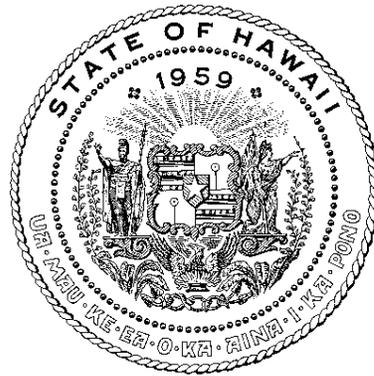


State Energy Resources Coordinator



Annual Report 2001

**State of Hawaii
Department of Business, Economic Development & Tourism**

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Security, Economic Vitality Are Focuses of Hawaii's Energy Program

The position of Energy Resources Coordinator was created in 1974 by the Legislature to address economic, environmental and energy security issues resulting from Hawaii being the most oil-dependent of the 50 states. It is held by the Director of the Department of Business, Economic Development, and Tourism (DBEDT).

The heightened awareness of security issues which followed the September 11 terrorist attacks brought energy vulnerability to the attention of policy makers. Hawaii, as the most isolated and oil-dependent state in the nation, is particularly at risk.

Hawaii relies on imported petroleum for 89% of its primary energy (see Fig. 1). All of the oil is imported, primarily from foreign nations, with a declining amount coming from Alaska.

Transportation, particularly by aircraft, is a particularly critical aspect of our island economy. Jet fuel consumption is disproportionately high compared to the mainland U.S., due to the state's mid-Pacific location.

Both residents and visitors rely on air transportation to travel among the islands as well as between Hawaii and the U.S. Mainland or other nations.

Aviation accounted for 36% of the oil used in Hawaii during 2000.

By comparison, on average, the U.S. uses about 9% of its oil as aviation fuels.

Hawaii's electric utility sector used 32% of the imported oil in 2000. The islands' electricity grids are not interconnected. Fuels must be transported interisland by sea. Residents pay among the nation's highest costs for electricity and gasoline.

These are among the challenges facing the Energy Resources Coordinator, whose staff has been working to enhance energy security, improve the state's economy, and reduce

nologies generates jobs.

The goals of the State's energy program have been incorporated into the Hawaii State Plan and codified in the Hawaii Revised Statutes, which require planning for and giving due consideration to all of the following four objectives:

- ◇ dependable, efficient, and economical statewide energy systems capable of meeting the needs of the people;
- ◇ increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased;

- ◇ greater energy security in the face of threats to Hawaii's energy supplies and systems; and
- ◇ reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.

By law, the State's energy policy also requires that the total costs and benefits of all energy resource options—including efficiency—be compared. This ensures that economic, environmental and social impacts are all considered. Alternative transportation fuels and efficient transportation practices must also be promoted.

The Energy, Resources, and Technology Division (ERTD) implements programs to meet these goals. Achievements for 2001 are detailed in the following pages.

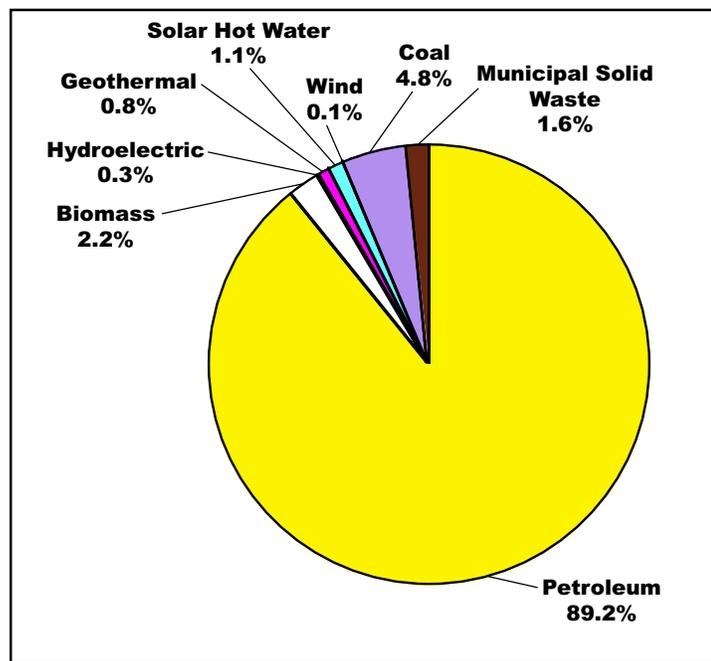


Figure 1. State of Hawaii Energy Resources in Year 2000

dependence on imports.

In Hawaii, every barrel of oil saved translates to more dollars available to the local economy, in addition to the environmental benefits. Also, implementing energy conservation measures and renewable energy tech-

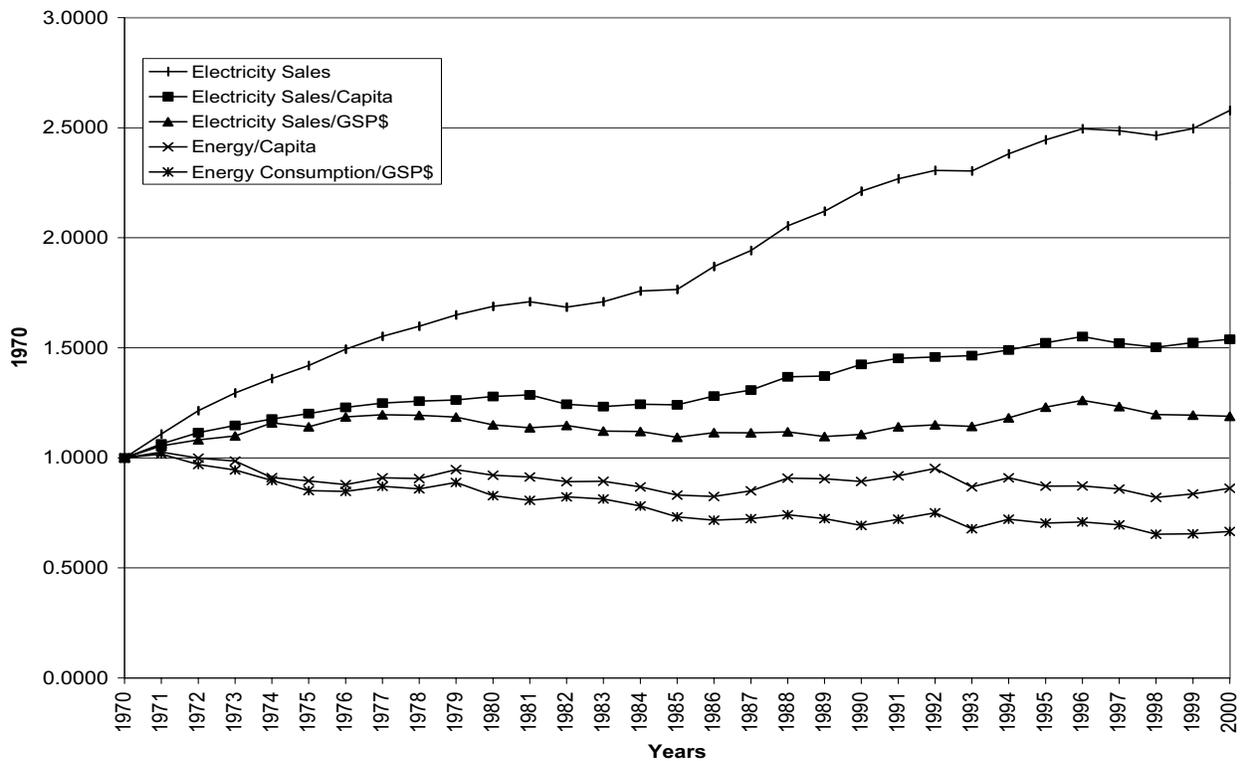


Figure 2. Key Energy and Economic Indicators in Hawaii, 1970-2000

Continued Increases in Electricity, Oil, and Energy Consumption Mark 2000

Although Hawaii's economy is significantly more energy efficient than it was in 1970 and Hawaii residents continue to use less energy per capita than they did three decades ago, the previous steady drop in energy use appears to be flattening (see Fig. 2).

Slight upturns in energy consumption per dollar of the Gross State Product (GSP) and in personal energy use appear to be driven by increasing electricity consumption.

Energy continues to be a key factor shaping Hawaii's economy, environment and standard of living. A stable energy supply is essential to continued prosperity. Energy efficiency also ensures that fewer dollars leave the state for fuel purchases. In

addition, reduced expenditures for energy release consumer dollars for other purchases in the State's economy.

In 2000, overall energy use per capita (based on de facto population) increased 3.06 percent from the previous year.

However, over the longer term, efficiency has been improving; there has been a 14 percent decline in energy use per capita since 1970.

In contrast, electricity sales continue to rise faster than the de facto population. Between 1970 and 2000 the average increase in electricity sales was about 3.2 percent, while the average de facto population growth was 1.7 percent.

During 2000, electricity sales in-

creased 3.31 percent from 1999. This also resulted in about a 0.97 percent increase in electricity sales per capita. Electricity sales in 2000 were more than two-and-a-half times 1970 levels.

In 2000, isle residents and businesses spent \$3.38 billion on energy, or about nine percent of Hawaii's \$39.4 billion GSP (in 2000 dollars). This is an increase of two percentage points over the percentage of GSP spent on energy in 1999. An estimated 325 trillion Btu of primary energy was consumed in Hawaii last year.

Petroleum consumption totaled 49.8 million barrels; this is an increase of 17.8 trillion Btu and 2.2 million barrels from 1999.

Federal, State Funds Support Energy Efficiency and Technology Initiatives

Slightly over \$2.4 million in State and federal funds were budgeted for Hawaii energy programs in fiscal year 00-01, as shown in Table 1. The State fund expenditures are for projects only; federal figures also include personnel costs.

DBEDT continues to attract significant non-state funds for energy and technology programs which benefit the residential, commercial and transportation sectors of the State's economy.

In all, the State's energy-related programs leveraged over \$2 million from federal sources such as the U.S. Department of Energy (USDOE), a match of approximately \$5 for every dollar of State money budgeted.

The largest component of the budget was Buildings sector projects, which include the development of guidelines for efficient residences, financing energy efficient retrofits in public buildings, promulgating the Model Energy Code, an analysis of the use of cold seawater for air conditioning, and the many initiatives of the Rebuild Hawaii Consortium.

These projects were budgeted at \$825,365, which does not include funds provided by private sector or County partners.

The second largest component of the budget is the Utilities sector, which includes updating the Hawaii Energy Strategy, energy emergency preparedness and hazard mitigation, initiatives to export energy technologies to other Pacific Rim nations, petroleum data rule making, carbon sequestration, and renewable energy research.

These projects were budgeted at \$663,737.

In the Industrial sector, ERTD administered projects in resource conservation, technical assistance for recycling, and technology innovation. These activities were supported by \$428,601 in federal and State funds.

Strategic Technology projects supported by federal funds include the Hawaii-Philippines collaborative project. A total of \$289,734 was budgeted for Strategic Technology, primarily in State money.

Renewable fuels technologies were the focus of the Transportation sector, supported by \$157,671 in federal and State funds.

Special programs such as the Hawaii Science Bowl and the State Science and Engineering Fair, in addition to a variety of activities in public information and general education, made up the Education sector. Funding for these efforts totalled \$50,680.

Description	State Funds	Federal Grants	Total
Education	0	\$50,680	\$50,680
Transportation	\$23,750	\$133,921	\$157,671
Buildings	\$62,464	\$762,901	\$825,365
Industrial	\$26,000	\$402,601	\$428,601
Utilities	\$27,600	\$636,137	\$663,737
Strategic Technology	\$254,734	\$35,000	\$289,734
Totals	\$394,548	\$2,021,240	\$2,415,788

Table 1. ERTD Energy Program Budget for the Fiscal Year Ending 6/30/01

State Legislature Sets Renewable Energy Goals for Electric Utilities

Hawaii joined a national trend toward “renewable portfolio standards” (RPS) with the passage of Act 272, Relating to Renewable Energy Resources, during 2001.

The law establishes goals for the use of renewable energy resources by Hawaii’s electric utilities. Hawaii is the 12th state to adopt such standards. RPS are generally seen as methods of stimulating local economies and providing local environmental benefits.

Additionally, in Hawaii, increased use of renewable energy can improve our security in the event of disruptions in the international oil market, natural disasters, and other emergencies.

The law set the following goals for utilities’ use of renewable energy:

- 7% by 2003;
- 8% by 2005; and
- 9% by 2010.

The percentages for 2003 and 2005 conform to recommendations

by consultants hired by DBEDT to study the issue. The consultants also recommended a target of 10.5% for 2010. The analysis, published in March 2001, is available on ERTD’s website at <http://www.hawaii.gov/dbedt/ert/rps01/>.

The study analyzed renewable portfolio standards options using a computer-based model to compare the costs of various options to each other and to the utilities’ most recent Integrated Resource Plans, which rely almost exclusively on additional fossil-fueled generation. The report includes an appendix of updated cost and performance estimates for renewable technologies.

The report also concluded that increasing the use of renewable resources would not increase costs to Hawaii’s residents. If oil costs rise or renewables’ costs fall, residents could actually enjoy increased savings.

Although about 7% of Hawaii’s electricity sold to utility customers in 2000 was derived from renewable resources such as wind, solar, geothermal, biomass, municipal waste, and hydroelectricity, closures of sugar mills on Kauai and Maui will likely reduce the renewable energy portion to 6.7% in 2001.

If no additional renewable electricity is available for utility sale through 2010, only 5.8% of electricity in that year will come from renewable sources. However, currently planned renewable projects could bring renewable energy generation to about 8.4% if they are built (see articles on page 12). Also, energy saved by using solar water heaters and heat pumps can also be counted toward the RPS goals. Thus the 9% goal should be achievable.

Code Updated for Increased Efficiency

The City and County of Honolulu now requires R-19 insulation—or equivalent technologies—in all new residences, and in renovations and additions over 100 square feet.

This is the first time such measures are being applied to non-air conditioned homes on Oahu. Efficiency measures for commercial buildings, high-rise apartments and homes with air conditioning have already been incorporated into the Building Codes by Honolulu, Hawaii and Kauai Counties.

Also, Hawaii County’s code already addresses efficiency in air con-

ditioned homes as well as low-rise residential apartments.

Techniques such as combining attic ventilation with a radiant barrier will also meet the new code, and are expected to cool homes by 5 to 8 degrees. The measures’ cost will be quickly offset by eliminating the need for air conditioners and fans.

Updates to the Model Energy Code for commercial buildings were also adopted by the City and County, making 11 improvements recommended by the State “Cooling Climates” task force, such as power limits for exterior lighting.



Honolulu Mayor Harris, surrounded by supporters of the Model Energy Code, added residential efficiency provisions following ERTD recommendations.

September 11 Attacks Spur Responses

The terrorist attacks in New York and Washington, D.C., on September 11, 2001, resulted in immediate examinations of potentially vulnerable facilities, including power plants, in Hawaii and across the nation.

Hawaii's Energy Council, created to respond to energy emergencies resulting from natural disasters and other threats, quickly used its communication network to notify member organizations of State Civil Defense (SCD) advisories.

Conversely, officials at SCD and USDOE were kept abreast of security measures being taken by the local energy industry.

For many years, Hawaii has maintained its energy emergency preparedness program in a high state of readiness. Thus, ERTD and the Energy Council were able to rapidly adapt emergency response plans and protocols to the context of a terrorist threat, and are continuing to support improvements to State and energy industry preparedness and security measures.

For example, working with the Energy Council, SCD and local law enforcement agencies, ERTD has

developed comprehensive Critical Infrastructure Security Guidelines and Employee Security Guidelines, both of which are posted on ERTD's and SCD's web sites. Also, ERTD helped identify the energy facilities most critical to State economic and national security interests, and supported security assessments of these facilities.

ERTD also participated in a "leadership exercise" involving a scenario which simulated a terrorist attack on a critical O'ahu energy facility.

The ultimate goal is the security and protection of essential energy infrastructure facilities that provide electricity and fuel for military installations, the visitor industry, and all commercial and residential sectors.

In addition to the activities of the State Energy Council, Kauai County's Energy Council convened on September 12 to discuss security and contingency measures.

A more routine exercise of the State's energy emergency network occurred from June 4-8, during the annual Makani Pahili hurricane preparedness drills.

Other preparedness work contin-

ued. The first phase of an inventory of emergency generators, expected to be useful if the utility grids are compromised, was completed in February 2001.

The data have been incorporated into an interim application of the Pacific Disaster Center's geographic information system. Global positioning system information is being sought for points included in the survey but lacking that data.

Phase 2 of the inventory commenced on January 15, 2001. To date, over 70 emergency and essential service facilities have been assessed to determine their need for emergency generation.

A third project also was completed in 2001: the acquisition of two new 275-kilowatt diesel generators for Young Brothers, the interisland barge company. The generators will provide power for container refrigeration in an emergency.

These assessments were recommended by the 1996 Hawaii Hazard Mitigation Study, undertaken with support from USDOE after the devastation caused by Hurricane Iniki in 1992.

Awards Honor Efficient Projects

The 2001 Energy Efficiency Awards were announced in September by Hawaiian Electric Company, Inc. (HECO), Maui Electric Company, Ltd. (MECO), and Hawaii Electric Light Company, Inc. (HELCO) during the Pacific Coast Electrical Association conference in Waikoloa.

The three Projects of the Year were:

- ✓ the U.S. Postal Service's Honolulu Plant and Distribution Center, which installed energy efficient air conditioning and lighting, reducing power consumption by 20%;
- ✓ Marco's Southside Grill, a Kihei restaurant which reduced consumption by 15% with an air conditioner which provides hot water in addition to cooling, plus T8 fluorescent lamps with electronic ballasts; and
- ✓ the Hawaii County Building, Fire and Police Stations, whose lighting and cooling initiatives are part of the Rebuild Hawaii program (see page 13).

New Fuels Law Also Encourages Renewables

Act 143, Relating to Energy Content of Fuels, is another legislative measure which will encourage the use of renewable energy.

The law adjusts the State fuel tax to reflect the energy content of alternative fuels, and reduces the fuel tax on alternative fuels for several years.

First “BuiltGreen”™ Home Dedicated

Hawaii’s first “BuiltGreen” energy-efficient home, the result of a broad-based partnership, was dedicated on May 15, 2001 in Waianae Valley.

The home, on Department of Hawaiian Home Lands (DHHL) property, cost less than \$128,000 and incorporates numerous features to reduce electricity consumption and improve occupant comfort. Honsador, a partner in the project, now offers homes built to the same specifications for other customers.

The three features which save the most energy are solar water heating, a radiant barrier in the roof and walls, and natural ventilation.

Also incorporated into the home are a ridge vent, a venting skylight, a white roof and ceiling fans.

None of these are “high-tech” solutions, but in combination they offer



Energy-saving features add to the comfort of this affordable home, which takes advantage of solar energy, natural ventilation, and efficient lighting.

superior savings and improved living conditions.

Open house weekends were conducted in May and attended by over 400 people, many of whom were planning remodeling projects.

Partners for the project included DBEDT; USDOE; DHHL; the Building Industry Association (BIA); Honsador Lumber Corporation; Honolulu Chapter, American Institute of Architects (AIA); and HECO.

Net Metering Law Passed

Hawaii residents can now sell independently-generated renewable electricity to their local utilities at more favorable rates, thanks to a new “net metering” law.

Net metering allows the owners and operators of small, renewable energy facilities to sell surplus electricity to the utilities at the same retail rate they pay to the utilities for purchased electricity. In practice, utilities will provide a credit for electricity sold to the grid. Systems can be residential or commercial.

The net metering law, Act 272, limits individual systems to no more than 10 kilowatts of capacity. It also provides that utilities do not need to accept additional net-metered generators once those on the system reach a total of 0.5% of the utility’s peak electricity demand.

Hawaii is now the 34th state in the U.S.A. to allow net metering.

The State’s first net-metered system is a software company in Kawaihae which now uses photovoltaics to provide about one-third of the 90 kilowatt-hours it requires daily. Since it is a commercial operation, State and federal tax credits combine to cover roughly half the installation cost.

Hawaii Leads Nation in Solar Installations

Hawaii is the national leader in the federal Million Solar Roofs program, which seeks the installation of one million solar water heating or electric systems across the country by 2010.

From the program’s inception in June 1997 through May 2001, over 13,000 systems had been installed

Publications Promote Efficiency

A major report, *Field Guide for Energy Performance, Comfort and Value in Hawaii Homes*, was published in mid-2001. Aimed at architects and building professionals, the book was produced in cooperation with the AIA and distributed during summer workshops.

A consumer brochure focusing on highly-effective efficiency techniques was distributed at numerous events.

in Hawaii—1,800 on federal property—creating roughly 150 jobs.

To date, these solar systems have saved nearly 500 megawatt-hours of electricity and over \$61 million in utility bills. Over the course of 15 years, more than 900,000 barrels of oil will be displaced.

Hawaii Residents, Businesses Benefit from Information Disseminated at Public Events

ERTD and its many partners actively disseminated information relating to resource-efficient construction during 2001. The numerous technology transfer events included:

Home Building and Remodeling Show. Sponsored by BIA, the Show was held from Feb. 1-4. ERTD presented a seminar and set up a booth with new displays. Over 12,000 people attended the event; more than 8,000 publications were distributed by ERTD.

Hawaii Green Buildings Conference. A major event for contractors and others interested in resource- and energy-efficient housing, this conference attracted over 180 people

on May 18. Workshops on topics such as "Greening Your Bottom Line" and "Residential Energy Efficient Building Guidelines" provided technical and practical choices. Sponsors included DBEDT, BIA, HECO, and others.

"Remodel It Right" Seminars. ERTD participated in these periodic seminars, sponsored by BIA. Between 25 and 50 people attended each session.

Fun With The Sun. An informative booth was part of the Bishop Museum's Family Day on May 24.

Parade of Homes. This year, BIA's annual event highlighting new residential design incorporated

"BuiltGreen" criteria. These criteria were developed by consensus among architects, builders, developers and other professionals, including DBEDT.

Residential Energy Efficient Guidelines Workshops. A series of seminars held on Kauai, Maui and Hawaii during August attracted 170 design professionals and homeowners. The workshops explored ways of designing homes for comfort without air conditioning, and other energy efficient strategies.

Pacific Rim Steel Framing Conference. A presentation by ERTD on September 10 introduced 25 attendees to energy-efficiency concepts.

Building Trade Expo. Some 5,000 people attended this conference, sponsored by the American Institute of Architects and the Construction Specifiers Institute. ERTD presented a seminar on the City and County of Honolulu's recent inclusion of 11 new efficiency measures in the Building Code (see page 4). High-performance windows were also discussed.

Leadership in Energy & Environmental Design. A LEED training session was held on May 17, attracting 38 professionals. LEED is a rating system based on a comprehensive, voluntary design and assessment tool. The system helps building industry professionals improve performance and measure sustainability.

An Integrated Approach to Building Commissioning. Part of ASHRAE's training series, this workshop was held June 14-15 and attracted 56 professionals. It explained the benefits of building commissioning and provided detailed specification materials as well as case studies.

Suzuki-Jones Garners Award

Gail Suzuki-Jones, a Materials Exchange Specialist with ERTD, received an Honorable Mention for

the first annual AIA Associate of the Year Award.

According to Rachel Panida, AIA, "Gail's tremendous efforts in the area of Associate Development and Energy and the Environment make her truly deserving of this national recognition."

The award, sponsored by Architectural Record, was presented in May at the AIA's Convention in Denver.

Suzuki-Jones is responsible for programs relating to efficient building construction, materials exchange, reduction of construction and demolition waste, and efficient use of resources.



Gail Suzuki-Jones (right), took ERTD's display of "Green Office" project information to many events for energy professionals and the public.

Efficiency Partnerships Reap Economic and Environmental Benefits

The estimated benefits to Hawaii's economy from ongoing energy efficiency initiatives include:

- ✓ 95.2 gigawatt-hours of energy savings per year;
- ✓ \$12.1 million in annual cost savings;
- ✓ 935 jobs created;
- ✓ \$60 million in direct income to Hawaii's economy; and
- ✓ 90,000 tons of carbon dioxide reduction.

These figures combine the impacts of performance contracts completed under the Rebuild Hawaii program, utility demand-side management efforts, and other State-supported efficiency initiatives.

Rebuild Hawaii is an active network of all levels of government, political and business leaders, industry and nonprofit organizations. The coalitions promoted by Rebuild Hawaii have proven to be extremely effective at advancing energy and resource efficiency statewide.

In 2001, ERTD was awarded two competitive grants totaling \$170,000 by USDOE for Rebuild Hawaii. This brings the total number of successful grants to five since 1997, with awards totaling \$493,000.

During 2001, Rebuild Hawaii partners completed these milestones:

Energy \$mart Schools

HECO is training students to be energy auditors. To date, students at Kalaheo and Waianae High Schools have completed audits of their campuses' energy use, as well as analyses of 20 small businesses in their communities. The results were presented to the 2001 Legislature and the Board of Education.

In a related effort, an audit of the energy consumed by lighting in Maui public schools has been completed by Maui Community College and other cooperators. The college produced a financial analysis and sample documents for implementing efficiency retrofits.

The audit projects a 34% reduction in lighting energy consumption if T12 fluorescent lamps are replaced with more efficient T8 lamps and electronic ballasts. This would save 32 Maui public schools approximately \$369,000 per year.

The Maui schools have been ranked by square footage, energy savings, student body size and other factors to facilitate prioritization.

Public Housing

Twenty-four units at the Maili II Multi-Family Housing development have been constructed to use 42% less energy than the average home on Oahu.

The annual savings are estimated at more than 100,000 kilowatt-hours for this partnership of the Housing and Community Development Corporation of Hawaii, HECO, and the U.S. Department of Housing and Urban Development.

The homes incorporate many energy-saving features, including longer roof overhangs for shading, landscaping, radiant barriers, solar water heating, ridge vents, and compact fluorescent lighting.

Green Offices

The Green Office Project, initiated in 2000 when an exhibit and informational materials were developed, continued as an AIA initiative

during 2001. The Honolulu Chapter, AIA, sponsored additional exhibitions at major conferences and made presentations on the Green Office concept, which includes the use of recycled and locally-available materials as well as energy efficiency.

Low-Cost Solar Heating

A nonprofit organization on the island of Hawaii is spearheading an effort to install 100 low-cost solar water heaters for low-income residents. The first systems were installed in mid-2001.

Other New Projects

To assist Rebuild Hawaii partners increase awareness of their programs, data are being gathered for use in marketing and technology transfer.

An energy audit of the Kauai Lagoons golf course irrigation system is also underway.

The City and County of Honolulu is forming a team to implement energy performance contracting in its facilities.

Maui Community College will study the efficiency of its energy management system, as well as the feasibility of ice storage.

Public awareness activities regarding new gas technologies will be introduced by The Gas Company.

2002 Projects Announced

Three new high schools, one on Hawaii and two on Oahu, will join the Energy \$mart Schools initiative.

Also, the U.H. School of Architecture will develop cooling guidelines for the portable classrooms used at many public schools.

Transportation Initiatives Address Oil Dependence

Hawaii's transportation sector uses almost two-thirds of the oil imported into Hawaii. While aviation fuel alone accounts for 35% (see Fig. 3) and marine fuel 7%, Hawaii's policymakers and businesses can only significantly influence the ground transportation sector, which uses about 19% of Hawaii's oil. Efforts are underway to improve efficiency and to provide non-oil alternatives.

The Honolulu Clean Cities coalition, which includes ERTD, sponsored free workshops for fleet managers and vehicle dealers on the types of alternative fuels and alternatively-fueled vehicles currently available in Hawaii.

There are 80 Clean Cities members nationwide. It is a voluntary public/private partnership aimed at improving air quality, strengthening the local economy, and enhancing public awareness of alternative fuels.

The use of biodiesel, a fuel made from vegetable oils, expanded significantly in 2001. Pacific Biodiesel, a private company manufacturing fuel from waste restaurant oils, constructed a processing plant on Oahu. The output of its first facility, on Maui, is already fully consumed by contracted buyers.

Biodiesel can be used in existing diesel engines with little or no modification. It is the first and only alter-

native fuel to have successfully completed the health effects testing requirements of the Clean Air Act. The study concluded that biodiesel constitutes no health threat and its use results in a 90% reduction in air toxins.

Environmentally sensitive companies such as The Pacific Whale Foundation and Na Pali Eco Adventure Tours use biodiesel, as does the County of Maui.

Hawaii Volcanoes National Park initiated a three-year biodiesel demonstration in 2001, part of a national movement to reduce fossil fuel consumption. Sixteen park vehicles, including pickups, dump trucks and earth moving equipment, are utilizing biodiesel; the only engine modification necessary was the replacement of some hoses.

Electric vehicles received a boost from a Hyundai demonstration which

brought 15 prototype Santa Fe SUVs to Honolulu for a two-year test drive. The vehicles are being used by the City and County, the State, HECO, and Hickam Air Force Base; information from the test will be used for design improvements.

The vehicles run off 27 nickel-metal hydride batteries and have an expected range of 100 miles per charge.

One reason for the selection of Oahu as a test site is the 18 recharging systems being installed by HECO. These rapid-charge stations require only 30 minutes for a full battery recharge.

Additionally, an electric tram was selected for use at the Honolulu International Airport. The zero-emissions vehicle is intended eventually to replace the existing diesel-powered Wikiwiki shuttles. The tram will begin service in 2002.

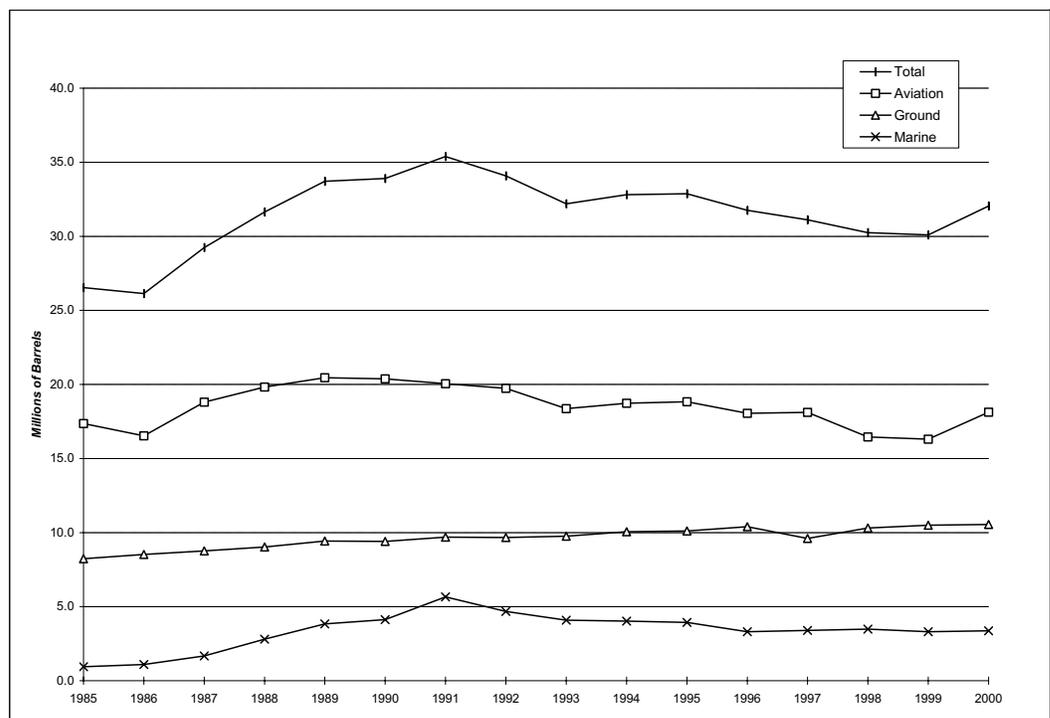


Figure 3. Annual Transportation Fuel Use, All Sectors

Export of Hawaii Expertise is Anticipated by Pacific Rim Study

Asia, with 54% of the world's population, is the fastest growing region in terms of energy consumption, electricity consumption, economic growth, and increased greenhouse gas emissions.

China alone will add more electricity generation than any other nation during the next decade, more than twice the capacity expected to be built in the U.S.

These facts present opportunities for the application of Hawaii companies' expertise and experience in renewable electricity generation, efficient technologies, and energy planning. DBEDT initiatives have explored partnerships in Asia and the Pacific Rim which can improve other nations' energy and resource efficiency while providing business opportunities for Hawaii operations.

Cooperation with the Republic of the Philippines has included studies of biomass cogeneration as well as efficiency programs.

With DBEDT advice, the Philippines established its first-ever model performance contract. ERTD also helped the Philippine government create a national energy management program to better manage energy use and facilitate conservation and improved efficiency. This initiative, modeled after the U.S.'s Federal Energy Management Program, will be officially launched in 2002.

A draft Philippines National Energy Plan for 2002-2011 gives both energy management and efficiency increased prominence.

The Philippines cooperative effort was completed in September.

Outreach to other countries continues under the auspices of the Center for Asia-Pacific Infrastructure Development. A three-day meeting was held in August, allowing local businesses and government agencies to explore the potential for work overseas. Energy efficiency is among the target projects.

Students Motivated by Energy Events

Competitions drew young talent across the state into energy studies.

The annual State Science Bowl, supported by ERTD and USDOE, was held January 20. Top scoring Iolani School represented Hawaii at the national event in Washington, D.C. The second-place Roosevelt High School team toured scientific sites in Hawai'i County.

ERTD staff judged entries in the State Science and Engineering Fair, held in Honolulu during March, and made awards for energy-related junior and senior research projects.

The Electron Marathon, a multifaceted electric vehicle competition which awards engineering accomplishments as well as writing, public speaking and interpersonal skills, was held on March 24 at Ford Island in Pearl Harbor.

Kohala High School won the Marathon, completing 53 laps in one hour, three more than runner-up Seabury Hall.

Helping Businesses Minimize Waste, Save Money

Factsheets detailing case studies of how four Hawai'i businesses minimized waste and promoted jobsite recycling were published in late 2001.

Technical assistance was provided to help the four developers and contractors implement practices outlined in ERTD's previous publication, *A Contractor's Waste Management Guide*. Highlights of the yearlong effort include:

Kaneohe Marine Corps Air Base — A project at the bachelor's enlisted quarters saved nearly \$80,000 in disposal costs and donated 40 tons of furniture (worth \$118,000) to homeless shelters.

Hawaiian Dredging — The Pearl Harbor Fuel Modernization Project saved more than \$31,000 in disposal costs, helped generate revenue of \$2500, and recycled 104 tons of material.

Island Demo — The demolition at Victoria Ward Center diverted 700 tons of debris from landfills; 100 tons were reused and 18 tons were donated.

Gentry Homes — Waste disposal costs for new single family homes were reduced from \$589 to \$280, saving \$64,000 per year.

Further assisting businesses, ERTD's Clean Hawaii Center and

the U.S. Environmental Protection Agency established Aloha Shares in July 2001.

An internet-based materials exchange program, Aloha Shares links businesses owning surplus, usable materials with nonprofits which can utilize them. There is no cost to participate, and businesses making donations can glean tax credits as well as reduced waste disposal costs.

Extending outreach to youth, an activity book—*The Kahuli, the Kolea, the Honu & Kim, an Adventure in Recycling, Reducing and Reusing*—was distributed to elementary schools statewide in the spring.

Photovoltaics Used in Diverse Projects

The world's largest hybrid solar energy project was dedicated in 2001, as was a simple solar parking lot lamp. Both are examples of the expanding role of solar energy in Hawaii's economy (see Fig. 4).

Parker Ranch's hybrid solar/wind power station was dedicated in ceremonies held during March. The 175-kilowatt photovoltaic array is mounted on a tracking system which rotates the panels from east to west to maximize solar exposure. Five wind turbines with a combined capacity of 50 kilowatts supplement the solar power.

The installation, which takes two of the ranch's total of 225,000 acres, provides electricity to booster pumps

needed to deliver water to Parker Ranch's 20,000 cattle. The grid-intertied system is located on the western slopes of Mauna Kea.

In contrast, a low-pressure sodium security light installed at Laupahoehoe High School's parking lot requires only 70 watts of solar electricity, but has a high impact on students' energy awareness. The light is part of the Sun Power for Schools program sponsored by HELCO, and on other islands by HECO and MECO.

Photovoltaics are also proposed for the Mauna Loa Observatory, which performs solar and atmospheric research for the National Oceanic and Atmospheric Adminis-

tration. Funds for a \$50,000 feasibility study and system design were secured via a competitive grant in 2001; the studies are expected to be completed in late 2002.

A pre-screening by the National Renewable Energy Laboratory concluded that the Observatory would be a good site for a 40-kilowatt grid-connected system. HELCO, which will be performing the analysis, is expected to finance the eventual installation.

Solar electricity also powers part of Kauai County's Sensory Control and Data Acquisition (SCADA) system, which monitors and transmits information from critical, remote water storage tank sites.

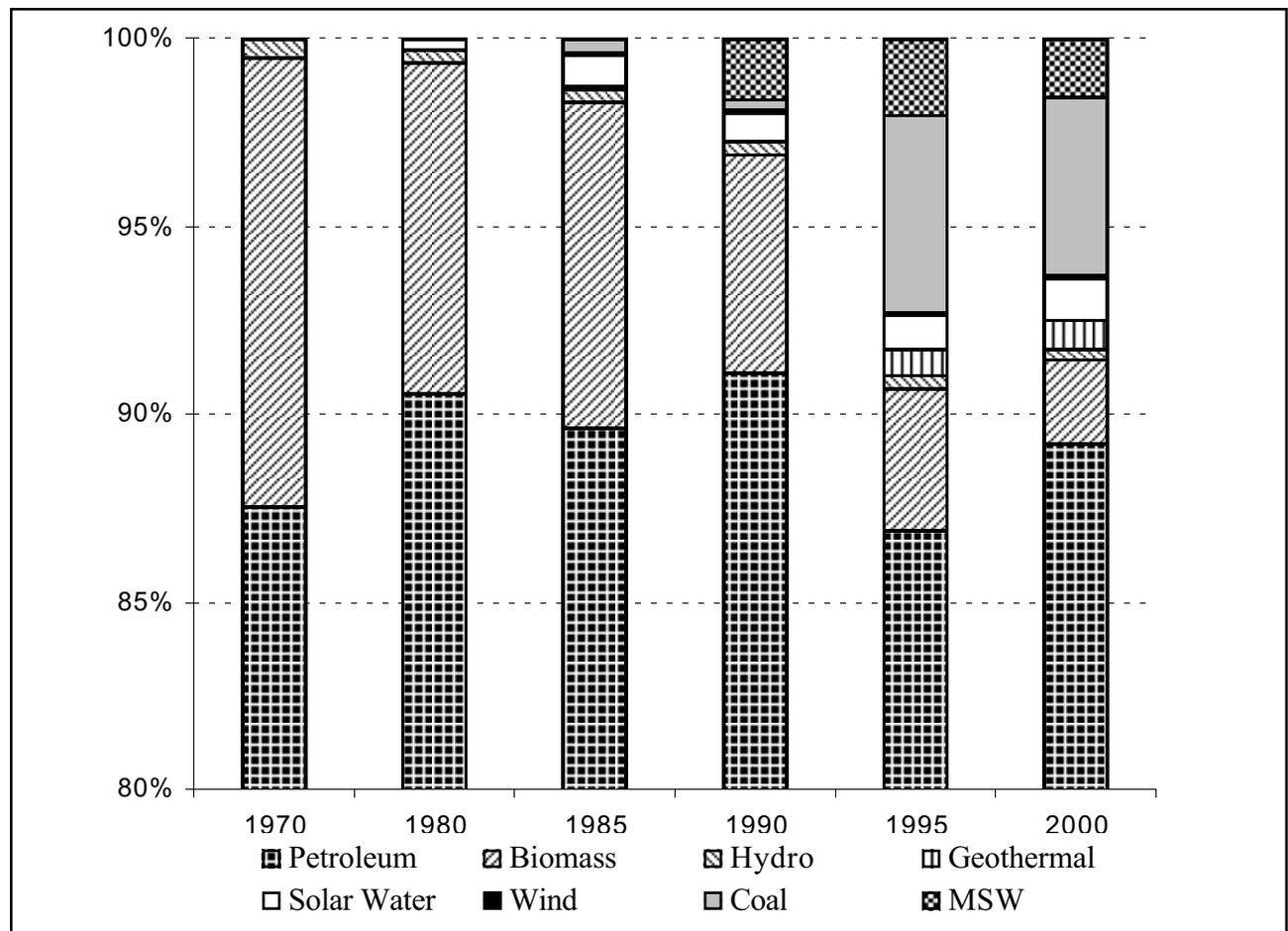


Figure 4. Hawaii's Primary Energy Demand, by Type

Progress for Wind Projects

All approvals are in for the 10 megawatt Kahua Power Partners wind farm at Kahua Ranch, North Kohala. The \$17 million project is affiliated with Zond Pacific. As of December 2001, construction had not yet begun.

Another Zond project, on Maui, has received State land use approval and successfully negotiated a price to sell its electricity to MECO. The power purchase agreement is still being negotiated for the 27-turbine, 20 megawatt project proposed for Kealaloloa Ridge above Maalaea.

Hawi Renewable Energy Development has signed a power purchase agreement with HELCO for its proposed 5.28 megawatt project near Upolu Point. An amendment is pending signature, after which Public Utilities Commission (PUC) ap-

proval will be sought. The \$8 million project might be limited to 3 megawatts of output if the Kahua project is also online.

A third Big Island wind farm, Apollo Energy Corporation at South Point, is working toward an agreement with HELCO to repower its 9.25 megawatt wind farm to 20 megawatts. Pricing and performance standards are among the issues being negotiated.

HELCO itself owns and operates the 2.3 megawatt Lalamilo wind farm near Waimea.

Wind power has also been proposed for Kauai. Kauai Electric Company is discussing a 5.4 megawatt wind farm with Pacific Winds, Inc. No site has been identified, however, and obtaining permits is expected to take at least two years.

Geothermal Power to Expand

In 2001, Puna Geothermal Venture (PGV) received approval from Hawaii County to expand production incrementally to 60 megawatts. Current production, which was limited by the original 1989 permit, is 30 megawatts, making geothermal heat the source of nearly one-fourth of the Big Island's electricity.

In the same permit action, the County confirmed that PGV must continue to pay \$50,000 per year into the County's Geothermal Asset Fund, which currently totals over \$1 million.

More stringent noise regulations were also stipulated, dropping from the 70 decibels allowed by State law to 54 decibels, based on a monthly average, after plant expansion. In addition, neighbors must now be advised 72 hours, rather than 24, in advance of any well venting.

In a separate action, PGV was selected by NELHA to operate the Nohi O Puna geothermal research facility, adjacent to PGV's power generating station. NELHA's action conforms with the recommendations of Senate Concurrent Resolution 19, passed by the 2001 Legislature.

PGV will refurbish and expand the visitor center and will solicit proposals for the development and operation of a geothermal heat source on the property. It is intended that heat will be transferred from PGV property to Nohi O Puna; there are no plans for further drilling at the Nohi O Puna site.

Nohi O Puna is the site of an earlier, State-owned demonstration geothermal power plant and experiments in the direct use of geothermal heat, such as greenhouse heating and food drying.

Cold Ocean Water Supports Business

A new 9,000-foot pipeline, which will bring as much as 28,000 gallons of cold, deep ocean water to the Natural Energy Laboratory of Hawaii Authority (NELHA) facilities at Keahole Point, was deployed in late 2001. A second pipeline will bring in up to 40,000 gpm of warm surface water.

This expansion will encourage additional private ventures to locate at NELHA. Currently, 26 businesses lease space there, employing over 170 people. Nearly all are aquaculture-related enterprises.

The possibility of establishing a second such facility is under study. Kekaha, Port Allen and South Point were ranked highly. Preliminary designs for the Kekaha site were completed by teams of graduate ocean engineering students at U.H.

Cold seawater can also provide air conditioning, as demonstrated by a small system at NELHA. Preliminary feasibility analyses are being completed for at least six locations. Air conditioning consumes 35%-45% of a typical hotel or office building's energy.

Hydrogen Reviewed

Hydrogen fuel is under study at the U.H. Hawai'i Natural Energy Institute (HNEI). This preliminary assessment will produce a case study on the production and storage of hydrogen using fuel cell technology.

A report will be submitted to the 2002 Legislature, and may lead to a commercial hydrogen fuel production demonstration project.

A law supporting a public/private partnership within DBEDT, with assistance from HNEI, to promote hydrogen research and development was passed in 2001.

Efficiency Projects Benefit Counties

Efficiency retrofits of County facilities on Hawaii and Kauai, initiated under the auspices of the Rebuild Hawaii program (see page 8), are providing significant savings to local governments in these times of tight budgets.

On Hawaii, work began on retrofits to the Hilo Public Safety Building and the Kona Police Station. Incorporating new lighting and air conditioning, this \$1.4 million project was funded, like previous retrofits, through a tax-exempt municipal lease.

The contractor guarantees annual energy cost savings of at least \$139,000 for both facilities.

Meanwhile, lighting retrofits to 27 Fire and Police Stations, completed in February, resulted in energy and operational savings of \$57,000. Efficiency measures installed at the Hawaii County Building in Hilo also tallied over \$65,000 in savings during its fourth year of operation.

So far, cumulative savings from these projects has exceeded \$364,000.

These existing projects won top Energy Efficiency Awards from the State's public electric utilities in September (see page 5).

Kauai County is also very active in efficiency retrofits. The new Police/Civil Defense Operating Center, currently under construction, will include an air conditioning heat recovery system, variable volume pumps, occupancy sensors, low-e glazing windows, an energy management system and high-efficiency motors.

Completion is anticipated in the fall of 2002. Of the total cost of \$142,000, rebates from Kauai Electric will cover approximately \$111,000. The average payback for all measures is half a year.

Improvements to lighting at Kauai County's Water Department were completed in August 2001. At a cost of \$6,128, 40% of which was covered by Kauai Electric rebates, 163 fixtures were updated to T8 fluorescent lamps with electronic ballasts.

A difficult retrofit of chandeliers at the historic Kauai County Building was completed in April 2001. A careful selection of lamps which will preserve the appearance of the chandelier while providing equivalent illu-

mination resulted in 52-watt incandescent bulbs being replaced by 7-watt compact fluorescents.

The third year of a performance contract covering lighting retrofits at 29 County buildings ended March 1. Savings were determined to be 98% of the goal, totaling 350,000 kilowatt-hours and \$80,000 in energy and operational costs.

Because the performance contract includes a savings guarantee, the 2% shortfall will be paid by the contractor to the County.

Technology Transfer Events Bring Knowledge to the Public

Workshops on topics ranging from solar financing to facility maintenance were offered throughout the State during 2001, advancing the level of expertise for energy professionals as well as increasing awareness among the general public.

On January 11, a Combined Heat and Power Workshop was held in Honolulu. Fuel cells, distributed generation and microturbines were among the technologies examined.

Federal, State and City facility managers were given the opportunity to update their knowledge of maintenance technologies at an Operations and Maintenance Workshop sponsored in February by the Federal Energy Management Program.

A workshop on financing options for solar thermal and solar electric systems was offered in Honolulu on June 15 as part of the Million Solar Roofs program. Software to help calculate paybacks was distributed.

An inaugural meeting on October 29 of government, industry, university and nonprofit representatives interested in participating in the

USDOE Regional Biomass Energy Program was hosted by ERTD. The group's goal is to increase use of bioenergy and bio-based products in Hawaii.

Two workshops promoting distributed generation were held in Honolulu. In July, Distributed Generation Opportunities for Hawaii and the Other Pacific Islands described how user-owned generation can provide reliable electricity, heating, and cooling, often with increased efficiency and reduced costs.

The follow-up Workshop on Interconnection of Distributed Generation, held in December, provided information on technical and policy aspects of interconnection standards.

Distributed generation technologies are increasingly common as a means of producing electricity on-site. They include small photovoltaic, wind, and hydro systems, as well as fuel cells and microturbines.

A \$100,000 study of distributed generation potential in Hawaii was funded during 2001, and will be completed in late 2002.