewable Energy Generation (item 2) by the RPS standard for 2010, which is 10% of total sales, or 10% of item 6.

Source: Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc. and Maui Electric Company, Limited's Renewable Portfolio Standard Status Report, for year ended December 2005, 2006, and 2007

3.4 Demand Analysis

Table 3.4, on the next page, compares HECO's forecast and actual sales from 2000 to 2010. The actual sales were on average 2% different from the forecast sales during the period of 2000 to 2010, and normally below the forecast sales. The table shows that actual sales declined in the 2005-2007 timeframe. HECO updated the demand forecasts in 2007 to account for lower than expected demand growth.

Table 3.4: Forecast and Actual Sales of HECO during 2000-2010

Unit: GWh

Year	Forecast Sales (1)	Actual Sales (2)	Difference (1)-(2)
2000	7,606	7,212	+394
2001	7,739	7,277	+462
2002	7,382	7,390	-8
2003	7,538	7,522	+16
2004	7,702	7,733	-31
2005	7,960	7,721	+239
2006	7,650	7,701	-51
2007	7,721	7,675	+46
2008	7,831		
2009	7,921		
2010	8,016		

Sources: Forecast sales 2000 to 2001 from HECO forecast dated 4/1997 (IRP-2); 2002 to 2003 from HECO forecast dated 8/23/02 (IRP-2 evaluation – letter dated 1/13/03 to Sharon Nishi, CA; 2004 to 2005 from HECO forecast dated 2/04 (IRP-3 May 2007 Evaluation Report, Table 3.1-1; 2006 to 2010 from HECO forecast dated 8/06 (IRP-3 May 2007 Evaluation Report, Table 3.1-1)

3.5 HECO's Current Performance Evaluation

By law, HECO and its affiliates, HELCO and MECO, can combine the use of renewable electrical energy to meet the RPS requirement. The RPS data in 2006 and 2007 showed that HECO's use of renewable electrical energy exceeded 10% of its total electricity sales on Oahu, although the percent of renewable generation of the 10% RPS target was less than 50% in 2005 and 2007. In the future, although energy demand on the island of Oahu is expected to increase, it is likely that HECO will be able to retain its percentage of renewable electrical energy in total electrical sales through 2010. This is due to its continued power purchase of renewable energy from existing IPPs (e.g., H-POWER and AES), continued savings from the DSM programs, and several new renewable energy projects coming on stream. The new projects that are expected to be in operation within the IRP-3 period include:

1) Non-Firm Renewable Energy. HECO issued a PUC-approved RFP in June 2008 seeking bids for projects that can provide up to 100 MW of non-firm renewable energy for Oahu. HECO seeks to acquire the renewable energy resources, which could commence commercial operation in the 2010-2014 timeframe, with a preference for resources that achieve commercial operation before 2013.

2) Biofuels. HECO received approval from the PUC to build a new 110 MW simple cycle CT generating unit at Campbell Industrial Park. HECO plans to have this biofueled CT run primarily as a peaking unit beginning in 2009. In August 2007, HECO entered into a 35-year supply contract with Imperium Renewables Hawaii, which is subject to Commission approval, for biodiesel to fuel the new CT. Imperium is planning to build a

trans-esterification plant on Oahu near Kalaeloa Harbor and produce biodiesel from sustainable imported and locally grown feedstock. Imperium has been granted all major construction permits and had hoped to build the facility by the end of 2008, but the start of construction has recently been put on hold pending the development of new financing. However, since the supply contract allows for Imperium to source the biodiesel from their existing production facilities outside Hawaii, the delay of the Hawaii facility will not impact the start up of the planned 110 MW CT.

3) PV Systems. HECO awarded a contract to Hoku Solar in May 2007 to develop a PV system on the rooftop of the Archer Substation, located at HECO's Ward Avenue facility. The Solar Energy Purchase Agreement (SEPA) governs Hoku Solar's development of a 218 kW PV system and HECO's purchase of energy from the system. HECO expects to have the system in place and in service at the end of 2008 or early 2009.

4) Sea Water Air Conditioning. HECO signed a contract with Honolulu Sea Water Air Conditioning, LLC (HSWAC) to develop a 25,000-ton seawater air conditioning system for downtown Honolulu. HSWAC has completed its equity financing and has customer commitments for over 70% of the system capacity. An environmental impact statement for the project has been prepared. The system is expected to be online in 2010.

5) Waste-to-Energy. The City and County of Honolulu announced plans in January 2008 to expand the existing H-POWER waste-to-energy facility with the addition of a third boiler. The City and County plan to negotiate with Covanta, the current operator of H-Power, to build a third boiler to be in service by 2011.

6) Projects grandfathered from competitive bidding.

4.0 Hawaii Electric Light Company, Inc.

HELCO, an affiliate of HECO, sells power to about 79,000 customers on the Big Island of Hawaii. In 2007, HELCO sold 1,163 GWh of electricity of which 39% came from its own generation and the rest came from IPPs. Oil (diesel and fuel oil) is the main fuel used for power generation on the Big Island (69%). The rest of the power comes from renewable energy sources including geothermal (18%), wind (9%) and hydropower (4%).

4.1 HELCO's Existing Electric System

Currently, HELCO owns and operates 24 fossil-fueled generating units, totaling about 180 MW (net capacity). Those include 5 steam units fueled with No. 6 fuel oil, 10 diesel engine generators, 5 diesel CTs, and 4 distributed generation diesel engines. HELCO also owns and operates one wind farm at Lalamilo, and two run-of-river hydro facilities at Puueo and Waiau (two units at each hydro facility). In addition to its own operations, HELCO buys power from IPPs from both fossil-fueled generation and renewable sources. The two IPPs that provide firm capacity power to the HELCO grid are Hamakua Energy Partners L.P. (HEP) from its 60 MW combined-cycle power plant, and Puna Geothermal Ventures (PGV) from its 30 MW geothermal power plant.

In addition to the two firm capacity IPPs, HELCO buys power from several IPPs on a non-firm, as available basis, including wind power from Hawi Renewable Development (HRD) and Apollo Energy Corporation (AEC), and hydropower from Wailuku River Hydro and other small IPP hydro, with a total capacity of about 43.4 MW. The PPA with HRD was signed in 2003 for 10.56 MW of as-available energy from the Hawi Wind Farm, which became operational in 2006. The PPA agreement with AEC is for as-available energy from its wind farm. AEC repowered its existing 7 MW Kamaoa Wind Farm located at South Point, and installed an additional 13.5 MW wind capacity for a total of 20.5 MW. AEC named its new wind farm Pakini Nui. The Pakini Nui wind farm is operated by AEC's wholly owned subsidiary Tawhiri Power LLC and became operational in April 2007. HELCO's existing electric system is shown in Table 4.1, on the next page.

Table 4.1: HELCO's Current Sources of Electricity Supplies

	Fuel Type	Net Capacity (MW)	Contract Expiration Date
HELCO Owned -Firm Capacity			
Steam units (5 units)	MSFO	62.2	--
Diesel engines (10 units)	Diesel	24.5	--
Combustion Turbines (5 unit)	Diesel	88.9	--
Distributed Generators (4 units)	Diesel	4.0	--
HELCO Owned -Non-Firm Capacity			
Lalamilo Wind Farm	Wind	2.3	--
Puueo Run-of-River Hydro	Hydro	3.25	--
Waiau Run-of-River-Hydro	Hydro	1.10	--
IPP-Firm Capacity			
Puna Geothermal Venture	Geothermal	30	2027
Hamakua Energy Partners	Naphtha	60	2030
IPP-Non-Firm, As-Available Capacity			
HRD Wind Farm	Wind	10.56	2021
AEC (Pakini Nui Wind Farm)	Wind	20.50	2027
Wailuku River Hydro	Hydro	12.10	2023
Other IPP Hydro	Hydro	0.273	n/a

Source: HELCO IRP-3 Report (Docket No. 04-0046), Tables 6.2-1, and 6.2-2

4.2 HELCO's Integrated Resource Planning

To date, HELCO has filed three IRP reports: the first in 1993 (IRP-1 or IRP-93), the second in 1998 (IRP-2 or IRP-98) for 1999-2018, and the last one in May 2007 (IRP-3) for the period 2007-2026. HELCO filed an Evaluation Report of IRP-1 in June 1997. HELCO also filed an Evaluation Report of IRP-2 in March 2004, which validated the forecasts and assumptions used in IRP-2, provided updates and revised Action Plans for resource options in DSM programs, renewable energy technologies, distributed generation, combined heat and power and conventional generation.

4.2.1. DSM Programs

HELCO has been implementing DSM programs since the first IRP. HELCO's existing DSM programs include three commercial and industrial programs and one residential program. These programs provide incentives to customers to install energy efficiency measures such as solar water heating (for residential customers), or high-efficiency lighting, air-conditioning and motors (for commercial and industrial customers) and therefore reduce the demand of electricity on the HELCO system. Specifically, these programs are:

- Commercial and Industrial Energy Efficiency Program (CIEE). The program provides various energy efficiency options from air-conditioning to lighting to existing commercial and industrial customers. Cash rebates are offered to customers who purchase qualified high-efficiency electric equipment. The program also provides vendor incentives to dealers who sell high-efficiency electric equipment.
- Commercial and Industrial New Construction Program (CINC). The program provides customers with design assistance and custom rebates for the construction of energy-efficient buildings and facilities. The program covers both new buildings/facilities and old buildings/facilities undergoing major renovation.
- Commercial and Industrial Customized Rebate Program (CICR). The program is to assist customers in identifying energy efficiency opportunities in conventional end uses and in their business-specific processes. It provides rebates for customized energy efficiency measures in existing facilities not covered by either the CIEE or CINC programs.
- Residential Efficient Water Heating Program (REWH). The program promotes the use of solar water heating and high-efficiency electric water heaters to customers in existing residences. Cash rebates are offered to residential customers who purchase qualified equipment.

In the IRP-3 integration analysis, three new DSM programs (Residential New Construction Program, Energy Solutions for the Home Program, and Residential Qualifying Income Program) and two load control programs (Residential Direct Load Control Program, and Commercial and Industrial Load Management) were included. However, due to the Commission's Decision and Order No. 23258, that established the transition of the administration of all energy efficiency DSM programs to a non-utility, third party administrator effective around January 2009, HELCO proposes to continue its existing four DSM programs, with modifications, until the transition to the non-utility market structure is completed. HELCO also proposes to implement two new load control programs beginning in 2008, but not to pursue the new energy efficiency programs.

Table 4.2 shows the estimated incremental savings from all of HELCO's DSM programs. The data shows that HELCO conservatively assumed about equal amounts of energy savings from its DSM programs each year during 2007 to 2010.

Table 4.2: Incremental Savings of All HELCO's DSM Programs

	2007	2008	2009	2010
Reduction of Peak Load (MW)	1.41	2.82	4.74	7.57
Reduction of Energy (MWh)	7,114	14,228	21,365	28,527
Expenditures ($000s) [1/]	2,525	2,621	3,333	3,916

Note: [1/]Includes expenditures on administration and incentives
Source: Table 5.7-1, HELCO IRP-3 Report (Docket No. 04-0046)

4.2.2 Renewable Energy Resources

HELCO analyzed various renewable resource options in the IRP-3 process. In addition to the existing contracts with renewable energy IPPs and its own renewable energy operations, renewable resources in the HELCO IRP-3 Preferred plan for the period of 2007 to 2026 includes:

- 37 GWh/year from renewable energy resources (beginning in 2014),
- 25 MW of firm capacity renewable resource (beginning in 2022), and
- 856 GWh of energy over the 20-year planning period from customer-installed PV resources.

HELCO's Sustainability Strategy is consistent with the Preferred Plan, with the possibility of additional potential IPP renewable energy projects including:

- 30 MW geothermal,
- 30 MW pumped storage hydro,
- 40 MW wind with storage,
- 8 MW waste-to-energy,
- 2 to 25 MW biomass,
- 1 MW hydro,
- 1 MW solar thermal,
- Landfill gas,
- Biofuels,
- Other emerging technologies, and grid enhancement

4.3 HELCO's Renewable Portfolio Standard Status Report

HELCO's RPS report is provided to the Commission as part of the HECO RPS status reports, which have been developed for the years 2001 through 2007. Each report documents results for a single year for the combined HECO Utilities (HECO, HELCO, and MECO). In this section, the information for HELCO is presented from the three reporting years 2005, 2006, and 2007.

HELCO owns and operates both fossil fueled power plants and small-scale renewable energy plants—hydro plants and one small wind farm. The energy from HELCO's renewable energy sources only accounts for about 1% of total energy supply. The majority of renewable energy utilized is from geothermal by PPA with PGV. Totally, about 33% of electricity sold by HELCO in 2007 was generated from a diverse portfolio of renewable energy resources, increasing from 26% in 2006 and 24% in 2005. Unlike HECO, electrical energy savings using renewable displacement technologies (solar water heating) and electrical energy savings using energy efficiency technologies did not contribute significantly to HELCO's RPS. Total sales of electricity by HELCO from 2005 to 2007 are shown in Table 4.3, on the next page.

Table 4.3: Total Sales of Electricity by HELCO

Unit: GWh

	2005	2006	2007
(1) Fossil Sales (6-5)	**787**	**789**	**701**
(2) Renewable Generation			
Geothermal (PGV)	221	212	230
Hydro (Wailuku River Hydro)	30	31	27
Hydro (Puueo & Waiau—HELCO owned)	9	24	15
Wind (Pikini Nui Wind Farm—AEC/ Tawhiri)[1/]	5	1	82
Wind (HRD)		23	34
Wind (Lalamilo Wind Farm—HELCO owned)	2	1	.4
Other IPP Hydro	1	1	.3
Total	**268**	**293**	**388.7**
(3) Electrical Energy Savings Using Renewable Displacement Technologies			
Solar Water Heating	10	11	13
Photovoltaic Systems	1.6	2.2	4.4
Total	**11.6**	**13.2**	**17.4**
(4) Energy Efficiency Technologies			
Total	**49**	**54**	**57**
(5) Total Sales of Renewable Electrical Energy (2)+(3)+(4)	**329**	**360**	**463**
(6) Total Electricity Sales	**1,116**	**1,149**	**1,163**
Percent of Renewable Electrical Energy in Total Sales (5)/(6)	**29.4%**	**31.3%**	**39.8%**
Percent of Renewable Generation in 10% Target[2/] (2) / [(6) x 0.10]	**240.1%**	**255.0%**	**334.2%**

Note: [1/]Included power from Kamaoa Wind Farm (2005 & 2006) and Pakini Nui Wind Farm (2007), operated by Apollo Energy Corporation and its wholly owned subsidiary Tawhiri Power LLC..
[2/]HRS § 269-92(b)(1) states that "At least fifty per cent of the renewable portfolio standards shall be met by electrical energy generated using renewable energy as the source". This number is calculated by dividing the Renewable Energy Generation (item 2) by the RPS standard for 2010, which is 10% of total sales, or 10% of item 6.

Source: Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc. and Maui Electric Company, Limited's Renewable Portfolio Standard Status Report, for year ended December 2005, 2006, and 2007

4.4 Demand Analysis

The forecast and actual sales of HELCO are compared in Table 4.4, on the next page. The difference between the forecast sales and actual sales during 2000 to 2010 was in an average of 5%, with forecast sales normally less than actual sales. The forecast sales were different from actual sales by less than 1% during 2005 to 2007. With HELCO's planned capacity to meet the forecast sales, it is likely that HELCO will be able to meet its customers' electricity demand in 2010 without any shortfall.

Table 4.4: Forecast and Actual Sales of HELCO during 2000-2010

Unit: GWh

Year	Forecast Sales (1)	Actual Sales (2)	Difference (1)-(2)
2000	911	954	-43
2001	919	959	-40
2002	932	995	-63
2003	946	1,046	-100
2004	960	1,083	-123
2005	1,115	1,117	-2
2006	1,140	1,149	-9
2007	1,162	1,163	-1
2008	1,185		
2009	1,203		
2010	1,211		

Sources: Forecast sales 2000-2004 from HELCO forecast dated 9/11/97 (IRP-2 Report, Appendix E); 2005-2010 from HELCO forecast dated 6/3/04 (IRP-3 Report 2007-2026 May 2007, Appendix L)

4.5 HELCO's Current Performance Evaluation

Renewable energy has been a large source of total power generation in the HELCO system. The amount of renewable energy generation is high and has been increasing every year. The 30 MW firm capacity contract for geothermal power from PGV, which is the main renewable energy resource, will continue until 2027. All non-firm contracts for IPPs (wind and hydro), which provide power as available, are expected to continue through the contract expiration years, which are between 2021-2027.

PGV is currently proposing to modify its existing PPA to provide an additional 8 MW to its existing facility, which will enhance the overall stability of the HELCO system. On May 15, 2008, the PUC issued a decision and order declaring the 8 MW expansion of PGV to be exempted from competitive bidding, which will enable HELCO and PGV to pursue negotiations for a new or amended PPA.

In the short term, through 2010, HELCO should be able to continue providing electricity to its customers with a high proportion of renewable energy sources in total electric sales. HELCO also has new potential projects coming on stream, including:

1) Tradewinds Biomass. HELCO signed a PPA with Tradewinds Forest Products, LLC (Tradewinds) in July 2007 to purchase energy produced from biomass (scrap wood from a veneer operation) at Tradewinds' cogeneration facility to be built in O'okala. HELCO will purchase between 2 MW and 3.6 MW of electricity from Tradewinds on a scheduled basis. An interconnection requirements study has been completed. HELCO and Tradewinds are in discussions on amending the PPA. An amendment is expected to be completed by mid 2008 and will be submitted to the PUC for approval. Tradewinds expects to sell energy to HELCO starting in fall 2010.

2) Hamakua Biomass Energy. Hamakua Biomass Energy (HBE) has proposed a 30 MW biomass combustion plant to be located in Hamakua. HBE's proposed facility would not be exempted from competitive bidding under the PUC's Framework for Competitive Bidding. In order to continue PPA negotiations with HBE, HELCO needs an approved waiver from competitive bidding from the PUC. Currently, a request for waiver from competitive bidding for HBE is being reviewed by the PUC in Docket No. 2008-0091.

In the Action Plan (2007-2011), HELCO describes several additional renewable energy technologies that it will pursue. These include potential use of pumped storage hydroelectric systems to provide ancillary services, and use of biofuels in existing and new units. These new projects can contribute to the long-term renewable energy portfolio of HELCO.

5.0 Maui Electric Company, Ltd.

MECO is an affiliate of HECO. MECO has three separate power grids providing electricity for customers on the islands of Maui, Molokai and Lanai. In 2007 MECO sold 1,280 GWh of electricity to about 66,000 customers on the three islands. MECO generates about 84% of the electricity sold, and purchases about 16% from IPPs. The fuel used in MECO's operation is diesel and fuel oil. The electricity from renewable energy source comes from IPPs, mainly from wind (9%) and biomass (4%). Hydropower contributes at a smaller amount to MECO's system.

5.1 MECO's Existing Electric System

MECO owns and operates 27 generating units at two power plants and one substation site on Maui. The four steam units located at Kahului Generating Station are fueled with No. 6 fuel oil (LSFO), with the capability of burning No.2 diesel fuel oil. Fifteen diesel engine generators located at Maalaea Generating Station are fueled with diesel fuel oil. Two dual-train combined-cycle units (DTCC), each consisting of two CTs and one heat recovery (unfired) steam turbine generator (STG), are also located at the Maalaea Station, and fueled by diesel. MECO also owns two standby diesel engine generators fueled with diesel fuel oil, which are located at the Hana Substation.

MECO also owns and operates a total of four firm-capacity generating units and six peaking generating units, for a total of approximately 12.1 MW at Palaau Generating Station in Molokai, and a total of eight-firm-capacity generating units totaling 9.4 MW at Miki Basin Generating Station in Lanai.

In addition to its own generation, MECO has power PPAs with three IPPs—Hawaiian Commercial & Sugar Company (HC&S), Kaheawa Wind Power, LLC (KWP), and Makila Hydro. HC&S sells power to MECO through a firm power contract in a fixed scheduled dispatch arrangement of 12 MW on-peak and 8 MW off-peak. In addition, HC&S provides 4 MW of under-frequency relay-controlled interruptible load (system protection) that is automatically used during system emergencies. HC&S is a subsidiary of Alexander and Baldwin. Its main business is sugar production at its sugar factory, the Puunene Mill. Bagasse (i.e., sugar cane waste) is used as the primary fuel to produce steam and electricity for sugar processing at the mill. No.6 fuel oil (MSFO) and coal are also used as the secondary fuels. HC&S also has hydroelectric generation. HC&S's existing PPA with MECO will continue through at least December 31, 2014.

KWP entered into a PPA with MECO in December 2004 to furnish power to the MECO grid for 30 MW of non-firm, as available wind power from its Kaheawa Pastures wind farm. The wind farm consists of 20 General Electric Wind Energy 1.5 MW wind turbines. KWP began selling energy to the Maui grid in June 2006.

MECO also executed a PPA with Makila Hydro in May 2005 for non-firm as-available hydro power from Makila's 500 kW hydro-electric facility. The hydro facility was operational in late 2006, but was damaged in the October 15, 2006 earthquake. The plant is currently closed for repairs, which are expected to be completed by late 2008.

All of the non-utility generators are located on Maui. MECO does not receive any purchase power from non-utility generators on Molokai and Lanai. MECO's existing electric systems are shown in Table 5.1.

Table 5.1: MECO's Existing Electricity System

	Fuel Type	Net Capacity (MW)	Contract Expiration Date
MECO Owned			
Kahului Generating Station (4 Steam Units)	MSFO	32.3	--
Maalaea Generating Station (15 Diesel Engines Units)	Diesel	94.8	--
Maalaea Generating Station (2 units DTCC)	Diesel	115.5	--
Hana Substation (2 Standby Diesel Generators)	Diesel	2.0	--
Palaau Generating Station—Molokai	Diesel	12.01	--
Miki Basin Generating Station—Lanai	Diesel	9.4	--
IPP-Firm Capacity			
HC&S	Bagasse/hydro/Oil/ Coal	16.0	2014
IPP-Non-Firm, As-Available Capacity			
Kaheawa Wind Farm	Wind	30.0	2026
Makila Hydro	Hydro	0.5	2026

Source: MECO IRP-3 Report (Docket No. 04-0077), Tables 5.6-1

5.2 MECO's Integrated Resource Planning

MECO has produced three IRPs and two evaluation reports. MECO filed the first IRP (IRP-1) in 1993. The second IRP was filed in May 2000 (referred to as IRP-2000 or IRP-2), covering the period of 2000-2020. The third IRP (IRP-3), covering the period of 2007-2026, was filed in April, 2007. MECO filed two evaluation reports after IRP-1– 1997 Evaluation Report (on June 2, 1997) and 1998 Evaluation Report (on July 8, 1998). MECO also filed two evaluation reports after IRP-2—2004 Evaluation Report (on April 30, 2004) and 2005 Evaluation Report (on April 29, 2005).

5.2.1 DSM Programs

MECO began implementing its DSM programs in 1996. These programs were applied to all three of the MECO Divisions—Maui, Molokai and Lanai. The programs were included in IRP-2 for the implementation over a 20-year period, 2000-2020, and are part of IRP-3. These programs are:

- Commercial and Industrial Energy Efficiency Program (CIEE). The program provides various energy efficiency options from air-conditioning to lighting to existing commercial and industrial customers. Cash rebates are offered to customers who purchase qualified high-efficiency electric equipment. The program also provides vendor incentives to dealers who sell high-efficiency electric equipment.
- Commercial and Industrial New Construction Program (CINC). The program provides customers with design assistance and custom rebates for the construction of energy-efficient buildings and facilities. The program covers both new buildings/facilities and old buildings/facilities undergoing major renovation.
- Commercial and Industrial Customized Rebate Program (CICR). The program is to assist customers in identifying energy efficiency opportunities in conventional end uses and in their business-specific processes. It provides rebates for customized energy efficiency measures in existing facilities not covered by either the CIEE or CINC programs.
- Residential Efficient Water Heating Program (REWH). The program promotes the use of solar water heating and high-efficiency electric water heaters to customers in new and existing residences. Cash rebates are offered to residential customers who purchase qualified equipment.

These four DSM programs have accounted for a total energy savings of 258.63 GWh, and a system peak reduction of 3.06 MW through the year 2004. These existing four programs are being implemented and will continue in all three divisions—Maui, Molokai and Lanai—at least through 2011, the end of the current Action Plan (2007-2011). The programs are enhanced to enable MECO to acquire greater energy saving and peak reductions. Greater enhancements in the DSM programs include increasing the average incentive per unit of energy savings for the commercial and industrial programs, considering smaller solar water heating units for incentives for cases in which limited hot water usage may shorten equipment life in the residential program, and evaluating financing mechanisms to enable greater customer participation. In addition, MECO has plans to implement a residential CFL program in the County of Maui in 2008, Residential Direct Load Control (RDLC) and the Commercial & Industrial Direct Load Control (CIDLC) on the island of Maui in 2009, and will not implement the three new DSM programs—Residential Energy Star® Qualified New Homes, Residential Energy Star® Qualified Products and Efficient Lighting, and Residential Low Income Energy Efficiency—until the transition of DSM programs to non-utility third party administrators is completed in 2009.

For Lanai and Molokai, due to the size and isolation of their systems, DSM programs are offered as service programs. The programs are similar to the energy efficiency DSM resource programs on Maui, but are not expected to generate significant energy savings.

The estimated energy savings from MECO's DSM programs during 2007 to 2010 are shown in Table 5.2. The savings were estimated at a relatively constant amount of about 10 GWh per year.

Table 5.2: Incremental Savings of All MECO's DSM Programs

	2007	2008	2009	2010
Reduction of Peak Load (MW)	1.54	6.61	10.10	13.24
Reduction of Energy (GWh)	9.77	20.00	31.49	42.98
Expenditures ($000s)[1/]	3,377	4,916	5,356	5,950

Note: [1/]Includes expenditures on administration and incentives
Source: Table 6.7-1, MECO IRP-3 Report (Docket No. 04-0077)

5.2.2 Renewable Energy Resources

MECO developed the IRP-3 Preferred Plan and a sustainability strategy for the Maui, Lanai, and Molokai Divisions. For the Maui Division, the renewable energy sources identified in the Preferred Plan include an acquisition of a nominal 10 MW renewable energy resource in 2011 (with a 10 MW wind project being a benchmark resource), a nominal 25 MW firm capacity renewable energy resource in 2018 (with a 25 MW biomass being a benchmark resource), and a nominal 10 MW firm renewable energy resource in 2023 (with a 7.1 MW waste-to-energy unit being a benchmark resource). PV systems will be installed throughout the planning period. Possible renewable energy projects using biofuels will be examined throughout the planning period (2007-2026).

For the Molokai Division and Lanai Division, no specific renewable energy projects are stated in the Preferred Plan through 2026 besides PV systems and possible renewable energy projects using biofuels.

The Action Plan, however, states the plan to investigate ancillary services benefits and the feasibility of pump storage hydro generation on Maui, and conduct a wind assessment and pursue wind energy resources on Molokai and Lanai.

A sustainability strategy for MECO includes more renewable energy, emerging technologies and the use of biofuels earlier in the timeline than what would have been identified through traditional IRP analysis.

5.3 MECO's Renewable Portfolio Standard Status Report

MECO's RPS report is provided to the Commission as part of the HECO RPS status reports that were developed for the years 2001 through 2007. Each report documents results for a single year for the combined HECO Utilities (HECO, HELCO, and MECO).

In this section, the information for MECO is presented from the three reporting years 2005, 2006, and 2007.

Electricity sold from the MECO grid is generated from diesel, fuel oil, coal as well as bagasse, hydro, and wind. A small amount of biodiesel has been used to date. The major biodiesel contracts will be negotiated in the future when the planned biodiesel production facility is expected to come online in 2009.

As shown in Table 5.3, during 2005 to 2007, renewable energy contributed over 10% of total electricity sales by MECO, with an increasing trend from 14% in 2005 to 19.4% in 2006 and 24.7% in 2007. Renewable generation as the source of renewable energy was also over 50%.

Table 5.3: Total Sales of Electricity by MECO

Unit: GWh

	2005	2006	2007
(1) Fossil Sales (6-5)	**1,077**	**1,021**	**964**
(2) Renewable Generation			
Biomass/hydro (HC&S)	75	79	69
Wind (KWP)		57	126
Biodiesel	0.1	0.2	1.4
Photovoltaic Systems	0.3	0.7	1.3
Total	**75.4**	**136.9**	**197.7**
(3) Electrical Energy Savings			
Solar Water Heating	23	26	30
Total	**23**	**26**	**30**
(4) Energy Efficiency &DSM Programs			
Total	**77**	**82**	**88**
(5) Total Sales of Renewable Electrical Energy (2)+(3)+(4)	**175**	**245**	**316**
(6) Total Electricity Sales	**1,252**	**1,266**	**1,280**
Percent of Renewable Electrical Energy in Total Sales (5)/(6)	**14.0%**	**19.4%**	**24.7%**
Percent of Renewable Generation in 10% Target[1/] (2) / [(6) x 0.10]	**60.2 %**	**108.1%**	**154.5%**

Note: [1/]HRS § 269-92(b)(1) states that "At least fifty per cent of the renewable portfolio standards shall be met by electrical energy generated using renewable energy as the source". This number is calculated by dividing the Renewable Energy Generation (item 2) by the RPS standard for 2010, which is 10% of total sales, or 10% of item 6.

Source: Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc. and Maui Electric Company, Limited's Renewable Portfolio Standard Status Report, for year ended December 2005, 2006, and 2007

5.4 Demand Analysis

The forecast and actual sales of MECO are compared in Table 5.4. The difference between the forecast sales and actual sales during 2000 to 2010 was an average of 5%, with forecast sales normally less than actual sales. The actual sales were about 2.5% greater than forecast during 2000 to 2005. MECO showed a demand growth of 2.5-3% through 2005, and then electricity demand grew at only 0.3% in 2005, followed by only 1.1% in 2006 and 2007. With MECO's planned capacity to meet the forecast sales, it is likely that MECO will be able to meet its customers' electricity demand in 2010 without any shortfall.

Table 5.4: Forecast and Actual Sales of MECO during 2000-2010

Unit: GWh

Year	Forecast Sales (1)	Actual Sales (2)	Difference (1)-(2)
2000	1,078	1,106	-28
2001	1,104	1,134	-30
2002	1,132	1,159	-27
2003	1,167	1,207	-40
2004	n/a	1,247	n/a
2005	1,226	1,252	-26
2006	n/a	1,266	n/a
2007	n/a	1,280	n/a
2008	n/a		
2009	n/a		
2010	1,413		

Sources: Forecast sales from MECO forecast dated 6/8/98 (IRP-2 Report, Appendix G)

5.5 MECO's Current Performance Evaluation

MECO identified in the IRP-2 Evaluation Report in 2005 the need for additional firm central station generating capacity in the 2009 to 2011 timeframe. MECO took steps to install a simple cycle CT at its Waena site with planned operation in 2011. MECO, in addition, has planned for several new renewable energy projects in IRP-3. The potential projects include the following:

1) Auwahi Wind Farm and Pumped Storage Hydro. Shell WindEnergy Inc. and Ulupalakua Ranch Inc. announced an agreement to construct a 22 MW wind farm on ranch land in East Maui with a potential pumped storage hydro facility. MECO is in discussions with the companies to integrate the project into Maui's grid system.

2) Wave Energy. Oceanlink, an Australian-based company, announced plans to provide up to 2.7 MW of electricity to MECO from two to three floating platforms located one-half to three quarter mile north of Pauwela Point on the northeast coast of Maui. MECO

and Oceanlink are in negotiations for a PPA. The project could be operational by the end of 2010.

3) Biodiesel. MECO currently uses a small amount of biodiesel for startup with diesel-fired units at the Maalaea Generating Station. MECO is evaluating the technical and permitting feasibility of burning biodiesel in all of its diesel-fired units at Maalaea. MECO plans to negotiate a biodiesel purchase contract with BlueEarth Maui, LLC (BlueEarth Maui) for its biodiesel. The biodiesel plant is scheduled to be in operation by early 2011. It will initially produce 40 million gallons per year of biodiesel from palm oil imported from sustainable imported and locally grown feedstock. It is estimated that about 85% of MECO's generation capacity could potentially be converted from petroleum diesel to renewable biodiesel.

4) Pulehu Power. Bio Energy Systems of Hawaii is proposing an approximately 5.5 MW firm capacity biomass project that involves the gasification of dead and downed timber, and wattle trees into a burnable gas in a downdraft gasifier. Currently, a request for waiver from competitive bidding for Pulehu Power is being reviewed by the PUC in Docket No. 2008-0061.

5) Additional wind projects proposed for MECO's service territory.

6.0 RPS Performance Evaluation of Hawaii's Utilities

The central focus of this analysis is to provide the PUC with an assessment of the status of Hawaii utilities' efforts to meet the first requirement for the RPS that 10% of electricity used in the state will come from renewable resources and end use efficiency in 2010. Previous chapters have presented the current and projected status of efficiency and renewable energy programs at both the HECO Utilities and KIUC. This chapter will discuss the probability that both KIUC and the HECO Utilities will be able to meet the RPS target in 2010 given their current plans.

The overall probability that the utilities will meet the 2010 RPS goal is assessed by examining the uncertainty that exists in four basic areas: electricity demand, implementation of DSM programs, implementation of renewable energy programs, and uncertainty in the availability and performance of renewable energy technologies. Each of these factors could have significant influence over the ability of the utilities to meet the first RPS legislative mandate of 10% renewable energy electricity in the year 2010.

Uncertainty in electricity demand: The RPS requirement is calculated as percentage of total energy demand in a specified year (in this case 2010). If the actual demand will be significantly higher or lower than the projected demand, the ability of meeting the fixed percentage (10% for 2010) would be impacted. If demand is higher than expected, the planned implementation efficiency and renewable energy activities may not be sufficient to meet the requirement. Likewise, if overall electricity demand is less than anticipated, the percentage of demand met by planned efficiency and renewable energy projects would be higher than anticipated.

Uncertainty in the implementation of utility DSM programs: Through the IRP process, the utilities have projected the effectiveness of their planned DSM programs. The IRP plans will be reviewed, and the historical projections will be compared to the actual implemented results, and these actual variations will be used to judge the expected probability of meeting the 2010 requirement.

Uncertainty in the implementation and utilization of utility renewable energy projects: Natural variations in renewable energy resources can be difficult to anticipate. Information available from both the IRP process and recent historical data will be utilized to judge the expected probability of meeting the 2010 requirement for planned renewable energy electricity generation.

Uncertainty in the availability and performance of new renewable energy technologies: Due to the development of new RPS programs and other renewable energy support programs on the mainland, shortages could occur in the availability of renewable energy equipment. The National Renewable Energy Laboratory has recently reported that by 2010, clean-energy demand will outpace generation by 37% that in turn could impact the ability of Hawaii utilities to complete planned projects. Also, uncertainty as to whether government tax incentives for renewable energy project will continue could temper the development of future renewable energy projects. At the same time, new solar

technologies are becoming commercial that promise to reduce the price while improving the performance of renewable energy systems, thus making it possible for utilities to expand their renewable energy production programs. This uncertainty is expected to impact RPS related performance in the 2015 and 2020 timeframes greater than those of 2010, which is the focus of this report.

Finally, there is uncertainty in the definitions that the state and the utilities are operating under. One outcome from the current study is to start addressing the issue of proper definitions. While this is not an issue for the utilities reaching their required goals in 2010, it will most assuredly start to impact the future state requirements.

6.1 KIUC

Demand Uncertainty: The KIUC 2010 RPS mandate is defined as a percentage of total sales that includes direct sales and displaced sales due to its DSM programs and customer side renewable energy productions. Recent total sales history, which was taken from KIUC's 2007 RPS status report (Table 2.1) shows that change during those years ranged from 7.9 % to 0.8% with an average growth of 3.2% over the 5 most recent years where information is available. The value of 3.2% expected growth would seem to be conservative, given that the average growth during the longer 1997-2006 timeframe from KIUC's IRP reports (as shown in Table 2.2) was only 1.9%. Thus, for this review, an average annual growth rate of 3.2% will be applied to 2007 data in order to estimate the total electricity sales in 2010 (see Table 6.1).

Table 6.1 Projected KIUC Total Electricity Sales

Unit: MWh

Year	2003	2004	2005	2006	2007	2008*	2009*	2010*
Sales	438,768	473,608	477,255	481,461	496,718	512,613	529,016	545,945
Growth		7.9	0.8	0.9	3.2	3.2	3.2	3.2

* Projected based upon historical 3.2% annual growth

Also, given the current high global energy prices and economic uncertainties, this projection of electric sales is likely to be higher than the actual sales. This would mean that the potential for high, unexpected growth in electrical sales that would require a significant expansion in renewable electricity production in order to meet the 2010 RPS mandate is very low at this time.

DSM Program Implementation Uncertainty: The performance of KIUC's DSM programs can be seen in both the 2007 RPS status report (Table 2.1) and the 2006 IRP update report given in Table 2.2. Information from the 2007 RPS status report shows that the category of total "conserved energy," which includes solar water heating, net energy metering and DSM savings, has increased each year through 2007. The earlier time series data for 1997-2003 from the 2006 IRP update likewise shows a continual increase in electricity conserved due to utility DSM activities. For purposes of the Hawaii RPS, DSM savings are counted in a cumulative manner, with each year being added to the

previous year to obtain the year-end total. It is thus difficult to see a drop in the "conserved energy" category. The total conserved energy for the 2003-2007 period taken from the RPS status report is shown in Table 6.2 below. The growth rate varied from 0.9% to 7.3%, with an average of 3.1% over the 5 years where data was available. For this review, an average annual growth rate of 3.1% will be applied to 2007 data in order to estimate the total conserved energy in 2010.

Table 6.2: KIUC Total Conserved Energy (CE)

Unit: MWh

Year	2003	2004	2005	2006	2007	2008*	2009*	2010*
Total CE	26,437**	26,685	28,644	29,382	29,822	30,746	31,670	32,682
Growth		0.9%	7.3%	2.6%	1.5%	3.1%	3.1%	3.1%

Notes: *Projected based upon a 3.1% annual growth rate
** Total CE for 2003 was estimated by combining the actual DSM impact given in Table 2.2 with the solar water heating and net energy metering impact giving in Table 2.1.

Given the continual expansion of KIUC's DSM program through 2008-2010, the probability is high that KIUC will at least maintain the "conserved energy" quantities contained in the 2010 projection shown in Table 6.2.

Uncertainty in Renewable Generation: The data presented in KIUC's 2007 RPS status report shows the impact of resource variability on actual generation. Table 6.3 summarizes total renewable energy generation on Kauai during 2003 to 2007.

Table 6.3: KIUC Total Renewable Energy Generation (RE)

Unit: MWh

Year	2003	2004	2005	2006	2007
Total RE	25,490	36,053	37,900	37,443	26,895

The table shows that although renewable energy generation increased in 2004 and 2005, it decreased in 2006 and 2007. KIUC explained the decrease as due to reductions in its hydro generation from the Waiahi hydro plants due to (1) reduced rainfall resulting in reduced water supply, (2) ditch system repairs, and (3) shutdown of the lower Waiahi hydro to accommodate a movie production in the nearby area. In addition, KIUC explained that total power purchases from other firms were reduced compared to 2006 due to reduced rainfall. As discussed in Chapter 2, KIUC is in the process of diversifying its renewable energy generation, and it has reported that a 6.4 MW biomass to energy facility and a 12.5 MW wind farm could be in commercial operation by 2010. As a conservative estimate of the amount of renewable energy generation that may be available in 2010, a simple average of the 2003-2007 data yields 32,756 MWh as the estimated renewable energy generation for 2010.

Probable 2010 RPS Estimate: The conservative values estimated above have been combined in Table 6.4 to provide an estimate of the probable performance of KIUC in meeting the 2010 RPS of 10% of renewable electrical energy. The best information available shows that KIUC will most likely exceed the 2010 standard by having an overall RPS generation of 12%. Of this total, it is estimated that at least 60% will come from renewable generation, which is 10% above the minimum of 50% that has been set by the Hawaii RPS legislation.

Table 6.4: Probable KIUC 2010 RPS Estimate

Year	2008	2009	2010
(1) Renewable Generation (MWh)	32,756	32,756	32,756
(2) Conserved Energy (MWh)	30,746	31,670	32,682
(3) Total Electricity Sales (MWh)	512,613	529,016	545,945
Percent of Renewable Electrical Energy in Total Sales [(1)+(2)]/(3)	12.4%	12.2%	12.0
Percent of Renewable Generation in 10% Target[1/] (1) / [(3) x 0.10]	63.9%	61.9%	60.0%

Note: [1/]HRS § 269-92(b)(1) states that "At least fifty per cent of the renewable portfolio standards shall be met by electrical energy generated using renewable energy as the source". This number is calculated by dividing the Renewable Energy Generation (item 1) by the RPS standard for 2010, which is 10% of total sales, or 10% of item 3.

6.2 The HECO Utilities

The HECO Utilities provide electric service to about 95% of the people of Hawaii. The total sales of electricity from the HECO Utilities were 10,089 MWh in 2005, 10,116 MWh in 2006, and 10,118 MWh in 2007. These combined sales were provided by power generated from fossil fuels, and renewable energy and include electrical energy savings using renewable displacement technologies, and electrical energy savings using energy efficiency technologies.

As allowed by the RPS law, the HECO Utilities can combine their renewable energy portfolio to meet Hawaii's RPS. During the years of 2005 to 2007, the HECO Utilities have utilized renewable energy and energy efficiency technologies and achieved renewable electrical energy use beyond 10% of net electricity sales. The percent of renewable electrical energy in total net sales in 2005 was 11.7%, and increased to 13.8% in 2006, and 16.1% in 2007. The percentage of electrical energy from renewable energy as the source in total renewable energy also exceeded the requirement of 50%.

Table 6.5, on the next page, shows total sales of electricity by the HECO Utilities during 2005 to 2007 classified by energy source.

Table 6.5: Total Sales of Electricity by HECO, HELCO and MECO

Unit: GWh

	2005	2006	2007
(1) Fossil Sales (6)-(5)	**8,909**	**8,717**	**8,494**
(2) Renewable Generation			
Municipal Solid Waste	333	395	326
Geothermal	221	212	230
Hydro	40	56	42.3
Wind	7	82	242.4
Biomass/Hydro	75	79	69
Biodiesel	0.1	0.2	1.4
Total	**678.4**	**827.6**	**911.1**
(3) Electrical Energy Savings Using Renewable Displacement Technologies			
Solar Water Heating	84	95	109
Photovoltaic Systems	**2.3**	**3.4**	**7.4**
Total	**86.3**	**98.4**	**116.4**
(4) Electrical Energy Savings Using Energy Efficiency Technologies			
Quantifiable Energy Conservation	418	476	598
Total	**418**	**476**	**598**
(5) Total Sales of Renewable Electrical Energy (2)+(3)+(4)	**1,180**	**1,399**	**1,626**
(6) Total Electricity Sales	**10,089**	**10,116**	**10,118**
Percent of Renewable Electrical Energy in Total Sales (5)/(6)	**11.7%**	**13.8%**	**16.1%**
Percent of Renewable Generation in 10% Target[1/] (2) / [(6) x 0.10]	**67.2%**	**81.8%**	**90.0%**

Note: [1/]HRS § 269-92(b)(1) states that "At least fifty per cent of the renewable portfolio standards shall be met by electrical energy generated using renewable energy as the source". This number is calculated by dividing the Renewable Energy Generation (item 2) by the RPS standard for 2010, which is 10% of total sales, or 10% of item 6.

Source: Hawaiian Electric Company, Inc., Hawaii Electric Light Company, Inc. and Maui Electric Company, Limited's Renewable Portfolio Standard Status Report, for year ended December 2005, 2006, and 2007

Demand Uncertainty: As mentioned earlier, the 2010 RPS mandate for the HECO Utilities will be the combined RPS of HECO, HELCO, and MECO. The RPS is defined as a percentage of total sales that year that includes direct sales and displaced sales from their DSM programs and customer-side renewable energy productions. The HECO Utilities have projected their 2010 total electricity sales as part of their individual IRP-3 reports. The HECO Utilities' combined actual and projected total electricity sales are shown in Table 6.6 on the next page.

Table 6.6: Projected HECO Utilities Total Electricity Sales

Unit: GWh

Year	2003	2004	2005	2006	2007	2008*	2009*	2010*
Sales	9775	10,063	10,090	10,116	10,118	10,354	10,500	10,640
Growth		2.95	0.27	0.26	0.02	2.33	1.41	1.33

Note: *Projected growth taken from HECO, HELCO, and MECO individual projections
Source: Combined data from Table 3.4, 4.3, and 5.3 of this report

Table 6.6 shows that the HECO Utilities experienced unexpected low growth during the recent years of 2003-2007, with an average annual growth rate of only 0.87%. This number is a little over 50% of the growth that they projected to occur in 2008-2010. Thus, the probability that the HECO Utilities will have total electricity sales significantly greater than the projected number of 10,640 GWh in 2010 is estimated to be very low. In fact, the actual 2010 sales is likely to be under the projected value due to current global economic conditions that will undoubtedly negatively impact Hawaii in the near future. However, for this analysis, HECO's combined projected total electricity sales of 10,640 GWh in 2010 are used as a conservative estimate for the RPS projection.

DSM Program Implementation Uncertainty: The performance of the current HECO Utilities' DSM programs can be seen by comparing the three RPS status reports that have been developed for 2005, 2006 and 2007 and shown in Table 6.5. Future projected DSM impacts taken from the IRP reports (summarized in Table 3.2) show a constant annual increase of 38.9 GWh. Information from the combined RPS status reports show that the total electrical energy savings of both renewable energy displacement technologies (solar water heater) and electrical energy savings through quantifiable energy conservation have increased significantly in the reporting years of 2006 and 2007, where savings increased by 13.1% and 23.8%, respectively. For a conservative projection of total electrical energy savings in the future, this analysis assumes a constant increase of 38.9 GWh. This actual and projected electrical energy savings during 2005 to 2010 is shown in Table 6.7.

Table 6.7: HECO Utilities Total Electrical Energy Savings (TEES)

Year	2005	2006	2007	2008*	2009*	2010*
TEES (GWh)	502	571	707	759	811	863
Growth		13.1%	23.8%	7.3%	6.8%	6.4%

*Projected based upon a fixed annual increase of 52 GWh taken from IRP-3

Since the observed increase in total electrical energy savings in the past two years was more than double what had been projected earlier by HECO, using HECO's IRP projection for the next three years is a very conservative assumption. Another reason for using this conservative value is the uncertainty associated with the January 2009 transition to a non-utility third party DSM administrator. Although existing programs are likely to continue, new programs are unlikely to be developed until the transition to the non-utility third party administrator is completed.

Uncertainty in Renewable Generation: The HECO Utilities have demonstrated continual growth in renewable energy generation as reported in their last three RPS status reports which are summarized in Table 6.5 above. Total renewable generation has increased from 678.4 GWh in 2005 to 827.6 GWh in 2006, and 917.3 GWh in 2007. This amounts to about a 35% increase in just over three years. HECO has a broad portfolio of renewable energy fuels. Thus, reduced generation of one resource has generally been picked up by increased generation of another resource. Although recent history shows an increasing trend in renewable energy generation, a conservative estimate for renewable energy generation during 2008 to 2010 is made by averaging the actual production shown during 2005 to 2007. That yields a value of 808 GWh of renewable generation each year through 2010. Since the review of the IRP plans shows that the HECO Utilities continue to develop their renewable energy generation capacity, using such an average will account for any uncertainty that does exist in both bringing on new capacity in the near future and natural variability in current renewable energy resources.

Probable 2010 RPS Estimate: The conservative values estimated above have been combined in Table 6.8 below to provide an estimate of the probable performance of the HECO Utilities in meeting the 2010 RPS of 10% of renewable electrical energy. The best information available shows that the HECO Utilities will most likely exceed the 2010 standard by having an overall RPS generation of 15.7% in 2010. Of this total, it is estimated that at least 76% will come from renewable generation, which is 26% above the minimum of 50% that has been set by the Hawaii RPS legislation.

Table 6.8: Probable HECO Utilities 2010 RPS Estimate

Year	2008	2009	2010
(1) Renewable Generation (GWh)	808	808	808
(2) Total Electrical Energy Savings (GWh)	759	811	863
(3)Total Electricity Sales (GWh)	10,354	10,500	10,640
Percent of Renewable Electrical Energy in Total Sales [(1)+(2)]/(3)	15.1%	15.4%	15.7%
Percent of Renewable Generation in 10% Target[1/] (1) / [(3) x 0.10]	78.0%	77.0%	76.0%

Note: [1/]HRS § 269-92(b)(1) states that "At least fifty per cent of the renewable portfolio standards shall be met by electrical energy generated using renewable energy as the source". This number is calculated by dividing the Renewable Energy Generation (item 2) by the RPS standard for 2010, which is 10% of total sales, or 10% of item 6.

6.3 Conclusions

Pursuant to HRS § 269-95, HNEI assessed the capability and likelihood of the electric utility companies in the state (HECO, HELCO, MECO, and KIUC) to achieve the 2010 RPS in a cost-effective manner.

This report was developed to serve as the deliverable under Task 4 as part of the "Assessment of Renewable Portfolio Standard Goals" conducted by HNEI for the PUC. In conducting this analysis, HNEI reviewed and commented upon the existing and on-going IRP documents being developed by the state utilities. The IRP plans are integral for evaluating how the utilities plan to meet obligations under the RPS law. The focus of these analyses was to provide the PUC with an assessment of the status of the state utilities' efforts to meet the first requirement for the RPS – 10% of electricity used in the state from renewable resources in 2010. An assessment of current end use energy efficiency and demand response plans of the utilities was also performed. This is because up to 50% of the RPS requirements can be met through end use energy efficiency programs.

In addition to the IRP plans, this report drew upon information provided by the utilities in their RPS status reports filed with the PUC. Each utility has filed reports on their performance on an annual basis since 2001 for the HECO Companies and since 2005 for KIUC. The utilities also provided additional information to HNEI as requested to supplement that available from the existing IRP and RPS reports.

The review of existing plans found that, although KIUC and the HECO Companies had different mixes of energy efficiency programs, both have been successful in applying their programs to reduce energy consumption in their respective service territories on a continuing basis. In a similar manner, the review of the development of renewable energy based generation showed that each utility had a continued increase in the development of the renewable energy resources that were most cost-effective on their respective islands. Based on the past performance actual data characterizing both the implementation of energy efficiency programs to reduce energy demand and renewable energy based generation programs to increase renewable energy supply, HNEI projected that KIUC will have a minimum RPS percentage of 12% in 2010 and the HECO Companies will have a minimum RPS percentage of 15.7% in 2010.

The Hawaii RPS law also states that at least 50% percent of the RPS should be met by electrical generation using renewable energy as the source. For this goal, HNEI projects that KIUC will actually have a minimum of 60% of its RPS goal met by electrical generation using renewable energy sources while the HECO Companies will have a minimum of 76% of their RPS goal met by electrical generation using renewable energy as the source.

In making these projections, it was clear that significant challenges exist to meeting the ultimate RPS requirement of 20% by the year 2020. There are also important areas for clarification in the RPS legislation that HNEI believes need to be addressed as Hawaii moves towards its 2020 requirement. These challenges will be reviewed in detail in the final report of this project.

Glossary

"Action Plan" means a Program Implementation Schedule generated pursuant to Section III.A.2 of the IRP Framework.

"Annual RPS Report" means a report filed pursuant to Section III.A.5 of the RPS Framework.

"Commission" means the Public Utilities Commission of the State of Hawaii.

"Compliance Plan" means a plan that the Commission may in its discretion require an electric utility to file, in accordance with Section III.B of the RPS Framework, if the utility did not meet the RPS at its most recent Goal Date, or if the Commission determines that the utility will likely be unable to meet the RPS at its next Goal Date.

"Compliance Year" means a Reporting Year ending on one of the three dates stated in HRS § 269-92(a), i.e., (1) the year ending on December 31, 2010; (2) the year ending on December 31, 2015; and 3) the year ending on December 31, 2020.

"Cost-effective" is defined in accordance with HRS § 269-91.

"DSM" means demand-side management.

"Demand-side management program" means a program designed to influence utility customer uses of energy to produce desired changes in demand. It includes conservation, load management, and energy efficiency resource programs.

"Electric utility" or "utility" is defined in accordance with the definition of "Electric utility company" in HRS § 269-91.

"Explanation" means a filed explanation of a utility's failure to comply with the RPS statute, as required by HRS § 269-94.

"Framework" means the RPS framework, filed in the Commission's RPS docket, Docket No. 2007-0008.

"Goal Date" means December 31st of each Compliance Year.

"HECO" means Hawaiian Electric Company, Inc.

"HECO Companies" means HECO, MECO and HELCO, collectively.

"HELCO" means Hawaii Electric Light Company, Inc.

"HRS" means the Hawaii Revised Statutes.

"IPP" means an independent power producer that is not subject to the Commission's regulation or jurisdiction as a public utility.

"IRP" means integrated resource planning.

"IRP Framework" means the Commission's Framework for Integrated Resource Planning, dated May 22, 1992, as amended by In re Pub. Util. Comm'n, Docket No. 05-0075, Decision and Order No. 22490, filed on May 26, 2006.

"IRP Plan" means an electric utility's Integrated Resource Plan that has been submitted to the Commission for review and approval in the utility's IRP proceeding, in accordance with the Commission's IRP Framework. The overall goal of integrated resource planning is the identification of the resources or the mix of resources for meeting near and long term customer energy needs in an efficient and reliable manner at the lowest reasonable cost. Each electric utility is responsible for developing an IRP Plan that meets the energy needs of its customers. The IRP Framework requires each electric utility to develop a long-range, twenty (20)-year plan and a medium-range five (5)-year Action Plan to be submitted on a three (3)-year planning cycle for the Commission's review and approval. The IRP process is a vehicle for the Commission, the electric utilities, energy stakeholders, and the public to understand and influence the planning process involved in identifying and evaluating themix of demand-side and supply-side energy resources needed to meet near and long-term energy needs in an efficient and reliable manner at the lowest reasonable cost.

"MECO" means Maui Electric Company, Limited.

“PPA” means a power purchase agreement or contract to purchase firm capacity, energy, or both, from an electric utility.

“RFP” means a written request for proposal issued by the electric utility to solicit bids from interested third-parties, and where applicable from the utility or its affiliate, to supply a future generation resource or a block of generation resources to the utility pursuant to the competitive bidding process.

“Renewable electrical energy” is defined in accordance with HRS § 269-91, which includes: (1) Electrical energy generated using renewable energy as the source; (2) Electrical energy savings brought about by the use of renewable displacement or off-set technologies, including solar water heating, seawater air-conditioning district cooling systems, solar air-conditioning, and customer-sited, grid connected renewable energy systems; and (3) Electrical energy savings brought about by the use of energy efficiency technologies, including heat pump water heating, ice storage, ratepayer-funded energy efficiency programs, and use of rejected heat from co-generation and combined heat and power systems, excluding fossil-fueled qualifying facilities that sell electricity to electric utility companies and central station power projects.

"Renewable energy" is defined in accordance with HRS § 269-91, meaning energy generated or produced utilizing the following sources: (1) wind; (2) sun; (3) falling water; (4) biogas (including landfill and sewage-based digester gas); (5) geothermal; (6) ocean water, currents and waves; (7) biomass (including biomass crops, agricultural and animal

residues and wastes, and municipal solid waste); (8) biofuels; and (9) hydrogen produced from renewable energy sources.

"Reporting Year" means the calendar year prior to the date on which a utility is required to file an Annual RPS Report pursuant to Section III.A.5 of the RPS Framework.

"RPS" or "Renewable Portfolio Standard" is defined in accordance with HRS § 269-91.

"Total electrical energy sales" or "net electricity sales" means the total MWhs of electrical energy sold by a utility to its customers during a given year.