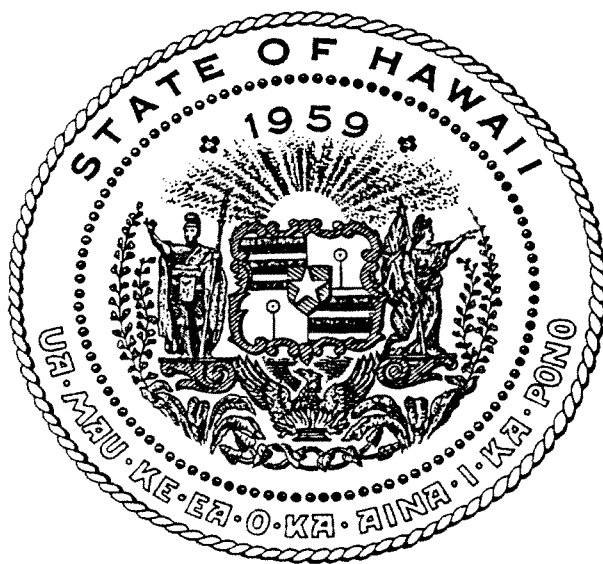


# Energy Division

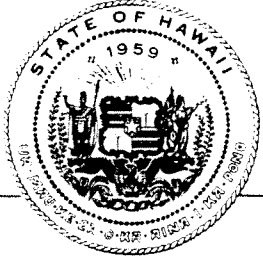
## Energy Program Transition Plan



Prepared by the Hawaii Energy Division

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April 1992



DEPARTMENT OF BUSINESS,  
ECONOMIC DEVELOPMENT & TOURISM

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92:0097L-002

April 22, 1992

MEMORANDUM

TO: Energy Division Staff


FROM: Maurice H. Kaya

SUBJECT: Energy Program Transition Plan "White Paper"

This is to provide you with the enclosed subject "white paper" for your reference. I would also like to thank all of you for your part in the development of this plan.

Quarterly meetings will be conducted to review our progress in the accomplishment of our objectives and in implementing the transition plan. Our next quarterly "progress" review is scheduled for June 9, 1992, as part of our regular "Division" meeting. In this meeting, please be prepared to report briefly on the objectives which you have been assigned, as part of our Energy Program Transition Plan.

Thank you again for your contributions to our planning efforts, and for your continued support.



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Enclosure

MHK/JB

cc: Murray E. Towill  
Takeshi Yoshihara

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# **ENERGY PROGRAM TRANSITION PLAN**

## **A WHITE PAPER**

### **The Problem**

Petroleum Violation Exxon (federal) funds are diminishing, will expire, and will represent the loss of 46% of current energy program funds. Without supplemental funding, program effectiveness may be severely hampered; and

Over the last seventeen years, \$80 million have been expended to increase Hawaii's energy self-sufficiency -- one of the State's statutory energy objectives -- but with little statistical progress made to reduce the State's extreme dependence (92%) on imported petroleum and other fossil fuels.

### **Energy Program Transition Plan Purpose**

To develop a transition plan to increase Energy Program self-sufficiency by strengthening in-house expertise and the program support base with other-than-Federal funding; and

Focus program activities for maximum efficiency and effectiveness to achieve the State's energy objectives.

## **Energy Program Transition Planning Process**

The steps in the planning process to transition the Energy Program are illustrated in Chart 1. This process serves as a framework for determining organizational requirements through the identification of essential functions, assessing functional strengths and gaps, and reassessing objectives and priorities. The remaining steps comprehensively examine the organization to determine ideal resource requirements, funding strategies, resource availability, and performance requirements for effective accomplishment of the Energy Division's mission and goals.

## **Energy Division Mission Statement**

Increase Hawaii's energy self-sufficiency, while supporting efficient, reliable, economic and environmentally responsible energy systems capable of meeting Hawaii's needs.

## **Energy Division Goals**

Provide leadership to Hawaii's energy community by:

1. Reducing Hawaii's dependence on imported fossil fuels;
2. Influencing the mix of supply-side and demand-side resources to optimize economic and societal costs of reliable energy services;
3. Increasing public awareness of energy issues; and

4. Providing the State with energy security and emergency preparedness.

## Functional Analysis Summary

- **Consultants' findings & recommendations**

A key finding of the institutional analysis for the Hawaii Integrated Energy Policy Development Program (HEP) concluded that critical State energy management functions needed to be strengthened, particularly forecasting and planning capabilities. Also, this analysis found that staff levels and training were insufficient. A summary of the functions examined, criteria used, and analysis results are provided in Charts 2, 3, and 4.

The HEP recommendations developed in response to these findings with regard to exercising more effective organizational leadership in energy are as follows:

- Establish a proactive new role for State government and strengthen its functional capabilities;
- Establish a comprehensive energy planning process to carry out the above role; and

- Establish a stable resource base to sustain energy program staff and program activities.

- **Energy Division “Essential Functions”**

The HEP process identified and recommended twelve essential energy management functions, which were developed from task force discussion, comments received from public information meetings, and an institutional analysis. These functions are summarized in Chart 5. These functions were validated as essential to mission accomplishment in the November 1991 Energy Division strategic planning retreat.

### **Energy Division Objectives (*Prioritized*)**

The criteria used to select and assess Energy Division objectives are as follows:

1. High energy savings potential;
2. Displacement of fossil fuels is significant;
3. Dollar savings is substantial;
4. Impact on target audience is sizable; and
5. Supports accomplishment of Energy Division mission and goals.

<b>CONSERVATION OBJECTIVES</b>	<b>DEADLINE</b>	<b>LEAD</b>	<b>PRIORITY*</b>
1. Building Code Implementation.....		<b>H. Wiig</b>	<b>A</b>
• Final Draft	4/92		
• Manual	7/92		
• Implementation all Four Counties	12/92		
2. Educational/Informational			
• Schools.....		<b>S. Kam</b>	<b>A</b>
- Gather Curriculum	8/92		
- Need Program	ongoing		
- Redefine Target Groups	1/92		
- Develop/Establish Energy Cadre (Made up of Teachers/Students)	8/92		
- Implement In-Service Training Program (i.e., 1/2 Credit Course or 3 hour Non-Credit Course)	8/92		
• Professional/Commercial Sector.....		<b>S. Kam</b>	<b>B</b>
- Architects; Engineers; Contractors	12/91		
General Business (Small and Large)			
- Meeting	12/92		
• Government.....		<b>S. Kam</b>	<b>B</b>
- Elected Representatives	(i.e., Spring		
and County Code Officials -	PV Workshop)		
• General Public			
3. Integrated Resources Planning.....		<b>L. Udui</b>	<b>A</b>
• Participate in PUC Docket	As Needed		
- Interim Technical Assistance	12/91		
- Technical Assistance Hired	3/92		
- Workshops	TBD		
- Participate Collaborative Meetings	As Needed		
- Collaborative Fund Administration	3/92		

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\* The priority levels and the objectives of this plan are as follows:  
A = Absolutely must-do to accomplish mission.  
B = Priority, but not absolutely essential to mission accomplishment.  
C = "Nice To Do."

<u>CONSERVATION OBJECTIVES</u>	<u>DEADLINE</u>	<u>LEAD</u>	<u>PRIORITY*</u>
4. Demand Side Management Programs and Resource Assessment (Data Base).....		<b>L. Udui</b>	A
• DSM Data Base, First Data Base	9/92		
- Kauai DSM Project Interfaces	6/92		
- HECO DSM	ongoing		
5. Retrofits and Audits			
• Green Lights Partner.....	3/92	<b>H. Wiig</b>	A
- ICP Cycle XIV - Grant Application	4/92		
- DOT Street Lighting	11/92		
- Complete all Old ICP Projects	9/92		
- Third Party Financing - Green Lights Buildings	9/92		
- Audit, Follow Up On, Six Major Buildings	10/92		
• Revise Dollars from Sense Program.....	3/92	<b>M. Bean</b>	A
- \$500K for Retrofitting State Facilities	ongoing		
• Ice Storage Contract to HECO.....	6/92	<b>M. Bean</b>	A
• Heat Pipe Money to DAGS and implement installation.....	6/92	<b>M. Bean</b>	A
• Audits and Assistance to Other Departments.....	ongoing	<b>M. Bean</b>	B
6. Housing, Finance, & Development Corp. Policy.....		<b>L. Udui</b>	A
• Board to Adopt an Administrative Requirement Regarding Energy Efficiency	6/92		
- First Report on Financial Impact of Energy Efficiency Water Heating on Affordable Housing	12/92		
7. Reports - Ongoing			
• Management Summary Report.....	Quarterly	<b>C. Shon</b>	A
- Legislative Report on PVE Funds	January		
- Annual Oil Overcharge Reports	July		

\* The priority levels and the objectives of this plan are as follows:

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<b>ALTERNATE ENERGY OBJECTIVES</b>		<b>DEADLINE</b>	<b>LEAD</b>	<b>PRIORITY*</b>
10.	Renewable Resource Assessment.....		<b>T. O'Brien</b>	
	• Lynette Study - Completed	3/92		A
	• DOE/DBED Study RFP out	4/92		A
	- Consultant Contract	6/92		
	- Legislative Action	4/93		
11.	Alternative Energy Technology.....		<b>T. O'Brien</b>	
	• Development (R, D, D & C)			A
	- Alternate Fuels Production Economics	6/93		
	- Biomass Gasifier	12/94		
	- Kahua West Pumped Hydro	3/94		
	- Kailua Waste Water Methane	6/94		
	- Milolii PV Housing	6/93		
	- Molokai Wind/Diesel Hybrid	8/93		
	- Solar Assessment	2/93		

<b>GEOHERMAL OBJECTIVES</b>		<b>DEADLINE</b>	<b>LEAD</b>	<b>PRIORITY*</b>
12.	Geothermal.....		<b>D. Nakano</b>	
	• Final Master Development Plan	12/92		A
	• Draft EIS Started	7/92		A
	• First Geothermal Energy on Line	4/92		A

<b>PLANNING AND RESOURCE OBJECTIVES</b>		<b>DEADLINE</b>	<b>LEAD</b>	<b>PRIORITY*</b>
13.	Funding - Permanent State Funding.....		<b>M. Kaya</b>	A
	• Budget Due	9/92		
	• Funding and Reorganization			
	- Develop Legislative Package	9/92		
	- Develop Funding Needs	8/92		
	- Establish Most Effective Organization	6/92		

\* The priority levels and the objectives of this plan are as follows:

A = Absolutely must-do to accomplish mission.

B = Priority, but not absolutely essential to mission accomplishment.

C = "Nice To Do."

<b>PLANNING AND RESOURCE OBJECTIVES</b>	<b>DEADLINE</b>	<b>LEAD</b>	<b>PRIORITY*</b>
14. Regional Petroleum Reserve.....		<b>J. Tantlinger</b>	
• DOD/State/DOE Agreement on RPR	12/92		B
• Guaranteed Access	Ongoing		B
15. Implement HEP.....		<b>J. Tantlinger/ S. Alber</b>	
• Legislative Package ('92 Session).....	12/91.....	<b>J. Tantlinger</b>	A
• Coordinate Implementation Plan.....		<b>J. Tantlinger/ S. Alber</b>	A
and Initiate HEP Recommendations:			
- Near-Term	12/92		
- Mid-Term	12/93		
- Long-Term	12/95		
• Legislative Package ('93 Session).....	8/92.....	<b>S. Alber</b>	A
16. Energy Division Office			
• Facilities			
• Office Equipment			
• Standardized Procedures - Draft Manual.....	8/92.....	<b>B. Funayama</b>	B
17. Modeling			
• Release HES Project #1 RFP.....	12/91.....	<b>V. Chiu-Irion</b>	A
- Select Contractor	2/92		
- Start Work	3/92		
- Preliminary Model(s) Up and Running	9/92		
• Data Base.....		<b>L. Zane/ V. Irion</b>	A
- Energy Data Base and Promote	continuing		
Collection of all Energy-Related Data			
18. Kauai Survey Tabulation and Analysis.....		<b>V. Chiu-Irion</b>	
• Fall '90 Survey	4/92		A
• Residential Lighting Demonstration	Ongoing		A
Survey			

\* The priority levels and the objectives of this plan are as follows:

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<b>PLANNING AND RESOURCE OBJECTIVES</b>		<b>DEADLINE</b>	<b>LEAD</b>	<b>PRIORITY*</b>
19.	Energy Emergency Preparedness.....		<b>J. Tantlinger/ J. Bac</b>	
	• Assist Counties Develop EEP Plans.....	12/92.....	<b>J. Bac</b>	A
	• Energy Div. Staff Mobilization exercise.....	7/92.....	<b>J. Bac</b>	B
	• Establish EEP GIS System.....	9/92.....	<b>J. Bac</b>	B
	• Complete Aviation Fuels Study.....	8/92.....	<b>J. Tantlinger</b>	B
20.	Program Evaluation.....	ongoing.....	<b>M. Kaya</b>	A
	• Team Building Workshop	3/92		C
21.	Reports - Ongoing			
	• CIP Report.....	3rd Quarter.....	<b>L. Zane</b>	A
	• Variance (Annual).....	3rd Quarter.....	<b>L. Zane</b>	A
	• ERC Report.....	4th Quarter.....	<b>S. Kam</b>	A
	• BTU Saving.....	4th Quarter.....	<b>L. Zane/ D. Kawakami</b>	A
	• Financial Status Report.....	Quarterly.....	<b>J. Pang</b>	A
	• Annual Expenditure Plan (GF & FED)....	August & April.....	<b>J. Pang</b>	A
	• Contract Status Report.....	Monthly.....	<b>J. Pang</b>	A
	• Budget Variance Report (Internal).....	Quarterly.....	<b>J. Pang</b>	A
	• Inventory.....	Quarterly.....	<b>J. Pang/ L. Zane</b>	A
	• Legislative Report on PVE Funds.....	Annual.....	<b>J. Pang</b>	A
	• Annual Oil Overcharge Report.....	July.....	<b>J. Pang</b>	A
22.	HES Program Management Assistance.....	ongoing.....	<b>J. Tantlinger/ S. Alber</b>	
	• Develop/Maintain HES Program Management System.....	7/92 - 1/95.....	<b>S. Alber</b>	A
	• Development of Externalities Accounting System, Project #7.....	12/93.....	<b>J. Tantlinger</b>	A
	• Develop Performance Management System, Project 7.....	1/95.....	<b>S. Alber/ J. Tantlinger</b>	A

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<u>PLANNING AND RESOURCE OBJECTIVES</u>	<u>DEADLINE</u>	<u>LEAD</u>	<u>PRIORITY*</u>
HES Program Management Assistance			
• Conduct Interim Externalities Workshop.....	5/92.....	<b>J. Bac/ E. Udui</b>	A
• Contingency Planning, Project 6.....	11/94.....	<b>J. Tantlinger</b>	A
• Fossil Fuels & Coal Review Final Report.....	7/93.....	<b>L. Zane</b>	A
23. Provide Energy Related Legislative Support to Director, DBED.....	Annually..... Jan-Apr	<b>M. Kaya</b>	A

## Energy Program Resource Summary

### - Organizational structure

An HEP institutional analysis (by RCG, Hagler, Bailly, Inc.), a strategic planning assessment (by Dr. Theodore Helmer, Professor of Strategic Planning, Northern Arizona University), and an energy emergency preparedness (EEP) evaluation (by Ms. Susan Brown, Manager, Fuels Planning Office, California Energy Commission) of the Energy Division suggested strengthening of the State's energy organization to improve energy programs.

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The HEP institutional analysis found that energy management in Hawaii was organizationally fragmented and that strengthened legislative authority was indicated. Critical energy management functions needed strengthening, particularly energy demand/supply forecasting and comprehensive planning. Further, the HEP analysis suggested the establishment of a new State energy agency to increase the stature of, and administrative emphasis on, energy activities.

The assessment by Dr. Helmer found that there exists an opportunity for improved coordination and interface within the existing organization. This assessment supported the establishment of a Planning, Policy, & Resources Branch to integrate functions and provide clearer lines of coordination and interface. The function of this Branch would be to assist the Program Administrator to coordinate and integrate the functions of the other two branches by consolidating and performing the data services, accounting, planning, and policy analysis functions.

The evaluation by Ms. Brown noted the absence of permanent in-house EEP functional capability to do comprehensive fuels planning and forecasting for the purpose of oil supply and price monitoring, and related data management and analysis activities to support

contingency planning and emergency response. This evaluation supported the consolidation of these two components of the EEP function and the replication of the California fuels planning office (on a smaller scale) to handle fuels planning, forecasting, contingency planning, and energy emergency response within a single office. The benefits of this reorganization would be greater efficiency in the use of existing resources resulting from the linking of closely related analytical functions requiring similar staff expertise.

The above cited analyses suggested that organizational restructuring will improve performing critical State energy management functions such as supply/demand forecasting, data analysis, comprehensive planning, and integration and coordination functions. To improve performance through organizational restructuring, action has been initiated to recommend the formation of an Energy Planning, Policy and Resources (PPR) Section, and later possibly a PPR Branch within the Division.

- **Staff**

The energy program expenditure plan's downward projection in Chart 9, illustrates the expected impact of diminishing PVE funds in supporting future program requirements involving salary and contract staff. Program

management is currently provided by staff, two-thirds of whom are supported by federal PVE funds and not by State funded positions. Consequently, the loss of PVE funds is expected to severely affect programs as experienced staff is lost due to budget limitations. Therefore, DBED's Director supports as a priority the appropriation of State funds to permanently support energy program functions and staff.

## - **Funding**

### **Budgetary History**

One step in the transition planning process (Chart 1) was to develop a funding history of energy program expenditures (Charts 6, 7, and 8). These charts show expenditure by program measure for the broad functional areas in which funds are allocated, and by program areas under the program measures.

### **Budgetary Projections**

Chart 9 reflects the expenditure plan to stretch remaining federal funds to 1997. Federal funds support about one-half contract service and two-thirds of staff. An HEP recommendation supports the use of State funds to make up the shortfall in federal funds.

## **Organizational Issues**

Concurrent with the transition planning process the Energy Division has begun implementation of a performance management system to address organizational issues, such as the determination of priorities, performance measurement, and increase teamwork. The Division's strategic planning activities provide the context to identify, discuss and resolve organizational issues. Quarterly meetings are planned to maintain focus on and to evaluate progress toward the accomplishment of Energy Division mission, goals and objectives.

## **Conclusions**

The following conclusions are drawn from the discussion above:

- There is recognition of, and an ongoing effort to provide more effective energy programs through the Division's strategic planning process and performance management system;
- The loss of Federal PVE funds will occur and is likely to adversely impact program effectiveness if alternative funding is not established;
- To strengthen performing critical energy management functions, an organizational restructuring of the Energy Division should be considered; and

- There appears to be a need for improving critical functions in energy management through the strengthening of Energy Division statutory authority, staffing, technical capability, funding, management, and results.

## **Recommendations**

Based on the conclusions above, the following recommendations should be pursued:

- Increase State funding support of the Energy Division to reflect diminishing Federal PVE funds;
- Reorganize the Energy Division to recognize the need to consolidate energy data services, planning and policy analysis functions in a section or branch;
- Establish within the Energy Division an energy supply/demand forecasting and data analysis capability; and
- Continue to actively carry out the strategic planning process and the performance management system.

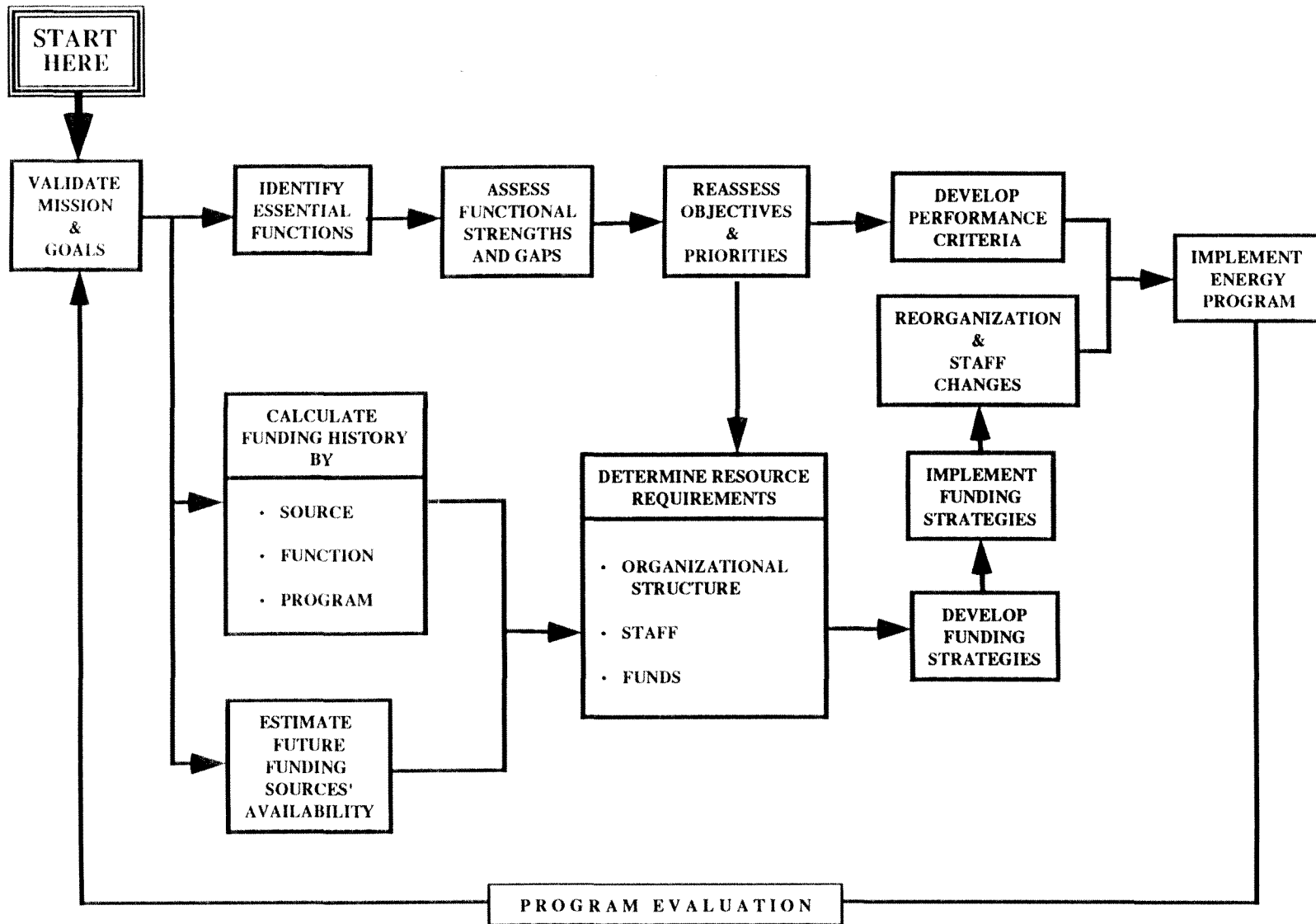
## APPENDIX A: Energy Program Descriptions

- **Alternate Energy Development** is designed to displace oil dependency and facilitate the development and commercialization of alternative energy resources by providing financial and regulatory incentives for development, making the development process less costly and time consuming, and mitigating possible environmental impacts. Current initiatives focus on statewide resource assessments of technologies, demonstration of a biomass gasifier, and promotion of alternative transportation fuels.
- The **Energy Conservation Program** focuses on maximizing the cost-effectiveness of energy use, while reducing energy consumption through the development, introduction and implementation of energy efficient alternatives. Current activities are being conducted in the areas of energy efficient building technology, equipment and appliances; regulated utilities' planning and programs; energy education and awareness; transportation; and recycling.
- The **Energy Emergency Preparedness (EEP) Program** seeks to ensure that essential services are maintained, and economic and personal hardships are minimized in the event of a disruption of petroleum supplies to the State. Current efforts are aimed at strengthening contingency planning and emergency response capability, and periodic exercises of EEP plans.

- **Hawaii Geothermal Development** supports the commercial development of geothermal energy as a near-term source of alternative firm power. Current efforts focus on the drilling of observation holes to assess geothermal resource potential and resource characteristics, the preparation of a master plan for guiding large-scale geothermal development and an accompanying inter-island transmission cable. A priority of this program is to assist with commercial development first for the Big Island where the resource occurs. Any decision to expand that scope is contingent on preparing an EIS to comply with State and Federal requirements.
- **The Hawaii Integrated Energy Policy Development (HEP) Program** is a policy initiative designed to achieve maximum integration of the energy related activities of all major public and private agencies and organizations. The principle deliverable of the HEP Program is a recently developed comprehensive State integrated energy policy.
- **The Hawaii Integrated Energy Strategy (HES) Program** is composed of a series of projects designed to reduce Hawaii's vulnerability to energy supply disruptions -- particularly petroleum -- through the development of an integrated state energy strategy. Important program emphases are the building of increased program self-sufficiency, developing in-house expertise, providing leverage to federal HES funds with State

general funds, and from public/private cost-sharing. HES also operationalizes general policy direction developed through HEP.

- **Institutional Conservation Program (ICP)** is a retrofit program designed to reduce energy use in non-profit schools and hospitals (built prior to May 1989). This program provides professional technical review and cost-shares up to 50% of the cost to purchase and install energy-saving equipment.
- **Integrated Resources Planning (IRP)** as a process involves the examination of all potential energy options, and the consideration of associated social, environmental and economic costs in utility planning of future energy resource requirements. IRP is unique in that it considers demand-side/supply side options as well as renewable energy/fossil fueled/purchased power alternatives.
- **Public Information and Education** is designed to generate energy awareness, understanding, wise energy use, and support for energy conservation and alternative energy development in lieu of oil dependency. Statewide outreach programs are conducted through the schools, private associations, public events, and state and local government offices.



**HAWAII ENERGY PROGRAM TRANSITION PLANNING PROCESS**

## **CRITICAL ENERGY FUNCTIONS**

### DEFINITION

A component of energy management without which a state cannot adequately and economically meet the state's needs:

- Energy emergency preparedness
- Information handling (i.e., data acquisition and management)
- Demand/supply forecasting
- Energy policy development and analysis
- Comprehensive energy planning
- Energy utility regulation (electricity and gas)
- Coordination/integration
- Resource/Technology assessment
- Technology development and commercialization
- Standards, codes and guidelines
- Technical assistance (i.e., energy program design, implementation and evaluation)
- Public education/information dissemination

Source: Energy Management and Permitting Analysis; RCG, Hagler, Bailly, Inc.

Chart #2

## FUNCTIONAL ANALYSIS OF EXISTING INSTITUTIONS

### Evaluation of 12 critical functions based on 6 criteria:

- 1) Statutory authority - the degree to which State agencies have the legal authority to direct and manage the particular function.
- 2) Staffing - the adequacy of existing staffing levels.
- 3) Technical capability - the adequacy of in-house technical knowledge and experience.
- 4) Funding - the adequacy of the level of funding and surety of its source.
- 5) Management - the effectiveness of internal management and direction, includes the establishment of priorities.
- 6) Results - the ability to complete an activity and the effectiveness of its results.

### Scoring

The criteria were valued on a five point scale:

1 = Non-existent      3 = Needs strengthening      5 = Adequate

Source: Energy Management and Permitting Analysis; RCG, Hagler, Bailly, Inc.

Chart #3

## FUNCTIONAL ANALYSIS OF HAWAII'S EXISTING INSTITUTIONS SUMMARY

FUNCTION	CRITERIA	Statutory Authority	Staffing	Technical Capability	Funding	Management	Results	Average Score
Energy emergency preparedness		3	2	5	4	5	3	3.7
Information handling		3	3	4	3	2	3	3
Demand/supply forecasting		1	1	3	2	2	1	1.7
Energy policy development & analysis		3	2	3	4	5	4	3.5
Comprehensive energy planning		3	2	3	2	2	2	2.3
Energy utility regulation		4	3	3	4	4	3	3.5
Coordination/Integration		3	2	4	5	2	2	3
Resource/technology assessment		3	5	4	3	2	3	3.3
Technology development & commercialization		3	4	4	4	3	2	3.3
Standards, codes & guidelines		3	3	3	3	3	3	3
Technical assistance		3	3	4	3	3	4	3.3
Public education/information dissemination		3	5	4	4	4	4	4
Average Score		2.9	2.9	3.7	3.4	3.1	2.8	

### KEY

1 = Non existent

3 = Needs strengthening

5 = Adequate

Source: Energy Management and Permitting Analysis; RCG, Hagler, Bailly, Inc.

Chart #4

## **ESSENTIAL ENERGY MANAGEMENT FUNCTIONS RECOMMENDED BY HEP PROCESS**

- Resource/Technology Assessments
- Demand/Supply Forecasting
- Policy Analysis/Development
- Energy Utility Regulation
- Technology Development & Commercialization
- Energy Emergency Preparedness
- Technical Assistance
- Energy Education
- Energy Information & Assistance
- Standards, Codes, & Guidelines
- R, D & D Coordination & Integration
- Biennial Energy Planning

**Energy Program Expenditures: 1982 To 1990  
By Broad Category  
Federal and State Funds**

Expenditure Category	Expenditure (Thous \$)	Percent
Alternate energy programs	23,618	56.2
ICP, capital improvements	4,175	9.9
ICP, Exxon funds	1,354	3.2
Low income resid. efficiency (WAP)	4,000	9.5
Education, (workshops, confer., publica.)	3,456	8.2
Transportation programs	1,460	3.5
Energy audits	485	1.2
Aquaculture at NELH	470	1.1
Irradiator	430	1.0
Energy planning HEP	412	1.0
Integrated Resource Planning (IRP)	308	0.7
Demand-side management (DSM)	216	0.5
Energy emergency preparedness (EEP)	208	0.5
Recycling	147	0.4
Other	973	2.3
Unknown	320	0.8
<b>Total</b>	<b>42,032</b>	<b>100.0</b>

**Alternate Energy Program Expenditures: 1982 To 1990  
Federal and State Funds**

Expenditure Category	Expenditures (Thous \$)	Percent
Geothermal programs	9,062	38.4
Hawaii Deep Water Cable (HDWC)	4,494	19.0
OTEC	2,419	10.2
NELH operations	1,435	6.1
Biomass	1,413	6.0
Photovoltaics	622	2.6
Hydroelectric	613	2.6
Technology transfer	488	2.1
Methane	440	1.9
Solar	184	0.8
Wind	106	0.5
Other	1,427	6.0
Unknown	915	3.9
<b>Total</b>	<b>23,618</b>	<b>100.0</b>

Source: DBED, Energy Division records.

**Chart #6**

**Educational Program Expenditures: 1982 To 1990  
Federal and State Funds**

Expenditure Category	Expenditure (Thous \$)	Percent
Transportation	584	16.9
Building efficiency & codes	535	15.5
Geothermal	458	13.3
Curriculum development	402	11.6
Consumer education	163	4.7
Alternate energy	247	7.2
General energy education	243	7.0
IRP & DSM	150	4.3
Recycling	126	3.7
Other	548	15.9
<b>Total</b>	<b>3,456</b>	<b>100.0</b>

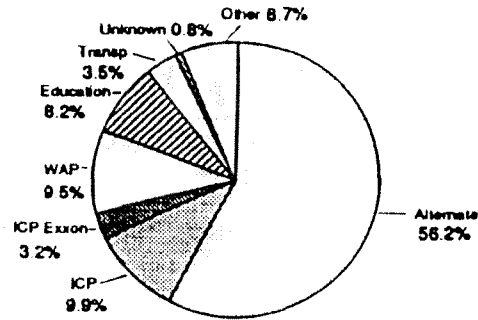
**Capital Improvement: 1982 To 1990  
Federal and State Funds**

Expenditure Category	Expenditures (Thous \$)	Percent
Institutional Conserv Prog. (ICP)	4,175	18.3
Exxon ICP	1,355	5.9
Geothermal	7,374	32.2
Hawaii Deep Water Cable (HDWC)	3,944	17.2
OTEC	2,332	10.2
Biomass	554	2.4
Hydroelectricity	513	2.2
Aquaculture at NELH	470	2.1
Irradiator	430	1.9
Photovoltaics	248	1.1
Solar	129	0.6
Wind	86	0.4
Other	1,244	5.4
Unknown	27	0.1
<b>Total</b>	<b>22,881</b>	<b>100.0</b>

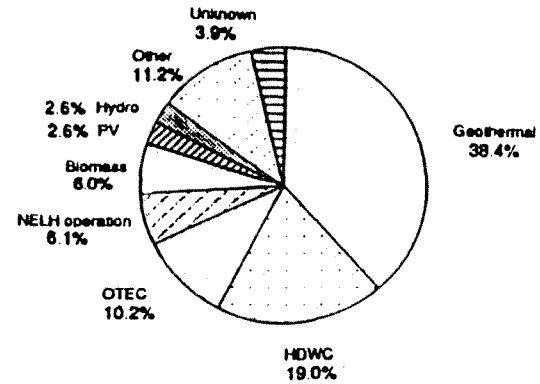
Source: DBED, Energy Division records.

**Chart #7**

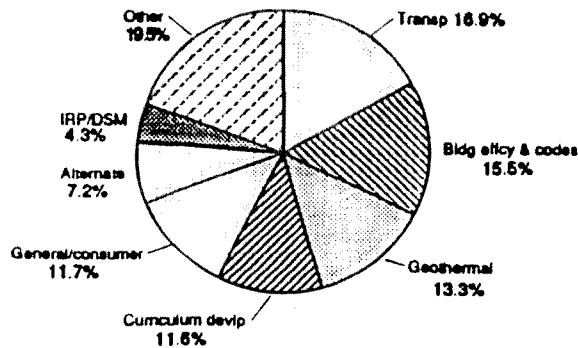
Energy Program Expenditures  
by Broad Category: 1982-1990



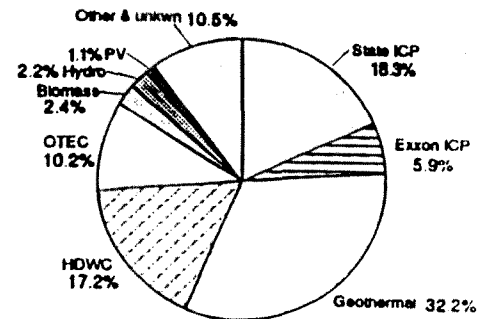
Alternate Energy Expenditures  
1982-1990



Energy Education Expenditures  
1982-1990



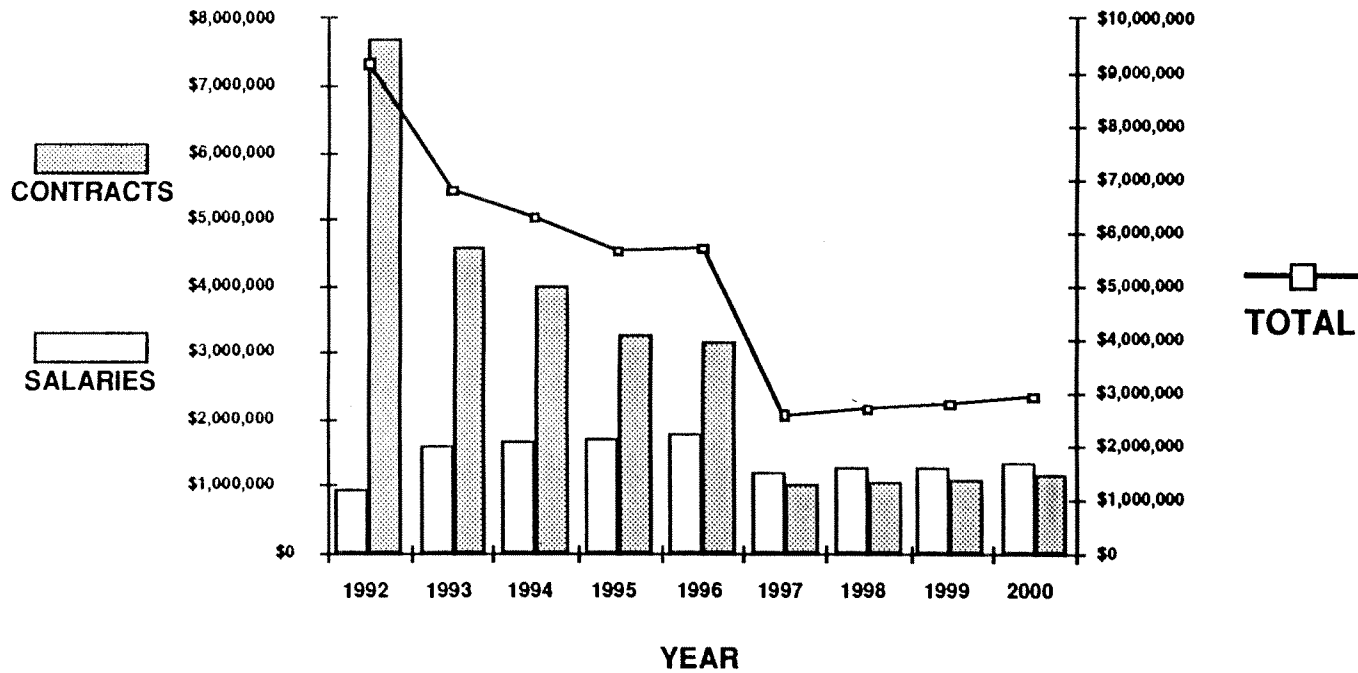
Energy Capital Improvements  
1982-1990



Source: DBED, Energy Division records.

Chart #8

## HAWAII ENERGY PROGRAM EXPENDITURE PLAN 1992 -- 2000



Source: DBED Energy Division

**Chart #9**