

**STUDY OF ELECTRICITY COSTS,  
CONSUMPTION, AND CONSERVATION  
AT THE UNIVERSITY OF HAWAII  
FINAL REPORT**

**A Report to the Governor and the Legislature of the State of Hawaii**

**Submitted by the  
Legislative Auditor of the State of Hawaii  
Honolulu, Hawaii**

**Report No. 89-9  
January 1989**



## FOREWORD

The General Appropriations Act of 1987 (Act 216) as amended by the Supplemental Appropriations Act of 1988 (Act 390) included a provision (Section 181) requesting the Legislative Auditor to conduct a two-year study of electricity costs and consumption of the University of Hawaii, including but not limited to a review of budget projections compared with actual costs and consumption and an assessment of the university's efforts to achieve energy conservation. The Legislature further requested the Legislative Auditor to submit a preliminary report on this matter prior to the 1988 legislative session and a final report by the 1989 legislative session. The report included herewith constitutes the final report.

The preliminary report issued last year dealt primarily with the university's budgeting and expenditure of funds for electricity. In this report, the focus is on the university's energy conservation efforts and on the university's overall management of electricity consumption and costs.

We wish to acknowledge the cooperation and willing assistance extended to our staff by the president, other top officials, and affected personnel of the University of Hawaii; by staff members of the Energy Conservation Branch of the Energy Division of the Department of Business and Economic Development; by the U.S. Department of Energy; and by the several electric utility companies operating in Hawaii.

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## Chapter 1

### INTRODUCTION AND BACKGROUND

Pursuant to Section 181 of the General Appropriations Act of 1987 (Act 216), as amended by the Supplemental Appropriations Act of 1988 (Act 390), the Legislative Auditor conducted a two-year study of electricity costs and consumption of the University of Hawaii (UH). A preliminary report was submitted in January 1988. This report constitutes the final report.

#### Objectives of the Study

The objectives of the study are:

1. To determine UH's electricity costs and consumption, its sources of funding for electricity, and other relevant factors.
2. To assess the reasonableness and adequacy of UH's electricity budget for the 1987-89 fiscal biennium.
3. To evaluate UH's existing and planned electrical energy conservation measures.
4. To identify problems affecting UH's approach to budgeting for electricity and to electrical energy conservation and to recommend possible solutions to these problems.

#### Scope of the Study

This study was conducted with budgetary considerations as the primary concern. Regarding electricity costs and consumption, it largely involved UH's institutional support programs under which most of its electricity costs are budgeted. There is an institutional support program for each of the units under the university-wide system which include the University of Hawaii at Manoa (UH-Manoa), the University of Hawaii at Hilo (UH-Hilo), West Oahu College, Honolulu Community College, Kapiolani Community College, Leeward Community College, Windward Community College, Kauai Community College, and Maui Community College.

In the first year, the focus of the study was on UH's general fund electricity costs, consumption, and budgeting with particular attention given to UH's supplemental budget request for electricity for Fiscal Year (FY) 1988-89.

The main focus of the study in the second year was on UH's electrical energy conservation measures during fiscal years 1981-82 through 1987-88, and its current management of its electricity consumption and costs. UH's budgets for electricity for FY 1987-88 and for the 1989-91 fiscal biennium were also reviewed.

## Organization of the Report

This report is divided into two chapters. Chapter 1 is this introduction. It also provides some background information on the Legislature's concern over UH's electricity costs and consumption, and a summary of the Auditor's preliminary report on the first year of the study. Chapter 2 presents findings and recommendations of the second and final year of the study.

## Background

**Legislative concerns.** UH is a major consumer of electricity in the State, the fourth largest following Pearl Harbor Naval Base, Schofield Barracks, and Hickam Air Force Base. It purchases its electricity from electric utility companies serving the island areas where the university's various facilities are located.

As a result of sharp increases in the rates charged for electricity in FY 1980-81 and FY 1981-82 (caused by worldwide conditions affecting the price of fuel oil), UH incurred large deficits in its electricity accounts and had to request supplemental funding from the Legislature. Although other state agencies were similarly affected, the impact on the university was especially noticeable due to its greater usage of electrical energy and heavy dependence on state funds to pay for this utility service. Table 1.1 shows the volume of consumption of electricity by the ten largest users in State government.

Table 1.1  
State of Hawaii  
Electricity Consumption By Ten Largest Users  
for Fiscal Year 1987-88

Agency	Consumption in Kilowatt-Hours
University of Hawaii	128,387,264
Department of Transportation	119,393,784
Department of Education	66,950,109
Department of Accounting & General Services	39,617,234
Hawaii Housing Authority	22,120,754
Department of Health	20,805,746
Department of Human Services	11,657,058
Judiciary	8,201,964
Libraries	6,148,739
Department of Defense	3,312,841

Source: Department of Business and Economic Development, Energy Division, Electricity Monthly Reports for June 1988 for Oahu, Maui, and Hawaii.

The Legislature provided UH extra funding for electricity in FY 1981-82, but as a result began to take special interest in this particular item in UH's overall budget. During the ensuing years, however, electricity rates fell almost as rapidly as they had risen, as shown in Table 1.2. Thus, instead of deficits, surpluses began to show up in UH's electricity accounts.<sup>1</sup> These, in turn, gave rise to new concerns on the part of the Legislature--namely, about how UH used the extra funds and how to prevent such large budget excesses from recurring.

Table 1.2  
University of Hawaii  
Average Cost Per Kilowatt-Hour for  
Fiscal Years 1977-78 Through 1987-88

Fiscal Year	Avg. ¢/KWH	Fiscal Year	Avg. ¢/KWH
1977-78	4.07¢	1983-84	9.55¢
1978-79	4.55¢	1984-85	9.52¢
1979-80	5.46¢	1985-86	8.07¢
1980-81	8.16¢	1986-87	6.32¢
1981-82	10.65¢	1987-88	6.86¢
1982-83	9.87¢		

Sources: University of Hawaii, internal memorandum dated October 16, 1985, Subject: Final FY1984-85 General Fund Electricity Report, and data provided by the University of Hawaii Budget Office.

In trying to deal with these concerns, the Legislature encountered difficulties in obtaining a clear picture of what was happening to electricity expenditures at UH and of how UH was managing this aspect of its responsibilities. It asked UH to conduct a number of studies of its electricity costs and consumption and to explore ways to conserve electricity.<sup>2</sup> In response to these requests, UH submitted reports on its studies in November of 1982, 1983, and 1984.<sup>3</sup>

In addition, the Legislature has highlighted UH's electricity appropriations since 1983 by including special provisos relating to electricity in the various appropriations acts.<sup>4</sup> Generally, the effect of these provisos has been to specify the kilowatt hour usage and rate assumptions underlying UH's electricity appropriations. However, in FY 1986-87, through the proviso, the Legislature limited use of UH's electricity appropriations to "only" electricity costs. Similar limitations were placed on the 1987-89 electricity appropriations. Included with the last two years' provisos on appropriations for UH's electricity was a request for the Legislative Auditor to conduct a two-year study of UH's electricity costs, consumption, and conservation measures.

**Auditor's preliminary report.** In January of 1988, the Legislative Auditor issued a preliminary report on the first year of the study.<sup>5</sup> In this report, the Auditor stated that UH: (1) had realized substantial surpluses from the appropriations for electricity yearly since FY 1981-82; (2) had not lapsed unused electricity appropriations as required by law; and (3) had not adequately justified its supplemental budget request for additional funding for electricity for FY 1988-89. The Auditor also questioned the propriety of some of UH's expenditures of its electricity appropriations for FY 1986-87.

## Chapter 2

### REVIEW OF THE UNIVERSITY OF HAWAII'S ELECTRICITY CONSERVATION, MANAGEMENT, AND BUDGET

For a number of years the Legislature has been concerned about the budgetary implications of electricity consumption at the University of Hawaii (UH). In this chapter, we address those concerns and examine the university's practices with regard to energy conservation, overall management of electricity, and its electricity budget.

#### **Summary of Findings**

1. The University of Hawaii has implemented a substantial number of energy conservation measures at its various facilities directed primarily at improving the efficiency of air conditioning systems. These measures apparently have not obtained the large reductions in electricity consumption that had been anticipated, due in great part to problems with the particular measures and to inadequate attention to other aspects of facility management.

2. Despite its conservation efforts, the University of Hawaii's electricity consumption has increased in recent years to even higher levels than before. Examination of factors underlying this growth indicates the need for an expanded and more comprehensive approach to energy conservation at the university.

3. The critical importance of energy, particularly electricity, to the entire operations of the university is not adequately recognized by the University of Hawaii. As a result, the university's efforts to manage electricity lack clear direction and cohesion and are inadequate.

4. Problems remain in budgeting for electricity. The primary problem is a lack of data necessary for projecting consumption.

#### **Conservation Measures Fall Short**

Since the last sudden rise in electricity rates in the early 1980s, UH has made a concerted effort to implement a number of energy conservation measures. The nature and results of these efforts are discussed below.

**Focus on improving facilities.** Faced with large impending budget deficits, UH immediately imposed operational restrictions on all campuses, such as limiting the hours and days for use of facilities and especially for use of air conditioning. It then focused on making changes to its

facilities. After first making the easier and less costly changes to facilities, UH embarked on an energy conservation capital improvements program to implement larger and more expensive facility modifications for which UH sought capital improvement financing from the Legislature and federal matching funds.

*Over \$8.5 million in capital improvement appropriations.* As shown in Table 2.1, UH obtained a total of \$8.7 million in capital improvement appropriations in fiscal years 1981-82 through 1987-88 for energy conservation projects. The State funded \$6.5 million, or 75 percent, and \$2.2 million, or 25 percent, came from the federal government.

Federal funding played a significant role in UH's efforts to improve the energy efficiency of its buildings. The availability of matching funds through the U.S. Department of Energy's Institutional Conservation Program (ICP)<sup>1</sup> not only gave UH another source of funding but also provided the incentive for the State to support and invest in the more costly energy improvements that UH proposed. Most of UH's major projects have been partially federal funded.

Table 2.1  
Funding for Energy Conservation Projects  
By Campus and Funding Source  
For Fiscal Years 1981-82 Through 1987-88

Campus Unit	State Funds	Federal Funds	Total Funds	Percent of Total
U.H.-Manoa	\$3,568,425	\$1,388,141	\$4,956,566	56.7
U.H.-Hilo	529,790	15,510	545,300	6.2
Community Colleges	2,426,562	817,667	3,244,229	37.1
Total	<u>\$6,524,777</u>	<u>\$2,221,318</u>	<u>\$8,746,095</u>	<u>100.0</u>

Source: University of Hawaii, Manoa Facilities Planning Office, Report on Energy Conservation Measures Appropriations for FY 1981-88, and data from the Community Colleges Facilities Planning Office.

All of the campuses received energy conservation appropriations. More than half, or \$4.96 million, went to UH-Manoa; 6 percent, or \$.55 million, to UH-Hilo; and 37 percent, or \$3.24 million, to the community colleges. Among the community colleges, the larger shares went to Honolulu Community College, with \$1.3 million; Leeward Community College, with almost \$1 million; Kauai Community College, \$579,000; and Maui Community College, \$346,000. Little went to Kapiolani Community College and Windward Community College--only \$29,000 and \$5,000 respectively.

**Use of appropriations.** UH used these energy conservation funds primarily to improve the efficiency of its electrical machinery and systems. It focused on air conditioning and lighting systems, areas of greatest electricity consumption on the various campuses. The greater amount was invested in air conditioning systems for better equipment, reconfiguration of systems, and mechanizing or computerizing operational controls. Lighting fixtures were changed and improved controls installed. Also, a few gas appliances were converted to electrical ones.<sup>2</sup>

**Large reductions were projected.** UH undertook major energy conservation projects in the expectation that they would produce significant reductions in electricity consumption. Table 2.2 presents UH's major energy conservation measures by campus. It shows appropriations, projected reductions in consumption, and dates completed. When proposing these measures, UH estimated that they would result in total reductions of over 15.5 million kilowatt hours annually if installed.

Except for a light management system at Honolulu Community College, all of the reductions were to be derived from modifications to the air conditioning systems on six UH campuses: UH-Manoa, UH-Hilo, Honolulu Community College, Leeward Community College, Maui Community College, and Kauai Community College. Over half were to be from projects at UH-Manoa.

**Lack of evaluation.** At the time of this study, most of UH's energy conservation measures had been operating for at least a year and, in some cases, for a number of years. Yet, the question of their effectiveness remained largely unexamined.

UH had focused on developing "front-end" projections of electricity savings as these were required to justify budget and funding requests. Since funding was not contingent on results, UH had not made much effort to ascertain and assess actual results.

Only recently, prompted by renewed legislative interest in its electricity consumption and by some increase in price, UH has made some attempt to weigh the impact of its conservation measures. However, lack of data precluded reaching any clear conclusions.

**Inadequate data.** UH explained that it could not directly measure the impact on consumption of any of its conservation measures due to its limited ability to monitor and measure changes in its electricity consumption. Through the years, UH has relied primarily on billing meters and bills from the electric utility companies for documenting its monthly electricity consumption. However, there has been no consistent scheme for installing and using these meters. The number of meters per campus, their placement, and their scope of measurement have varied.

Table 2.2  
Major Energy Conservation Measures  
By Campus, Amount of Appropriations, Projected Savings  
in Kilowatt-Hours, and Completion Dates  
Fiscal Years 1981-82 Through 1987-88

Campus Unit	Amount of Appropriations	Type of Measure	Projected Annual Savings In KWH	Date Completed
U.H.-Manoa	\$2,533,386	Installation of a Chilled Water Loop for AC	5,247,240	3/84-7/85
	<u>788,000<sup>a</sup></u> \$3,311,386	Energy Management Control System for AC	<u>4,622,304<sup>a</sup></u> 9,869,544	12/86
U.H. Hilo	\$ 508,000	Installation of a Chilled Water Loop for AC	213,980	11/85
Honolulu Community College	\$ 110,800	Light Management System	145,920	10/85
	848,000 <sup>b</sup>	Modifications to AC	2,590,197	7/86-1/87
	140,000	Modifications to Chilled Water Loop System for AC	129,475	7/87
	<u>212,000</u> \$1,310,800	Energy Management Control System for AC	<u>387,000</u> 3,252,592	7/87
Leeward Community College	\$ 585,400	Modifications to AC	1,158,460	1/85-1/87
	<u>228,000</u> \$ 813,000	Energy Management Control System for AC	<u>312,717</u> 1,471,177	8/88
Kauai Community College	\$ 331,725	Modifications to AC	428,176	1/85-1/86
	<u>186,000</u> \$ 517,725	Energy Management Control System for AC	<u>88,777</u> 516,953	1/86
Maui Community College	\$ 177,551	Modifications to AC	114,000	11/85
	<u>142,000</u> \$ 319,551	Energy Management Control System for AC	<u>88,600</u> 202,600	12/88 <sup>c</sup>
<b>Total</b>	<b><u>\$6,780,862</u></b>		<b><u>15,526,846</u></b>	

AC = air conditioning

<sup>a</sup>U.H. is in the process of completing the third phase of installations. The estimated date of completion is December 1988. This involves \$130,000 in appropriations and 440,544 KWH projected savings.

<sup>b</sup>Includes appropriations for heat pumps which produced savings in gas but increased electricity consumption.

<sup>c</sup>As of October 1988 installation was completed but orientation and trial usage remained to be done.

Sources: University of Hawaii, Manoa Facilities Planning Office, Report on Energy Conservation Measures Appropriations for FY 1981-88; data from the Community Colleges Facilities Planning Office; and University of Hawaii Report to the 1985 Legislature, Act 301, SLH 1983, Section 40, amended by Act 285, SLH 1984, Electricity.

Some campuses have only one master meter that measures electricity for the whole campus. These include Maui Community College, Kauai Community College, Leeward Community College, and Honolulu Community College. UH-Hilo, Kapiolani Community College, and Windward Community College have multiple meters each of which measures electricity for a number of buildings. UH-Manoa has a master billing meter covering a large number of buildings, plus many other billing meters for various smaller buildings scattered around the main campus. UH-Manoa is the only campus which has installed some submeters of its own to individually monitor buildings under its master meter, but these were not fully functional at the time of this study.

Without the ability to measure electricity consumption of specific systems or even individual buildings in most cases, UH has not been able to establish specific baseline amounts of consumption prior to installation of conservation measures or to monitor the impact of such measures afterward.

UH has also lacked information on other factors affecting consumption which could have assisted the evaluation of results. Although cited by administrators as significant to consumption, specific data on changes in operational hours, program changes, and additions or deletions of buildings and equipment have been either unavailable, difficult to access, or incomplete.

**No indication of savings.** Although the exact impact of UH's energy modifications has not been measureable, UH administrators acknowledge that available data do not indicate the realization of any large reduction in electricity consumption. Not only have reductions been small, if any, but also increases have shown up when decreases had been expected. This is true even when actual dates of completion, estimated additional consumption from new buildings, and estimated longer hours of operation have been taken into consideration. This is found particularly for UH-Manoa, UH-Hilo, Honolulu Community College, Leeward Community College, and Kauai Community College.

It is agreed that available data reflect increases in consumption, the causes of which have not all been clearly or fully identified. At the same time, however, they also indicate problems that have occurred with respect to UH's energy conservation measures.

**Problems with chilled water loop systems.** Chilled water loop systems were adopted by UH as major ways to make its campus air conditioning systems more efficient. It installed such systems at five campuses, including UH-Manoa, UH-Hilo, Honolulu Community College, Leeward Community College, and Kauai Community College. Energy conservation funds were used to build new systems at UH-Manoa and UH-Hilo and to modify existing systems at the community colleges.

*UH-Hilo and community colleges.* The systems at UH-Hilo and the community colleges are based on the concept of air conditioning many buildings by a single large central air conditioning plant. Chilled water from a central plant is pumped from building to building through a system of pipes, cooling each building along the way. Leeward and Kauai have campus-wide systems which join all of their buildings to one plant. UH-Hilo and Honolulu have smaller systems involving only a few of their buildings.

It was projected that these chilled water loop systems would consume less electricity than would be required to air condition each building separately. However, these loop systems are effective only when all buildings are used at the same time. They are inefficient when only a part of the loop needs air conditioning.

Thus, during the early 1980s when UH limited its operations to regular daytime hours on weekdays, the loop systems helped conserve electricity. But in recent years, restrictions on hours were lifted, and all campuses have increasingly held classes and other activities in the evenings and on weekends which require only partial use of facilities. Lacking other suitable alternatives, UH has often had to use its entire loop systems to air condition only a few classrooms or buildings in use at those times.

As a result, electricity consumption on those campuses has increased by more than actually needed based on use. The impact has been greatest at Leeward and Kauai since all of their buildings are joined in a single loop. For example, to air condition its theatre for weekend performances, Leeward has had to use its large central plant and also pump chilled water to twelve other buildings in the process. While modifications have given some systems the ability to pump water past some buildings which limits some of the wasted effort, large amounts of water are still being chilled and pumped for relatively long and circuitous distances.

*UH-Manoa.* In 1985, UH completed installation of a long awaited chilled water loop system at UH-Manoa. This project was its most costly investment towards energy conservation and has been widely touted as a major saver of electrical energy among all of the state government's electrical systems. Unlike chilled water systems of the other campuses, it had no central plant. Instead, it joined together the existing independent air conditioning systems of eleven of UH-Manoa's larger buildings. It was projected that the collective use of these systems would decrease UH-Manoa's electricity consumption.

In conjunction with the loop system and to maximize its savings, a computerized energy management control system was also installed in 1986. This computer system was to monitor the loop system, calculate the optimum combinations of equipment to run, and automatically control the loop system's operations.

Both the loop system and the computerized control system have not met UH's expectations. The energy management control system as now constructed has insufficient monitoring and remote control devices. Thus, it has not functioned as planned and has so far conserved no energy.

UH-Manoa administrators believe the loop system has reduced electricity consumption but admit that the reduction has been much less than projected. Moreover, they acknowledge serious problems regarding the loop's operations and results. Much of the inadequacy of the system is attributed to its basic design. Consultants retained by UH and by the state and federal energy programs disagree, however, on whether modification of the existing single loop or construction of multiple loops would be the most cost effective remedy. Further analyses of UH-Manoa's chilled water loop system are expected before any corrective action will be taken.

**Ineffectiveness of energy management control systems.** UH also has attempted to conserve electricity use by computerizing the operations of its large air conditioning systems through so-called energy management control systems. Such systems were installed at five campuses including UH-Manoa, Honolulu Community College, Leeward Community College, Kauai Community College, and Maui Community College.

At Honolulu, Leeward, and Kauai, we found that these computer systems have possibly effected some savings of energy by allowing for more precise scheduling of use, but the reduction in energy consumption has not been extensive. Their major benefit has been to make the task of operating air conditioning systems (turning machinery on and off) less labor intensive by replacing manual timer controls with computerized and remote timer controls, located in most cases more conveniently in administrative or maintenance offices.

Additionally, the largest and most costly computer system, at UH-Manoa, was not effective as originally constructed as indicated in the preceding discussion of UH-Manoa's chilled water loop. At Maui, the management system was just recently installed, is not yet operating, and so its capabilities are not yet clear.

**Need for more attention to facilities.** Despite eight years of effort by UH to improve the energy efficiency of its facilities, much remains to be done. Further attention is needed not only to air conditioning (as indicated in previous discussion), but also to lighting, establishing a process of regular and systemwide review of facilities, and carrying out regular maintenance of facilities.

**Lighting.** Although UH has implemented a number of measures to improve lighting in terms of energy use, including better lamps, ballasts, and updated fixtures, there is still much inefficient lighting throughout the various UH campuses. Further, the opportunities for energy conservation through better lighting controls has been little explored. While facilities' administrators have

acknowledged that lighting could be improved, there were no current plans to implement such measures other than at UH-Manoa and Honolulu Community College. Most had not yet examined lighting thoroughly and had no clear idea of the specific options that might be available, or the costs and benefits that would be involved.

*Energy audits.* A larger problem is the lack of knowledge on the part of most campus administrators of the current status of their facilities in terms of energy efficiency. Except for UH-Manoa, the various campuses have had no recent audits or assessments of their facilities for energy efficiency. Previous energy audits were done years ago, mostly between 1980 and 1983. As earlier discussed, there has been no periodical reassessment to determine the effectiveness of modifications installed or to consider changing operational conditions and new energy conservation technologies and devices.

Additionally, many UH facilities have never been audited or included in prior energy conservation efforts. Among these are many newer buildings built after 1977 (and therefore ineligible for federal funding)<sup>3</sup> and others located off the main campuses, primarily UH-Manoa's research stations located on Oahu and the neighbor islands.

*Equipment and maintenance.* Another fundamental problem underlying UH's difficulties in achieving energy savings is the poor condition of much of UH's facilities and equipment. A lack of funding over the years for regular maintenance has prevented UH from properly maintaining its buildings; servicing its equipment, including electrical machinery; and replacing worn parts on a timely basis. Rather than taking preventive measures, administrators have often had to wait until breakdowns or damage occurred before attending to a known problem. For example, only some of the campuses have regularly serviced their air conditioning systems, and the extent of this service has varied. Most could not afford comprehensive care for even those systems which consumed the most electricity at UH.

This situation has allowed a general waste of electricity from poorly running equipment and has also affected UH's energy conservation projects. Poorly maintained equipment or systems have worked against measures installed with them to conserve energy or increase energy efficiency. For example, at UH-Manoa, a number of key chillers in its chilled water loop system have been out-of-service for over a year at least, needing either repair or replacement. In October of 1988, five chillers were still inoperable. Although that system has other deficiencies, its lack of fully functional components has clearly obstructed efforts to obtain optimum coordination among affected facilities.

In the last two years, the Legislature has provided a greater amount of funding to UH for various repairs and maintenance projects and to "establish and implement a cyclical schedule

of repair and maintenance of grounds and facilities within the fiscal biennium 1987-89.”<sup>4</sup> Thus, UH is in the process of assessing its needs and developing a schedule for regular maintenance and a computer program to monitor and track its progress. It also has funds to start to replace some worn equipment including some chillers at UH-Manoa.

Although 1987-89 funding for this purpose was relatively substantial, it provided for just the beginning of a much needed program of preventive maintenance. Continuing support will be needed for UH to accomplish fully the overhaul needed of its facilities and to sustain them in good working condition. Greater support will also be needed for UH to maintain its equipment, including especially its electrical equipment and to service such equipment on a regular basis. Such upkeep is important to all of UH’s programs and a basic necessity for energy efficiency and conservation at UH.

### ***Recommendations***

*We recommend that the University of Hawaii thoroughly review and evaluate its overall approach to energy conservation relative to air conditioning on its campuses, giving particular attention to its chilled water loop systems and energy management control systems. In so doing, it should identify and examine consumption of all systems in use; assess the usefulness, problems, and inefficiencies of each system; and determine how each system might be improved.*

*We further recommend that the University of Hawaii continue and expand its efforts systemwide to improve energy efficiency in its facilities, giving special attention to lighting, to the periodic auditing and assessment of energy use in facilities, and to regular maintenance and replacement of electrical equipment.*

### **Need for a More Comprehensive Energy Program**

Despite large expenditures for energy conservation, UH’s electricity consumption has increased significantly in recent years. In this section we examine the factors contributing to this situation.

**Electricity use higher in FY 1987-88.** Table 2.3 presents electricity consumption of UH’s institutional support programs for fiscal years 1980-81 through 1987-88.

As portrayed in this table, each campus showed reductions yearly through FY 1982-83. In FY 1983-84, all, except for Honolulu and Leeward community colleges, began to use more electricity and have continued to do so each year since. While Leeward dropped further in FY 1983-84, it started an upward climb the following year. Honolulu declined through FY 1985-86, but it, too, has also increased the last two fiscal years.

Table 2.3  
 University of Hawaii  
 Institutional Support Programs\*  
 General Funds Electricity Consumption  
 for Fiscal Years 1980-81 Through 1987-88  
 In Kilowatt-Hours

Program	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88
UoH 106 Institutional Support—Manoa	71,620,511	70,450,738	68,022,312	68,288,615	71,435,770	78,243,313	82,706,346	86,989,248
UoH 216 Institutional Support—Hilo	4,735,146	5,792,124	5,304,680	5,404,248	5,603,760	5,863,553	6,186,007	6,481,086
UoH 305 Institutional Support— Honolulu Community College	5,950,323	5,121,418	4,643,064	4,888,157	4,503,462	4,485,149	4,712,751	5,004,391
UoH 315 Institutional Support— Kapiolani Community College	1,753,760	1,639,873	1,569,269	1,751,973	1,932,133	2,177,312	2,540,296	2,905,077
UoH 325 Institutional Support— Leeward Community College	4,665,608	3,880,207	3,863,078	3,786,084	3,986,438	4,079,370	4,696,441	4,847,160
UoH 335 Institutional Support— Windward Community College	664,800	637,400	508,520	549,640	618,054	640,240	682,960	703,310
UoH 505 Institutional Support— Maui Community College	1,513,495	1,328,266	1,280,081	1,316,953	1,337,952	1,446,951	1,625,877	1,754,000
UoH 605 Institutional Support— Kauai Community College	1,887,600	1,864,200	1,717,200	1,790,400	1,710,600	1,746,600	1,878,600	1,915,200
TOTAL	92,791,243	90,714,226	86,908,204	87,776,070	91,128,169	98,824,488	105,012,747	110,599,472

\* Excluding West Oahu College.

Sources: University of Hawaii, Internal Memorandum dated October 15, 1985, Subject: Final FY1984-85 General Fund Electricity Report; and data provided by the University of Hawaii Budget Office.

By the end of FY 1987-88, all except Honolulu had more than offset previous reductions and were consuming more than in FY 1980-81. UH-Manoa increased by the largest amount--15.4 million kilowatt-hours. Honolulu was the only campus with less electricity consumption than in FY 1980-81.

As a whole, UH's electricity consumption also dropped initially, from 92.8 million kilowatt-hours in FY 1980-81 to a low of 86.9 million kilowatt-hours in FY 1982-83. However, at the end of FY 1987-88, it had increased to 110.6 million kilowatt-hours, or 19 percent higher than in FY 1980-81. Thus, UH has been unable to effect any lasting decrease in electricity consumption and, instead, is now using significantly more.

**Reasons for increases.** While a large part of UH's increased electricity consumption is attributable to the addition of new facilities--buildings, lights, air conditioning and other basic equipment--these facilities do not account for all of the additional utilization. Existing facilities throughout the system have also been using more electricity.

Each year for the last three years, the amount of kilowatt-hours used per square foot increased at every campus. UH has used this measure over the past years as an indication of its progress in controlling its electricity consumption. This upward swing after some years of decline is of concern, particularly in view of declining enrollment,<sup>5</sup> and therefore has been given close examination.

Three factors are most evident systemwide throughout UH and appear to have significant bearing on UH's increased use of electricity. These factors are: (1) longer operating hours; (2) wider use of air conditioning; and (3) increased mechanization, including computers.

**Longer hours.** In the early 1980s when electricity costs were high, UH limited evening and weekend use of facilities. As costs declined, these restrictions were lifted. A growing number of part-time students (despite declining enrollment of regular students overall) prompted UH to offer more evening classes to suit their needs. Community interest, especially in computer training, also spurred UH to increase other evening and weekend non-credit courses. Extended class hours also mean longer hours for the operation of support facilities, such as air conditioning and lighting in buildings and parking lots.

For example, UH-Manoa now closes buildings at 11:00 p.m. instead of 5:30 p.m., the time previously set during the last energy crunch. In another case, Honolulu Community College extended its regular hours for the first four days of the week from 5:00 p.m. to 9:00 p.m.

**More air conditioning.** As part of its earlier efforts to conserve energy, UH also had restricted the use of air conditioning and the acquisition of replacements or new window units. Moreover, it limited the air conditioning of new buildings. In recent years, much less restraint has been imposed.

The hours in which air conditioners run has expanded with the changes in overall operating hours at UH. Large and small systems are now often in operation in the evenings and on weekends. There has also been a proliferation of window units throughout the UH system. For example, at UH-Manoa there were 293 window units installed over the last five years, 76 in 1987-88 alone. All of the other campuses have acquired more of these smaller units in recent years. In addition, most new buildings are now being built entirely air conditioned.

Throughout the system, natural ventilation is no longer considered a viable alternative for most activities on the campuses. Windward Community College, Maui Community College, and Kapiolani Community College at Diamond Head retain more natural ventilation than the others, but these situations, too, are not considered altogether satisfactory.

There are several reasons for this widespread conversion to air conditioning. Need for cooler and cleaner environments for computers, other sensitive equipment, and science labs is often cited as a primary reason for increased air conditioning. Other problems with natural ventilation have been noted--including noise, dust, wind, rain, insects, heat and humidity--which disrupt or disturb the comfort of classes, offices, and other aspects of campus operations. To accommodate these various demands, air conditioning is fast becoming the standard environment in UH facilities.

*Increased mechanization.* Another factor in UH's growing electricity consumption is the acquisition of more equipment (electrically run) throughout its operations. In working toward greater efficiency and modernization, UH increasingly is turning to more automation and so-called high tech equipment in all aspects of operations.

This trend is best exemplified by the greater application of computers throughout UH. Various operational functions such as student registration, student records, financial management, and procurement are computer assisted. Computers are used more in instruction, research, and study, by both students and faculty.

For example, in 1985, only 6 personal computers were used for administrative functions. By 1988, the administration employed 349 personal computers and 3 minicomputer systems. The number of CRT terminals (input devices with TV-like screens and typewriter-like keyboards) has increased from 32 to 198, while the number of printers has grown from 23 to 310, including 81 laser printers. It is estimated that computers and related equipment will use 248,000 kwh more of electricity in 1988 than they consumed three years ago. To some extent this represents a trade-off of electricity previously used by machines that computers have replaced. On the other hand, computers have also replaced manual processes and have added new uses thereby increasing overall electricity consumption.

**More consumption in the future.** The foregoing reasons can also be expected to contribute to further utilization of electricity at UH. Planning for UH indicates that more air conditioning, further extension of operating hours, and greater mechanization will occur in coming years.

The basis for increased electricity use lies in the strategic planning objectives adopted by UH for 1985-95 to ensure access to the university and to enable it to adapt to continuing scientific and technological change.

More specifically, UH is seeking to improve access through "coordinated programs involving outreach degrees, continuing education, and community service" and to maximize use of facilities and resources for this purpose, including evening hours and weekends.<sup>6</sup>

UH is also planning to expand greatly its use of telecommunications systems. Its objective in this regard is "to incorporate telecommunication systems selectively into all aspects of the teaching and research mission of the university" so that "all students, faculty and staff should have easy, continuous and inexpensive access to terminals for word processing, formal and informal instruction, electronic mail and computer-conferencing services locally and worldwide, data retrieval and manipulation from local, national, or international sources, and other purposes related to teaching and learning."<sup>7</sup> Still another objective is to "harness technology to improve administrative efficiency and effectiveness," by utilizing computers and telecommunications "for such purposes as student enrollment, class registration, advising, placement, evaluation, intra-student and administration communication, and planning and budgeting requirements."<sup>8</sup>

**Need to address users.** It is apparent that energy consumption at UH will continue to be significantly affected by operational activities. Although the larger consumption of electricity still results from basic operations, especially air conditioning, the use of individual air conditioners and other equipment and machines is apparently a growing factor. Consequently, electricity consumption is being affected increasingly by individual users--faculty, students, and operational staff.

However, UH's energy conservation efforts are limited to modification of its basic facilities--i.e., its physical plant. It is not addressing other aspects of electricity consumption, particularly the human component.

In earlier years, UH tried to influence people at UH to save energy through the assistance of energy committees and distribution of promotional posters and stickers. But these efforts were discontinued years ago. According to UH, such efforts declined as electricity costs dropped and operational restrictions were felt no longer needed.

However, recent increases in electricity costs and the growing role of users call for UH to enlist again the support of its users. While the situation does not seem to warrant severe

restrictions or large cutbacks in use of electricity, it appears prudent for UH to put increased effort into energy education and promotion of energy efficiency in addition to improvement of its facilities. It is important that UH start to examine more closely its burgeoning use of electricity, to determine more clearly and specifically the reasons, to search for ways to avoid waste, to develop energy efficient practices, and to cultivate an energy awareness and a judicious approach to the use of electricity.

### ***Recommendations***

*We recommend that the University of Hawaii thoroughly examine and analyze its electricity consumption to identify significant factors, especially those contributing to its growth in recent years and the extent of impact of each. In this regard, it should establish systems for monitoring electricity consumption systemwide that track and document the progress of important factors and provide it with sufficient information to effectively manage electricity use on its campuses.*

*We further recommend that the University of Hawaii broaden its approach to energy conservation to address important factors contributing to electricity consumption in addition to those facility improvements already targeted. In so doing, it should give particular attention to the effect of the human component on its electricity consumption and develop an ongoing program of information, education and training for its users, including students, faculty, administration, and operations staff.*

### **Need For a Coherent and Comprehensive Approach to Energy Management**

Preceding sections of this report show that UH has had very limited success in conserving electricity. Instead, its electricity consumption has increased, and even greater consumption can be expected in the future.

**A critical issue for UH.** The increase of UH's electricity consumption to levels higher than during the last energy crisis at the beginning of the decade, accompanied by its greater dependence on electricity to maintain basic operational functions, places UH in a more vulnerable position now than when high costs and deficits last threatened its operations. It would be subject to severe disruption should its own electricity systems fail or if electricity should become somehow less available than at present. Yet, the prospect of such an occurrence is very real. This is particularly evident when the already large size of UH's electricity budget is taken into account.

As indicated in previous discussion, UH already faces a number of pressing issues related to its electricity systems and its growing consumption of electricity. UH needs to identify more

specifically and examine the reasons and factors underlying its electricity consumption, to improve the condition of its facilities, and to develop a more comprehensive and effective program of energy conservation.

Expenditures for electricity already constitute a major budget item in UH's budget. For example, more is spent annually for electricity than is spent to operate some of the community colleges for a whole year. Moreover, rapid and drastic price increases are a constant threat. The price of electricity has recently taken an upswing and is widely predicted to rise and remain higher in the not too distant future. Although less obvious at this time, the supply of electricity could also become limited. The large dependence of the entire state on electricity for energy and on oil for electricity, plus the uncertainty of price and supply of oil, and a growing demand for electricity statewide, could result in supply problems at some time in the future.

Therefore, it is important that UH immediately start to address its present problems and take steps to assure that its electricity systems are reliable, efficient, and prepared to keep pace with the overall development of UH. It is of equal importance that UH seriously consider its prospects for the future regarding electricity and weigh alternatives to total reliance on current sources of electricity. Prudence calls for solid and meaningful planning for adverse contingencies and an active participation in the search and development of alternative energy sources for UH facilities and programs, whether they are presently least costly or not.

Thus, UH needs to manage its electricity requirements in a comprehensive, cohesive, and concerted manner to assure that all vital issues are adequately and effectively addressed. Yet, we find that UH has not given the issue of electricity or energy any special emphasis, and the matter is managed in a fragmented and extremely limited manner.

**Lack of priority and direction.** The basic problem underlying UH's inability to manage better its electricity consumption and energy needs has been the lack of top level recognition and priority given to this area of concern. Energy is not dealt with on any systemwide and continuing basis at the higher levels of UH administration.

The omission of attention to energy and electricity is notable in UH's basic planning documents which set forth the issues and objectives of priority to the UH administration. There are no objectives related to energy or electricity in UH's Strategic Plan for 1985-95, nor planning assumptions that set forth the underlying role of energy or electricity. UH's Agenda for Action, which provides a more detailed guideline and program agenda on a biennium basis, lists many priority actions for physical facilities--such as master plans for particular campuses, certain facilities to be built, and repair and maintenance--but makes no reference to electricity or electrical systems.<sup>9</sup>

Further, UH provides no overall administrative framework to assure that energy and electricity management would be comprehensively and consistently addressed. It has no systemwide program, objectives, policies, or plans relating to this subject. Moreover, no one has been assigned overall responsibility for energy management at UH. Two top level positions, the Vice President for Finance and Operations and the Director of the Budget, are involved with electricity by the nature of their general responsibilities, but neither has been given specific responsibilities for energy management nor has either exercised any systemwide coordination in this area.

Although all programs and administrative activities contribute to UH's growing utilization of electricity, this area of concern is generally viewed as an operational problem--that is, one to be handled by facilities managers--at each of the separate campuses.

**Inadequate attention at campus level.** However, the campuses also have no organized framework for energy or electricity management or comprehensive approach to electricity or energy-related problems. Electricity systems are generally attended to when specifically necessary (such as when breakdowns occur), but have to compete with other needs for improvement and maintenance.

Particular attention has been given to electricity in the development of energy conservation projects and in budgeting. However, involvement in and support for these aspects on most campuses are minimal. Many campus administrators have become discouraged by the ineffectiveness of energy conservation measures and are no longer pursuing new projects. Although facility uses are changing, operational requirements are increasing, and system problems are emerging, most campuses have not reevaluated their facilities to consider further modifications. The few projects being considered are carryovers from prior years. Budgeting is mostly perfunctory and reflects a general lack of data and understanding of rising consumption.

According to campus administrators, electricity is an increasing concern but difficult for them to attend to due to lack of expertise within their own staffs and limited resources with which to obtain assistance.

**Planning.** A major deficiency regarding energy and electricity at UH is a lack of planning. There are no overall energy management plans or energy conservation plans at any of the campuses, even for facilities. Although general plans for electricity systems had once been developed for all campuses as part of their physical master planning, these have not been kept current.

The university is giving no consideration to the real possibility of future price and availability constraints. It has not developed any contingency plans or even identified priority activities or

programs for consideration should cutbacks be suddenly necessary, nor has it planned to try to lessen its dependence on current sources of electricity through the development of alternate energy uses at UH.

*UH-Manoa.* Energy and electricity needs pose the greatest difficulty for UH-Manoa, the largest campus in the UH system and the one with the highest electricity consumption. It has, therefore, been the most energetic in trying to address its problems. It has remained actively involved in trying to make its facilities more energy efficient. Besides working on its chilled water loop system and energy management information system, UH-Manoa is reevaluating energy use in a number of major buildings and seeking funds to modify lighting and for other energy conservation and electricity related projects. Additionally, it has improved its budgeting with respect to electricity rates.

But UH-Manoa's management of electricity and energy is still inadequate. It, too, has insufficient understanding of its electricity consumption, lacks plans for energy conservation and its electricity systems, has no program to address the users of electricity on its campus, and is without any defined and comprehensive approach to the management of energy and electricity on its campus. UH-Manoa also cites insufficient expertise and limited resources as obstacles to more effective action in this area of responsibility. If this largest unit within the UH system is unable to grapple effectively with the issue of electricity consumption, it should come as no surprise that the other campuses are not dealing with the subject adequately.

### *Recommendations*

*We recommend that the University of Hawaii give greater emphasis and clearer focus to the management and planning of its energy and electricity needs. To that end, the top level administration should give this subject specific direction and priority by: (1) defining planning and management issues and areas of emphasis; (2) providing an overall management framework that assures comprehensive and systemwide attention, clearly assigns responsibilities (both overall and at the campus unit level), and provides for effective coordination among various campuses, administrative levels, and outlying programs; and (3) allocating adequate resources to properly manage energy needs systemwide.*

*We further recommend that the University of Hawaii establish an ongoing planning and evaluation process that will specifically address energy needs and related issues and will assure sufficient and timely planning. More specifically, it should coordinate planning of electrical distribution systems of the various campuses and other outlying programs with long-range strategic plans. It should also plan for contingencies, including the identification of critical and priority*

*activities and programs, the delineation of actions to be taken in the event another energy crisis emerges, and the investigation of alternative energy applications within the university's own operations.*

### **Update on UH Electricity Budgeting**

**Proposed electricity budgets for 1989-91.** UH's proposed electricity budgets for 1989-91 under its Institutional Support Programs clearly demonstrate the continuing growth of UH's electricity costs. These budgets amount to \$10.2 million for FY 1989-90 and \$11.4 million for FY 1990-91, for a total of \$21,680,645 for electricity at UH campuses for the coming biennium.

UH-Manoa's request of \$15.3 million constitutes 70.4 percent of the total. The community colleges' budgets together are \$4.7 million, or 21.6 percent. UH-Hilo with \$1.7 million has 8 percent. Examination of these budgets shows that increases are expected in both rates and consumption for all of the campuses.

Table 2.4 presents a comparison of UH's proposed electricity budgets for 1989-91 and appropriations for electricity for 1987-89. Overall UH is requesting \$5.9 million or 37.3 percent more for electricity for these programs than was appropriated for the previous biennium. Asking for \$4.2 million more, UH-Manoa has the larger share of this increase.

**Problems remain in budgeting.** In our preliminary report on UH's electricity costs and consumption issued last year,<sup>10</sup> we noted two basic problems with UH's budgeting: (1) a lack of coordination and consistency among the various campuses, and (2) inadequate methodology and data for projecting electricity rates and consumption. Our review of UH's budgeted and actual electricity consumption amounts for FY 1987-88 and of its overall approach to budgeting for electricity for fiscal biennium 1989-91 reveals that these two basic problems still persist.

Although we examined projection variances in detail as requested by the Legislature, our study shows that the particulars for each campus are of much less importance than the collective situation affecting UH as a whole. Therefore, in this section we discuss primarily the larger and more fundamental issues.

**Lack of coordination and consistency.** As with other matters relating to electricity at UH, there was no systemwide coordination of budgeting for electricity for 1989-91. The University Budget Office did issue system-wide general instructions and a standard format for preparing electricity budgets. However, the actual process of budgeting was left to campus administrators, and the resulting budgets were not monitored for consistency. As a consequence, varying methods were used both in projecting rates and in projecting consumption.

Table 2.4  
 Institutional Support Programs<sup>a</sup>  
 Comparison of Proposed Budgets for 1989-91  
 With Appropriations for 1987-1989 for Electricity

Program	Amounts Appropriated for 1987-89	Amounts Budgeted for 1989-91	Amount of Change	Percent of Change
UoH 106 Institutional Support Program— Manoa	\$11,043,716	\$15,265,234	\$ 4,221,518	38.2
UoH 216 Institutional Support Program— Hilo	1,534,474	1,727,052	192,578	12.6
UoH 305 Institutional Support Program— Honolulu Community College	784,878	931,479	146,601	18.7
UoH 315 Institutional Support Program— Kapiolani Community College	641,596	903,129	261,533	40.8
UoH 325 Institutional Support Program— Leeward Community College	722,873	1,416,172	693,299	95.9 <sup>b</sup>
UoH 335 Institutional Support Program— Windward Community College	100,287	152,991	52,704	52.6
UoH 505 Institutional Support Program— Maui Community College	399,747	526,274	126,527	31.7
UoH 605 Institutional Support Program— Kauai Community College	<u>562,704</u>	<u>758,314</u>	<u>195,610</u>	34.8
<b>Total</b>	<b><u>\$15,790,275</u></b>	<b><u>\$21,680,645</u></b>	<b><u>\$5,890,370</u></b>	<b>37.3</b>

<sup>a</sup>Excluding West Oahu's which covers only a few administrative offices.  
 There are also a few other electricity budgets in other programs for  
 lesser amounts that are largely for off-campus facilities.

<sup>b</sup>This large increase was not justified as necessary. Thus Leeward was  
 in the process of exploring alternatives and significant decreases in  
 its electricity budget are expected.

Sources: 1988 Hawaii Session Laws, Act 390, sec. 181; and data from University  
 of Hawaii budget office.

*Rates.* As noted in last year's report, rates were projected differently not only between UH-Manoa and the other campus units but also among campuses outside of UH-Manoa.

For the coming biennium, UH-Manoa used a computer program obtained from the Hawaiian Electric Company for projecting its electricity rates. This program allowed UH-Manoa to project rates according to the different rate structures applicable to its various accounts instead of having to rely on an overall averaged rate as it had in past years.

While this computer program appears to be usable also for the other campus units, the latter did not become aware of it until after they had developed and submitted their budgets. As a result, they continued to project rates just as they had before, using a flat rate of increase. In addition, despite a decision among the community colleges to use the same percentage rate of increase, they ended up taking different approaches. Most showed a 5 percent increase for each year of the coming biennium, but one showed no rate increases while another, on Oahu, reflected a 10 percent increase for each year. UH-Hilo and West Oahu made their projections separately.

*Consumption.* The UH electricity budget forms provide specifically for the consideration of the effects of energy conservation measures and of adding new or renovated facilities. Thus, these two factors were consistently addressed in UH's projections of electricity consumption. However, only some campuses attempted to estimate the impact of anticipated longer operating hours and additional equipment. While the smaller campuses specified reasons for adjustments, UH-Manoa simply used a 2 percent "growth factor," an admitted guesstimate to cover increases that might occur for reasons other than new buildings.

*Current service base.* Discrepancies also showed in the methodology used by UH to derive consumption and rates for current services, the base figures upon which the 1989-91 biennium budgets were developed.

Logically, it would seem that UH should use as the base or starting point for consumption projections the most up-to-date indicators of actual consumption available. Therefore, in budgeting for the 1989-91 fiscal biennium, UH should use actual consumption amounts for FY 1987-88 as a starting point. It should then estimate its consumption for FY 1988-89 taking into account all known conditions at the time the budget is being prepared. This estimate for FY 1988-89 should then be used as the current services base for estimating consumption for FY 1989-90, and the resultant projection there should be the base for projecting consumption for FY 1990-91. In other words, budgets for electricity should extend logically from current experience through the budget period, taking into account circumstances expected to occur along the way.

However, in many of its electricity budgets, UH did not build upon current consumption information. Some of the budgets were based on only partial actual data for FY 1987-88, and on outdated consumption projections for 1988-89. In these cases, UH simply used the consumption projections shown in the appropriations act for 1988-89. Having been made over two years ago, these consumption projections are outdated and in many cases quite divergent from recent actual experience. As a result, the amounts used as the current services base for 1989-91 in these instances are not adequate. In budgets for which UH made current estimates for FY 1988-89, it did not provide any explanatory detail on how they were derived.

UH-Manoa's budget was particularly confusing in this regard. While a current estimate for FY 1988-89 had in fact been made, this estimate was not shown in its budget and appropriations figures were used instead. It appears then that increases expected for FY 1988-89 were combined with the "growth factor" for FY 1989-90, making it appear disproportionately large for that year. The net result is that UH-Manoa does not give a clear picture in its budget of how it expects electricity consumption to increase over the three years covered.

UH's use of rates from the appropriation act of 1988-89, and not current estimated rates for FY 1988-89 based on actual rates for FY 1987-88, also produced results which were either incorrect according to the expressed methodology or very confusing. For example, the UH-Manoa budget presented rate increases of 3.2 percent, 14.7 percent, and 8 percent for FY 1988-89, FY 1989-90, and FY 1990-91 respectively. However, when actual data for FY 1987-88 are taken into account, the projected rate for FY 1988-89 would amount to an increase of 11.2 percent instead of 3.3 percent. Further, UH-Manoa does not explain either of these rates of increase for FY 1988-89 although both differ from the increase it had last estimated during the 1988 session of the Legislature.

**Inadequate methodology and data.** As previously indicated, UH's electricity consumption projections have not taken many influencing factors into proper consideration. Apart from looking at previous consumption, about the only other factors taken into account have been hoped-for reductions attributable to energy conservation measures and increases related to the addition of facilities. Even in these cases, the accuracy and reliability of adjustments are highly doubtful due to the lack of adequate base data and the unavailability of suitable means of measuring change.

Adjustments related to equipment changes (such as the greatly expanded use of air conditioners and of computers) and to operational changes (such as extending hours into the evenings and weekends) have only infrequently been included. As in the case of energy

conservation measures and facility additions and deletions, budget administrators have been seriously hampered in gauging the effects of these other factors by the absence of basic data and by the lack of ways to identify or measure the changes that are occurring or are planned.

UH-Manoa has had the most difficulty with regard to taking relevant factors into consideration due to its larger size and complexity of organization. Unlike the smaller campuses where those preparing electricity budgets are also involved with the rest of the campus' budget, budgeting for electricity at UH-Manoa is somewhat removed from other budget preparation. Campus Operations administrators are responsible for preparing the campus' Institutional Support Program's electricity budget which covers most of the campus' electricity costs. While they also budget for capital improvement and repair and maintenance projects and therefore are able to include facility changes in electricity calculations, they have little access to information concerning changes planned and budgeted under other programs that also affect electricity consumption. Under UH's present budget process, budgets for other programs are not screened for electricity impact by the programs themselves nor is Campus Operations given the opportunity to review the budgets for that purpose. As a result, Campus Operations is forced to rely on an arbitrary 2 percent "growth factor" to allow for unknown increases in the coming biennium.

So long as these conditions persist, UH will continue to lack a reliable and credible foundation for its consumption projections, and wide discrepancies can be expected between its actual requirements and its budget requests for electricity. To overcome this problem, it will have to develop an adequate methodology for projecting consumption and then take the necessary steps to ensure that the required information is actually collected and used.

### *Recommendations*

*In view of the fact that budgeting shortcomings identified in our first report continue to exist at the University of Hawaii, we reiterate our previous recommendations on this subject. In effect, this means that the University of Hawaii should:*

*1. Develop a consistent and reasonable methodology for budgeting for electricity that delineates clearly the processes by which it projects rates and consumption and derives dollar requests. In so doing, it should give particular attention to improving the projection of electricity consumption and making sure all information on significant electricity usages, including new and expanded uses, is taken into consideration.*

*2. Utilize such methodology to support the electricity budget requests which it submits to the Legislature, including its requests for appropriations for the 1989-91 biennium.*

## NOTES

### Chapter 1

1. Hawaii, Legislative Auditor, *A Study of Electricity Costs and Consumption at the University of Hawaii, Preliminary Report*, Report No. 88-2, Honolulu, 1988.
2. 1982 Haw. Sess. Laws, Act 264, sec. 264.  
1983 Haw. Sess. Laws, Act 301, sec. 40.  
1984 Haw. Sess. Laws, Act 285, sec. 40.
3. Hawaii, University of Hawaii, *Report to the 1983 Legislature, 1982 Supplemental Appropriations Act, H.B. 2070, HD-1, CD-1, Part III, Act 264, Section 62A, Accounting System Covering Electricity Costs, Section 62B, Salary & Other Savings to Pay for Electricity Costs*, Honolulu, 1982.

Hawaii, University of Hawaii, *Report to the 1984 Legislature on H.B. 1, (HD-1, SD-1, CD-1), Section 40, 1983, Electricity*, Honolulu, 1983.

Hawaii, University of Hawaii, *Report to the 1985 Legislature, Act 301, S.L.H. 1983, Section 40, Amended by Act 285, S.L.H. 1984, Electricity*, Honolulu, 1984.

4. 1983 Haw. Sess. Laws, Act 301, Sec. 40.  
1984 Haw. Sess. Laws, Act 285, Sec. 40.  
1985 Haw. Sess. Laws, Act 300, Sec. 135.  
1986 Haw. Sess. Laws, Act 345, Sec. 135.  
1987 Haw. Sess. Laws, Act 216, Sec. 181.  
1988 Haw. Sess. Laws, Act 390, Sec. 181.
5. Hawaii, Legislative Auditor, *A Study of Electricity Costs and Consumption at the University of Hawaii, Preliminary Report*.

### Chapter 2

1. The Institutional Conservation Program is administered by the State of Hawaii through the Department of Business and Economic Development's Energy Division. It offers 50 percent federal matching funds for certain energy conservation projects such as studies and retrofits to buildings built prior to 1977. Schools and hospitals, both government and private, are eligible.

2. UH also modified its electrical systems to improve its power factor and control of its electricity demand. While these changes do not decrease UH's consumption, they qualify UH for lower electricity rates and, therefore, result in dollar savings.
3. UH relies on the Department of Accounting and General Services (DAGS) to assure that new buildings are designed for energy efficiency. However, neither UH nor DAGS has monitored the energy performance of new buildings to determine if conservation measures designed into buildings have proven energy efficient under actual usage.
4. 1987 Haw. Sess. Laws, Act 216, sec. 183, 190, and 205.  
1988 Haw. Sess. Laws, Act 390, sec. 183, 190, and 205.
5. Hawaii, University of Hawaii, Institutional Research Office, *Fall Enrollment Report, University of Hawaii, Fall 1987*, Honolulu, 1987. Enrollment of regular students at the University of Hawaii has decreased from a high of 47,210 in Fall 1982 to 42,747 in Fall 1987.
6. Hawaii, University of Hawaii, *A Strategy For Academic Quality 1985-95*, Honolulu, 1984.
7. *Ibid.*
8. *Ibid.*
9. "University of Hawaii Agenda For Action III, 1989-91," memorandum from Albert J. Simone to University Executive Council Members, Strategic Plan Advisory Council, Campus Faculty Senate Chairs, UHM and UHH/WOC Deans and Directors, Community College Provosts, Student Governance Organizations, April 8, 1988.
10. Hawaii, Legislative Auditor, *A Study of Electricity Costs and Consumption at the University of Hawaii, Preliminary Report*, Report No. 88-2, Honolulu, 1988.

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**RESPONSE OF THE AFFECTED AGENCY**

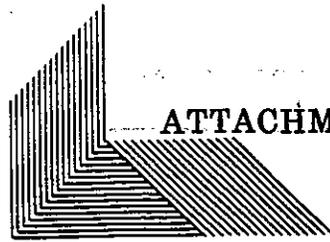
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## COMMENTS ON AGENCY RESPONSE

A preliminary draft of this Study of Electricity Costs, Consumption, and Conservation at the University of Hawaii: Final Report was transmitted on January 5, 1989, to the Chairman of the Board of Regents and the President of the University of Hawaii for their review and comments. A copy of the transmittal letter to the Chairman of the Board of Regents is included as Attachment 1. A similar letter was sent to the President. The response from the University of Hawaii is included as Attachment 2.

The university expressed appreciation for the study, but did not comment on any of the specific recommendations contained in the report.

THE OFFICE OF THE AUDITOR  
STATE OF HAWAII  
465 S. KING STREET, RM. 500  
HONOLULU, HAWAII 96813



ATTACHMENT 1

January 5, 1989

COPY

Ms. Gladys Brandt, Chairman  
Board of Regents  
University of Hawaii  
2444 Dole Street  
Honolulu, Hawaii 96822

Dear Chairman Brandt:

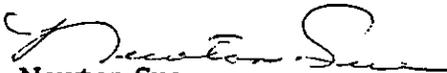
Enclosed is copy No. 4 of our preliminary report on the **Study of Electricity Costs, Consumption, and Conservation at the University of Hawaii, Final Report**. This study was prepared pursuant to Section 181 of the General Appropriations Act of 1987 (Act 216) as amended by the Supplemental Appropriations Act of 1988 (Act 390).

We invite your comments on the report. If you decide to submit comments, we ask that you (1) notify us by telephone of this intention by January 9, 1989, and (2) submit your written comments by January 20, 1989, so that they can be included in the final report.

Since the report is not in final form and there could be changes to the report, access to it should be restricted to those persons whom you might wish to call upon to assist you in reviewing the report. The only other parties who have been provided with copies of this preliminary report are the Governor, the presiding officers of the Legislature, and the President of the University of Hawaii. Public release of the report will be made solely by our office and only after the report is published in its final form and submitted to the Legislature.

We appreciate the assistance and cooperation extended to us by the administration and staff of the University of Hawaii during the course of the study.

Sincerely,

  
Newton Sue  
Acting Legislative Auditor

Enclosure

ATTACHMENT 2



Board of Regents of the University of Hawaii

Bachman Hall 209, 2444 Dole Street  
Honolulu, Hawaii 96822  
(808) 948-8213

An Equal Opportunity Employer

January 23, 1989

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Mrs. Gladys A. Brandt

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Mr. John T. Ushijima  
Mr. Dennis R. Yamada

Mr. Newton Sue  
Acting Legislative Auditor  
Office of the Auditor  
465 S. King Street, Room 500  
Honolulu, Hawaii 96813

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OFFICE OF THE AUDITOR  
STATE OF HAWAII

Dear Mr. Sue:

SUBJECT: Preliminary Report on the Study of  
Electricity Costs, Consumption, and  
Conservation at the University of  
Hawaii

Thank you for giving us the opportunity to offer comments on the above report. Your recommendations are well received. We find them to be most helpful toward our efforts to better govern the University.

It has come to my attention that the manner in which your staff conducted the study was most exemplary. Thank you for the courtesy.

Sincerely,

Gladys A. Brandt  
Chairman, Board of Regents

GAB:mo