



COLLEGE OF SOCIAL SCIENCES  
**HAWAII ENERGY POLICY FORUM**  
UNIVERSITY OF HAWAII AT MĀNOA

## **Hawaii Energy Policy Forum and Energy Industries “Energy by Example” Audit Awards Status Report October 2006-November 2007**

### **Introduction**

In August 2006, the Hawaii Energy Policy Forum (Forum) invited over 100 executives from the business, government and media sectors to an Executive Energy Briefing. Through a contribution from Energy Industries (EI), the Forum awarded four energy audits valued at \$20,000 each, to organizations that agreed to use the audits to implement energy efficient measures in their organizations, and to provide data to the Forum to subsequently report energy impacts of the audit recommendations. The “Energy by Example” audits were awarded to government and business organizations to inspect their respective buildings as follows: (1) the Hawaii State Capitol, (2) Farrington High School, (3) University of Hawaii—Saunders Hall, and (4) United Laundry Services.

EI performed a Preliminary Energy Assessment<sup>1</sup> of the Hawaii State Capitol, Farrington High School, the University of Hawaii-Saunders Hall, and United Laundry Services, to identify potential energy conservation measures (ECMs) at the facilities and to assess the viability of various energy-efficiency programs. The results of the studies are provided in this report. Additionally, each of the awardees were contacted to report on their progress to date, and if actions were taken the cost and cost savings thereafter. The awardees will be monitored annually to determine the effects of the audit.

### **The Building: The Hawaii State Capitol**

The Hawaii State Capitol is a 5-floor building located in the center of downtown Honolulu. It serves as the “seat” of the Hawaii State Government housing the offices and chambers for members of the Hawaii State Legislature as well as for the Governor and Lieutenant Governor. Various administrative offices and a parking garage are also located within the facility.

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<sup>1</sup> A Preliminary Energy Assessment involves the examination of energy bills, review of nameplate information on equipment, review of existing energy information, and the establishment of reasonable assumptions on energy consumption to perform cost-benefit analyses on possible energy-efficient projects.

## **Findings**

EI examined the facility and identified the major energy consuming systems for possible energy saving opportunities. The major energy consuming systems are: heating, ventilation, and air conditioning (HVAC) systems, building water supply and distribution, and general lighting systems. Associated equipment included the chillers and their associated water pumps, air-handling units (AHUs), cooling towers, booster pumps, and T8 and compact fluorescent lamps (CFL) located throughout the facility. There are also split system air conditioning units that provide cooling to some offices and computer rooms.

EI found that the Hawaii State Capitol's current annual electrical energy consumption and costs are:

- Electrical Consumption/Usage: 6,100,000 kilowatt-hours (KWH)/yr
- Total cost: \$1,069,701

## **Recommendations**

The following Energy Conservation Measures (ECMs) will result in substantial savings without sacrificing functionality.

- ECM-1 Variable Frequency Drives (VFDs) on Chillers
  - Install VFDs on two large centrifugal chillers
  - Estimated cost of system: \$164,000
- ECM-2 Variable Primary Flow on Chilled Water Pumps
  - Replace existing primary chilled water pumps with more efficient units
  - Estimated cost of system: \$126,000
- ECM-3 VFDs for condenser water pumps
  - Replace pump motors with more efficient motors
  - Estimated cost of system: \$80,000
- ECM-4 Replace water booster pumps
  - Replace pumps with more efficient units
  - Install variable frequency drives connected to programmable logic control
  - Estimated cost of system: \$66,000
- ECM-5 Variable Frequency Drives for Cooling Towers
  - Install VFDs and premium efficient motors
  - Estimated cost of system: \$114,000
- ECM-6 VFDs on AHUs 2HP and Above
  - Implement VFD strategy
  - Estimated cost of system: \$618,000
- ECM-7 Parking Garage Lighting and (Light Emitting Diode) LED Exit Signs

- Replace current exit signs with LED exit signs
  - Replace old fluorescent lamps with newer models
  - Estimated cost of system: \$36,000
- ECM-8 Install an Energy Management System (EMS)
    - LONWorks EMS System
    - Estimated Cost of system: \$196,000

The total estimated cost of installing the recommended ECMs is \$1.4 million. If implemented, the measures will save the state \$262,000 and 1,637,000 KWH per year.

Because of the availability of financing such as a Municipal Lease Purchase, the estimated \$1.4M project can be implemented without any cash outflow from the Capitol's budget.

The program could provide the State Capitol with significant financial benefits beginning in the first year. These include:

- \$0 front-end payment on project.
- \$262,000 of annual cash inflow from energy savings.
- \$65,600 one-time cash incentive for energy-efficiency from local utilities.
- Unspecified amount in savings from avoided repair and maintenance expenses.
- Unspecified tax benefits.

### **Actions Taken to Date**

The Department of Accounting and General Services (DAGS) reported that the Preliminary Energy Assessment provided an excellent starting point in identifying cost-effective alternatives to reduce energy consumption. It has provided data, which enabled initiation of further in-depth studies such as:

- DBEDT-Energy Division and Hawaiian Electric Company (HECO), through HECO's Energy\$olutions for Business program, contract to have intensive data logging energy assessments performed on the State Capitol Building.
- Retro-commissioning (ReCx) Assessment for the State Capitol Building.
- State Capitol Indoor Air Quality Analysis project for selected House and Senate offices in the State Capitol Building.
- DBEDT-Energy Division LEED Silver (Existing Building) Assessment project to determine preliminary budget estimates for related costs.

DAGS-Central Services Division and DBEDT-Energy Division staff will investigate implementation of "low cost/no cost" ECMS (energy conservation measures) for the State Capitol Building. DAGS-Public Works Division has initiated a pilot project

involving the installation of carbon dioxide sensors in selected House and Senate offices.

## **The Building: Farrington High School**

With over 2,400 students, Farrington High School is the most populated public school in Hawaii. It was first opened in 1936 and named in honor of Wallace Rider Farrington, the governor of Hawaii from 1921–1929. Located at 1564 North King Street, Honolulu, Hawaii 96817, Farrington High School serves the Honolulu suburb of Kalihi.

### **Findings**

Energy Industries (EI) examined representative rooms and areas to assess the performance of energy consuming systems throughout the Farrington High School campus. EI found that Farrington High School's current annual electrical energy consumption and costs are:

- Electrical Consumption/Usage: 2,245,360 kilowatt-hours (KWH)/yr
- Total cost: \$416, 089.74

Lighting and air conditioning were found to be the major energy consuming systems with a large number of desktop computers also identified as an additional significant source of energy consumption.

The major energy consuming systems are those associated with air conditioning and lighting. Most of the classrooms, as typical in Hawaii public schools, are cooled via natural ventilation rather than a centralized air conditioning system. However, classrooms that serve as computer labs have window air conditioning units.

Classroom lighting at Farrington High School has been upgraded to T8 fluorescent lamps with electronic ballasts. The hallway corridors of the classroom building are illuminated with high-pressure sodium lamps that run 24 hours. The school gym is illuminated with metal halide and T8 fluorescent lamps.

### **Recommendations**

The following Energy Conservation Measures (ECMs) in water heating, desktop computers, classroom cooling and ventilation, and gym lighting will result in substantial savings without sacrificing functionality. And, to further reduce the facility's consumption of electricity from the utility grid, a renewable energy measure (REM) could tap into solar energy potential for the school.

- ECM-1 Lighting Retrofits and Occupancy Sensors for Classrooms
  - Replace existing T8 fluorescent lamps with Super T8 28-watt fixtures
  - Incorporate occupancy sensors to the new lamp retrofits
  - Estimated cost of system: \$16,000
- ECM-2 Solar Water Heating for the Cafeteria

- Estimated cost of system: \$21,000
- ECM-3 Replace Cathode-Ray Tube (CRT) Monitors with Liquid-Crystal Display (LCD) Monitors
  - Estimated cost of system: \$6,000
- ECM-4 Ceiling fans for classrooms
  - Replace plug-in fans with ceiling fans
  - Estimated cost of system: \$10,000
- ECM-5 Gym Lighting Retrofit
  - Replace metal halide lamps with new T5 fluorescent fixtures
  - Replace T8 fluorescent lamps with T5 fluorescent lamps
  - Estimated cost of system: \$22,000
- REM-1 Photovoltaic (PV) System
  - Install PV system
  - Estimated cost of system: \$550,000 (not including 35% and 30% State and Federal Tax Incentive)

The estimated installation cost of the ECMs is \$75,000, which would result in an estimated annual savings of \$11,600, 56,000 KWH, and 900 gallons of synthetic natural gas (SNG).

Due to the availability of financing, such as a Municipal Lease Purchase, the estimated \$75,000 project can be implemented without any cash outflow from the school's budget.

The program could provide Farrington High School with significant financial benefits beginning in the first year. These benefits include:

- \$0 front-end payment on project
- \$11,600 of annual cash inflow from energy savings
- \$2,020 one-time cash incentive for energy-efficiency from local utilities
- Unspecified amount in savings from avoided repair and maintenance
- Unspecified tax benefits

### **Actions Taken to Date**

The Department of Education was contacted but with the turnover in staff no follow-up has been reported. The Forum will contact the DOE regularly to monitor its progress.

### **The Building: Saunders Hall - University of Hawaii**

Saunders Hall is a seven-floor building used for a variety of academic purposes at the University of Hawaii at Manoa. The building is located at 2424 Maile Way, Honolulu, HI 96822. Academic facilities in the building include lecture rooms,

faculty offices, a library, and computer labs. Among the systems examined were heating, ventilation, and air conditioning (HVAC), lighting, and plug loads.

### **Findings**

HVAC equipment accounts for most of the building energy usage as air conditioning is provided 24 hours a day. Approximately two air-handling units (AHUs) are installed on each floor to cool the faculty offices and classrooms. Some of the faculty offices are also served with fan coil units to provide additional cooling.

Lighting also accounts for a significant portion of the energy use. Lighting is found in all classrooms, offices, hallway corridors, elevators, and restrooms.

Other energy consuming systems and equipment in the building are plug loads including desktop computers. Computer workstations are located in most of the faculty offices, library, and computer labs.

Energy Industries (EI) found that Saunders Hall's current annual electrical energy consumption and costs are:

- Electrical Consumption/Usage: 4,204,000 kilowatt-hours (KWH)/yr
- Total cost: \$1,069,701

### **Recommendations**

To improve efficiencies, reduce energy consumption, and to reduce the cooling load and reliance on the electricity grid, the following Energy Conservation Measures (ECMs) and Renewable Energy Measures (REMs) are recommended:

- ECM-1 Chiller(s) Replacement (to Smardt – Turbocor)
  - Estimated cost of system: \$480,000
- ECM-2 Variable Primary Flow on Chill Water Pumps
  - Install new condenser and chilled water pumps with NEMA motors and variable frequency drives (VFDs)
  - Estimated cost of system: \$118,000
- ECM-3 VFDs on Condenser Water Pumps
  - Replace pump motors with NEMA motors
  - Estimated cost of system: \$46,000
- ECM-4 Emergency Management System
  - Estimated cost of system: \$80,000
- ECM-5 VFDs for Cooling Towers
  - Estimated cost of system: \$62,000
- ECM-6 VFDs on AHUs above 3HP
  - Implement VFD strategy
  - Estimated cost of system: \$76,000

- ECM-7 Lighting Retrofit / Occ. Sensors / Stairwell Occusmart
  - Upgrade lighting with occupancy sensors
  - Estimated cost of system: \$30,600
- ECM-8 Occupancy Sensors for Office Fan Coil Units
  - Install thermostats with occupancy and humidity sensors for office fan coil units
  - Estimated cost of system: \$118, 800
- ECM-9 Green Roof
  - Use of green plants on the building roof to reduce cooling load
  - Estimated cost of system: \$118,000
- REM-1 Roof Solar PV System
  - Estimated cost of system: \$550,000 (does not include 30% federal and 35% state tax credit)

Due to the availability of financing such as a Municipal Lease Purchase, the estimated \$1,129,400 ECM project can be implemented without any cash outflow from the school's budget.

The program could provide Saunders Hall with significant financial benefits beginning in the first year. These benefits include:

- \$0 front-end payment on project
- \$153,750 of annual cash inflow from energy savings
- \$42,908 one-time cash incentive for energy-efficiency from local utilities
- Unspecified amount in savings from avoided repair and maintenance
- Unspecified tax benefits

### **Actions Taken to Date**

The School of Social Sciences, the primary occupant of Saunders Hall, submitted a budget request of \$980,000 for the recommended ECM retrofits in 2006, and started a "Sustainable Saunders" campaign involving students, faculty, and two legislators who were in the College's Legislator-in-Residence Program, Senator Suzanne Chun Oakland and Representative Barbara Marumoto. The 2007 Legislature did not fund the request. However, the College and the Chancellor's Office are hopeful of support for this initiative.

### **The Building: United Laundry Services**

United Laundry Services, Inc. is located at 2291 Alahao Place, on Sand Island Access Road, Honolulu. United Laundry Services provides linen and cloth laundry for medical facilities and major hotels throughout Oahu and the neighbor islands.

## **Findings**

Energy Industries (EI) examined the facility and its energy systems and looked for possible energy saving opportunities. Among the systems that were examined were heating, ventilation, and air conditioning (HVAC), lighting, steam, compressed air, and exhaust and refrigeration systems.

United Laundry Services, Inc., mechanical systems are specific to the business. In most facilities audited, air conditioning accounts for a majority of the utility bill. At United Laundry Services, the AC system accounts for a small fraction of the energy used when compared to the laundering systems comprised of motors, pumps and large washers to properly clean the volume of linen handled. The warehouse area is broken into three sections: the office, hotel laundry, and medical laundry. Lighting also accounts for a significant portion of building energy usage at United Laundry Services.

EI found that United Laundry Services' current annual electrical energy consumption and cost are:

- Energy Usage/Consumption: 3,921,600 kilowatt-hours (KWH)/yr
- Total cost: \$629,790.09

## **Recommendations**

To improve efficiencies and reduce energy consumption, the following Energy Conservation Measures (ECMs) are recommended:

- ECM-1 Split Air Conditioning Consolidation
  - Replace existing condensers to a single Fujitsu Variable Compressor Unit
  - Estimated cost of system: \$18,000
- ECM-2 Steam Boiler Stack Economizer
  - Estimated cost of system: \$145,000
- ECM-3 Boiler Heat Recovery Units
  - Estimated cost of system: \$60,000
- ECM-4 Installation of Pony motor on Air Compressors
  - Install 20 HP pony motor in front of the three compressors
  - Estimated cost of system: \$32,000
- ECM-5 Repair Steam Leaks, Duct Leaks, Compressed Air Leaks
  - Estimated cost of system: \$2,428
- ECM-6 Retrofit Vending Machines to Vending Misers
  - Install new vending machine controllers for soda machines
  - Estimated cost of system: \$3,000
- ECM-7 Variable Frequency Drives (VFDs) on Roof Exhaust Fans
  - Slow fans down at night and cooler months when facility is not in use

- Estimated cost of system: \$66,000
- ECM-8 Lighting – Back of House Retrofit T12 to T8 and T5 to HID High Bay Replacement
  - Replace old technology fluorescent lamps with new generation of lamps
  - Replace HID lamps with longer-lasting and cooler T5 lamps
  - Estimated cost of system: \$77,218

The program could provide United Laundry Services, Inc. with significant financial benefits beginning in the first year. These include:

- \$0 front-end payment on project
- \$128,311 of annual cash inflow from energy savings
- \$17,757 one-time cash incentive for energy-efficiency from local utilities
- Unspecified amount in savings from avoided repair and maintenance
- Unspecified tax benefits.

**Actions Taken to Date**

United Laundry Services found the energy assessment helpful in providing information on cost-effective strategy measures. United Laundry is still reviewing the assessment, and implementation action plans will be determined by the end of November 2007.