HAWAII ENERGY STRATEGY

PROGRAM GUIDE

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State of Hawaii

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

Energy Division

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Honolulu, Hawaii 96813**

MASTER

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**SUBJECT: An Open Letter to Readers of the Hawaii Energy Strategy (HES)
Program Guide**

Dear Reader:

The Hawaii Energy Strategy program will produce an integrated energy strategy for the State of Hawaii by the end of 1994. The seven projects of the Hawaii Energy Strategy program will consolidate previous knowledge of Hawaii's energy situation, develop tools to collect and analyze energy-related data, and will take a look into Hawaii's energy future. Perhaps most important, based upon the work of the program, recommendations and initiatives will be developed to ensure Hawaii's people are served by dependable, efficient, and economical energy systems and that Hawaii gains increased energy self-sufficiency.

The resulting final report will serve as a guide to business, environmental groups, government, and Hawaii's people in their roles in Hawaii's energy community. Business will have additional information for its own strategic planning. Additional data on renewable energy, for example, will assist businesses developing Hawaii's abundant potential renewable energy resources. Environmental groups will see the potential to help preserve Hawaii's clean environment through cleaner technologies. The State and County government will have additional information and capability to develop recommendations, legislation, and policies to foster the most desirable energy future for Hawaii. The public will gain a better understanding of Hawaii's energy situation to help make individual choices and to take individual actions to improve their own and Hawaii's use of energy.

Input from all of these sectors is important. This guide is intended to provide you with information about the program. Based upon this information, your suggestions for improving the Hawaii Energy Strategy program will be greatly appreciated.

Mufu Hannemann

SECTION 1. HAWAII ENERGY STRATEGY PROGRAM OVERVIEW

The Hawaii Energy Strategy program, or HES, is a set of seven projects which will produce an integrated energy strategy for the State of Hawaii. It will include a comprehensive energy vulnerability assessment with recommended courses of action to decrease Hawaii's energy vulnerability and to better prepare for an effective response to any energy emergency or supply disruption. The seven projects are designed to increase understanding of Hawaii's energy situation and to produce recommendations to achieve the State energy objectives of:

- Dependable, efficient, and economical state-wide energy systems capable of supporting the needs of the people; and
- Increased energy self-sufficiency.

The seven projects under the Hawaii Energy Strategy program include:

- Project 1: Develop Analytical Energy Forecasting Model for the State of Hawaii.
- Project 2: Fossil Energy Review and Analysis.
- Project 3: Renewable Energy Resource Assessment and Development Program.
- Project 4: Demand-Side Management Program.
- Project 5: Transportation Energy Strategy.
- Project 6: Energy Vulnerability Assessment Report and Contingency Planning.
- Project 7: Energy Strategy Integration and Evaluation System.

The Hawaii Energy Strategy program began on March 3, 1992, under a Cooperative Agreement with the United States Department of Energy, and is scheduled for completion by December 31, 1994. A generalized schedule is provided as Appendix 1.

SECTION II. BACKGROUND

Hawaii's Energy Problem. Hawaii depends on imported oil for 90% of its energy. This makes Hawaii the most vulnerable state in the nation to the disruption of its economy and way of life in the event of a disruption of the world oil market or rapid oil price increases. Currently, 40% of Hawaii's oil comes from Alaska and the remainder from the Asia-Pacific region. The export capabilities of these sources of supply are projected to decline significantly -- approximately 50% -- by the year 2000. This will likely increase Hawaii's dependence on the oil reserves of the politically unstable Middle East.

Hawaii is also vulnerable to possible disruptions of its supply in the event of a crisis. The long distance from the U.S. Strategic Petroleum Reserve in Louisiana and Texas, combined with a declining number of U.S. tankers capable of transiting the Panama Canal, make timely emergency deliveries problematic.

Environmental protection is also a major concern for Hawaii and its residents. Energy production from fossil fuels is the major source of local and global air pollutants, while petroleum shipping and handling pose risks to fragile marine habitats and coastal resort areas. An energy policy which internalizes the environmental and social costs of fossil fuels will place added value on energy efficiency and renewable energy, but could result in an increase in the market price of energy to consumers.

Hawaii's Energy Potential. Hawaii has significant, yet relatively untapped, renewable energy resources and energy-efficiency potential. Biomass, wind, solar, geothermal, hydroelectric, and ocean resources can provide clean, stable sources of energy supply. The Islands' energy savings potential would likely allow utilities to defer construction of additional fossil fuel-fired power plants by reducing electricity demand through conservation and increased energy efficiency. Efficiency gains in the transportation sector are also possible.

The Hawaii Integrated Energy Policy Program. All of these considerations, coupled with the fact that Hawaii is no less dependent on imported oil today than it was during the first oil crisis of 1973-1974, pointed out the need for the State government to create a more effective energy policy development and planning process. Hawaii recognized that such a process would have to

involve both the general public and the direct representation of Hawaii's "energy community."

To prepare an integrated energy policy for the State, the Energy Division of the Department of Business, Economic Development & Tourism (DBED) initiated the Hawaii Integrated Energy Policy (HEP) program in 1990. The program was structured to allow the broadest possible representation of Hawaii's "energy community" in the process. A task force organizational structure and process were established. During the development of the Hawaii Integrated Energy Policy, between 1990 and 1991, 57 individuals representing 34 agencies and organizations served on the various Hawaii Integrated Energy Policy Task Forces. The groups consisted of people from Federal, State, and County governments; regulated energy utilities; oil companies; private development companies; environmental groups; and university and private energy research organizations.

Another key contributor to the Hawaii Integrated Energy Policy process was the Hawaii Public Utilities Commission's (PUC) Integrated Resource Planning (IRP) Docket. The majority of the Docket's 25 parties participated in a collaborative process that recommended Integrated Resource Planning principles and objectives, and, on an individual basis, testified on issues raised during the Integrated Resource Planning Docket.

Two additional activities enabled hundreds of energy-conscious Hawaii residents to participate in the Hawaii Integrated Energy Policy development process. In 1989, the Enhancing Renewable Energy Development in Hawaii Workshop was held. It also involved a state-wide energy questionnaire survey. Two years later, in July and August 1991, a series of Hawaii Integrated Energy Policy public review meetings was conducted state-wide.

The development of the Hawaii Integrated Energy Policy was managed by the State Energy Resources Coordinator (ERC), Hawaii's Director of Business, Economic Development & Tourism. Chapter 196 of the Hawaii Revised Statutes (HRS) gives the ERC ultimate responsibility for the State's energy management activities and is the statutory authority upon which the Hawaii Integrated Energy Policy program is based.

Major Findings of the Hawaii Integrated Energy Policy Program. The analysis conducted in the Hawaii Integrated Energy Policy program revealed that no single energy policy can address

Hawaii's complex energy situation. The major findings were:

1. There is a need to address institutional responsibilities, and financial and organizational requirements in State energy management and development.
2. Hawaii's extensive renewable energy research and development activities are not being conducted within a coordinated and comprehensive framework.
3. Energy conservation and improved energy efficiency deserve greater emphasis in development of Hawaii's indigenous resources.
4. Hawaii's vulnerability to oil supply disruptions will increase over the decade.
5. The State must expand its energy policies to include the transportation sector.
6. Hawaii is as dependent on imported oil now as it was in 1974 where its policy of energy self-sufficiency was established.

Hawaii Integrated Energy Policy Policy Recommendations. Based upon these findings, the principal policy recommendations that emerged from the first iteration of the Hawaii Integrated Energy Policy program were:

1. Create a new energy agency with the intent of increasing the stature of, and administrative emphasis on, energy activities.
2. Prepare and publish a biennial Hawaii Energy Plan to replace the Energy Functional Plan.
3. Amend the Hawaii State Plan, HRS 226-18, to include an additional objective to "ensure energy security" and an additional policy to "promote alternate fuels and energy efficiency by encouraging diversification of transportation options and infrastructure "

4. Prepare and publish a comprehensive renewable energy and energy efficiency research and development (R&D) strategy with specific resource assessment, basic and applied research, and commercialization and implementation activities.
5. Analyze the effectiveness of transportation policy options, including public transit, energy pricing and other fiscal policies, and infrastructure changes, that will reduce the demand for petroleum-based fuels.

The Hawaii Integrated Energy Policy and the Hawaii Energy Strategy. The Hawaii Energy Strategy program focuses on making many of the specific recommendations of the Hawaii Integrated Energy Policy operational. For example, these include increasing the Energy Division staff's technical knowledge, and improving the State's energy analysis capability by developing a comprehensive energy modeling system.

SECTION III. GOALS, OBJECTIVES, AND BENEFITS

Goals. The Hawaii Energy Strategy will achieve the following program goals:

- Increased diversification of fuels and sources of supplies of these fuels;
- Increased energy efficiency and conservation;
- Development and implementation of regulated and non-regulated energy development strategies with the least possible overall cost to Hawaii's society;
- Establishment of a comprehensive energy policy analysis, planning, and evaluation system;
- Increased use of indigenous, renewable energy resources; and
- Enhanced contingency planning capability to effectively contend with energy supply disruptions.

Objectives. The Hawaii Energy Strategy will be developed in the form of seven projects, each with its own set of objectives in support of the overall program goals above. These objectives will be detailed below in the discussion of each of the projects.

Benefits. The Hawaii Energy Strategy will assist State of Hawaii planners and policy makers, members of the Hawaii energy community, and the public in better understanding Hawaii's current energy situation, possible future energy scenarios, and a preferred energy future for Hawaii.

The Hawaii Energy Strategy will provide a comprehensive and integrated system for:

- Energy resource data and technology assessments, analyses, and forecasting;
- Energy policy analysis and evaluation; and
- Energy planning, plan implementation and evaluation.

The integrated strategy will also be useful for regional planning analyses and federal analyses by the U.S. Department of Energy. Federal policies, embodied in the National Energy Strategy, can be tested and evaluated at the state level. Hawaii represents an ideal candidate for such analysis because its geographic isolation allows policy makers to readily track energy flows, given the right analytical tools.

SECTION IV. HAWAII ENERGY STRATEGY

PROGRAM

The Hawaii Energy Strategy program is comprised of seven distinct projects to be conducted in coordination with each other within the program's three year schedule. Implementation of Hawaii Integrated Energy Policy recommendations and strengthening Energy Division staff expertise through skills improvement and acquisition is emphasized in all of the projects. This section describes each of the Hawaii Energy Strategy projects in detail.

PROJECT 1: DEVELOP ANALYTICAL ENERGY FORECASTING MODEL FOR THE STATE OF HAWAII

Project 1: Purpose and Objectives.

Project 1 will develop the capability for the State of Hawaii to conduct comprehensive energy assessments, forecasts, and analyses. The following are the project's objectives:

1. Establish a computerized model for energy forecasting and assessment. This system will be capable of projecting the demand for energy over a time horizon of at least 20 years under a variety of different scenarios dealing with the level and mix of economic activity, energy prices, technological change, regulatory standards, and utility demand-side management (DSM) programs.
2. Develop a data gathering and management system to support the energy forecasting and assessment system. This will be conducted in conjunction with Project 4, DSM Assessment.
3. Conduct training to develop State staff expertise in using and updating the analytical energy forecasting model.

This project is predicated on the following assumptions:

- Development of a forecasting capability is a fundamental first step toward realizing the role DBED has publicly identified for itself in Hawaii's Integrated Resource Planning framework.

This project must be closely integrated with Project 4, Demand-Side Management, and separate Integrated Resource Planning technical assistance projects to ensure that energy forecasting assumptions and results are consistent across all three projects. This project will also support DBED's current participation in Hawaii's first Integrated Resource Plan.

- Development of a forecasting capability also is an important step in exercising the statutory authorities and responsibilities for energy planning vested in DBED.
- A state-wide initiative in energy forecasting will contribute to the development of more useful and informative forecasts by the utilities.
- There is a need for a state-wide forecast in addition to utility forecasts because the State and the utilities have different perspectives and needs.

How Project 1 Will Be Accomplished.

Energy Division staff and contractor technical support will identify forecasting needs and define objectives; review relevant literature; identify data, computer hardware and software, and training requirements; and train the Energy Division staff to use and update the system. In conjunction with the staff involved in the other projects (e.g., Project 4: Demand-Side Management), an energy database will be established. Data collection efforts will be coordinated to serve the database.

The evaluation process will consider a variety of model types, including:

- Individual sector models, such as the residential, commercial, and industrial sector energy models developed for the Electric Power Research Institute which could be integrated with models which forecast non-electricity energy demand; and

- Multi-sector forecasting models as used in certain other states.

A custom model or set of modified models is another option. In addition, computer hardware to run the model will also be required.

Project 1 Deliverables.

1. Review of existing forecasting models including discussion of applicability to Hawaii .
2. Energy resource reporting requirements and format.
3. Computer hardware and software energy forecasting and analysis system.
4. Identification of proposed policy and legislative initiatives necessary to acquire the required energy resource data.
5. Training and procedures manual for operation and update of computer system.

Project 1 Plan. Barakat & Chamberlin, Inc., the technical support consultant, and the DBED Energy Division developed the following plan to complete the project:

1. Identify forecasting needs and define objectives.
2. Review existing forecasting models and recommend whether DBED should acquire any of these models.
3. Assess organizational needs.
4. Acquire and modify existing models.
5. Identify hardware requirements and install software.
6. Identify data requirements.
7. Develop data reporting format.
8. Develop policy and legislative initiatives to gather data.

9. Compile and prepare data inputs.
10. Generate trial forecasts.
11. Evaluate trial forecasts.
12. Establish priorities for refinement.
13. Refine model.
14. Refine data inputs.
15. Develop staff training and procedures manual.
16. Train staff.

PROJECT 2: FOSSIL ENERGY REVIEW AND ANALYSIS

Project 2 Purpose and Objectives.

Project 2 will conduct a comprehensive Hawaii and Pacific area fossil energy review and analysis. The project will examine oil, gas, and coal opportunities in Hawaii. The objective is to obtain a clearer understanding of fossil energy use in Hawaii and to use this information to develop the capability to conduct comprehensive energy assessments, forecasts, and analyses. The project will also investigate the possible additional use of coal in Hawaii and the changes needed in infrastructure, the costs of changes, and possible economic and environmental impacts. Project 2 is divided into two parts: an Oil and Gas Opportunities Analysis, and a Coal Opportunities Analysis.

Oil and Gas Opportunities Analysis Objectives.

1. Assess current state of fossil energy supply in Hawaii, the Pacific Islands, and the Pacific Rim.
2. Assess and forecast the near-, mid-, and long-term viability of these fossil energy resources in terms of supply and geopolitical factors.
3. Investigate and assess Hawaii's industries as to their use of fossil fuels and what part these fuels play in their economic output and employment.

4. Investigate and assess the nature of the energy industry in Hawaii to determine how the makeup of this industry affects the vulnerability issue in the State.
5. Develop a detailed description of the State's fuel import and export flows and a detailed description of State-wide fuel production, storage and distribution.
6. Conduct a pre-feasibility assessment to determine cost-benefit estimates, including infrastructure changes necessary for diversification of current fossil fuel base in any transition to a renewables-based energy scenario.
7. Develop recommendations for "optimal" near-, mid-, and long-term fossil fuel mix objectives for Hawaii/Pacific region.
8. Develop recommendations for potential changes to industry practice and State government's role in supporting changes to ensure competition and adequacy of supply of energy resources.

Coal Opportunities Analysis Objectives.

1. Assess attitudes toward coal use on the part of industry and influential groups in Hawaii to determine potential barriers to coal use that should receive special emphasis in the analysis.
2. Assess coal supply from Pacific Rim areas including factors such as costs, vulnerability issues, and Jones Act constraints that affect the delivered cost of domestic coal. Assess the near- to mid-term options for reducing the cost of delivered coal.
3. Review existing and emerging coal-based power production technologies, including associated cost, environmental impacts, land-use, and infrastructure requirements.

4. Evaluate the potential for converting existing oil-fired capacity to coal, including repowering and coal-water and ultra-fine coal slurries.
5. Evaluate the potential of new coal-fired plants versus alternative supply options.
6. Determine the adequacy of existing capacity expansion models for longer term planning needs, and whether additional tools would be helpful. Examine alternative oil price tracks to determine how existing oil and new oil capacity might complement each other over time.

How Project 2 Will Be Accomplished.

Energy Division staff and the technical consultant, the East-West Center Energy Program, will review relevant literature; employ energy resource econometric models; conduct cost/benefit analyses; and formulate recommendations for diversification.

For the Coal Opportunities Analysis, the U.S. Department of Energy's Office of Fossil Energy has done considerable work analyzing costs of new and developmental fossil energy technologies. A study also examined the land use "footprints" for certain technologies. U.S. Department of Energy and Hawaii Energy Division staff will work together to identify available information and appropriate areas for assistance from the East-West Center.

The two reports will be integrated into an overall fossil energy review.

Project 2 Deliverables. The study will achieve the above objectives through the following four major tasks:

1. **Overview of Fossil Energy.** Provide a comprehensive overview of the world and regional fossil fuels industries and how they relate to the situation faced by Hawaii. Accomplishing this task requires extensive background on the world resource situation, the relevant transportation and processing technologies in use, the end-uses and cross-substitutions

of fuels, the environmental impacts of fuels, the emerging trends in worldwide and regional usage and an examination of the geopolitical factors affecting the markets.

2. **Fossil Fuels in the Hawaii Economy.** Provide a baseline assessment of Hawaii's situation in the fossil-fuels market. This will include a review of the current uses of fossil fuels in the State (including identification of data insufficiencies), an examination of the role played by each fuel in the State economy and a description of the current and emerging patterns of import dependency, an evaluation of the degree of fuel substitution that can be achieved in various uses, and the identification of the most critical dependencies or bottlenecks in the supply system.
3. **"Greenfield Options": The Potentials and Drawbacks of Technologies and Fossil Fuels Not Presently Used in Hawaii.** Provide an appraisal of the role of relevant fossil fuel technologies not presently used in Hawaii. Fossil fuel technologies not presently used include both "emerging" technologies (such as clean coal technologies now becoming available), as well as more conventional use of fuels that have not been deployed in the state. This appraisal will include profiles of the technologies, examination of their scales and roles, identification of relevant siting, safety, and environmental parameters, and a comparison of these technologies with each other and with Hawaii's current end uses.
4. **Scenario Development and Analysis.** Assist the State government in developing better capabilities for long-term planning of the State's energy system with regard to fossil fuels. This includes making technical coefficients and cost estimation procedures available. The augmentation of the

State government's analytical capabilities is an ongoing process which reaches far beyond the scope and term of any given study. Achieving this goal in the Hawaii Energy Strategy will consist of either providing alternate scenarios of fossil fuel use and vulnerability under various policies, or assisting the State government in developing the skills and tools needed to produce such scenarios as needed.

PROJECT 3: RENEWABLE ENERGY RESOURCE ASSESSMENT AND DEVELOPMENT PROGRAM

Project 3 Purpose and Objectives. One of the goals of the Hawaii Energy Strategy is to increase the use of indigenous, renewable energy resources. Project 3 will produce a comprehensive assessment of Hawaii's renewable energy resources (wind, solar, biomass, hydroelectric, ocean thermal energy, and wave energy) and prepare a long-range strategy for developing them. The project will refine and build upon the previously completed renewable energy work in Hawaii by establishing the project-specific potential contributions renewables can make to Hawaii's energy mix. Project objectives are as follows:

1. Summarize existing renewable energy resource assessments.
2. Determine suitability, currency, and quality of existing resource data.
3. Determine additional resource data requirements including possible monitoring sites, best current monitoring methodologies, and instrumentation requirements.
4. Conduct and report on an in-depth, comprehensive assessment of Hawaii's renewable energy resources.
5. Develop projections and strategy for a reasonable renewables energy component in Hawaii's total energy mix.

How Project 3 Will Be Accomplished. The State of Hawaii is endowed with an abundance of renewable energy resources. In the past, many studies, using many different approaches, have examined these resources for a variety of purposes. As an initial step in comprehensively understanding and evaluating Hawaii's renewable energy resources, DSED contracted R. Lynette & Associates (RLA) to complete a *Comprehensive Review and Evaluation of Hawaii's Renewable Energy Resource Assessments*.

The RLA study evaluated past renewable energy resource assessments and made recommendations for further resource assessment work in each of the following technologies: wind, solar, geothermal, hydroelectric, biomass, wave energy, and ocean thermal energy conversion (OTEC).

In completing their report, RLA evaluated each past assessment to establish the usefulness of the data for overall assessment purposes, as well as its usefulness to commercial developers of the renewable resource. Factors examined included the reasonableness of any assumptions made and the quality of instrumentation and data recording procedures. The results of these evaluations were combined with generalized information concerning land use electrical infrastructure, and the current and projected commercial status of each technology to develop recommendations for further assessment work.

RLA identified wind and solar as the two renewable energy resources requiring additional monitoring and measurement. Biomass, hydro, OTEC, and wave energy have adequate resource data available, or the status of the technology does not warrant further measuring and monitoring at this time.

Although geothermal resource assessment work was evaluated in the RLA study, geothermal will not be included in Project 3.

The results of the RLA study were used to help develop the Request for Proposals for this project and are preliminary to it. The following summarizes the scope of work for Project 3. It is divided into three phases.

Project 3 Plan.

Project Phase 1 - Development of a Renewable Energy Resource Assessment Plan.

1. Identify geographic areas in Hawaii with renewable energy resource potential and conduct a detailed analysis of land use, ownership, and availability.
2. Identify constraints to renewable energy resource development and eliminate areas with existing or planned competing uses.
3. Conduct a detailed analysis of existing infrastructure and utility compatibility.
4. Conduct field surveys.
5. Identify locations of existing monitoring sites and identify and characterize existing monitoring equipment.
6. Identify additional monitoring sites and prioritize.
7. Prioritize renewable energy resource utilization technologies identified as appropriate for further study.
8. Conduct a preliminary evaluation of public acceptance and environmental, visual, and cultural impacts.

Project Phase 2 - Development of Renewable Energy Resource Supply Curves.

1. Compile cost and performance data on renewable energy conversion systems.
2. Analyze and reduce existing renewable energy resource data.
3. Compile and publish the Hawaii Sugar Planters' Association (HSPA) solar data collected since 1975.

4. Develop renewable energy resource supply curves for biomass, hydroelectric, OTEC, and wave energy (in this order of priority).

5. Develop preliminary renewable energy resource supply curves for wind and solar (using existing data).

Project Phase 3 - Collect Additional Wind and Solar Research Data and Develop a Plan for Integrating Renewable Energy Resources into the State's Energy Supply Mix.

1. Collect at least one year's worth of additional wind and solar data at selected locations (especially direct solar radiation data needed for concentrating systems) and provide recommendations for an on-going renewable resource assessment program.
2. Develop updated renewable energy resource supply curves for wind and solar energy.
3. Develop a plan for integrating renewable energy resources into the State's energy supply mix.
4. Coordinate this study with the Hawaii Integrated Energy Policy, Hawaii Energy Strategy, and Integrated Resources Planning programs.

PROJECT 4: DEMAND-SIDE MANAGEMENT (DSM) ASSESSMENT

Project 4 Purpose and Objectives.

Demand-side management is any utility activity aimed at modifying the customer's use of energy to produce desired changes in demand. It includes conservation, load management, and efficiency resource programs. DSM offers the potential for lower customer utility bills and avoidance of major plant investments. Benefits are also possible in reducing environmental impacts of utility energy supply production and potential diversification of resources. Moreover, the Public Utility Commission has directed Integrated Resource Planning which involves identification of the

resources or mix of resources for meeting near- and long-term consumer energy needs in an efficient and reliable manner at the lowest reasonable cost. DSM is considered a resource in Integrated Resource Planning.

The DSM Assessment Project will develop a comprehensive assessment of Hawaii's demand-side resources. Project objectives are as follows:

1. Develop a framework and format for end-use and DSM measures. Identify data gaps and establish a work plan for collecting missing data. Develop a measure database.
2. Conduct a state-wide assessment of end-use energy consumption by Island and sector, with an emphasis on the commercial sector. This will include establishing a base case, DSM measure screening, and identification of Hawaii-specific DSM Program concepts.
3. Identify the additional resource data requirements and an approach to obtain the necessary data and training for DSM program development and to conduct periodic end-use assessments.
4. Institutionalize a DSM assessment, characterization, and evaluation capability within DBED.
5. Collect data to fill in data gaps identified as a result of Hawaii Energy Strategy Project 1, Analytical Energy Forecasting Model, and this project's work.

How Project 4 Will Be Accomplished.

Much work has been accomplished on DSM and this project will build upon the previous work. This includes the following:

1. Report on Integrated Resource Planning in Hawaii by the Public Utilities Commission, August 1989.
2. Public Utilities Commission Integrated Resource Planning Docket, ongoing.

3. Act 319, passed by the 1990 Legislature amending the State Plan to include DSM in the State energy policy.
4. Energy Division Extrapolated Estimate of Oahu Electricity End-Use and Savings Potential, October 1990.
5. Report on Cooperative DSM Pilot Program Assessment for Kauai by DBED and Kauai Electric, October 1990.
6. Cooperative DSM Residential Lighting Demonstration Program by Kauai Electric and DBED, started in 1991.
7. Hawaiian Electric Company (HECO) DSM Commercial Lighting Pilot Program. started in 1991.
8. Integrated Resource Planning Workshop. December 1991.
9. Formation of a Database Task Force, including briefings for members on "End-Use Data Types and Sources", and study of database frameworks for end-use and measure databases beginning in 1992.
10. Demand-side Management Program Design, Planning, and Evaluation Workshop, May 1992.
11. Presentation by DBED staff on "What is DSM?" to Hawaiian Electric Company (HECO), Hawaii Electric Company (HELCO), Maui Electric Company (MECO), Kauai Electric (KE), and the Gas Company (GASCO) public information meetings on Integrated Resource Planning, May-June 1992.
12. Formation of HECO Demand-Side Management Advisory Group, DBED staff participation in meetings, ongoing.

13. Formation of HELCO, MECO, KE, and GASCO Advisory Groups and participation in meetings, ongoing.
14. Cooperative GASCO Residential Survey, July 1992.

Project activities will be coordinated with and consistent with utility Integrated Resource Planning as determined by Public Utilities Commission's Integrated Resource Planning Decision and Order 11630. Unless proprietary in nature, data collected under this project will be made public.

The project will be accomplished in three phases. Phase I will involve developing a framework and format for databases of end-use and DSM measures, identifying data gaps, establishing a work plan to collect missing data, and developing a measure database. Phase II will involve establishing a base case and conducting a state-wide DSM assessment by Island and sector and institutionalizing DSM assessment and evaluation capabilities within DBED. Phase III will involve collecting data identified by the project as necessary for DSM assessment.

Project 4 Deliverables.

1. End-Use database framework and format.
2. Measure database framework and format.
3. Measure database (DSM Measures Handbook).
4. Identification of available and unavailable data for demand-side assessment. (This will incorporate findings of HES Project 1 and HES Project 4 and may consist of several working memoranda throughout the term of the contract.)
5. Work plan for correcting data deficiencies, including gathering required data and an approach and long term plan for obtaining and maintaining the data required for DSM assessment and characterization of DSM measures. (This will incorporate findings of HES Project 1 and HES

Project 4 for end use and measure data) .

6. Database training.
7. DSM Opportunity Report detailing state-wide end-use energy consumption and savings potential by island and sector and initial DSM program recommendations.
8. Training in DSM characterization, assessment, and evaluation.
9. Memo recommending models, hardware, and software for DSM assessment.
10. Training in operating software and models.
11. Institutionalization of DSM characterization, assessment, and evaluation.
12. Training in DSM characterization, assessment, and evaluation.
13. Data collection, as required .
14. Coordination with HES Project 1.
15. Monthly narrative progress reports.
16. Quarterly Status Reports for the U.S. Department of Energy.
17. Draft Final Report, a comprehensive statement of the technical results of the work performed by task in a format to be provided by DBED.
18. Final report.

PROJECT 5: TRANSPORTATION ENERGY STRATEGY

Project 5 Purpose and Objectives. This project will develop a transportation energy strategy which addresses the areas of transportation energy demand and transportation energy supply. Hawaii's energy security would be improved by diversifying the fuels used for transportation and reducing dependency on imported fossil fuels. The transportation sector is

currently the largest energy-consuming sector in Hawaii, accounting for 63% of the petroleum demand. Local production of transportation fuels and feedstocks could also improve Hawaii's economic security and provide jobs for Hawaii's people.

Transportation Energy Demand.

Transportation planning has received a great deal of attention in Hawaii. However, energy concerns have not weighed heavily in transportation planning and energy demands have not been considered or quantified. In the short term, there are significant opportunities for energy efficiency and the use of alternate fuels in currently existing transportation plans. Evaluation and consideration, in the early stages of transportation planning, of the energy demands associated with each of the various transportation alternatives is necessary for the success of any long-term energy demand management and planning effort

The Transportation Energy Demand portion of this project will provide a basis for such management and planning. The objectives are as follows:

1. Assess energy requirements of current and proposed County, State, and regional transportation plans, taking into account air, ground, and marine transport fleet characteristics, fuel consumption levels trends and projections. Develop a transportation energy demand profile.
2. Identify energy savings potential in each (air ground, and marine) transportation sector.
3. Estimate potential for fuel substitution by alternative fuels in each transportation sector.

Transportation Energy / Fuels Supply

Development. Considerable activity in the area of alternative fuel production, demonstration, use and impacts has taken place and continues internationally, nationally, and locally. Locally, several studies, research, and demonstration projects on the production of fuels from biomass, and the use of alternative fuels and electric vehicles, have been carried out. In 1991, an *Evaluation of the Use by the State Motor Pool of Alternative Fuels* was completed at the request of the Hawaii State Legislature. The transportation

energy supply portion of the project will provide a basis for management and planning of transportation fuel supplies. The objectives are as follows:

1. Describe Hawaii's existing and potential transportation energy and fuels system, taking into account desired goals such as energy efficiency, energy security, appropriate costs price stability, environmental impacts, and overall benefits to the State economy. Refinery issues, vehicle availability, fuel production costs, infrastructure requirements, and various non-technical issues are to be included. Screening criteria, scoring scale, weighting factors, and rankings of various alternative energy and fuels technologies relative to Hawaii will be developed.
2. Identify and quantify indigenous resources for production of fuels and energy; identify and discuss the most promising conversion technologies and possible energy and fuel production costs.
3. Develop an action plan incorporating both short- and long-term steps for supplying transportation energy to meet future projected demand.

Integration and Recommendations:

1. Identify policies and actions with regard to the transportation sector for achieving overall goals of increasing energy security and efficiency of energy use, diversifying energy supply, enhancing stability, and maximizing local benefits.
2. Determine optimum transportation fuel and energy mix and implementation plan for each of the study's analysis years.

How Project 5 Will Be Accomplished.

Energy Division staff and the technical consultant, Parsons Brinckerhoff Quade & Douglas, Inc. (PBQD), in association with the Hawaii Natural

Energy Institute and Acurex Environmental, Inc., will develop the Transportation Energy Strategy with public input through the Hawaii Energy Strategy Public Participation Program.

Project 5 Deliverables.

1. Transportation Energy Demand.
 - a. Transportation Energy Demand Profile.
 - b. Energy Savings Potential.
 - c. Potential Use of Alternative Fuels.
2. Transportation Energy Supply.
 - a. Potential Transportation Energy and Fuels Systems.
 - b. Indigenous Resources.
 - c. Action Plan.
3. Integration and Recommendations.
 - a. Identify Policies, Actions, and Monitoring Programs.
 - b. Determine Optimum Fuel Mix and Implementation Plan
 - c. Prepare Transportation Energy Strategy.
4. General.
 - a. Provide DBED with Data and Analysis Tools.

PROJECT 6: ENERGY VULNERABILITY ASSESSMENT REPORT AND CONTINGENCY PLANNING

Project 6 Purpose and Objectives. This project will comprehensively assess Hawaii's vulnerability to energy supply disruptions and to evaluate the State's capability to effectively contend with an energy supply disruption. The objectives are as follows:

1. Report on the comprehensive assessment of Hawaii's vulnerability to energy supply disruptions.
2. Evaluate prospective industry and State emergency preparedness actions (initiatives and responsive) and acceptable levels of risk in view of potential vulnerabilities.
3. Identify potential initiatives and plans to enhance Hawaii's contingency planning and response capability to effectively contend with energy supply disruptions.

How Project 6 Will Be Accomplished.

Energy Division staff, with specialized technical support contractors (to be selected), will develop the vulnerability assessment, complete a contingency plan review and evaluation, and identify relevant initiatives. The U.S. Department of Energy will prepare reports relevant to establishment of regional petroleum reserves as may be required by Congress and will share them with Energy Division staff. Support contractors may conduct pertinent energy emergency simulations to be specified by the State of Hawaii and DOE.

Project 6 Deliverables. Project 6 will produce the following deliverables:

1. Report on vulnerability assessment.
2. Report on evaluation of prospective industry and state emergency preparedness actions, levels of risk, and potential initiatives and plans to enhance emergency preparedness .

PROJECT 7: ENERGY STRATEGY, INTEGRATION AND EVALUATION SYSTEM

Project 7 Purpose and Objectives.

Project 7 will integrate for implementation the findings of the overall Hawaii Energy Strategy program into a comprehensive State energy strategy. Policy, legislative, and regulatory initiatives for implementation and evaluation will be developed. The objectives are as follows:

1. Integrate and synthesize the Hawaii Energy Strategy program into a final report. Facilitate the integration of information between the other six projects and inclusion of that information in the final report.
2. Presentation of the draft final report to the public to obtain feedback for inclusion in completing the final published report.
3. Identify, assess and recommend the optimal public policy mechanisms (e.g., legislative, regulatory, or both) by which to implement a least-cost strategy for energy (regulated and non-regulated) development in Hawaii.
4. Use existing energy policy and planning management frameworks for synthesis, integration, implementation, and evaluation of policy and planning initiatives that will emerge from the component projects of the proposed development of a State energy strategy.
5. Develop, propose, implement, and evaluate policy initiatives and plans to institutionalize an energy strategy performance management system within State government (this may include legislative proposals that may be required to levy data reporting requirements to achieve this objective).
6. Develop an energy externalities cost/benefit accounting system for the State of Hawaii.
7. Write a detailed written report with a stand-alone summary version to describe the outcomes of this and other Hawaii Energy Strategy projects in an integrated, logically sequenced manner. Coordination of format and input content with other Hawaii Energy Strategy projects will be required. Prepare in a format for publication.

How Project 7 Will Be Accomplished.

The Energy Division staff will accomplish program objectives and integrate the findings of the component projects of the overall Hawaii Energy Strategy program. The externalities portion of the project will be coordinated with the relevant methodology(ies) which may be employed by the Hawaii Public Utilities Commission in its energy utility Integrated Resource Planning Procedures.

The final report will present an analysis and recommendations for legislative and/or regulatory mechanisms by which to develop Hawaii's regulated and non-regulated energy resources at the least possible cost to Hawaii's society.

The ongoing Hawaii Integrated Energy Policy (HEP) process and organizational structure will be used as the principal means to conduct the comprehensive management functions described as project objectives. It will include drafting proposed legislative, regulatory, and other policy initiatives required to implement, monitor, and evaluate the energy strategy developed within the framework of the overall program.

Project 7 Deliverables.

1. Comprehensive report on the development of the Hawaii Energy Strategy. The report will incorporate the integrated findings of the component projects of the overall energy strategy program. Included in this report should be recommendations for preferred near-, mid-, and long-term fossil fuel mix goals to meet fuel diversification objectives for Hawaii and the Pacific region. The study must also consider the future potential of increased use of renewables and demand-side management and attendant effects on reducing vulnerability. This report will also present an analysis and recommendations for legislative and/or regulatory mechanisms by which to facilitate development of Hawaii's regulated and non-regulated energy resources at the least possible cost to Hawaii's society.
2. A simple, spreadsheet based, computerized performance management system to monitor and evaluate the progress and effectiveness of the implementation of policy initiatives and plans which result from the various components of the integrated State energy strategy.
3. Training of existing Energy Division staff to operate and update the performance management system.
4. An energy externalities cost/benefit accounting system which includes the following:
 - a. An assessment of existing energy externalities cost/benefit accounting systems;
 - b. An energy externalities cost/benefit accounting system for the regulated and non-regulated sectors for Hawaii, which ensures total fuel cycle costs and benefits are considered in energy planning and development in these sectors;
 - c. Evaluation and proposals regarding externalities cost/benefit accounting systems in support of Integrated Resource Planning proceedings; and
 - d. A set of recommended public policy mechanisms (e.g., legislative, regulatory, or both) to implement the energy externalities cost/benefit accounting system for the regulated and non-regulated energy sectors in Hawaii.
5. A "package" of proposed legislative, regulatory, and other policy initiatives to implement the energy strategy developed within the framework of the overall program.

SECTION V. HAWAII ENERGY STRATEGY PROGRAM/PROJECT MANAGEMENT AND COORDINATION

Hawaii Energy Strategy Management Team and Organization. (See Appendix 2 for a directory.) The Hawaii Energy Strategy is a cooperative effort between the State of Hawaii Energy Division and the United States Department of Energy. The Energy Program Administrator, Maurice H. Kaya, is the Energy Division's Hawaii Energy Strategy Program Manager and Principal Investigator, and Jay Braitsch, Deputy Director, Office of Planning & Environment is the Department of Energy's Program Manager.

The Energy Division Hawaii Energy Strategy Program Manager and his subordinate Project Coordinators and Project Managers manage the day-to-day activities of the program. The Energy Division designed the overall program in consultation with the Department of Energy. The Energy Division subsequently issued requests for proposals, received and evaluated the proposals, recommended their selection to the Director of DBED, and developed the details of contracts with the consultants selected. While working with the consultants on the execution of the projects, the Energy Division Hawaii Energy Strategy Project and Program Managers keep their corresponding Department of Energy Managers apprised of major activities. Department of Energy Managers provide guidance and recommendations as appropriate.

HAWAII ENERGY STRATEGY MANAGEMENT TEAM

The Hawaii Energy Strategy Management Team is as follows:

Position	State of Hawaii Energy Division	U.S. Dept. of Energy
Program Manager	Maurice Kaya	Jay Braitsch
Program Coordinators	John Tantlinger Steven Alber	
Project 1 Manager	Vicky Chiu-Irion	Rich Dye
Project 2 Manager	Steven Alber	Rich Dye
Project 3 Manager	Tom O'Brien	Andrew Krantz
Project 4 Manager	Carilyn Shon	Diane Pirkey
Project 5 Manager	Tom O'Brien	David Rodgers
Project 6 Manager	John Tantlinger	Glenn Coplon
Project 7 Managers	John Tantlinger & Steven Alber	Jay Braitsch

The Hawaii Energy Strategy Program Management Structure is depicted in Figure 1 on the next page.

HAWAII ENERGY STRATEGY DEVELOPMENT PROGRAM

FIGURE 1
PROGRAM MANAGEMENT

Hawaii Energy Strategy Consultant Teams. Consultants have been selected to provide technical support to most of the Hawaii Energy Strategy projects. The following lists the consultant for each project and the consultant's Project Manager:

Project 1	Barakat & Chamberlin, Inc. Dr. Andrew A. Goett
Project 2	East-West Center Energy Program Dr. David Issak
Project 3	R. Lynette & Associates Ms. Karen Conover
Project 4	Barakat & Chamberlin, Inc. Mr. Dan Frederick
Project 5	Parsons Brinckerhoff Quade & Douglas, Inc. Dr. David Atkin

Consultants for Projects 6 and 7 have not been selected at this time.

Hawaii Energy Strategy Project Interrelationships. The seven Hawaii Energy Strategy Projects are interrelated. Communication and coordination between the projects is essential to preclude delays, duplication of effort, and gaps between the projects.

Inter-Project Communication and Coordination.

Energy Division Principal Investigator.

The Energy Division Principal Investigator is responsible for the overall program. He selected Energy Division Program Coordinators and Project Managers. He oversees the consultant selection process and signs contracts with the consultants on behalf of DBED. He sets overall policy, provides direction, and guidance.

Energy Division Program Coordinators.

The Energy Division Program Coordinators are providing several means to assist the Project Managers and the consultants in coordinating their efforts. These include:

- The *Hawaii Energy Strategy Program Guide*;
- The original *Proposal for the Development of an Integrated Energy Strategy for the State of*

Hawaii, November 22, 1991;

- Data Flow Diagrams;
- A periodically updated Critical Path Method (CPM) chart;
- Conducting Hawaii Energy Strategy Task Force Meetings with minutes approximately every three weeks;
- Memorandums providing guidance for specific issues;
- Standardized contract formats;
- Draft outline of Hawaii Energy Strategy Final Report as a guide to project input form and content (Appendix 3); and
- Consultation .

Energy Division Project Managers.

Energy Division Project Managers play a critical role by sharing information between projects and ensuring their requirements of other projects are stated as early as possible. They also are responsible for assisting coordination between the consultant supporting their project with other consultants involved in other Hawaii Energy Strategy projects.

Department of Energy Project Managers.

Department of Energy Project Managers provide guidance and recommendations to the Energy Division Project Managers from a U.S. Department of Energy perspective and monitor the progress of the program and its compliance with DOE requirements.

Consultant Project Managers.

Consultant Project Managers also play a major role in coordination. As they work on tasks for their projects, they convey information requirements from other projects to their Energy Division Project Manager. Direct liaison with other consultants will be arranged by Energy Division Project Managers as required.

SECTION VI. HAWAII ENERGY STRATEGY PUBLIC PARTICIPATION PROGRAM

Public Participation Program. The Hawaii Energy Strategy Public Participation Program includes direct public participation and a public information program. Direct public participation includes two elements — Technical Advisory Groups under the auspices of the Energy Policy Advisory Committee and formally established opportunities for participation by the general public.

Technical Advisory Groups. Technical Advisory Groups are based on the Energy Policy Advisory Committee (EPAC) and its Integration Group (IG) established during the development of the Hawaii Integrated Energy Policy. The Committee and IG are comprised of members of Hawaii's "energy community", including energy companies, utilities, environmental groups, and State and County government organizations. The EPAC continues to serve as advisors to the Director of DBED in his role as Hawaii's Energy Resources Coordinator. Sub-committees were formed by project groups for periodic review of the progress and results of each project. The sub-committees will establish the frequency of their review. The following subcommittees were formed:

- Forecasting and Demand-Side Management. (Projects 1 and 4)
- Fossil Fuels and Renewable Energy. (Projects 2 and 3)
- Transportation. (Project 5)
- Energy Emergency Preparedness. (Project 6)

The technical review of Project 7, the Energy Strategy Integration and Evaluation System, will involve the Integration Group as a whole.

Public Involvement. Public involvement is based upon an introductory Hawaii Energy Strategy Workshop held on October 23, 1992. The purpose of the Workshop was to provide the general public with information about the Hawaii

Energy Strategy program and to invite comments, ideas, and suggestions for additional public participation. Once a draft Hawaii Energy Strategy report has been completed and approved for review, state-wide public review meetings will be conducted to provide the general public with a final opportunity to provide their recommendations before the report is finalized.

The Workshop was announced via press and invitations to people who have shown an interest in energy issues in the past. Copies of the *Hawaii Energy Strategy Program Guide* were sent to registrants. People unable to attend were able to request the Workshop Package and a Questionnaire to provide their ideas.

The Workshop included a briefing on Hawaii Energy Strategy, presentation of overviews of each project, and group discussion of the projects in separate groups. Group discussions sought to determine how the projects could be improved, what would be the most effective and efficient means of public participation in the Hawaii Energy Strategy program between the introductory workshop and final public review meetings, how participants recommended we reach the general public with information on Hawaii Energy Strategy, and what the participant's preferred vision for Hawaii's energy future was. Two iterations of group discussions were held, following which the discussion leaders, from the Center for Alternative Dispute Resolution, reported the results. A questionnaire was also given to participants to obtain their written input.

The results of the workshop have been compiled in the Proceedings of the Hawaii Energy Strategy Workshop. Copies were provided to all participants and are available from the Energy Division.

Taking the results and recommendations of the Workshop into account, the Energy Program Administrator and the Hawaii Energy Strategy Program Managers will establish an appropriate follow-on public participation program.

Public Information Program. The Hawaii Energy Strategy public information program will include news releases on Hawaii Energy Strategy program and individual projects; articles for business, trade, and general interest magazines; speakers for interest groups and other organizations.

Appendix 1 Hawaii Energy Strategy Program Schedule

Appendix 2

Hawaii Energy Strategy Directory

State of Hawaii
Department of Business, Economic Development & Tourism
Energy Division
335 Merchant Street, Room 110
Honolulu, Hawaii 96813

Program Manager and
Principal Investigator: Maurice Kaya (808) 587-3812

Program Coordinators: John Tantlinger 587-3805
Steven Alber 587-3837

Project 1 Manager: Vicky Chiu-Irion 587-3838

Project 2 Manager: Steven Alber 587-3837

Project 3 Manager: Tom O'Brien 587-3815

Project 4 Manager: Carilyn Shon 587-3810

Project 5 Manager: Tom O'Brien 587-3815

Project 6 Manager: John Tantlinger 587-3805

Project 7 Managers: John Tantlinger 587-3805
Steven Alber 587-3837

United States Department of Energy

Program Manager: Jay Braitsch, Deputy Director
Office of Planning and Environment (FE-4)
U.S. Department of Energy
Washington, DC 20585 (202) 586-4680

Project 1 Manager: Richard A. Dye
Office of Planning and Environment (FE-4)
U.S. Department of Energy
Washington, DC 20585 (202) 586-6499

Project 2 Manager: Richard A. Dye
(see above)

Project 3 Manager: Andrew Krantz
Office of Technical Assistance (CE-54)
U.S. Department of Energy
Washington, DC 20585 (202) 586-5335

Project 4 Manager: Diane Pirkey
Office of Energy Demand Policy (PE-50)
U. S. Department of Energy
Washington, DC 20585(202) 586-4839

Project 5 Manager: David Rodgers
Biofuels Systems Division (CE-331)
U.S. Department of Energy
Washington, DC 20585(202) 586-5348

Project 6 Manager: Glenn Coplon
Office of Energy Emergency Operations (IE-24)
U.S. Department of Energy
Washington, DC 20585(202) 586-1311

Project 7 Manager: Jay Braitsch
(see above)

Hawaii Energy Strategy Consultant Teams

Project 1 Dr. Andrew A. Goett
Barakat & Chamberlin, Inc.
1800 Harrison Street, 18th Floor
Oakland, CA 94612(510) 893-7800

Project 2 Dr. David Issak
East-West Center Energy Program
East-West Center
1777 East-West Road
Honolulu, HI 96848(808) 944-7541

Project 3 Ms. Karen Conover
R. Lynette & Associates
15042 N.E. 40th Street, Suite 206
Redmond, WA 98052(206) 885-0206

Project 4 Mr. Dan Frederick
Barakat & Chamberlin, Inc.
1800 Harrison Street, 18th Floor
Oakland, CA 94012(510) 893-7800

Project 5 Dr. David Atkin
Parsons Brinckerhoff Quade & Douglas, Inc.
Two Waterfront Plaza, Suite 220
500 Ala Moana Boulevard
Honolulu, HI 96813(808) 531-7094

Appendix 3

Hawaii Energy Strategy Draft Final Report Outline

THE HAWAII ENERGY STRATEGY EXECUTIVE SUMMARY

- i. Introduction
- ii. Table of Contents
- I. Purpose and Background (include how HES was prepared)
- II. Hawaii's Current Energy Situation
- III. Hawaii's Energy Future
- IV. Hawaii's Possible Energy Futures (scenarios)
- V. A Preferred Energy Future for Hawaii
- VI. Hawaii's Energy Strategy
 - A. Short-term Action Plan (Energy Functional Plan)
 - B. Long-term Action Plan

THE HAWAII ENERGY STRATEGY VOLUME

- i. Introduction
- ii. Table of Contents
- I. Purpose and Background
 - A. An Energy History of Hawaii
 - B. The National Energy Strategy and Hawaii
 - 1. Background
 - 2. Status of Implementation
 - C. The Hawaii Integrated Energy Policy (HEP)
 - 1. Hawaii's Energy Policy Statement
 - 2. Background
 - 3. Status of Implementation
 - D. The Hawaii Energy Strategy (HES) (description of component projects)
 - 1. Energy Forecasting
 - 2. Fossil Fuel Assessment
 - 3. Renewable Energy Assessment
 - 4. Demand-Side Management Assessment
 - 5. Transportation Energy Strategy
 - 6. Contingency Planning

- 7. Integration and Evaluation
- E. Description of Scenarios and The Integrated Approach
- F. Hawaii's Biennial Planning Process (proposed)
- II. The Problem: Hawaii's Current Energy Situation
 - A. Hawaii's Energy Supply
 - 1. Fossil Fuels (from fossil fuel study; includes transportation, refinery, and storage aspects)
 - 2. Renewable Energy
 - 3. Energy Efficiency (role in meeting demand)
 - B. Hawaii's Energy Demand
 - 1. Residential Energy Demand
 - 2. Commercial Energy Demand
 - 3. Industrial Energy Demand
 - 4. Agricultural Energy Demand
 - 5. Transportation Energy Demand
 - C. Energy, the Economy, and the Environment
 - 1. Energy Prices
 - 2. Environmental Impacts
 - 3. Externalities
 - D. Contingency Planning to Ensure Hawaii's Energy Needs
- III. Hawaii's Energy Future
 - A. Fossil Fuels in Hawaii's Future
 - 1. Overview
 - 2. Oil and Petroleum Products
 - 3. Natural Gas (LNG)
 - 4. Coal
 - B. Renewable Energy in Hawaii's Future
 - 1. Overview
 - 2. Biomass
 - 3. Geothermal Energy
 - 4. Hydropower
 - 5. Wind Energy
 - 6. Solar Energy
 - 7. Ocean Thermal Energy Conversion
 - 8. Wave Energy
 - C. Energy from Hawaii's Regulated Utilities in the Future
 - 1. Integrated Resource Planning
 - 2. Energy Supply

- a. Electricity
 - b. Gas
 - 3. Demand-Side Management
 - a. Electricity
 - b. Gas
 - D. Transportation Energy in the Future
 - 1. Projected Transportation Energy Demand
 - a. Air
 - b. Ground
 - c. Marine
 - 2. Future Transportation Energy Supply Options
 - a. Air
 - b. Ground
 - c. Marine
 - E. Contingency Plans for the Future
 - F. Hawaii's Future: Energy, the Economy, and the Environment
- IV. Hawaii's Possible Energy Futures (2, 5, 10, and 20 year or 3, 6, 9, and 21 year projections)
- A. Base Case
 - 1. Total Energy Demand (state and county/island breakdown)
 - 2. Supply Portfolio
 - 3. Demand-Side Management and Conservation
 - 4. State/County Fiscal Outlays and Receipts
 - 5. End-Use Consumer Costs (cents/kWh electricity, \$/therm gas, \$/gallons liquid fuels)
 - 6. Externalities (e g , emissions , jobs)
 - 7. Technology
 - B. Recessionary Case
 - 1. Total Energy Demand (state and county/island breakdown)
 - 2. Supply Portfolio
 - 3. Demand-Side Management and Conservation
 - 4. State/County Fiscal Outlays and Receipts
 - 5. End-Use Consumer Costs (cents/kWh electricity, \$/therm gas, \$/gallons liquid fuels)
 - 6. Externalities (e g , emissions, jobs)
 - 7. Technology
 - C. Pessimistic Case
 - 1. Total Energy Demand (state and county/island breakdown)
 - 2. Supply Portfolio

- 3. Demand-Side Management and Conservation
 - 4. State/County Fiscal Outlays and Receipts
 - 5. End-Use Consumer Costs (cents/kWh electricity, \$/therm gas, \$/gallons liquid fuels)
 - 6. Externalities (e g , emissions, jobs)
 - 7. Technology
- V. Hawaii's Preferred Energy Future
 - A. Total Energy Demand (state and county/island breakdown)
 - B. Supply Portfolio
 - C. Demand-Side Management and Conservation
 - D. State/County Fiscal Outlays and Receipts
 - E. End-Use Consumer Costs (cents/kWh electricity, \$/therm gas,\$/gallons liquid fuels)
 - F. Externalities (e g , emissions, jobs)
 - G. Technology
- VI. Hawaii's Energy Strategy
 - A. Short Term Action Plan
 - B. Long Term Action Plan
- VII. References
- VIII. Glossary (Definitions of words and acronyms)
- XIV. Index
- X. Appendices
 - A. Forecasting Model(s)
 - B. Scenario Assumptions
 - C. Others

END

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