Kauai Island Utility Cooperative
2004 Annual Report







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Messages from the CEO and Chairman of the Board

Aloha KIUC Members,

The employees, board of directors, and you, the membership, are continuing to work towards our goal of making the first cooperative in Hawaii a success. Once again, KIUC has returned to its member-owners, $3.1 million of patronage capital and an additional $1 million distribution from the KPS power plant purchase for a total of $4.1 million. KIUC is unique in the co-op world in that a patronage capital refund from a newly formed co-op is unusual. It is KIUC's management and board of directors' goal to continue these refunds as we forge on to control our own destiny.

As you all are aware, our cost of supplying electrical energy to our membership is directly related to the oil industry, and the price of oil continues to rise with little or no relief in sight. To counter this uncontrollable expense, we must utilize every avenue of renewable options available to us. We have recently completed our review of a study outlining what would best serve KIUC's member requirements, and have begun the task of appraising the most appropriate scenarios for our community. We are staying in constant contact with other co-ops that share our dependency on petroleum, as well as the rest of the electrical industry. Our quest into renewable energy resources has just begun.

We will continue to investigate the possibility of wind, hydro, biomass, solar and photo voltaic. In addition, we are interested in bio-diesel, and the support crops that could and would be grown on our island. Battery Energy Storage Systems are also being addressed as possible load conditioning, peak-shaving additions that would result in cleaner electrical power as well as fuel conservation.

As part of our vision, KIUC must ensure we are responsive to the needs and requirements of our member-owners. We hope you'll take the time to read our 2004 KIUC Annual Report or to view it online at www.kiuc.coop, and to let us know how we can better serve you in the future.

Very truly yours,

Dutch Achenbach

Dutch Achenbach
President & CEO

KIUC Box Score:

2004 Total Margins (profits) from operations	**$12,594,561**
2004 Total Margins to be Returned to Membership	**$3,148,640**
Special One-Time Refund*	**$1,000,000**
Total Member Equity (2 years)	**$17,754,770**
Total Member Equity (2 years) as a percent	**6.20%**
System Improvement Projects in 2004	**$9,721,818**
Balance in Line of Credit facilities at 12/31/2004	**0**
Fuel Saved by Improved Efficiencies (Kapaia Power Station purchase, operational efficiency improvements, including hydro's)	**3,818,781 gallons**

*KPS purchase

Aloha Membership,

Year two of your ownership brought many challenges for your company and the board of directors. We said aloha to our former CEO, Alton Miyamoto, who retired, and then we conducted a nationwide search reviewing over 100 resumés before hiring our new CEO, 40-year utility veteran, Dutch Achenbach. So please join the board in welcoming Dutch and his wife Dora to our community.

We have all seen our electric bills rise during the past two years. Your base rate for electricity usage has not changed since 1996, when crude oil was $18 per barrel. Recently we have seen oil prices as high as $58 per barrel. Your bill increases have gone strictly to pay for this increased fuel cost. In response, the board commissioned several feasibility studies to look at ways to reduce our cost of fuel and our dependence on oil.

First, we commissioned an engineering study to look at energy efficiency for our main Port Allen combustion turbine to determine if replacing it with a new energy-efficient model would be a benefit to the membership. The decision will be made based on the replacement's compatibility with our long-term Integrated Resource Planning now underway.

Next, we are in the process of finishing a study on additional storage facilities for fuel which could provide us with buying options from more than one source so opportunities for competition could help reduce our overall fuel cost.

Finally, we commissioned a renewable energy study looking at wind, hydro, photovoltaic, wave energy, biomass/coal and bio diesel as potential options specifically for the island of Kauai to help us reduce our oil dependency. In addition, we are looking at storage technology to help stabilize our system as we bring on incremental daily demand both in terms of energy savings and power quality issues. The renewable energy study is on our website www.kiuc.coop, and the battery study should be completed by early June. We will then set up a series of member meetings in various communities to share with our membership the options available to our island, as we work together toward directing our energy future.

On a sad note, one of our first-elected directors, Abel Medeiros, passed away in April. We appreciate his contribution in KIUC's first operating year, and he will be missed. During our last election in March the membership elected two new directors, Peter Yukimura and Teofilo "Phil" Tacbian. We welcome these new directors who are already working hard on your behalf. I'm also happy to report that the directors who have been on the board for more than a year, Ron Kouchi, Saburo Yoshioka, Susan Stayton, Dee Crowell, Raymond Paler and Jim Mayfield have all completed their Certified Credentialed Directors training, have passed the national testing requirements and have been certified by the National Rural Electric Cooperative Association.

In closing, the financial reports for KIUC are exceptional with member equity at year's end at 6.20 percent enabling us within the next 30 days to return an additional $3,148,640.25 worth of patronage capital refund checks to you, along with an additional $1 million one-time savings from acquiring the ownership of Kauai Power Partners now known as the Kapaia Power Station.

On behalf of your board of directors I am very happy to report to our member/owners that Kauai Island Utility Cooperative is in fine financial health.

Sincerely,

Gregg Gardiner

Gregg Gardiner
Chairman of the Board
Kauai Island Utility Cooperative

We are pleased to report that the KIUC results of operations through December 31, 2004 remained strong. Total revenues, expenses and net income totaled $118.9 million, $106.3 million, and $12.6 million, respectively, for the twelve-month period ending December 31, 2004.

As is the case for all electric utilities, the cost of power generation is the largest expense, totaling $55.2 million or 46.4% of revenues. Fuel costs are the largest component of power generation. Administrative and general costs are $8.9 million or 7.5% of revenues. Operations and maintenance of electric lines cost $3.0 million or 2.5% of total. Member services cost $2.2 million or 1.9% of the total revenues.

Being very capital intensive, depreciation (and amortization) of the utility plant was $17.0 million or 14.3% of total revenues. Interest on long-term debt, although a very favorable sub-5%, totals $10.2 million or 8.6% of revenues. Although not subject to federal income taxes, state and local taxes are $9.8 million or 8.2% of revenues. Revenues less total expenses equal margins of $12.6 million or 10.6% of total revenue. Margins are allocated to consumer members and paid when appropriate.

During 2004, KIUC Management determined that an error was made in the allocation of the 2002 and 2003 patronage capital to members. We have corrected the mis-allocation and have taken steps to ensure complete and accurate patronage capital allocations in the future.

As a result, you may see an adjustment on your 2004 patronage capital refund statement. If you have any questions regarding your 2004 patronage capital refund or the 2002-2003 adjustment, please contact a Member Services Representative at (808) 246-4303.

Through December 31, 2004, the total financial benefit (direct and indirect) to KIUC members is significant. These direct financial benefits include the following: $3 million refund from the prior owner, $4.2 million in avoided rate increases ($2.1 million per year), $1.7 million patronage capital refund for 2002 and 2003, $3.1 million patronage capital refund for 2004, $1 million special one-time patronage capital refund for 2004, to be returned to members in 2005. This amounts to $13 million in direct financial benefits through December 31, 2004.

In addition, the indirect financial benefits (ie., ownership) include patronage capital that is held by KIUC on behalf of its members to be distributed at future dates as determined by the KIUC Board of Directors. This amounts to $13.7 million in indirect financial benefits to KIUC members as of December 31, 2004.

Balance Sheets
December 31, 2004 and 2003

Assets	2004	2003
Utility Plant		
Electric plant in service	$389,437,082	$387,479,962
Construction work in progress	3,300,807	2,266,723
Total utility plant	392,737,889	389,746,685
Accumulated provision for depreciation	(150,099,521)	(138,505,129)
Net utility plant	242,638,368	251,241,556
Investments:		
Investments in associated organizations	100,994	- 0
Other investment	8,449,902	3,000,000
	8,550,896	3,000,000
Current Assets:		
Cash and cash equivalents	5,109,132	1,830,940
Accounts receivable:		
Customers	8,043,097	5,715,870
Unbilled	6,499,462	4,751,732
Allowance for doubtful accounts	(79,045)	(86,781)
	14,463,514	10,380,821
Materials and supplies	9,045,208	8,007,996
Prepaid expenses and other	952,874	1,154,036
Total current assets	29,570,728	21,373,793
Deferred Charges	5,751,296	6,010,306
Total assets	**$286,511,288**	**$281,625,655**
Equity and Liabilities		
Equity:		
Memberships	$ 279	$ 257
Patronage capital	17,754,491	6,879,907
Net unrealized gain on investments	51,222	- 0
Total equity	**17,805,992**	**6,880,164**
Long-Term Liabilities:		
RUS mortgage notes, less current portion	231,073,284	208,017,055
CFC mortgage notes, less current portion	7,632,313	39,574,000
Postretirement benefit obligations	4,038,498	4,077,104
Customer advances for construction	1,324,965	2,894,114
Deferred credits	8,730,201	7,301,315
Total long-term liabilities	**252,799,261**	**261,863,588**
Commitments and Contingencies		
Current Liabilities:		
Current portion of long-term debt	5,825,000	2,541,000
Accounts payable	4,010,429	5,479,749
Customer deposits	496,047	432,345
Other current and accrued liabilities	5,574,559	4,428,809
Total current liabilities	15,906,035	12,881,903
Total equity and liabilities	**$286,511,288**	**$281,625,655**

These financial statements were audited by KMH LLP, an independent Certified Public Accounting firm. A full report including the accompanying notes, which are an integral part of these financial statements, is available for your review at KIUC.

Statements of Revenues and Patronage Capital

For the years ended December 31, 2004 and 2003

	2004	2003
Operating Revenues	$118,907,802	$99,185,257
Operating Expenses:		
Cost of power	55,220,546	41,079,605
Depreciation and amortization	17,021,299	16,686,714
Transmission operations	351,065	259,628
Transmission maintenance	322,838	286,685
Distribution operations	1,062,267	1,172,326
Distribution maintenance	1,756,110	1,571,449
Consumer accounts	1,798,833	1,405,921
Consumer service and information	359,718	303,245
Administrative and general	8,784,875	6,658,131
Other	9,800,072	8,614,126
Total operating expenses	96,477,623	78,037,830
Operating margins before interest expense	22,430,179	21,147,427
Interest Expense:		
Long-term debt	10,151,776	8,851,175
Capital lease and other obligations	38,079	6,074,567
Total interest expense	10,189,855	14,925,742
Operating margins	12,240,324	6,221,685
Nonoperating Margins:		
Interest income	339,421	136,035
Other nonoperating expense	(25,267)	(62,124)
Total nonoperating margins	314,154	73,911
Other Capital Credits and Patronage Dividends	40,083	10,533
Net margins	12,594,561	6,306,129
Retirement of patronage capital	(1,719,977)	- 0
Patronage Capital, beginning of period	6,879,907	573,778
Patronage Capital, end of period	$17,754,491	$6,879,907

Statements of Comprehensive Income and Change in Members' Equity

For the Years Ended December 31, 2004 and 2003

	2004	2003
Net margins	$12,594,561	$6,306,129
Other comprehensive income:		
Unrealized gain during the period on available-for-sale investments	51,222	- 0
Comprehensive income	$12,645,783	$6,306,129

	Memberships	Patronage Capital	Accumulated Other Comprehensive Income	Total
Balance at December 31, 2002	$257	$ 573,778	$ - 0	$ 574,035
Net margins	- 0	6,306,129	- 0	6,306,129
Balance at December 31, 2003	257	6,879,907	- 0	6,880,164
Net margins	- 0	12,594,561	- 0	12,594,561
Change in accumulated other comprehensive income	- 0	- 0	51,222	51,222
Membership additions	22	- 0	- 0	22
Retirement of patronage capital	- 0	(1,719,977)	- 0	(1,719,977)
Balance at December 31, 2004	$279	$17,754,491	$51,222	$17,805,992

Statements of Cash Flows

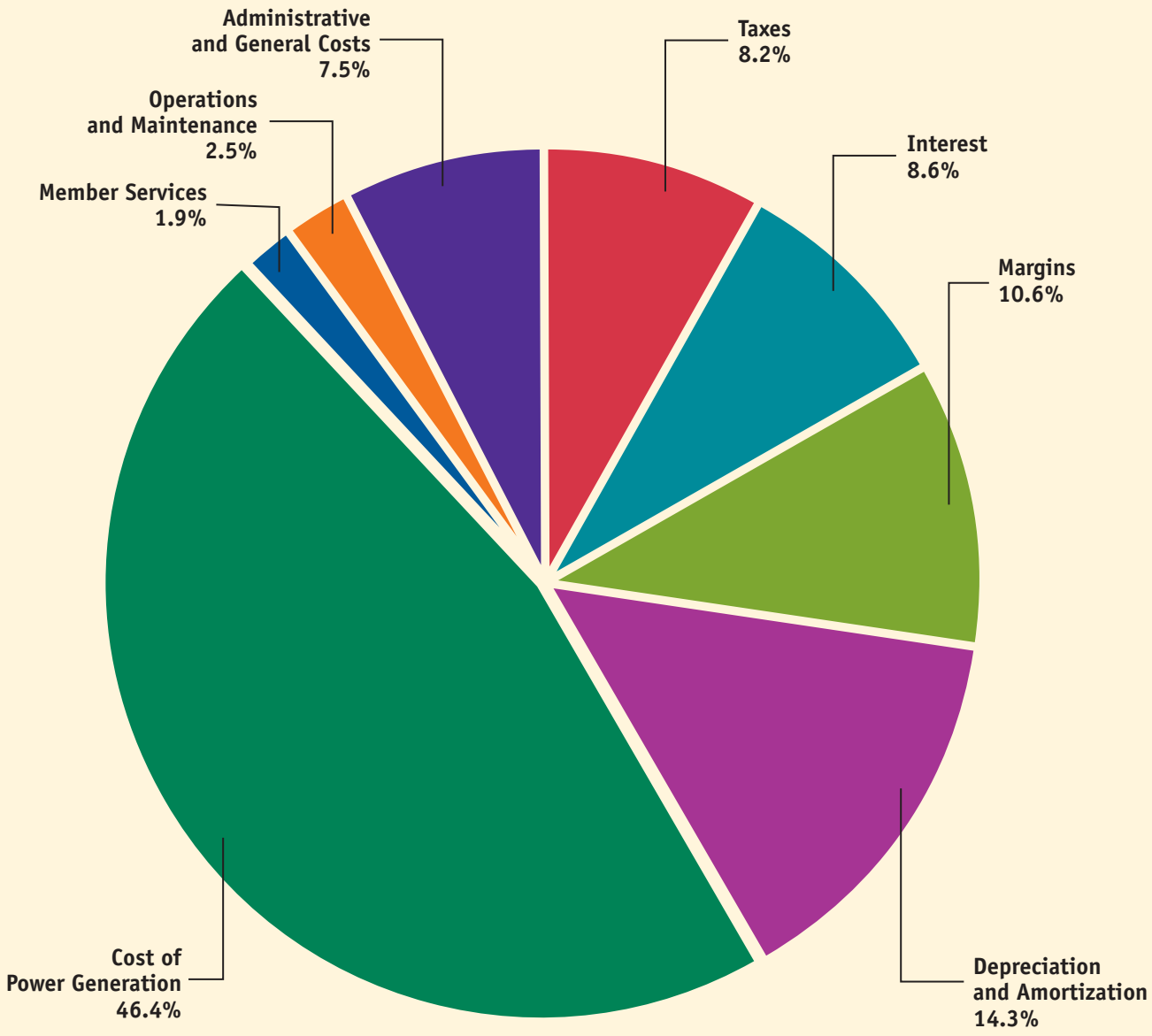
For the Years Ended December 31, 2004 and 2003

	2004	2003
Cash Flows From Operating Activities:		
Cash received from customers	$114,825,109	$99,092,767
Cash paid to suppliers and employees	(77,889,067)	(63,609,481)
Interest received	14,075	35,344
Interest paid	(9,908,435)	(13,964,495)
Net cash provided by operating activities	27,041,682	21,554,135
Cash Flows From Investing Activities:		
Construction of utility plant	(9,721,818)	(11,554,402)
Cost of investments acquired	(6,999,674)	(3,000,000)
Sales of investments	1,500,000	- 0
(Increase) decrease in:		
Materials and supplies	(1,037,212)	(1,296,107)
Deferred charges-preliminary surveys and investigations	(247,075)	73,101
Net cash used in investing activities	(16,505,779)	(15,777,408)
Cash Flows From Financing Activities:		
Proceeds from long-term debt	32,960,000	41,200,000
Payments on long-term debt	(34,228,240)	- 0
Payments to cushion of credit	(4,333,218)	(6,067,945)
Payments to line of credit	- 0	(5,955,400)
Payments to retire capital lease obligation	- 0	(38,599,792)
Proceeds from memberships issued	22	25
Increase in customer deposits	63,702	5,318
Retirement of patronage capital	(1,719,977)	- 0
Net cash used in financing activities	(7,257,711)	(9,417,794)
Net increase (decrease) in cash	3,278,192	(3,641,067)
Cash and cash equivalents, beginning of period	1,830,940	5,472,007
Cash and cash equivalents, end of period	$5,109,132	$1,830,940

Statements of Cash Flows

For the Years Ended December 31, 2004 and 2003

	2004	2003
Reconciliation of Net Margins to Net Cash Provided by Operating Activities:		
Net margins	$12,594,561	$6,306,129
Adjustments to reconcile net margins to net cash provided by operating activities:		
Depreciation and amortization	17,021,299	16,686,714
Provision for uncollectible accounts receivable, net	(7,736)	(6,093)
Change in:		
Customer and other accounts receivable	2,173,048	(94,797)
Current and other assets	(4,066,557)	584,133
Accounts payable	(963,298)	(92,741)
Postretirement benefit obligations	(38,606)	(4,759,562)
Current and other liabilities	328,971	2,930,352
Total adjustments	14,447,121	15,248,006
Net cash provided by operating activities	$27,041,682	$21,554,135



Twelve-month period ending December 31, 2004
Total Revenue $118.9 million

Power	46.4%	Interest	8.6%	Operations	2.5%
Depreciation	14.3%	Taxes	8.2%	Member Services	1.9%
Margins	10.6%	Administrative	7.5%		

Your Electric Bill and the Cost of Oil

When the Public Utilities Commission authorized the purchase of Kauai Electric by Kauai Island Utility Cooperative, they made some recommendations:

1. KIUC would charge KE rates and would refund to their members 25% of margins
2. KIUC would develop an Equity Management Plan targeting 2% equity per year to ensure fiscal solvency for our members

KE's base rates were set at .1747 cents per kWh and became effective in September of 1996. This rate was based on a fuel oil cost of approximately $12.40 per barrel world oil prices, and has not changed since its original effective date in 1996. In the 1970s, long before the rate case of 1996, the PUC began allowing for an Energy Rate Adjustment Clause so bills could be adjusted to pay for increases and decreases in the price of fuel, and ONLY for fuel. The ERAC does NOT pay for people, poles, trucks, buildings, etc. Your electric bill fluctuates due to the variations in the price of fuel used in our power plant. KIUC passes through the actual cost of fuel with NO markup.

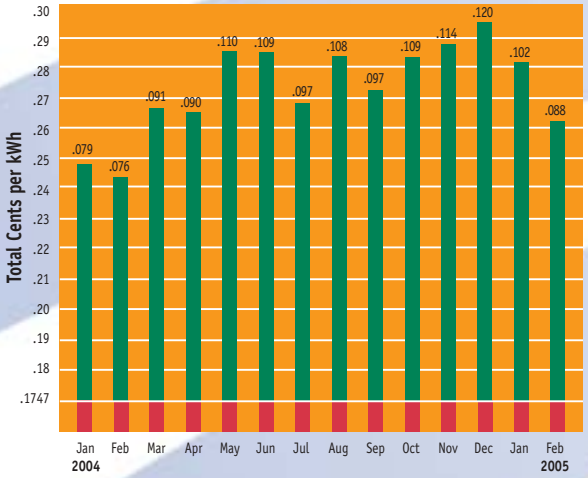
The chart below shows the effect of oil prices (ERAC) on your electric bill:

Residential Bill based on 500kWh

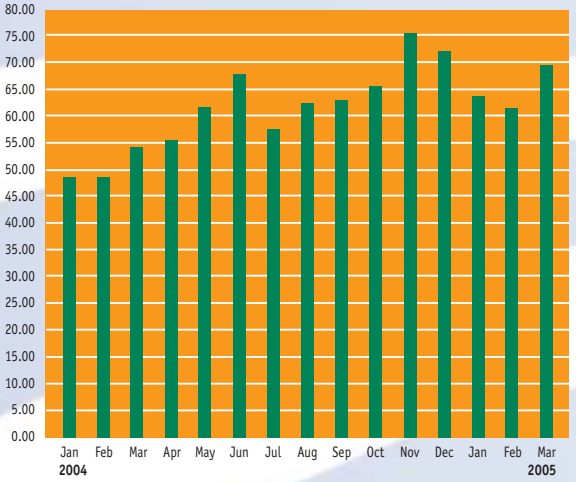
	Dec '98	Dec '03	Dec '04
Oil Price	$13.00	$31.11	$48.47
Diesel Price	$0.54	$1.04	$1.64
KWH Charge	*$87.45*	*$87.45*	*$87.45*
ERAC	$4.31	$19.68	$49.00

Note: the kWh charge is unchanged

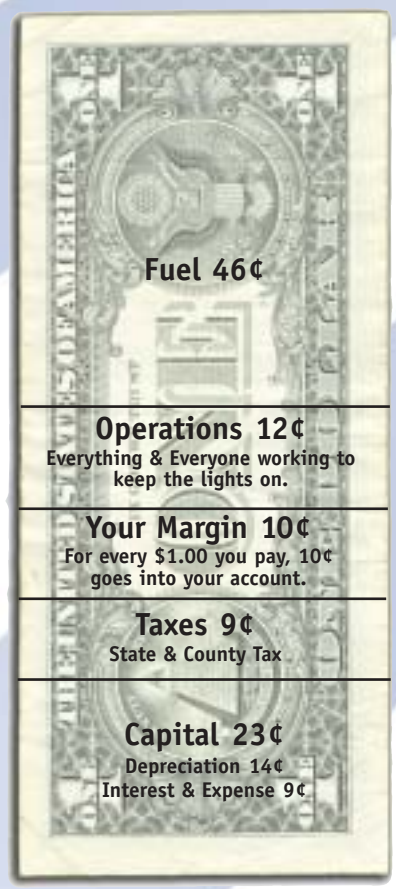
Base Rate Plus Additional Fuel Change



Fuel Oil Costs/Dollars Per Barrel



Where Your Electric Dollar Goes



Patronage Capital

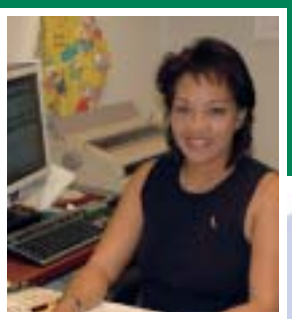
As a member of an electric cooperative, you receive a benefit reserved for owners of a company, a return on your investment through the allocation and disbursement of capital credits. Capital credits come from the money a cooperative has leftover after paying all of its expenses in a given year. At the end of the year, that money is credited to each member's account according to the amount of energy the member paid for.

When KIUC's finances permit, that money will be retuned to members in the form of patronage capital refunds.

A rural electric cooperative is a non-profit business that exists solely to provide its members with electricity. In a co-op, margins don't belong to the company; they belong to the individual members who paid money on their monthly bills.

In effect, the members of a cooperative are the shareholders. Because of that, when the cooperative takes in more money than is needed to operate the business, pay outstanding loans and pay any additional expenses, the owners are entitled to a share. That's the philosophy behind member equity.

2004 Strategic Accomplishments



Equity Management Plan

KIUC developed an Equity Management Plan in 2004 as part of a process to determine the optimum mix between:

a) equity retained by the cooperative to build financial stability and,

b) equity returned to members in the form of patronage capital refunds or other mechanisms to address the high cost of electricity on Kauai.

The initial product of an ongoing process, the 2004 Equity Management Plan (EMP) has been developed to provide a comprehensive overview and discussion of the financial planning for KIUC. It includes a discussion of the history, regulatory issues, and lender requirements that impact KIUC's financial policies and resulting projected financial performance.

The 2004 Equity Management reflects implementing the following activities, the compilation of which provides a financial performance that addresses the objectives of KIUC's principal constituencies

Strategic Initiatives KIUC will continue energy conservation programs and other strategic directions as expressed by members through Focus Groups and surveys.

Patronage Capital Refunds KIUC is assumed to continue to pay 25% of the prior year's margins in patronage capital refunds through 2010.

Revised Depreciation Accrual Rates KIUC is assumed to implement the revised depreciation accrual rates from the depreciation study as of June 30, 2005.

Elimination of Lost Gross Margin Collections KIUC is assumed to eliminate the Lost Gross Margin ("LGM") component of the RCA surcharge beginning as of June 30, 2005.

Renewable Energy and Efficiency Investments KIUC is assumed to invest $18.0 million by 2012 in renewable generation and an additional $21.0 million to improve the efficiency of the existing generation units.

Debt Prepayment KIUC is assumed to prepay RUS debt through 2012 by as much as $21.0 million.

IRP Framework

As a regulated electric utility in Hawaii, KIUC is required to periodically develop an Integrated Resource Plan (IRP). The IRP is the result of a process that compares supply-side (i.e. generation) to demand-side (i.e. energy efficiency/ conservation/load management) options to determine which options are best to serve the electrical energy needs of KIUC's consumers. The IRP Framework contains the guidelines that determine the evaluation criteria.

Soon after becoming a member owned electric cooperative, KIUC realized that the guidelines in the existing IRP Framework would not allow KIUC to develop an IRP that fully represented KIUC's member/owner's needs and desires. As such, KIUC developed and submitted to the PUC for their approval, a "Co-op" Integrated Resource Plan Framework. The intent was to be allowed to use guidelines reflecting KIUC's cooperative ownership structure. PUC approval is expected in third quarter 2005. In the meantime, KIUC is beginning to develop the parts of the IRP that are independent of the framework. These include load and fuel forecasts, selecting an Advisory Panel, selecting a consultant and developing a benchmarked base year from which forecasted data will be applied. The IRP is expected to be complete in early 2006.

Renewable Generation Research

KIUC initiated a comprehensive study in 2004 to evaluate the technical and economic feasibility of renewable generation on the island of Kauai. The first phase of the project was to evaluate all potential renewable technologies and, based upon a scoring matrix, identify the top five for a more in depth evaluation in the study's second phase. The five technologies are, in alphabetic order, Biomass (direct burn of vegetation grown solely for that purpose), Hydro, Landfill gas(burning the methane by-product), Municipal Solid Waste incineration (burn the garbage that otherwise goes into the landfill), and Wind Turbines.

2005 and Beyond

In times of high energy costs and increased environmental awareness, "renewable energy" is becoming a more familiar term these days. There are several reasons for an electric utility to pursue renewable energy:

- Reduce dependency on the ever-increasing cost of oil,
- Conserve our natural resources,
- Limit the effects of power generation on the environment,
- Comply with state and federal mandates for incorporating renewable energy into utility power generation portfolios.

Kauai's electric power generation is largely dependent on fuel oil. The environmental impacts and ever-increasing cost of oil are of great concern to KIUC. Renewable energy represents one of the best alternatives to oil-generated electricity. Over the past few years, KIUC staff conducted extensive research into the various renewable technologies and their potential implementation on Kauai. Most recently, KIUC hired a consultant to identify and rank possible renewable energy projects for Kauai. The results of this study, called " A Renewable Energy Assessment" is available to KIUC's members through its website at www.kiuc.coop. The information contained in assessment will play a vital part in KIUC's development of plans and processes for encouraging renewable energy projects in the near future.

When considering new generation projects, KIUC needs to evaluate generating station ownership options that could be advantageous to its members. At one end of the spectrum, KIUC would construct, own, and operate renewable energy facilities. This would allow KIUC to take advantage of the low cost financing available to Cooperatives. The other extreme is for KIUC to purchase power from a facility owned and operated by an independent power producer. KIUC may also choose to partner with various developers. In such a partnership, a developer could build and initially own the facility but provide KIUC the option to purchase the facility at a later date. Under this option, the developer would benefit from the various government renewable energy production tax incentives available to "for-profit" entities while allowing KIUC to take advantage of its low cost financing and expertise in operating power generating facilities.

Potential renewable energy projects that KIUC identifies will be will be evaluated in its Integrated Resource Planning (IRP) process. The purpose of the IRP is to integrate the generation options (supply-side) with energy efficiency options (demand-side) in a plan that best meets the electrical needs of our consumers. Once the IRP determines the best generation options, KIUC will most likely solicit bids to provide the projects under the appropriate ownership model. The timeframes for implementing the various projects are dependent upon the technology selected. For example, landfill gas could be implemented in 1-2 years. Conversely, a municipal-solid-waste facility may take 3-5 years due to siting, environment study and permitting requirements, and finally, construction.

Wind

Introduction

Wind power systems convert the movement of air to electricity by means of a rotating turbine and a generator. A typical utility-type wind turbine consists of a tubular tower, horizontal-axis, and a three-bladed propeller with variable pitch blades for speed control. These turbines range in size from 0.60 MW to 2 MW and are often grouped together to form wind farms.

Wind is the fastest growing form of renewable generation. In the U.S., wind turbine capacity exceeded 6,000 MW at the start of 2004. The booming U.S. market has been driven by a combination of growing state mandates, such as in Hawaii, and the federal Production Tax Credit (PTC). The PTC provides a 1.8¢/kWh incentive for electricity produced by wind.

Potential for Kauai and KIUC

Wind energy is a mature renewable energy technology which can provide competitively priced electricity. Wind resources on Kauai are moderate with select areas having very good wind regimes. Wind regimes are rated from 1 to 7 with a Class 7 area having wind speeds in excess of 20 miles per hour. Class 4 sites and higher are usually considered economically viable. However, Class 3 may also be viable in Hawaii due to the high electric rates.

Generally, the best wind regimes are located on exposed ridgelines, particularly north of Hanapepe and Kalaheo in the south and around the Kalalau Valley in the northwest. There is a large region of moderate Class 3-5 winds stretching in a band across the southern portion of the island from Port Allen to Poipu.

Theoretically, wind could provide all of Kauai's electrical needs. However a more realistic near-term estimate is that wind could provide about 30 GWh/yr or about 6% of Kauai's needs. This is due to intermittency of wind, siting, access, and environmental issues. Further development of wind energy would require additional flexible generation, energy storage, and advanced load management.

Cost

Capital costs for a typical 10 MW wind farm are between $1,200 – 1,600/kW. This would result in a levelized cost of electricity of 4.4-5.7¢/kW. Substantially higher costs are necessary for wind projects that require upgrades to transmission and distribution lines.

Advantages and Disadvantages

Advantages

- mature, proven technology
- less expensive than conventional generation
- no emissions
- good potential on Kauai

Disadvantages

- visual impact
- environmental impact (bird kills)
- intermittent, consequently will require storage or backup generation

Hydro

Introduction

Hydroelectric power is generated by capturing the kinetic energy of water as it moves from one elevation through a turbine to a lower elevation. The amount of energy captured by the turbine is dependent on the head (distance the water is falling) and flow rate of the water. Often, the water is raised to a higher potential energy level by blocking its natural flow with a dam. Another method of capturing the kinetic energy is to divert the water of a natural waterway, through a penstock and back to the water. KUIC is most interested in developing such "run-of-river" applications. Other forms of hydro generation include wave, tidal, and pumped storage technologies.

Potential for Kauai and KIUC

Hydro generation is a mature renewable energy technology which can provide competitively priced electricity. Hydro resources on Kauai are very good with consistently heavy rainfall and sharp elevation drops. On the other hand, Kauai stream flows vary considerably throughout the year, making hydro an intermittent, "as available" resource unless dams are utilized.

Kauai currently has seven hydro units (8.9 MW) that were originally installed by the sugar industry. A recent "Renewable Energy Technology Assessment" report for KIUC identified an additional 60 MW or 320 GWh of hydro potential. However, social opposition, environmental concerns, and access issues make some of this potential undevelopable.

Cost

The capital costs for a typical hydro plant is between $1,700 - $5,700 kW. The capital costs vary widely due to site-specific requirements for penstocks and civil works. The levelized cost of electricity is between 3.6 – 10.9¢/kW.

Advantages and Disadvantages

Advantages

- mature, proven technology
- less expensive than conventional generation
- no emissions
- good potential on Kauai

Disadvantages

- environmental impact due to dams and diversions
- "run-of-river" facilities are intermittent and require storage or backup generation
- significant public opposition due to environmental, cultural, and tourism concerns

Biomass and Municipal Solid Waste

Introduction

Biomass is any material of recent biological origin. There is a huge variety of biomass resources, conversion technologies, and end products as shown below. Two technologies that show significant potential for Kauai are "Direct Fired Biomass" and mass burn of municipal solid waste.

Biomass Sources

- Forests
  - Natural regrowth
  - Energy forests
  - Forest residue
  - Processing residues
- Agriculture
  - Crop residues
  - Processing residues
  - Energy crops
- Wastes
  - Municipal
  - Industrial

Processing

Drying
Extrusion
Compression
Chipping
Carbonization
Anaerobic digestion
Fermentation
Gasification
Pyrolysis
Fischer tropsch

Fuel Products

Solid Fuels
Charcoal
Wood chips
Pellets/briquettes
Gaseous Fuels
- Methane
- Pyrolysis gas
- Producer gas

Liquid Fuels
- Plant esters/oils
- Ethanol
- Methanol
- Pyrolysis liquids
- Biodiesel

End Markets

Electricity
Heat
Solid fuels
Transport

Direct biomass combustion power plants burn the biomass in boilers to produce steam, which is expanded through a turbine to produce electricity. Prior to combustion in the boiler, the biomass fuel may require some processing (drying, chipping, etc) to improve the physical and chemical characteristics. Wood is the most common biomass fuel. Other biomass fuels include agricultural residues such as bagasse, dried manure and sewage sludge, black liquor, and dedicated fuel crops such as fast growing grasses and eucalyptus. The capacity of biomass plants is usually less than 50 MW because of the expense of transporting a dispersed fuel to a central location.

Municipal solid waste (MSW) may also be burned to generate electricity. The three most common types of MSW plants are 1) mass burn, 2) refuse derived fuels, and 3) plasma arc. In a mass burn plant, the MSW is burned similar to the direct biomass combustion described above. In a refuse derived fuel facility, the trash is pre-processed to remove the recyclable materials and convert it to fluff or pellets for ease of handling. A plasma arc facility burns the trash using a high temperature electric arc. For Kauai, the mass burning of MSW is most promising primarily due to cost.

Potential for Kauai and KIUC

Kauai has very good potential for power production from biomass. Until recently, the island generated a significant portion of its power from bagasse, the fibrous residue from sugarcane. However, the amounts of electricity that can be generated by bagasse available from the one remaining sugar plantation is limited to about 8.6 MW. Other agricultural wastes such as wood, corn, and coffee residuals are available but in much smaller

qualities. Fuel crops such as banagrass could be utilized but at much higher cost. A recent study estimated that over 600 GWh/yr could be generated from a 90 MW plant if only 20 percent of Kauai's agricultural lands were converted to banagrass.

The potential for power production from MSW on Kauai is good but limited. The Kekaha landfill currently accepts over 200 tons of waste per day. This quantity is sufficient to generate about 44 GWh/yr of electricity from a 7 MW plant. Our recent renewable energy study also explored the option of a combined biomass/MSW plant with a capacity of 32 MW.

Capital costs for a 20 MW direct burn biomass plant would be approximately $4,600/kW. This would result in a levelized cost of electricity of between 18.0 to 20.5 ¢/kW. The relatively high cost for electricity is due to the small plant size and a lack of low cost agricultural waste fuel.

Capital costs for 7.3 MW mass burn MSW plant would be approximately $11,350/kW. This would result in a levelized cost of between 2.0 to 10.9 ¢/kW assuming a tipping fee of between $50 to 90/ton. Tipping fees are what the trash haulers pay a landfill or MSW plant to accept their trash.

Advantages and Disadvantages

Direct Burn of Biomass

Advantages

- mature, proven technologies
- utilizes existing agricultural infrastructure and expertise
- creates/retains agricultural jobs
- good potential on Kauai
- carbon neutral

Disadvantages

- more expensive that conventional generation

Mass Burn of MSW

Advantages

- mature, proven technologies
- minimizes trash going into landfill
- less expensive than conventional generation

Disadvantages

- limited potential on Kauai
- emission of pollutants such as dioxins
- odor and noise

Biodiesel

Introduction

Biodiesel is a non-toxic, biodegradable, and renewable fuel that can be used in diesel engines with little or no modification. Biodiesel can be produced from oils and sources of free fatty acids such as animal fat, vegetable oil, and waste greases. Biodiesel is produced by removing excess hydrocarbons from these oils to create a shorter chain molecule that is chemically more comparable to diesel fuel. Sodium methoxide is added to the oil causing the mixture to settle into two simpler constituents: glycerin and methyl ester. The methyl ester is collected, washed, and filter to yield biodiesel. The glycerin has several commercial uses, the most common one being the manufacture of soap. The facility where biodiesel is made is relatively simple and easily scaled to meet local needs.

The feedstock oil can be derived from a variety of sources including soybean, cotton, palm, and rapeseed. Waste oil, grease, and fats from restaurants and food processors (meat packers) can also be used. In the U.S., soybean and corn oil are the two most common feedstocks.

Potential for Kauai and KIUC

Given Kauai's high fuel prices and agricultural infrastructure, biodiesel is an attractive alternative for transportation and power production. The amounts of available restaurant waste oil and grease are limited and too small to be considered for power production. Dedicated oil crops would need to be planted for large scale production. Palm oil is considered one of the best sources of vegetable oil and is well suited for tropical climates. The reported yield of biodiesel from oil palms is 635 – 1,000 gallons per acre per year. A recent study concluded that 17.8 millions gallons could be produced from just twenty percent of Kauai's agricultural lands. For comparison, 2.2 million and 24 million gallons of conventional diesel are used on Kauai each year for transportation and power production respectively.

Cost

Capital costs for use of biodiesel are minimal as it can be used in diesel engines with minimal modifications. Most diesel engine manufacturers have warranted their engines for use with 5-20% blends (B5-B20) of biodiesel. The production cost of biodiesel can range from being competitive with conventional diesel to as much as 2.5 times higher depending upon the feedstock and transportation costs. Biodiesel is currently being sold on Maui for $2.35/gallon. However, it is manufactured from restaurant waste oil (zero cost) and is exempt from Maui County road tax. The levelized cost for electricity produced from biodiesel would be between 18 to 23¢/kW. However, KIUC is currently investigating the price with several biodiesel suppliers.

Advantages and Disadvantages

Advantages

- can be used in existing equipment with little modifications
- lower sulfur and particulate emissions
- utilizes existing agricultural infrastructure and expertise
- creates/retains agricultural jobs

Disadvantages

- more expensive than conventional generation
- higher Nox emissions