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**HAWAI'I AT THE CROSSROADS:  
A LONG-TERM ENERGY STRATEGY**

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a report on the challenges

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and opportunities for Hawaii's

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energy future addressed by

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The Hawaii Energy Policy Forum

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UNIVERSITY OF HAWAII AT MĀNOA

**HAWAII ENERGY POLICY FORUM**

## ■ Strategic Principles

Any energy strategy in Hawai‘i must deal with complex and often conflicting issues. There are no simple solutions, and the only certainty is that many of today’s ideas and solutions will change in the future. In recognition of this fact, we must maintain flexibility and insure that, wherever possible, today’s policies do not pre-empt tomorrow’s opportunities. If we do not consciously make strategic assumptions and decisions about our future, forces from outside Hawai‘i will impose decisions on us. With this perspective in mind, we propose seven guiding principles to achieve our vision of an “...environmentally friendly, renewable, safe, reliable, and affordable energy system.”

1. To implement aggressive energy efficiency and fuel switching programs that reduce our dependence on fossil fuels and defer the need to construct major new central power stations.
2. To revitalize the state regulatory system as a prerequisite for final decisions on new power plant construction.
3. To give preference to the most economic and technically feasible renewable alternatives which meet our vision when new power plants are required. (Our studies suggest that, in the near term these alternatives are wind and urban refuse.)<sup>1</sup>
4. To give preference to distributed power schemes where siting and emission standards can be met.
5. To diversify the sources of imported energy and begin the transition to a long-term hydrogen economy. (This might involve, for example, expanded discussions and analysis of the Ethanol and Liquefied Natural Gas or LNG options.)
6. To restructure the vehicle fleet to improve fuel economy, including feebate cross-subsidies for new car purchases, accelerated scrapping of older, less-efficient vehicles and a tire labeling and inflation awareness campaign.
7. To restructure the current process for siting new energy projects by augmenting opportunities for public consultation and participation. This would include schemes for compensatory development that provide tangible financial or development incentives to communities that host major energy facilities.

<sup>1</sup> *Addressing issues associated with the intermittent nature of wind resources is an important task. We believe this task should be approached in a collaborative manner, including participation by the utility, industry, EPRI, NREL and UH.*

## ■ The Hawaii Energy Policy Forum

In May 2002, the University of Hawai'i gathered major energy stakeholders in the State to convene as the Energy Policy Forum. The purpose of the Forum was to develop an energy vision for Hawai'i through the year 2030 and to formulate a strategy consistent with its implementation. The Energy Strategy contained in this report is the result of this series of deliberations by the Forum on the energy future of Hawai'i. It is intended for use in achieving the vision that the Forum agreed upon between June and August of 2002.

The Forum itself is a unique experiment in collaborative energy policy making. It includes representatives of the electric utilities; oil and natural gas suppliers; environmental groups; the renewable energy industry; the state legislature; federal, state and county agencies; the general business community; and major energy consumers.

The Forum facilitated discussion of a preferred energy future for Hawai'i and explored the relevant issues and constraints faced in achieving this preferred future. In addition to questions about energy supply/demand and technology, the Forum considered the roles of energy planning agencies, the Public Utilities Commission, and the Legislature in energy decision-making. It also recognized social and cultural issues that have been ignored by most energy planning efforts in the past. The intent was to incorporate as many different perspectives and the broadest possible experience into the design of a flexible, forward-looking energy strategy that provides environmentally friendly, renewable, safe, reliable, and affordable energy for the State.

The University received an initial grant from Hawaiian Electric Company to convene the Forum. This was supplemented by grants from the Hawai'i Community Foundation and the Department of Business Economic Development and Tourism, as well as administrative and fiscal support donated by the University of Hawai'i. The Rocky Mountain Institute also made a major contribution by conducting one of the studies commissioned on behalf of the Forum. In addition, members of the Energy Policy Forum, the UH Directors of the Hawai'i Natural Energy Institute, the Environmental Center, the Social Science Research Institute, and the Deputy Director of College of Social Sciences Public Policy Center have donated their expertise and time to this project. The Social Science Research Institute served as the secretariat to the Forum; Ms. Regina Gregory and Ms. Irene Takata as Forum staff; and Mr. Sam Pintz as the primary policy consultant to the Forum.

The Energy Policy Forum had three initial meetings to formulate a vision for Hawaii's energy future and to identify impediments to achieving that vision. The Forum also identified six critical studies to support development of the energy strategy:

- Environmental requirements of energy producers
- Hydrocarbons outlook
- Regulation, taxation and incentives
- Renewable and unconventional energy
- Reduction of Hawaii's energy demand through increased efficiency
- Social, economic and cultural issues

Forum members developed terms of reference for the first five studies and formed sub-committees to address social, economic, and cultural issues critical to energy policy and planning in Hawai'i. Consultants contracted by the Research Corporation of the University of Hawai'i completed the first four studies and presented the results to Forum members for discussion over the course of seven meetings. The Rocky Mountain Institute joined the University as a partner in the strategy development process and conducted the energy efficiency study, which was also presented to the Forum and discussed.

The commissioned studies were undertaken by distinguished energy analysts. These individuals not only have broad national and international experience, but also possess intimate knowledge of the unique problems of Hawai'i. Dr. Charles Feinstein of the World Bank conducted the study of environmental requirements of energy power producers in the future, as a response to global climate change and international efforts to curb greenhouse gas emissions. A team from FACTS Inc., a world-renowned oil and natural gas consulting firm based in Honolulu and lead by Dr. Fereidun Feshakeri, conducted the hydrocarbons outlook study. This study evaluated energy options for Hawai'i in the face of changing oil and gas supply patterns. Mr. Carl Freedman of

Haiku Design and Analysis in Maui and Mr. Jim Lazar of Micordesign Northwest, both well recognized nationally with local experience, conducted the regulation, taxation, and incentives study that focused heavily on the organization and function of the Public Utilities Commission and the Division of Consumer Advocacy. Mr. Warren Bollmeier and Dr. Tom Loudat conducted the renewable energy study, building on their previous work and on an energy resource assessment recently released by the Hawai'i Natural Energy Institute at the University of Hawai'i.

Sub-committees on energy efficiency and on Hawaiian cultural issues held several meetings and made reports to the Forum. Consultants and suppliers of Liquefied Natural Gas (LNG), who were invited to Hawai'i on behalf of the Forum, also gave a series of presentations.

In December 2003, an Energy Policy Summit was convened to review the results of the Forum's deliberations and of the studies and sub-committee work which were presented in plenary. Senator Daniel Akaka gave the keynote address to 150 energy stakeholders who participated in the one and a half day Summit. Breakout groups on social and cultural issues, regulatory reform, energy conservation and efficiency, renewable energy, and hydrocarbon alternatives as a bridge to the future discussed policy options being considered by the Forum. Two Forum meetings were held following the Summit to formulate the energy strategy that is contained in this document. Following the Summit, sub-committees on siting issues, social justice and on Hawaiian cultural issues met. They will provide the Forum with additional input.

Implementation of elements of the strategy summarized in this document are already being discussed by the Legislature, the Public Utilities Commission, the Department of Business Economic Development and Tourism, the Department of Commerce and Consumer Affairs, county governments, and private sector energy companies in Hawai'i. Reflecting these gratifying developments, members have agreed that the Energy Policy Forum should continue work toward implementation of this strategy.

The Energy Policy Forum would like to thank those organizations and agencies that supported our efforts, and we hope that this strategy will help move us closer to our vision of Hawaii's energy future.

## ■ Executive Summary

Over the past two and a half years members of the Energy Policy Forum have attempted to understand the complex nature of Hawaii's energy sector and to develop a long-term strategy for the State. The document that follows is the distillation of this search. It is neither a revolutionary nor a status quo document. It reaffirms several basic notions that underlie conventional energy policy in Hawai'i, but it departs from several politically correct ideas, which have been embraced, but not always critically examined.

Central to the Forum strategy are its long term *vision* and *goal*. The Forum's vision is similar to statements that have been the cornerstone of state energy policy for the past ten years. The vision stresses the need for policies that provide, "...environmentally friendly, renewable, safe, reliable, and affordable energy resources." To pursue this vision the Forum felt that it was necessary to define a specific long-term goal against which interim and transitional policies could be judged. This goal is the encouragement of measures that facilitate achieving a hydrogen-powered fuel cell-based energy sector.

There are several factors that distinguish the Forum's policy strategy from previous energy sector initiatives. First, the pattern of oil supplies to Hawai'i is rapidly changing from declining sources in Alaska and Australia to an increasing dependence on less politically secure sources in Asia. As a result, our oil supplies are potentially becoming more vulnerable. Second, the Forum was able to commission a number of simultaneous studies across a wide array of energy issues. These studies included assessments of:

hydrocarbon supply-demand; environmental issues; energy regulation, taxation and incentives; renewable energy options; energy efficiency; and natural gas imports. This crosscutting analysis provided the Forum with a comprehensive view of strategic policy issues at-a-single-point-in-time. Third, the Forum was constituted as an informal collaborative group of stakeholders. This made it possible to exchange ideas and discuss viewpoints outside adversarial legal and regulatory frameworks.

## **The Short Term**

In the short term, the Strategy focuses on three important issues: revitalization of Hawaii's regulatory system, a comprehensive energy efficiency/conservation program, and development of procedures to address cultural issues and achieve social equity and justice. All three of these issues should be accorded the highest priority because they represent keys to a range of future options.

### *Regulatory Reform*

Over the past several years the Public Utility Commission's (PUC) analytical and regulatory capacity has been eroded by a lack of resources, staff, and focus. As a result, important policy issues about renewable energy, utility competition, and financial incentives have gone unresolved. Moreover, some agencies which support the PUC in its deliberations (like the Division of Consumer Advocacy) are in a potential conflict-of-interest situation where they are expected to both advocate a particular point of view and to provide an objective analysis to the PUC. We propose a number of measures to guide a revitalization effort.

### *Energy Efficiency*

A comprehensive energy efficiency program is important for two fundamental reasons. First, it represents an opportunity for tangible savings to energy consumers. Second, it can help defer the construction of new fossil-fueled central power plants. If built, these central stations will commit the state to increased dependence on imported oil or coal for the next thirty years or more. By deferring the construction of large central station plants and by pursuing a strategy of adding smaller plants distributed throughout the power network, we can buy time for several promising renewable energy technologies to mature and become economically competitive. Cost effective energy efficiency programs range from solar water heating to expanded use of more efficient light bulbs and basic architectural design choices. Through improvement in the efficient use of electricity, we can both enjoy immediate benefits (through reduced electricity bills) and increase the likelihood that our children will have access to affordable, abundant and renewable energy supplies.

While our vehicle fleet is already among the most efficient in the country, a great deal more can be done to increase energy efficiency. New hybrid vehicles that have recent-

ly entered the market promise high levels of fuel economy with little or no sacrifice in performance or safety. Hybrids and other fuel-efficient vehicles can reshape our vehicle fleet. To encourage the purchase of hybrid vehicles, *feebate* cross-subsidy programs can reduce purchase costs to buyers until such time as the technology is firmly established. Financial incentive programs could encourage owners of older, less efficient cars to voluntarily scrap their vehicles. Our consultants estimate that through these electricity and transportation efficiency programs, Hawaii's energy consumers could achieve three billion dollars (\$3,000,000,000) in direct savings.

### *Hawaiian Cultural Values and Social Justice*

The Forum recognizes that a major impediment to achieving its long-term vision is conflict over social and cultural issues. These issues are often reflected in opposition to the siting of energy facilities. In the future, the siting of new power plants and transmission lines will result in intense struggles between host communities, environmental groups, government agencies, and public utilities. Although not restricted to Hawaiians, many of these struggles will be over violations of basic Hawaiian values and traditions. In particular, the Forum's strategic vision is intended to be consistent with Hawaiian values of *konohiki* (stewardship), *malama* (caring for), and *kuleana* (responsibility).

In addition to cultural values, the Forum is concerned about fundamental issues of social justice. These issues involve both the imposition of negative environmental impacts on poorer communities and burdens placed on one community rather than others. The Forum takes the view that the current system of public consultation favors richer communities at the expense of poorer ones. We believe that there should be some form of *compensatory development* associated with hosting energy facilities. Moreover, early and on-going consultation with communities potentially affected by energy infrastructure development is imperative. Unless cultural and social justice issues are addressed, the siting of new energy facilities will severely impede the implementation of any future energy strategy.

## **The Medium Term**

### *Renewable Energy*

In the medium term, there is considerable potential for development of renewable energy resources. Our analysis suggests that of the available renewable options, wind and electrical generation from the disposal of urban refuse (e.g. H-Power project on O'ahu) are economic possibilities. Although there are significant technical and investment problems to be overcome, we have identified potentially viable renewable energy projects in each county. These projects could become operational over the next decade. Beyond wind and urban refuse, the picture is less clear and depends in large measure on the interaction of three factors:

- The willingness of consumers to subsidize renewable energy development
- The cost of imported hydrocarbon fuels and
- The continued development of renewable energy technology

We are confident that significant changes in these factors will take place over the coming decade and that a broader array of renewable technologies will become economically competitive.

A major renewable energy resource that might affect our transportation fuel requirement is the production of ethanol on the neighbor islands. While pure ethanol vehicles are unlikely to ever be economic in Hawai'i, gasoline-ethanol blends could reduce our gasoline requirements by 6-7%. Ethanol programs would create new agricultural industries and rural employment in the state.

### *Natural Gas*

The other medium term energy source that we have investigated is natural gas. Recent discussions with liquefied natural gas (LNG) suppliers have suggested several advantages of introducing this fuel. Gas would initially replace fuel oil in electric generation plants on O'ahu. In time, it might be distributed to residential consumers and expand its commercial use. The chief advantages of substituting natural gas for fuel oil are that 1) it is environmentally much cleaner burning and 2) world prices have historically been less volatile than oil prices. In addition, potential suppliers suggest that natural gas for Hawai'i could come from politically stable overseas sources like Australia. Finally, many analysts believe that natural gas will serve as an interim hydrogen source to the fuel cell technology of the future. Substituting natural gas for residual oil may have a significant negative impact on Hawaii's oil refineries and would require the development of new port infrastructure. We believe that on balance, the advantages of natural gas imports should be investigated further.

## **The Long Term**

In the long term, a number of changes will be necessary in the energy sector. New infrastructure and organizational structures will be necessary to accommodate the transition to the hydrogen powered fuel cell economy. New renewable energy technologies will emerge and necessitate new investment programs. Of equal importance will be the need to develop systems to integrate these renewable technologies with existing facilities.

Hawaii's isolation presents special problems that will need to be addressed. The physical isolation from the U.S. Mainland and between our main islands means that we lack the ability to easily import or export electrical energy to match changes in supply and

demand. Over time, this isolation will constrain our ability to take advantage of our renewable resources. In addition, many elements in our physical infrastructure will need to be rethought and redesigned with greater energy efficiency in mind. To meet the challenges of the future it will become necessary to rethink our urban planning, redesign our energy distribution systems, and reevaluate the historic relationships between our energy institutions. All this will take visionary political leadership and a commitment to overcome the inertia of public opinion and the pressure of economic interest groups.

## **I. Revisiting State Energy Objectives**

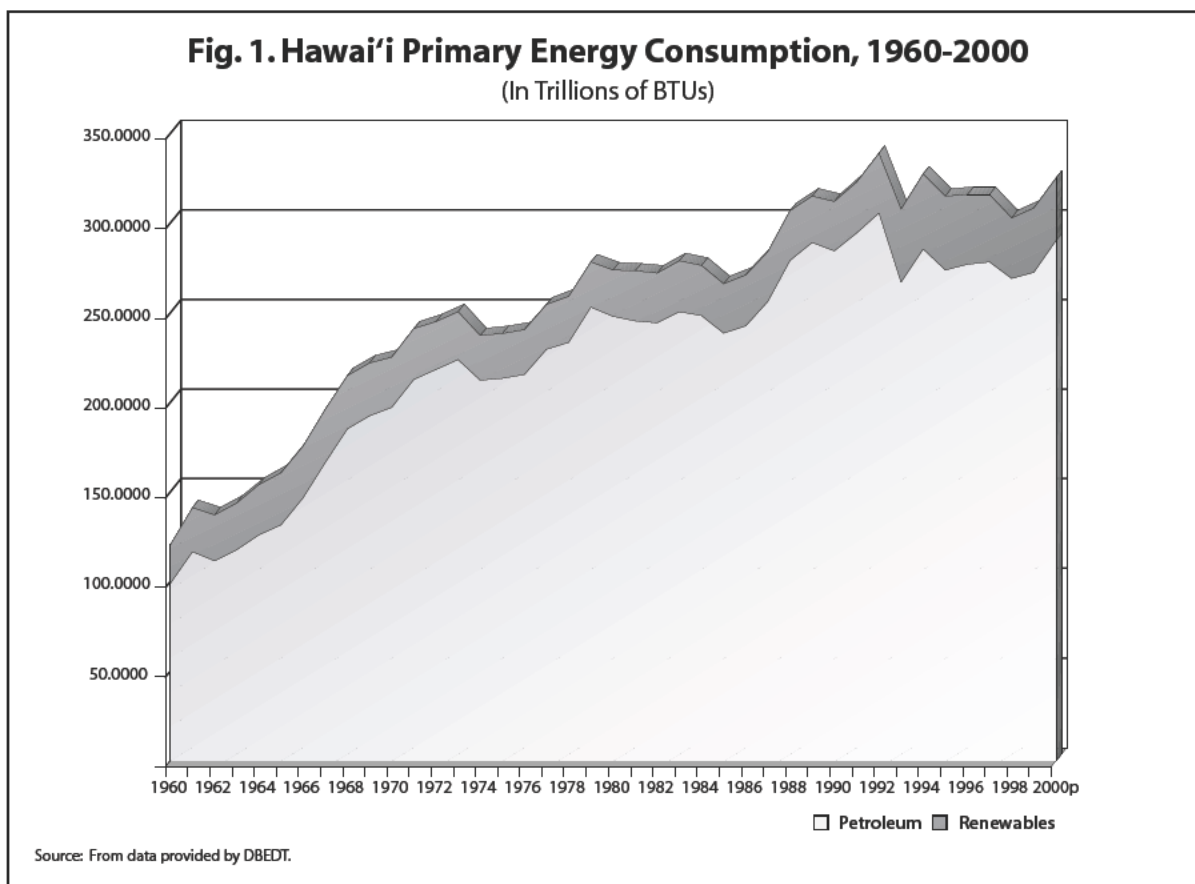
### **Perspective**

Over the past three decades Hawaii's energy strategy has focused on increasing self-sufficiency by encouraging development of renewable energy sources. We agree and endorse this strategic objective. However, as energy consumption has increased, the proportion of energy being provided by renewable sources has not kept pace. This is largely due to the decline in sugar production and the resultant sugar waste (bagasse), which is used to produce electricity, and to the lack of renewable energy development. While the percentage of our energy from renewable sources is declining, the sources of our fossil fuel supplies are also changing. Traditionally we have received about half of our imports from Alaska, Indonesia and Australia, but Alaskan and Australian sources are rapidly declining. Replacement sources are being increasingly committed to supply high demand growth in countries like China and are generally from politically less secure countries. As a result, Hawaii's energy vulnerability will increase as our supply sources change. Even without a direct supply disruption, oil prices are likely to remain volatile, and the possibility of a supply crisis cannot be discounted. As the recent California power emergency suggested, poorly structured policy mandates can easily create an energy crisis, leaving massive financial losses and business upheavals in its wake.

The reasons for our failure to achieve our stated energy goals are many and complex. Many factors are not entirely, or even partially, under the control of the local government. While changing economics of global industries like sugar and oil are beyond Hawaii's control, there are things that government can and should do immediately. In

the medium and long term, the State needs to implement energy policy measures that contribute to the achievement of explicit goals. Further, the constraints and consequences at different steps toward achievement of the goals must be recognized. Finally, we feel that any energy policy must focus primarily on those steps that Hawaii's stakeholders can, in fact, implement and influence. It is not enough to simply wave the green flag of renewable energy and hope for a golden tomorrow. We must begin to realistically plan for the future today, or there may be some unpleasant surprises just around the corner.

In this report we will attempt to identify the goal, milestones, technologies and constraints that Hawai'i needs to address over the next three decades to achieve the energy vision articulated by the Energy Policy Forum. While our strategic road map is painted with a broad brush, we believe that it is sufficiently detailed to identify specific immediate actions that can and should be taken by the major energy stakeholders in the state, with appropriate support by all stakeholders. However, we recognize that to be truly useful, a strategy must be dynamic and acknowledge the enormous uncertainties that cloud our future. To address these uncertainties, we suggest a basic, underlying principle: In considering important energy decisions it is prudent to, wherever possible, avoid choices that preempt future options.



## **II. Framework**

### **Imperatives That Need To Be Addressed**

Most public opinion polls suggest that energy is not a high priority in the minds of Hawaii's residents. With the exception of occasional public debates over the price of gasoline and electricity or the siting of energy infrastructure, important energy issues are largely invisible to the general public. Hawaii's energy policy is a complex and sophisticated arena with far-reaching consequences where there are few simple or straightforward answers. We believe there are several factual imperatives in Hawaii's energy sector that deserve both immediate and long-term attention. These imperatives include:

- The continued growth in energy demand in the power sector will lead to large investments in new power plants. Depending on the technology and service life, these new investments could foreclose future options for reducing our energy dependence on imported fossil fuel from politically unstable areas.
- Hawaii's development of renewable energy resources lags behind the growth in energy demand.
- Crude oil for Hawaii's refineries in the future will come increasingly from politically less secure sources and price spikes will become increasingly more frequent.
- Hawai'i has the highest energy prices in the United States; and prices are unlikely to come down.
- Hawaii's regulatory system is not functioning as effectively as it could be and needs revitalization and reform.

- Global warming will probably result in new emission controls on both power producers and vehicles thereby increasing the cost of energy in Hawai‘i. These additional costs will be substantially greater if the State reacts rather than anticipates new federal environmental requirements.
- There are mounting pressures to increase the quality and reliability of electricity service because of advances in electronic technology. Failure to meet these requirements will make Hawai‘i unattractive to development and growth of companies that utilize electronic technology.

These are real problems that need to be addressed without delay. While there are no silver bullet solutions, we believe that through systematic strategic planning and commitment, substantial progress can be made to meet these challenges.

## **Energy Security and Vulnerability**

Energy security and the vulnerability of imported energy fuel supplies to disruption are the primary reasons for increasing energy self-sufficiency in the State.<sup>2</sup> Given that the State imports 95% of its energy fuel supplies, there is little doubt that Hawai‘i is vulnerable to external supply disruption. There are competitive local energy resources, like solar water heating and wind farms. However, many of the other local import substitutes (in the form of indigenous renewable resources) are currently more expensive than oil and coal and/or they are constrained by the limits of island geography. In practice, these factors have often translated into a direct conflict between the lowest-energy-cost-to-consumers and reduced energy vulnerability.

Supply security can certainly be purchased for a price. However, there is no clear consensus that consumers and political leaders are willing to pay that price and renewable energy resources may not provide the kind of base-load electric power security that is required. One of Hawaii’s most abundant renewable energy resources, wind, does not produce ‘firm’ power because wind speeds are so variable. Geo-thermal has also not proven as reliable an energy source on the Big Island as originally expected. Therefore, given Hawaii’s limited renewable energy options, it may be necessary to consider how energy security can be enhanced by the diversification of conventional fuel imports and points of origin. We need to maintain an open mind toward interim solutions for increasing our energy security.

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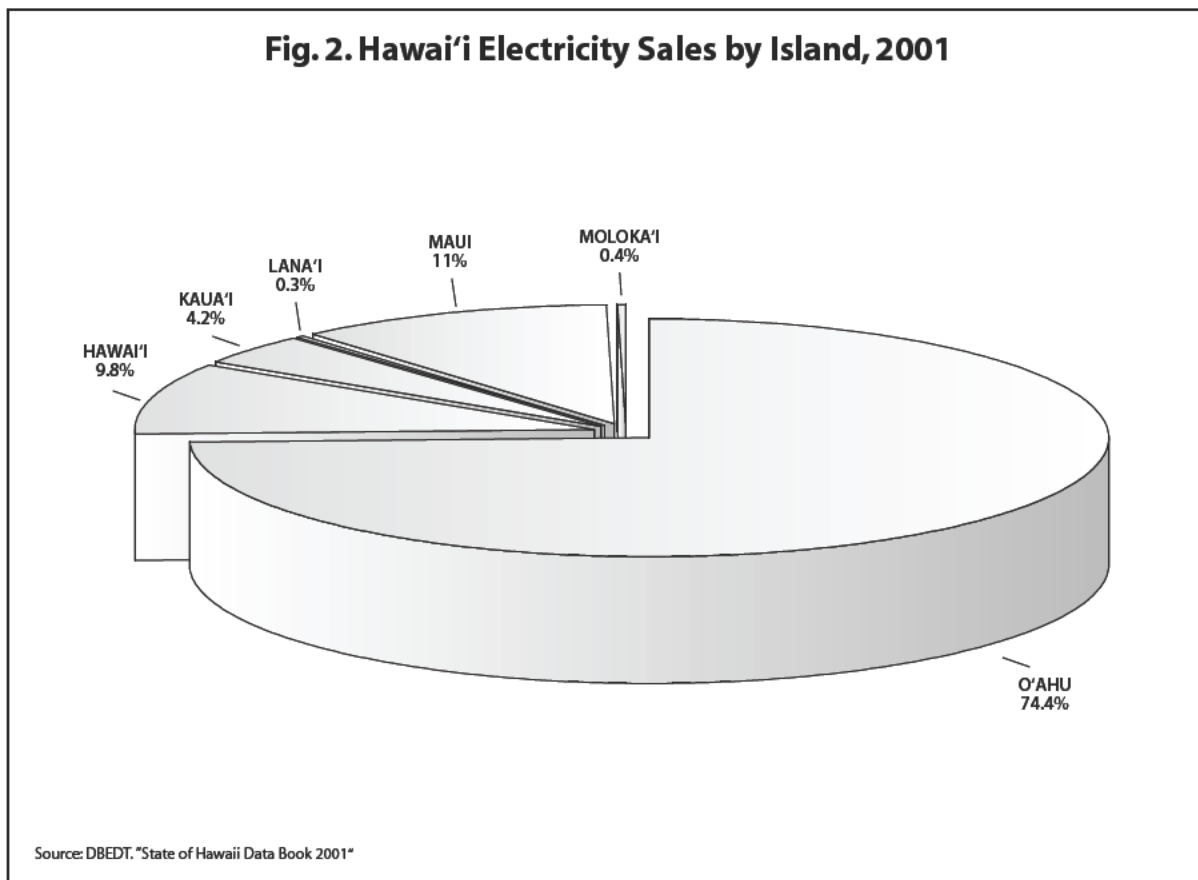
2 *Other important reasons for developing indigenous energy sources are increases in local employment, economic activity and taxes in the State.*

## Resource Distribution Versus Energy Demand Distribution

Hawai'i is not a single unified energy market. Therefore, we believe that it is a mistake to adopt a *one-size-fits-all* energy strategy when population, land, resources, and transportation and energy demands are vastly different for each of the main Hawaiian Islands. At a minimum, there are two Hawaiis...one being O'ahu and the other encompassing the neighbor islands. Until such time as cost-effective and technology-efficient interisland energy transfer mechanisms (e.g., transmission lines, liquid fuels, etc.) become apparent, we feel that energy policy needs to accept that what may be an appropriate near-term strategy on the neighbor islands may be inappropriate for O'ahu, and vice versa. Having said this, there clearly are policy areas, such as institutional development, regulatory revitalization and energy efficiency, where general statewide policies make sense.

## Energy and State Economic Development

Energy permeates every aspect of Hawaii's economy. Virtually everyone who lives in Hawai'i knows that the state has some of the highest gasoline prices and utility rates in the nation. However, the fact that Hawaii's energy sector is a major source of state revenue and provides 5-7% of total state tax revenue is less well recognized. Moreover, when taken as a whole, the energy sector is a significant employer. As we move for-



ward, we need to understand that *good* energy policy measures, such as aggressive energy efficiency programs and improved regulatory capacity, may impact tax revenues and employment in the energy sector.<sup>3</sup>

In general, state policy toward new energy development has been highly concessionary, although often ineffective at encouraging actual investment. The difficulty in attracting new energy investors is partly a reflection of inherent difficulties in overcoming the disadvantages of our small, isolated energy markets with limited growth potential, and Hawaii's poor reputation as a place for doing business. There is clear evidence that the incentives and disincentives offered by government need to be rethought into a more coherent policy.

In contrast to its supportive attitude toward new energy investments, state and county governments seem to see energy supplies and suppliers as cash cows with energy taxes in the State being among the nation's highest. To compound the problem, relatively little energy tax revenue has historically found its way back to the energy sector, much less being used to invest in energy efficiency and renewable projects.

One of the mantras of public policy in the State is that energy prices are high due to a lack of competition among suppliers. This often leads to calls for direct government intervention or new regulation. Such calls are in contrast to the fact that successive administrations and legislatures have consistently under-funded regulatory agencies and the development of analytical capacity in executive departments to implement the State's energy policy.

## **Environmental Stewardship**

The environmental impact of energy projects does not receive particular attention or policy consideration in Hawai'i. Environmental questions are handled under the common legal framework used for all activities in the state. Regrettably, this common framework is largely reactive and is often initiated only after important development decisions and planning commitments have been made. Moreover, this framework is largely a function of federal environmental standards over which the State has little control.

We believe that federal environmental policy for the energy sector will inevitably change to reflect international concerns over global warming resulting from greenhouse gas (GHG) emissions. While Hawai'i contributes about 0.07% to U.S. emis-

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<sup>3</sup> *The relationship between energy efficiency and employment/tax revenues in Hawai'i is unclear. For example, recent studies suggest that solar water heating tax credits may increase tax receipts and employment.*

sions, GHG reduction requirements are likely to be applied throughout the country. These requirements will further aggravate local energy prices. Also, as an island state, Hawai'i has much to lose from global warming.

We also believe new regulatory approaches linked to carbon releases will accompany these changes in regulatory and emission standards. Carbon-linked regulation will open new compliance options such as carbon trading and carbon taxes. Much of the information needed to implement these policies is already available from previous studies, and we feel that the State should adopt a proactive view toward new fossil fuel and renewable energy projects. Failure to anticipate changes in national and international environmental regulatory systems will impose significant costs on Hawaii's energy consumers that could have been mitigated.

### **Hawaiian Values and Social Justice**

Little direct attention has been given to the role that the values and traditions of the host culture plays in energy decision-making and energy policy in Hawai'i. The whole issue of environmental stewardship is clearly linked to *konohiki* (stewardship), *malama* (care for), and *kuleana* (responsibility). These values are at the heart of our concern for our environmental future and energy strategy for Hawai'i. Clearly, the environmental, aesthetic, and social impacts of energy infrastructure have fallen on some communities in Hawai'i more than others. In many cases, these communities have been less financially and/or legally equipped to fight regulatory battles against the siting of landfills, waste water treatment facilities, power plants or transmission lines in their back yard. Decisions about energy policy and the siting of energy infrastructure need to address both the role of Hawaiian values and traditions and the issue of social justice.

### **Public Involvement and Participation**

Hawai'i has an elaborate array of planning and permitting processes at both the state and county levels. Numerous permits and 5-10 years are required to bring a new conventional energy project on-line in the state.<sup>4</sup> One of the primary objectives of the permitting process is to provide affected stakeholders with an opportunity to voice their opposition or support for proposed options or projects. This is a laudable objective that should be jealously protected. However, the current system is not equitable for all stakeholders. It works best for stakeholder groups that are well informed and have the resources to organize and follow through the entire process. Obviously projects that face little or no public opposition are more likely to proceed. This is regardless of

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<sup>4</sup> Interestingly, the number of required permits for windfarms is substantially less.

whether the lack of opposition is due to the merits of the project or because there is no organized group present. Areas like Ewa, where such groups did not exist in the past, can find themselves shouldering a disproportionate share of industrial, waste management, and energy projects. This is a clear, but seldom acknowledged, consequence of our current public participation system.

To supplement the existing public consultation process, we believe that it would be useful to consider a scheme for *compensatory development*. Under such a scheme communities or regions, which are significantly impacted by energy projects, would receive direct financial assistance, rebates or credits on those services. Such schemes are used extensively in other parts of the world to win public support for energy projects. Even when compensatory development is being contemplated, early consultation with communities on the scope and impact of development is essential.

### **III. Strategic Elements**

#### **The Vision**

Early in the Energy Forum’s deliberations, members were asked to develop a long-term energy vision. The vision that emerged is not fundamentally different from the visions that have been advanced as cornerstones of state energy thinking for over thirty years. In fact, most elements of the vision have already been codified in state law. This Forum’s vision can be summed up as follows:

“Hawai‘i will have environmentally friendly, renewable, safe, reliable, and affordable energy resources. Our energy technology and systems will be efficient, with the best available emission controls; decentralized; meet consumers’ needs; and maximize the use of Hawaii’s energy assets. Hawai‘i will encourage investment in energy system development and continually assess energy development options based on a full accounting of costs and benefits.”

While most of the elements in our vision are self-evident, the *reliability* objective deserves special comment. Achieving a *reliable* energy system involves a host of interdependent options and encompasses an entire network of decisions by energy stakeholders. Each link in this network implies assumptions about the adequacy of prior links. For example, it is not enough to have adequate electrical generating capacity if the primary fuel supply is vulnerable. Nor is it enough to have assured fuel supplies and planning for new generating capacity if no new sites for electrical generators are available. On an entirely different path, it seems to us somewhat curious to promote

high tech development for the state without simultaneously being able to insure power quality and a reliable energy supply. Inevitably, the energy network is only as strong as its weakest link. In Hawai'i, the weakest links over the past decade have been an ineffective regulatory system and public resistance to the siting of new energy infrastructure. It seems to us that with skill, patience, sensitivity, and a long-term strategic vision, these problems can be addressed with innovative Hawai'i-specific policy making. But addressing these issues must go substantially beyond the status quo.

## **A Strategic Planning Goal to Meet Our Vision**

What became apparent over the two years of Forum meetings and from the commissioned studies were the difficulties in translating the vision into a working strategic action plan. It also became clear that a unifying long-term energy goal was needed, reflecting the State's unique resources, geography and economy as well as external developments in environment, technology and sources of primary energy. One outgrowth of setting a strategic goal is to provide a perspective and point of view on an otherwise overwhelming list of energy options in both the transportation and power sectors. In short, a strategic goal provides a measure for evaluating alternatives.

The consensus that emerged was that Hawaii's long-term goal should be to enable the State to move into the era of hydrogen powered fuel cell technology as rapidly and economically as possible. Many policy analysts now agree that hydrogen powered fuel cells will become the backbone of energy supply by the middle of the twenty-first century.

In his 2003 State of the Union Address, President Bush announced that the federal government would invest over \$1.7 billion in hydrogen and fuel cell research over the next five years. When combined with private sector expenditures and the programs of foreign governments, over \$5 billion will be spent in the immediate future to move toward a hydrogen future. Over the long-term, financial commitments for hydrogen and fuel cell development and its adoption may easily approach the recently announced costs of establishing a manned base on the moon. The payoff from this hydrogen transition is expected to be a fundamental restructuring of how electricity and transportation needs are met in a decentralized and environmentally friendly way. Although the implications of a future hydrogen economy have been under study by the U.S. government for some time, there has been only limited consideration of how near- and medium-term planning decisions might affect the long-term attainment of this goal.

While we believe that hydrogen may be our most promising long-term option, we would caution that achievement of a practical and economic hydrogen economy faces formidable technical challenges and is still well into the future. Since we cannot cate-

gorically assume that hydrogen powered fuel cells will ever become economically feasible, we believe that our best near-term course of action is to insure that whatever preparatory steps we take in this direction are fully justified and defensible on conventional economic and policy criteria. In short, while we might keep our eyes on the (hydrogen) horizon, we need to keep our feet firmly on the ground.

The hydrogen fuel cell goal is itself a moving target. While the ultimate dream is to produce hydrogen fuel from renewable energy sources, analysts seriously doubt that this goal can be achieved in the near future. More likely, an interim stage will be required where hydrogen technology is developed in parallel with efficiency advances in fossil fueled and renewable energy. During this transitional period, it may be necessary to extract hydrogen from fossil fuels.

### **Strategic Planning Must Be Timely and Sequential**

While it is impossible to predict the future, there are several identifiable strategic elements that enjoy a broad stakeholder consensus and should seriously be considered as part of any energy strategy. These strategic elements can be grouped within near- (1-3 years), medium- (3-15 years) and long-term (15-30 year) timeframes. In general, these time frames reflect a changing strategic emphasis, with near-term elements focusing on institutional and regulatory reform; medium-term elements dealing with project development choices; and long-term issues addressing technological transitions. In considering these elements, two things should be kept in mind. First, the elements become less clear as we move further into the future. Second, many of the elements are dependent on successful achievement of earlier elements. For example, to make optimal new project development choices, we need regulatory and institutional reform, continuity and commitment, and a strong, independent analytical capacity in state regulatory and planning divisions.

### **A Strategic Collaborative Process**

Before presenting our strategy for achieving the State's long-term goal, we would make one further point. It is important that any energy strategy be a partnership between the public and private sectors and between energy producers and consumers. Hawai'i is a collection of small energy markets, and mistakes can prove costly both in terms of inappropriate mandates and/or choices and missed opportunities. While adversarial relationships and conflicting stakeholder interests will certainly continue, we feel that there are many issues where consensus-seeking cooperation can replace competition between stakeholders. Unlike the California energy experiment, there are clear examples of very successful consensus-based policy making in Hawaii's energy sector. We believe that a collaborative process provides a useful counterpoint to an over-dependence on government intervention...and often produces better results. We need to

strengthen the channels and opportunities for voluntary stakeholder communication and interchange in the energy sector. Especially since, as was pointed out previously, the process tends to favor groups who are well organized and have the resources to follow the process through.

## **Near-Term Priorities**

### *Regulatory Reform*

Hawaii's regulatory system is in need of repair. The Public Utilities Commission (PUC) and the Division of Consumer Advocacy are understaffed, underfunded, and need a clearer vision of their roles. We believe there is a broad consensus among all energy stakeholders that the current regulatory and incentive systems need to be revitalized and that this revitalization is a major prerequisite for the achievement of any successful energy strategy.

We have identified several issues that deserve priority attention in repairing the regulatory system. Recommended actions to address these issues include:

- Strengthen the Integrated Resource Planning (IRP) system to encompass all energy companies and utilities in addressing energy needs of the communities and make it the central regulatory planning tool for all state and county agencies, regulatory and legislative bodies.
- Develop utility rate structures that support the State's energy policy by sending proper market signals to consumers.
- Separate the dual role of objective analysis and advocacy in the Division of Consumer Advocacy by institutionally separating these functions.
- Properly staff the PUC and Division of Consumer Advocacy; revise job classifications and salary schedule to encourage staff retention; eliminate public service fund spillover provision that allows funds to be transferred to general fund.
- Improve public access to state regulatory filings, schedules, documents and notification.
- Review state tax and incentive policies to insure that they are consistent with environmental and energy efficiency goals.

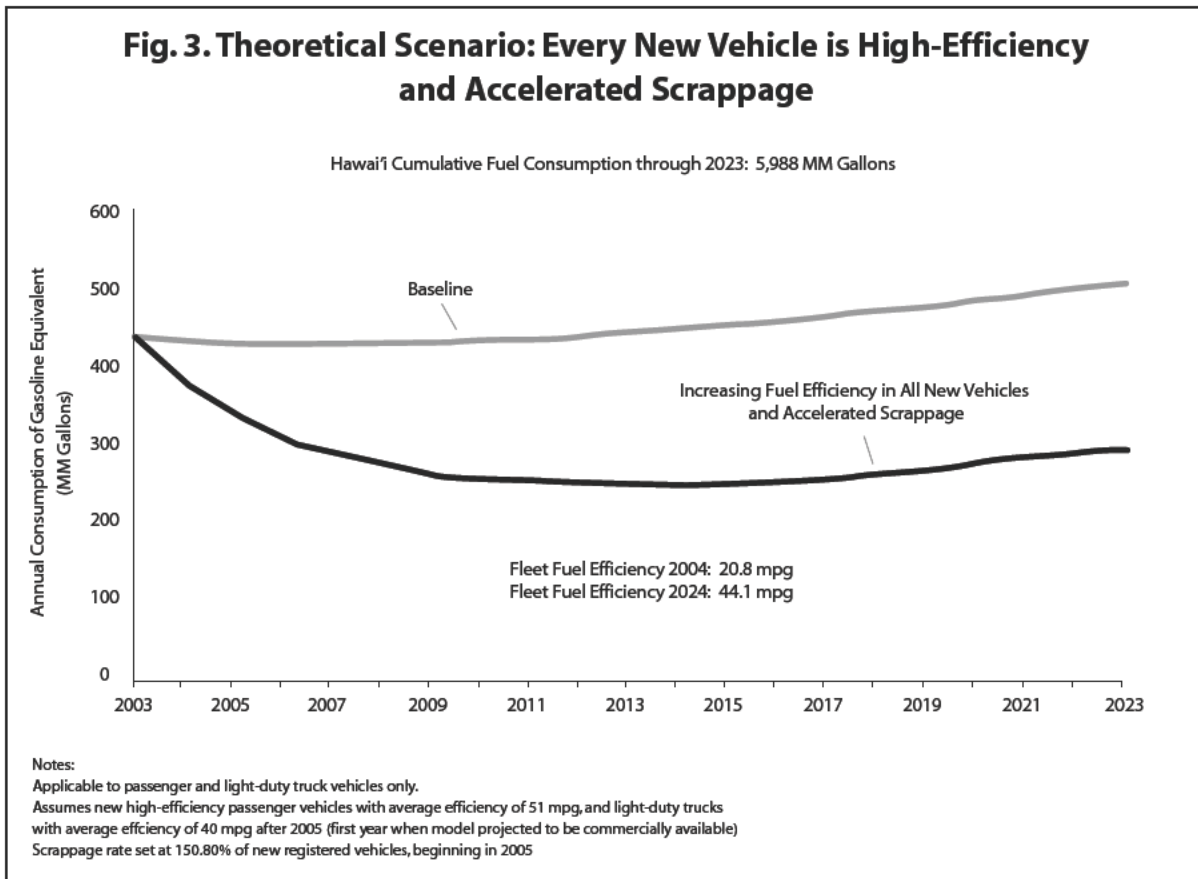
Many of these issues can be addressed internally by the PUC and early indications are encouraging. The new PUC leadership has already begun to address important regulatory issues and to take steps toward strengthening the agency's internal capacity.

An essential part of a rehabilitated regulatory system is adequate staffing and financial resources. Over the past decade, the State's budgetary process has neglected the PUC and Division of Consumer Advocacy's needs and transferred monies collected from the ratepayers, the public utilities fee, to the State's General Fund. In 2002 the public serv-

ices fee amounted to nearly \$12 million, of which less than \$5 million (41%) was spent on PUC activities. We believe that diversion of these revenues for other purposes represents a *hidden tax* on all utility customers and is a major contributing factor in the breakdown of the regulatory system.

*Energy Efficiency*

Energy efficiency efforts have been underway in Hawai‘i since the Arab Oil boycott of 1973. Model energy building codes, utility demand side management programs, and the use of more energy efficient aircraft have all reduced the growth of energy consumption. However, members of the Forum believe that there is a great deal more that can be accomplished. Our consultants estimate that still-to-be-realized savings from improved energy efficiency could total over \$3 billion<sup>5</sup> over the next twenty years. Much of these savings would remain in the pockets of energy consumers, but there would also be very significant indirect advantages to energy suppliers. Potential savings from improved efficiency are almost equally split between reduced costs to electrical consumers and savings associated with a more efficient vehicle fleet. Most of these savings would be achievable at little or no inconvenience or lifestyle changes to consumers.



<sup>5</sup> However, as noted previously, care must be taken as supposedly “good” energy policy measures such as aggressive energy efficiency programs and improved regulatory programs may result in changes in tax revenues and jobs.

Direct efficiency savings to electrical consumers could result from the following actions:

- Remove the rule requiring that Demand Side Management (DSM) measures have payback periods of more than two years before they can be included in electric utility DSM programs, until such time as energy efficiency measures become standard practice by most consumers.
- Pursue new funding and institutional relationships to encourage solar water heating and other DSM opportunities for low income, multi-family housing, and renter groups and U.S. military bases.
- Encourage the counties to restructure building codes to make energy efficiency a major architectural design objective. Provide incentives for solar water heaters and other energy efficient appliances for all new residential construction when and where feasible.
- Immediately extend the application of existing financial recovery mechanisms for the DSM programs. Formulate and implement new cost recovery and incentives mechanisms to encourage aggressive utility DSM programs.

Improved vehicle efficiency might be achieved by programs that encourage more fuel-efficient conventional vehicles, the widespread introduction of new hybrid vehicles, and programs that focus owner attention on maintaining optimal tire inflation. With this in mind, we suggest the following:

- Initiate a *feebate* program to encourage the purchase of fuel-efficient vehicles meeting the State's strategic energy goal. Implement plan(s) for an increase in state vehicle registration taxes on energy inefficient vehicles.
- Develop a vehicle buy-back program to encourage the scrapping of older, less fuel-efficient cars.
- Initiate tire labeling and consumer awareness programs to encourage the initial purchase of tires with low rolling resistance and the maintenance of proper inflation of vehicle tires.

Efficiency programs and carefully planned resource expansion in the electricity sector would also provide important strategic benefits to Hawai'i. Although electricity demand in the state is growing relatively slowly, the time is rapidly approaching when new generating capacity will be needed throughout the state. Resource expansion in smaller, dispersed increments using more efficient units would serve to preserve future options for the transition to hydrogen-fueled technology, as well as the development of new renewable energy projects. However, if through energy efficiency and fuel diversity programs, demand growth can be slowed, then the need to build new generating capacity might be further deferred.

### *Cultural Values and Social Justice*

In the future, siting of power plants and transmission lines will result in battles between host communities, environmental groups, government agencies, and public utilities. Fundamentally, as in the past, many of these battles will be over violations of Hawaiian values, traditions, and sacred sites. They will also result in the imposition of a disproportional share of the negative environmental impacts on poorer communities or on one community rather than another. In order to address these concerns, some near-term steps can be taken.

- Develop methods for assessing the impact of energy policy and siting decisions on low-income groups and seniors.
- Engage Hawaiian practitioners, values, traditions, and critical island thinking at all levels of discussion about energy decisions. This can initially be done through focus groups.

Sub-committees of the Energy Policy Forum have already laid a foundation for both of these initiatives. The sub-committees will continue to find ways to implement these recommendations.

### **Medium Term Priorities**

#### *Diversification as a Supply Strategy*

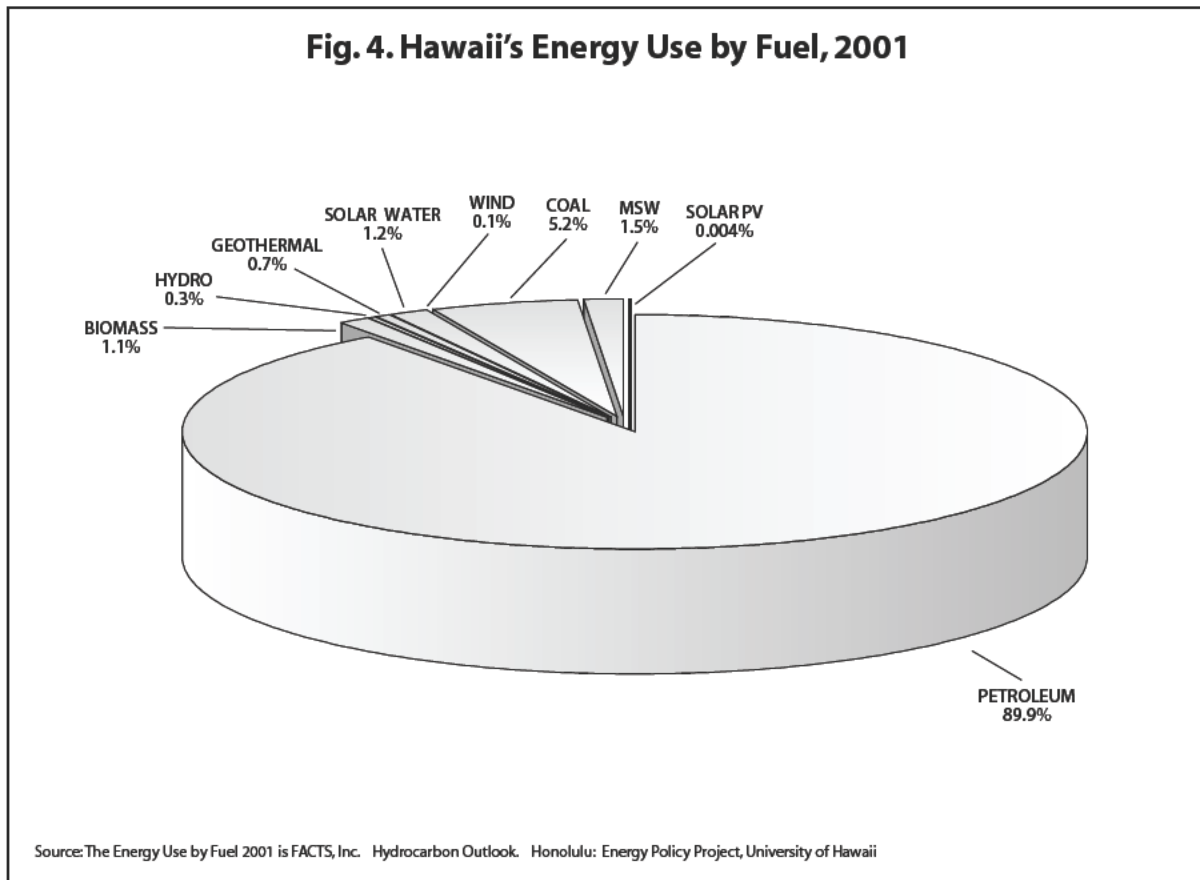
Under any future scenario, there will be an ongoing need for imported hydrocarbons (oil, oil products and coal) in Hawai'i. This continued dependence is inevitable, and rather than equating energy security solely with self-sufficiency, we should include supply diversity in the equation. For Hawai'i, a diversity strategy might be based on 1) renewable electricity resources 2) biomass-based alcohol fuels (see Fig. 4.), 3) imported crude oil for in-state refining, 4) imported oil products like jet fuel and propane, 5) coal, and 6) Liquefied Natural Gas (LNG). Beyond these existing energy sources, we should also consider any new energy sources that might become available over the medium term. An important corollary to a security-through-fuel-diversification strategy is, given a politically unstable world, diversification of the geographic source of the fuels.

#### *Sizing and Location*

Over the past twenty years, small electricity-generating systems have become increasingly more efficient, creating an opportunity for their use as distributed energy resources (DER). DER refers to a variety of small, modular power generating technologies that can be combined with energy management and storage systems to improve the operation of energy systems. DER systems that capture and use waste heat from primary electric generation to raise steam for electricity generation and other purposes are called combined heat power (CHP) or cogeneration plants. These smaller power plants have given utilities, independent power producers and building owners new options to meet energy, electricity, heating and cooling needs.

Distributed energy resources (DER) can reduce the need for large power plants and high voltage transmission lines and can reduce transmission losses. Some large electricity customers (like resort hotels, military installations, and hospitals) can economically install combined heat power (CHP) plants. DER and CHP use will likely increase in the future, especially if energy costs continue to increase.

The main problems faced by DER are project siting concerns. These include fuel delivery and storage, introduction of power plant emissions to areas with no previous emissions, and insuring that system grid reliability is not sacrificed. Both independent power producers and the electric utilities are currently pursuing distributed power projects. However, a planning or regulatory framework is currently not in place to insure that the full benefits of this promising technology can be fully realized while properly addressing the risks. Establishing a policy and guidelines for the integration, operation, reliability and accountability for distributed generation should be a PUC priority. A first step in this direction is the PUC initiated docket, opened in October 2003, to investigate distributed generation.



### Renewable Resources Development

Our consultants have identified substantial renewable energy projects on every island. A county-by-county list of these projects is listed in the Fig. 5 table. While some renewable technologies such as solar photovoltaic cells are not yet economic, other renewable technologies are increasingly attractive. The two technologies that appear most promising for early adoption are wind and electrical generation from municipal solid waste or refuse.<sup>6</sup>

Before the full potential of renewable resources can be realized, technology must be developed to allow the integration of intermittent resources like wind into relatively small power grids while maintaining system stability. This problem is much more difficult to solve in Hawai'i than on the U.S. Mainland, where large power grids are interconnected and have sufficient inertia to absorb the variations in intermittent supplies. Nevertheless, we are confident that major wind and municipal refuse projects will become economic and operational on most islands over the next ten years.

Other problems that need to be resolved involve siting and permitting of renewable projects. There is still community, landowner, and sometimes government resistance

**Fig. 5. Potential Renewable Energy Projects by County**

(Through 2008-2010)

COUNTY/TECHNOLOGY	CAPACITY (Megawatts)	PROJECT(S)	RENEWABLE ENERGY AS A % OF TOTAL ELECTRICAL GENERATION	
			2003	2008-2010
<b>Hawai'i</b>			25.1%	36.9%
Wind	30	Hawi, Kahua, South Point		
Biomass	8	Refuse		
Solar	1.75	Distributed		
<b>Maui</b>			3.1%	6.9%
Wind	20	Kaheawa Pastures		
Biomass	15	Refuse, Cane Residues		
Solar	1.85	Distributed		
<b>O'ahu</b>			4.2%	36.9%
Wind	50	Kahuku		
Biomass	10	3rd HPower Boiler		
Solar	6.6	Distributed		
<b>Kaua'i</b>			6.5%	25.5%
Wind	10	—*		
Biomass	9	Refuse		
Solar	.4	Distributed		
<b>State Total</b>			6.1%	11.7%
Wind	100	---		
Biomass	42	---		
Solar	10.6	---		

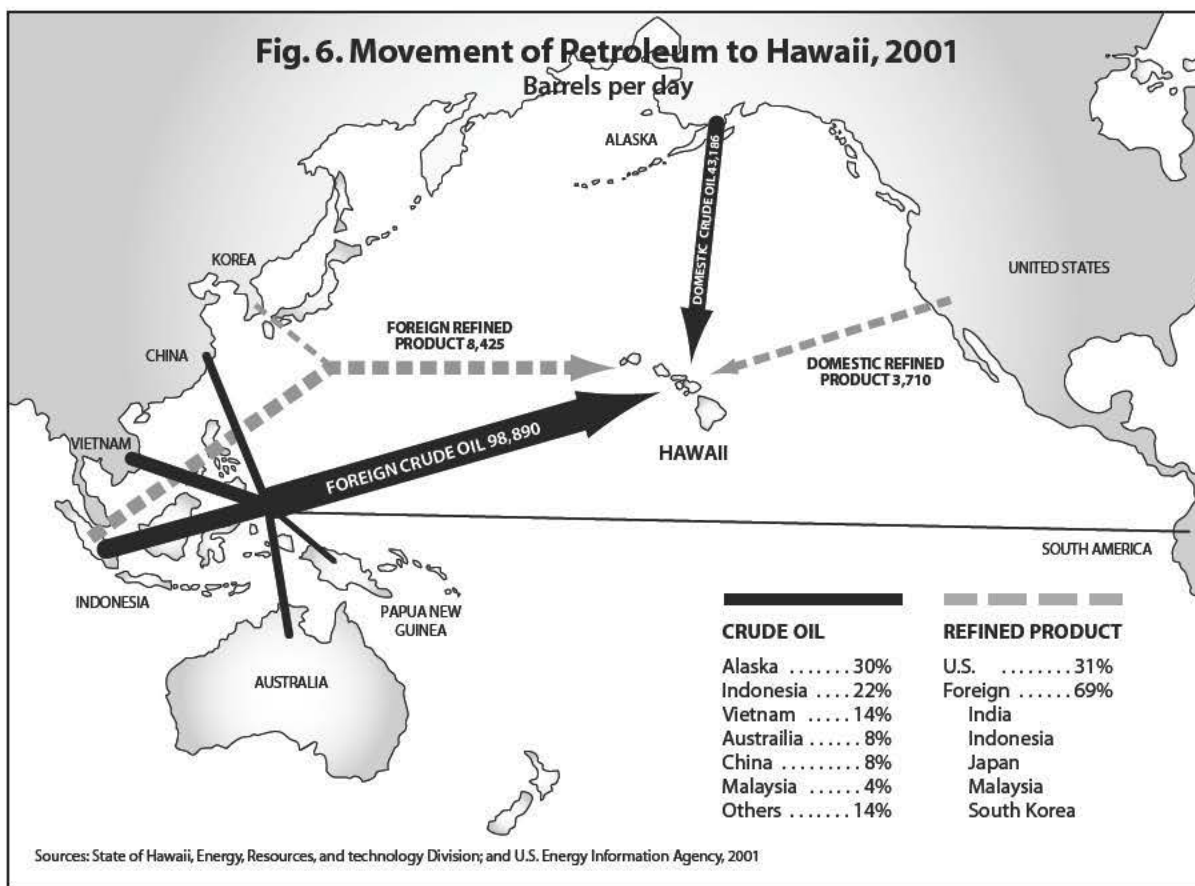
\* A suitable windfarm site on Kaua'i has yet to be identified  
Source: Bollmeier W., Loudat T. and Prahlad K., *Renewables and Unconventional Energy in Hawaii*

6 Municipal refuse can create electricity in four ways: through direct combustion, anaerobic digestion, gasification and utilization of methane gas generated by sanitary landfills.

to siting and permitting various renewable projects in Hawai'i.<sup>7</sup> Over a longer period, the picture is less clear for other renewable technologies and depends in large measure on the interaction of three factors:

- The willingness of consumers to subsidize renewable energy development;
- The cost of imported hydrocarbon fuels; and
- The maturation of renewable technologies currently in the market and development of new renewable energy technologies.

The development of new renewable energy projects does not exist in a vacuum. It is dependent on several elements of the energy system. For example, a successful energy efficiency program could defer the need for all new generating projects, including renewable energy sources. Likewise, the development of intermittent renewable resources like wind may not be technically feasible under distributed generation scheme without a direct (standby/backup) link to the transmission grid. Similarly, while the resources for wind development are promising on some of the neighbor islands, the smaller electrical load and greater distances between load centers make integration of intermittent wind resources technically challenging. Finally, municipal solid waste schemes based on direct combustion (e.g., H-POWER on O'ahu), while meeting EPA regulations, still contribute their share of emissions and transportation



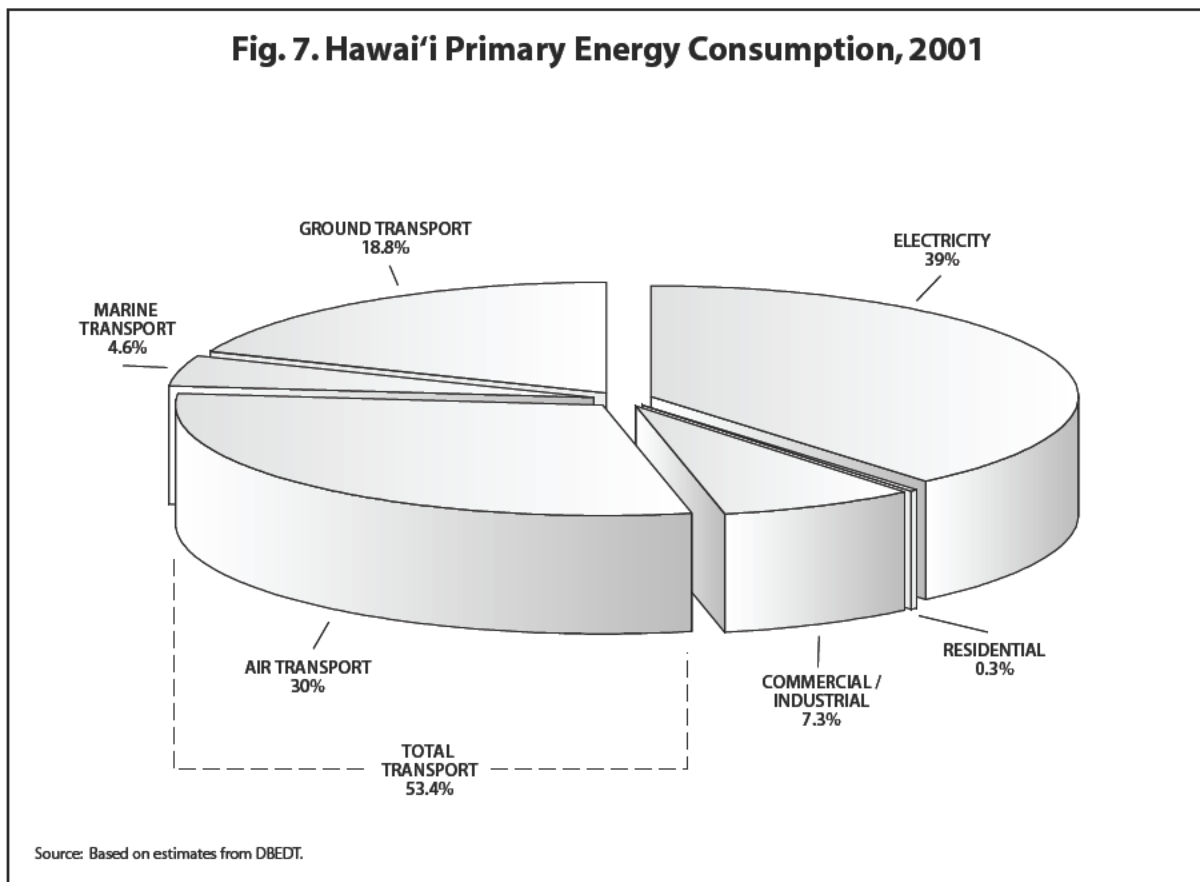
7 An example is long standing public reaction to the geothermal project on the Big Island.

impacts. Nevertheless, we believe that there are sufficient potential opportunities to justify the State's continued emphasis on new renewable development.

### *Supply of Conventional (Hydrocarbon) Fuels*

Historically, Hawai'i has received a significant share (46% in the year 2000) of its crude oil supply from the Alaska North Slope fields and from Australia. The remainder comes from an assortment of Asia-Pacific countries. With the depletion of the Alaskan resources and the decline of Australian exports, future oil and coal supplies to the State will increasingly come from politically less stable countries in Asia. This shifting supply pattern from politically secure supplies to increasing dependence on potentially volatile overseas sources is cause for strategic concern. While there is some scope for substituting crude oil blends of several different crude oils, Hawai'i refiners have less flexibility than many of their Mainland counterparts. In Hawai'i, the oil refineries are limited due to the unique demand for specific petroleum products, and because they are not technically sophisticated.

Three products dominate the demand for oil products in Hawai'i: gasoline, jet fuel and residual fuel oil. While gasoline and jet fuel demand is associated with the State's transportation needs, heavy fuel oil supplies go almost exclusively to support the generation of electricity. Hawai'i's oil refineries cannot support all of these needs and sizable quantities of jet fuel are imported every year.



Recently, several international companies have approached the State about the substitution of liquefied natural gas (LNG) for residual oil as an alternative fuel for the electric utility industry. A task group of state infrastructure planners and utility engineers have been studying these proposals and the Energy Forum has commissioned a special study of this possibility.

We believe that the broader implications of natural gas imports warrant further investigation for several reasons.<sup>8</sup> First, natural gas is an inherently cleaner fuel than most petroleum products and coal (unless gasified), and its substitution would result in a substantial reduction in certain air emissions including major greenhouse gases. Second, since most of the suppliers are suggesting Australia as a supply source, substitution may increase the security of supply vis-a-vis oil imports from politically unstable areas. Third, as a result of contracting practices in the LNG industry, prices have historically been much less volatile than international oil prices.<sup>9</sup> Fourth, the necessary infrastructure for LNG imports will require considerable construction investments that could easily exceed \$100 million and this would generate jobs. Fifth, natural gas is commonly accepted to be the initial source of hydrogen for the fuel cell technology that will revolutionize energy markets in the medium to long term. An LNG distribution network could be an important first step toward establishing a hydrogen distribution system.

On the other hand, the LNG option could create problems for the State, depending on how it is implemented. For example, it is highly likely that total replacement of residual oil sales with LNG will result in one of the State's two oil refineries closing. Unless economic alternatives are found for the displaced residual fuel oil, a refinery closure could cost the State three or four hundred jobs at the refinery and in support industries. Depending on transportation options, there might also be a need to import small amounts of gasoline from outside of the State. A subtler issue is matching the statewide distribution of expected LNG use with the technical and economic feasibility of the infrastructure required. At present, it appears that the LNG option would only be feasible if two of the existing HECO power plants on O'ahu are converted to use gas. Thus, as pointed out earlier, an O'ahu energy plan may differ significantly from a plan for the neighbor islands. On balance, we feel that LNG is sufficiently attractive to continue investigating likely commercial prices, seeking ways to mitigate costs, and achieving wider distribution of potential benefits.

For surface transportation, the most promising medium term renewable energy option appears to be the production of ethanol from biomass resources on the neighbor

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<sup>8</sup> LNG is currently the major form of natural gas that is under consideration. However, transport of compressed natural gas (CNG) is also feasible and should be examined as part of a broader study.

<sup>9</sup> Price volatility, or fluctuation, is important since it makes it more difficult to forecast future fuel prices. Uncertainty over fuel forecasts can make the justification of renewable energy projects more complex.

islands. While an alcohol powered vehicle fleet for the State is unlikely to be either practical or economic, the blending of ethanol with gasoline for use in conventional vehicles is a well-established practice in many parts of the world. This strategy might reduce gasoline consumption by 6% while creating a new substantial rural industry. Several ethanol projects have been evaluated over the last two decades, and the new technology being proposed in a recently completed Kaua'i feasibility study may overcome some of the initial investment barriers.

As suggested in the energy efficiency section, the pre-hydrogen transportation option with the most promise is the emergence of hybrid vehicles that combine small conventional gasoline engines with electric motors. There is substantial opportunity for innovative incentive programs to accelerate early adoption of this technology in Hawai'i.

### **Long-Term Strategic Possibilities**

Over the long-term (15-30 year) time horizon, an increasing number of project decisions will need to be made primarily on the basis of their impact on introducing emerging hydrogen powered fuel cell technologies. It is not possible, at this point, to predict which decisions or projects might fall into this category. However, there are a few long-term considerations that deserve mention.

#### *Options for Consolidation of Markets*

As noted at the onset, Hawaii's energy sector is a collection of isolated island energy markets. The regrettable consequence of this segmentation is that certain energy options involving economies of scale which are available to Mainland energy suppliers and consumers are simply not relevant in Hawai'i. However, if some form of market consolidation could be achieved, much more of the State's renewable resources could be developed on an economic basis. There are two possibilities for improving the consolidation of energy markets: electrical transmission links between the islands and the transfer of liquid fuels, such as ethanol, liquefied petroleum gas (LPG), and liquefied natural gas (LNG), between islands. Electrical transfers have much higher potential benefits than liquid fuel transfers, but the technical and financial problems of under-sea electrical cables are formidable.

In the early 1990's a major transmission study was undertaken with a view to bringing Big Island geothermal power to O'ahu. The study indicated that a statewide transmission network was not an economically attractive idea. On the other hand, it seems possible that a less ambitious plan connecting, for example, O'ahu-Moloka'i-Maui would certainly be less costly and might still have significant benefits for a large fraction of

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<sup>10</sup> *A much more distant technological possibility might be the wireless transmission of power via microwaves, which has often been demonstrated in laboratory and small pilot programs but is far from a practical reality.*

the state.<sup>10</sup> However, the concept of developing generating plants on one island for export of power to another island is likely to generate much community discussion and possible opposition.

#### *Expanding Natural Gas Distribution*

If LNG (or Compressed Natural Gas) imports proved feasible on O‘ahu, the construction of an expanded gas distribution system could be a relatively simple and obvious option. Such an expanded system would benefit enormously by having basic import costs met from power plant sales and could give commercial and residential consumers an alternative to electricity. Such an expanded distribution network would be a natural step toward the infrastructure necessary to provide a hydrogen source for eventual fuel cell introduction.

#### *Mass Transit and Urban Planning*

Since a large fraction of the State’s energy consumption is linked to surface transportation, there are significant long-term opportunities for making energy a primary focus of urban planning. An obvious target is mass transit, but there are a number of other physical planning tools that might be considered to make our urban environments more energy efficient. Such efforts might be enhanced by demographic trends that show an increasing fraction of workers being self-employed and working from home offices.

### **Conclusion**

There are clearly opportunities to move Hawaii’s energy systems toward the vision of environmentally friendly, renewable, safe and affordable energy resources; and to adopt energy technologies that are decentralized and efficient with the best available emission controls.

To take advantage of these opportunities, energy stakeholders must work together to insure implementation of the recommendations contained in this strategy. Hopefully, the spirit of cooperation and constructive dialogue that characterized the Energy Policy Forum can continue and contribute to the achievement of the Forum’s vision.

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Deliberations of the Hawaii  
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marized on the Forum website:

<http://hawaiienergypolicy.hawaii.edu/>

Minutes of Forum meetings, sub-  
committee reports, power point  
presentations and reports based  
on the studies commissioned by  
the Forum, and a summary of  
deliberations at the December  
2003 Energy Policy Summit are  
available on that website.



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